ISSN 0014-5602

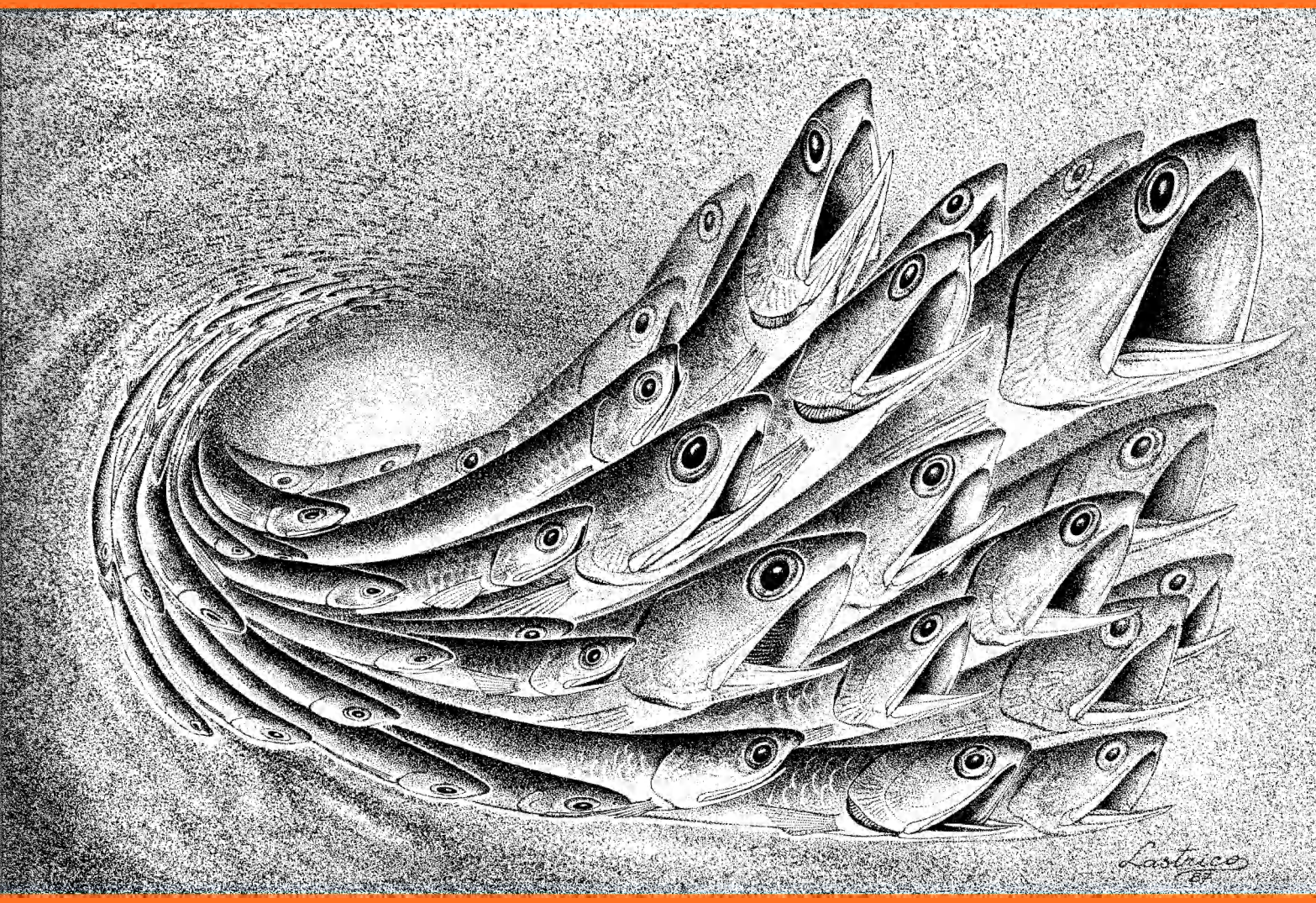
FAO SPECIES CATALOGUE

VOL. 7. CLUPEOID FISHES OF THE WORLD

(suborder CLUPEOIDEI)

AN ANNOTATED AND ILLUSTRATED CATALOGUE
OF THE HERRINGS, SARDINES, PILCHARDS, SPRATS, SHADS
ANCHOVIES AND WOLF-HERRINGS

Part 2 - Engraulididae



UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

F A O S P E C I E S C A T A L O G U E

VOL 7 CLUPEOID FISHES OF THE WORLD

(Suborder CLUPEOIDEI)

An Annotated and Illustrated Catalogue of the Herrings, Sardines, Pilchards, Sprats, Shads, Anchovies and Wolf-herrings

Part 2 - Engraulididae

prepared by

Peter J.P. Whitehead
British Museum (Natural History)
Cromwell Road, London SW7 5BD, UK

and

American Museum of Natural History
Central Park West at 79th Street
New York 10024, USA

Gareth J. Nelson
American Museum of Natural History

and

Thosaporn Wongratana
Faculty of Science
Chulalongkorn University
Bangkok 5, Thailand

UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1988

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

M-43

ISBN 92-5-102667-X

PREPARATION OF THIS DOCUMENT

The present publication was prepared under the FAO Regular Programme, with the support of the United Nations Development Programme, as part of the UNDP/FAO Global Project on Survey and Identification of the World's Marine Fishery Resources (GLO/82/001). It is the seventh worldwide species catalogue in the FAO Fisheries Synopses series.

The authors are the foremost specialists in clupeoid taxonomy; they have also had considerable experience in the field, especially with regard to clupeoid fisheries. Dr Whitehead has been the author of the clupeoid sections in most of the regional FAO identification sheets so far published.

All illustrations signed TW were kindly provided by Dr Thosaporn Wongratana (Chulalongkorn University, Bangkok); the remainder were redrawn (and modified) at FAO from the literature or from the author's sketches, under the supervision of Dr Whitehead and the editor.

The index of scientific and vernacular names was prepared in collaboration with FAO's Fishery Information, Data and Statistics Service.

In producing these catalogues and other taxonomic works within the Global Project, FAO is very much aware that the participation of specialists depends not only on their willing cooperation, but also on the moral and other support that they themselves receive for such work from their own institutions. In the present case the support of the British Museum (Natural History) and of the American Museum of Natural History is gratefully acknowledged.

Technical Editor: Dr Walter Fischer, Fishery Resources and Environment Division, FAO

Illustrators: 0. Lidonnici and P. Lastrico, FAO, Rome. All drawings initialled "TW" were drawn from specimens by Dr Thosaporn Wongratana, Chulalongkorn University, Bangkok, Thailand. Ms M. Kautenberger-Longo: distribution maps, page composition and collation.

ABSTRACT

This is the seventh in the FAO series of worldwide illustrated catalogues (synopses) of major groups of organisms that enter marine fisheries. The present catalogue includes all clupeoid fishes (suborder CLUPEOIDEI - herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings), comprising 4 families, 82 genera and some 355 species, contributing to more than a quarter of the world fish catch. Keys are given to the families, subfamilies and genera, with a glossary of technical terms and measurements, and a review of major literature sources within each FAO fishing area. Genera and species are diagnosed, with drawings, scientific and vernacular names, information on habitat, biology, fisheries, and distribution (with map); reference is also made to subspecies and to any taxonomic or other problems. The occurrence of the species within the FAO fishing areas is tabulated. All scientific names applied to clupeoid species are given in the synonymies, and these as well as the vernacular names are indexed; there is also a complete bibliography of all literature cited.

Distribution:

Authors
FAO Fisheries Department
FAO Regional Fisheries Officers
Regional Fisheries Councils and Commissions
Short Marine Distribution

For bibliographic purposes this document should be cited as follows:

Whitehead, P.J.P., G.J. Nelson and T. Wongratana, 1988 FAO species catalogue. vol.7. Clupeoid fishes of the world (Suborder Clupeoidei). An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, anchovies and wolf-herrings. Part 2. Engraulididae. FAO Fish.Synop., (125)Vol.7,Pt.2:305-579

ADDENDUM TO PART I

Since publication of Part 1 of the Catalogue in late 1985, an important clupeoid paper by Wongratana (1987a) clarifies the status of three hitherto unnamed species of Herklotsichthys:

Herklotsichthys Species A (see page 83) = H. lippa Whitley, 1951. The latter was wrongly considered a junior synonym of H. quadrimaculatus see page 81).

Herklotsichthys Species B (see page 84) = H. collettei Wongratana, 1987.

Herklotsichthys Species C (see page 85) = H. castelnaui (Ogilby, 1897). The latter is already included (page 75).

Two recent papers provide new names for a West African pellonuline and an Australian pristigasterid:

Microthrissa Species A (see page 153) = Microthrissa normanae Whitehead, 1986.

Ilisha species (see page 269),= Ilisha lunula Kailola, 1986, Beagle, 3(1):52, figs 1,2 (northern Australia and Papua New Guinea),

Although every effort was made to locate all synonyms of clupeoid fishes, undoubtedly a few have eluded the search. Seven additional names that may have nomenclatural importance are:

Clupea pallasi probatowi Makushok, 1935:23 (Yugorskii Shar Strait, Kara Inlet) = Clupea pallasii see page 117).

Sardinella (Amblyaster) jonesi Lazarus, 1983:78, fig.1 (Vizhinjam, India) = ? Amblygaster sirm (see page 88 but), no spots, also lower gillrakers 37-48 (cf.33-43).

Corica biharensis Kamal & Ahsan, 1978:28 (Ganges River at Bihar) = ? Corica soborna Hamilton-Buchanan, 1822 (see page 180). However, it is said to differ from that species in several respects.

Alosa fallax lariana Pirola (Lake Como) = Alosa fallax lariana Pirola. Accepted as a distinct subspecies by Svetovidov (1952:308 and 1963:346), but without diagnosis or reference to Pirola's paper.

Alosa caspia vistonica Economidis & Sinis, 1987 (Lake Vistonis, Macedonia) = Alosa caspia subsp.A(see page 198).

Ilisha paulistana Miranda-Ribeiro, 1961 = ? Pellona harroweri (Fowler, 1917) (see page 283).

Engraulis desmaresti Risso, 1827:455, pl.9, fig.22 (or Clupea desmaresti on page 479) (Medeiterranean)=Sardinella maderensis (Lowe, 1839) (see page 106). Risso's name should be considered a nomen oblitum (see Whitehead & Bauchot, 1986:47).

Thirteen apparent subspecies of Clupea harengus were recognized by Schnakenbeck (1931:529), who proposed the names, atlanticus, borealis, britannicus, caledonicus, cimbricus, frisius, islandicus, ivernicus, norvegicus, scandicus, scoticus and septemtrionalis. However, in the title to this work and throughout the text it is clear that Schnakenbeck regarded these taxa as races.

For the most complete assessment of the Peruvian upwelling ecosystem and its relation to the biology and fishery of the Peruvian anchoveta Engraulis ringens (page 322) see:

Pauly, D. and I. Tsukayama, 1987. The Peruvian anchoveta and its upwelling ecosystem: three decades of change. ICLARM Studies & Reviews, 15(391), xii + 351 pp.

Finally, a new species of the otherwise New World genus Odontognathus has been discovered from Borneo and will be described by Yoichi Sato.

The diagram of relationships of clupeoid-like fishes (Fig.2 on page 3 of Part 1) should be modified. Grande (1985:287) has now shown that the Upper Cretaceous fossil genus Ornategulum is not a clupeomorph; thus the superorder CLUPEOMORPHA should be moved one step up the line.

The irritation caused by typographical errors is generally compounded rather than assuaged by long lists of corigenda - most readers prefer to find the errors themselves. However, the percentage of clupeoids in the world fish catch should be 27.9% (not 17.9%) and the central drawing of canine teeth on page 181 (Clupeichthys) should be struck out. Where spellings differ between text and index, the latter is definitive, while errors in dates have been similarly adjusted in the Bibliography.

Acknowledgements

To the very sincere thanks expressed in Part 1 of this Catalogue must be added my deep gratitude to my two collaborators, Dr Gareth Nelson and Dr Thosaporn Wongratana, for so graciously allowing me to use their meristic and other data, the first on New World species, the second on Indo-Pacific species. Without this generous help the task of compiling the Catalogue would have been considerably more arduous and the data less inclusive. It must be stressed, however, that the final taxonomic decisions are my own, including the erection of the new genus Jurengraulis, since we were not always in full agreement.

As in Part 1, the illustrations of Indo-Pacific species are those drawn by Dr Wongratana; they are the most accurate and elegant of any yet produced and it is a great privilege to be able to use them here. The remaining drawings were occasionally taken direct from the literature, but were mostly carefully redrawn by Mr Oliviero Lidonnici (FAO, Rome), who also redrew some of my small sketches; Mr Paolo Lastrico is also thanked for his valuable assistance in other aspects of the artwork, including the cover drawings for both parts of the Catalogue.

The text was typed from my hand-written work and most skillfully set on the page by Mrs Michèle Kautenberger-Longo with speed, accuracy and characteristic tolerance for my errors, additions and deletions.

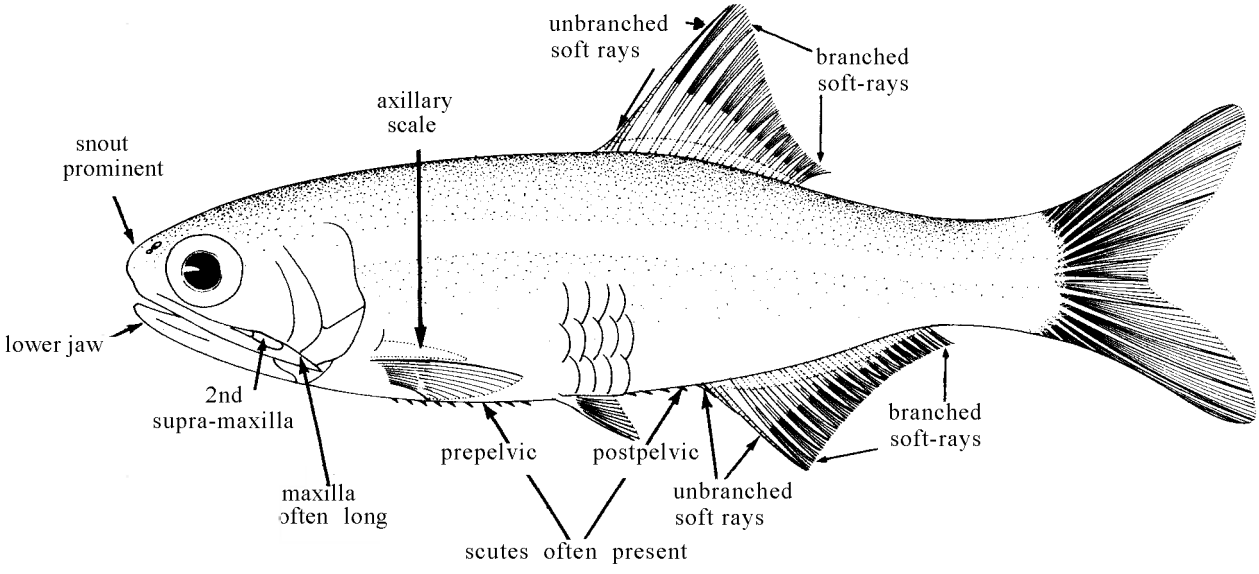
TABLE OF CONTENTS

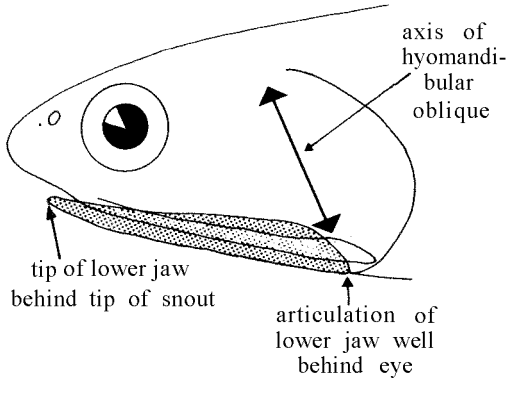
2.4 FAMILY ENGRAULIDIDAE

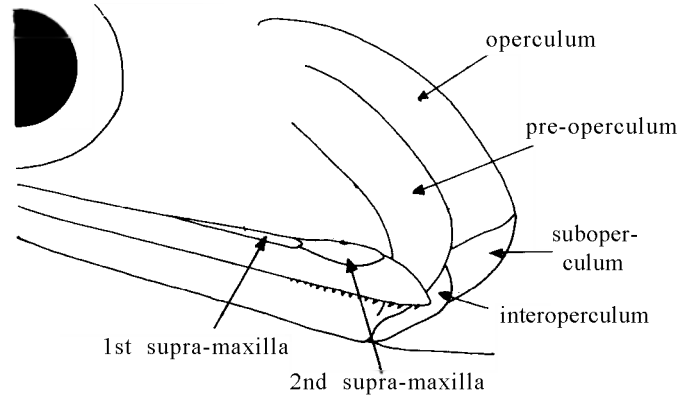
ENGR

FAO Names : En - Anchovies.

Diagnostic Features : Small or moderate-sized clupeoid fishes (usually 10 to 20 cm standard length, but Thryssa scratchlevi to 37 cm and some pygmy freshwater species in the Amazon). Anchovies are characterized by a usually prominent pig-like snout projecting beyond the tip of the lower jaw, the latter almost always long, slender and "underslung", its articulation behind the eye, usually well behind. Typically, there are 2 supra-maxillae. Jaw teeth are usually small or minute (absent in Cetengraulis; large and canine-like in Lycothrissa and Lycengraulis). Gillrakers are usually short and not numerous (but long and up to 100 or more in Anchovia). A pelvic scute with lateral arms is always present; most Indo-Pacific species have pre- and often post-pelvic scutes, and some have a small spine-like scute just before the dorsal fin; Engraulis and New World anchovies lack such scutes. The dorsal fin is short and usually near the midpoint of the body (far back in Pterengraulis, far forward in Coilia); the pectoral fins are low on the body (with 5 to 19 free unbranched upper finrays in Coilia); the pelvic fins are before, under or behind the dorsal fin base, with i 6 finrays (except Colia ramcarati with i 9 or 10); the anal fin is usually moderate (about 15 to 25 finrays), but long in Thryssa (to 50 finrays), Setipinna (to 80) and Coilia (to over 100). The scales are moderate, about 30 to 60 in lateral series, very often shed. Typically, the back is blue/green and the flanks silver (sometimes with a distinct silver stripe); fins are hyaline or faint yellow, sometimes chrome or orange, as also the mouth and/or the gill cavity; black markings may occur on fin tips or margins, or just behind the gill opening, but apparently no species has black spots on the flanks (cf. the clupeids).







Biology, Habitat and Distribution : Anchovies are typically marine coastal and schooling fishes, occurring in all seas from about 60° N to 50° S, but some species enter brackish or freshwater to feed or spawn and some live permanently there and are found high up the Amazon. Most species feed on small planktonic animals (especially crustaceans), either by locating individual prey or by more indiscriminent filter-feeding (e.g. Cetengraulis). Most, perhaps all, scatter quite large numbers of eggs from which hatch planktonic larvae.

Interest to Fisheries : Anchovies yielded 4 046 105 tons in 1.982, or 21.4% of the total clupeoid catch. This figure was considerably higher during the boom years of the Peruvian anchovy, which alone in 1970 yielded 13 059 900 tons or 61.4% of the total clupeoid catch. Only 8 anchovy species were individualIy reported in 1982: the Peruvian anchovy and five other species of Engraulis (3 570 522 tons, or 88.2% of the total anchovy catch) and the two species of Cetengraulis (70 063 tons, or less than 2%), the remainder being unidentified species of Stolephorus (231 344 tons, or about 6%) or unidentified anchovies (4.3%). Almost certainly individual statistics for species (or groups of species) of Thryssa in the Indo-Pacific region are justified.

Remarks : The family name Engraulidae has been used in almost all previous literature, but it is an incorrect derivation from Engraulis; the correct (but less euphonic) derivation is Engraulididae (as explained by Steyskal, 1980:170).

Anchovies are essentially clupeids with a different head: the mesethmoid projects well forward of the vomer (and well forward of the pre-maxillae) and supports a paired rostral organ (Nelson, 1984a), while the suspensorium of the lower jaw (essentially the hyomandibular) is inclined obliquely backward and not vertical (Grande & Nelson, 1985:fig.2). The group was given the status of superfamily (Engrauloidea) by Grande (1985:261).

Unlike clupeids, with over a hundred fossil species described and a history reaching back to the Palaeocene (Grande, 1985), the anchovies have yielded only 4 definite fossil species (2 based on skeletons, 2 merely on otoliths), of which the oldest is from the Miocene:

Lower Miocene of New Zealand	:	Anchoa nitida Schwarzhans, 1984 (otoliths only)
Miocene - Lower Pliocene of Cyprus	:	Engraulis tethensis Grande & Nelson, 1985
Pliocene of Borneo/Sumatra	:	Setipinna retusa Stinton, 1962 (otoliths only)
Pliocene - Pleistocene of Italy	:	Engraulis macrocephalus (Lindini & Menesini, 1978).

Nevertheless, Grande & Nelson (1985) considered the Engraulididae to be as old a group as the Clupeidae, believing that there must have been ecological reasons for the lack of fossil anchovies.

Relationships within the Engraulididae have until recently been based on a subfamily Engraulinae and a subfamily Coiliinae (the rat-tailed Coilia only) (Whitehead, 1985:12). Since only one genus, Engraulis, is common to both the Indo-West Pacific and the New World (also the eastern Atlantic), there appeared to be a clear division between the New and Old World anchovies. Lance Grande and Gareth Nelson have questioned this by relating the Indo-Pacific genera Stolephorus and Encrasicholina more closely to Engraulis and all the New World genera than to the other Indo-Pacific genera (Thrissina, Thryssa, etc.) (Grande & Nelson, 1985; also Nelson, 1983).

Some 139 anchovy species are listed here, placed in 16 genera, but more species will be described and no doubt there could be some splitting of the genera. For convenience, and until relationships become clearer, the genera will be placed in a single family, Engraulididae.

KEY TO THE GENERA :

New and Old World genera are separated since only Engraulis occurs in both areas (included in each key).

A. New World Genera

The genus Amazonsprattus is not included in this key; it can be recognized by the small size of adults (mature at 1.5 cm standard length), only i 5 pelvic finrays, and maxilla reaching only just to front of eye (see Fig.11).

1a. Dorsal fin origin in front of anal fin origin or only slightly behind, near to midpoint of body

2a. Jaw teeth small and even, not canine-like in lower jaw

3a Anal fin origin under or behind base of last dorsal finray (Fig.1); body not strongly compressed, usually oval or nearly round in cross-section

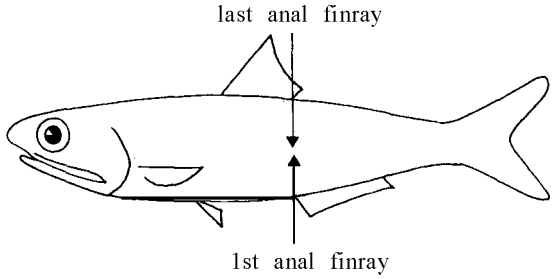


Fig.1

4a. A few short gillrakers present on hind face of 3rd epibranchial (Fig.2)

5a. Pseudobranch shorter than eye, not reaching onto inner face of operculum (Fig.3); maxilla tip blunt, not reaching onto preoperculum (Fig.4). . . . . **Anchoviella**
(part, see lla below)

5b. Pseudobranch longer than eye, reaching onto operculum (Fig.5)

6a. Maxilla tip pointed, reaching onto preoperculum (Fig.6). . . . . **Anchoa**
(subgenus Anchovietta)

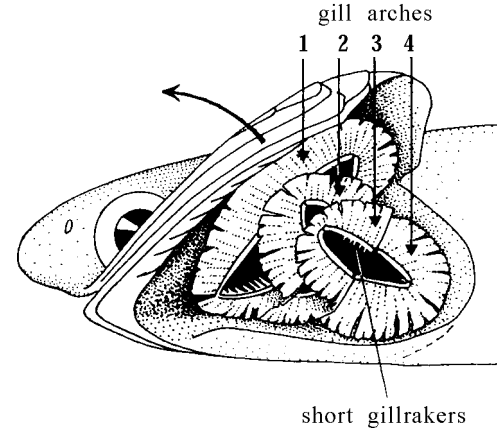
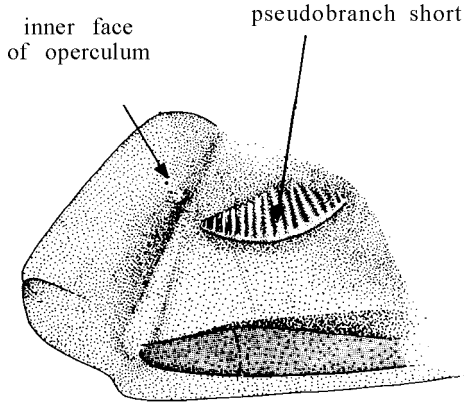
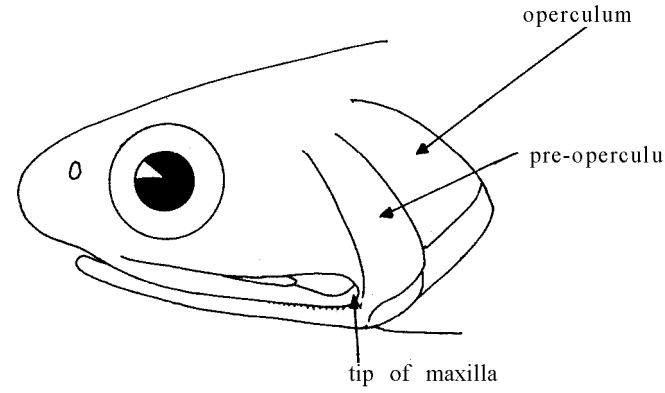


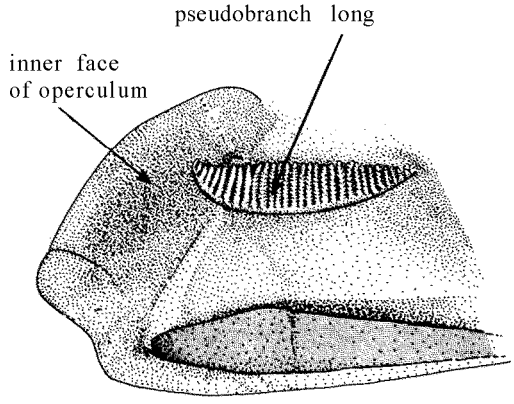
Fig. 2



gill cover seen from inside Fig. 3

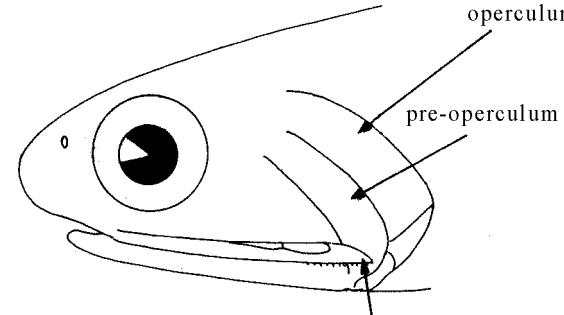


Anchoviella Fig. 4



inner face of gill cover

Fig. 5



Anchoa Fig. 6

6b. Maxilla tip blunt, not reaching onto pre-operculum (Fig.7). . . . . **Engraulis** (encrasicolus group)

4b. No gillrakers on hind face of 3rd epibranchial (Fig.8)

7a. Pseudobranch longer than eye, reaching onto inner face of operculum

8a. Western South Atlantic . . . . . **Engraulis** (anchoita only)

8b. Eastern South Pacific. . . . . **Engraulis** (rigens only)

7b. Pseudobranch shorter than eye

9a. Eastern North Pacific. . . . . **Engraulis** (mordax only)

9b. Amazon system. . . . . **Jurengraulis** gen.nov.

3b. Anal fin origin below dorsalfin base, usually well in front of base of last dorsal finray

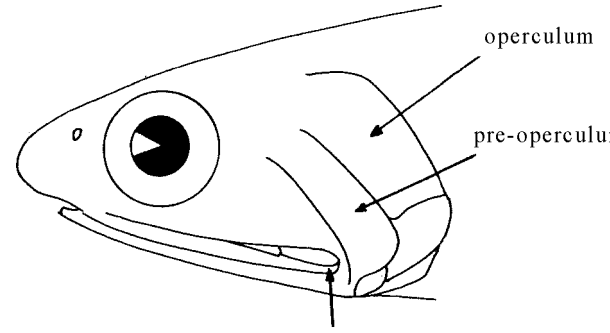
10a. Lower gillrakers 12 to 35; a few short gillrakers on hind face of 3rd epibranchial

11a. Maxilla short, tip blunt, not reaching onto pre-operculum (also Anchoa **analis**, but branched anal finrays 28 to 34, cf. 10 to 24) . . . . . **Anchoviella** (part, see also 5a above)

11b. Maxilla long, tip pointed, reaching onto pre-operculum (except in A. analis, see 11a above) . . . . . **Anchoa** (subgenus Anchoa)

10b. Lower gillrakers 45 to 135 (except in juveniles); no gillrakers on hind face of 3rd epibranchial

12a. Gill membrane normal, branchiostegal rays 9 or more (Fig.9) . . . . . **Anchovia**



Engraulis (encrasicolus group) Fig. 7

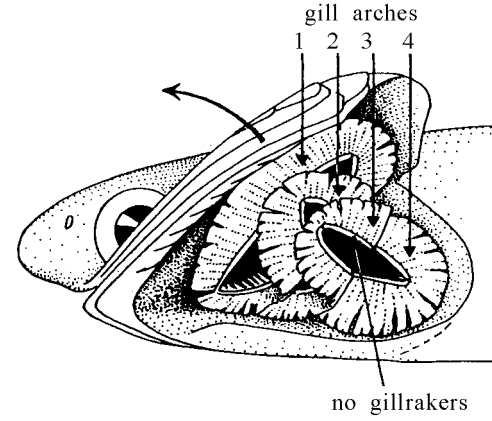
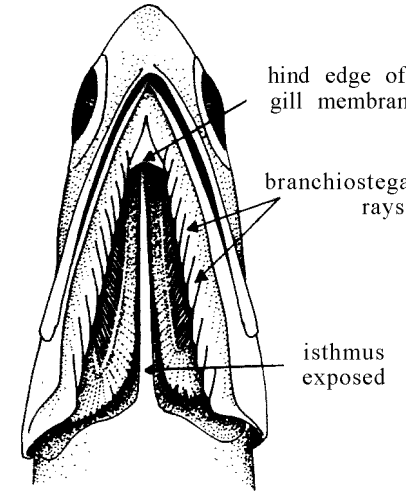


Fig. 8

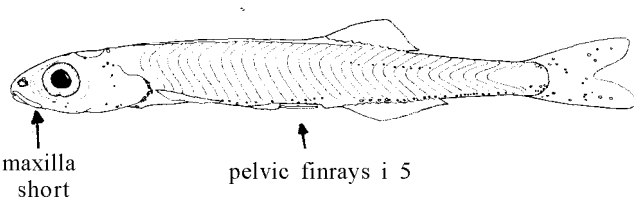


Anchovia Fig. 9

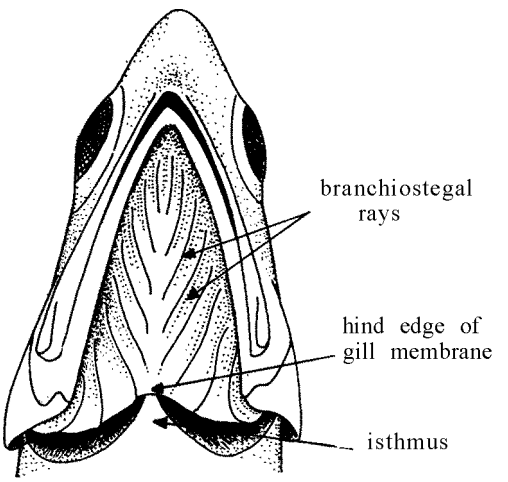
12b. Gill membrane broadly covering isthmus, branchiostegal rays 8 (Fig.10). . . .**Cetengraulis**

2b. Jaw teeth enlarged, canine-like in lower jaw . . . . . .**Lycengraulis**

1b. Dorsal fin origin well behind anal fin origin, Well behind midpoint of body . . . . . **Pterengraulis**



Amazonsprattus Fig.11



Cetengraulis Fig.10

B. Old World Genera

1a. Body normal, not greatly tapering and "rat-tailed", caudal fin large, forked (Fig.12) and anal fin not joined to caudal fin; upper pectoral finrays not detached from each other

2.a. No pre- or post-pelvic scutes (Fig.13); also, body somewhat cylindrical, little compressed. . . . . **Engraulis**

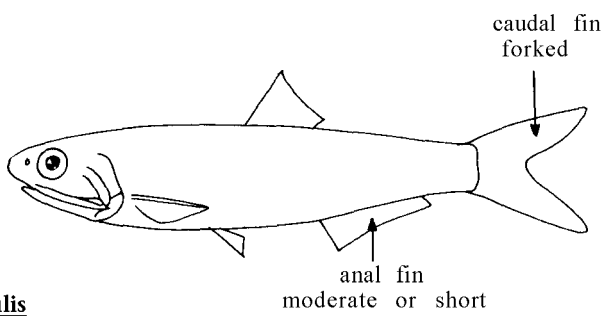
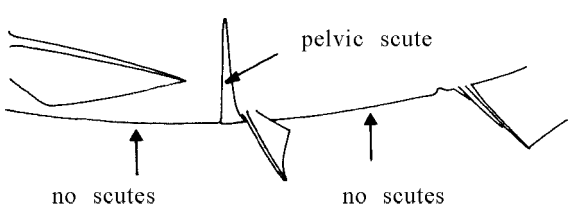


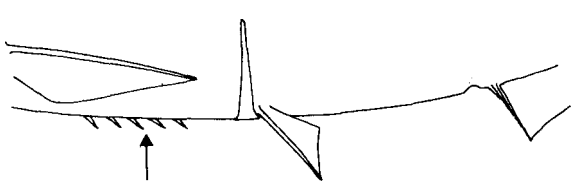
Fig.12

2b. Pre-pelvic scutes present, often also post-pelvic scutes and a spine-like scute before dorsal fin

3a. Pre-pelvic scutes only, needle-like (Fig.14) (but sometimes absent in the Hawaiian Encrasicholina purpurea); anal fin short, with less than 25 finrays



Engraulis Fig.13



Encrasicholina, Stolephorus Fig.14

4a. Isthmus muscle not reaching forward to hind edge of gill membrane, the urohyal exposed (Fig. 15a) . . . . . **Encrasicholina**

4b. Isthmus to and beyond gill membrane (Fig.15b) . . . . . **Stolephorus**

3b. Post-pelvic as well as pre-pelvic scutes present (Fig.16); anal fin long, 27 to 81 finrays

5a. Teeth normal (small or minute)

6a. Upper pectoral finray not extended as a filament

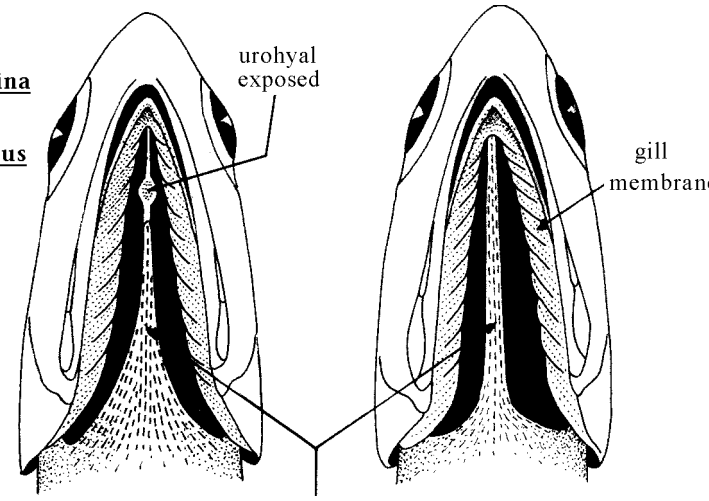
7a. Dorsal fin normal, at least 12 finrays; post-pelvic scutes strong, sharply keeled . . . . . **Thryssa**

7b. Dorsal fin minute, only 5 or 6 finrays; post-pelvic scutes membranous, hidden by scales . . . . . **Papuengraulis**

6b. Upper pectoral finray a filament; a single supra-maxilla (Fig.17) . . . . . **Setipinna**

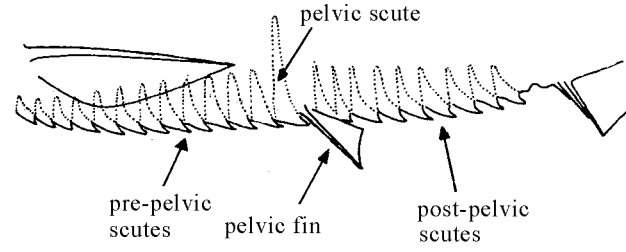
5b. Teeth in jaws canine-like (Fig. 18) . . . . . **Lycothrissa**

1b. Body tapering, "rat-tailed", caudal fin small, rhomboid; 5 to 19 upper pectoral finrays unbranched and free from each other (Fig.19) . . . . . **Coilia**

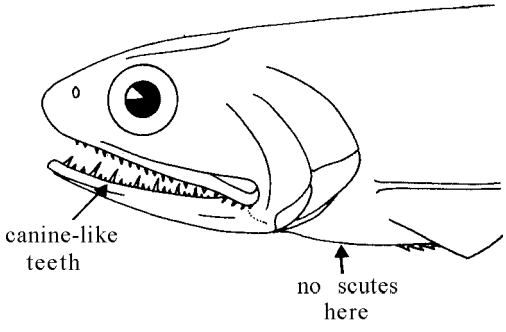


a) Encrasicholina b) Stolephorus

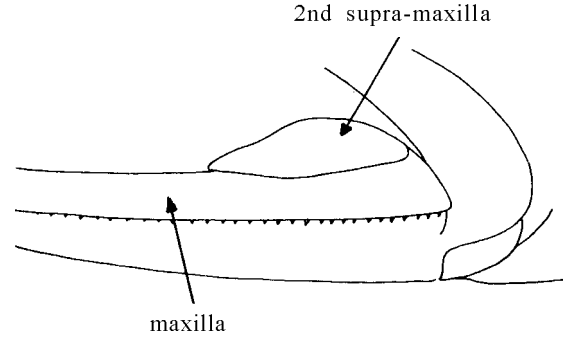
Fig.15



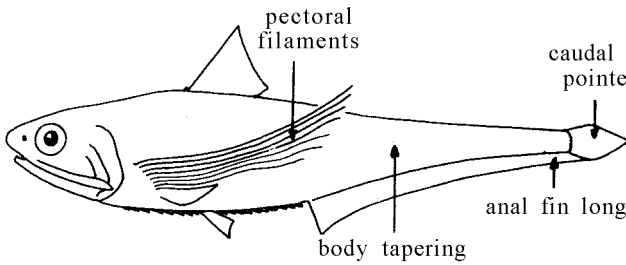
Thryssa,etc. Fig.16



Lycothrissa Fig.18



Setipinna Fig.17



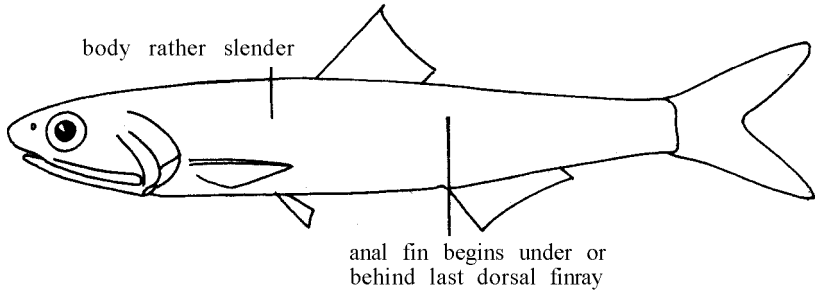
Coilia Fig.19

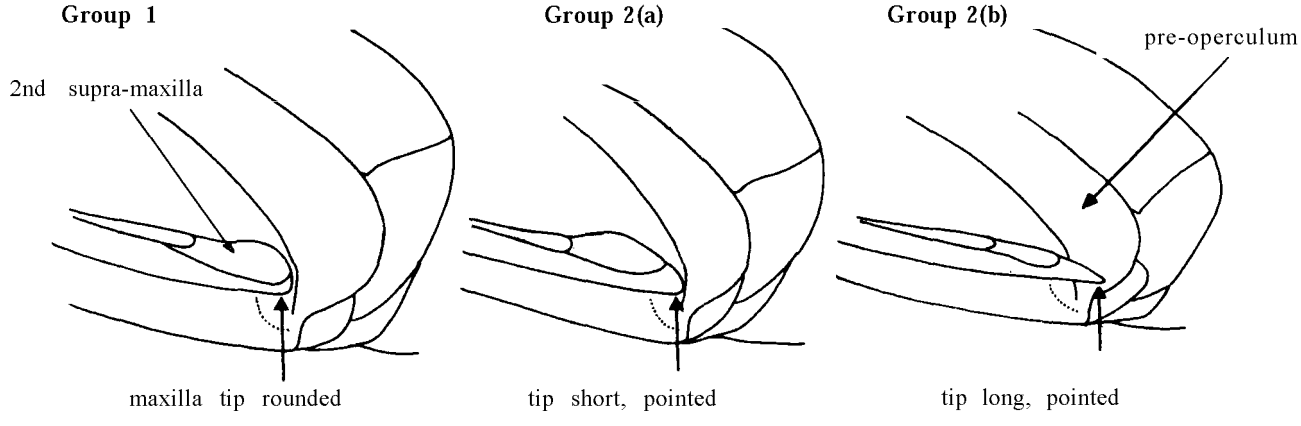
Engraulis Cuvier, 1816

ENGR Engr

Engraulis Cuvier, 1816, Règne animal, 1st ed., 2:174 (type: Clupea encrasicolus Linnaeus). Engraulis Bosc, 1816, Nouv.dict.hist.nat. (nouv.ed.), 1:493 (on Engraulis Cuvier, MS, no type). Encrasicholus Fleming, 1828, Hist.Brit.anim.:183 (type: Clupea encrasicolus Linnaeus; corrigenda states "for Encrasicholus read Engraulis"; for Lacepéde's use of Encrasicholus, see Whitehead, 1967a:136). Alpismaris Swainson, 1838, Nat.hist.anim., 1:90 (as a subgenus of Engraulis, name only, two Mediterranean species, not named). Austranchovia Whitley, 1931, Aust.Zool., 6:311 (type: Atherina australis Shaw).

Diagnostic Features : Moderate, rather round-bodied anchovies (to 20 cm standard length, usually about 12 to 15 cm), oval in cross-section and little compressed. Snout pointed and prominent; maxilla short, just reaching to front margin of pre-operculum, tip blunt, barely extending beyond tip of second supra-maxilla (but somewhat pointed in anchoita, ringens and mordax and reaching well onto pre-operculum in mordax); fine teeth on lower jaw; gillrakers slender and numerous (lower gillrakers 27 to 45); gillrakers present on posterior face of third epibranchial (except anchoita, mordax, ringens). Pseudobranch longer than eye and reaching onto inner face of operculum (except mordax). Dorsal fin origin at about midpoint of body; anal fin short, with iii 13 to 20 finrays, its origin under base of last dorsal finray or somewhat behind.

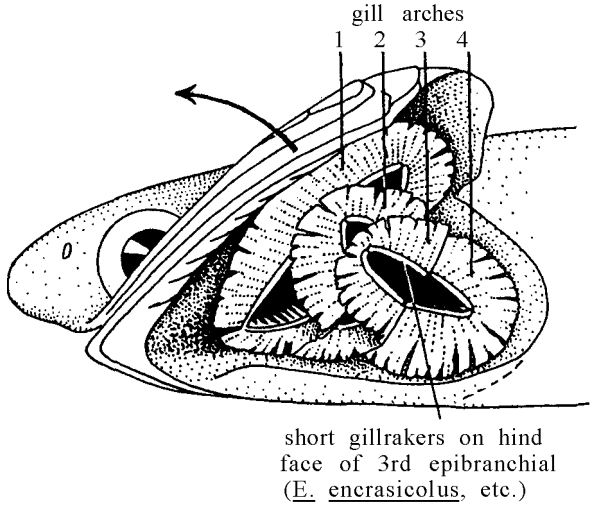




E. encrasicolus, etc.

E. anchoita
E. ringens

E. mordax



Biology, Habitat and Distribution : Marine, but in some cases entering estuaries and tolerating salinities down to only 5‰; virtually worldwide, in tropical as well as temperate waters. Mainly filter-feeders, but also 'pecking' at small planktonic organisms. Forming large or in some cases enormous schools which support important fisheries. Except in the Western Atlantic, those in temperate water occur with a species of Sardina or Sardinops whose abundance seems to vary inversely with that of the anchovy, the two presumably competing for food (at least at some stage in their life history).

Species : Careful revisionary work may show that the five members of the encrasicolus-group (encrasicolus, eurystole, capensis, japonicus, australis) are a single species; the differences between them appear to be slight and overlapping. The three New World species (anchoita of the Atlantic, mordax and ringens of the Pacific) differ in important characters, which would justify recongnition of a distinct subgenus were it not that mordax shows further departures that bring it close to the subgenus Anchovietta of Anchoa (see Remarks under E. mordax). Until such problems can be resolved, 8 species of Engraulis are recognized here:

Group 1 (lower gillrakers 27 to 43, a few small ones present on hind face of third epibranchial; tip of maxilla blunt, not extending beyond tip of second supra-maxilla; branched anal finrays 13 to 15; pseudobranch longer than eye)

E. australis (Shaw, 1790) Southern Australia
E. capensis Gilchrist, 1913 Southern Africa, also western Indian Ocean
E. encrasicolus (Linnaeus, 1758) Eastern Atlantic
E. eurystole (Swain & Meek, 1884) Western North and central Atlantic
E. japonicus Temminck & Schlegel, 1846 Western North and central Pacific

Group 2 (lower gillrakers 37 to 49, no gillrakers on hind face of third epibranchial; tip of maxilla pointed, extending beyond tip of second supra-maxilla; branched anal finrays 16 to 22)

Subgroup **a** (maxilla short, just reaching to pre-operculum; pseudobranch longer than eye; tip of lower jawbefore nostril)

E. anchoita Hubbs & Marini, 1935 Western South Atlantic
E. ringens , 1842 Eastern South Pacific

Subgroup **b** (maxilla longer, reaching onto pre-operculum; pseudobranch shorter than eye or just equal to it; tip of lower jaw to below nostril)

E. mordax Girard, 1856 Eastern North Pacific.

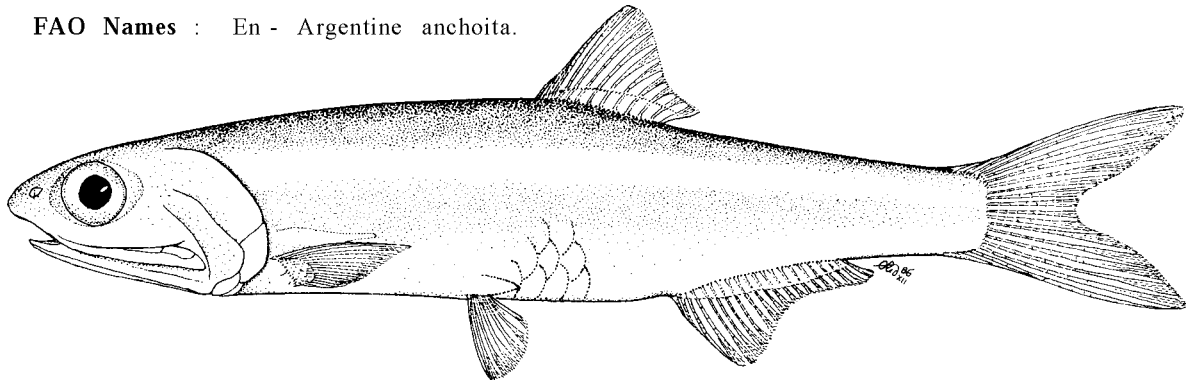
Engraulis anchoita Hubbs & Marini, 1935

ENGR Engr 6

Engraulis anchoita Hubbs & Marini, in Marini, 1935, Physis B.Aires, 11:448, fig.2 (Mar del Plata, Argentina).

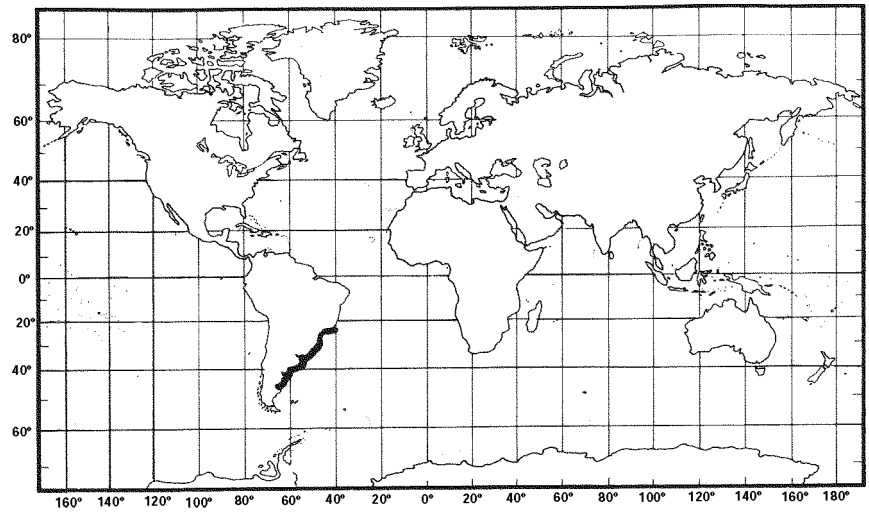
Synonyms : Engraulis anchoita-Hildebrand, 1943:18, fig.4 (on the types); Fowler, 1943:311, fig.1 (Punta Jose, Maldonado, Uruguay ; Hildebrand & Carvalho, 1948:285 (Sào Sebastào Island, Sào Paulo, Brazil); Ciechomski, 1965:6, figs 1-3 (Mar del Plata, eggs); Idem, 1967a:58 (Mar del Plata, synopsis); Idem, 1967b:67 (Mar del Plata, eggs and larvae); Idem, 1967c:72 (Mar del Plata, food); Whitehead, 1973a:89, fig.30b(maxilia)(relationships); Roux, 1973:51 (just southwest of Rio de Janeiro); Weiss, Feijó de Souza & Santos, 1976:12 et seq., figs 2,4,6 (breeding); Weiss & Feijó de Souza, 1977:2 et seq., figs 1-3,5 (larvae); Figueiredo & Menezes, 1978:29, fig.38 (compiled); Stehmann, 1979:62, fig.56 (Argentina) ; Bellisio, López & Torno, 1979:55, fig.20 (photo) (Argentina, synopsis); Matsuura & Nakatani, 1980:48, fig.4 (off Santos, Brazil; abundance of eggs); Hansen, Cousseau & Gru, 1984:29 et seq., figs 1-7 (Argentina, growth, mortality); Sanchez & Ciechomski, 1984:52 et seq., fig.1 (Argentina, biomass of spawners); Nelson, 1984:425, tabs 1,2 (relationships, anal finrays, vertebrae); Acuña & Castello, 1986:32 (S.Brazil, pop., growth, reprod.).

FAO Names : En - Argentine anchoita.



Diagnostic Features : Body slender, oval in cross-section, its depth about 5.5 times or more in standard length. Snout prominent, pointed, about 3/4 eye diameter; maxilla moderate, tip bluntly tapering or a little rounded, reaching to front margin of pre-operculum, extending a little beyond tip of second supra-maxilla; teeth in jaws small, numerous. Lower gillrakers 38 to 45, long and slender; no gillrakers on hind face of third epibranchial; pseudobranch long, reaching onto inner face of operculum. Anal fin short, with iii 17 to 20 finrays, its origin a little behind base of last dorsal finray. A broad silver stripe along flank, disappearing in adults. Anchoa marinii also has a long pseudobranch and just overlaps in anal finray count, but anal fin origin below midpoint of dorsal fin base; A. filifera and A. lyolepis have a long pseudobranch and a posterior anal fin origin, but like A. marinii have a longer and more sharply pointed maxilla (to or almost to hind border of pre-operculum); also, no species of Anchoa has more than 30 lower gillrakers.

Geographical Distribution : Western South Atlantic (from a little north of Rio de Janeiro at 22°S to San Jorge Gulf, Argentina, at about 47°S).



Habitat and Biology : Marine, pelagic, coastal and to about 800 km or more from the shore; forming dense schools at about 30 to 90 m depth in summer off Argentina, but down to 100 to 200 m depth in winter (Bellisio, López & Torno, 1979:56). Feeds as juveniles on zooplankton (copepods, their eggs and larvae, especially calanoids), but with phytoplankton becoming increasingly important. Spawns throughout year, most intensely and close to shore in October/November and again but more offshore and less intensely in May/June (distinct spring and autumn spawners proposed by Fuster de Plaza, 1964; situation perhaps more complex according to Ciechomski, 1967a). Schools around southern Uruguay and northern Argentina move offshore toward the end of the year and northward in March to June, moving south again and close to shore in August to October.

Size : Reported to reach 22 cm total length, i.e., about 17 cm standard length.

Interest to Fisheries : Mainly exploited seasonally by small Argentinian fishing boats over the shelf, chiefly during the migration period September to October. The total reported catch for 1982 was 10 137 t, but according to Bellisio, López & Torno (1979:57) the annual sustainable catch could be increased to between 786 000 and 1 180 000 t. Some consumed fresh, the rest canned.

Local Names : ARGENTINA: Anchoita.

Literature : Ciechomski (1967a,b,c - a good synopsis, with some detailed information on breeding and feeding, also a number of further references to earlier work), Bellisio, Lopez & Torno (1979 - synopsis), Acuña & Castello (1986 - good sumrnary of literature).

Remarks : The relationship of this species to 'true' Engraulis (E. encrasicolus, E. eurystole, etc.) or to the Pacific species (E. ringens, E. mordax) is not yet clear. Unlike Clupea which is confined to the Northern Hemisphere and is 'replaced' by Strangomera in the southern Hemisphere (eastern South Pacific), Engraulis encrasicolus and related species occur in the Southern Hernisphere (African and Australian waters), thus it is surprising to see E. anchoita 'replacing' the 'true' Engraulis in the South Atlantic. This seems to argue that its real affinities are with the eastern Pacific E. ringens and E. mordax.

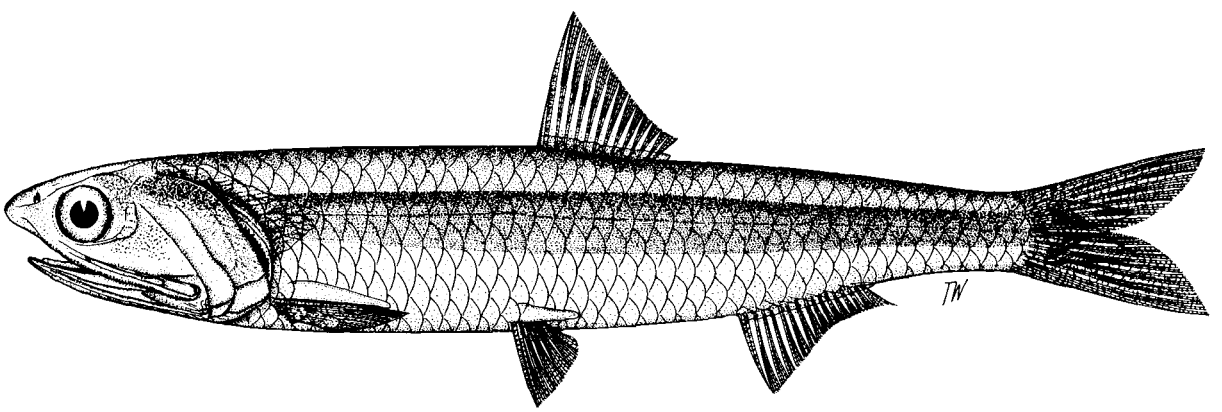
Engraulis australis (Shaw, 1790)

ENGR Engr 2

Atherina australis Shaw, 1790, in White's Voy.N.S.Wales:296, pl.1.64, fig.1 (New South Wales).

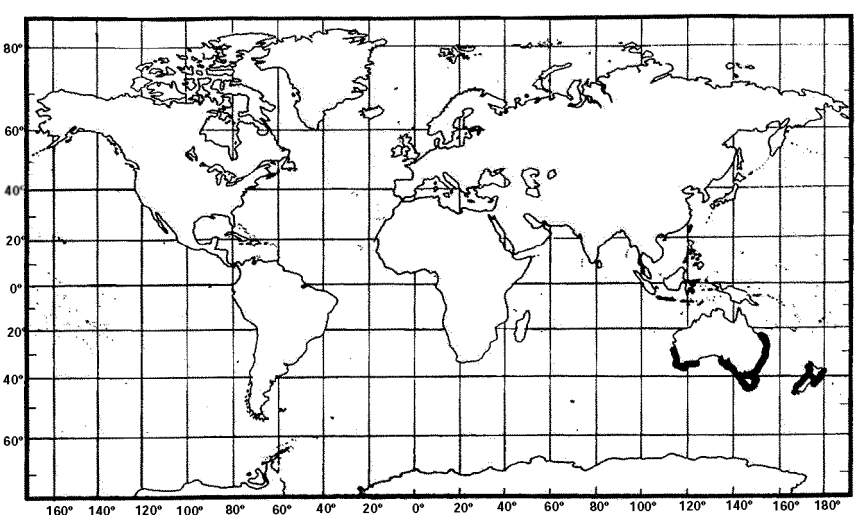
Synonyms : Engraulis encrasicholus var. antipodum Günther, 1868:386 (Van Diemen's Land and New Zealand); Engraulis antipodum:Jordan & Seale, 1926:382 Victoria, Australia); Engraulis antarcticus Castelnau, 1872:186 (Melbourne); Engraulis australis-Blackburn, 1950:4 et seq., (biology; fraseri subsp.nov., W. Australia); Ogilby, 1954:5, fig.4 (Queensland); Munro, 1956:26, fig.182 (Australia, synopsis; subspecies australis, antipodum, fraseri); Scott, Glover & Southcott, 1974:72, fig. (South Australia, as subspecies antipodum ; Grant, 1978:92, fig. (on Munro); Ayling, 1982:105, fig. (New Zealand, synopsis); Hutchins & Thompson, 1983:18, fig.56 (southwestern Australia); Last, Scott & Talbot, 1983:174, fig.13.4 (Tasmania, synopsis); Whitehead & Bauchot, 1986:31 (types of antarcticus).

FAO Names : En - Australian anchovy.



Diagnostic Features : Hardly differs from the European anchovy (E. encrasicolus) and can be identified from that description. For most of its range it is the only anchovy present, but in the extreme north it may overlap with species of Encrasicholina or Stolephorus, which have small needle-like scutes before the pelvic fins; species of Thryssa have compressed bodies and a keel of scutes along the belly.

Geographical Distribution : Southern Australia (from Queensland at about Cape Capricorn south to southern Tasmania; entire southern coast of Australia (except for Great Australian Bight) and north to about Red Bluff, Western Australia), also New Zealand (most of the North Island and all but the southeast coast of the South Island, where it appears to be replaced by Sprattus).



Habitat and Biology : Marine, pelagic, mostly inshore, forming compact schools (much preyed upon by larger fishes, common dolphins and birds); chiefly found in bays, inlets and estuaries, sometimes in lowered salinities, but older fishes tending to move out to sea in winter and back in the spring. Feeds on plankton. Spawns in inlets, bays and also estuaries, probably throughout the year but mainly in late spring to early autumn and especially in the warm summer months (about November to February); eggs ellipsoidal.

Size : Perhaps to as much as 14 cm standard length, but usually to 8 to 12 cm.

Interest to Fisheries : In Australia, mainly exploited in Victoria (especially in Port Phillip Bay), in earlier times chiefly as a **baitfish** for anglers and caught by liftnet; after 1946 caught in greater quantities by beach seine and used for fish paste, but never a large fishery. No special fishery in New Zealand. Catches not recorded by FAO and probably rarely more than about 100 t.

Local Names : AUSTRALIA and NEW ZEALAND: anchovy, Australian anchovy.

click for next page

Literature : Blackburn (1950 - good synopsis, with large bibliography).

Remarks : Blackburn (1950) recognized three subspecies:

a) E. australis australis: mean number of vertebrae 43 to 44; southern Queensland to almost southern boundary of New South Wales

b) E. australis antipodum: mean number of vertebrae 45 to 46; extreme south of New South Wales, Victoria,Tasmania, eastern part of south Australia'

c) E. australis fraseri: mean number of vertebrae 43 to 44; Western Australia

More work is needed to confirm that these really are distinct and not merely a trend to higher meristic counts in cooler waters.

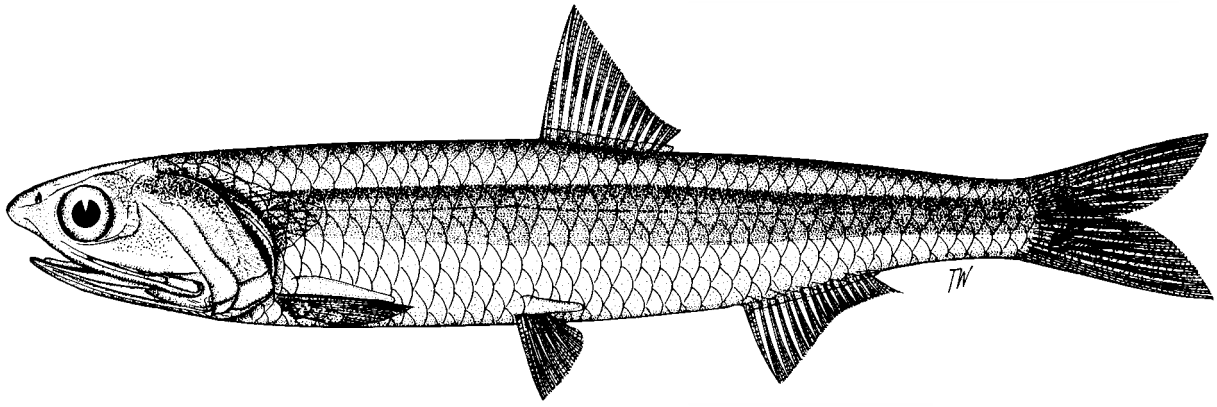
Engraulis capensis Gilchrist, 1913

ENGR Engr 5

Engraulis capensis Gilchrist, 1913, Mar.biol.Rep., Cape Tn, 1:42, fig. (South Africa).

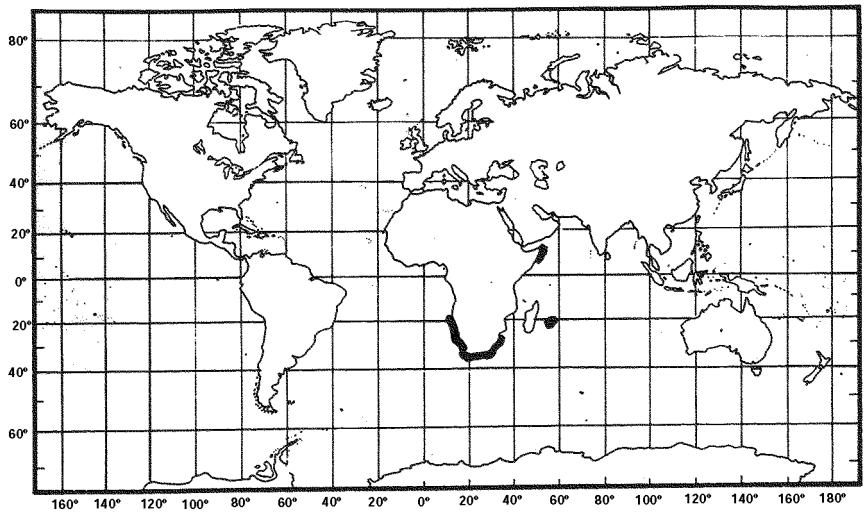
Synonyms : ? Clupea vittargentea Lacepède, 1803:424, 458 (Mauritius, on Commerson MS; nomen dubium); Engraulis encrasicolus:Pappe, 1853:30 (South Africa); Castelnau, 1861:68 (Cape Town); Engraulis japonicus:Smith, 1949:95, fig.123 (synopsis); Wongratana, 1980:219, pls 184, 185 (synopsis, but Japanese material also included); SFSA, 1986:205, fig.55.1 (South Africa); Engraulis capensis-Barnard, 1925:116 (Saldanha Bay, Table Bay, False Bay, Natal); Whitehead, 1964c:885 (Seychelles); Anders, 1965:103 (spawning); Baird & Geldenhuys, 1973: unpaged (biology, fishery); King & Macleod, 1976:18 et seq., (food); Brownell, 1983:181 et seq., (laboratory rearing); Boyd & Hewitson, 1983:71 et seq. (distribution of larvae); Whitehead & Bauchot, 1986:47 (vittargentea discussed).

FAO Names : En - Southern African anchovy.



Diagnostic Features : Hardly differs from the European anchovy (E. encrasicolus) and can be identified from that description. Of other anchovies in southern and eastern African waters, species of Stolephorus have 3 to 7 sharp needle-like scutes along the belly, while species of Thryssa have compressed bodies and a keel of scutes along the belly. See ENGR Engr 4 (as E. japonicus) Fishing Area 51.

Geographical Distribution : Southeastern Atlantic and western Indian Ocean (Atlantic coasts of southern Africa, from Anbola/Namigia border south to Cape Town, then north to about Lourenço Marques; recorded from Mauritius and thé Seychelles, also in upwelling area around Somalia).



Habitat and Biology : Marine, pelagic, coastal, in shallow inshore waters, but also down to about 200 m, forming large schools. Feeds chiefly on calanoid copepods when juvenile, gradually switching to phytoplankton at about 5 cm standard length. Spawns from early spring to late summer (October to April in southern African waters, with a peak in November/December in the south, but in February off Namibia), in coastal waters and not more than 80 km offshore; eggs ellipsoidal.

Size : To 13 cm standard length.

Interest to Fisheries : Not fully exploited in southern African waters until 1965, but in some years then contributing over half the total pelagic fish catch, but with considerable fluctuations, including a tendency for increased catches as the sardine fishery declined. Caught chiefly by purse seines, the anchovy schools sometimes so dense that up to 100 t could be caught in the early days with a single throw (Robinson, 1966); catches increase from April and reach a peak in May. The total catch for 1982 was 389 615 t.

Local Names : SOUTH AFRICA: Kaapse ansjovis.

Literature : Baird & Geldenhuys (1973 - biology, fishery); King & Macleod (1976 - food).

Remarks : The northern limit of this species along the Atlantic coast of Africa is arbitrary since there is perhaps no distributional break between these populations and those of the European anchovy (E. encrasicolus). It is not yet certain that the two are distinct. The Indian Ocean records from Mauritius and the Seychelles may represent strays, but the appearance of Engraulis during upwelling off Somalia seems more regular.

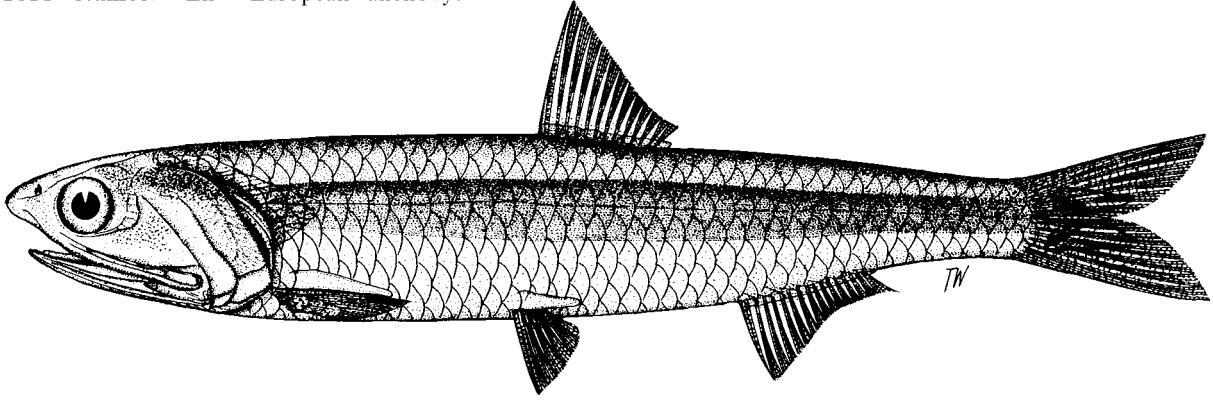
Engraulis encrasicolus (Linnaeus, 1758)

ENGR Engr 1

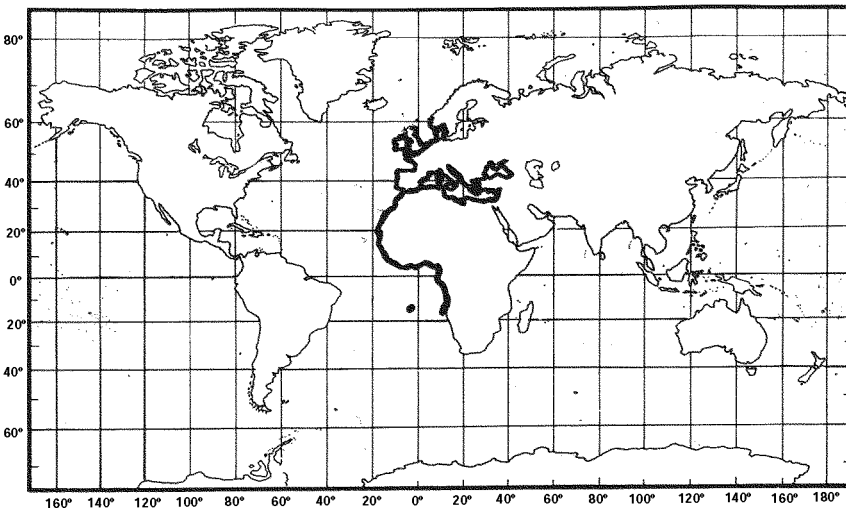
Clupea encrasicolus Linnaeus, 1758, Syst.nat., 10th ed.:318 (European Seas).

Synonyms : Engraulis amara Risso, 1827:456 (southern Europe,? Nice; see Whitehead & Bauchot, 1986:47); Engraulis meletta Cuvier, 1829:323 (on Melet of Duhamel, 1772; see Whitehead & Bauchot, 1986:49); Engraulis vulgaris Nilsson, 1832:25 (Sweden); Engraulis argyrophanus Valenciennes, 1848:49 (Atlantic en route for Cape of Good Hope; see Whitehead, 1969a:125); Engraulis russoi Dulzetto, 1947:27, figs 1-6 (Messina); Scuderi, 1957:242 (var. oliveri from Lago Verde); Anchoviella guineensis Rossigno & Blache, 1961:285 (off Cape Lopez, Gabon and Pointe Noire, Congo); Daget & Iltis, 1965:54, fig.29 (Ebrié lagoon, Ivory Coast); Marchal, 1967:1 et seq. (West Africa, eggs, larvae, key); Engraulis guineensis:Fagetti & Marak, 1972:5 (Senegal to Pointe Noire, Congo, larvae); Anchoa guineensis:Bravo de Laguna & Santaella Alvarez, 1973:32 (21 30' to 16°45'N); Engraulis encrasicolus (misspelt encrasicholus by many authors) - Fage, 1920:6, 33 (Atlantic and Mediterranan races, each with two groups; misspelt encrassicholus); Pusanov, 1926:93 (subspecies atlanticus and mediterraneus after the Atlantic and Mediterranean races proposed by Fage, 1920; also subspecies maeoticus of Black Sea); Aleksandrov, 1927:77, 98 (subspecies atlanticus on Fage's northern group of the Atlantic race and aquitanicus on southern group; also mediterraneus and adriaticus on Fage's eastern and western groups of the Mediterranean race; also ponticus for Adriatic); Majorowa, 1934:18, 19 (subspecies ponticus, natia occidentalis and orientalis); Dulzetto, 1940:397, pls I, 11, figs 2,4 (subspecies symaetensis, Catania, eastern Sicily); Demir, 1963:1 et seq. (synopsis of biology); Bánárescu, 1964:247, figs 108, 109 (larvae) (Black Sea, subspecies ponticus); Svetovidov, 1964a:127, fig.38 (Black Sea, subspecies ponticus and maeoticus; synopsis, very large bibliography); Demir, 1945a:1 et seq. (revision of 1963 version); Tortonese, 1967:59 (subspecies ponticus, maeoticus, symaetensis, also E. russoi); Whitehead, 1967a:125 (types of argyrophanus; meletta discussed); Wheeler, 1969:126 (Europe, synopsis); CLOFNAM, 1973:lll (full synonymy); Wheeler, 1978:71, 74 (fig.) (Europe, synopsis); Bauchot & Pras, 1980:101, p1.10 (synopsis); CLOFRES 1984:43 (Suez Canal, Gulf of Suez); Lloris et al., 1984:60 (list of Catalan refs); FNAM, 1984:282, fig. (synopsis, misspelt encrasicholus); Whitehead & Bauchot, 1986:30, 31, 49 (types of argyrophanus, guineensis and meletta); CLOFETA, in press (synonymy).

FAO Names: En - European anchovy.



Diagnostic Features : Body slender, elongate, oval in cross-section, its depth about 6 times in standard length. Snout pointed; maxilla short, tip blunt, reaching almost to front border of pre-operculum, not projecting beyond tip of second supra-maxilla; tip of lower jaw reaching to below nostril. Lower gillrakers 27 to 43; gillrakers present on hind face of third epibranchial. Pseudobranch longer than eye, reaching onto inner face of operculum. Anal fin short, with iii 13 to 15 finrays, its origin well behind base of last dorsal finray. A silver stripe along flank, disappearing with age. Unmistakable since the only anchovy species in its range. See ENGR Engr 1, Fishing Areas 34, 47 (part), also 37.



Geographical Distribution : Eastern North and Central Atlantic (coasts of Europe south from about Bergen, Norway, but not Baltic and rare in the north; whole Mediterranean and Black and Azov seas, with stray individuals in Suez Canal and Gulf of Suez; southward along coast of West Africa to Angola, also recorded from St. Helena).

Habitat and Biology : Mainly marine, pelagic, coastal and forming large schools, but recorded down to 400 m depth off West Africa and descending in winter to 100 to 150 m depth in the Mediterranean; euryhaline tolerating salinities of 5 to 41°/oo and in some areas entering lagoons, estuaries or lakes, especially in the warmer months during the spawning season. A tendency to extend into more northern waters in summer and generally to move into the surface layers, retreating and descending in winter. Feeds on planktonic organisms, especially calanoid copepods, cirrepede and mollusc larvae, and fish eggs and larvae. Spawning over an extended period from April to November with peaks usually in the warmest months, the limits of the spawning season dependent on temperature and thus more restricted in northern areas. Eggs ellipsoidal to oval, floating in the upper 50 m, hatching in 24 to 65 hours.

Size : To 20 cm standard length, but usually about 12 to 15 cm, those in tropical waters smaller than those in northern waters.

Interest to Fisheries : Chiefly caught in the Mediterranean and adjacent seas. The total catch in 1982 was 688 016 t (Turkey and USSR both over 200 000 t, but catches of over 50 000 t frequently recorded for Italy and only a little less by Spain). Caught by purse seines, lampara nets, beach seines and also by midwater trawl in winter. Usually canned, salted or processed, but also marketed fresh or frozen in African countries.

Local Names : A long list of names is given by Demir (1963), of which the most common are: ALGERIA: Anchovba; FRANCE: Anchois; ITALY: Acciuga; ROMANIA: Hamsia; SPAIN: Anchoa, Boquerón; USSR: Hamsa.

Literature : Demir (1963, 1965a - excellent summary of biological data, good bibliography), Svetovidov (1964a - Black Sea, very large list of references), Bànàrescu (1964 - Black Sea, synopsis); see also CLOFNAM and CLOFETA for large synonymies.

Remarks : The southern limit of the species was formerly considered to be Morocco, with accidental strays south to Cape Blanc (CLOFNAM, 1973:112). Whitehead (1964c) extended the range to West Africa as far south as Angola and St. Helena. The southern limit at the Angola/Namibia border is arbitrary since there is perhaps no distributional break between these populations and those of the Southern African anchovy (here recognized as E. capensis).

Attempts to split the European anchovy into races and even subspecies have not been wholly successful. Svetovidov (in CLOFNAM, 1973:111) thought that only E. russoi of Aleksandrov (1927) and E. russoi var. oliveri of Scuderi (1957:242 - Lago Verdi) might prove to be subspecies, but more studies are needed.

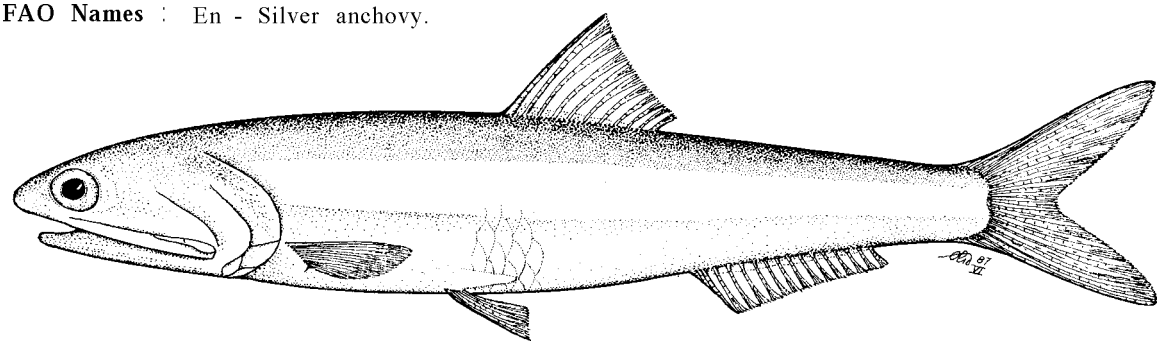
The relationship of the encrasicolus-group to anchoita, mordax and ringens of the New World is discussed under the genus.

Engraulis eurystole (Swain & Meek, 1884) | ENGR Engr 3

Stolephorus eurystole Swain & Meek, 1884, Proc.Acad.nat.Sci.Philad., 36:35 (Woods Hole, Massachusetts).

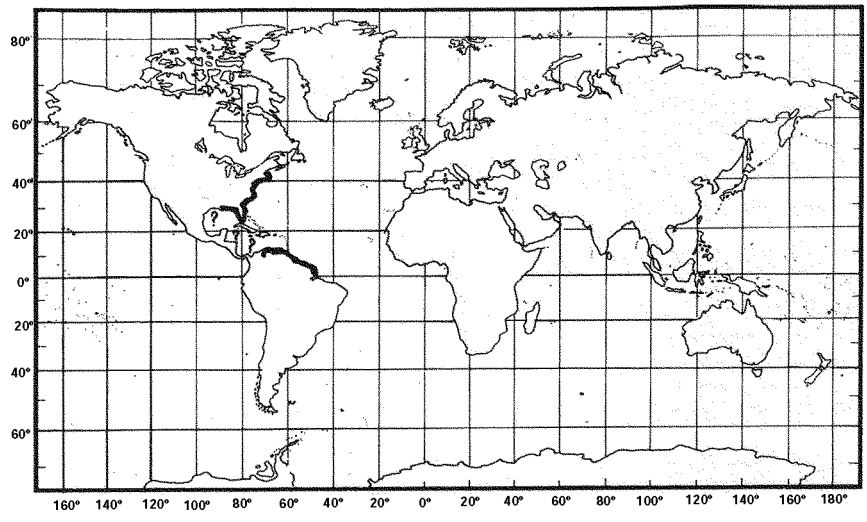
Synonyms : Stolephorus perfasciatus:Swain, 1883:55 (Woods Hole); Stolephorus argyrophanus:Jordan & Evermann, 1896:444 Gulf Stream, occasionally northward); Anchovia argyrophana Sumner, Osborn & Cole, 1913:743 (Woods Hole); Anchoviella argyrophanus Jordan & Seale 1926:402 (Provincetown, Massachusetts); Jordan, Evermann & Clark, 1930:48 (eurystole a synonym); Anchoviella estauquae Hildebrand, 1943:115, fig.48 (Gulf of Venezuela); FWNA 1964:211, fig.45 (repeat); Cervigón, 1966:145 (Venezuela); Whitehead, 1964c:884 (Tobago; spelling corrected to estanquae following Hubbs, 1953); Anchovia eurystole: Fowler, 1906:109 (New Jersey); Anchoviella eurystole: Hildebrand, 1943:112 fig.47 (Woods Hole to Beaufort, North Carolina); FWNA, 1964:208, fig.44 (synopes); Daly, 1970:100 (Miami, Florida; also E. estauquae); Engraulis eurystole-Whitehead, 1973a:91, figs 32, 33 (jaws) (Tobago, Trinidad, Guyana, Surinam); Hastings, 1977:116 (northern Gulf of Mexico at Choctawhatchee Bay, Florida).

FAO Names : En - Silver anchovy.



Diagnostic Features : Hardly differs from the European anchovy (see E. encrasicolus) and can be identified from that description. Differs from Atlantic species of Anchoviella by its much longer pseudobranch (more than eye diameter and reaching onto inner face of operculum); differs from Atlantic species of Anchoa in its short and blunt-tipped maxilla (cf. pointed and reaching onto pre-operculum or beyond). See ENGR Engr 3, Fishing Area 31.

Geographical Distribution : Western North and central Atlantic (from Massachusetts south to Florida, north-eastern Gulf of Mexico - at least to about Mississippi Sound, but not recorded elsewhere - and Venezuelan coast south to northern Brazil at 2°19'N).



Habitat and Biology : Marine, pelagic, coastal and forming compact schools; down to about 65 m depth, but commonly in shallow sheltered waters, harbours, etc. Soawnino peak in July/ August (Nichols & Breder,1927:44); eggs ellipsoidal.

Size : To 10.7 cm standard length.

Interest to Fisheries : Little or none in northern areas, but perhaps enters artisanal fisheries in the southern part of its range.

Local Names :

Literature : FWNA (1964 - synopsis, notes on eggs and larvae).

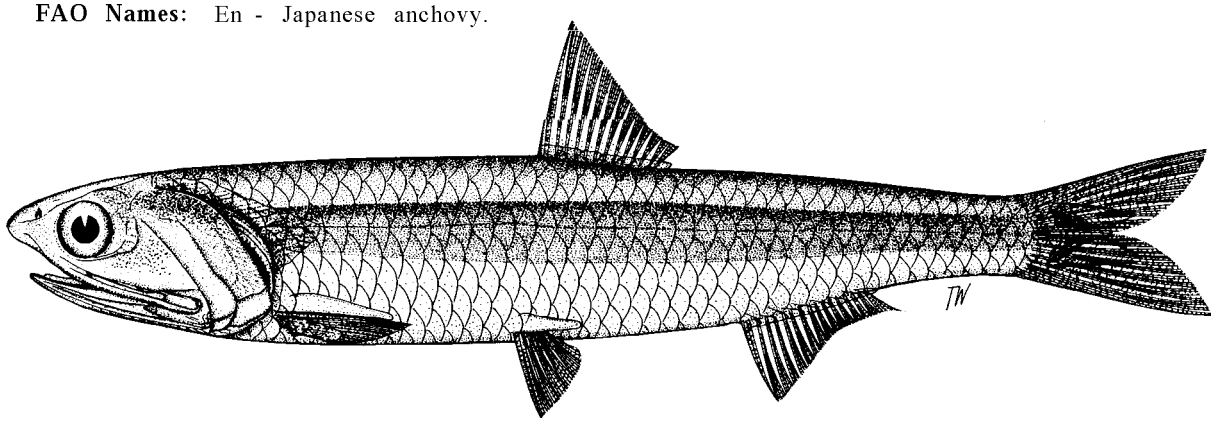
Remarks : Hildebrand (1943) separated the northern eurystole from the southern estanquae, but Whitehead (1973a:94) found no consistent differences. The separation of E. eurystole from E. encrasicolus is similarly difficult to define, especially when comparing fishes from the warmer waters (which seem to reach a smaller adult size).

Engraulis japonicus Temminck & Schlegel, 1846 — ENGR Engr 4

Engraulis japonicus Temminck & Schlegel, 1846, Fauna Japonica,Poiss., pt.13:239, pl. 108, fig.3 (southwest Japan).

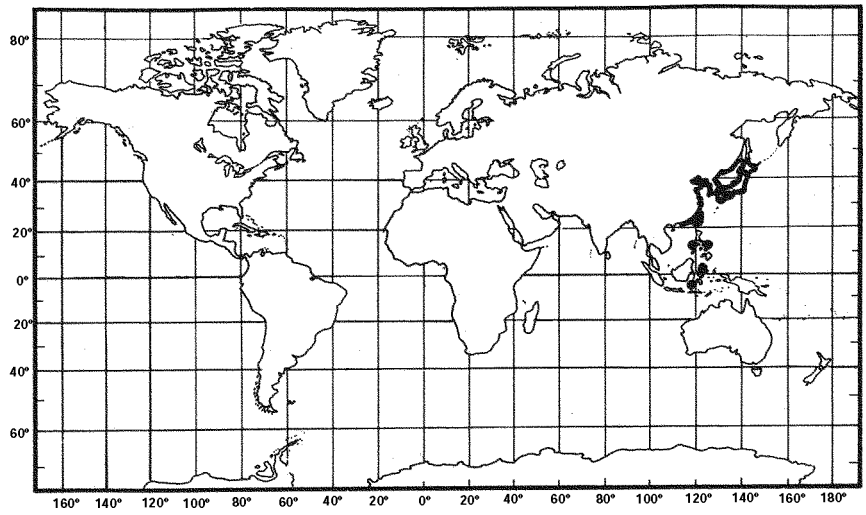
Synonyms : Atherina japonica Houttuyn, 1782:340 (= nomen dubium - see Note below); Engraulis zollingeri Bleeker, 1849c:69,73 (Macassar, = Ujung Pandang, Sulawesi, Indonesia; zollingeri of subsequent authors is Encrasicholina punctifer); Stolephorus celebicus Hardenberg, 1933a262 (Manado, Sulawesi); Engraulis japonicus (or incorrectly japonica; Engraulis is masculine) Fowler, 1941d:694 (Japan, Korea, large synonymy); Hayashi & Tadokoro, 1962b:30, figs 1,2 (heads) (Japan, comparison with 'Stolephorus zollingeri'); Whitehead, 1964c:885 (Sulawesi, zollingeri = japonicus); Whitehead, Boeseman & Wheeler, 1966:109, pl.14 fig.2 (Bleeker's fig.) (types of zollingeri); Hayashi, 1967:44 et seq. (Japan, biology, fishery); Shen, 1969:21, figs 3,4 (gillrakers), 5 (gut) (gill structure and food); Idem., 1971:101 et seq. (Taiwan Island, synopsis of biology, fishery). Note: Houttuyn's name japonica, variously applied to species of Engraulis, Stolephorus and Spratelloides with consequent confusion, was considered a nomen dubium by Whitehead, 1963b and was subsequently suppressed by the International Commission by Opinion 749 of 1965.

FAO Names: En - Japanese anchovy.



Diagnostic Features : Differs very little from the European anchovy (see E. encrasicolus) and can be identified from that description. Of other anchovies found in the southern part of its-distribution, only species of Encrasicholina and Stolephorus are similar in appearance (slender, rather round-bodied), but all have small spine-like scutes before the pelvic fins (usually 2 to 7 scutes, but occasionally 1 or very rarely none in S. commersonii). Species of Thryssa have compressed bodies and a keel of scutes along the belly.

Geographical Distribution : Western North and central Pacific (southern Sakhalin Island, Sea of Japan and Pacific coasts of Japan, and south to almost Canton/Taiwan Island; rare records off Philippine coasts (Luzon, western Mindanao) and from Manado and Ujung Pandang, Sulawesi, Indonesia).



Habitat and Biology : Marine, pelagic and near the surface, mainly coastal, but to over 1000 km from the shore, forming large schools, tending to move more northward and inshore (into bays and inlets) in spring and summer, but without well-defined migrations. Feeds on copepods (the post-larvae chiefly taking the eggs and nauplii), but also on other small crustaceans, and molluscan larvae, as well as fish eggs and larvae; the data given by Shen (1969:tab.3) suggest that diatoms form an important food item in juveniles and adults, as might be expected by analogy with E. capensis. Spawns throughout the year, with peaks in winter and early spring in southern parts of Japan, and in spring and in autumn in the Pacific waters of central Japan and off northern Taiwan Island, mainly in the second year of life; eggs ellipsoidal, hatching in about 30 hours at 20 to 25° C, or 48 hours at 18° C.

Size : To about 16 cm standard length, usually about 12 to 14 cm.

Interest to Fisheries : Fished commercially in Japan since the 10th century; abundant catches from about 1890 to 1912, fluctuating to 1930, a decline, followed by an increase and further fluctuations, usually inversely correlated with fluctuations in the catch of sardines (Sardinops melanostictus). Not only adults, but post-larval stages (sirasu in Japan) exploited. Mostly caught by two-boat purse seines (60%) and boat seines, in autumn in northern parts of Japan, in spring and autumn in the Sea of Japan. The total catch in 1982 was 359 709 t.

Local Names : JAPAN: Katakuchi-iwashi.

Literature : Uchida et al. (1958 - good illustration of eggs and larvae), Hayashi (1967 - synopsis of biology and fishery), Shen (1969, 1971 - feeding, general biology), Jiang & Zheng (1984 - eggs and larvae).

Remarks : The Philippine and Indonesian records seem to represent stray fishes; as yet there is no indication that the Japanese anchovy is geographically linked to the Australian anchovy.

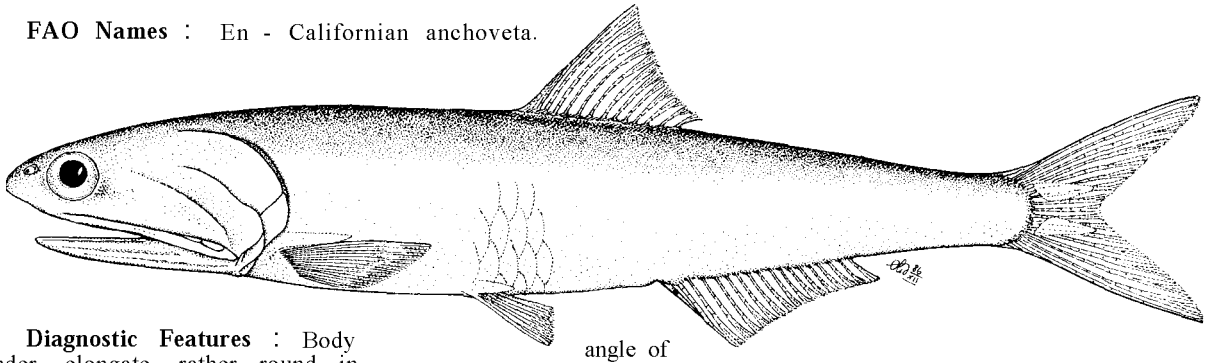
Engraulis mordax Girard, 1856

ENGR Engr 8

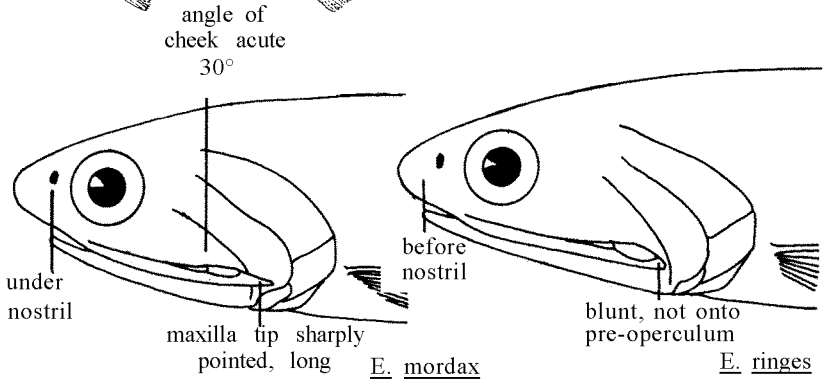
Engraulis mordax Girard, 1856, Proc.Acad.nat.Sci.Philad., 7:138 (San Francisco; not Shoalwater Bay, Washington as sometimes stated).

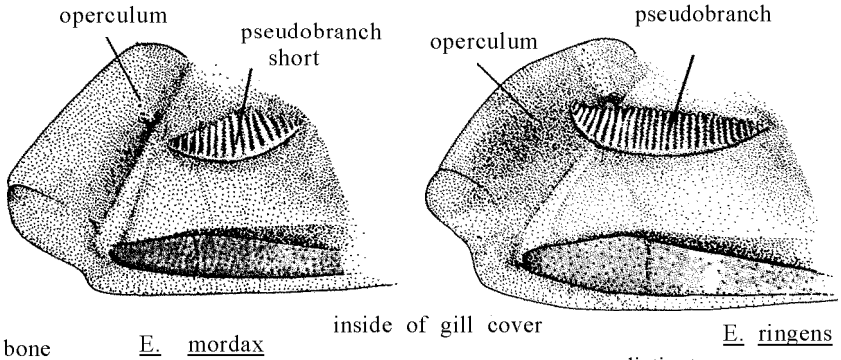
Synonyms : Engraulis nanus Girard, 1858:335 (San Francisco); Anchovia maui Fowler & Bean, 1923:4 (Maui, Hawaii; error, presumably eastern Pacific); Engraulis mordax-Hubbs, 1925:14 (California Bay to Coronado; subspecies mordax and nanus); Jordan & Seale, 1926:389 (San Francisco); Hildebrand, 1943:14, 15, figs 1,2 (mordax and nanus) (probably full range of species); Miller, 1956:2O et seq. (fishery biology); Ahlstrom, 1956:33 et seq.,figs 14, 15 (very good drawings of eggs and larvae) (Point Conception to Point San Juanico); Loukashkin & Grant, 1965:635 et seq. (reactions to light); Messerschmidt, 1969:17 et seq. (various contributions on abundance, distribution and exploitation); Whitehead, 1973a:89 (relationships); Hart, 1973:104, fig. (synopsis, good bibliography); Hubbs et al., 1979:7 (California; subspecies mordax and nanus); Hewitt, 1980:2 to 101 (figs of larval distribution); Horn & Allen, 1981:53 (upper Newport Bay, California, ecology); Eschmeyer, Herald & Hamman, 1983: 74, pl. 7 (synopsis).

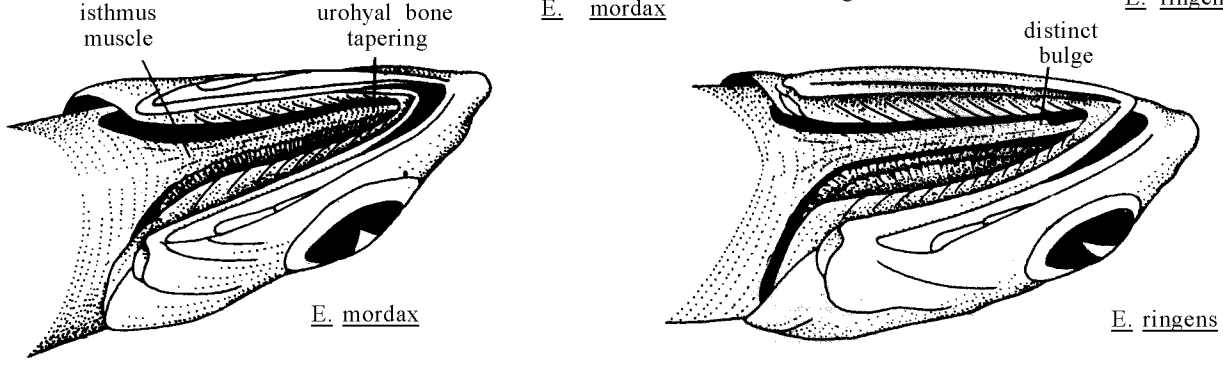
FAO Names : En - Californian anchoveta.

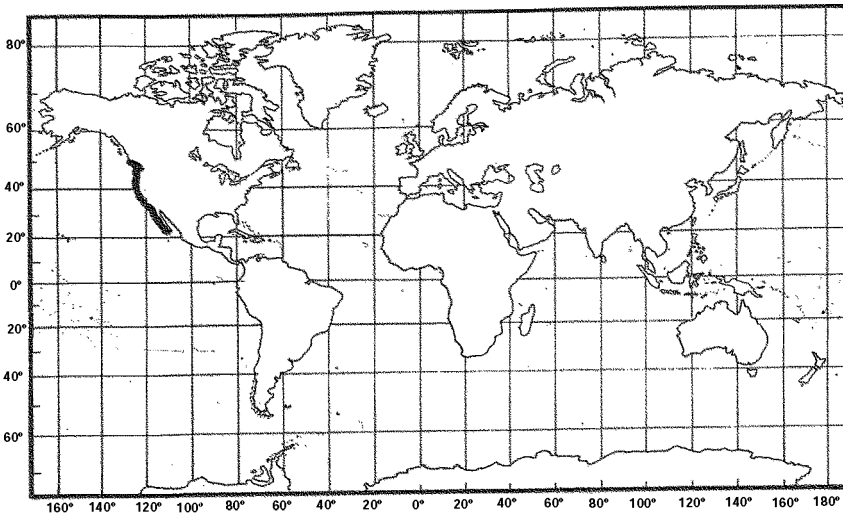


Diagnostic Features : Body slender, elongate, rather round in cross-section, its depth about 5 to 6 times in standard length. Snout quite sharply pointed; maxilla moderate, tip sharply pointed, reaching to or almost to hind border of pre-operculum, projecting well beyond tip of second supramaxilla; tip of lower jaw below nostril. Lower gillrakers 37 to 45, long and slender; no gillrakers on hind face of third epibranchial. Anal fin origin under about base of last dorsal finray or a little behind. A silver stripe along flank in young individuals, disappearing with age. The high number of gillrakers distinguishes it from all Pacific species of Anchoa (to 32 in A. delicatissima, but maxilla longer and sharply pointed and anal fin origin under front part of dorsal fin base). Anchoviella balboae (gillrakers to 33) is not found north of Panama.









Geographical Distribution : Eastern North Pacific (northern part of Vancouver Island south to Cape San Lucas, Baja California).

Habitat and Biology : Marine, pelagic, usually coastal and within about 30 km of shore, but to 480 km and down to 219 m depth, forming large tightly packed schools; enters bays and inlets (e.g., to about 2 km up Newport Bay, mainly in July and September - Horn & Allen, 1981:53). Feeds on euphausiids, copepods and decapod larvae (at least in British Colombia - Hart, 1973:105), both by random filter-feeding and by 'pecking' at individual prey. Spawns from British Colombia south to Magdalena Bay, Baja California, but most abundantly between Point Conception and Point San Juanico (about 35° S to 25° S); spawns throughout year, either in inlets or offshore, mainly in winter and early spring (January to March or April), but depending on hydrological conditions (preferred temperatures 10 to 23.3°C in upper water layers and around 22.00 hours); eggs ellipsoidal, floating perpendicular at first, later horizontal, hatching in 2 to 4 days.

Size : To 24.8 cm total length (about 20.5 cm standard length), usually about 12 and 14 cm standard length at 2 and 3 years.

Interest to Fisheries : Restricted by law solely as a **baitfish** in California in 1949 to 1955, but since then also used for canning or processing into **fishmeal** or oil, as also in British Colombia in the 1940s when very abundant. Wide fluctuations in populations, partly in relation to hydrology, but complicated by the relation with the also fluctuating populations of the California pilchard (Sardinops caeruleus). The recorded catch in 1982 was 294 859 t (247 997 t by Mexico), fished with lampara nets, but after about 1946 mainly by purse seines.

Local Names : FAO Yearbook: North Pacific anchovy; USA: Northern anchovy (AFS list).

Literature : Hart (1973 - good summary).

Remarks : Three subpopulations were proposed by McHugh (1952), but Miller (1956:23) doubted this. Hubbs (1925) and Hildebrand (1943) recognized two subspecies:

(a) E. mordax mordax: body more elongate, its depth 5 to 6 times in standard length; head shorter, about 3.25 to 3.75 times in standard length; vertebrae usually 45 or 46; adults to 14 cm standard length or more; British Colombia to Baja California.

(b) E. mordax nanus: body rather deeper, its depth 4.75 times in standard length; head longer, about 3 times in standard length; vertebrae usually 43 or 44; adults generally to less than 8 cm standard length; Bays of California.

Although the Californian anchoveta is superficially very similar to the Peruvian anchoveta (E. ringens) and appears to have a similar biology, the two differ in characters which fully justify their separation at species level:

	E. mordax	E. ringens
(a)	Tip of lower jaw reaching only to below nostril	Tip of lower jaw reaching to midpoint of snout, i.e. before nostril
(b)	Maxilla tip sharply pointed, reaching to hind border of pre-operculum	Maxilla tip blunter, reaching only to front border of pre-operculum
(c)	Angle of cheek very acute (about 30°)	Angle of cheek less acute (about 40°)
(d)	Pseudobranch as long as eye, not reaching onto inner face of operculum	Pseudobranch longer than eye, reaching onto inner face of operculum
(e)	Urohyal bone (attachment of isthmus muscle) only slightly bulging anteriorly	Urohyal bone with a very strong bulge on lower edge at point where isthmus muscle ends

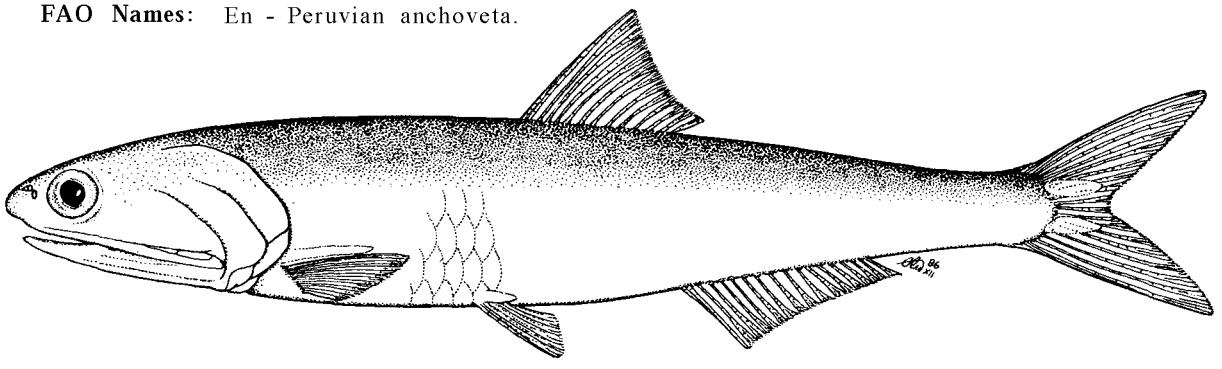
Engraulis ringens Jenyns, 1842

ENGR Engr 7

Engraulis ringens Jenyns, 1842, Zool.voy.Beagle, fishes:138 (Callao, Peru).

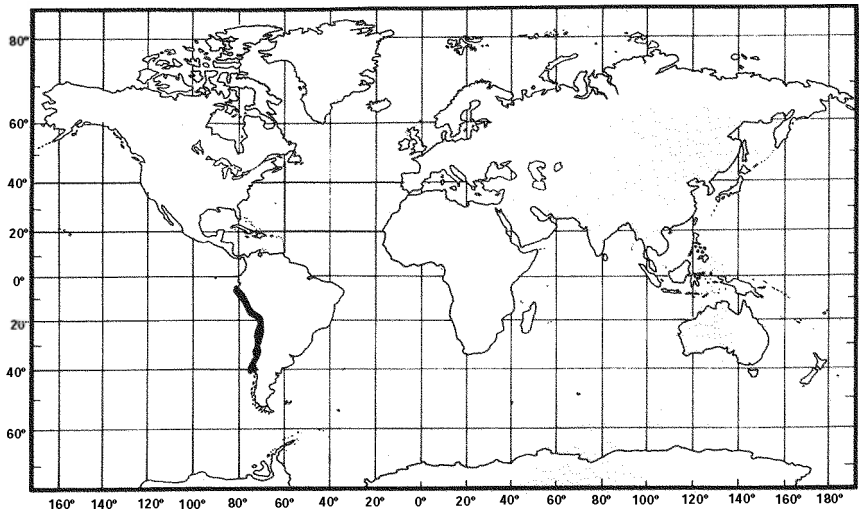
Synonyms : Engraulis pulchellus Girard, 1856:199 (Caldera Bay, Chile); Engaulis tapirulus Cope, 1877:45 (Pacasmayo Bay, Peru - identification given by Böhlke, 1984:101 based on Type); Stolephorus tapirulus: Abbott, 1899:335 (types); Anchoviella tapirulus:Fowler, 1941a:235 (listed); Engraulis ringens:Delfin, 1901:41 (Chile refs); Jordan & Seale, 1926:390 (Callao, Peru; Panama fish = Anchoa arenicola); Hildebrand, 1943:16, fig.3 (various localities in Chile and Peru); Fowler, 1944:19 (large list of Chile refs);Hildebrand, 1946; 97, fig.20 (off Cañete, Chimbote, Lobos de Tierra, Peru); Mann, 1954:137, fig. (synopsis); Fischer, 1958:lll et seq., figs 1 to 3 (Chile, eggs and larvae); De Buen, 1958:102 (Chile, good list of Chile refs); Jordan, 1963:27 et seq. (Peru, vertebrae); Einarsson & Rojas de Mendiola, 1963:5 et seq. (Peru, eggs and larvae); Saetersdal & Valdivia, 1964:88 et seq. (Chile, fecundity, maturation); Whitehead, 1973a:89, fig.30c (maxilla) (relationships); Pequeño & Moreno, 1979:98, fig.59 (bad) (synopsis); Bore & Martinez, 1981: unpaged fig. (photo) (synopsis); Leible & Alveal, 1982:20, fig. (Concepción, Chile, synopsis); Sharp & Csirke (eds), 1983:987, 1011, 1027 (three papers on growth, recruitment, egg mortality and distributions).

FAO Names: En - Peruvian anchoveta.



Diagnostic Features : Body slender, elongate, rather round in cross-section, its depth about 4.5 to 5.5 times in standard length. Snout pointed; maxilla short, tip bluntly rounded, reaching to but not beyond front border of pre-operculum, projecting beyond tip of second supra-maxilla;tip of lower jaw in front of nostril. Lower gillrakers 38 to 49, long and slender, increasing with size of fish; no gillrakers on hind face of third epibranchial. Anal fin origin well behind base of last dorsal finray. A silver stripe along flank in young individuals, disappearing with age. The high number of gillrakers distinguishes it from all Pacific species of Anchoa: other anchovies that may be sympatric in northern Peru are deeper-bodied and more compressed (Anchovia, Cetengraulis).

Geographical Distribution : Eastern South Pacific (norbhern Peru from about Aguja Point at 6 S southward to Chiloë, Chile at 42° 31'S, the distribution dependant on the coastal extent of the Peru Current).



Habitat and Biology : Marine, coastal, mainly within 80 km of coast, but occasionally as far out as 160 km, forming huge schools, chiefly in surface waters (descending in daytime to up to 50 m, rising at night). Entirely dependant on the rich plankton of the Peruvian Current, its northern distribution limited in Peruvian waters in years when a 'tongue' of warmer and less saline surface water extends southward over the northbound coastal Peru Current (the so-called El Niño phenomenon). Feeds on plankton by filter-feeding, with up to 98% diatoms recorded in some studies (chiefly Coscinodiscus, Schroderella, Skeletonema and Thalassothrix); copepods, euphausiids, fish eggs and dinoflagellates also taken. Breeds throughout year along entire coast of Peru, but with a major spawning in winter/spring (July to September) and a lesser one in summer (February and March); also throughout year off Chile, with peaks in winter (May to July) and the end of spring (especially December); mature at about I year (about 10 cm standard length); eggs ellipsoidal. Attains about 8 cm standard length in 6 months, 10.5 cm in 12 months and 12 cm in 18 months; longevity about 3 years.

click for next page

Size : To about 20 cm standard length.

Interest to Fisheries : The most heavily exploited fish in world history, yielding 13 059 900 t in 1971, but with great fluctuations and a decline since that year. The total catch in 1982 was 1 831 627 t (94% from Peru, 6% from Chile), used almost wholly for reduction. The fishes are recruited to the fishery at about 8 cm standard length at age 5 or 6 months. They are caught by purse seine vessels (known as bolicheras in Peru). A good summary of the dynamics of the fishery is given by Schaeffer (1967) and the state of the fishery is monitored in publications by the Instituto del Mar del Peru in cooperation with FAO (in Boletins and Informes of the Instituto).

Local Names : CHILE: Anchoveta (Arica), Chicora (Iquique), Sardina bocona (Valparaiso), Sardina (Talcahuano, San Vicente); PERU: Anchoveta, Anchoveta peruana.

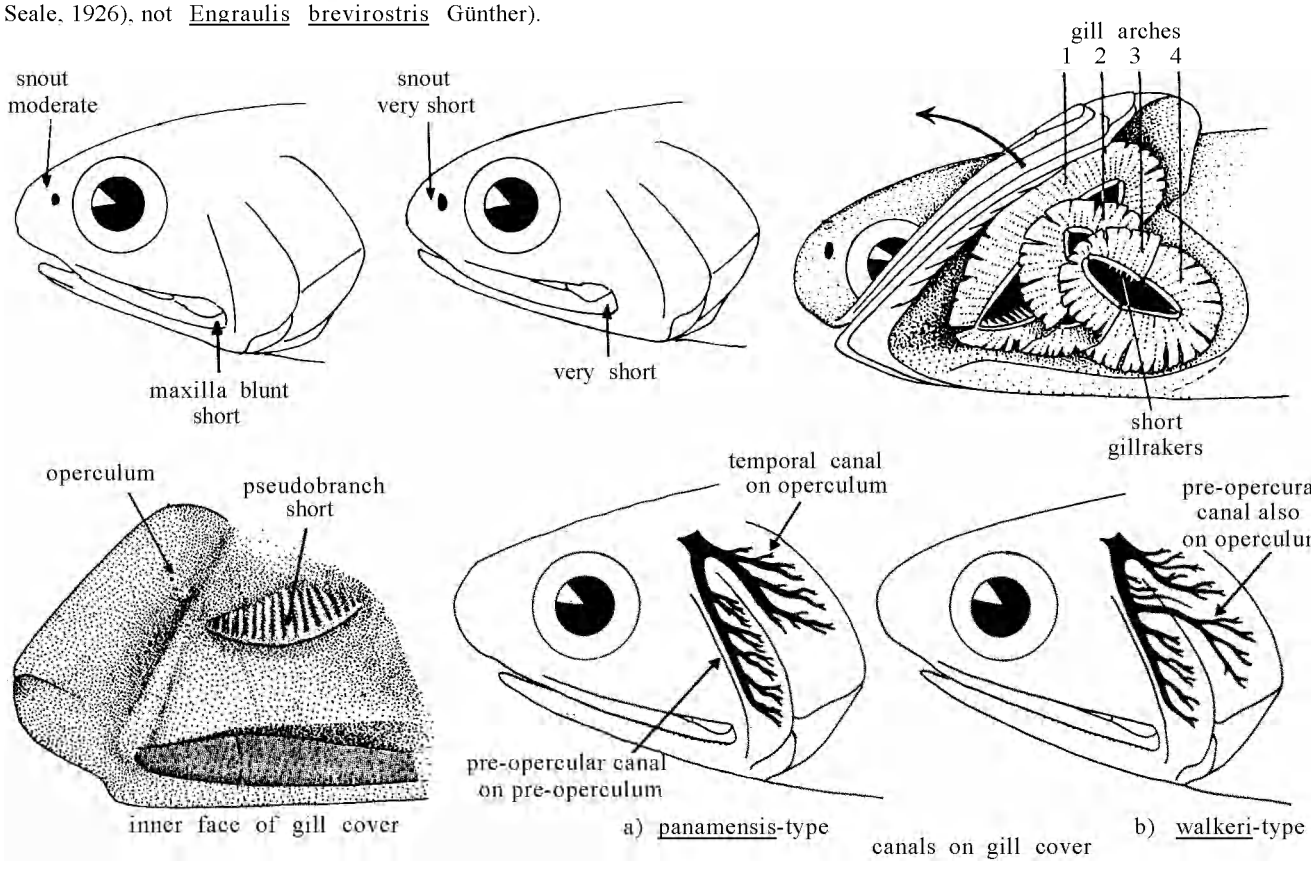
Literature : Numerous papers in recent years, especially on the fishery; additional earlier references given in Jordan & Chirinos de Vildoso (1965) and Schaefer (1967).

Remarks : Distinctions between this species and the Californian anchoveta (E. mordax) are discussed under the latter species.

Anchioviella Fowler, 1911

ENGR Anchoviel

Anchoviella Fowler, 1911, Proc.Acad.nat.Sci.Philad., 43:211 (type: Engraulis perfasciatus Poey). Amplova Jordan & Seale, 1925, Copeia, (1):31 (type: Anchovia brevirostra Meek & Seale = Anchoviella balboae (Jordan & Seale, 1926), not Engraulis brevirostris Günther).



Diagnostic Features : Fairly small, somewhat compressed anchovies. (to 12 cm standard length, usually about 6 to 8 cm, but some that may only attain 3 cm). Snout pointed in some, bluntly rounded and very short in others (scarcely longer than pupil); maxilla short (not or only just reaching to front margin of pre-operculum), tip blunt, barely extending beyond tip of second supra-maxilla; fine teeth on lower jaw; gillrakers slender, increasing in larger fishes in some species (lower gillrakers as few as 14 to 18, usually about 20 to 25, but to 30 or even 35 in some); gillrakers present on hind face of third epibranchial. Pseudobranch shorter than eye, not reaching onto inner face of operculum. Canals on gill cover with (walkeri-type) or without (panamensis-type) a pre-opercular branch passing back onto the operculum to run downward parallel to the temporal canal. Dorsal fin origin at about midpoint of body; anal fin short, moderate or long (10 to 15 branched rays in some, usually about 15 to 22, but 28 to 34 in A. analis), its origin usually below dorsal fin base (but behind base of last dorsal finray in some). The short and blunt maxilla distinguishes Anchoviella from Anchoa, and the short pseudobranch distinguishes it from Engraulis of the Atlantic.

Biology, Habitat and Distribution : Marine, estuarine and/or purely freshwater; Atlantic and Pacific coasts and drainage of North, central and South America. Some species filter-feed on small planktonic organisms, those with few gillrakers feed on larger animals (crustaceans, etc.).

Species : Hildebrand (1943), in the first comprehensive revision of the genus, recognized 19 species. More recent studies (Whitehead, 1973a; Cervigón, 1982; Nelson, unpublished) have removed some of Hildebrand's species to other genera (Engraulis, Anchovia) or included others since described or placed in synonymies, to make 13 Atlantic species and 2 Pacific species (total 15 species). A number of further species from the Amazon have been recognized and await description (chiefly by Dr G. Nelson). To aid identification, the species are arranged geographically (north to south) for each region and the purely freshwater species are listed separately (excluding those that may penetrate into freshwater from estuaries):

Atlantic only :

A. blackburni Hildebrand, 1943 Western central Atlantic
A. elongata (Meek & Hildebrand, 1923) Western central Atlantic
A. perfasciata (Poey, 1860) Western central Atlantic

A. brevirostris (Günther, 1868) Western central and South Atlantic
A. cayennensis (Puyo, 1945) Western central and South Atlantic
A. lepidentostole (Fowler, 1911) Western central and South Atlantic

Pacific only :

A. analis Miller, 1945 Northern part of eastern central Pacific
A. balboae (Jordan & Scale, 1926) Southern part of eastern central Pacific

Freshwater :

A. alleni (Myers, 1940) Upper Amazon
A. carrikeri Fowler, 1941 Upper to lower Amazon
A. guinanensis (Eigenmann, 1912) Middle and lower parts of Orinoco south to Amazon
A. jamesi (Jordan & Seale, 1926) Upper and middle parts of Orinoco south to Amazon
A. manamensis Cervigón, 1982 Lower parts of Orinoco and Guyanas rivers
A. nattereri (Steindachner, 1880) Lower part of Amazon
A. vaillanti (Steindachner, 1908) Sâo Francisco River

Remarks : The definition of the genus Anchoviella has relied mainly on the short and blunt maxilla (cf. long and pointed in Anchoa), coupled with the absence of those specialized features that characterize other New World genera (Anchovia, Centegraulis, Lycengraulis, Pterengraulis). The posterior anal fin origin in A. perfasciata and A. cayennensis (behind dorsaal fin base) and the tendency for the posterior frontal fontanelles to be occluded in larger specimens, allies these two species with Engraulis sensu stricto (which has a long pseudobranch). The very long anal fin in A. **analis** allies it with the Anchoa panamensis-group, where it would be placed but for its short and blunt maxilla.

The following nominal species certainly or probably do not belong in Anchoviella.

Engraulis iquitensis Nakashima, 1941 (Peruvian Amazon)
Does not accord with any described species of Anchoviella of the upper Amazon (A. **alleni**, A. carrikeri, A. **jamesi**). With reservations it is identified as Lycengraulis batesii.

Anchoviella miarcha (Jo dan & Gilbert, 1882) (Mazatlan, Mexico)
The types are lost and the name is best regarded as a nomen dubium (Nelson, 1983:49)

Anchovia scitula Fowler, 1911 ('San Diego, California')
The hoiotype is the Indo-Pacific Stolephorus indicus (Nelson, 1983:49)

Anchoviella parri Hildebrand, 1943:131, fig.58 (San Felipe Bay, Gulf of California)
An upper Gulf form of A. lucida, perhaps a distinct species

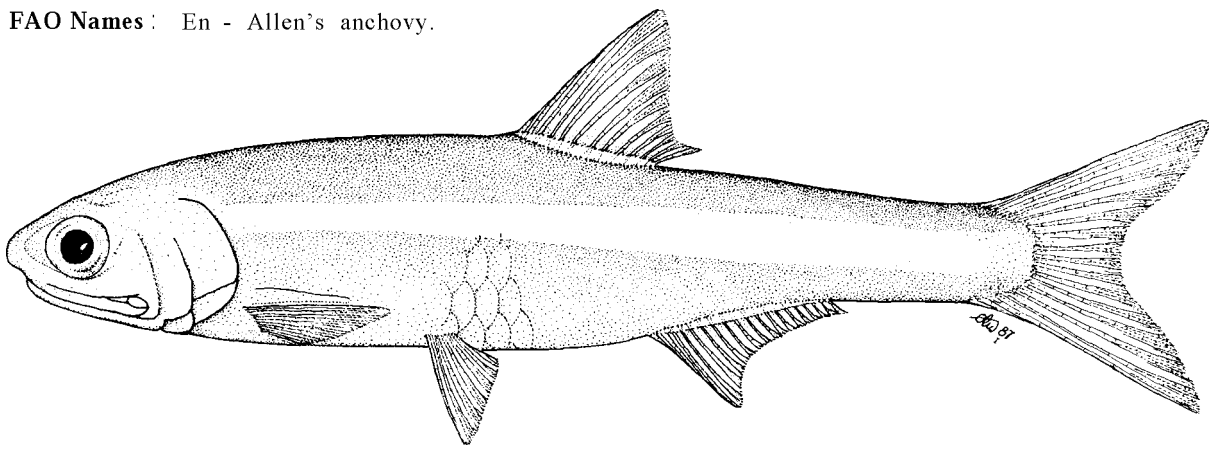
Anchoviella alleni (Myers, 1940)

ENGR Anchoviel 2

Amplova **alleni** Myers, 1940, Proc.Calif.Acad.Sci., 23(29):441 (Lake Cashiboya, Ucayali and Morona Rivers, Peruvian Amazon system).

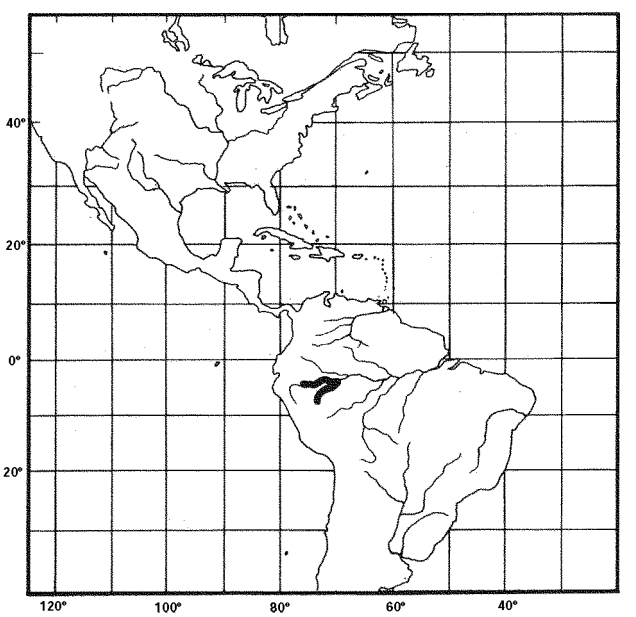
Synonyms : Anchoviella guianensis:Whitehead, 1973a:157 (**alleni** placed in synonymy, no specimens seen); Amplova **alleni**:Eigenmann & Allen, 1942:333, pl.22, fig.3 (photo)(Lake Cashiboya, Ucayali and Morona Rivers); Anchoviella alleni-Hildebrand, 1943:124, fig.53 (Lake Cashiboya and Morona River at Gosulimacocha); Fowler, 1948:18, fig.10 (compiled).

FAO Names : En - Allen's anchovy.



Diagnostic Features : Body fairly slender, moderately compressed, its depth about 5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla short, failing to reach pre-operculum by about 1/2 pupil diameter; lower gillrakers 24 or 25; gill cover pattern not recorded. Anal fin fairly short, with iii 15 to 18 finrays, its origin below or a little behind base of last dorsal finray. A silver stripe along flank, up to eye diameter in depth. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: the marine and estuarine A. lepidentostole and A. brevirostris (also snout much shorter), and the fresh water A. guianensis and A. carrikeri gillrakers not more than 26 and 24; also, A. guianensis in middle and lower parts of Amazon and in Orinoco).

Geographical Distribution : Upper Amazon system (Lake Cashiboya, Ucayali, Marañon and Morona Rivers).



Habitat and Biology : Fresh water lacustrine and riverine, in upper reaches. More data needed.

Size : To 8.8 cm standard length.

Interest to Fisheries : Presumably contributes to artisanal catches, since it is said to be the common anchovy of the Marañon (Myers, 1940:441).

Local Names :

Literature :

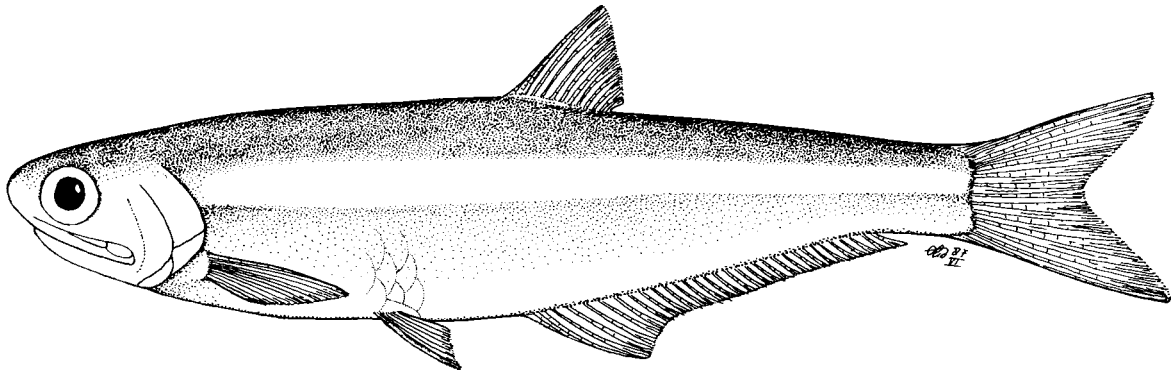
Anchoviella analis Miller, 1945

ENGR Anchoviel 13

Anchoviella analis Miller, 1945, J.Wash.Acad.Sci., 35(8):266, fig.1 (Laguna de Mexcaltitán, Mexico).

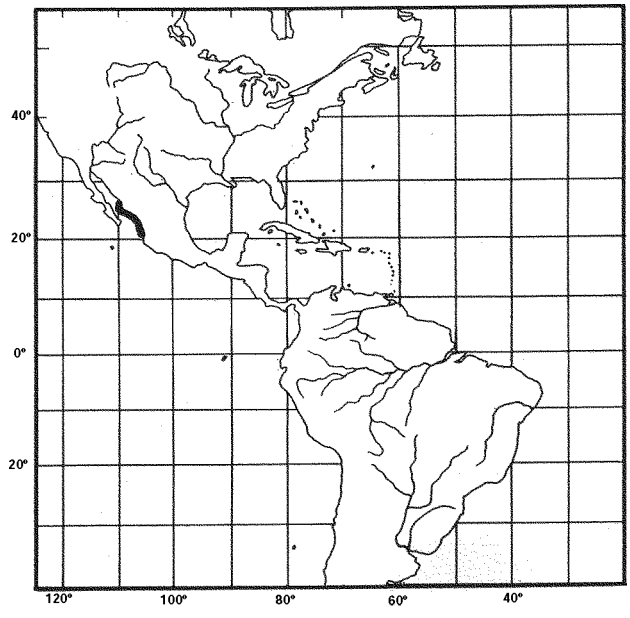
Synonyms : Anchoa panamensis :Warburton, 1978:503, 512, 515, tabs 3-6, 8, fig.7 (Huizache-Caimanero lagoon, northwest Mexico; community structure, abundance); Idem, 1979:455, tabs I-III, figs 2-4 (same locality, growth); Anchoviella analis-Miller, 1960:250, fig.1 (Rio Yaqui south to Tuxpan, Mexico; redescription).

FAO Names: En - Longfin Pacific anchovy.



Diagnostic Features : Body fairly elongate, strongly compressed, its depth about 4 to 4.5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla moderate, tip obliquely rounded, almost reaching to pre-operculum; lower gillrakers 21 to 24; gill cover canals of panamensis-type. Pectoral fins long, reaching to or just beyond pelvic fin base; anal fin very long, with iii 28 to 34 finrays, its origin under or just before or behind dorsal fin origin. A silver stripe along flank, about 3/4 eye diameter. No other Anchoviella species has so many anal finrays (only A. balboae present in eastern Pacific). Strongly resembles some long-finned Anchoa species (especially A. panamensis), but the Anchoa maxilla is longer and more pointed, reaching onto or beyond the pre-operculum.

Geographical Distribution : Eastern central Pacific (Mexico, from the Rio Yaqui south to about Tuxpan, Nayarit).



Habitat and Biology : In shallow coastal lagoons (at 1 to 2 m), also in estuaries, but apparently not in the sea, living in somewhat murky to muddy brackish to salt water over mud or firm sand with a veneer of mud (Miller, 1960). One of the top three dominant fishes in the Huizache-Caimanero lagoon system in Mexico (Warburton, 1979).

Size : To about 10 cm standard length.

Interest to Fisheries : Perhaps of some potential interest, with a total estimated annual production of 9.24 g m^2 in the Huizache-Caimanero lagoons of Mexico (Warburton, 1979).

Local Names :

Literature : Miller (1960 - notes on ecology), Warburton (1978, 1979 - growth, abundance, place in lagoon community).

Remarks : It seems likely that this species belongs to the panamensis-group of Anchoa and is not a species of Anchoviella, but the present definition of Anchoa (maxilla long, tip pointed) excludes it.

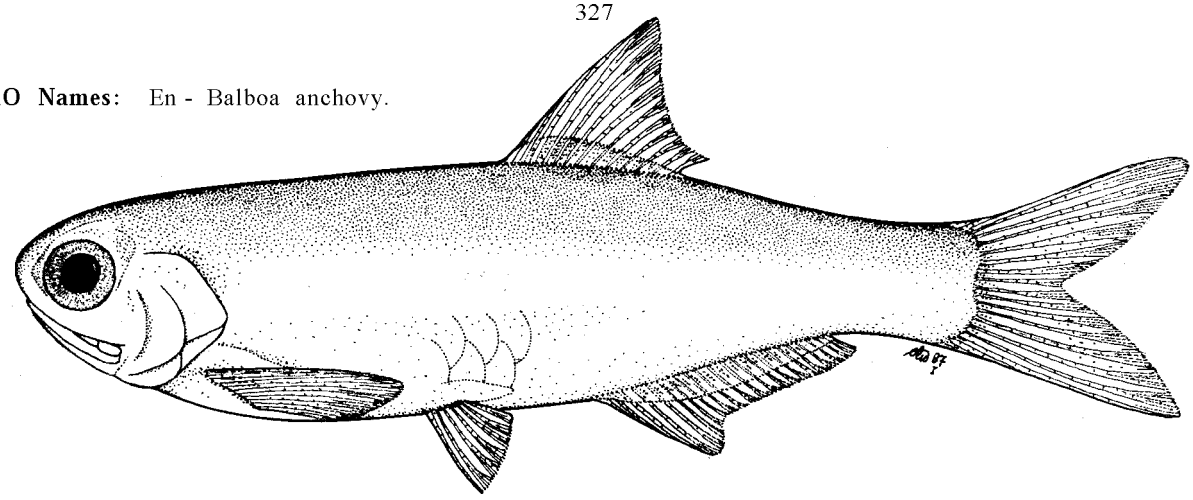
Anchoviella balboae (Jordan & Seale, 1926)

ENGR Anchoviel 14

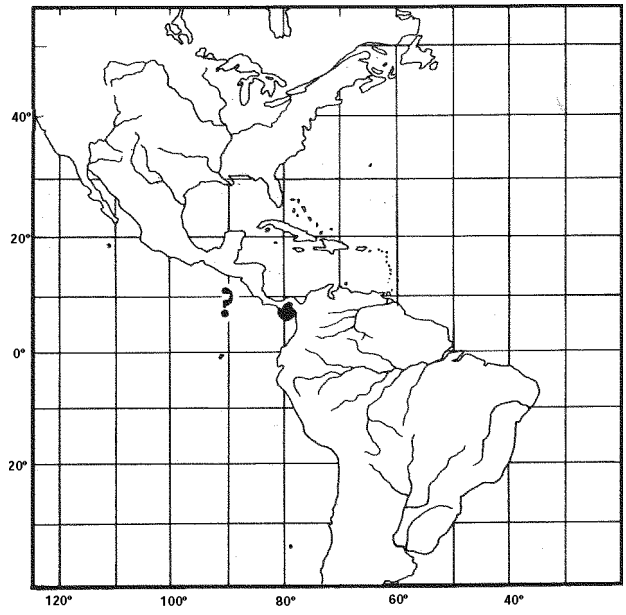
Amplova balboae Jordan & Seale, 1926, Bull.Mus.comp.Zool.Harv., 67(11):411 (Balboa, Canal Zone).

Synonyms : Anchovia brevirostra:Meek & Hildebrand, 1923:198, pl.12, fig.1 (Balboa; the subsequent type of balboae); Stolephorus brevirostris:Hildebrand, 1925:284 (Cutuco, Salvador); Amplova balboae:Myers, 1940:439 (On Meek & Hildebrand ; Anchoviella balboae-Hildebrand, 1943:135, fig.60 (Balboa, Miraflores Locks and Chame Point, Panama; Cituro, Salvador doubtful).

FAO Names: En - Balboa anchovy.



Diagnostic Features : Body fairly stout, somewhat compressed, its depth about 3.5 to 4 times in standard length. Snout very short. **scarcely longer** than pupil: maxilla short, tip bluntly rounded, not quite reaching to articulation of lower jaw; lower gillrakers increasing with size of fish, 22 in a juvenile, 28 to 33 in adults (35 fide Hildebrand, 1943:136); gill cover canals of walkeri-type. Pectoral fin large, reaching almost to pelvic fin; anal fin moderately long, with iii 17 to 23 **finrays**, its origin under about middle of dorsal fin base. No silver lateral stripe recorded (Hildebrand, 1943). Distinguished from Pacific species of Anchoviella (A. analis) and Anchoa by the very short snout.



Geographical Distribution : Eastern central Pacific (Panama; Salvador perhaps an error).

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

Size : To 7.2 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature :

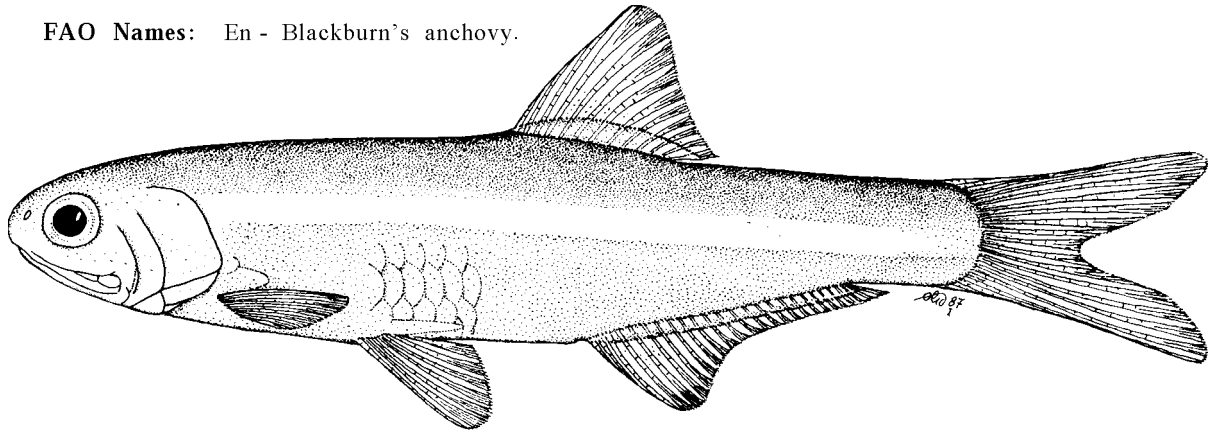
Anchoviella blackburni Hildebrand, 1943

ENGR Anchoviel 3

Anchoviella blackburni Hildebrand, 1943, Bull.Bingham oceanogr.Coll., 8(20):129, fig.57 (Estanques Bay and Jacque Point, Gulf of Venezuela).

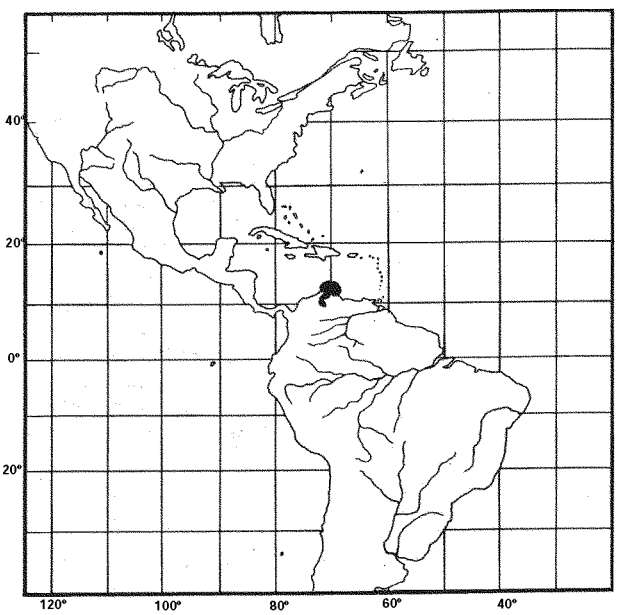
Synonyms : Anchoviella blackburni-Schultz, 1949:48 (Boca del Caño de Sagua, Bahia de Estanques, Punta Jacque, Bahia Salinas, small lagoons to north of Maracaibo,Venezuela); FWNA, 1964:226, fig.51 (synopsis); Cervigón, 1966:146 (compiled).

FAO Names: En - Blackburn's anchovy.



Diagnostic Features : Body fairly slender, somewhat compressed, its depth about 4.5 to 5 times in standard length. Snout short, a little over 1/2 eye diameter; maxilla short, tip bluntly rounded, failing to reach preoperculum by about 1/2 pupil diameter; lower gillrakers 15 to 18; gill cover canals of panamensis-type. Anal fin long, with iii 22 to 24 finrays, its origin a little in advance of midpoint of dorsal fin base. A silver stripe along flank, about 1/2 to 3/4 eye diameter. Only Anchoviella vaillanti of Brazil overlaps in both gillraker and anal finray counts (but branched anal finrays not more than 22 and anal fin origin below last dorsal finray base); A. manamensis of the Orinoco and Surinam also has 18 or fewer gillrakers, but branched anal finrays only 15 to 18.

Geographical Distribution : Southern Caribbean (northern coast of Venezuela), possibly also Surinam.



Habitat and Biology : Marine, pelagic, coastal, but also in small lagoons and in Lake Maracaibo. More specimens and data needed.

Size : Known only from juveniles of about 3 cm standard length or 3.8 cm total length.

Interest to Fisheries : Probably none, considering its apparent rarity (at least in museum collections)

Local Names :

Literature :

Remarks : Known only from small specimens, for which the low gillraker count (15 to 18) may be a juvenile character. However, few Anchoviella species have such a high anal finray count (iii 22 to 24) and these do not occur in the Caribbean area (A. nattereri, A. lepidentostole); A. elongata of the Panama region has not more than 22 branched anal finrays.

The record of A. blackburni from Surinam by Boeseman (1956:184) was tentative; the gillrakers were 16 or 17 at 2 to 3 cm standard length, but if they increase with size, then perhaps the specimens were juvenile A. guianensis (20 to 25 in adults).

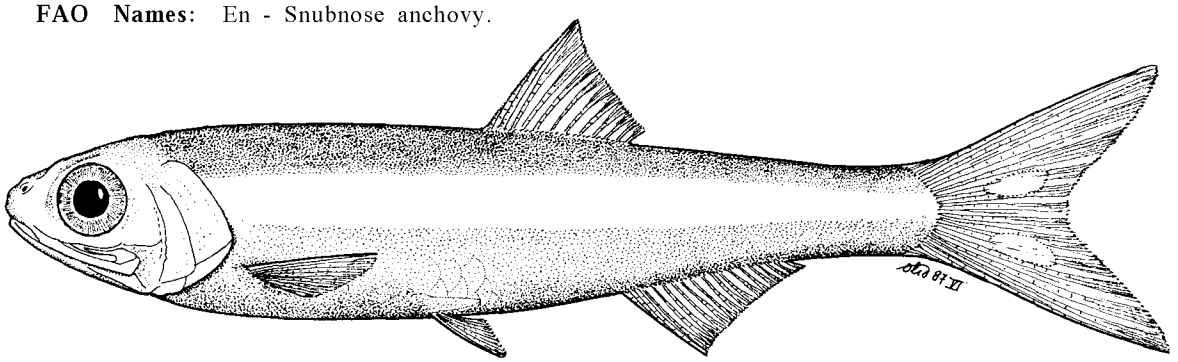
Anchoviella brevirostris (Günther, 1868)

ENGR Anchoviel 4

Engraulis brevirostris Günther, 1868, Cat.Fish.Brit.Mus.,7:392 (Caxoeira on Paraguaçu River, Bahia, Brazil).

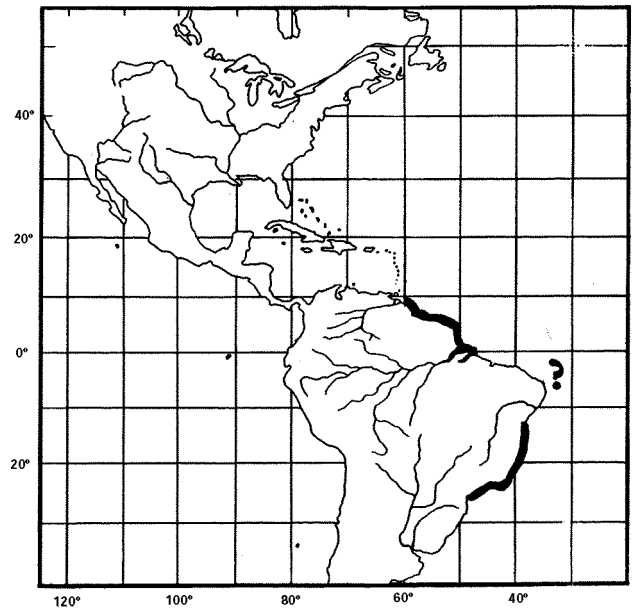
Synonyms : Anchoviella brasiliensis Hildebrand, 1943:138, fig.62 (Rio Ribeira de Iguapé, Sào Paulo, Brazil); Fowler, 1948:20, fig.11 (listed); Carvalho,1951:62, p1.2, fig.5 (Rio Ribeira de Iguape); Nomura CK Menezes, 1964:352 (same); Anchoviella hildebrandi Carvalho, 1950b:78, fig.1 (near Cachoeira, Paraguacu River, i.e., type locality of brevirostris); Idem, 1951:61, pl.2, fig.4 (Paraguacu River); Menezes, 1974:216 (hildebrandi types lost); Amplova brevirostris:Myers, 1940:438 (key), 440 (compiled); Anchoviella brevirostris-Hildebrand, 1943:119 (on Günther; Amazon specimens not this species); Carvalho, 1951:52, pl.1, fig.2 (Amazon at Teffé, Paraguaçu at Caxoeira, Piauf River); FWNA, 1964:216, not figured (synopsis, excluding Amazon specimens); Whitehead, 1973a:figs 57, 58 (jaws) (Guyana, Surinam, off Amazon mouth at 2°29'N, 48°58'W); Figueiredo & Menezes, 1978:28, fig.36 (Guianas to Paraná coast, Brazil); Cervigón, 1982:217 (Perdenales, Caño Mánamo, Orinoco, Venezuela).

FAO Names: En - Snubnose anchovy.



Diagnostic Features : Body fairly slender, somewhat compressed, its depth about 4 to 5 times in standard length. Snout very short, about 1/2 eye diameter and projecting only slightly beyond lower jaw; maxilla short, tip bluntly rounded, failing to reach pre-operculum by about 1/2 pupil diameter; lower jaw longer than upper, its symphysis almost at tip of snout; lower gillrakers 23 to 27; gill cover canals of panamensis-type. Anal fin short, with iii 15 to 17 (rarely 15) finrays, its origin below last part of dorsal fin base (but not behind it). A silver stripe along flank, narrow in front, about 3/4 eye diameter over anal fin. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: A. perfasciata (not south of Trinidad) and A. alleni (Peruvian Amazon); A. quianensis and A. carrikeri (snout projects clearly beyond lower jaw, walkeri type gill cover canals); in addition, all these species have the anal fin origin under or behind the last dorsal finray base.

Geographical Distribution : Western central and South Atlantic (Orinoco mouth, the Guianas south to Rio Ribeiro do Iguape, Sào Paulo coast, Brazil).



Habitat and Biology : Marine, pelagic, coastal, down to 50 m depth, but also estuarine and into almost freshwater. Ripe or almost ripe individuals caught in March and May (Orinoco - Cervigón, 1982:218).

Size : To 7.2 cm standard length.

Interest to Fisheries : Probably contributes to artisanal clupeoid catches in estuaries.

Local Names :

Literature : Cervigón (1982 - brief notes on breeding

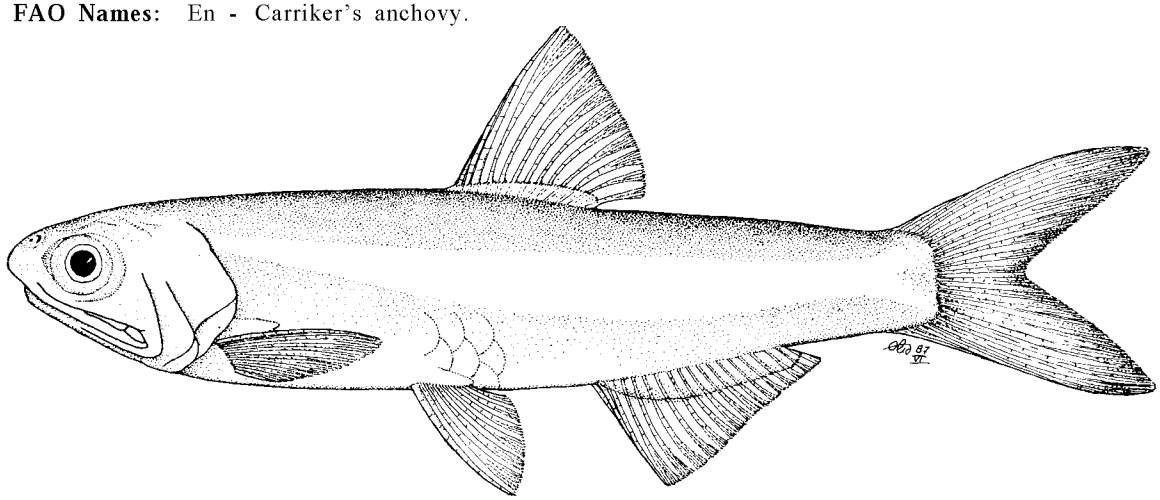
Anchoviella carrikeri Fowler, 1941

ENGR Anchoviel 5

Anchoviella carrikeri Fowler,1941, Proc.Acad.nat.Sci.Philad., 92:73, fig.28 (mouth of Chapare River, Cochabamba, Bolivia).

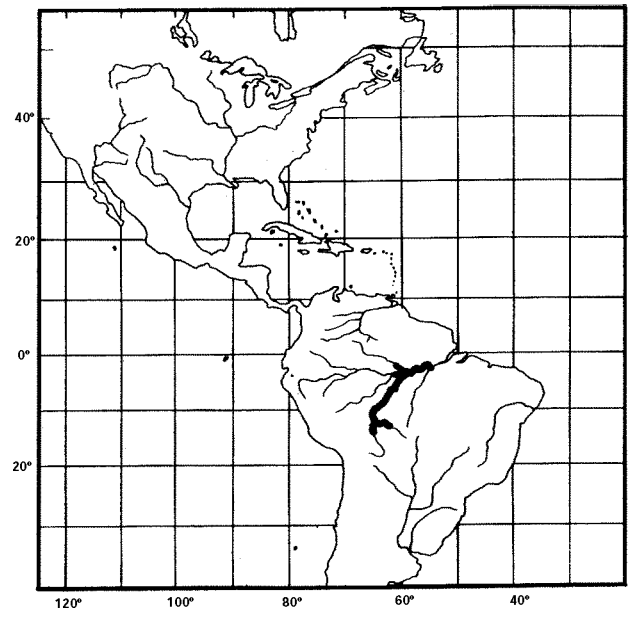
Synonyms : Anchoviella brevirostris: Hildebrand 1943:119 (carrikeri doubtfully placed in synonymy, no specimens seen); Anchoviella carrikeri-Campos, 1942:205, fig.18 (compiled).

FAO Names: En - Carriker's anchovy.



Diagnostic Features : Body fairly slender, moderately compressed, its depth about 4.75 to 5 times in standard length. Snout moderate, a little over 1/2 eye diameter; maxilla moderate, tip bluntly rounded, failing to reach pre-operculum by about 1/4 pupil diameter; lower gillrakers 20 to 24; gill cover canals of walkeri- type. Anal fin moderate, with iii 15 to 18 finrays, its origin a little behind base of last dorsal finray. A silver stripe along flank, widening to about eye diameter over anal fin. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: A. guianensis (not in upper Amazon; maxilla shorter, failing to reach pre-operculum by 1/3 to 1/2 pupil diameter); A. brevirostris, A. elongata and A. alleni (all with panamensis-type gill cover canals; only A. alleni in uper Amazon and gillrakers 24 or 25)

Geographical Distribution : Amazon (Chapare River mouth to lower reaches).



Habitat and Biology : Freshwater, riverine, in middle and upper reaches. More data needed.

Size : To 6.5 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature : Fowler (1941 a-good description, but gillrakers wrongly given as 14 or 15).

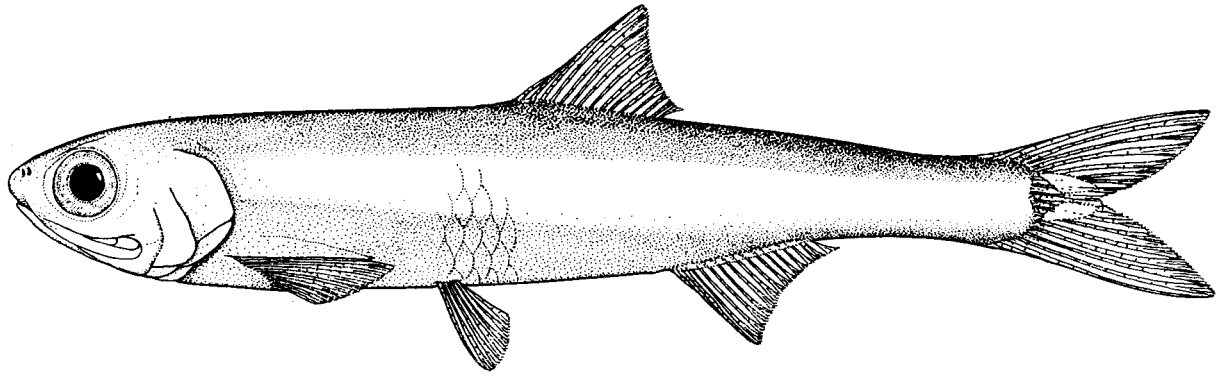
Anchoviella cayennensis (Puyo, 1945)

ENGR Anchoviel 11

Stolephorus cayennensis Puyo, 1945, Bull.Soc.Hist.nat.Toulouse, 80:101, fig.1 (Cayenne River at Macouria, but reported also from Mahury and mouth of Kourou Rivers); Idem, 1949, Faune Emp.franc., 12, Poiss.Guyane franc., 157, fig.80 (repeat).

Synonyms : Anchoviella victoriae Hildebrand & Carvalho, 1948:292, fig.3 (Victoria, Espirito Santo, Brazil); Carvalho, 1951:51, pl.1, fig.1 (Vitória); Menezes, 1974:216 (types of victoriae); Anchoviella cayennensis-FWNA, 1964:212 (on Puyo); Whitehead, 1973a:161, 186 (key), figs 61, 62 (Surinam, Trinidad).

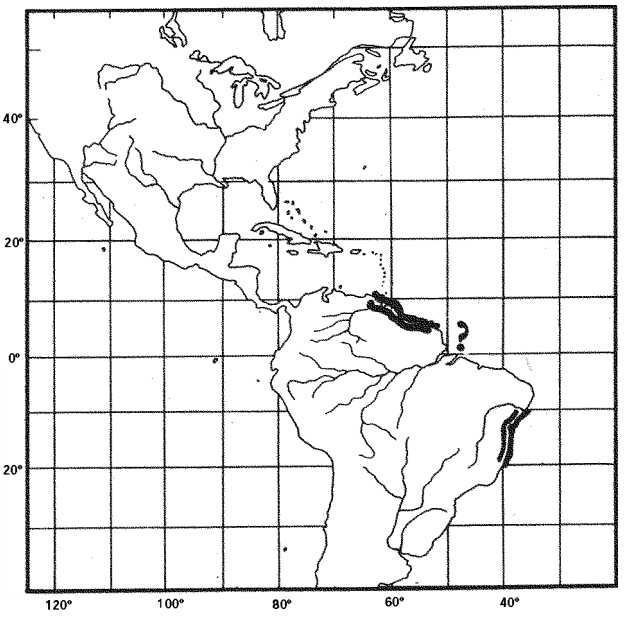
FAO Names: En - Cayenne anchovy.



click for next page

Diagnostic Features : Body elongate, slightly compressed, its depth about 5.5 times in standard length. Snout moderate, about 1/2 eye diameter; maxilla short, tip evenly rounded, failing to reach pre-operculum by 1/2 pupil diameter; lower gillrakers 29 to 35; pseudobranch short,about 3/4 eye diameter; gill cover canals of panamensis-type. Pectoral finrays i 14 to 15; anal fin short, with iii 12 to 14 finrays, its origin slightly behind base of last dorsal finray. A bright silver stripe along flank, about 3/4 eye diameter, dark bordered above. Closely resembles A. oerfasciata. which has 24 to 30 lower gillrakers and occurs north and west from Trinidad. No other Atlantic Anchoviella has more than 21 gillrakers. Engraulis also has a short, blunt maxilla, but pseudobranch at least equal to eye diameter.

Geographical Distribution : Western central and South Atlantic (French Guiana south to at least 20°S, i.e., Victoria, Brazil).



Habitat and Biology : Estuarine, presumably tolerating a range of salinities, but no data on penetration into freshwater or fully marine habitats. More data needed.

Size : To 12 cm standard length.

Interest to Fisheries : Presumably contributes to artisanal anchovy catches, but museum collections imply that it is not abundant.

Local Names :

Literature :

Remarks : The very close resemblance to A. perfasciata and the apparently clear geographical separation of the two suggests that cavennensis may in the future be considered merely a subspecies of perfasciata.

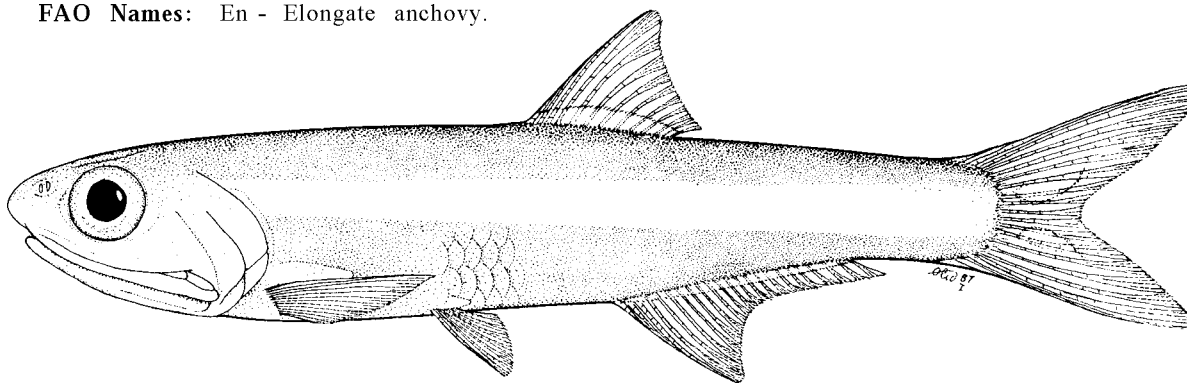
Anchoviella elongata (Meek & Hildebrand, 1923)

ENGR Anchoviel 15

Anchovia elongata Meek & Hildebrand, 1923, Publs Field Mus.nat.Hist., (zool.Ser.), 15(215):198, pl.12, fig.2 (Mindi Cut, Canal Zone, Panama).

Synonyms : Anchoviella elongata-Hildebrand,1943:126, fig.54 (Mindi near Gatun, Canal Zone, and Porto Bello and Puerto Pilon, Panama); FWNA, 1964:223, fig.49 (synopsis); Gilbert & Kelso, 1971:23 (Tortuguero Lagoon, Costa Rica; also earlier specimens identified as Anchoa lamprotaenia by Caldwell, Ogren & Giovannoli, 1959); Dahl, 1971:165, fig.203 (Pasacaballos at mouth of Canal del Dique, Colombia).

FAO Names: En - Elongate anchovy.



Diagnostic Features : Body slender, moderately compressed, its depth 5 to 5.5 times in standard length. Snout moderate, about 2/3 eye diameter; maxilla relatively long, tip bluntly rounded, reaching to and a little beyond front margin of pre-operculum; lower gillrakers 21 to 24; gill cover canals of panamensis-type. Anal fin fairly long, with iii 18 to 22 finrays, its origin below about middle of dorsal fin base. A silver stripe along flank, less than eye diameter. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: A. alleni (Upper Amazon) and A. guianensis (Guianas region), both with the anal fin origin below or behind base of last dorsal finray), and A. lepidentostole (not north of Trinidad; also, walkeri-type gill cover canals).

Geographical Distribution : Southwestern Caribbean (Belize south to Panama and northeastern Colombia).

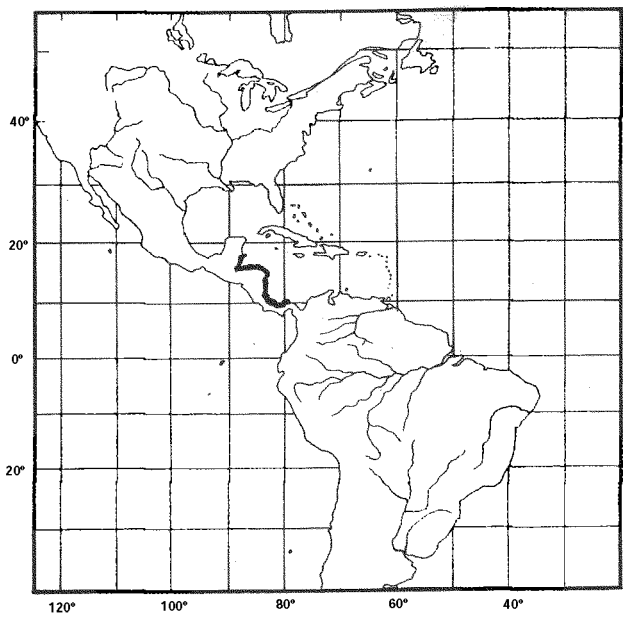
Habitat and Biology : Along beaches and in estuaries, lagoons or other brackish habitats, apparently able to tolerate a wide range of salinities, but perhaps not entering freshwater.

Size : To 8.2 cm standard length.

Interest to Fisheries : May contribute to artisanal anchovy catches.

Local Names :

Literature : Gilbert & Kelso (1971 - ecology in Costa Rica lagoons).



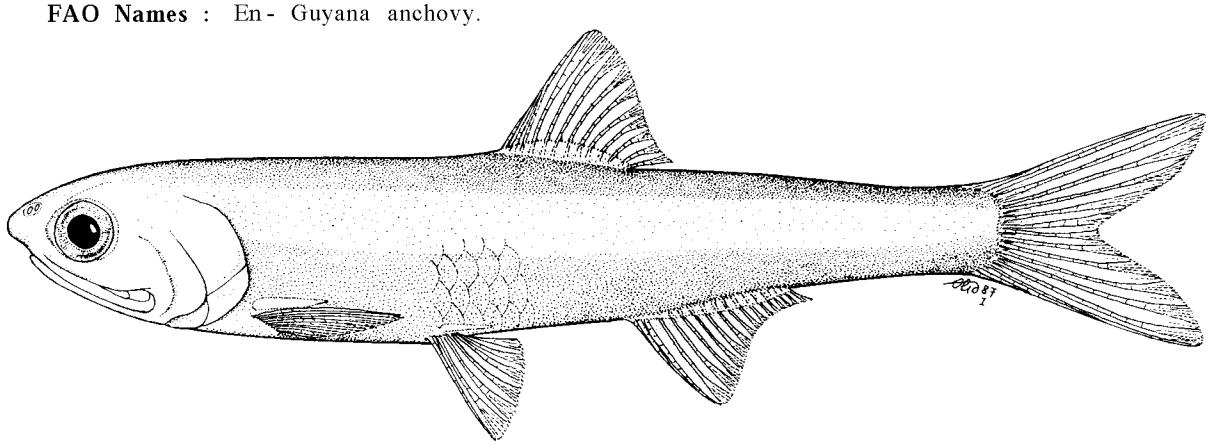
Anchoviella guianensis (Eigenmann, 1912)

ENGR Anchoviel 6

Stolephorus guianensis Eigenmann, 1912, Mem.Carnegie Mus., 5:447, pl.62, fig.5 (Bartica Rocks and Morawhanna, Demerara River, Guayana).

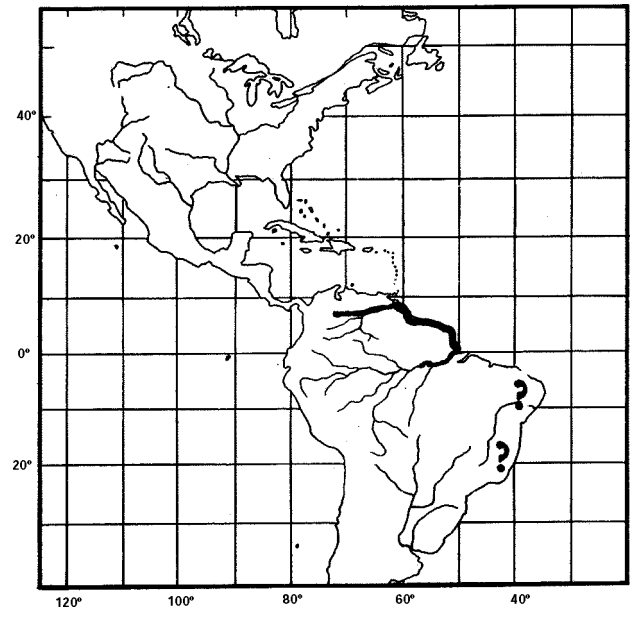
Synonyms : ? Stolephorus brownii:Puyo, 1949:154, fig.77 (French Guiana); Amplova guianensis:Myers, 1940:440 (Lagoa Grande, lower. Amazon near Obidos; not brevirostris specimens of Pearson, 1925 from Lake Rogoagua, Bolivia); Anchoviella guianensis-Fowler, 1931b:392, 406 (La Brea Beach, Trinidad; also Caño de Guanoco, Venezuela); Hildebrand, 1943:122, fig.52 (Guyana; also Itacoatiara, Amazonas); Fowler, 1948:20 (listed); Carvalho, 1951:53, pl.1, fig.3 (Itacoatiara, Lagoa Grande); FWNA, 1964:217, fig.47 (synopsis); Cervigón, 1966:146 (no Venezuelan specimens); Whitehead, 1973a:157, figs 59, 60 (the Guianas; alleni wrongly included in synonymy); Cervigón, 1982:218, fig.14A (Orinoco delta).

FAO Names : En - Guyana anchovy.



Diagnostic Features : Body fairly slender, moderately compressed, its depth 4 to 5 times in standard length. Snout short, a little over 1/2 eye diameter; maxilla moderate, tip bluntly rounded, failing to reach pre-operculum by 1/3 to 1/2 pupil diameter; lower gillrakers 20 to 26; gill cover canals of walkeri-type. Anal fin short, with iii 14 to 18 finrays, its origin a little behind base of last dorsal finray. A silver stripe along flank, widening to about 1/2 eye diameter over anal fin base. Atlantic Anchoviella species that overlap in gillraker and anal finray counts are: A. carrikeri (upper Amazon; maxilla longer, failing to reach pre-operculum by 1/4 pupil diameter), A. brevirostris (lower jaw longer than upper, its symphysis almost at tip of snout, also panamensis-type gill cover canals), and A. jamesi (anal origin below about middle of dorsal fin base); A. alleni occurs in the upper Amazon system and A. perfasciata usually has more gillrakers, but fewer anal finrays.

Geographical Distribution : Western central and South Atlantic (Orinoco system, as far up as Puerto Gaitan on Manacacias River in Colombia, certainly in delta; lower parts of rivers of Guyana, Surinam and French Guiana; lower part of Amazon, but lower limits not known; upper Amazon specimens not this species.



Habitat and Biology : Estuarine and riverine, apparently tolerating only very low salinities. Breeding in December, a female of 58 mm standard length having 1 980 eggs (Cervigón, 1982:219 - Orinoco mouth).

Size : To 6 cm standard length, perhaps larger.

Interest to Fisheries : Probably contributes to riverine artisanal fisheries.

Local Names :

Literature : Cervigón (1982 - notes on ecology and breeding).

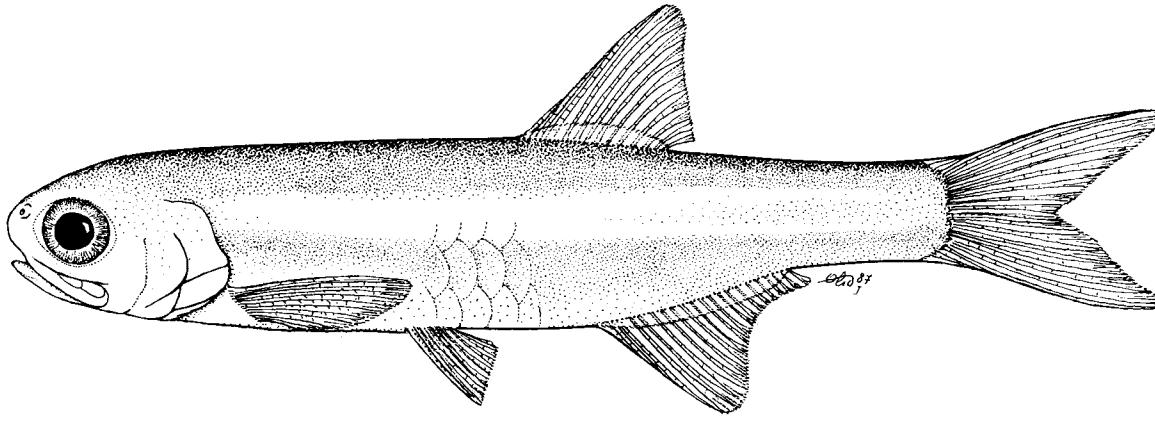
Anchoviella jamesi (Jordan & Seale, 1926)

ENGR Anchoviel 7

Amplova jamesi Jordan & Seale, 1926, Bull.Mus.comp.Zool., 67:410 (Jutai River and Lago Alexo, Brazil).

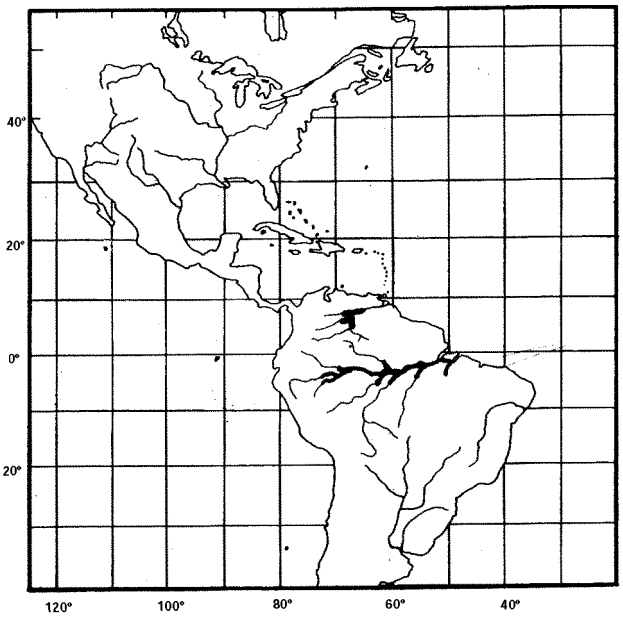
Synonyms : Amplova jamesi Myers, 1940:441 (on Jordan & Seale); Anchoviella jamesi-Hildebrand, 1943:137, fig.61 (Lago Alexo, Brazil); Fowler, 1948:22, fig.14 (listed); Carvalho, 1951:60, p1.2, fig.3 (Lake Aleixo, Amazon); Lüling, 1969:577 (Yarina Cocha at Pucallpa, Ucayali River, Brazil).

FAO Names : En - James's anchovy.



Diagnostic Features : Body fairly slender, somewhat compressed, its depth 4.5 to 6 times in standard length. Snout very short, about 1/2 eye diameter; maxilla very short, tip bluntly rounded, reaching only a little beyond hind rim of eye; lower gillrakers 17 to 21; gill cover canals of panamensis-type. Anal fin moderate, with iii 16 to 21 finrays, its origin below about middle of dorsal fin base. A silver stripe along flank. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: A. elongata (Panama region) and A. manamensis (vertebrae 34 to 36, cf. 40 in A. jamesi; also, unbranched dorsal finrays always iii, cf. often ii in A. jamesi); A. guianensis (snout also short, but gillrakers not less than 20), A. carrikeri, A. vaillanti and A. lepidentostole all have the walkeri-type gill cover canals.

Geographical Distribution : Amazon system (Ucayali, Jutai, Tapajbs, Tocantins and probably other tributaries, also Rio Negro) and Orinoco (middle reaches).



Habitat and Biology : Freshwater, riverine, in middle and upper reaches. More data needed.

Size : To about 4 cm standard length.

Interest to Fisheries : Little or none.

Local Names :

Literature :

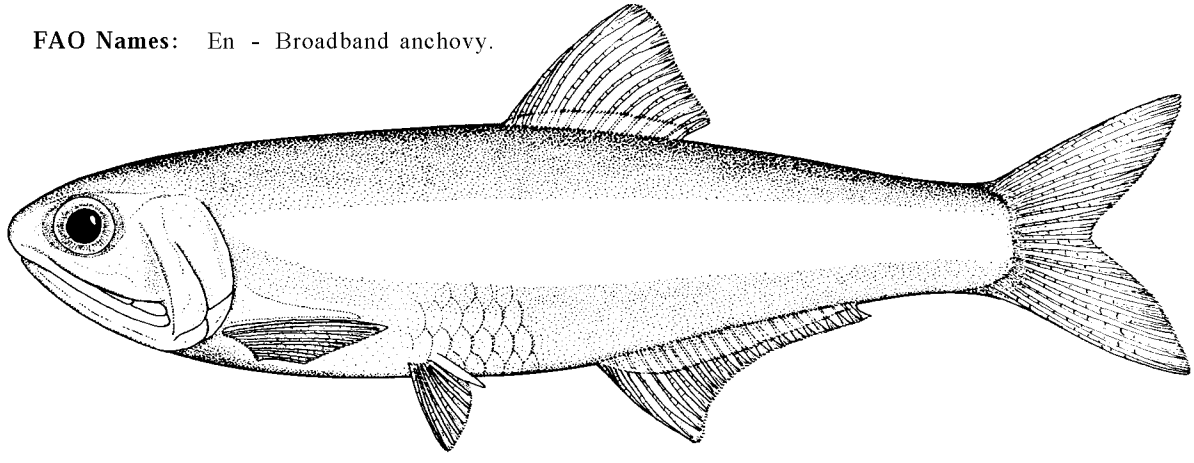
Anchoviella lepidentostole (Fowler, 1911)

ENGR Anchoviel 1

Anchovia lepidentostole Fowler, 1911, Proc.Acad.nat.Sci.Philad., 63:214, fig.3 ('Surinam').

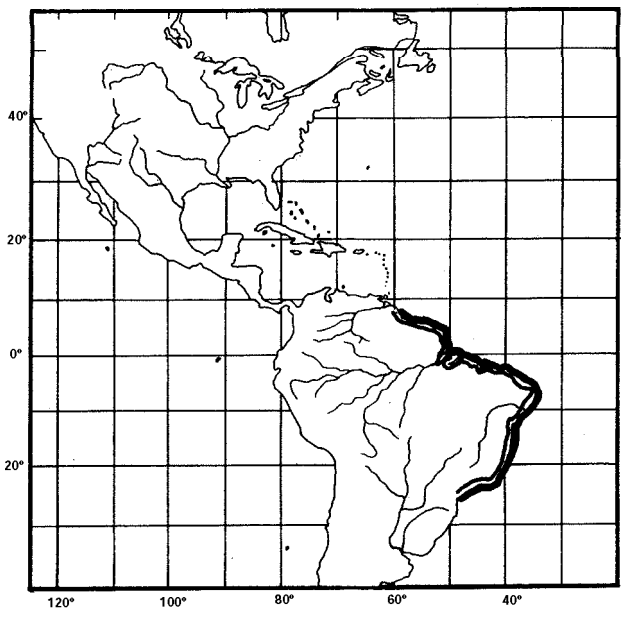
Synonyms : Anchoviella iheringi Fowler, 1941b:124, fig.2 (Rio Jaguaribe, Brazil); Idem, 1948:22, fig.13 (distinguished from lepidentostole); Hildebrand & Carvalho, 1948:292 (on Hubbs); Carvalho, 1951:55, p1.1, fig.4 (Rio Jaguaribe, Ceara ; Anchoviella hubbsi Hildebrand, 1943:128, fig.56 (Rio Ribeira de Iguape, Sao Paulo, Brazil); Fowler, 1948:20.(listed); Carvalho, 1951:57, p1.2, fig.1 (Rio Ribeira de Iguape up to about Xiririca and Cananéia); Nomura & Menezes, 1964:352 (synopsis and references); Anchoviella nitida Hildebrand & Carvalho, 1948:294, fig.4 (Victoria, Brazil); Carvalho, 1951:56,p1.1, fig.5 (Vitória); Menezes, 1974:216 (nitida types); Cervigón, 1980:227, fig.2.77 (listed); Amplova lepidentostole:Myers, 1940:439 (on Fowler); Anchoviella lepidentostole- Hildebrand, 1943:127, fig.55 (`Surinam', the types); Boeseman, 1963:296 (Surinam); FWNA, 1964:224, fig.50 (synopsis); Whitehead, 1973a:149, fig.56 (Venezuela, Guyana,Surinam, northern Brazil); Figueiredo & Menezes, 1978:28, fig.35 (Brazil, abundance); Cervigon, 1982:215, figs 2, 3 (Orinoco delta, ecology, biology); Nelson, 1984:86, fig.1 (rostral organ).

FAO Names: En - Broadband anchovy.



Diagnostic Features : Body moderately elongate and compressed, its depth 4 to 5 times in standard length. Snout short, about 2/3 eye diameter; maxilla relatively long, tip bluntly but obliquely rounded, reaching to pre-operculum; lower gillrakers 18 to 25; gill cover canals of walkeri-type. Anal fin fairly long, with iii 19 to 23 finrays, its origin below about middle of dorsal fin base. A broad silver stripe along flank, equal or greater than eye diameter below dorsal fin. Atlantic Anchoviella species that overlap in gillraker and anal finray counts are: A. blackburni (gillrakers not more than 18, branched anal finrays not less than 22; also, walkeri-type gill cover canals, as also in A. jamesi) and A. vaillanti (maxilla not reaching to pre-operculum, gillrakers 14 to 19), and A. elongata (Panama area, panamensis - type canals). See ENGR Anchoviel 1, Fishing Area 31.

Geographical Distribution : Western central and South Atlantic (Orinoco delta south to Ponta da Cotinga, Paraná coast of Brazil).



Habitat and Biology : Coastal, pelagic, inshore and down to 50 m depth, schooling, but most likely anadromous, entering estuaries and penetrating into fresh water (to 100 km from the Orinoco mouth fide Cervigón, 1982: 216). Orinoco specimens caught in March had fed on brachyuran megalops (Cervigón, loc.cit.). Spawns apparently in May in the Orinoco delta, perhaps migrating into fresh water from the estuary; males mature at 4.8 cm standard length, females at 7.2 cm, with about 20 202 eggs in a specimen of 7.7 cm, both sexes at maturity having a large amount of visceral and intermuscular fat (Cervigón, loc.cit.); enters Rio Ribeira de Iguape, Brazil., in October to March (Nomura & Menezes, 1963).

Size : To 11.6 cm standard length.

Interest to Fisheries : Occurs in large numbers during the hot months in the region of Rio Ribeira de Iguape on the Sào Paulo coast of Brazil and is said to be of commercial importance (Figueiredo & Menezes, 1978: 28). Probably makes a significant contribution to artisanal anchovy catches elsewhere.

Local Names : BRAZIL: Manjuba (applied to most anchovies).

Literature : Nomura & Menezes (1963 - excellent summary of Brazilian published data on biology), Cervigón (1982 - biology in Orinoco).

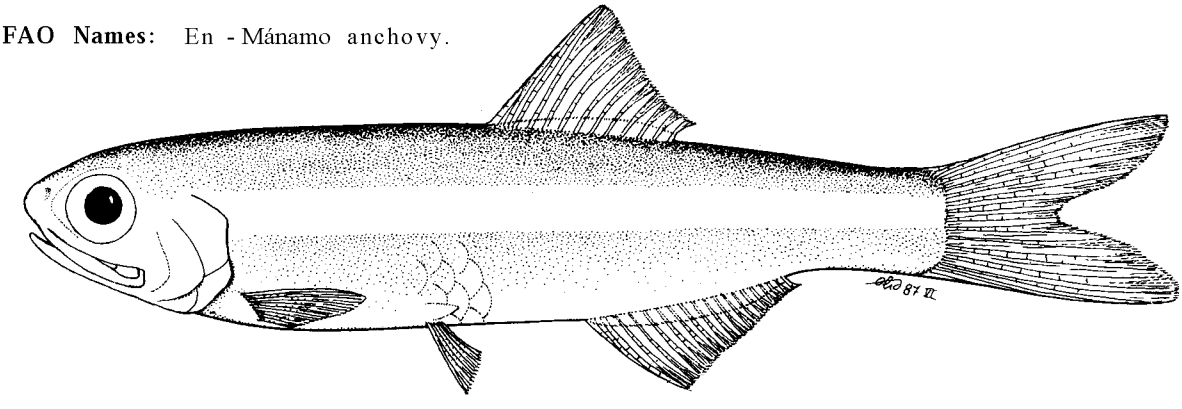
Anchoviella manamensis Cervigón, 1982

ENGR Anchoviel 8

Anchoviella manamensis Cervignon, 1982, Recurs.Pesq.Rio Orinoco:220, figs 5, 6 (Caño Mánamo near Tucupita, Orinoco delta).

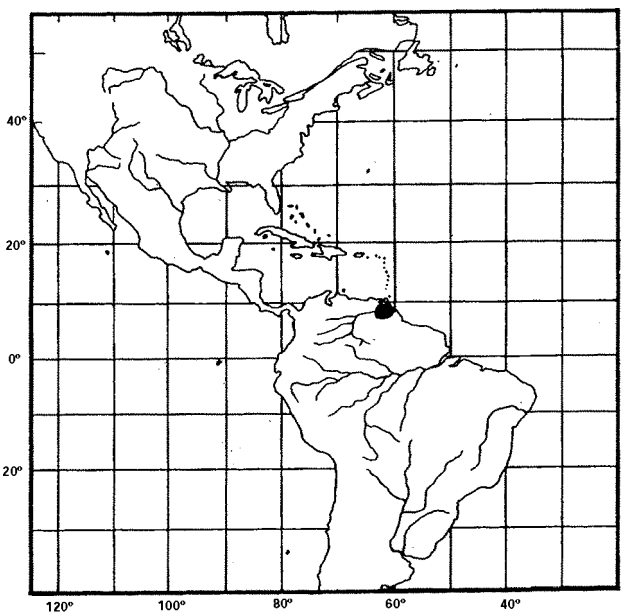
Synonyms : None.

FAO Names: En - Mánamo anchovy.



Diagnostic Features : Body fairly slender, sornewhat compressed, its depth 4.5 to 5 tirnes in standard length. Snout very short, about 1/2 eye diameter; maxilla very short, tip bluntly rounded, reaching only a little beyond hind border of eye; lower gillrakers 15 to 16 (rarely 17); gill cover canal pattern not recorded. Anal fin fairly short, with iii 15 to 18 finrays, its origin below about middle of dorsal fin base. Atlantic Anchoviella species that overlap in both gillraker and anal finray counts are: A. jamesi (middle and upper Amazon, middle Orinoco, but vertebrae 40, cf. only 34 to 36 A. manamensis) and A. vaillanti (Sào Francisco River, Brazil; branched anal finrays 17 ta 22, fin origin just behind dorsal fin base).

Geographical Distribution : Orinoco delta, also Guyana and Surinam.



Habitat and Biology : Freshwater, in large schools together with juvenile Anchovia surinamensis and slightly larger juvenile Lycengraulis batesii, which appear to feed on the Anchoviella (Cervigón, 198:221). Mature by about 2 cm standard length; a female of 2.5 cm had 157 large eggs in the ovary (Cervigón, loc.cit.). This is evidently a progenetic species (adult at juvenile stage).

Size : To 2.5 cm standard length.

Interest to Fisheries : Probably too small to make much contribution.

Local Names :

Literature : Cervigón (1982 - notes on biology).

Anchoviella nattereri (Steindachner, 1880)

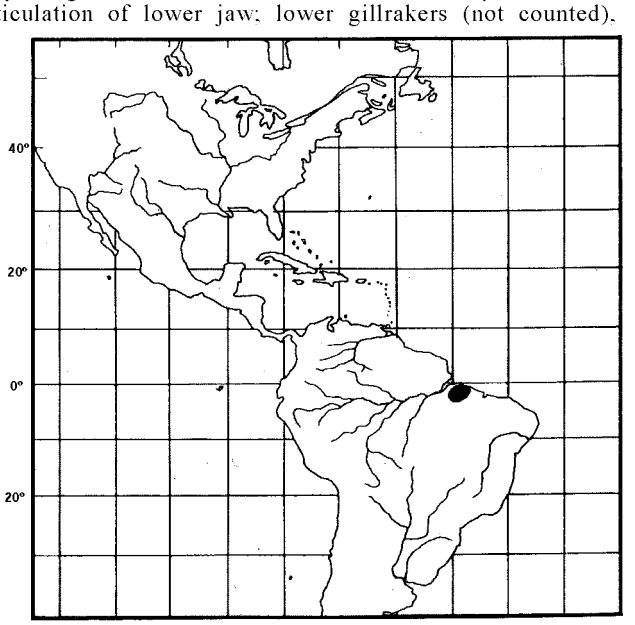
ENGR Anchoviel 9

Engraulis nattereri Steindachner, 1880, Sber.Akad.Wiss.Wien, 80:174 (Parà, Brazil); Idem, 1880, Ichthyol. Beitr., (8):56(repeat).

Synonyms : Anchoviella nattereri-Hildebrand, 1943:133 (on Steindachner); Whitehead, 1970:32 (Steindachner type lost; original description summarized).

FAO Names: En- Natterer's anchovy.

Diagnostic Features (from Steindachner): Snout fairly long, 4 times in head but less than eye diameter; maxilla short, tip nearly square, not quite reaching to articulation of lower jaw; lower gillrakers (not counted), about equal to eye diameter. Pectoral fin long, reaching halfway along pelvic fin; anal fin long, with 28 or 29 finrays (probably iii 26 or 27, since first unbranched ray minute), its origin below middle of dorsal fin base. An indistinct silver stripe along flank. The anal fin position and finray count suggest A. blackburni, A. elongata and A. lepidentostole, of which only the last might be expected from Pará (but pectoral fins not to pelvic fin base).



Geographical Distribution : Western South Atlantic drainage (Pará, Brazil - type locality).

Habitat and Biology : Presumably riverine or estuarine. More material and data needed.

Size : To 5 cm (the lost type).

Interest to Fisheries : No data.

Local Names :

Literature : Apparently not seen since first described.

Remarks : Possibly this is a senior synonym for A. lepidentostole, but only if Steindachner exaggerated the length of the pectoral fins (not even to pelvic fin base in most or all Anchoviella).

Anchovia nattereri of Jordan & Seale (1926:413), also from Pará had long pectorals, but also 98 gillrakers (as in Anchovia surinamensis) and a triangular point on the sub-operculum border (not in the Atlantic drainage A. surinamensis, but found in the Pacific A. macrolepidota; also in Anchoa spinifer, which however has only 12 to 19, lower gillrakers). Hildebrand (194327) suggested Anchovia clupeoides, but this lacks the triangular point on the sub-operculum.

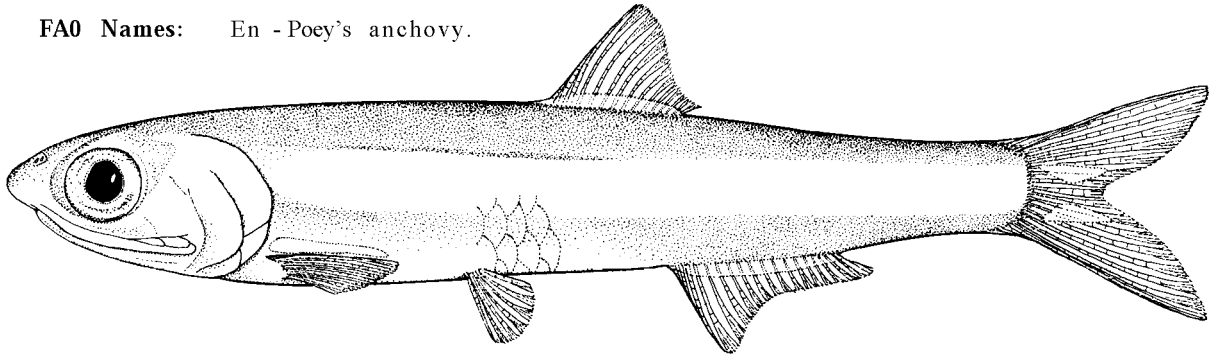
Anchoviella perfasciata (Poey, 1860)

ENGR Anchoviel 12

Engraulis perfasciatus Poey, 1860, Memorias hist.nat.Cuba, 2:312 (Cuba).

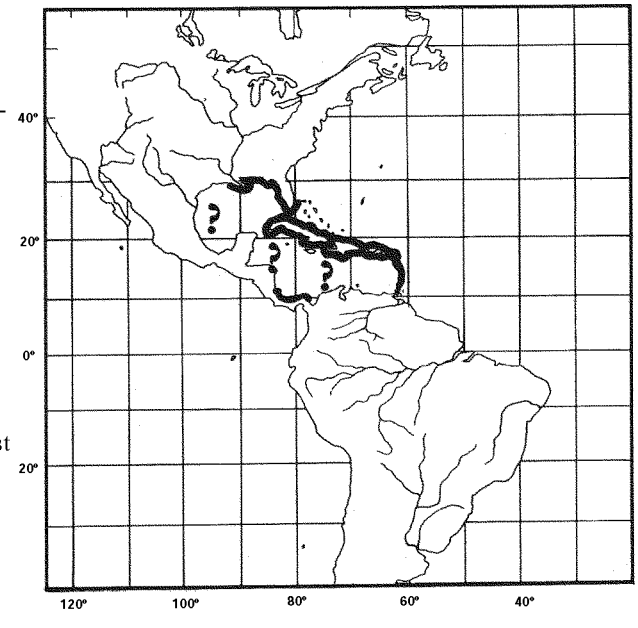
Synonyms : Engraulis perfasciatus:Günther, 1868:391 (San Domingo, Cuba); Stolephorus perfasciatus:Swain & Meek, 1885:34 (Florida, Cuba); Anchovia perfasciata:Jordan & Thompson, 1905233 (Florida); Fowler, l911:211 (Puerto Rico); Hildebrand, 1941224 (Beaufort, North Carolina); Anchoviella perfasciata-Jordan & Seale, 1926:394 (Cuba, Poey specimens); Hildebrand, 1943:116, fig.49 (Cuba, Jamaica, Puerto Rico, St. Lucia); FWNA,1964:213, fig.46 (synopsis; large synonymy and notes on it); Daly, 1970:88, figs 5,6f (photos), tabs 2-7 (Florida); Whitehead, 1973a:149 (key only).

FA0 Names: En - Poey's anchovy.



Diagnostic Features : Body elongate, slightly compressed, its depth about 5.5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla short, tip bluntly rounded, failing to reach pre-operculum by 1/2 pupil diameter; lower gillrakers 24 to 30; pseudobranch short, about 3/4 eye diameter; gill cover canals of panamensis-type. Pectoral finrays i 13 to 15; anal fin short, with iii 10 to 15 finrays, its origin slightly behind base of last dorsal finray. A bright silver stripe along flank, about 3/4 or almost equal to eye, dark bordered above. Closely resembles A. cayennensis, which has 29 to 35 lower gillrakers and occurs to the south of Trinidad. Anchoviella alleni, A. brerostris and A. guianensis may occasionally overlap in gillraker and anal finray counts, but none occurs to the north of Trinidad: Engraulis has a short and blunt maxilla, but pseudobranch at least equal to eye diameter.

Geographical Distributio : Western central Atlantic (Beaufort, North Carolina south to Florida; Antilles from Cuba to St. Lucia, also Trinidad, but not recorded by Cervigón (1966) at Blanquilla and Los Roques off Venezuela; also occurs off Panama).



Habitat and Biology : Marine, pelagic, coastal, apparently not ,entering brackish water (cf. the closely related A. cayennensis); rare in Florida shore seine collections, but in great numbers under a night light", perhaps because it may stay some distance from the shore in daytime (Daly, 1970:92).

Size : To 8.5 cm standard length.

Interest to Fisheries : Probably not sufficiently abundant to contribute much to anchovy catches, at least in daytime shore seines.

Local Names : CUBA: Manjúa; USA: Flat anchovy (FWNA, AFS list).

Literature : FWNA (1964 - large synonymy, but apparently very little on the biology of the species).

Remarks : The marine Anchoviella perfasciata and the estuarine A. cavennensis differ from all other members of the genus in having the anal fin origin behind the dorsal fin base. Possibly cavennensis is merely a southern subspecies.

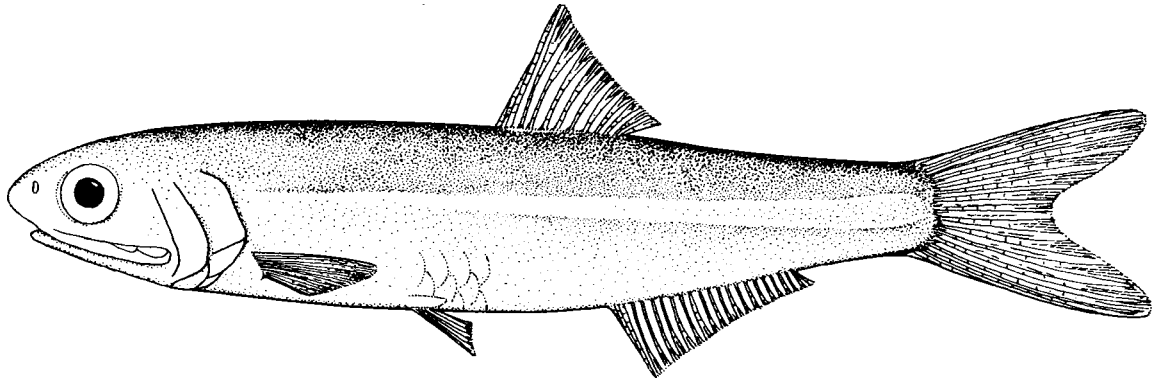
Anchoviella vaillanti (Steindachner, 1908)

ENGR Anchoviel 10

Engraulis vaillanti Steindachner, 1908, Anz.Akad.Wiss.Wien,45:193 (Joazeiro and Barra on Rio São Francisco, also Rio Grande do Norte and Rio Preta, Brazil).

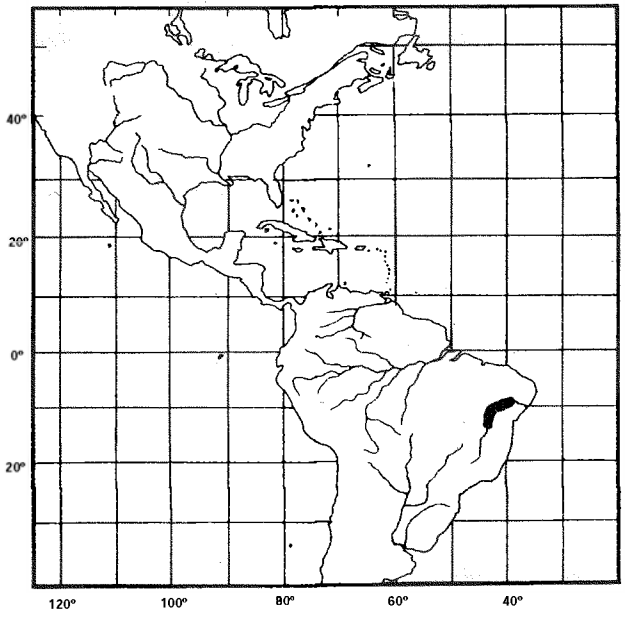
Synonyms : Amplova vaillanti:Myers, 1940:439 (Barra, Rio São Francisco); Anchoviella vaillanti-Hildebrand, 1943:125 (on Steindachner); Carvalho, 1951:54, no fig. (compiled); Whitehead,1970:30 (Steindachner types); Idem, 1973a:149 (key only).

FAO Names : En - Vaillant's anchovy.



Diagnostic Features : Body fairly slender, moderately compressed, its depth about 5 times in standard length. Snout moderate, a little less than eye diameter; maxilla moderate, tip bluntly rounded, failing to reach pre-operculum by about 1/2 pupil diameter; lower gillrakers 14 to 19; gill cover canals of walkeri-type. Anal fin moderate, with iii 17 to 22 finrays, its origin just behind base of last dorsal finray. A silver stripe along flank. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. jamesi and A. manamensis (anal fin origin under middle of dorsal fin base): A. carrikeri (upper Amazon), also A. lepidentostle (maxilla to pre-operculum, gillrakers 18 to 24).

Geographical Distribution : Western South Atlantic drainage (Sao Francisco River; the records for Rio Grande do Norte and the Rio Preta by Steindachner (1908) needed to be checked).



Habitat and Biology : Riverine, in middle reaches of rivers. More data needed.

Size : To 6.8 cm standard length.

Interest to Fisheries : No data.

Local Names :

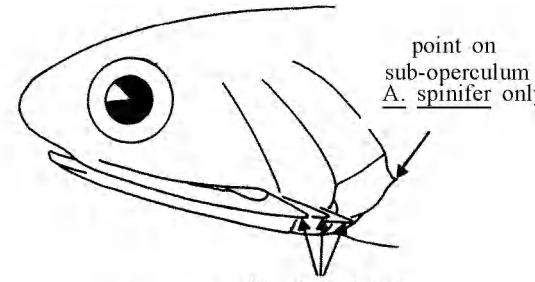
Literature :

Anchoa Jordan & Evermann, 1927

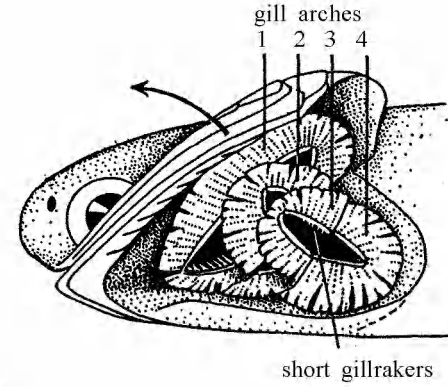
ENGR Ancho

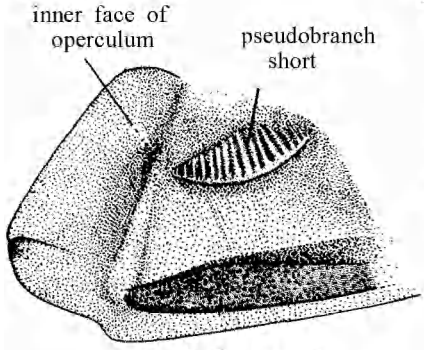
Anchoa Jordan & Evermann, 1927, Proc.Calif.Acad.Sci.,4(16):501, as subgenus of Anchoviella (type: Engraulis compressus Girard, 1858).

Diagnostic Features : Fairly small, slightly or quite strongly compressed anchovies (to about 13 cm standard length, usually 6 to 10 cm). Snout fairly pointed (strongly pointed in subgenus Anchovietta); maxilla long (reaching beyond front margin of pre-operculum), tip pointed, reaching well beyond tip of second supra-maxilla; fine teeth on lower jaw; gillrakers slender, increasing in larger fishes in some species (lower gillrakers as few as 12 to 14 or 19 in some, usually 17 to about 24, but to 28 in some and to 32 in A. delicatissima); gillrakers present on hind face of third epibranchial. Pseudobranch usually short, but longer than eye and extending onto inner face of operculum in A. marinii, A. starksi and the subgenus Anchovietta. Canals on gill cover with (walkeri-type) or without (panamensis-type) a pre-opercular branch passing back onto the operculum to run downward parallel to the temporal canal. Dorsal fin origin at about midpoint of body; anal fin short, moderate or long (14 to 22 branched finrays in some species, usually about 20 to 27, but up to 34 to 37 in other species); its origin usually below dorsal fin base (occasionally just in front, and in the subgenus Anchovietta below or behind the base of the last dorsal finray). The rather long maxilla and its pointed tip distinguishes Anchoa from Anchoviella (maxilla blunt, its tip barely extending beyond tip of second supra-maxilla).

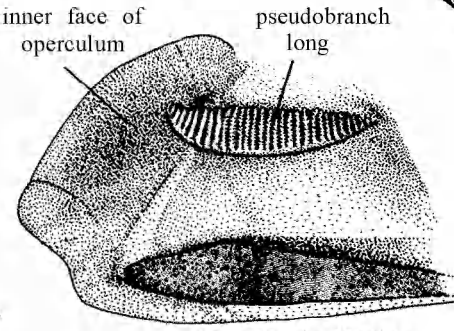


maxilla tip pointed
to pre-operculum, sub-operculum
or to gill opening

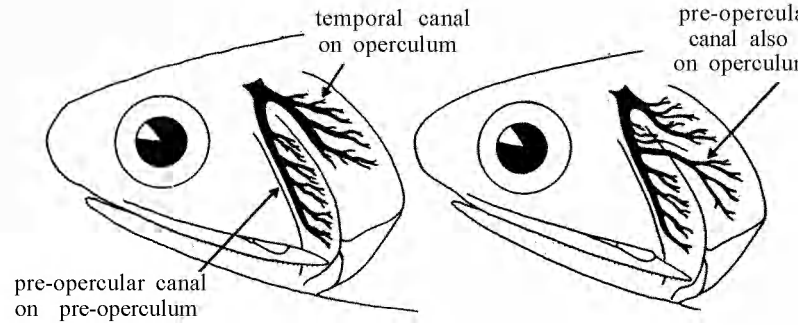




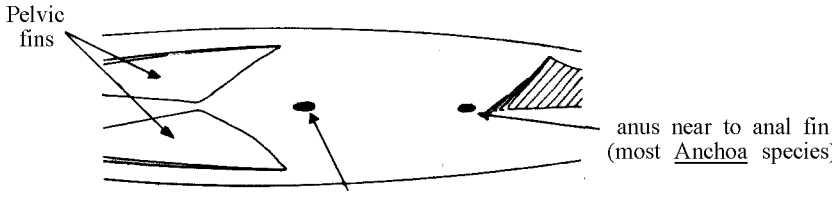
most Anchoa species
(except A. marinii, A. starksi
and Anchovietta)



subgenus Anchovietta
(A. lvolepis, A. filifera, A. nasus)



(a) panamensis-type **(b)** walkeri-type
gill cover canals



anus advanced
(A. cubana, A. choerostoma, A. lamprotaenia)

Biology, Habitat and Distribution : Marine, estuarine and some species penetrating into freshwater; Atlantic and Pacific coasts and lower parts of rivers of North, central and South America. Some species filter-feed on small planktonic organisms, those with few gillrakers feeding on larger animals (prawns, small fishes, etc.).

Species : Hildebrand (1943), in the first comprehensive revision of the genus, recognized 36 species. More recent studies (Whitehead, 1973a; Nelson, 1983, 1986; Nelson & Sonoda, 1987) have removed some of Hildebrand's species to other genera, or included others placed by him in other genera or in synonymies, to rnake 16 Atlantic species, 17 Pacific species, and one common to both areas (total 34 species). Nelson (1986) has proposed the subgenus Anchovietta for the species nasus, lyolepis and filifera. To aid identification, the species are arranged geographically (north to south) for each region:

Subgenus Anchoa (pseudobranch short (except in marinii, starksi); anal fin origin below or just before dorsal fin base).

Atlantic and Pacific :

A. spinifer (Valenciennes, 1848) Western central and South Atlantic, and eastern central Pacific

Atlantic only :

A. mitchilli (Valenciennes, 1848) Western North and central Atlantic
A. hepsetus (Linnaeus, 1758) Western North, central and South Atlantic

A. belizensis (Thomerson & Greenfield, 1975) Western central Atlantic
A. cayorum (Fowler, 1906) Western central Atlantic
A. choerostoma (Goode, 1874) Bermuda only
A. colonensis Hildebrand, 1943 Western central Atlantic
A. parva (Meek & Hildebrand, 1923) Western central Atlantic
A. trinitatis (Fowler, 1915) Western central Atlantic

A. cubana (Poey, 1868) Western central and South Atlantic
A. lamprotaenia Hildebrand, 1943 Western central and South Atlantic

A. januaria (Steindachner, 1880) Western South (possibly also central) Atlantic
A. marinii Hildebrand, 1943 Western South Atlantic
A. pectoralis Hildebrand, 1943 Western South Atlantic
A. tricolor (Agassiz, 1829) Western South Atlantic

Pacific only :

A. compressa (Girard, 1858) Northern part of eastern central Pacific
A. delicatissima (Girard, 1856) Northern part of eastern central Pacific
A. helleri (Hubbs, 1921) Northern part of eastern central Pacific
A. mundeoloides (Breder, 1928) Northern part of eastern central Pacific
A. scofieldi (Jordan & Culver, 1895) Northern part of eastern central Pacific (? also Ecuador)

A. argentivittata (Regan, 1904) Whole eastern central Pacific
A. curta (Jordan & Gilbert, 1882) Whole eastern central Pacific
A. exigua (Jordan & Gilbert, 1882) Whole eastern central Pacific
A. ischana (Jordan & Gilbert, 1882) Whole eastern central Pacific
A. lucida (Jordan & Gilbert, 1882) Whole eastern central Pacific
A. mundeola (Gilbert & Pierson, 1898) Whole eastern central Pacific
A. walkeri Baldwin & Chang, 1970 Whole eastern central Pacific

A. chamensis Hildebrand, 1943 Southern part of eastern central Pacific
A. eigenmannia (Meek & Hildebrand, 1923) Southern part of eastern central Pacific
A. panamensis (Steindachner, 1876) Southern part of eastern central Pacific
A. starksi (Gilbert & Pierson, 1898) Southern part of eastern central Pacific

Subgenus Anchovietta (pseudobranch longer than eye, reaching onto inner face of operculum; anal fin origin under or behind base of last dorsal finray)

A. lyolepis (Evermann & Marsh, 1902) Western central and South Atlantic
A. filifera (Fowler, 1915) Western central and South Atlantic
A. nasus (Kner & Steindachner, 1866) Eastern central and South Pacific

Remarks : The definition of the genus Anchoa has relied mainly on the rather long and pointed maxilla (cf. short and blunt in Anchoviella, Engraulis) coupled the absence of those specialized features that characterize certain other New World genera (Anchovia, Cetengraulis, Lycengraulis, Pterengraulis). Nelson (1986) split off lyolepis, filifera and nasus as an apparently natural group, subgenus Anchovietta. Undoubtedly other groups will be recognized and probably the separation of Anchoa and Anchoviella solely on the basis of maxilla form will prove to be artificial (e.g., analis, here placed in Anchoviella because of its short and blunt maxilla, seems more allied to the long-finned panamensis-group of Anchoa).

Identification of Anchoa species is difficult; the key given by Hildebrand (1943) is no longer reliable and his combination of Atlantic and Pacific species makes it unnecessarily complicated. However, by using the geographical area to narrow the choice of possible species, most can then be identified by counting the lower gillrakers and the branched anal finrays. The form of the cutaneous canals that branch across the gill cover is also useful, although not always easy to see unless the head of the specimen is dried thoroughly. The following characters may be of help:

Pseudobranch longer than eye: A. filifera, A. lyolepis and A. marinii of Atlantic; A. nasus and A. starksi of Pacific.

Anus advanced, near to pelvic fin tips: A. choerostoma, A. cubana, A. lamprotaenia, A. januaria, A. mitchilli, A. parva and A. trinitatis of Atlantic; no data for Pacific.

Lower gillrakers few: A. spinifer (12 to 19) of Atlantic and Pacific; A. eigenmannia (12 to 14) and A. scofieldi (12 to 14) of Pacific.

Lower gillrakers many (to 28 or more): A. cubana, A. januaria and A. parva of Atlantic; A. nasus (rare) and A. delicatissima (26 to 32) of Pacific.

Anal finrays many (to 29 or more); A. spinifer (31 to 37) of Atlantic and Pacific; A. compressa (27 to 31), A. eigenmannia (rare), A. mundeola (27 to 33) A. mundeoloides (26 to 31), A. panamensis (28 to 35) and A. walkeri (23 to 32) of the Pacific.

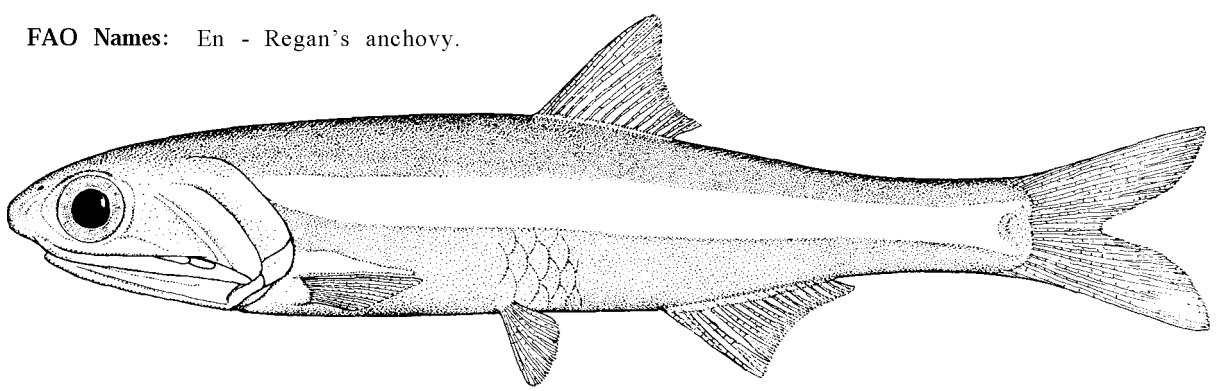
Anchoa argentivittata (Regan, 1904)

ENGR Ancho 24

Engraulis (Stolephorus) argentivittatus Regan, 1904, Ann.Mag.nat.Hist., (7)8:255 (Las Peñas, Jalisco = Puerto Vallarta, Mexico).

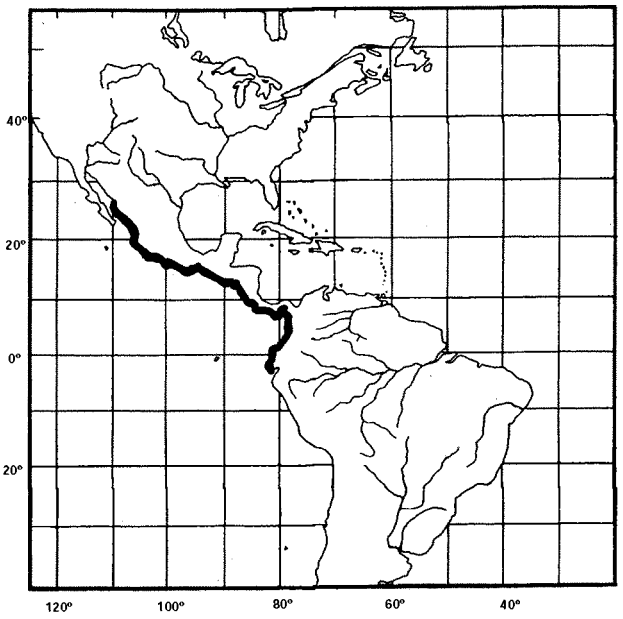
Synonyms : Anchoa arenicola Meek & Hildebrand, 1923:201, pl.13, fig.1 (Chame Point, Taboga Island, Naos Island and Balboa, Panama); Hildebrand, 1943:68, fig.27 (Panama,Colombia, Ecuador); Peterson, 1956:165 (Mazatlán, Costa Rica; Galapagos Islands wrongly cited); Cabo & Massay, 1969:8 (Ecuador, listed); Anchoa argentivittata-Nelson, 1983:48, tab.1 (vertebrae)(types; arenicola a synonym).

FAO Names: En - Regan's anchovy.



Diagnostic Features : Body fairly elongate, its depth 5.5 to 6.5 times in standard length. Snout long, about equal to eye diameter; maxilla moderate, tip rather bluntly pointed, reaching onto inter-operculum, but not to edge of gill cover; lower gillrakers 17 to 20; gill cover canals of panamensis-type. Anal fin very short, with iii 14 to 17 finrays, its orgin below or behind last dorsal finray base. A silver stripe along flank, about 3/4 eye diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. helleri of the northern Gulf of California (not less than 19 gillrakers or 17 branched anal finrays, also vertebrae 40 to 42, rarely 43, cf. 44 to 46), and A. ischana (silver stripe narrower, about 3/4 to 2/3 eye diameter, maxilla more narrowly pointed, reaching only sub-operculum, vertebrae usually 42 to 44).

Geographical Distribution : Eastern central Pacific (southern half of Gulf of California south to Ecuador; but not to Galapagos Islands fide Nelson, 1983).



Habitat and Biology : Marine, pelagic, coastal and schooling, caught over sand or gravel in the Gulf of Nicoya, but not in inner parts of Gulf (Peterson, 1956). May spawn over a protracted period in Gulf of Nicoya; eggs oval (Peterson, loc.cit.).

Size : To 10 cm standard length, or 12.5 cm total length (Hildebrand, 1943).

Interest to Fisheries : No data.

Local Names :

Literature : Peterson (1956 - some brief notes on ecology and breeding, as A. arenicola).

Remarks : Nelson (1983) resurrected the name argentivittata for this species, which had previously been referred to as arenicola; Hildebrand (1943:65) had tentatively placed argentivittata in the synonymy of Anchoa lyolepis (Atlantic), but the name was otherwise ignored.

Nelson (1983) accepted the separation of A. argentivittata from the very similar A. ischana, citing the distinctions found by Peterson (1956:158, key) in-Gulf of Nicoya specimens. However, the less sharply angled cheek in A. ischana and the presence of a dark stripe along the back are not apparent in Galapagos specimens (identified by Dr Nelson), although Peterson seems to have correctly noted the narrower silver stripe. This, and the rather more narrowly pointed maxilla tip, seem the best means of separating A. ischana from A. argentivittata.

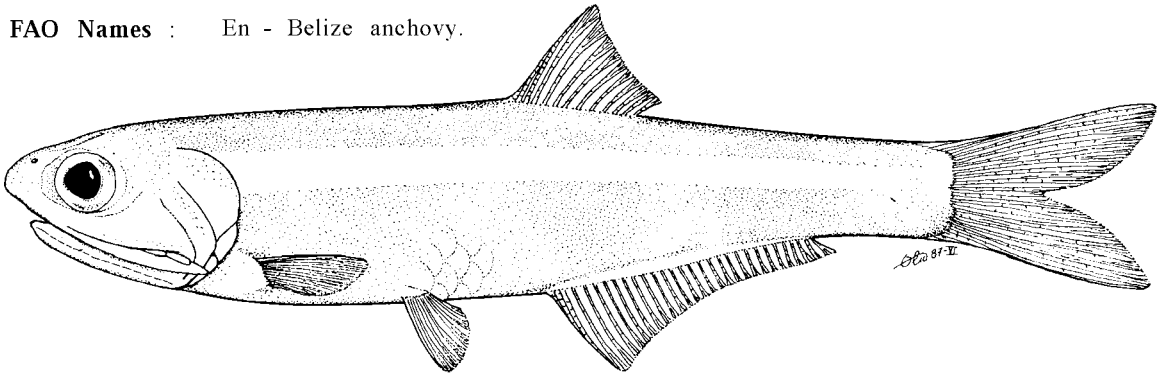
Anchoa belizensis (Thomerson & Greenfield, 1975)

ENGR Ancho 15

Anchoviella belizensis Thomerson & Greenfield, 1975, Copeia, (1):50, fig.1 (Sibun River, near Freetown, Belize).

Synonyms : None.

FAO Names : En - Belize anchovy.



Diagnostic Features : Body somewhat compressed, slender, its depth about 5 times in standard length. Snout less than eye diameter; maxilla long, tip pointed, reaching almost to gill opening; lower gillrakers 17 to 20; gill cover canals of walkeri-type. Anal fin rather long, with iii 23 to 28 finrays, its origin before midpoint of dorsal fin base. A pair of narrow dark lines along back, from occiput to tail; a silver stripe along flank, less than eye diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. trinitatis (Venezuela, Trinidad; gill cover canals of panamensis-type), A. pectoralis (Brazil) and A. lamprotaenia (branched anal finrays 17 to 23); the most similar species is A. cayorum, reported to be sympatric in the Sibun river, Belize (anal fin origin below midpoint of dorsal fin base).

Geographical Distribution : Caribbean area, freshwater (Belize, in Sibun River 20 km from sea; Guatemala, Rio Dulce, Lake Yzabel; ? eastern rivers of Honduras).

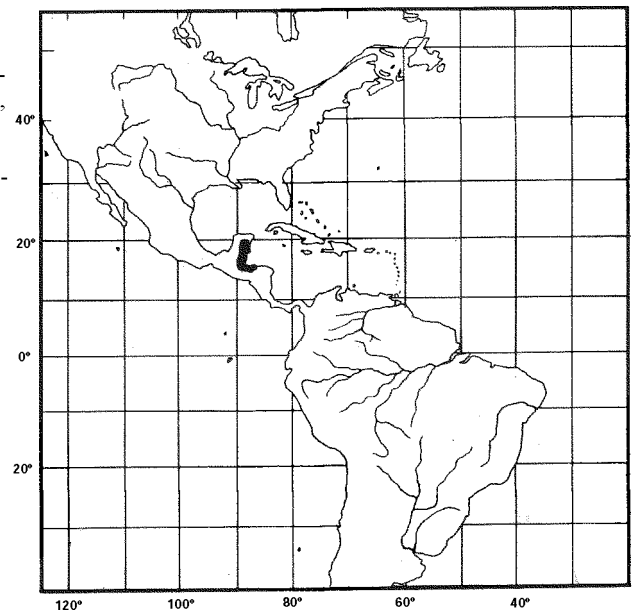
Habitat and Biology : Apparently entirely freshwater, presumably schooling. More data needed.

Size : To 5.8 cm standard length.

Interest to Fisheries : Unknown; probably little.

Local Names :

Literature :



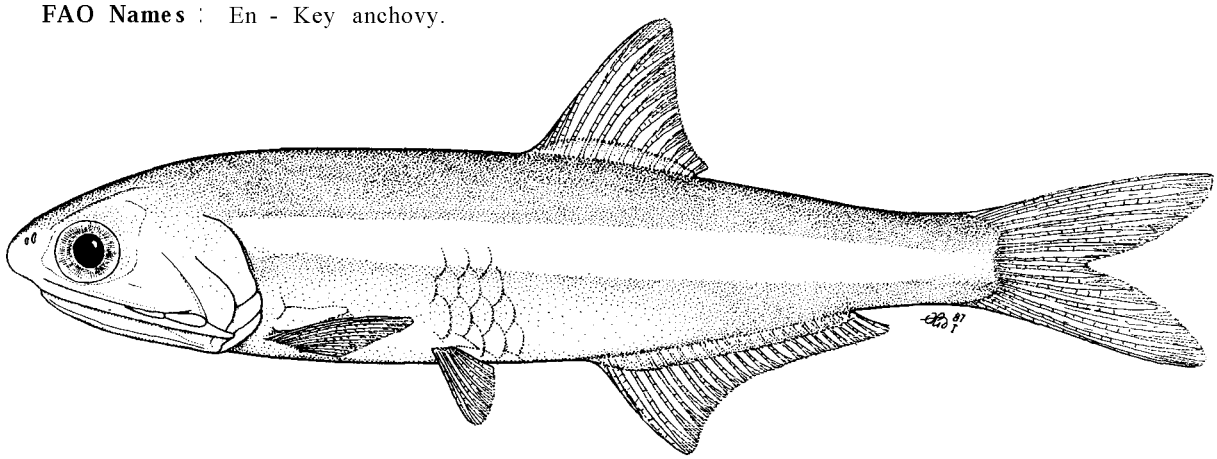
Anchoa cayorum (Fowler, 1906)

ENGR Ancho 12

Anchovia choerostoma cayorum Fowler, 1906, Proc.Acad.nat.Sci.Philad., 58:85, fig.4 (Hailer's Rock, Florida Keys).

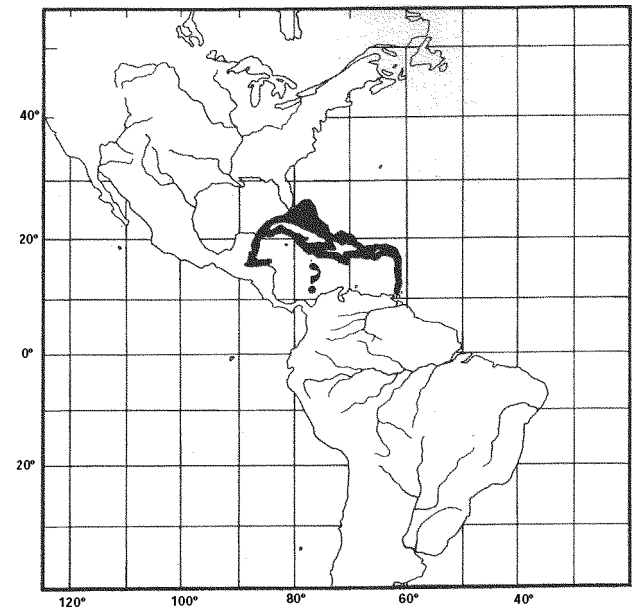
Synonyms : Stolephorus mitchilli:Bean, 1890206 (Cozumel, Yucatan); Anchovia cayorum:Fowler, 1911:219 (types); Anchoa cayorum-Hildebrand, 1943:50, fig.17 (synopsis); FWNA, 1964:173, fig.30 (Florida Keys to Cuba, Yucatan and Belize - synopsis); Cervigón,1969:217, fig.6 tabs 6, 19 (Los Roques Archipelago, Venezuela); Thomerson & Greenfield, 1973:52 (Sibun River, Belize - freshwater, if identification correct).

FAO Names : En - Key anchovy.



Diagnostic Features : Body somewhat compressed, slender, its depth about 5 times in standard length. Snout less than eye diameter; maxilla long, tip pointed, reaching almost to gill opening; lower gillrakers 16 to 19; gill cover canals of walkeri-type. Anal fin moderately long, with iii 21 to 26 finrays, its origin below about midpoint of dorsal fin base. A silver stripe along flank, a little less than eye diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. trinitatis (Venezuela, Trinidad; gill cover canals of panamensis-type, gillrakers 17 to 22), A. pectoralis (Brazil) and A. lamprotaenia (branched anal finrays 18 to 23); the most similar species is the freshwater A. belizensis (anal fin origin well before midpoint of dorsal fin base); A. lyolepis and A. filifera have a long pseudobranch.

Geographical Distribution : Caribbean area (Florida Keys, Cuba, Bahamas, Antilles, also Los Roques Archipelago off Venezuela; from Yucatan, possibly to western Venezuela; not in Gulf of Mexico).



Habitat and Biology : Marine, pelagic, schooling, apparently preferring clear oceanic waters (Cervigón, 1969:218); if correctly identified, then in Sibun River, Belize (Thomerson & Greenfield, 1975).

Size : To 8.5 cm standard length.

Interest to Fisheries : Unknown, probably little.

Local Names : CUBA: Manjuá; USA: Key anchovy (AFS list).

Literature : See synonymy.

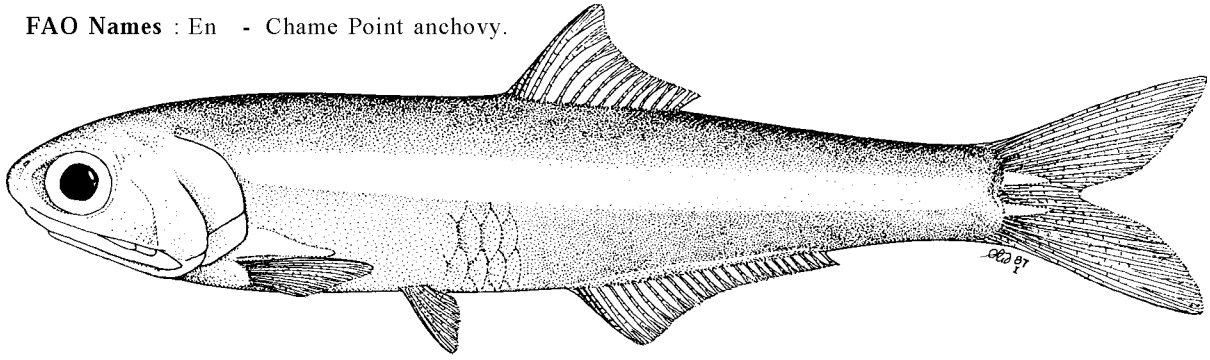
Anchoa chamensis Hildebrand, 1943

ENGR Ancho 25

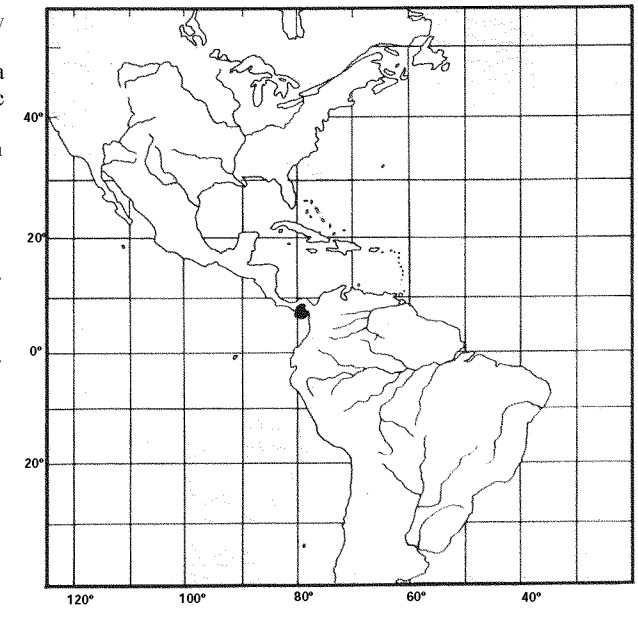
Anchoa chamensis Hildebrand, 1943, Bull.Bingham oceanogr.Coll., 8(2):54, fig.19 (Chame Point, Panama).

Synonyms : Anchoa chamensis-Nelson, 1983:tab.1 (vertebrae).

FAO Names : En - Chame Point anchovy.



Diagnostic Features : Body rather elongate, compressed, its depth about 5 times in standard length. Snout very short, about 1/2 eye diameter; maxilla short, tip bluntly pointed, just reaching onto inter-operculum; lower gillrakers 18 to 23; gill cover canals of walkeri-type. Anal fin moderate, with iii 21 to 24 finrays, its origin below about middle of dorsal fin base. A silver stripe along flank, about 3/4 eye diameter (above anal fin base); a distinct dark line along back and on edge of tail. Pacific Anchoa species that overlap in both gillrakers and anal finray counts are: A. curta (gillrakers usually not less than 2.31, A. walkeri and A. lucida (branched anal finrays not less than 22 or 23) and A. delicatissima (not south of Baja California).



Geographical Distribution : Eastern central Pacific (Panama Hay only).

Habitat and Biology : Marine, pelagic, coastal; more data needed.

Size : To 6 cm standard length.

Interest to Fisheries : No data.

Local Names:

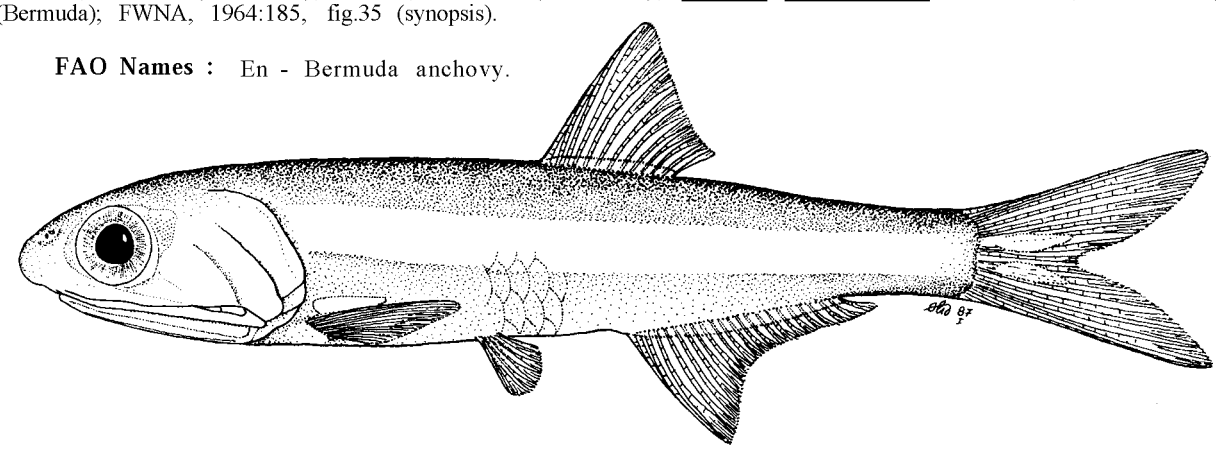
Literature :

Anchoa choerostoma (Goode, 1874) | ENGR Ancho 13

Engraulis choerostoma Goode, 1874, Am.J.Sci., 8:125 (Bermuda).

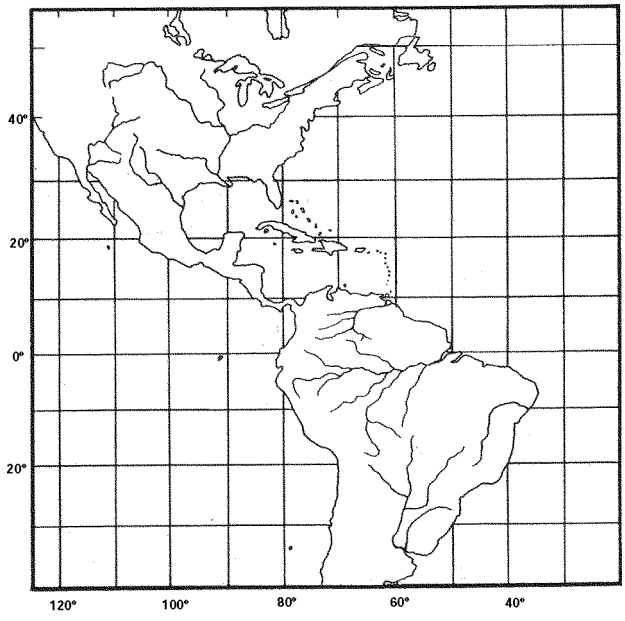
Synonyms : Stolephorus choerostoma:Jordan & Evermann, 1896:444 (on Goode's description); Barbour, 1985:113 (Bermuda; Puerto Rico incorrect); Bean, 1906:34 (Bermuda); Anchoviella choerostoma:Jordan, Evermann & Clark, 1930:48 (Bermuda); Fowler, 1930:146 (Bermuda); Anchoa choerostoma-Hildebrand, 1943:71 fig.28 (Bermuda); FWNA, 1964:185, fig.35 (synopsis).

FAO Names : En - Bermuda anchovy.



Diagnostic Features : Body moderately compressed, slender, its depth about 5 to 5.5 times in standard length. Snout short, about 3/4 eye diameter; maxilla long, tip sharply pointed, reaching almost to gill opening; lower gillrakers 24 to 27; gill cover canals of walkeri-type. Anal fin moderate, with iii 19 to 22 finrays, its origin below or behind midpoint of dorsal fin base. A silver stripe along flank, about 3/4 eye diameter. Although overlapping many other Atlantic Anchoa species in gillraker and anal finray counts, the only other Bermudan Anchoa is A. lyolepis (pseudobranch longer than eye, anal fin origin below base of last dorsal finray). Of species with walkeri-type canals in the western central Atlantic, it comes close to A. cubana and A. parva.

Geographical Distribution : Bermuda only.



Habitat and Biology : Marine, pelagic, coastal, schooling; apparently common (at least in August, but not July fide FWNA, 1964:186). Specimens with well-developed eggs were taken in June, 1927 (FWNA), suggesting a summer spawning period.

Size : To 7.5 cm standard length.

Interest to Fisheries : Probably little, but will school under a light and might be of value as a baitfish.

Local Names :

Literature :

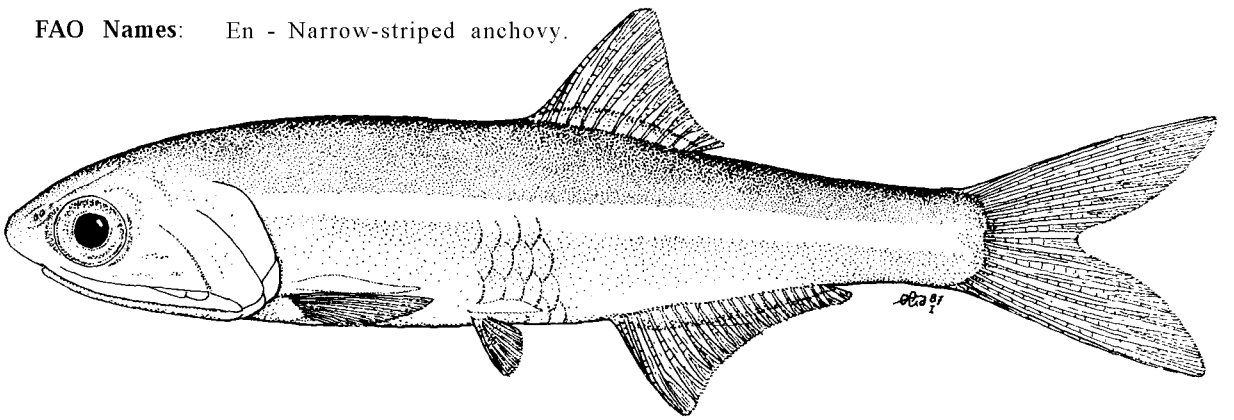
Remarks : The Panama and Puerto Rico specimens reported by Jordan & Seale (1926:404) were not this species, but perhaps Anchoa lyolepis (FWNA, 1964:186).

Anchoa colonensis Hildebrand, 1943 | ENGR Ancho 9

Anchoa hepsetus colonensis Hildebrand, 1943, Bull.Bingham oceanogr.Coll., 8(2):60, fig.22 (Colon, Panama).

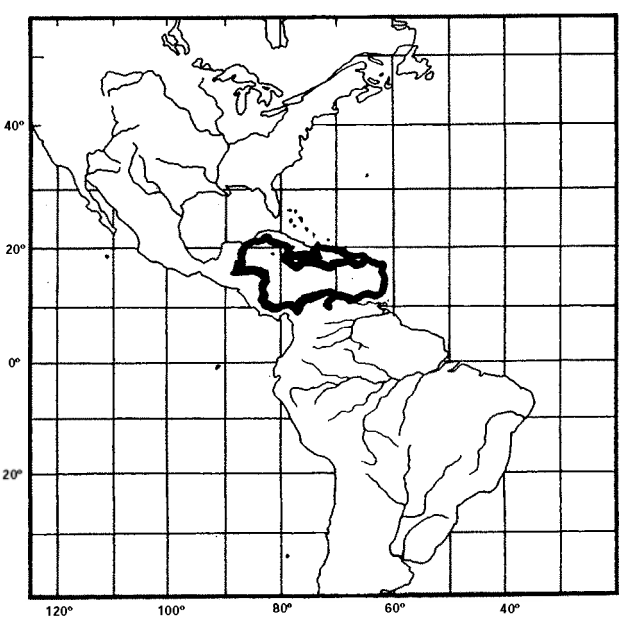
Synonyms : Anchoa hepsetus: presumably all Caribbean references apply to A. colonensis; Cervigón, 1969:234, fig.14 (Gulf of Venezuela,the banda estrecha element only); Whitehead, 1973a:132, fig.51a, 52a (maxilla) (Trinidad, French Guiana, but not batch b, which was true A. hepsetus); Cequea & Pérez, 1974:4 et seq., figs 1-6 (electrophoretograms) (separation from A. hepsetus on proteins, Venezuela); Cervigón, 1980:226, fig. 2.768 (photo, as banda estrecha); Anchoa hepsetus colonensis Hildebrand, 1943:60, fig.22 (Colon and Porto Bello, Panama); FWNA, 1964:197, fig.41 (separation from A. hepsetus hepsetus); Pérez et al., 1975:228 et seq., figs 1-4 (electrophoretograms), tab.1 (analysis of proteins, relationships Venezuela).

FAO Names: En - Narrow-striped anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth about 5 times in standard length. Snout pointed, about 3/4 eye diameter; maxilla long, tip pointed, reaching to hind margin of pre-operculum; lower gillrakers 19 to 22; gill cover canals of panamensis-type. Anal fin short, with iii 17 to 21 finrays. Anus nearer to anal fin origin than to pectoral fin tips. A narrow silver stripe along flank, about width of pupil. Very closely resembles A. hepsetus, which has a broader silver stripe (about 3/4 eye diameter). Other Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. marinii (Brazil; gillrakers and anal finrays at upper limit of range and beyond), A. michilli (gillrakers not less than 21, branched anal finrays not less than 20, also anus nearer to pectoral fin tips than to anal fin origin), A. lamprotaenia (anus also advanced; also the walkeri-type gill cover canals); A. lyolepis and A. filifera have a long pseudobranch.

Geographical Distribution : Caribbean area (Greater and Lesser Antilles to Trinidad; Venezuela westward to Panama and Yucatan), where it replaces the more widespread A. hepsetus.



Habitat and Biology : Marine, pelagic, coastal, forming dense schools, often in shallow water close to shore. Other aspects of its biology probably similar to those of A. hepsetus.

Size : To 10.2 cm standard length (thus a smaller species than A. hepsetus).

Interest to Fisheries : Unknown.

Local Names : CUBA: Manjda.

Literature : Not separated from A. hepsetus until recently, but reference to Caribbean 'hepsetus' may refer to A. colonensis.

Remarks : See under A. hepsetus for further separation from that species.

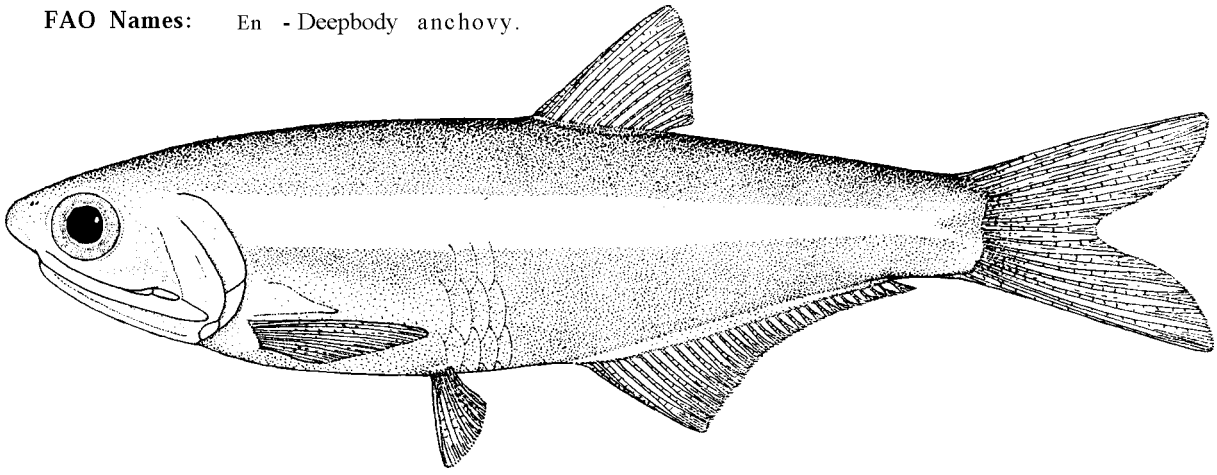
Anchoa compressa (Girard, 1858)

ENGR Ancho 17

Engraulis compressus Girard, 1858, Fishes.U.S.Senate Misc.Doc., (78)(4):336 (San Diego, California).

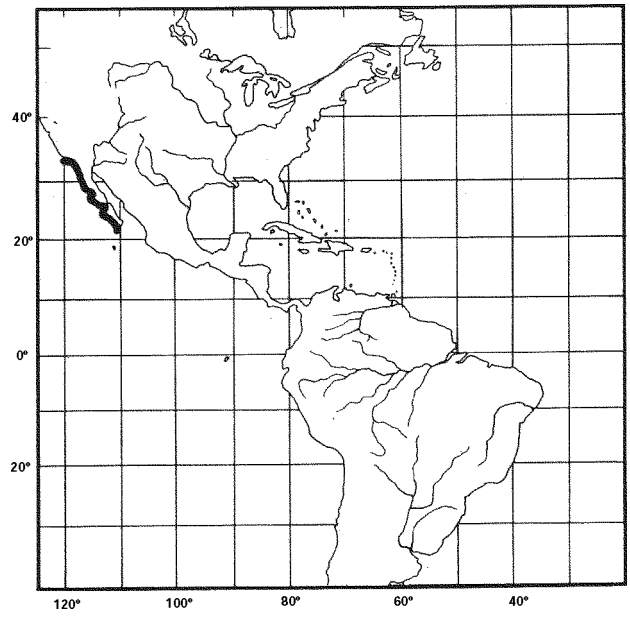
Synonyms : Stolephorus compressus:Eigenmann, 1893:140, pl.10, figs 1-5 (San Diego, California); Jordan & Evermann, 1896:447; Anchoviella compressa:Jordan & Seale, 1926:407 (San Diego; Mexico incorrect); Barnhart, 1936:16, fig.51 (southern California); Anchoa compressa-Hildebrand, 1943:39, fig.11 (San Diego and San Pedro, California); Chapman, 1944:311 et seq. (osteology); Miller & Lea, 1972:56, 57 (fig.) (compiled); Hubbs, Follett & Dempster, 1979:6 (listed); Horn & Allen, 1981:2, tab.1 (Newport Bay, California); Nelson, 1983:tab.1 (vertebrae); Eschmeyer, Herald & Hammann, 1983:74, pl.7 (California).

FAO Names: En - Deepbody anchovy.



Diagnostic Features : Body compressed, moderately deep (more so in larger fishes). Snout pointed, about 1/2 to 3/4 eye diameter; maxilla moderate, tip rather blunt, not reaching to hind border of pre-operculum; lower gillrakers 24 to 27; pseudobranch short, covered by skin; gill cover canals of panamensis-type. Anal fin long, with iii 27 to 31 finrays, its origin a little before midpoint of dorsal fin base. A bright silver stripe along flank, often as wide as eye, not fading on preservation. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. mundeola (not California or Pacific coast of Baja California) and A. panamensis (Panama Bay only; also, gillrakers 24 or fewer); in both these species the silver stripe is narrow, much less than eye diameter; overlaps the range of A. delicatissima, which has only 20 to 25 branched anal finrays. Engraulis mordax has the anal fin origin under or behind the last dorsal finray base.

Geographical Distribution : Eastern central Pacific (Point Conception, California to Magdalena Bay, on Pacific coast of Baja California; not in Gulf of California).



Habitat and Biology : Marine, pelagic, coastal and schooling, most commonly in bays and inlets (the fourth most abundant fish taken by various gear in Newport Bay, California; eggs the most abbundant of 7 species sampled, especially in May - see Horn & Allen, 1981). Ovarian eggs spherical (Baldwin & Chang, 1970).

Size : To 13.3 cm standard length.

Interest to Fisheries : Caught by seines, otter trawls and especially in gillnets (top species) in Newport Bay [Horn & Allen, 1981). Used as a baitfish.

Local Names : MEXICO: Anchoa; USA: Deepbody anchovy (AFS list).

Literature : Chapman (1944 - osteology), Heath (1980 - life history), Horn & Allen (1981 - abundance in Newport Bay, ecology).

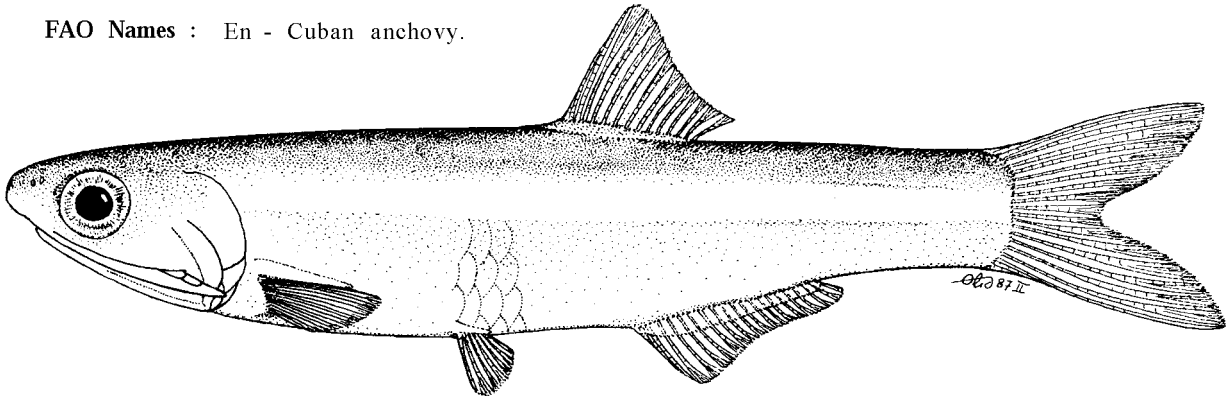
Anchoa cubana (Poey, 1868)

ENGR Ancho 7

Engraulis cubanus Poey, 1868, Repert.fisico-nat.Cuba, 2:420 (Cuba); Idem., 1881, in Grundlach, An.Soc.esp. Hist.nat., 10(4):(Puerto Rico).

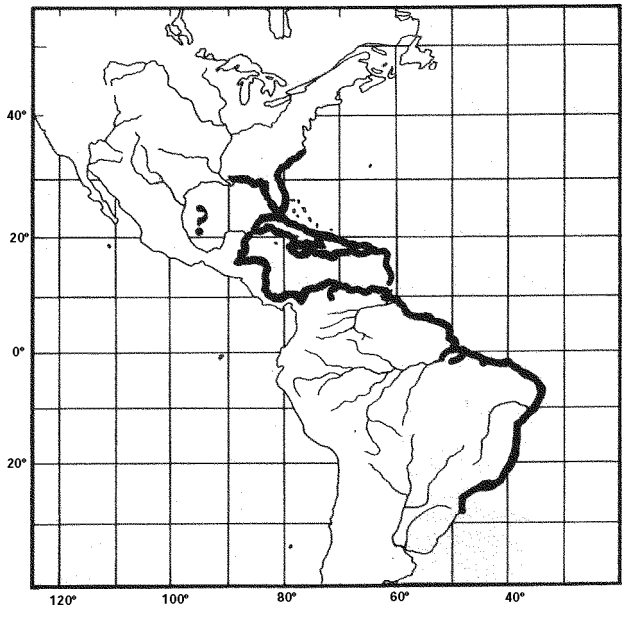
Synonyms : Stolephorus astilbe Jordan & Rutter, 1897:95 (Kingston, Jamaica); Anchoviella astilbe:Jordan & Seale, 1926:402 (syntypes); Anchoviella cubana:Jordan & Seale, 1926:399 (Poey specimens, Cuba); Hildebrand, 1943:76, fig.31 (Florida- on both coasts, Alabama, Louisiana, Yucatan, Guatemala; also, Cuba, Jamaica and St. Thomas); FWNA, 1964:188, fig.37 (synopsis); Gines Cervigón, & 1968:40 (Guianas coasts); Cervigón, 1969:229, figs 11, 23 (maxilla)(Florida, Jamaica, Venezuela, Surinam); Daly, 1970:72 (key only); Whitehead, 1973a:122, figs 47, 48 (maxilla)(Trinidad); Roux, 1973:52, fig.8 (between Rio de Janeiro and Santos).

FAO Names : En - Cuban anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth 5 to nearly 6 times in standard length. Snout pointed, about 3/4 eye diameter; maxilla long, tip pointed and projecting at least 1/2 eye diameter beyond second supra-maxilla, reaching beyond hind border of pre-operculum; lower gillrakers 24 to 30; gill cover canals of walkeri-type. Anal fin short, with iii 16 to 21 finrays, its origin below about midpoint of dorsal fin base. Anus nearer to pelvic fin tips than to anal fin origin. A narrow silver stripe along flank, about pupil diameter, disappearing on preservation. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. januaria and A. parva (maxilla shorter, not to hind edge of pre-operculum, the tip projecting not more than 1/2 eye diameter beyond second supra-maxilla); A. hepsetus and A. tricolor (anus nearer to anal fin origin; also Panamensis-type canals, as also in A. mitchilli and A. marinii, which have 20 or more branched anal finrays); A. lyolepis and A. filifera have a long pseudobranch.

Geographical Distribution : Western central Atlantic (North Carolina, both coasts of Florida, northern part of Gulf of Mexico (but perhaps throughout), Cuba and probably throughout the Greater and Lesser Antilles, Yucatan south and east to Venezuela and Surinam) and western South Atlantic (entire coast of Brazil south to at least Santos).



Habitat and Biology : Marine, pelagic, coastal, forming dense schools along beaches in water of 1 m or less (Cervigón, 1969:231); occurs down to about 60 m (FWNA,1964:190).

Size : To about 7 cm standard length, usually 5 to 6 cm.

Interest to Fisheries : Perhaps of local interest since it forms dense schools.

Local Names : CUBA: Bocón, Manjúa; USA: Cuban anchovy (FWNA, AFS list).

Literature : Cervigón (1969 - populations, habitat).

Remarks : Virtually overlaps the combined ranges of A. mitchilli, A. parva and A. januaria, all of which share an advanced anus and fairly similar gillraker and anal finray counts.

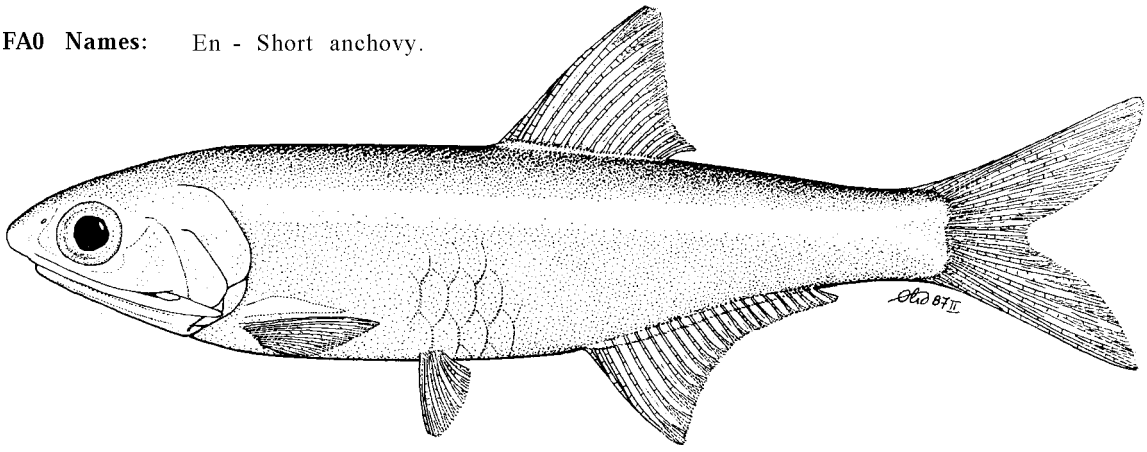
Anchoa curta (Jordan & Gilbert, 1882)

ENGR Ancho 32

Stolephorus curtus Jordan & Gilbert, 1882, Proc.U.S.nat.Mus., 4:343 (Mazatlan, Mexico).

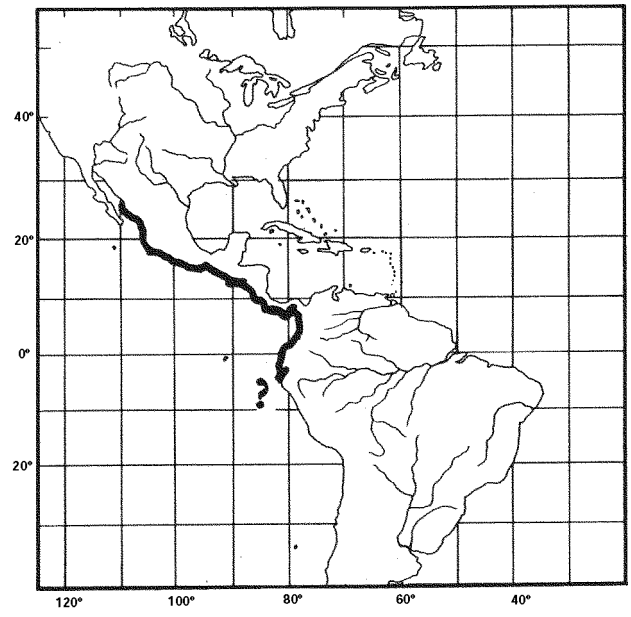
Synonyms : Stolephorus curtus:Jordan & Evermann, 1896:445; Anchovia curta: Gilbert & Starks, 1904:42 (Panama Bay); Meek & Hildebrand, 1923:206 (Panama Bay, in fresh or slightly brackish water); Anchoviella curta:Jordan & Scale, 1926:407 (Mazatlan, Mexico); Anchoa curta-Hildebrand, 1943:85, fig.36 (Mexico, El Salvador, Panama, Peru); Idem, 1946:100 (Puerto Pizarro, Peru); Peterson, 1956:168 (Costa Rica); Chirichigno, 1963:17 (Puerto Pizarro, Peru); Cobo & Massay, 1969:8 (Mexico, listed); Baldwin & Chan, 1970:142 (Rio Santiago, Nayarit, Mexico - with A. walkeri); Nelson, 1983:tab.1 (vertebrae).

FA0 Names: En - Short anchovy.



Diagnostic Feature : Body moderately elongate, but somewhat compressed, its depth 4.5 to about 5 times in standard length. Snout fairly short, about 3/4 eye diameter; maxilla long, tip sharply pointed, reaching almost to edge of gill cover; lower gillrakers 21 to 26 (usually 23 to 26); gill cover canals of walkeri-type. Anal fin moderate, with iii 19 to 23 finrays, its origin under or a little before midpoint of dorsal fin base. A narrow silver stripe along flank. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. ischana and A. helleri (gillrakers not more than 22, and panamensis-type canals, as also in A. starksi, which has a long pseudobranch); A. walkeri and A. lucida have not less than 23 branched anal finrays, while A. delicatissima has not less than 26 gillrakers.

Geographical Distribution : Eastern central Pacific (central part of Gulf of California, i.e., southward from Rio Yaqui, Mexico, to Panama and south to the Gulf of Guayaquil, Peru).



Habitat and Biology : Marine, pelagic, coastal and schooling, most often in muddy estuaries in fully salt, brackish or apparently freshwater, penetrating only a few kilometres up rivers. Maturing females caught in January, August and October in the Gulf of Nicoya, Costa Rica, suggesting a protracted spawning season; eggs oval (Peterson, 1956).

Size : To at least 6.4 cm standard length, or 7.8 cm total length (Hildebrand, 1943:87).

Interest to Fisheries : No data.

Local Names : COSTA RICA: Anchoa; ECUADOR: Pelada; MEXICO, PERU: Anchoa.

Literature : Peterson (1956 - brief note on breeding).

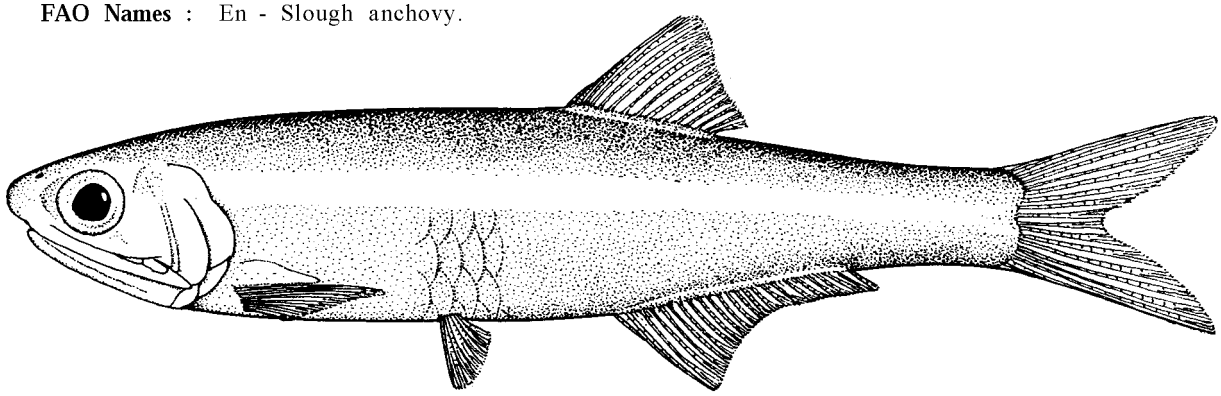
Anchoa delicatissima (Girard, 1856)

ENGR Ancho 28

Engraulis delicatissimus Girard, 1856, Proc.Acad.nat.Sci.Philad., 7:154 (San Diego, California); Idem, 1858, Fishes, U.S.Senate Misc.Doc., (78)(4):335 (repeat).

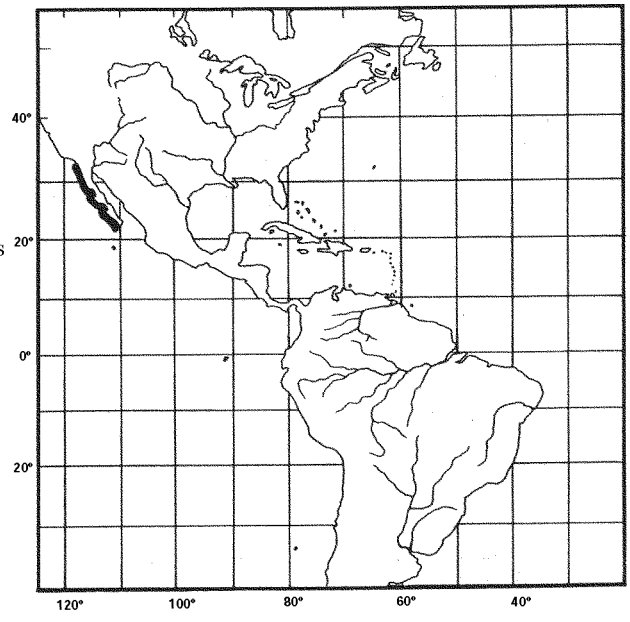
Synonyms : Stolephorus delicatissimus:Eigenmann, 1893:138, pl.12 (San Diego, California); Jordan & Evermann, 1896:444; Anchoviella delicatissima:Jordan & Seale, 1926:398 (San Diego); Anchoa delicatissima-Hildebrand, 1943:98, fig.41 (San Diego only); Miller & Lea, 1972:56, 57 (fig., key; synopsis); Hubbs, Follett & Dempster, 1979:7 (California, listed); Horn & Allen, 1981:48, tab.1 (Newport Bay, California); Nelson, 1983:tab.l (vertebrae); Eschmeyer, Herald & Hamman, 1983:74, pl.7 (California).

FAO Names : En - Slough anchovy.



Diagnostic Features : Body fairly elongate and compressed, its depth around 5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla moderate, tip pointed, reaching onto inter-operculum, but not to edge of gill cover; lower gillrakers numerous, 26 to 32; gill cover canals of walkeri-type. Anal fin moderate, with iii 20 to 25 finrays, its origin usually somewhat before midpoint of dorsal fin base. A silver stripe along flank, about 3/4 eye diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. starksi (gillrakers not more than 27, branched anal finrays not more than 20, also panamensis-type canals), and A. curta (gillrakers not more than 26); also, neither of these species occurs off California or the Pacific coast of Baja California. Overlaps the range of A. compressa, which has 27 to 31 branched anal finrays. Engraulis mordax has the anal fin origin under or behind the last dorsal finray base.

Geographical Distribution : Eastern central Pacific (Belmont Shores, Long Beach Harbor, California at 33°47'N, south to Magdalena Bay, on Pacific coast of Baja California; not in Gulf of California).



Habitat and Biology : Marine, pelagic, coastal, "common in estuaries and backwaters of bays, occasionally near shore outside of bays" (Miller & Lea, 1972: 56). The fifth most abundant fish taken by various gear in Newport Bay, California; a midwater schooling species caught in bag seine hauls mainly in July and September (Horn & Allen, 1981).

Size : To 6.5 cm standard length.

Interest to Fisheries :

Local Names : USA: Slough anchovy (AFS list).

Literature : Heath (1980 - life history), Horn & Allen (1981 - abundance in Newport Bay, ecology).

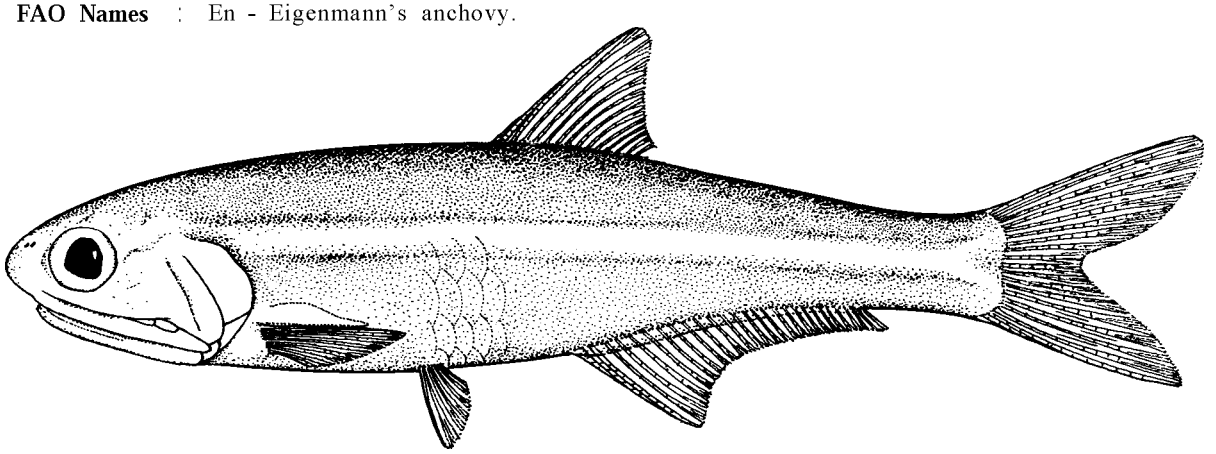
Anchoa eigenmannia (Meek & Hildebrand, 1923)

ENGR Ancho 27

Anchovia eigenmannia Meek & Hildebrand, 1923, Field Mus.Publ.,Zool., 15(1):205, P1.14. fig.2 (Taboga Island, Panama).

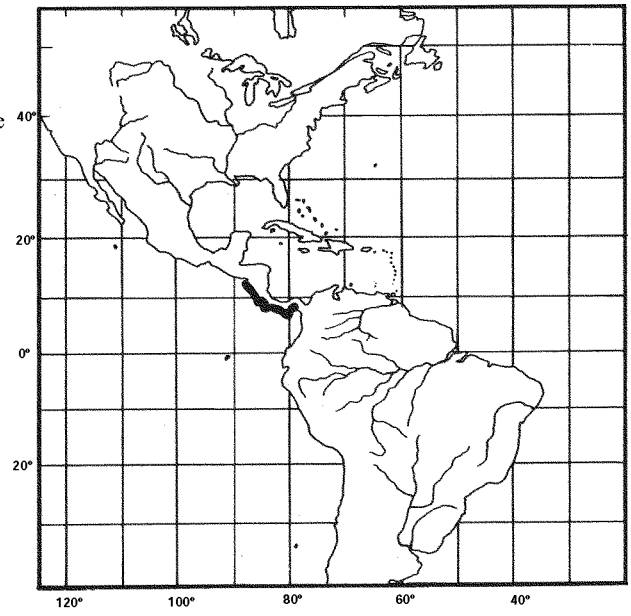
Synonyms : Anchoa eigenmannia-Hildebrand, 1943:47, fig.15 (Taboga and Pearl Islands, Panama); Peterson, 1956:162 (Costa Rica); Nelson, 1983:tab.1 (vertebrae).

FAO Names : En - Eigenmann's anchovy.



Diagnostic Features : Body moderately elongate, strongly compressed, its depth about 4.5 to 5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla moderate, tip pointed, reaching onto interoperculum, but not to edge of gill cover; lower gillrakers 12 to 14; gill cover canals of panamensis-type. Anal fin fairly long, with iii 24 to 29 finrays (usually 25 to 27), its origin before midpoint of dorsal fin base. A narrow silver stripe along flank, about 1/2 eye diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. ginifer (branched anal finrays 28 to 34) and A. scofieldi (branched anal finrays usually to 23 or 24, also anal fin origin usually under midpoint of dorsal fin base and vertebrae 42 to 44, cf. 41 to 43).

Geographical Distribution : Eastern central Pacific (Nicaragua, Costa Rica, Panama).



Habitat and Biology : Marine, pelagic, coastal; in the Gulf of Nicoya, Costa Rica, recorded only in the more oceanic outer part of the Gulf, along sandy beaches (Peterson, 1956).

Size : To 6.7 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature : Peterson (1956 - brief notes on ecology).

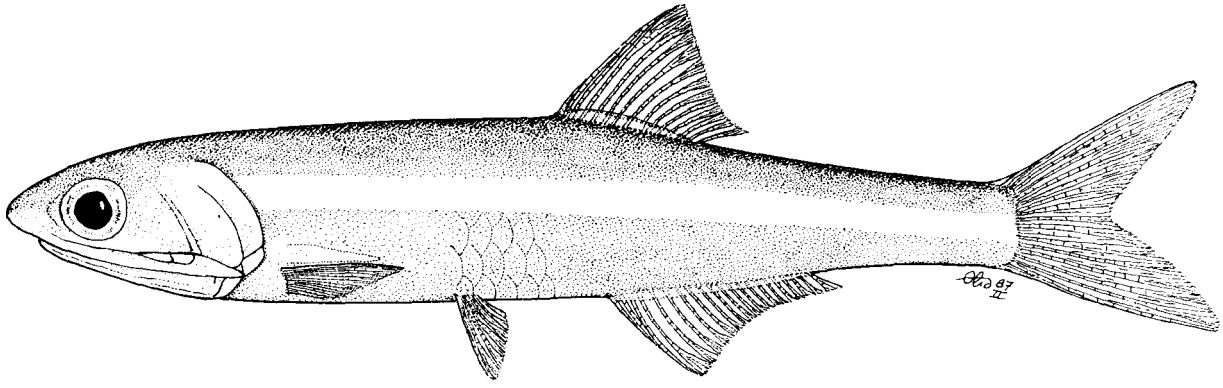
Anchoa exigua (Jordan & Gilbert, 1882)

ENGR Ancho 29

Stolephorus exiguus Jordan & Gilbert, 1882, Proc.U.S.natn.Mus. 4:342 (Mazatlan, Mexico).

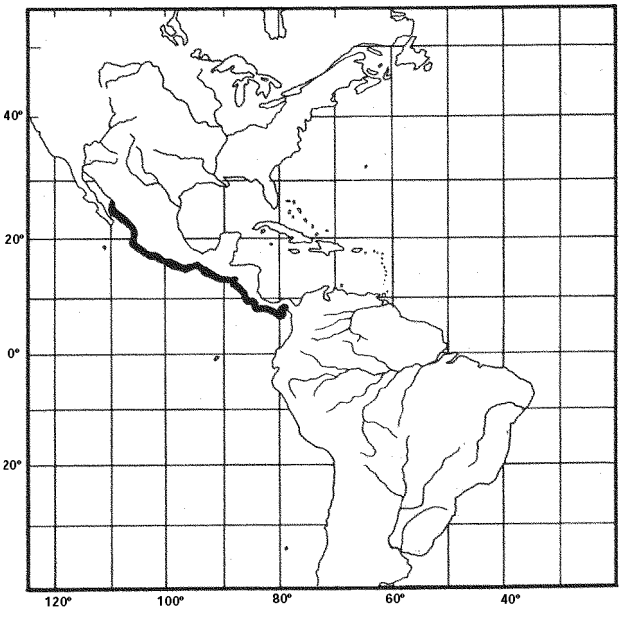
Synonyms : Anchoa tropica Hildebrand, 1943:80, fig.33 (Panama Bay and Cupica Island, Colombia); Anchovia exigua:Meek & Hildebrand, 1923:200 (Chame Point and Balboa, Panama); Anchoviella exigua:Jordan & Seale, 1926:395 (Mazatlan, Mexico); Anchoa exigua-Hildebrand, 1943:78, fig.32 (Mazatlan, Mexico and San Josef Island, Baja California); Peterson, 1956:167 (Costa Rica, tropica a synonym); ?Cobo & Massay, 1969:8 (Ecuador, listed; needs confirmation); Nelson, 1983:tab.1 (vertebrae).

FAO Names : En - Slender anchovy.



Diagnostic Features : Body slender, its depth about 5 to 6 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla rather long, tip pointed, reaching to or almost to edge of gill cover; lower gillrakers 22 to 27; gill cover canals of walkeri-type. Anal fin short, with iii 16 to 19 finrays, its origin below or a little before midpoint of dorsal fin base. A silver stripe along flank, less than eye diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. ischana (gillrakers not more than 22, and panamensis-type canals, as also in A. starksi, which has a long pseudobranch), A. curta (branched anal finrays not less than 19, as also in A. delicatissima, which has not less than 26 gillrakers).

Geographical Distribution : Eastern central Pacific (southern part of Gulf of California south to Panama, perhaps to Colombia).



Habitat and Biology : Marine, pelagic, coastal; found only in outer part of Gulf of Nicoya, Costa Rica, thus perhaps not entering estuaries (Peterson, 1956). Nearly mature females with oval and rather few eggs were recorded in the Gulf of Nicoya in August to September (Peterson, loc.cit.).

Size : To about 6 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature : Peterson (1956 - brief notes on ecology, breeding).

Remarks : Morrow & Posner (1957:14) recorded a single larva (19.6 mm standard length) from Talara Harbour, northern Peru; however, the low anal finray count also suggests A. ischana, A. starksi or A. argentivittata.

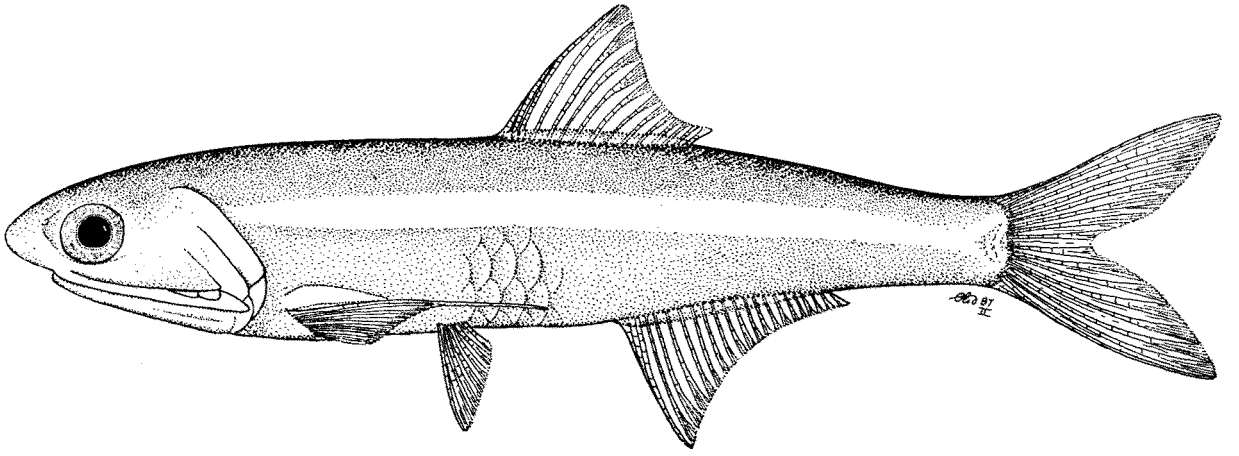
Anchoa filifera (Fowler, 1915)

ENGR Ancho 34

Anchovia filifera Fowler, 1915, Proc.Acad.nat.Sci.Philad.:524, fig.2 (Port-of-Spain, Trinidad).

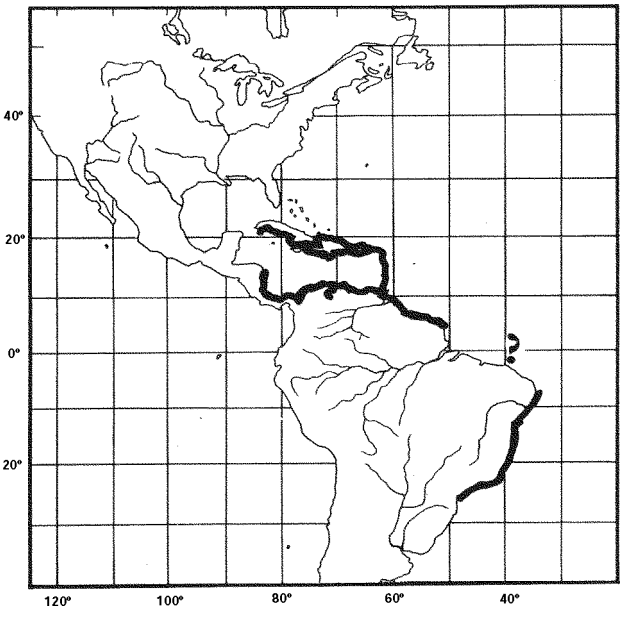
Synonyms : Anchoviella longipinna Beebe & Tee Van, 1928:48, fig. (Bizoton, Haiti); Anchoa howelli Hildebrand, 1943:106, fig.46 (Santos and Rio de Janeiro, Brazil); Carvalho, 1950a:65, pl.2, fig.10 (compiled); Gines & Cervigón, 1968:30, 40 (Guianas); Anchoviella filifera:Fowler, 1930:146 (Jamaica); Anchoa filifera-Hildebrand, 1943:105, fig.45 (Jamaica, Puerto Rico, Trinidad); FWNA, 1964:202, fig. 43 (synopsis);Cervigón,1969:218, fig.7, tabs 7, 20 (Puerto Rico, Venezuela, Guyana, Recife in Brazil; subspecies howelli accepted); Salaya & Salazar, 1969:253 (Venezuela); Whitehead, 1973a:140, fig.53 (Trinidad, French Guina); Eskinazi, 1974:290 (Canal de Santa Cruz, Pernambuco, Brazil; tab.1 as A. howelli); Palacio, 1974:21 (Peninsula de la Guajira, Colombia); Figueiredo & Menezes, 1978:31, fig.40 (Brazil, south to Cananéia, compiled); Nelson, 1986:895, tabs 1-4 (synonymy, subgenus Anchovietta).

FAO Names : En - Longfinger anchovy.



Diagnostic Features : Body rather round, elongate, its depth about 5 to 5.5 times in standard length. Snout long and pointed, only slightly less than eye diameter; maxilla long, tip pointed, reaching almost to gill opening, teeth near tip somewhat enlarged; lower gillrakers 21 to 27 (see Remarks); gill cover canals of panamensis-type; pseudobranch longer than eye diameter, with 30 or more filaments, extending onto inner face of operculum. Pectoral fin with first ray extended as a filament reaching as far as dorsal fin origin in larger fishes (but often broken); anal fin short, with iii 17 to 21 finrays, its origin under or behind base of last dorsal finray. A broad silver stripe along flank, about as wide as eye, apparently without a dark line above it. Closely resembles A. lyolepis (no pectoral fin filament, also vertebrae mostly 41 or 42; cf. mostly 39 in A. filifera); A. marini (whichmay overlap A. filifera at around 25 S° off Brazil) also has a long pseudobranch, but like all other Atlantic Anchoa species has the anal fin origin well under the dorsal fin base. Engraulis species have a long pseudobranch, but maxilla not beyond pre-operculum.

Geographical Distribution : Western Atlantic (Antilles, Trinidad and south to Brazil, apparently as far south as 24°58' S; also Venezuela to Panama and Honduras, but not in Gulf of Mexico).



Habitat and Biology : Marine, pelagic, coastal and schooling; trawled down to 25 m off Brazil, but equally taken in shore seines and recorded in brackish water (7.94 to 8.21‰) in the Canal de Santa Cruz, Pernambuco (Eskinazi, 1974:291). More data needed.

Size : To 10 cm standard length.

Interest to Fisheries : Contributes to clupeoid catches, but no special fishery.

Local Names :

Literature : See synonymy (but very little biological information).

Remarks : Damage to the pectoral filament produces a fish very similar to A. lyolepis (but vertebrae 38 to 40, mostly 39; cf. 39 to 43, mostly 41 to 42 in A. lyolepis). Under strong magnification -it can usually be decided whether a pectoral filament was originally present or not. Nevertheless, the filament is consistently absent in specimens from Honduras whose low vertebral count of 39 allies them more with A. filifera than with A. lyolepis (but gillrakers 21 to 23, thus consistent with either species). The best character separating filifera-like fishes frorn A. lyolepis is their distinctly larger teeth toward the end of the maxilla.

As with A. lyolepis, the extensive geographical distribution of A. filifera has suggested the presence of subspecies. Cervigón (1969) proposed.

A. filifera filifera : mainland- Venezuela south to Brazil

A. filifera longipinna : insular - Antilles

Additional meristic data (Nelson, 1986) tends to support this, with a third geographical unit in the western Caribbean:

A. South America: gillrakers 23 to 27, mostly 25 or 26 (eastern Colombia, Venezuela south to Brazil) (filifera)

B. Antillean: gillrakers 21 to 26, mostly 23 or 24 (Cuba to Lesser Antilles, including La Blanquella and Los Roques off Venezuela) (longipinna)

C. Western Caribbean: gillrakers 21 to 23, no pectoral filament (Gulf of Honduras) (no name)

Vertebral counts do not correlate with these geographical divisions, but branched anal finrays are marginally higher in the South American than in the Antillean group (18 to 21, mostly 18 to 20; cf. 17 to 20, mostly 17 to 19). For the moment, however the recognition of subspecies seems unjustified.

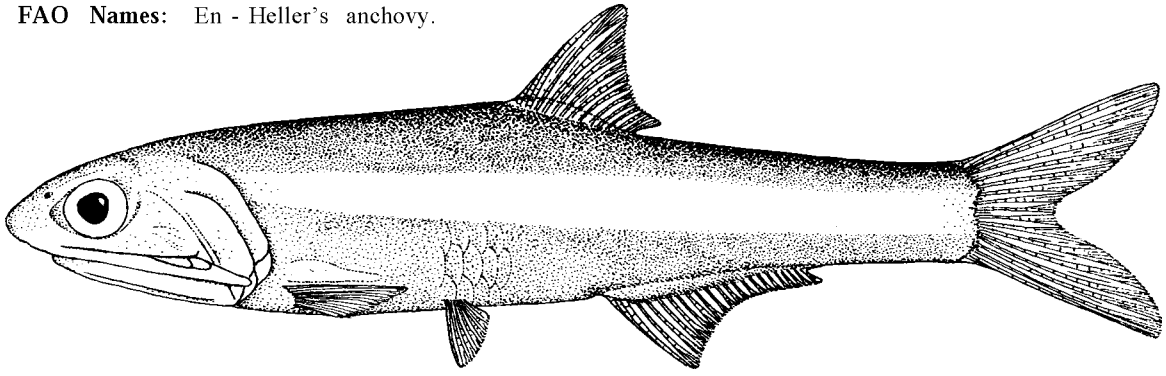
Anchoa helleri (Hubbs, 1921)

ENGR Ancho 21

Anchoviella helleri Hubbs, 1921, Proc.biol.Soc.Wash., 34:47 (San Filipe Bay, Gulf of California).

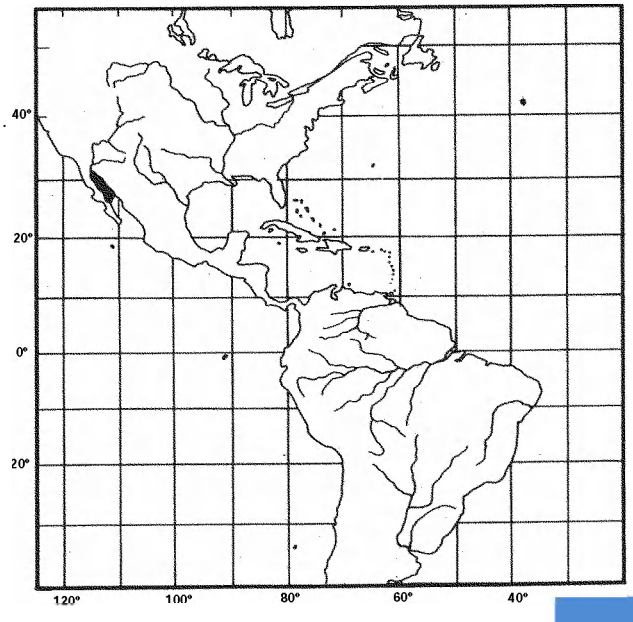
Synonyms : Anchoa helleri-Hildebrand, 1943:64, fig.24 (Cape San Lucas, Baja California and St. George's Island, Gulf of California); Nelson, 1983:tab.1 (vertebrae).

FAO Names: En - Heller's anchovy.



Diagnostic Features : Body rather elongate, but somewhat compressed, its depth about 4.5 to 5 times in standard length. Snout fairly long, almost equal to eye diameter; maxilla moderate, tip bluntly pointed, reaching onto inter-operculum, but not to edge of gill cover; lower gillrakers 16 to 21; gill cover canals of panamensis-type. Anal fin fairly short, with iii 17 to 21 (rarely to 23) finrays, its origin a little behind midpoint of dorsal fin base. A broad silver stripe along flank, deeper above anal fin (more than eye diameter). Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. ischana (very similar, but anal fin a little shorter, with 15 to 19 branched finrays and usually 42 to 44 vertebrae, cf. 40 to 42, rarely 43), A. chamensis (Panama only), A. walkeri and A. lucida (branched anal finrays not less than 23 or 22, and walkeri-type canals, as also in A. curta, which has not less than 21 gillrakers) and A. argentivittata (not more than 19 gillrakers or 17 branched anal finrays, also vertebrae 44 to 46, cf. 40 to 42, rarely 43) .

Geographical Distribution : Eastern central Pacific (northern part of Gulf of California south to Sonora).



Habitat and Biology : Marine, pelagic, coastal. More data needed.

Size : To about 8.5 cm standard length, or 10 cm total length (Hildebrand, 1943:65).

Interest to Fisheries : No data.

Local Names :

Literature :

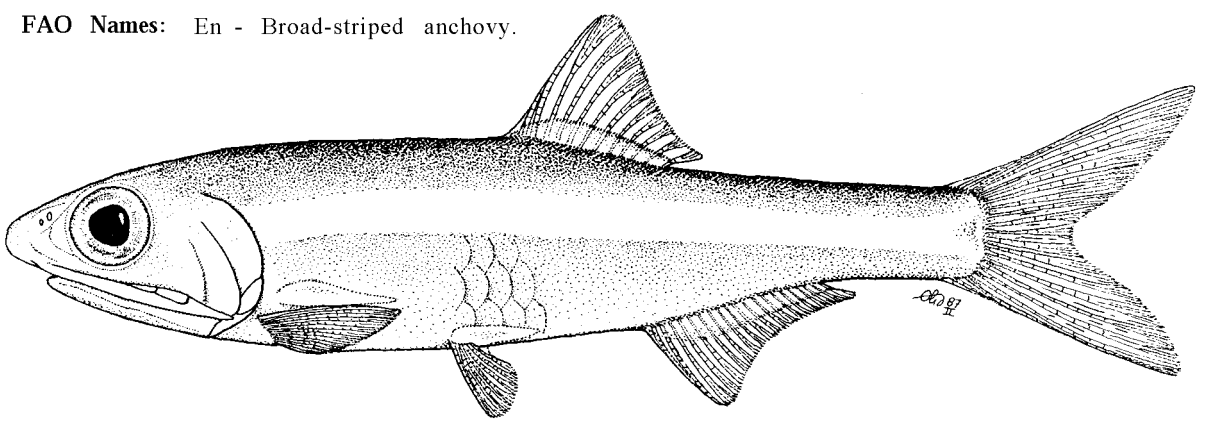
Anchoa hepsetus (Linnaeus, 1758)

ENGR Ancho 1

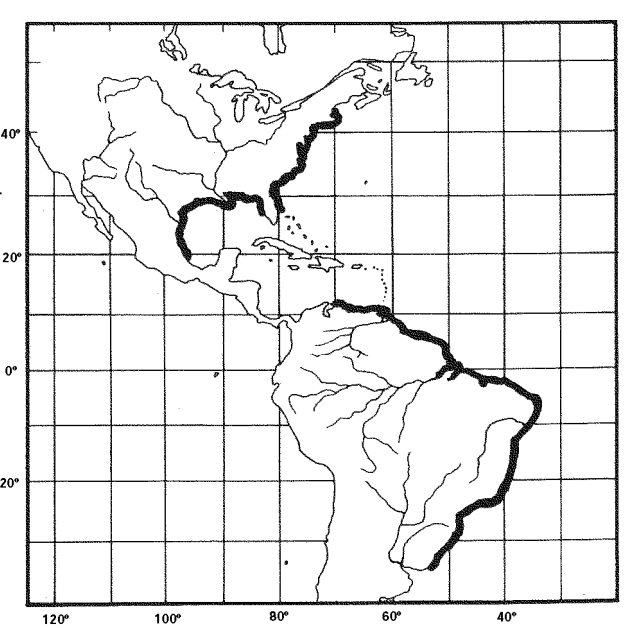
Esox hepsetus Linnaeus, 1758, Syst.nat., 10th ed, 1:314 (on Menidia of Browne, 1756:441, pl.45, fig.3, Jamaica; other elements doubtful).

Synonyms : Atherina menidia Linnaeus, 1766:519 (on Menidia of Browne, 1756 - see above, and on Argentea linea lata argentea of Gronovius, 1763:ll2; the remainder an atherinid); Atherina brownii Gmelin, 1789:1387 (on Linnaeus, 1766); Stolephorus perthecata Good & Bean, 1883:434 (Pensacola, Florida); Anchovia brownii:Fowler, 1906:109 (New Jersey); Anchoviella epsetus:Jordan & Seale, 1926:396 (New Jersey, South Carolina, Cuba specimens; others were A. lamprotaenia and A. tricolor fide FWNA, 1964:199); Anchoa ginsburgi Hildebrand, 1943:55, fig.20 (Gulf of Venezuela); Cervigón, 1966:139 (compiled); Anchoa hepsetus-Hildebrand, 1943:57, fig. 21 (synopsis; comparison with A. hepsetus colonensis = A. colonensis); FWNA, 1964:194, fig.40 (synopsis); Cervigón, 1969:234, fig.13 (Venezuela:Puerto Rico, Mexico, Mississippi, Florida, Georgia; banda ancha form only); Daly, 1970:75, figs 2, 6 (photos) (Florida); Dahl, 1971:163 (Colombia, compiled); Whitehead, 1973a:132, fig.51b, 52b (maxilla) (Trinidad batch b only, the described fishes being A. colonensis); González, Padrón & Subero, 1974:49 et seq., figs 1 to 6 (electrophoretograms) (separation from A. laprotaenia on proteins, Venezuela); Cequea & Pérez, 1974:4 et seq., figs 1 to 6 (electrophoretograms) (separation from A. colonensis on proteins, Venezuela); Pérez et al., 1975:228 et seq., figs 1 to 4 (electrophoretograms), tab.1 (analysis of proteins, relationships, Venezuela); Fineran & Nicol, 1976:296 et seq., figs 1 to 6 (retinal cones, Texas); Idem, 1977:325 et seq., figs 1 to 37 (eye pigment epithelium, Texas); Cervigón, 1980226, fig. 2.76A (photo, biol.).

FAO Names: En - Broad-striped anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth about 5 times in standard length. Snout pointed, about 3/4 eye diameter; maxilla long, tip pointed, reaching beyond hind border of pre-operculum, almost to gill opening; lower gillrakers 19 to 25; gill cover canals of panamensis-type. Anal fin short, with iii 16 to 20 finrays, its origin below about midpoint of dorsal fin base. Anus nearer to anal fin origin than to pelvic fin tips. A broad silver stripe along flank (a dark line above) of uniform width except narrowed immediately behind gill opening, about 3/4 eye diameter. Very closely resembles A. colonensis, which has a narrower silver lateral band, about width of pupil. Other Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. tricolor and A. marinii (Brazil; gillrakers not less than 24 in the first, branched anal finrays not less than 20 in the second), A. mitchilli (branched anal finrays not less than 20, also anus nearer to pectoral fin tips than to anal fin origin), A. lamprotaenia (anus also advanced; also the walkeri-type gill cover canals, as also in A. choerostoma of Bermuda and A. cubana, A. januaria and A. parva, all of which usually have more than 23 or 24 gillrakers). See ENGR Ancho 1, Fishing Area 31 (but A. colonensis illustrated).



Geographical Distribution : Western North Atlantic (Massachusetts, perhaps occasionally straying north to Maine or even Nova Scotia (FWNA, 1964:198), south to Fort Pierce, Florida - but not Florida Keys - and at least the northern part of Gulf of Mexico), and western central and South Atlantic (Gulf of Venezuela south to Uruguay); replaced by A. colonensis in the West Indies and perhaps on the western Caribbean coasts.

Habitat and Biology : Marine, pelagic, coastal, forming dense schools, often in shallow waters close to shore (but recorded down to 70 m); able to tolerate a wide range of salinities, from hypersaline to almost fresh. Feeds on copepods when young, then also on gastropods, foraminifera and an occasional ostracod and annelid

(FWNA,1964:197). Eggs elliptical (about 1.4 to 1.6 mm by 0.7 to 0.85 mm), transparent, without oil globule, yolk appearing 'cellular'; at Beaufort, North Carolina, breeding recorded in April through to July; breeds in harbours, estuaries and sounds.

Size : To about 12.5 cm standard length, usually 9 to 11 cm.

Interest to Fisheries : Although occurring in often large schools, it does not appear to be widely exploited. Caught in shore seines, also in fine-mesh trawls.

Local Names : USA: Striped anchovy (AFS list).

Literature : No comprehensive study of its biology has been made; earlier references to A. hepsetus may not always have been dealing with this species. Analyses of proteins have been carried out by Venezuelan workers and the histology of the eye has also been studied (see references at end of synonymy).

Remarks : Although Hildebrand (1943 and FWNA, 1964), Cervigón (1969) and Whitehead (1973a) acknowledged two forms or subspecies of A. hepsetus (hepsetus or banda ancha and colonensis or banda estrecha), it was the electrophoretic studies of Cequea & Perez (1974) that finally confirmed the presence of two species. It appears that A. colonensis replaces A. hepsetus in the Caribbean area, but overlaps it in eastern Venezuela (occurring in the same schools according to Cervigon, 1969). Whitehead (1973a:fig.52) illustrated a slightly longer maxilla in A. hepsetus, but this needs confirmation.

For further separation from A. mitchilli, see Remarks under that species.

The name hiulcus, long placed in the synonymy of hepsetus, is a senior synonym of lamprotaenia (see Remarks under that species). The complex history of other names used for the present species is fully discussed by Whitehead (1973b: 132-40).

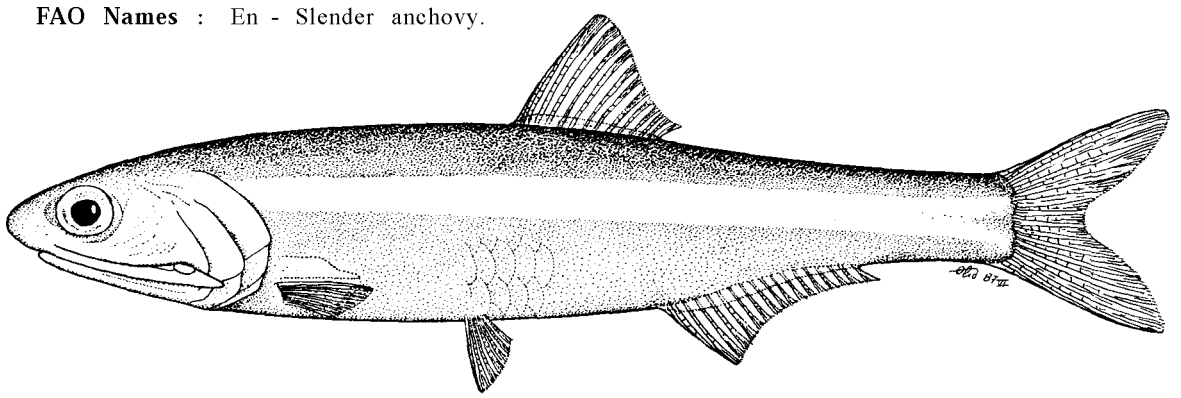
Anchoa ischana (Jordan & Gilbert, 1882)

ENGR Ancho 22

Stolephorus ischana Jordan & Gilbert, 1882, Proc.U.S.natn.Mus., 4:340 (Mazatlan, Mexico).

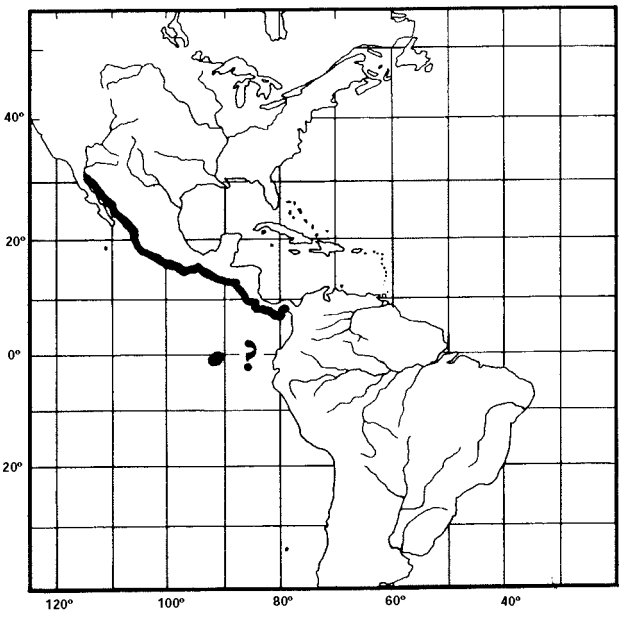
Synonyms : Anchoviella ischana: Jordan & Seale, 1926:397 (Mexico, perhaps also their Panama specimens); Anchoa ischana-Hildebrand, 1943:67, fig.26 (Magdalena Bay, Mazatlan and also Acapulco, Mexico); Peterson, 1956:163 (Costa Rica); Anon., 1976:69 (key), 70 (Mexico, listed); Nelson,1983:49 (distinguished from A. argentivittata = arenicola of authors).

FAO Names : En - Slender anchovy.



Diagnostic Features : Body rather elongate, but somewhat compressed, its depth about 5 to 6.25 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla moderate, tip narrowly pointed, reaching onto sub-operculum, but not to edge of gill cover; lower gillrakers 17 to 22; gill cover canals of panamensis-type. Anal fin short, with iii 15 to 19 finrays, its origin below posterior third of dorsal fin base. A narrow silver stripe along flank, deeper above anal fin (about 3/4 to 2/3 eye diameter). Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. helleri (very similar, but confined to northern end of Gulf of California, also anal fin longer, with 17 to 21 branched finrays and 40 to 42, rarely 43 vertebrae, cf. usually 42 to 44), A. argentivittata (silver stripe almost as wide as eye diameter, maxilla tip bluntly rounded, at most only just reaching onto sub-operculum, vertebrae 44 to 46) and A. curta (not less than 21 gillrakers, also walkeri-type canals).

Geographical Distribution : Eastern central Pacific (entire Gulf of California south to Panama, but not further south fide Nelson, 1983; also, Galapagos Islands).



Habitat and Biology : Marine, pelagic, coastal and schooling, frequently caught over sand or gravel in the Gulf of Nicoya, but also over mud (Peterson, 1956). May spawn throughout year in Gulf of Nicoya; eggs oval (Peterson, loc.cit.).

Size : To 12 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature : Peterson (1956 - some brief notes on ecology and maturity).

Remarks : The separation of A. ischana from the very similar A. argentivittata is discussed under that species.The separation of A. ischana from A. helleri of the northern Gulf of California is not clear-cut (overlap in anal finray and vertebral counts).

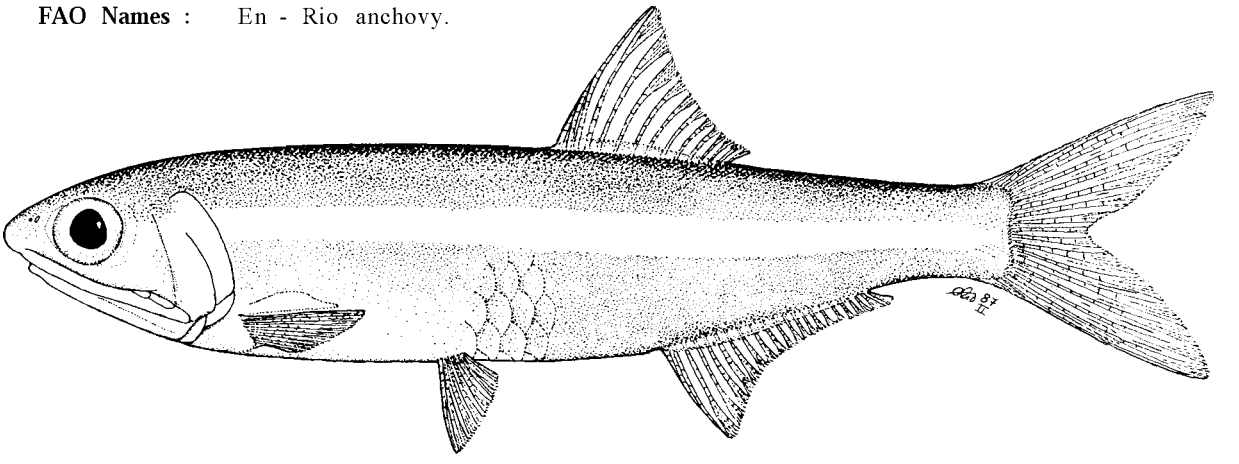
Anchoa januaria (Steindachner, 1880)

ENGR Ancho 14

Engraulis januarius Steindachner, 1880, Sber.Akad.Wiss.Wien, 80:176 (Rio de Janeiro harbour); Idem, 1880, Ichthyol.Beitr., (8):58 (repeat).

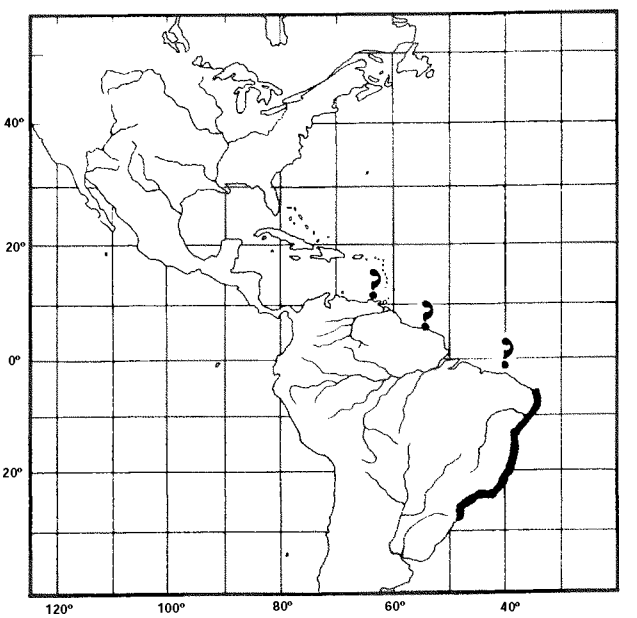
Synonyms : Anchovia januaria:Starks, 1913:9 (Natal, Brazil); Anchoviella januaria:Jordan & Seale, 1926:406 (Rio de Janeiro); Anchoa januaria-Hildebrand, 1943:81, fig.34 (Gulf of Venezuela, Natal, Rio de Janeiro); Hildebrand & Carvalho, 1948:287 (São Paulo market and Rio Casqueiro, São Vicente Island, Brazil); Fowler, 1948:17 (compiled); Carvalho, 1950a:59, pl.2, fig.6 (compiled); FWNA, 1964:183, fig.34 (synopsis); Cervigón, 1969:224, fig.9 (Lake Maracaibo, also Recife,São Pauio, Ubatuba); Whitehead, 1970:33 (lectotype of januaria); Eskinazi, 1972; 290, tab.1 (Santa Cruz canal, Pernambuco, Brazil); Figueiredo & Menezes, 1978:31, fig.41 (Venezuela to Rio Grande do Sul, Brazil - compiled).

FAO Names : En - Rio anchovy.



Diagnostic Features : Body somewhat compressed, moderately elongate, its depth about 5 times in standard length. Snout moderate, about 1/2 eye or a little more; maxilla moderate, tip not sharply pointed, not or only just reaching hind border of pre-operculum; lower gillrakers 24 to 29; gill cover canals of walkeri-type. Anal fin fairly short, with iii 19 to 22 finrays, its origin under about midpoint of dorsal fin base. Anus nearer to pelvic fin tips than to anal fin origin. A narrow silver stripe along flank, about 1/2 eye diameter or a little more. Most closely resembles A. parva, which seems not to occur south of Trinidad and has the anal fin origin before the midpoint of the dorsalfin base; also A. cubana (maxilla long, sharply pointed and reaching behind hind border of pre-operculum), the tip projecting more than 1/2 eye diameter beyond second supra-maxilla. Other Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. hepsetus and A. tricolor (anus nearer to anal fin origin, branched anal finrays 20 and 19 or less), A. marinii, A. lyolepis and A. filifera (pseudobranch equal to eye or longer) and A. mitchilli and A. choerostoma (to north of area).

Geographical Distribution : Western South Atlantic (Brazil, from Ceará to Santa Catarina). Cervigón (1969:224) identified as this species specimens from Lake Maracaibo, Venezuela, but his extensive collecting along the Caribbean coast of Venezuela failed to produce any and none was found in the Guianas region by Whitehead (1973a).



Habitat and Biology : Marine, pelagic and coastal, schooling; in the Santa Cruz canal, Pernambuco, the species was recorded in salinities of 7.94 to 31.31 ‰ (Askinazi, 1972:291). More data needed, based on correct identifications.

Size : To 7.4 cm standard length, usually about 5 to 6 cm.

Interest to Fisheries : Probably little.

Local Names : BRAZIL: Rabo de fogo (Pernambuco).

Literature :

Remarks : The occurrence of this fish to the north of Brazil needs clarification; its place seems to be taken by A. parva (see Remarks under that species).

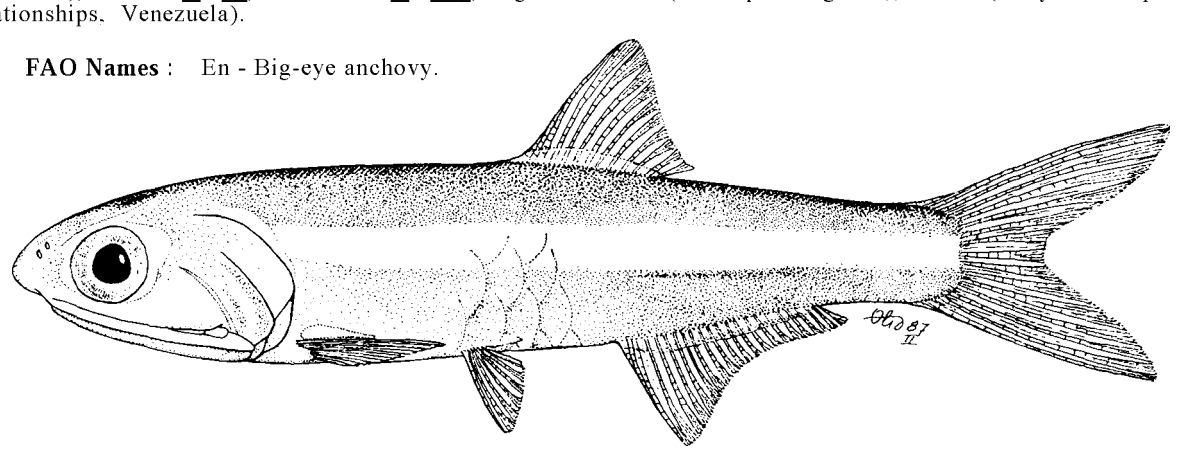
Anchoa lamprotaenia Hildebrand, 1943

ENGR Ancho 8

Anchoa lamprotaenia Hildebrand, 1943, Bull.Bingham oceanogr.Coll., 8(2):62, fig.23 (Key West, Florida).

Synonyms : Engraulis hiulcus Goode, in Goode & Bean, 1880:343 (Clear Weather Harbor, Florida); Stolephorus brownii:Jordan, 1885:106 (Key West, Florida); Anchovia brownii:?Meek & Hildebrand, 1923:204, pl.14, fig.1 (some specimens from Colón and Porto Bello, Panama; synonymy incorrect); Anchoviella epsetus: Jordan & Seale, 1926:396 (probably Florida specimens only); Anchoa lamprotaenia-FWNA,1964:192, fig.39 (Florida, Yucatan, Cuba, Puerto Rico, Belize, Panama; synopsis); Cervigón, 1969:232, fig.12 (Florida, Granada, Tobago, Los Roques Archipelago and Gulf of Cariaco, Venezuela, also Recife, Brazil); Daly, 1970:73, figs 1, 6 (photos Atlantic coast of Florida south from the Indian River, also Puerto Rico and Venezuela); Gilbert & Kelso, 1971:23 (Langunas del Tortuguero, Costa Rica); Whitehead, 1973a:128, fig.50 (Tobago, Trinidad, Surinam; comparison with A. hepsetus); Gonzalez, Padrón & Subero, 1974:49, figs 1 to 6 (electrophoretograms) (separation from A. hepsetus on proteins, Venezuela); Pérez et al., 1975:228 et seq., figs 1 to 4 (electrophoretograms), tab.1 (analysis of proteins, relationships, Venezuela).

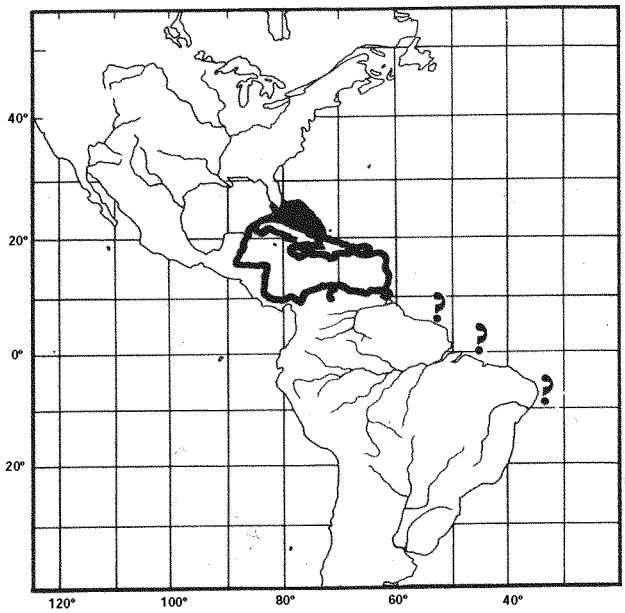
FAO Names : En - Big-eye anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth about 5 times in standard length. Snout pointed, about 3/4 eye diameter; maxilla long, tip pointed, reaching to hind border of pre-operculum; lower gillrakers 17 to 21 (rarely 22); gill cover canals of walkeri-type. Anal fin moderate, with iii 18 to 23 (rarely 24) finrays, its origin below about midpoint of dorsal fin base. Anus advanced, nearer to pelvic fin tips than to anal fin origin. A broad silver stripe along flank, a dark line above, expanded over anal fin, about 3/4 eye diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. hepsetus, A. colonensis and A. cayorum (all have the panamensis-type gill cover canals; also, the anus midway between pelvic fin tips and anal

fin origin, or nearer to the latter, as also A. pectoralis of Brazil, A. trinitatis of Trinidad and the southern Caribbean, and A. belizensis of Belize fresh waters); A. mitchilli has the anus nearer to the pelvic fin tips, but has the panamensis-type canals.

Geographical Distribution : Caribbean area (southern Florida, Cuba, Bahamas, Greater and Lesser Antilles, and Yucatan to Venezuela; not in Gulf of Mexico), also Trinidad south to Guianas; possibly Brazil.



Habitat and Biology : Marine, pelagic, coastal, forming dense schools; not entering the mangrove-lined lagoons of the Venezuelan mainland, but the dominant species of the Los Roques Archipelago and there found as much in the lagoons as outside them (Cervigón, 1969:233); frequently caught in mixed schools (with A. mitchilli) in the Miami area (Daly, 1970:92). Feeds on zooplankton. Ripe females recorded off Florida in June and July (FWNA, 1964:193). More data needed.

Size : To 9.2 cm standard length, usually about 6 or 7 cm.

Interest to Fisheries : Evidently forming large schools so perhaps of some local interest.

Local Names : CUBA: Manjúa; USA: Bigeye anchovy (AFS list), Longnose anchovy (FWNA).

Literature : See synonymy.

Remarks : Anchoa lamprotaenia closely resembles A. hepsetus. Daly (1970) tabulated differences (summarized in Whitehead, 1973a:131), of which the most striking is the advanced position of the anus in A. lamprotaenia (only just behind the pelvic fin tips).

The holotype of Engraulis hiulcus is clearly the present species (fide Dr G. Nelson); although hiulcus well predates lamprotaenia, it seems not to have been used subsequently as a senior synonym and mostly lay in the synonymy of Anchoa hepsetus (e.g.,Whitehead, 1973b:132). Since Hildebrand's two major clupeoid studies (1943, 1964) have guided all recent works, it is recommended that his use of the name lamprotaenia be continued and hiulcus considered a nomen oblitum.

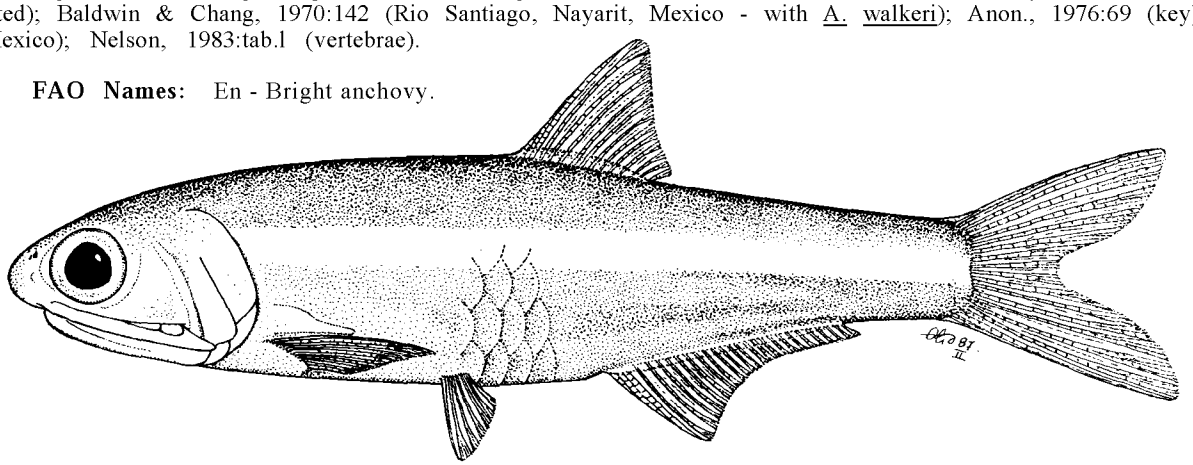
Anchoa lucida (Jordan & Gilbert, 1882)

ENGR Ancho 31

Stolephorus lucida Jordan & Gilbert, 1882, Proc.U.S.natn.Mus., 4:341 (Mazatlan, Mexico).

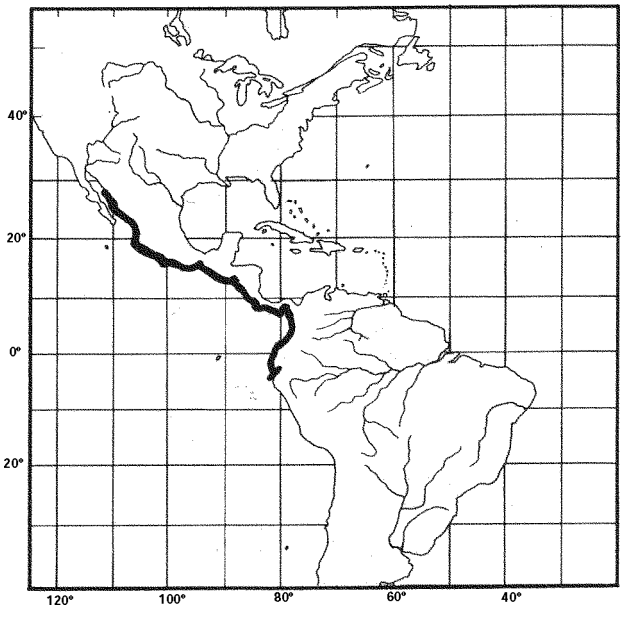
Synonyms : Anchovia lucidus:Jordan & Everman, 1896:446; Gilbert & Starks., 1904:42 (Panama; on **lucida** type); Anchoviella lucida:Jordan & Seale, 1926:400 (Mazatlan, Mexico); Anchoa lucida-Hildebrand, 1943:95, fig.39 (Gulf of California, Mazatlan, El Salvador, Panama, Colombia, Ecuador);Peterson, 1956:169 (Costa Rica); Chirichigno, 1963:18, fig.10 (photo) (Estero Lagarto, Puerto Pizarro, Peru); Cobo & Massay, 1969:8 (Ecuador, listed); Baldwin & Chang, 1970:142 (Rio Santiago, Nayarit, Mexico - with A. walkeri); Anon., 1976:69 (key), 70 (Mexico); Nelson, 1983:tab.1 (vertebrae).

FAO Names: En - Bright anchovy.



Diagnostic Features : Body moderately elongate, but somewhat compressed. Snout fairly short, about 3/4 eye diameter;maxilla moderate, tip somewhat bluntly pointed, reaching to inter-operculum; lower **gillrakers** 18 to 23; gill cover canals of panamensis-(Mexico) or walkeri-type. Anal fin fairly long, with iii 22 to 28 **finrays**, its origin below or a little behind midpoint of dorsal fin base. A narrow silver stripe along flank, about 1/2 eye diameter. Pacific Anchoa species that overlap in both gillraker and anal **finray** counts are: A. mundeoloides, A. mundeola, A. panamensis and A. spinifer (all occur within the range of A. lucida, but have panamensis-type canals; also, most specimens of A. lucida lie outside the range of anal **finrays** of the other species) A. curta (branched anal **finrays** usually 23 or more; and maxilla long and sharply pointed, as also in A. walkeri).

Geographical Distribution : Eastern central Pacific (San Felipe Bay, Gulf of California southward to Puerto Pizarro, northern Peru).



Habitat and Biology : Marine, pelagic and coastal, but most often recorded from bays, lagoons and estuaries, thus able to tolerate lowered salinities. A ripe female of 11 cm with oval eggs recorded in July by Peterson (1956).

Size : To 11.2 cm standard length.

Interest to Fisheries : No data.

Local Names : COLOMBIA: Anchoa, Anchoveta, Mejua; COSTA RICA: Anchoa, Bocona; ECUADOR: Ojitos, Pelada; MEXICO, PERU: Anchoa.

Literature :

Remarks : Although the form of the gill cover canals separates A. lucida from several species with a long anal fin (A. mundeoloides, etc.), there is need to find trenchant fieldcharacters.

Dr Gareth Nelson (pers.comm.) suspects that 'lucida' may include two distinct species.

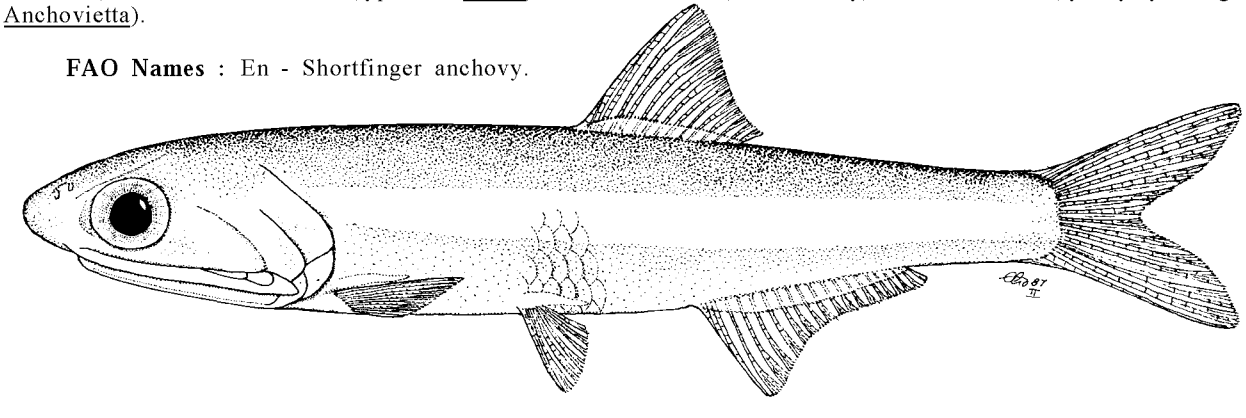
Anchoa lyolepis (Evermann & Marsh, 1902)

ENGR Ancho 2

Stolephorus lyolepis Everrnann & Marsh, 1902, Bull.U.S.Fish.Commn., 20(1):89, fig.13 (Culebra, Puerto Rico, juveniles).

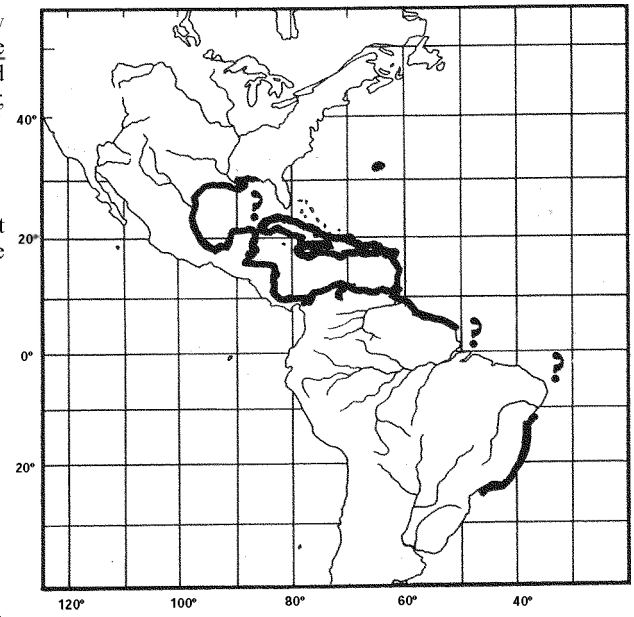
Synonyms : Anchovia platyargyrea Fowler, 1911:216, fig.4 (St. Martin, West Indies); Engraulis platyargyreus: Fowler,1928:468 (St. Lucia); Anchoviella platyargyrea:Jordan, Evermann & Clark, 1930:49 (types); Beebe Hollister, 1935:2ll (Union Island, Grenadines, West Indies); Anchoviella choerostoma:Jordan & Seale, 1926:404 (Panama and Puerto Rico specimens fide FWNA, 1964:2O2); Beebe & Tee Van, 1928:47, fig. (Haiti specimens fide FWNA, 1964:202); Anchovia choerostoma: Nichols, 1929:205, fig.39 (Puerto Rico specimens fide FWNA, 1964:202); Anchoa nasuta Hildebrand & Carvalho, 1948:288, fig.1 (Sào Sebastien Island, Brazil); Carvalho, 1950a:64, p1.2, fig.9 (compiled); Daly, 1970:78, tabs 2-7, fig.5 (Miami, also Cape Hatteras to Venezuela seen); Anchoviella lyolepis: Beebe & Tee Van, 1928:47, fig. (Haiti, juvenile); Anchoa lyolepis-Hiidebrand, 1943:65, fig.25 (Gulf of Mexico, Antilles, Venezuela); Schultz, 1949:43 (Punta Macolla, Venezuela); FWNA, 1964:200, fig.42 (synopsis); Cervigón, 1966:140 (Punta de Piedras, Venezuela); Idem.,1969:238, fig.15, tabs 12,26 (Puerto Rico, Virgin Islands, Venezuela, Colombia, Mexico, Florida; subspecies continentalis proposed); Dahl, 1971:164, fig. (Colombia, key); Whitehead, 1973b:144, figs 54,55 (Tobago, Trinidad, Surinam, northern Brazil); Palacio, 1974:22 (Punta Caribana, Colombia); Menezes, 1974:216 (types of nasuta); Anon.,1976:70 (Mexico, key); Nelson, 1986 (synonymy, subgenus Anchovietta).

FAO Names : En - Shortfinger anchovy.



Diagnostic Features : Body rather round, elongate, its depth about 5 to 5.5 times in standard length. Snout long and pointed, only slightly less than eye diameter; maxilla long, tip pointed, reaching almost to gill opening; lower gillrakers 19 to 27 (see Remarks); gill cover canals of panamensis-type; pseudobranch longer than eye diameter, with 30 or more filaments, extending onto inner face of operculum. Pectoral fin with first ray not extended as a filament; anal fin short, with iii 15 to 22 finrays, its origin under or behind base of last dorsal finray. A broad silver stripe along flank about equal to eye diameter (broader in smaller fishes), with a dark line above it. Closely resembles A. filifera (first pectoral finray a short filament, also vertebrae mostly 39; cf. mostly 41 or 42 in A. lyolepis); A. marinii also has a long pseudobranch, but like all other Atlantic Anchoa species has the anal fin origin well under the dorsal fin base. Engraulis species have a long pseudobranch, but maxilla not beyond pre-operculum. See ENGR Ancho 2, Fishing Area 31.

Geographical Distribution : Western Atlantic (New York south to Miami (rare on Gulf coast of Florida fide Daly, 1970 - as A. nasuta), Bermuda, Antilles, Trinidad and south to Brazil, apparently as far south as 25°30'S; also, Venezuela to Panama, Yucatan and to northern Gulf of Mexico).



Habitat and Biology : Marine, pelagic, coastal and schooling; trawled down 23 m off Brazil (down to about 50 m fide FWNA, 1964:202), but equally taken in shore seines. More data needed, based on secure identifications.

Size : To 7 cm standard length, mostly 5 or 6 cm.

Interest to Fisheries : Contributes to clupeoid catches, but no special fishery.

Local Names : COLOMBIA: Mejúa; USA: Dusky anchovy (AFS list).

Literature : See synonymy (but very little biological information in the rather numerous references).

Remarks : At present the separation of A. lyolepis from A. filigera depends chiefly on the presence of a small pectoral filament in A. filifera, although there appears to be a difference in vertebral counts (lyolepis 39 to 43, mostly, 41 or 42; filifera 38 to 40, mostly 39). Field identifications are made more difficult because the pectoral filament of A. filifera is often broken and only detectable as such under high magnification.

The extensive geographical distribution of A. lyolepis is matched by wide ranges in gillrakers and anal finray counts, suggestive of distinct sub-species. Cervigón (1969) proposed two subspecies:

A. lyolepis lyolepis: Bermuda, Antilles and 'oceanic' islands off Venezuella (La Blanquilla, Los Roques).

A. lyolepis continentalis: coasts and offshore islands of Caribbean, Gulf of Mexico (but not Trinidad or Surinam); two groups recognised:

Group 1. Gulf of Mexico, Florida (nasuta of Daly, 1970).

Group 2. Colombia, Venezuela.

Additional meristic data (Nelson, 1986) modifies Cervigón's conclusions and, on the basis of gillraker counts, suggests three areas of distribution (in which material from the first and last is as yet morphologically indistinguishable):

A. North American: gillrakers mostly 25 to 27 (New York south to Florida, Gulf of Mexico south to Yucatan) (no name).

B. Antillean: gillrakers mostly 21 to 23 (Bermuda; Cuba to Lesser Antilles, including La Blanquilla and Los Roques off Venezuela; also, Yucatan south to Colombia) (lyolepis, platyargyrea).

C. South America: gillrakers mostly 23 to 26 (western Venezuela to Brazil) (nasuta).

Unfortunately, neither anal finray nor vertebral counts correlate with these geographical divisions and for the moment the recognition of subspecies seems unjustified.

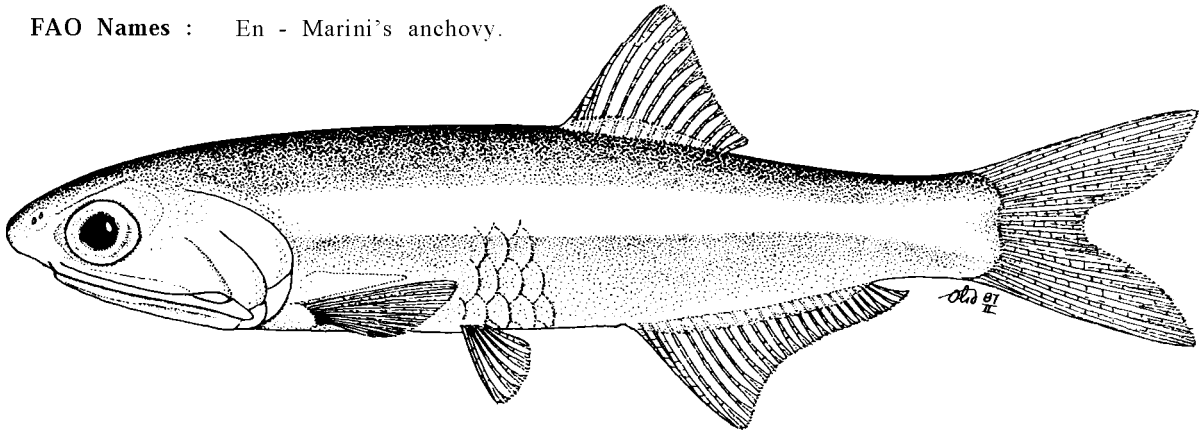
Anchoa marinii Hildebrand, 1943

ENGR Ancho 11

Anchoa marinii Hildebrand, 1943. Bull.Bingham oceanogr.Coll., 8(2):99, fig.42 (Montevideo, Uruguay to Mar del Plata, Argentina).

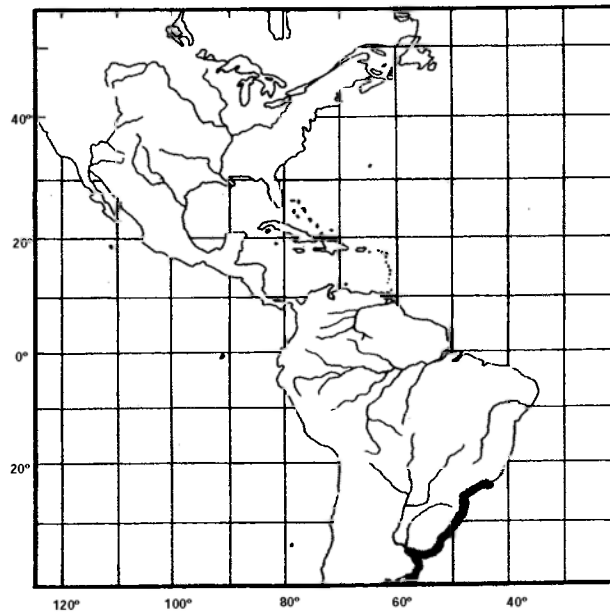
Synonyms : Anchovia platana Marini, 1935:446 (Argentina; nomen nudum); Anchoa marinii-Hildebrand & Carvalho, 1948:287 (Rio de Janeiro); Carvalho, 1950a:63, p1.2, fig.8 (compiled); Fusta de Plaza & Boschi, 1961:55 (Mar del Plata); Roux, 1973:52, fig.9 (between Rio de Janeiro and Santos); Weiss & Feijo de Souza, 1977:1 et seq., figs 1-3,5,6 (Buenos Aires, Argentina and Rio Grande do Sul, Brazil; early stages); Figueiredo & Menezes, 1978:31, fig.42 (Cabo Frio to Argentina-compiled); Cervigón, 1980:225, fig.2.75A (Mar del Plata, photo, biol.).

FAO Names : En - Marini's anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth about 4.5 to 5 times in standard length. Snout long and pointed, almost equal to eye diameter; maxilla fairly long, tip bluntly pointed, reaching just or almost to hind border of pre-operculum; lower gillrakers 22 to 26; gill cover canals of panamensis- type; pseudobranch long, more than eye diameter, with about 30 filaments. Anal fin moderate, with iii 20 to 24 finrays, its origin below midpoint of dorsal fin base. Anus nearer to anal fin origin than to pelvic fin tips. A narrow silver stripe along flank, about pupil diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. colonensis, A. mitchilli and A. choerostoma, which occur to the north of the range, while A. januaria, A. parva and A. cubana (if it reaches so far south) have the anus advanced (nearer to pelvic fin tips) and the pseudobranch short (as also in A. hepsetus ; length less than eye and about 20 to 25 filaments); Anchoa lyolepis and A. filifera have a long pseudaranch, but the anal fin origin is below or behind the last dorsal finray. Engraulis anchoita has a shorter maxilla and more gillrakers (38 to 45).

Geographical Distribution : Western South Atlantic (Rio de Janeiro south to Mar del Plata, Argentina; perhaps a little to the north and to the south of this area).



Habitat and Biology : Marine, pelagic, coastal and inshore, caught down to at least 20 m. Presumably feeds on zooplankton. Eggs recorded off Rio Grande do Sul, Brazil, in July and late-August to early September; eggs oval, 0.94 to 1.02 by 0.68 to 0.83 mm (Weiss, Feijó de Souza & Santos, 1976:tab.6); figured by Ciechomski (1968:figs 1-3);

Size : To 8.4 cm standard length.

Interest to Fisheries : No special fishery.

Local Names :

Literature : A number of studies have been made of the eggs and larvae of this species, including those by Ciechomski (1968), Weiss, Feijó de Souza & Santos (1976) and Weiss & Feijó de Souza (1977).

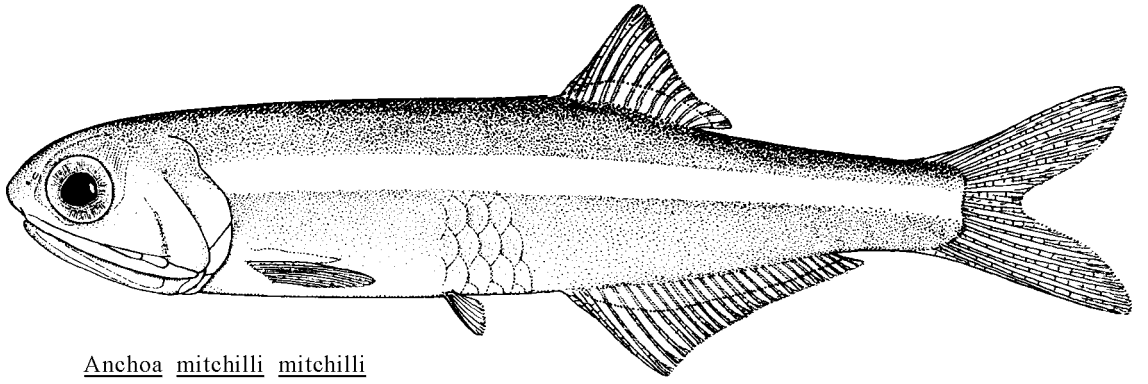
Anchoa mitchilli (Valenciennes, 1848)

ENGR Ancho 3

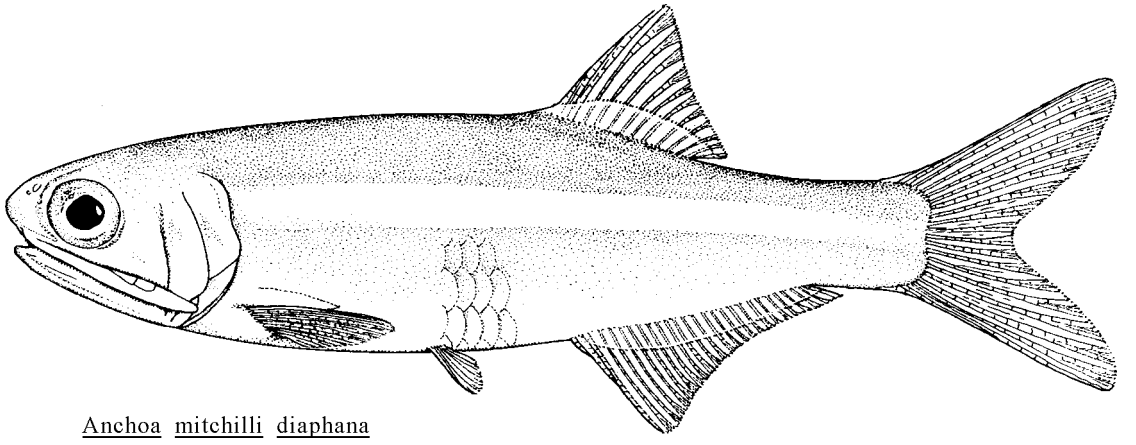
Engraulis mitchilli Valenciennes, 1848, Hist.nat.poiss., 21:50 (New York; also Lac Ponchartrain near New Orleans).

Synonyms : Engraulis louisiana Valenciennes, 1848:51 (on MS description by LeSueur, ex-Lac Pontchartrain near New Orleans; a nomen nudum since published as a synonym); Whitehead, 1967a:129 (louisiana a nomen nudum); Whitehead & Bauchot, 1986:33,48 (same); Anchoa mitchilli diaphana Hildebrand, 1943:91, fig.38 (distinguished from the more northern A. mitchilli mitchilli); Anchoa mitchilli-Hubbs & Hubbs, 1953:figs 1,2 (vertebral variation); FWNA, 1964:178, fig.32 (synopsis); Whitehead 1967a:127 (lectotype of mitchilli); Daly, 1970:85, fig.4 (photo) (Florida); Fineran & Nicol, 1976296 et seq., figs l-6 (retinal cones, Texas); Idem., 1977:325 et seq., figs l-37 (eye pigment epithelium, Texas); Swift, Yerger & Parrish, 1977:22 (Ochlockonee River estuary, Florida).

FAO Names: En -Bay anchovy.



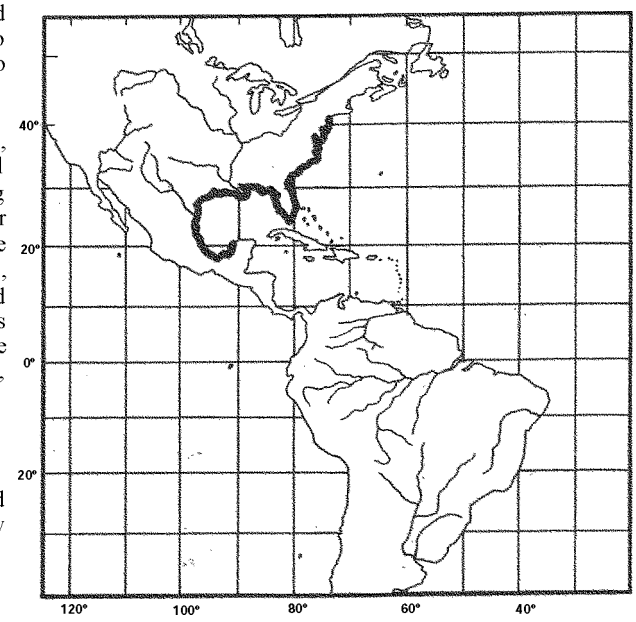
Anchoa mitchilli mitchilli



Anchoa mitchilli diaphana

Diagnostic Features : Body variable, more slender in northern populations, its depth about 4 to 5 times in standard length. Snout fairly blunt, a little over l/2 eye diameter; maxilla long, tip pointed, reaching beyond hind border of pre-operculum, almost to gill opening; lower gillrakers 21 to 25 (higher part of range in northern populations fide FWNA, 1964:tab.4); gill cover canals of panamensis-type. Anal fin moderate to long, with iii 20 to 27 (rarely 28 finrays, its origin below unbranched dorsal finrays. Anus nearer to pelvic fin tips than to anal fin origin. A narrow silver stripe along flank (broader and almost width of eye in northern populations fide FWNA, 1964:177). Very closely resembles A. cubana, which has the walkeri-type gill cover canals, also not less than 24 gillrakers and not more than 21 branched anal finrays. Other Atlantic Anchoa species that overlap in both gillraker and anal finray counts are A. trinitatis (Trinidad and southern Caribbean), A. hepsetus (branched anal finrays not more than 20; also anus nearer to anal fin origin, as also in A. choerostoma of Bermuda), A. lamprotaenia (gillrakers usually not more than 21, also gill cover canals of walkeri-type, as also in the South and Central American A. januaria and A. parva); A. lyolepis and A. filifera have a long pseudobranch. See Remarks for further distinctions from A. hepsetus. See ENGR Ancho 3, Fishing Area 31.

Geographical Distribution : Western North and Central Atlantic (from Casco Bay in Maine south to Florida Keys and westward around the Gulf of Mexico south to Yucatan; not in the West Indies).



Habitat and Biology : Marine, pelagic, coastal, down to about 36 m, but more commonly in shallow tidal areas with muddy bottoms and brackish waters, tolerating a wide range of salinities (virtually fresh to fully saline or even hypersaline); found only in spring and summer in the tidal portion of the Ochlockonee River, Florida (Swift, Yerger & Parrish, 1977:22). Feeds mostly on Mysis and copepods, also small fishes, gastropods and isopods (FWNA, 1964:178). Breeds off North Carolina from late April to mid-July, perhaps through to August' (FWNA, 1964:178).

Size : To about 10 cm standard length.

Interest to Fisheries : No special fishery, but used as a baitfish and to a limited extent to make anchovy paste (FWNA, 1964:178).

Local Names : USA: Bay anchovy (AFS list).

Literature : No comprehensive study of its biology has been made.

Remarks : Daly (1970:tab.3) clearly separated his Florida A. mitchilli from A. hepsetus on pectoral finray counts (i 9 to 12, usually 10 or 11; cf. i 13 to 16, usually 14 or 15 in A. hepsetus); a similar difference, in specimens over the entire range of A. mitchilli, is given in FWNA (1964). In addition, the anal fin origin is below the middle of the dorsal fin base in A. hepsetus (below unbranched dorsal finrays in A. mitchilli).

Hildebrand (1943 and FWNA, 1964) found considerable variation in body depth, width of body, number of lower gillrakers, pectoral fin length, number of vertebrae and width of silver stripe, all of which could be correlated with a northern and a southern form. He considered them subspecies and proposed the name Anchoa mitchilli diaphana for the slightly deeper southern form, although admitting that the two intergraded off the Carolinas.

The status of the name louisiana (nomen nudum) is explained by Whitehead & Bauchot (1986:48).

Anchoa mitchilli seems to be replaced by A. parva in the Caribbean.

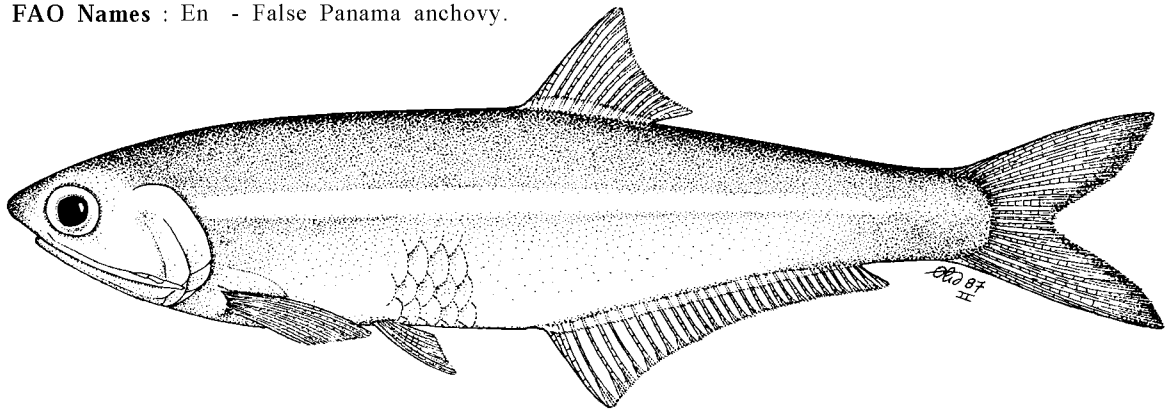
Anchoa mundeola (Gilbert & Pierson, 1898)

ENGR Ancho 19

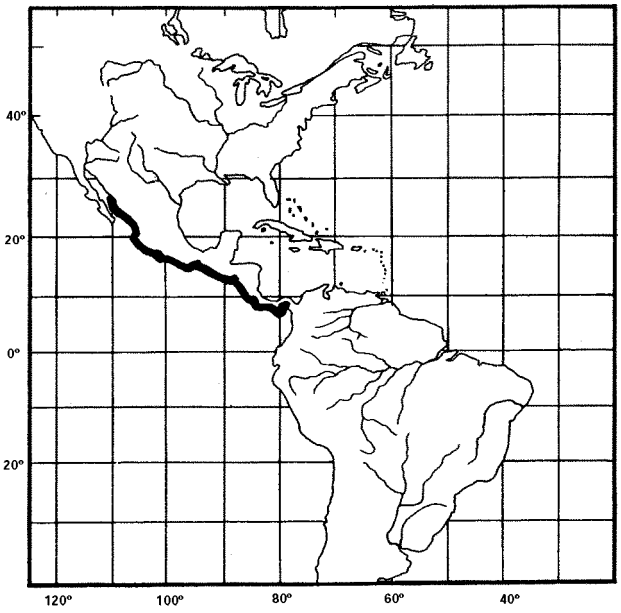
Stolephorus mundeolus Gilbert & Pierson, in Jordan & Evermann, 1898, Bull.U.S.natn.Mus., (47)(3):2812 (Panama Bay; 3 of the 17 syntypes are A. walkeri fide Nelson, 1986).

Synonyms : Anchoa panamensis (many or all records to the north of Panama); Peterson, 1956:159 (Gulf of Nicoya); Baldwin & Chang, 1970:139 et. seq. (mention only); Anchoviella mundeola: Jordan & Seale, 1926:408 (compiled); Anchoa mundeola-Nelson, 1983:50 (distinct from panamensis, types); Nelson & Sonoda, 1987:521, tabs l-3 (distinct from panamensis, types).

FAO Names : En - False Panama anchovy.



Diagnostic Features : Body compressed, moderately deep. Snout pointed, about 1/2 to 3/4 eye diameter; maxilla moderate, tip somewhat bluntly pointed, reaching to middle of inter-operculum; lower gillrakers 21 to 25 (increasing slightly with body growth); gill cover canals of panamensis-type. Anal fin long, with iii 27 to 33 (mostly 29 or 30) finrays, its origin under anterior rays of dorsal fin (occasionally just in front). A narrow silver stripe along flank, less than eye diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. panamensis (Panama Bay only; anal fin origin under or before dorsal fin origin; vertebrae 42 to 44, usually 43, cf. 39 to 41, usually 40 to 41 in A. mundeola) and A. compressa (Pacific coasts of California and Baja California, not in Gulf of California; silver stripe as broad as eye). Other Anchoa species with a long anal fin have not more than 20 gillrakers (rarely 21 in A. mundeoloides).



Geographical Distribution : Eastern central Pacific (Panama Bay north to Sonora, Mexico, i.e. at least the southern half of the Gulf of California).

Habitat and Biology : Probably similar to A. panamensis, with which it has been confused until recently, e.g. by Peterson (1956:161), who noted that in the Gulf of Nicoya, Costa Rica, it occurred only in the northern part where salinities are generally lower.

Size : To 12.5 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature : Not separated from A. panamensis, but most panamensis records north of Panama Bay will refer to A. mundeola (or perhaps to A. walkeri if the maxilla was long and sharply pointed).

Remarks : Nelson & Sonoda (1987) were able to separate A. mundeola from A. panamensis on only a single trenchant character. Its lower vertebral count (39 to 41 versus 42 to 4), although they found the anal fin origin generally less advanced in A. mundeola. Since the two are apparently sympatric in Panama Bay, one must conclude that they are distinct species. The rather similar A. compressa extends the range northward to California, but seems not to occur with A. mundeola.

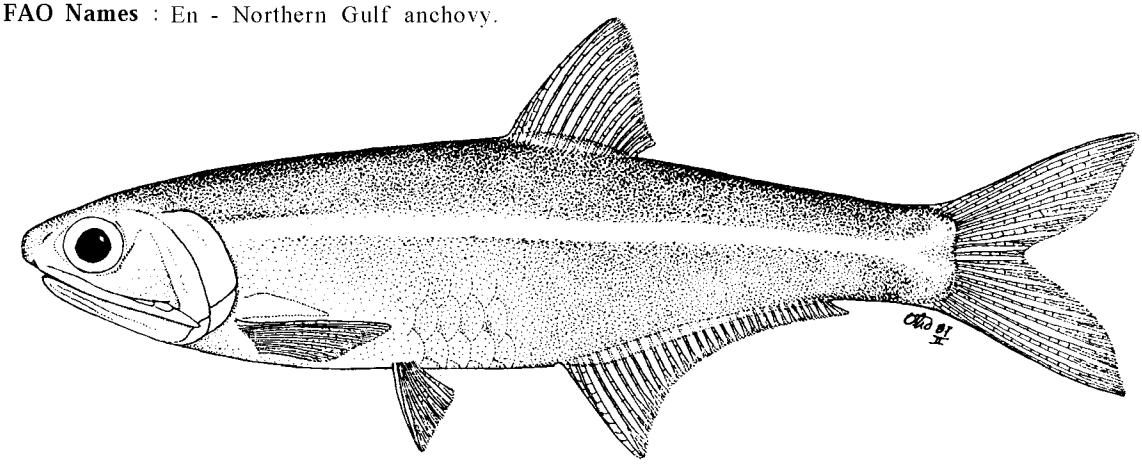
In both A. mundeola and A. panamensis (but not in A. compressa) there are small teeth along the upper edge of the hyoid bones, a fairly unusual feature in anchovies-teren raulis and some species of Stolephorus); also, the anus is nearer to the pelvic fin tips than to the anal origin (about equidistant in A. compressa).

Anchoa mundeoloides (Breder, 1928) | ENGR Ancho 18

Anchovia mundeoloides Breder, 1928, Bull.Bingham oceanogr.Coll., 2(2):9, fig.5 (San Filipe Bay, Gulf of California).

Synonyms : Anchoa schultzi Hildebrand, 1943:41, fig.12 (near mouth of Colorado River, northern Gulf of California, also probably San Juan Lagoon); Anchoa mundeoloides-Hildebrand,1943:45, fig.14 (San Filipe Bay, types; Panama cited, an error); Baldwin & Chang, 1970:142 (Rio Santiago, Nayarit, Mexico); Nelson, 1983:tab. 1 (vertebrae).

FAO Names : En - Northern Gulf anchovy.



Diagnostic Features : Body compressed, moderately deep, its depth about 4 to 4.5 times in standard length. Snout pointed, about 3/4 eye diameter; maxilla moderate, tip somewhat bluntly pointed, reaching just to interoperculum; lower gillrakers 17 to 21; gill cover canals of panamensi -type. Anal fin long, with iii 26 to 31 fmrays, its origin under about middle of dorsal fin base. A narrow silver stripe along flank, about width of pupil. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. mundeola (not less than 21 gillrakers), A. panamensis (Panama Bay only), A. spinifer (triangular projection on lower edge of gill cover), A. walkeri and A. lucida (walkeri-type canals; also, maxilla tip long and pointed in A. walkeri).

Geographical Distribution : Eastern central Pacific (northern part of Gulf of California only).

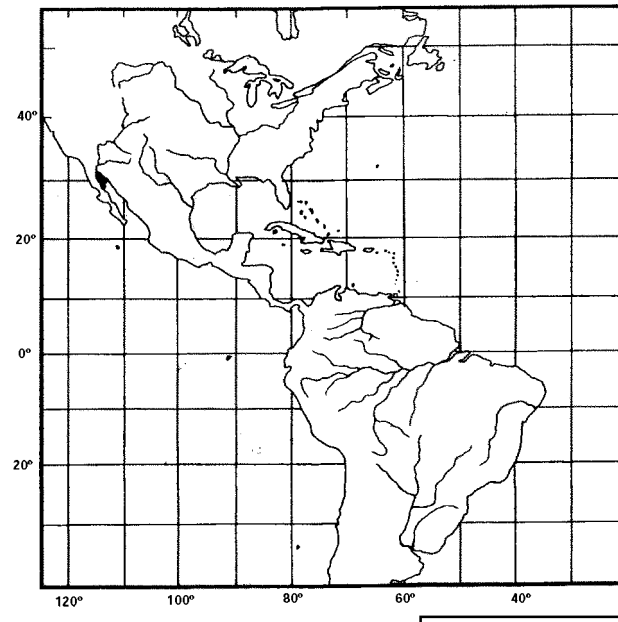
Habitat and Biology : More data needed.

Size : To about 12 cm standard length.

Interest to Fisheries : Probably none.

Local Names : EL SALVADOR, MEXICO: Anchoa

Literature :



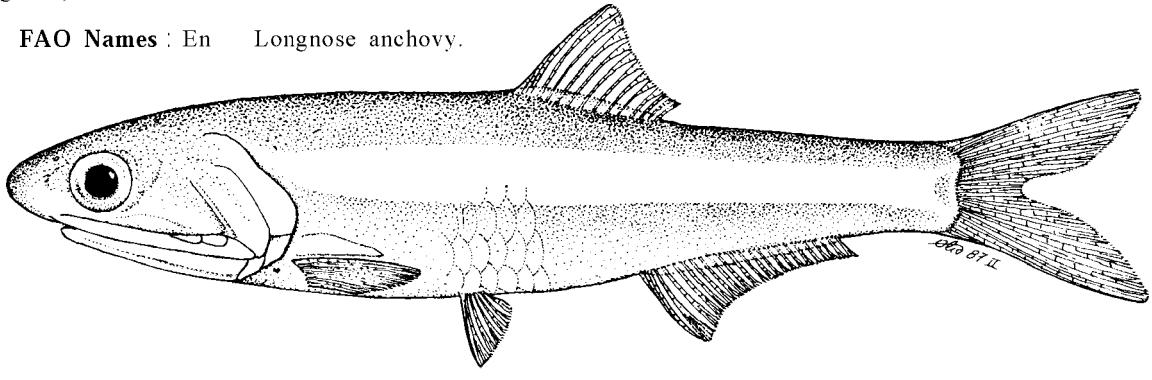
Anchoa nasus (Kner & Steindachner, 1866)

ENGR Ancho 33

Engraulis nasus Kner & Steindachner, 1866, Sber Akad.Wiss.Wein, 54:388, pl.2, fig.17 (Chincha Island, Peru).

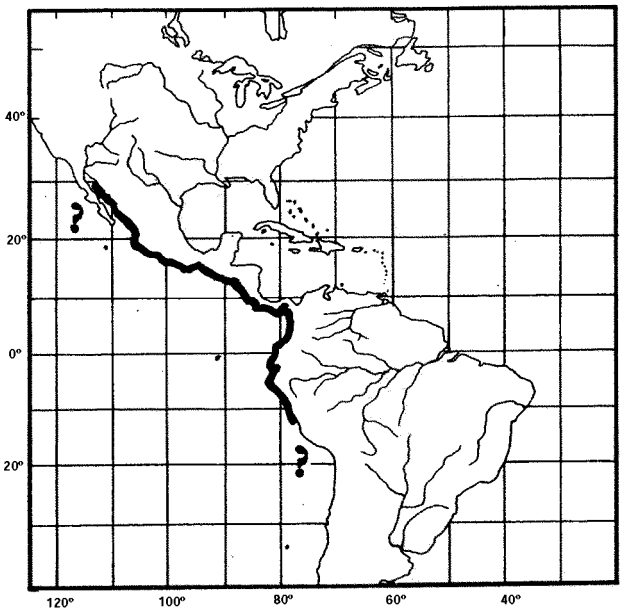
Synonyms : Stolephorus naso Gilbert & Pierson, 1898:2813 (Panama Bay); Gilbert & Starks, 1904:43 (Panama); Meek & Hildebrand, 1923:201 (Panama Bay); Anchoa naso:Hildebrand, 1943:100, fig.43 (Panama Bay and Gulf of Guayaquil); Idem, 1946:101, fig.21 (same); Peterson, 1956:170 (Costa Rica); Joseph, 1963:1 et seq. (Ecuador, biology); Cobo & Massay, 1969:7, fig.6 (Ecuador, listed); Engraulis peruanus Steindachner, 1880:60 (Callao, Peru); Anchoviella peruana: Jordan& Seale, 1926:401 (Callao, Peru); ? Stolephorus cultratus Gilbert, 189:244 (Santa Margarita Island, Baja California); Jordan & Evermann, 1896:443 (synopsis); Hildebrand, 1943:70, not figured (compiled, type lost); Engraulis nasus:Fowler, 1941a:235 (Peru, listed); Anchoa nasus-Hildebrand, 1943:102, fig.44 (Callao, also Gulf of Guayaquil, Peru); Idem., 1946:103, fig.22 (same); Chirichigno, 1963:18 (Puerto Pizarro, Gulf of Guayaquil); Cobo & Massay, 1969:7, fig.7 (Ecuador, listed); Whitehead,1970:34, pl.3a (nasus, peruana types); Nelson, 1983:tab.1 (vertebrae); Idem., 1986:894, fig.4 (max.), tabs 1-4 (synonymy, subgenus).

FAO Names : En Longnose anchovy.



Diagnostic Features : Body rather round, fairly elongate, its depth about 4 to 5 times in standard length. Snout long, about 3/4 eye diameter or more; maxilla long, tip pointed, reaching almost to gill opening; lower gillrakers 21 to 28 (see Remarks); gill cover canals of panamensis- type; pseudobranch longer than eye diameter, with 30 or more filaments, extending onto inner face of operculum. Anal fin moderate, with iii 20 to 25 finrays, its origin under or just behind base of last dorsal finray. A broad silver stripe along flank, about as wide as eye, faint or absent in fishes over about 10 cm standard length. Of Pacific Anchoa species, only A. starksi has such a long pseudobranch (but branched anal finrays only 16 to 20 and anal fin origin well under dorsal fin base). Engraulis species have many more lower gillrakers (37 to 49).

Geographical Distribution : Eastern Pacific (? Santa Margarita Island, Pacific coast of Baja California - see Remarks; northern Gulf of California at San Juanico Bay southward to Callao, Peru and perhaps further south).



Habitat and Biology : Marine, pelagic, coastal and schooling, entering bays and tolerating some lowering of salinity. No data on food. Spawns throughout year, but more intensively in the warmer months; eggs oval.

Size : To about 13.5 cm standard length (14.0 cm total length fide Hildebrand, 1943).

Interest to Fisheries : The most important tuna baitfish at Manta, Ecuador (Joseph, 1963).

Local Names : COLOMBIA: Anchoa, Mejúa; ECUADOR: Colorado, Pelada; PERU: Anchoa, Anchoveta blanca, Bocona, Chamache, Rubia del Mar, Samasa.

Literature : Peterson (1956 - notes on biology), Joseph (1963 - growth, fecundity, maturity).

Remarks : Hildebrand and others recognised two species, the northern nasus and the southern naso, perhaps best regarded as subspecies:

A. nasus nasus: gillrakers 25 to 28, mostly 26 or 27; vertebrae 40 to 42, mostly 41; Gulf of California south to about Gulf of Guayaquil.

A. nasus naso: gillrakers 21 to 25, mostly 23 or 24; vertebrae 41 to 43, mostly 42; Gulf of Guayquil south to Callao.

The record of A. nasus from the Pacific coast of Baja California (Santa Margarita Island) is based solely on the now lost type of Stolephorus cultratus. No other species of Anchoa is found both inside and outside the Gulf of California, so perhaps the locality was in error, or it was a specimen of Anchoa delicatissima, A. compressa or even Engraulis mordax.

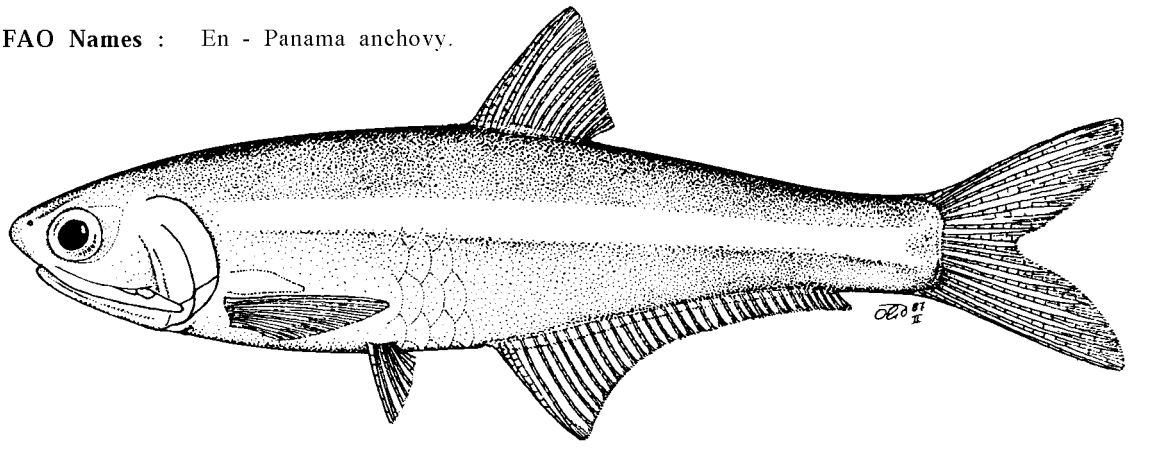
Anchoa panamensis (Steindachner, 1876)

ENGR Ancho 20

Engraulis panamensis Steindachner, 1876, Sber.Akad.Wiss.Wien, 72:589 (Panama); Idem, 1876, Ichthyol.Beitr (4):39 (repeat).

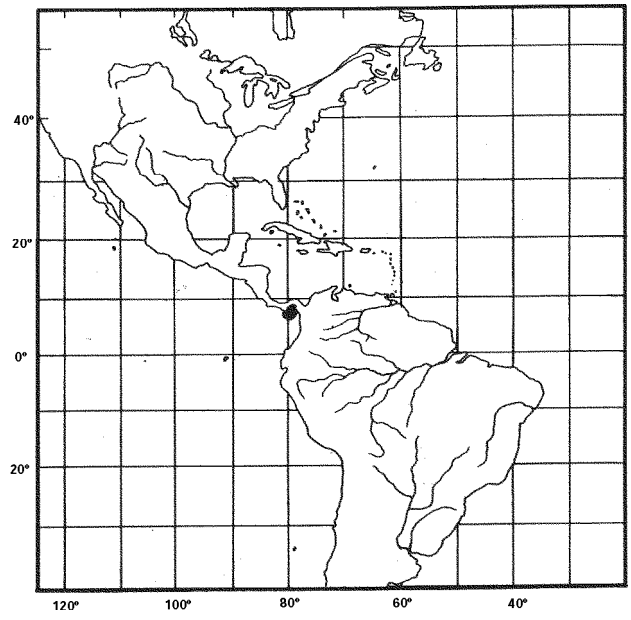
Synonyms : Anchovia panamensis: Gilbert & Starks., 1904:44 (Panama); Meek & Hildebrand, 1923:2137, pl.15, fig.1 (Panama Bay); Anchoa panamensis-Hildebrand, 1943:43, fig.13 (Panama Bay specimens only; those to the north are A. mundeola, that from Peru unknown); Anchoa panamensis-Whitehead, 1970:36 (lectotype); Nelson, 1983:50, fig.1 (gill cover canals), tab.1 (vertebrae); Nelson & Sonoda,1987:521, tabs 1-3 (meristics), fig.1 (gillrakers).

FAO Names : En - Panama anchovy.



Diagnostic Features : Body compressed, moderately deep. Snout pointed, about 1/2 to 3/4 eye diameter; maxilla moderate, tip somewhat bluntly pointed, reaching to middle of inter-operculum; lower gilirakers 19 to 24 (increasing slightly with body size); gill cover canals of panamensis-type. Anal fin long, with iii 28 to 35 (mostly 31 to 33) finrays, its origin under or slightly before dorsal fin origin. A narrow silver stripe along flank, about pupil diameter. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. mundeola (extends north of Panama Bay; anal fin origin usually before dorsal fin origin; vertebrae 39 to 41, cf. 42 to 44 in A. panamensis) and A. compressa (not south of Baja California; silver stripe as broad as eye). Occasional specimens of A. lucida have 28 branched anal finrays and overlap in gillraker counts, but gill cover canals of walkeri-type. Other Anchoa species with a long anal fin have not more than 20 gillrakers (rarely 21 in A. mundeoloides).

Geographical Distribution : Eastern central Pacific (Panama Bay only).



Habitat and Biology : Marine, coastal, pelagic, probably tolerating lowered salinities (as in A. mundeola). More data needed (that given by Warburton, 1978, 1979, refers to Anchoviella **analis**).

Size : To 12.5 cm standard length.

Interest to Fisheries : No data.

Local Names : COLOMBIA, COSTA RICA: Anchoa; ECUADOR: Chiminia; MEXICO: Anchoa; PANAMA: Anchoa, Anchoveta; PERU: Anchoa del Norte.

Literature :

Remarks : See under A. mundeola for comments on hyoid teeth and relationships.

The possible southward extension of the range of A. panamensis is unknown, but the Peruvian records of Hildebrand (1946:99) and Chirichigno (1963:17, fig.9) could equally apply to A. spinifer or even to a southward extension of A. walkeri, both of which have the rather long and pointed maxilla noted by Hildebrand (shorter and blunter in A. panamensis). The Ecuador record (listing) by Cobo & Massay (1969:8) is doubtful, although A. spinifer was also listed and the figure appears to be that species; perhaps the specimens of panamensis were walkeri.

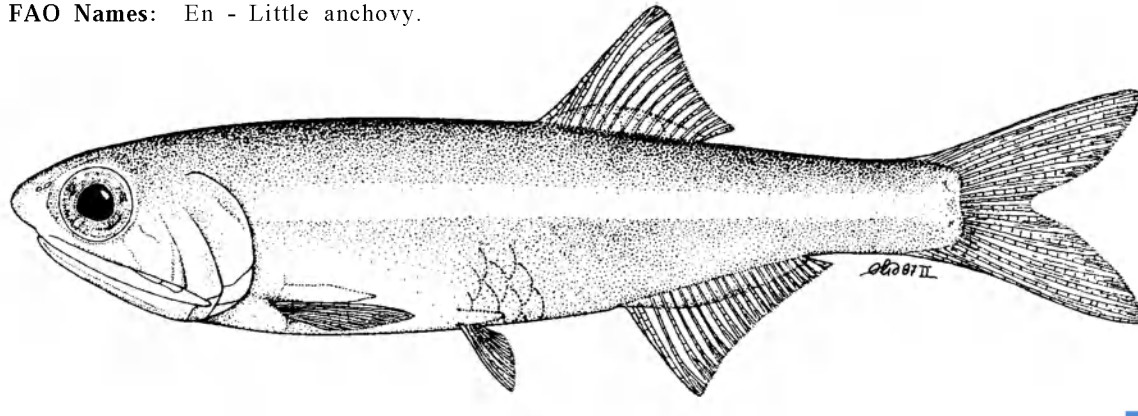
Anchoa parva (Meek & Hildebrand, 1923)

ENGR Ancho 4

Anchovia **parva** Meek & Hildebrand, 1923, Field Mus.Publ.Zool.,15(1):202, pl.10, fig.2 **(Porto** Bello, Panama).

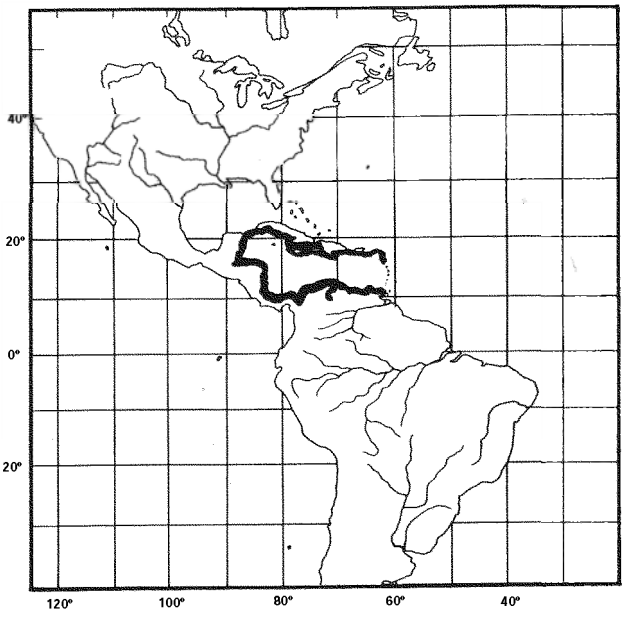
Synonyms : Anchoa parva-Hildebrand, 1943:83, fig.35 (Cuba, Jamaica, Panama, Venezuela); Schultz, 1949:43 (Lake Maracaibo); FWNA, 1964:181, fig.33 (also Trinidad; synopsis); Cervigón, 1966:141 (on Schultz, 1949); Idem., 1969:221, fig.8 (Puerto Rico, Margarita Island off Venezuela, Panama,also Fortaleza, Brazil); Dahl, 1971:163, fig.201 (Colombia); Whitehead, 1973a:125, fig.49, also 48 (maxilla) (Trinidad); Perez et al., 1975:228 et seq., figs 1-4 (electrophoretograms), tab.1 (analysis of proteins, relationships, Venezuela).

FAO Names: En - Little anchovy.



Diagnostic Features : Body fairly compressed, moderately elongate,its depth about 4.5 to 5 times in standard length. Snout moderate, a little over 1/2 eye diameter; maxilla moderate, tip sharply pointed, reaching to or a little beyond hind border of pre-operculum; lower gillrakers 23 to 30 (usually 25 to 27); gill cover canals of walkeri-type. Anal fin fairly short, with iii 17 to 22 finrays, its origin before midpoint of dorsal fin base. Anus nearer to pelvic fin tips than to anal fin origin. A narrow silver stripe along flank, about pupil diameter, barely apparent in preserved material. Most closely resembles A. januaria, which may not occur to the north of Brazil and has the anal origin below the midpoint of dorsal fin base also A. cubana (maxilla longer, reaching to sub-operculum, the tip more acutely pointed and projecting more than 1/2 eye diameter beyond second supra-maxilla). Other Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. hepsetus and A. tricolor (anus nearer to anal fin origin), A. lyolepis, A. marinii, A. filifera (pseudobrans equal to eye or longer) and A. mitchilli and A. choerostoma (to north of area). See ENGR Ancho 4, Fishing Area 31.

Geographical Distribution : Western central Atlantic (Cuba and Jamaica to at least Puerto Rico, if not throughout Lesser Antilles; Yucatan to Colombia, Venezuela and Trinidad, but apparently not to the south of this).



Habitat and Biology : Marine, pelagic, coastal, schooling; enters saline lagoons and, if identified properly, then also in fresh water (e.g., the middle and upper flights of the Gatun Locks, Canal Zone fide FWNA, 1964:182). More data needed, based on correct identifications.

Size : To 6 cm standard length, usually 4 to 5 cm.

Interest to Fisheries : Probably slight.

Local Names : CUBA: Manjuá.

Literature :

Remarks : This species seems to replace A. mitchilli in the Caribbean, and itself to be replaced by A. januaria to the south of Trinidad. All three have the anus advanced and overlap in fairly sirnilar gillraker and anal finray counts; the very similar A. cubana (anus also advanced) virtually spans the ranges of all three species.

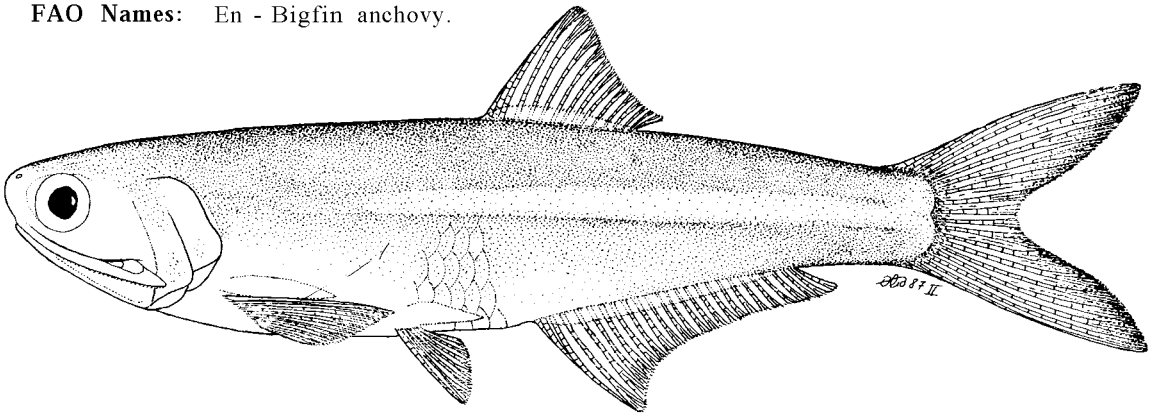
Anchoa pectoralis Hildebrand, 1943

ENGR Ancho 16

Anchoa Pectoralis Hildebrand, 1943, Bull.Bingham oceanogr.Coll., 8(2):52, fig.18 (Vigia, Brazil).

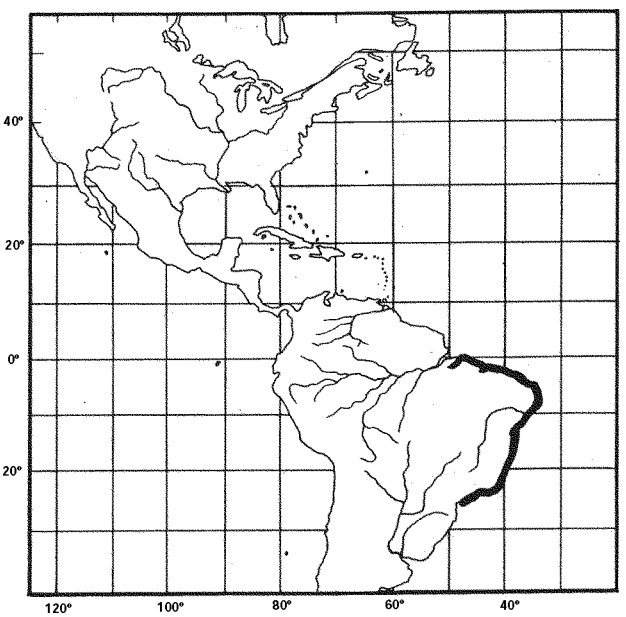
Synonyms : Anchoa ubatubae Hildebrand & Carvalho, 1948290, fig.2 (Ubatuba, Sào Paulo State, Brazil); Menezes, 1974:216 (types of ubatubae); Carvalho, 1950a:54, p1.1, fig.2 (compiled); Anchoa pectoralis:Fowler, 1948:18 (compiled); Campos, 1948:55, p1.1, fig.3 (compiled).

FAO Names: En - Bigfin anchovy.



Diagnostic Features : Body fairly strongly compressed, moderately slender, its depth a little over 4 times in standard length. Snout short, about 1/2 eye diameter; maxilla shorter than in most other Anchoa species, tip pointed, not reaching beyond hind margin of pre-operculum; lower gillrakers 17 to 20 (rarely 21); gill cover canals of walkeri-type. Pectoral fins large, with i 14 to 16 finrays, reaching or almost reaching to pelvic fin origin; anal fin fairly long, with iii 22 to 25 finrays, its origin below or just before midpoint of dorsal fin base. A silver stripe along flank, less than eye diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. trinitatis (Venezuela, Trinidad; snout pointed), A. lamprotaenia (branched anal finrays 18 to 23), A. cayorum (Caribbean area) and A. belizensis (Caribbean area). From these four species A. pectoralis is distinguished by its short snout and large pectoral fins (rarely to i 14 in A. lamprotaenia).

Geographical Distribution : Brazil (mouth of Para River southward to about 25°S off Cananéia).



Habitat and Biology : Marine, pelagic, presumably schooling; along beaches and down to 22 m; a single specimen from Coqueiros at the mouth of the Paraguacu River, thus able to tolerate lowered salinities. More data needed.

Size : To 6.8 cm standard length.

Interest to Fisheries : Unknown, probably none.

Local Names :

Literature :

Remarks : In describing A. ubatubae, Hildebrand seems to have forgotten his own A. pectoralis described five years earlier, or he would have attempted to distinguish the two - and failed!

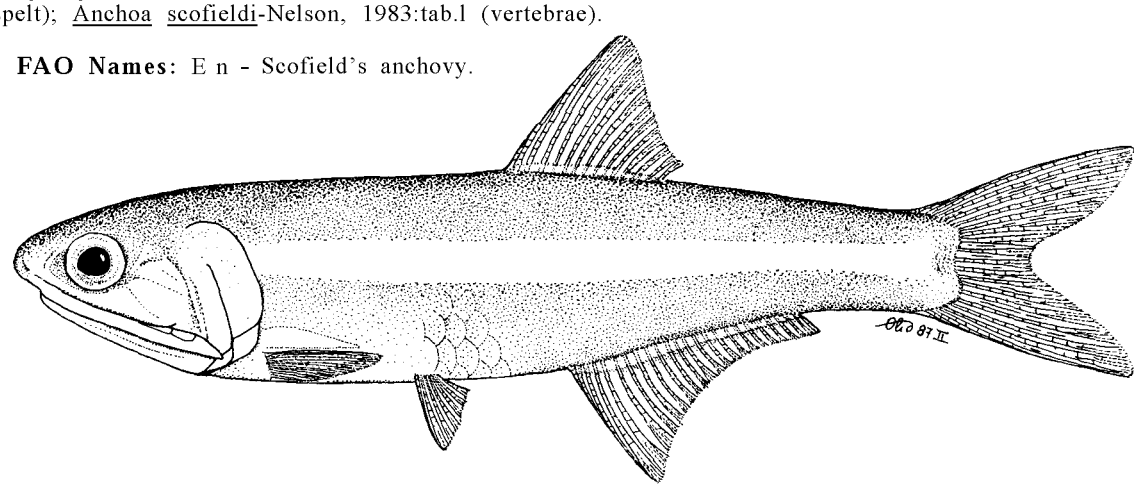
Anchoa scofieldi (Jordan & Culver, 1895)

ENGR Ancho 23

Stolephorus scofieldi Jordan & Culver, in Jordan, 1895, Proc.Calif.Acad.Sci., (2)5:410 (Mazatlan, Mexico); Idem, in Jordan & Evermann, 1898, Bull.U.S.natn.Mus., (47)(3):2814 (repeat).

Synonyms : Anchoa schofieldi:Hildebrand, 1943:49, fig.16 (Mazatlan, Mexico and La Plata Island, Ecuador; misspelt); Anchoa scofieldi-Nelson, 1983:tab.1 (vertebrae).

FAO Names: E n - Scofield's anchovy.



Diagnostic Features : Body moderately elongate, strongly compressed, its depth about 4.5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla moderate, tip pointed, reaching onto inter-operculum, but not to edge of gill cover; lower gillrakers only 12 to 14; gill cover canals of panamensis-type. Anal fin moderate, with iii 21 to 25 finrays, its origin under or just before midpoint of dorsal fin base. A broad silver stripe along flank, about width of eye. Pacific Anchoa species that overlap in gillraker counts are: A. spinifer (branched anal finrays 28 to 34) and A. eigenmannia (branched anal finrays rarely 24, usually 25 or more, also anal fin origin well before midpoint of dorsal fin base and vertebrae 41 to 43, cf. 42 to 44).

Geographical Distribution : Eastern central Pacific (Mazatlan, Mexico; a single Ecuador specimen from La Plata Island reported by Hildebrand (1943:50), with no records between, but this should be treated with caution).

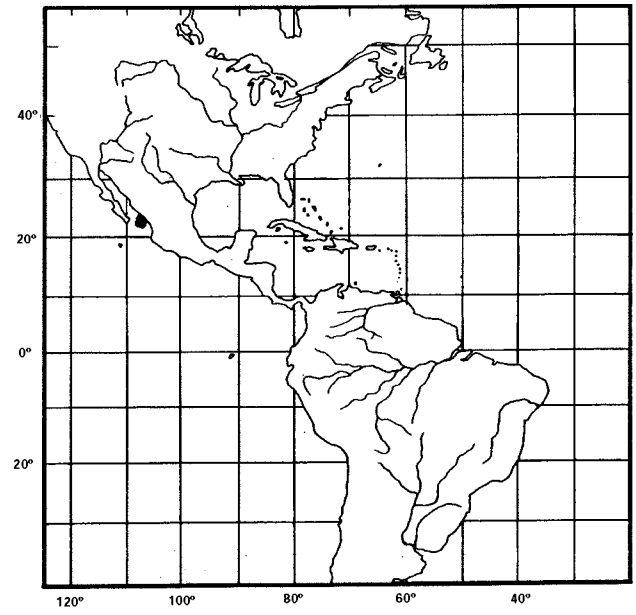
Habitat and Biology : Marine, pelagic, coastal. More data needed.

Size : To about 6.2 cm standard length, or 8.0 cm total length (Hildebrand, 1943:50).

Interest to Fisheries : No data.

Local Names : MEXICO: Anchoa.

Literature :



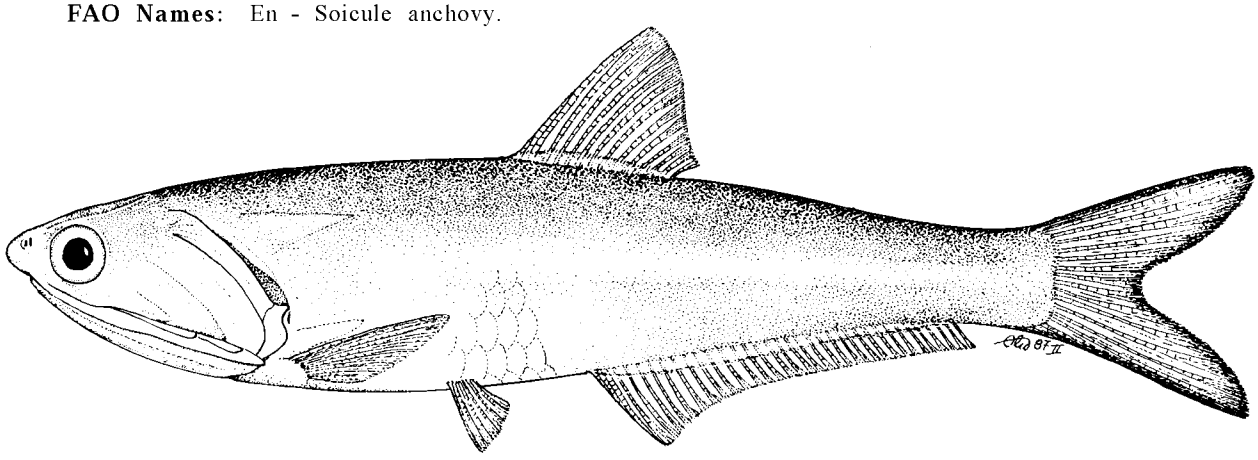
Anchoa spinifer (Valenciennes, 1848)

ENGR Ancho 5

Engraulis spinifer Valenciennes, 1848 (Sept.), Hist.nat.poiss., 21:39 (Cayenne).

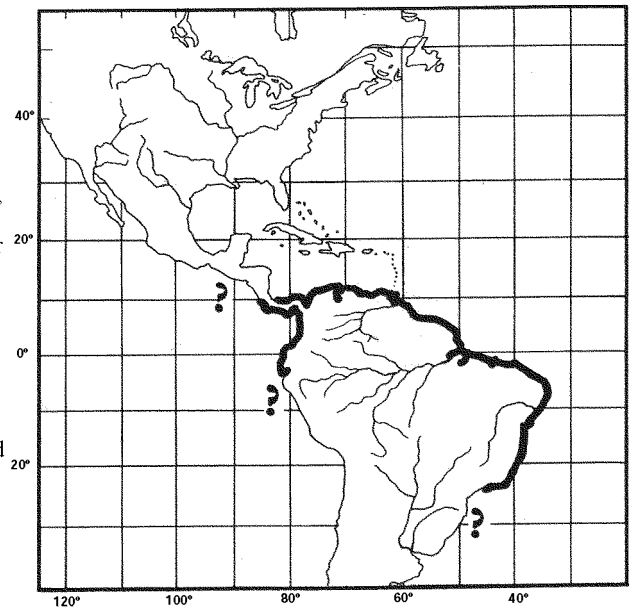
Synonyms : Engraulis thrissoides Müller & Troschel, 1849 (March):639 (Cuyuni River, Guyana); ? Anchoa panamensis:Chirchigno, 1963:17, fig.9 (Puerto Pizarro, etc., northern Peru - see Remarks); Anchovia spinifera Gilbert & Starks, 1904:45, pl.8, fig.15 (Panama Bay; misspelling or unjustified emendation of spinifer); Meek & Hildebrand, 1923:207 (compiled); Anchoviella spinifera:Jordan & Seale, 1926:409 (Panama; Cachoeira, Brazil); Jordan, Evermann & Clark, 1930:5 (range); Anchoa spinifera:Fowler, 1948:18, fig.8 (compiled); Carvalho, 1950a:52, pl.1, fig.1 (compiled); Figueiredo & Menezes, 1978:31, fig. 40 (Panama to Santos, Sào Paulo, Brazil - compiled); Anchoa argenteus Schultz, 1949:45, fig.5 (Lake Maracaibo, Venezuela); FWNA, 1964:169, fig.28 (argenteus-type only); Cervigón, 1969:213, fig.4 (Lake Maracaibo); Stolephorus spinifer: Eigenmann, 1912:449 (Guyana); Anchoviella (Stolephorus) spinifer:Lowe (McConnell), 1962:693 (Guyana); Anchoa spinifer-Hildebrand, 1943:38, fig.10 (Panama, both coasts, also Brazil); Peterson, 1956:160 (Gulf of Nicoya, Costa Rica); FWNA, 1964:169, fig.28 (synopsis); Cervigón, 1966:143, fig.58 (mouth of Orinoco River); Whitehead, 1967a:129, fig.11 (gill cover) (lectotype of spinifer); Cervigón, 1969:210, fig.3 (Panama, Venezuela, Guianas, Ceará, Rio de Janeiro); Roux, 1973:52, fig.7 (just south of Rio de Janeiro); Whitehead, 1973:114, fig.42 (Guyana, Surinam); Palacio, 1974:22 (Punta Espada, Colombia); Chirichigno, 1976:6, 56 (northern Peru at 3°34's); Cervigón, 1980:224, fig.2.75B (Surinam, photo, biol.); Idem, 1982:214 (Orinoco); Whitehead & Bauchot, 1986:33 (lectotype of spinifer).

FAO Names: En - Soicule anchovy.



Diagnostic Features : Body strongly compressed, fairly deep, its depth about 3 to 4 times in standard length. Snout about 3/4 eye diameter; maxilla long, tip pointed, reaching to or a little beyond edge of gill cover; tower gillrakers 12 to 19, the anterior gillrakers mere stumps; hind border of gill cover with a small triangular projection (on sub-operculum); gill cover canals of panamensis-type. Pectoral fins long, reaching beyond pelvic fin base; anal fin long, with iii 31 to 37 **finrays**, its origin below midpoint of dorsal fin base. A silver stripe along flank in small individuals, disappearing with age. The very long anal fin, compressed body and small triangular projection on the gill cover distinguish this species from all other Atlantic or Pacific Anchoa species. Lycengraulis species have canine-like teeth; Pterengraulis atherinoides has the anal fin origin below the dorsal fin origin, or a little in front. See ENGR Ancho 5, Fishing Area 31.

Geographical Distribution : Western central and South Atlantic (Panama to Trinidad and south to at least Santos, Brazil, perhaps further) and eastern central Pacific (Costa Rica south to northern border of Peru at 3°34'S, perhaps further. See Remarks).



Habitat and Biology : Marine, pelagic, coastal, apparently forming quite large schools; trawled down to 40 m, but usually in shallower water and entering river mouths, with one record from about 16 km up the Suriname River (Whitehead, 1973a:116, batch c') and apparently common in brackish and fresh water in the Orinoco delta at Tucupita (Cervigón, 1982:214), also abundant in the fresh water Pedro Miguel Lock, Panama (FWNA, 1964:168); not taken by beach seine in Cost Rica (Peterson, 1956:160). Feeds on small fishes, including clupeoids, and on prawns. Peterson (1956:161) suspected an extended spawning season in Costa Rica (small fishes caught in February, September and October). More data needed.

Size : To 18.6 cm standard length, usually about 14 or 15 cm.

Interest to Fisheries : Reported abundant in several areas and evidently contributes to artisanal fisheries, especially at river mouths.

Local Names :

Literature : Cervigón (1966 - food, ecology).

Remarks : Cervigón (1966:212) noted the rather patchy occurrence of A. spinifer along Venezuelan coasts and the same is perhaps true off Brazil. He also showed slight differences in gillraker, anal **finray** and vertebral counts between his A. spinifer and the Lake Maracaibo A. argenteus; since the two overlap in Lake Maracaibo and especially in view of the difference in vertebrae (spinifer 42 to 44; argenteus 41), Cervigón may have been correct to keep them distinct species.

Anchoa spinifer is the only anchovy species known from both the Atlantic and Pacific coasts of the Americas. Pacific specimens seem to be more slender and to have slightly more gillrakers, but more material should be studied.

The southward extension of range from Panama Bay is not well documented. Chirichigno (1976:58) recorded 3 specimens from off Caleta La Cruz, Peru (3°40'S) and distinguished it from A. panamensis; perhaps her earlier record of A. panamensis (Chirichigno, 1963:17, fig.9) from northern Peru was actually A. spinifer. The possible occurrence of the rather similar A. walkeri to the south of Panama cannot be excluded, however, especially as Chirichigno's photograph (fig.9) shows the anal fin origin below the dorsal fin origin (below about midpoint of dorsal fin base in A. spinifer).

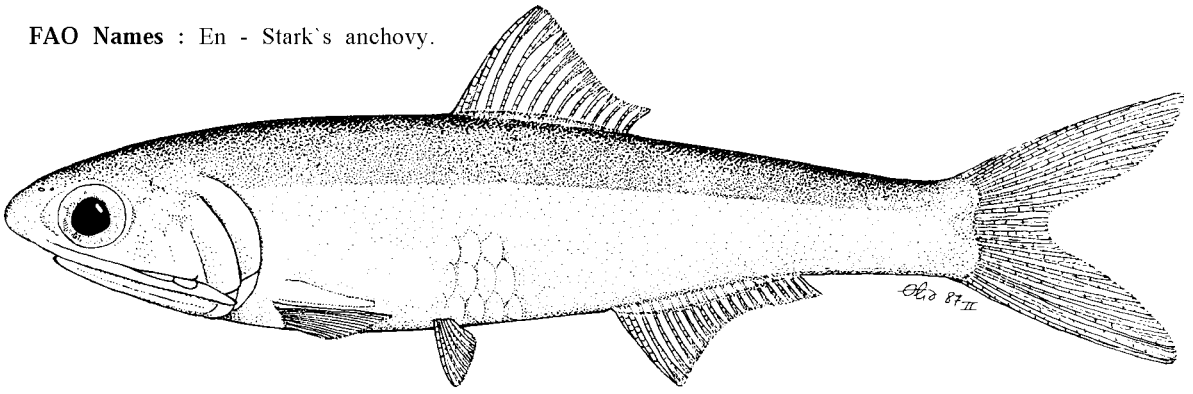
Anchoa starksi (Gilbert & Pierson, 1898)

ENGR Ancho 26

Stolephorus starksi Gilbert & Pierson, in Jordan & Evermann, 1898, Bull.U.S.natn.Mus., (47)(3):2813 (Panama Bay).

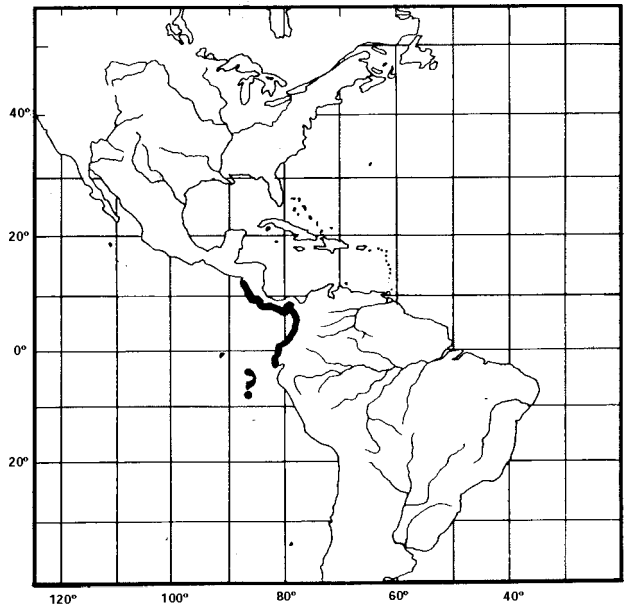
Synonyms : Engraulis clarki Hildebrand, 1943:19, fig.5 (Balboa, Gulf of Panama); Anchoa ischana:Meek & Hildebrand, 1923:203, pl.13, fig.2(Panama); Anchovia starksi:Gilbert & Starks, 1904:43 (Panama); Anchoa starksi-Hildebrand, 1943:72, fig.29 (El Salvador, Panama and one from the Rio Dagua, Colombia); Peterson, 1956:166, fig.7 (gillrakers) (Costa Rica, also Ecuador); ? Cobo & Massay, 1969:8, fig.9 (Ecuador, listed); ? Chirichigno, 1976:6, 58 (Zorritos, Gulf of Guayaquil, Peru at 3°40'S); Nelson, 1983:tab.1 (vertebrae); Idem., 1986:891 (types, **clarki** a synonym).

FAO Names : En - Stark`s anchovy.



Diagnostic Features : Body moderately deep, more so in larger fishes, its depth 4 to 5 times in standard length. Snout moderate, about 3/4 eye diameter; maxilla quite long, tip pointed, reaching alrnost to edge of gill cover; lower gillrakers 22 to 27 (increasing in larger fishes); pseudobranch long, extending onto inner face of operculum; gill cover canals of panamensis-type. Anal fin rather short, with iii 16 to 22 finrays, its origin under posterior third of dorsal fin base. A broad silver stripe along flank, lost in larger fishes. Pacific Anchoa species that overlap in both gillraker and anal finray counts are: A. ischana (gillrakers not more than 22), A. curta and A. delicatissima (branched anal finrays not less than 19 or 20, and walkeri-type canals, as also in A. exigua, which like all the previous species has a short pseudobranch, not more than eye diameter); Anchoa nasus has a long pseudobranch, but anal fin origin under or behind base of last dorsal finray.

Geographical Distribution : Eastern central Pacific (El Salvador to Panama, perhaps also south to Ecuador and northern Peru).



Habitat and Biology : Marine, pelagic, coastal, apparently tolerating lowered salinities since confined to inner parts of Gulf of Nicoya, Costa Rica (Peterson, 1956).

Size : To 7.7 cm standard length.

Interest to Fisheries : No data.

Local Names : COLOMBIA: Carnada, Mejúa; COSTA RICA: Anchoa; ECUADOR: Carnada azul, Carnada Verde; EL SALVADOR, PERU: Anchoa.

Literature :

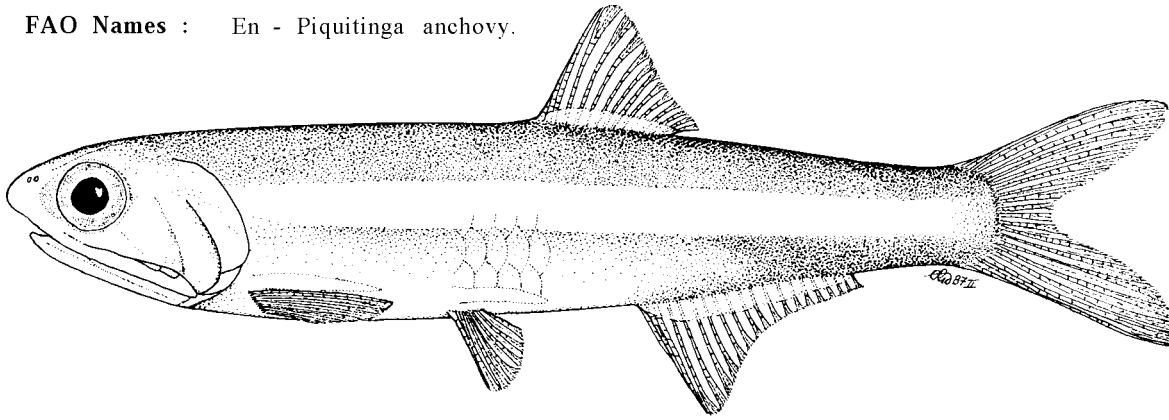
Anchoa tricolor (Agassiz, 1829)

ENGR Ancho 10

Engraulis tricolor Agassiz, in Spix & Agassiz, 1829, Select gen.spec.pisc.Bras., 51, pl.23, fig.1 (Bahia, Brazil).

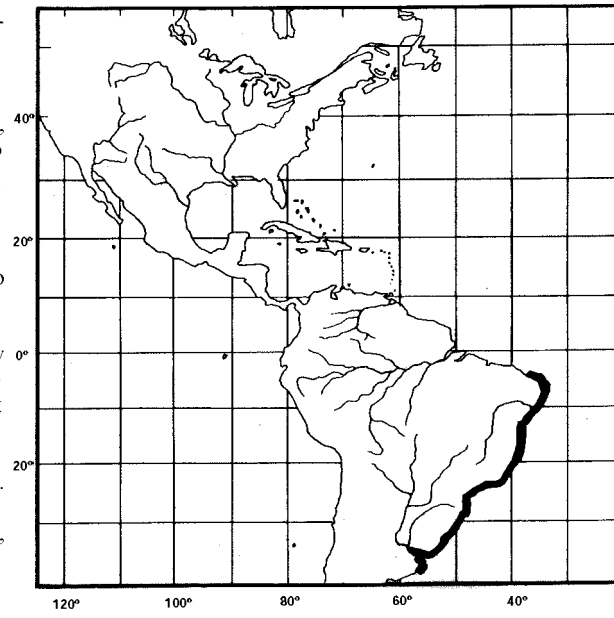
Synonyms : Engraulis lemniscatus Cuvier, 1829 (March):323 (on Spix drawing; nomen oblitum); Engraulis piquitinga Spix, in Spix & Agassiz, 1829 (May):pl.23, fig.1 (published as a synonym by Agassiz, thus a nomen nudum); Anchoviella salvatoris Fowler & Bean, 1923:6 (Rio de Janeiro); Anchoviella banairensis Marini, 1935:446 (Mar del Plata, Argentina; nomen nudum); Anchoa tricolor-Carvalho, 1950a:58, pl.1, fig.5 (compiled); Hildebrand, 1943:74, fig.30 (Natal, Brazil to Mar del Plata, A-a); Hildebrand & Carvalho, 1948:286 (Rio de Janeiro); FWNA, 1964:186, fig.36 (synopsis); Whitehead, 1967a:131 (lemniscatus a synonym); Cervigón, 1969:227, figs 10, 22 (maxilla) (Brazil:not in Venezuela); Whitehead & Myers,1971:487, 495, 496 (authorship of tricolor and lemniscatus, dating); Eskinazi,1972:291, tab.1 (Santa Cruz canal, Pernambuco, Brazil); Figueiredo & Menezes, 1978:32, fig. 43 (Ceará to Argentina, compiled); Kottelat, 1984:146 (tricolor, types in Neuchâtel); Whitehead & Bauchot, 1986:48 (status of lemniscatus).

FAO Names : En - Piquitinga anchovy.



Diagnostic Features : Body somewhat compressed, elongate, its depth about 5 times in standard length. Snout long and pointed, about 3/4 eye diameter; maxilla moderate, tip not sharply pointed, not or only just reaching to hind border of pre-operculum; lower gillrakers 23 to 28 (usually 24 to 27); gill cover canals of panamensis-type. Anal fin short, with iii 16 to 19 finrays, its origin below or behind midpoint of dorsal fin base. A broad silver stripe along flank, about 3/4 eye diameter. Anchoa species in the same area that overlap in both gillraker and anal finray counts are: A. hepsetus (maxilla sharply pointed, longer, almost to gill cover; also, gillrakers usually 24 or less), A. cubana, A. januaria and A. parva (walkeri-type canals, maxilla tip sharply pointed, anus nearer to pelvic fin tips).

Geographical Distribution : Western South Atlantic (from about Ceará, Brazil southward to Mar de Plata, Argentina).



Habitat and Biology : Marine, pelagic, coastal, schooling, also entering brackish water (e.g., down to 18°/oo in the Santa Cruz canal in Pernambuco, Brazil fide Eskinazi, 1972:tab.1 - but only to 29°/oo cited in text, p.291). More data needed.

Size : To about 9 cm standard length, usually 6 to 7 cm.

Interest to Fisheries : Reported seen frequently in markets in Rio de Janeiro (FWNA, 1964:188) and said to be abundant off Ceará and Pernambuco, Brazil, where it is sun-dried with other anchovies (Cervigón, 1969:228).

Local Names : BRAZIL: Tungào (Pernambuco).

Literature : Cervigón (1969 - some fishery data), Eskinazi (1972 - salinity tolerance).

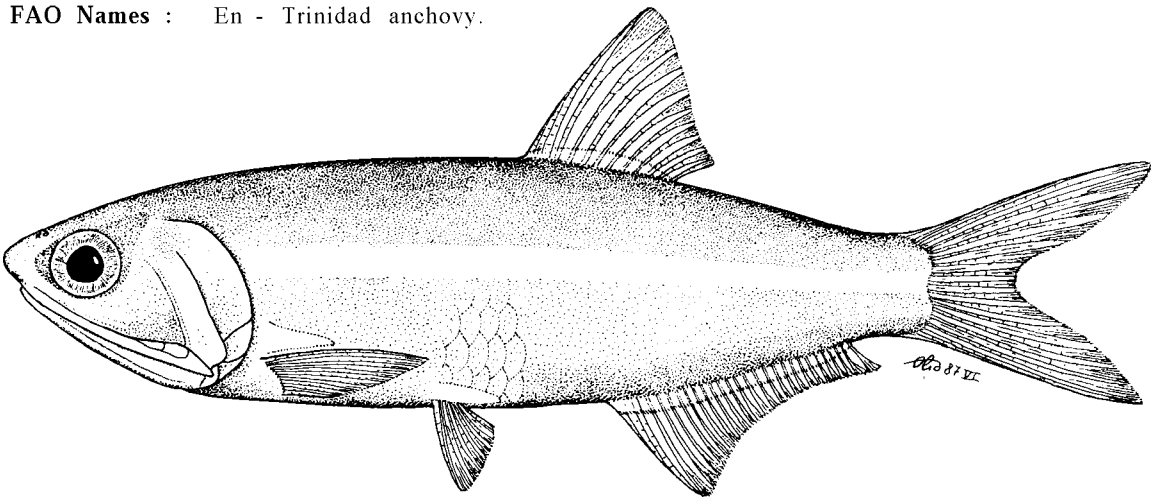
Anchoa trinitatis (Fowler, 1915)

ENGR Ancho 6

Anchovia trinitatis Fowler, 1915, Proc.Acad.nat.Sci.Philad., 527, fig.3 (Port-of-Spain, Trinidad).

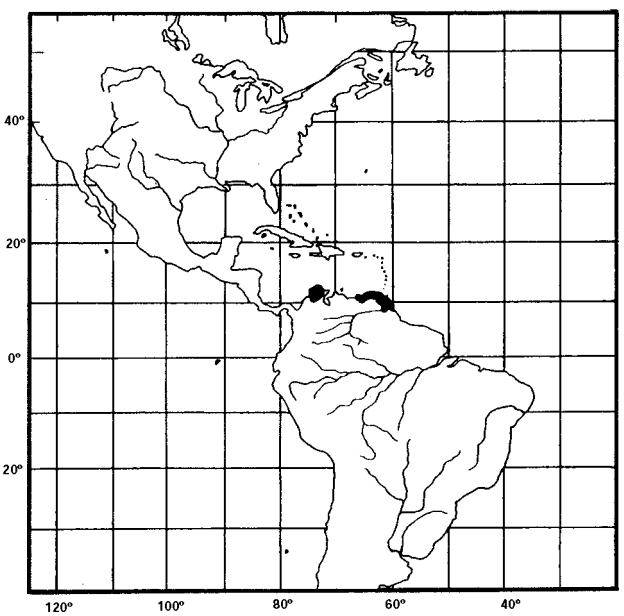
Synonyms : Anchoviella trinitatis:Fowler, 1931b:392 (Vessigney, Trinidad); Anchoa trinitatis- Hildebrand, 1943:96, fig.40 (synopsis); Schultz, 1949:44 (synopsis); FWNA, 1964:171, fig.29 (Trinidad, eastern Caribbean coast of Venezuela - synopsis); Cervigón, 1966:142 (lagoons, eastern Venezuela); Idem., 1969:215, fig.5 (Gulf of Venezuela and Margarita Island); ? Dahl, 1971:163, fig.199 (Cartagena, Colombia); whitehead, 1973a:121, fig.46 (synonymy, no Guianas specimens); Perez et al.,1975:228 et seq., figs 1-4 (electrophoretograms), tab.1 (analysis of proteins, relationships, Venezuela); Cervigón, 1980:226, fig.2.76C (photo).

FAO Names : En - Trinidad anchovy.



Diagnostic Features : Body somewhat compressed and moderately deep, its depth about 4 times in standard length. Snout sharply pointed but short, less than eye diameter; maxilla long, tip pointed, reaching almost to gill opening; lower gillrakers 18 to 22; gill cover canals of panamensis-type. Anal fin moderate, with iii 23 to 27 finrays, its origin below or just before midpoint of dorsal fin base. A silver stripe along flank, less than eye diameter. Atlantic Anchoa species that overlap in both gillraker and anal finray counts are: A. belizensis (fresh water, Belize, Honduras), A. pectoralis (Brazil), A. lamprotaenia (branched anal finrays 18 to 23, gill cover canals of walkeri-type), A. cayorum (walkeri canals) and A. mitchilli (gillrakers 21 to 25, not south of Yucatan). See ENGR Ancho 6, Fishing Area 31.

Geographical Distribution : Caribbean area (Trinidad and westward to Margarita Island and the Gulf of Venezuela, in lagoons; if Dahl (1971) is correct, then westward to Cartagena, Colombia).



Habitat and Biology : Marine, coastal, in shallow water (to 2 m), sometimes in large schools; also in mangrove-lined lagoons in turbid water; on the southern coast of Margarita Island they appear mainly in February to May at 5 to 7 cm standard length, while larger individuals occur throughout the year in the interior of lagoons (Cervigón, 1969:216-7). More data needed on food and breeding.

Size : To 11.5 cm standard length.

Interest to Fisheries : Unknown, but presumably contributes to clupeoid catches since often abundant.

Local Names :

Literature : Cervigón (1966, 1969 - data on habitat in Venezuela).

Remarks : Cervigón (1969) noted slightly higher anal and pectoral finray counts in his Gulf of Venezuela specimens than in those from Margarita Island (iii 25 to 30 and i 12 to 14; cf. iii 23 to 27 and i 12 to 13).

A Wagner-tree analysis of the protein data published by Perez et al. (1975 - haemoglobin, esterases, lactate dehydrogenase and some non-enzymatic proteins) showed that A. trinitatis is only distantly related to the other species of Anchoa tested (A. lamprotaenia, A. hepsetus, A. colonensis, A. parva .

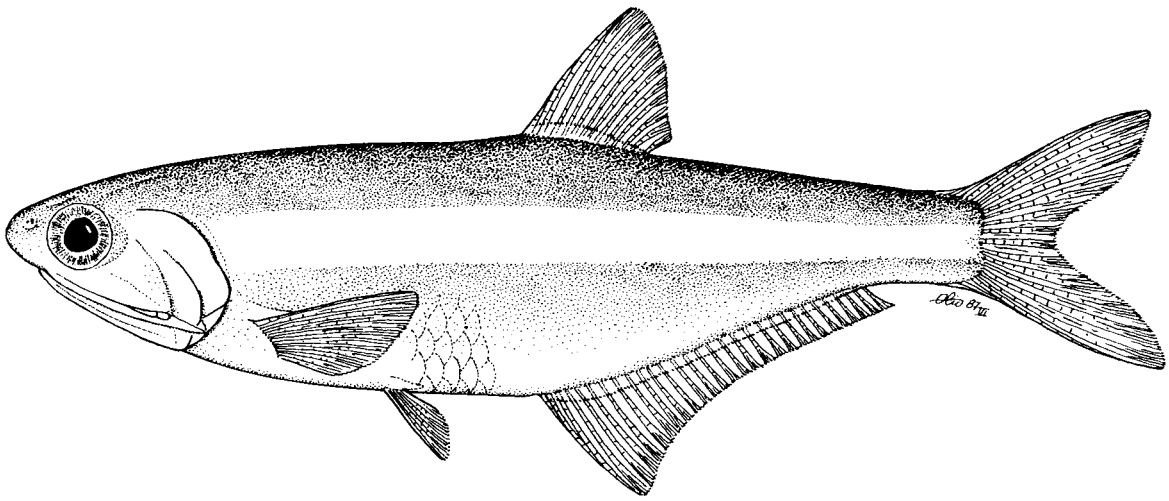
Anchoa walkeri Baldwin & Chang, 1970

ENGR Ancho 30

Anchoa walkeri Baldwin & Chang, 1970, Pacif.Sci.,24:140, figs 1,2 (maxilla) (San Blas, Nayarit, Mexico; also northern Gulf of California at San Felipe, Sonora, Sinaloa, Honduras, Costa Rica, Panama).

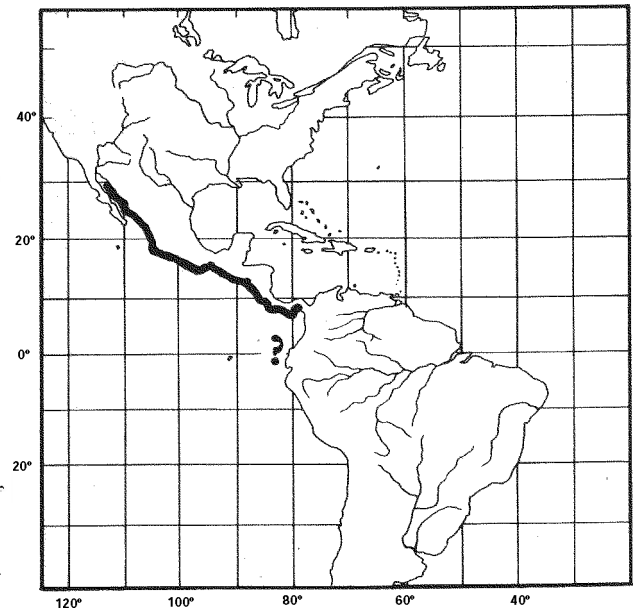
Synonyms : Anchoa walkeri-Nelson, 1983:52, fig.1 (gill cover canals), tab.1 (vertebrae) (3 mundeola-types this species); Nelson & Sonoda, 1987:tabs 1-3 (meristics, types).

FAO Names : En - Walker's anchovy.



Diagnostic Features : Body compressed, moderately deep, its depth about 4 times in standard length. Snout moderately pointed, about 3/4 eye diameter; maxilla long, tip sharply pointed, reaching to or just beyond gill opening, but shorter and more blunt at 4 to 5 cm standard length; lower gillrakers 17 to 22; gill cover canals of walkeri-type. Pectoral fins large, tip reaching to beyond pelvic fin base; anal fin long, with iii 23 to 32 **finrays**, its origin below dorsal fin origin or a little behind. Silver stripe along flank, as wide as eye in some places. Pacific Anchoa species that overlap in both gillraker and anal **finray** counts are: A. mundeoloides, A. mundeola and A. panamensis (maxilla tip more blunt, usually not to gill opening, and pamensis-type canals), A. spinifer (triangular projection on lower edge of gill cover and panamensis-type canals, as also in A. chamensis, which has a short and blunt maxilla), A. curta (gillrakers usually 23 or more, branched anal finrays 23 or less), and A. lucida (anal fin origin under or behind midpoint of dorsal fin base).

Geographical Distribution : Eastern central Pacific (Gulf of California at San Felipe, Baja California and along Sonora and Sinaloa coasts, Mexico, south to Honduras, Costa Rica and Panama; possibly it reaches further south. See Remarks).



Habitat and Biology : Marine, pelagic and coastal, presumably schooling; most often in warm, murky waters near shore and in bays near river mouths (no data on salinity tolerance, but specimens taken some km up the Rio Santiago, Nayarit, Mexico). Ovarian eggs elliptical.

Size : To 12 cm standard length.

Interest to Fisheries : No data.

Local Names :

Literature : Baldwin & Chan (1970 - ecology, ovarian eggs, relationships).

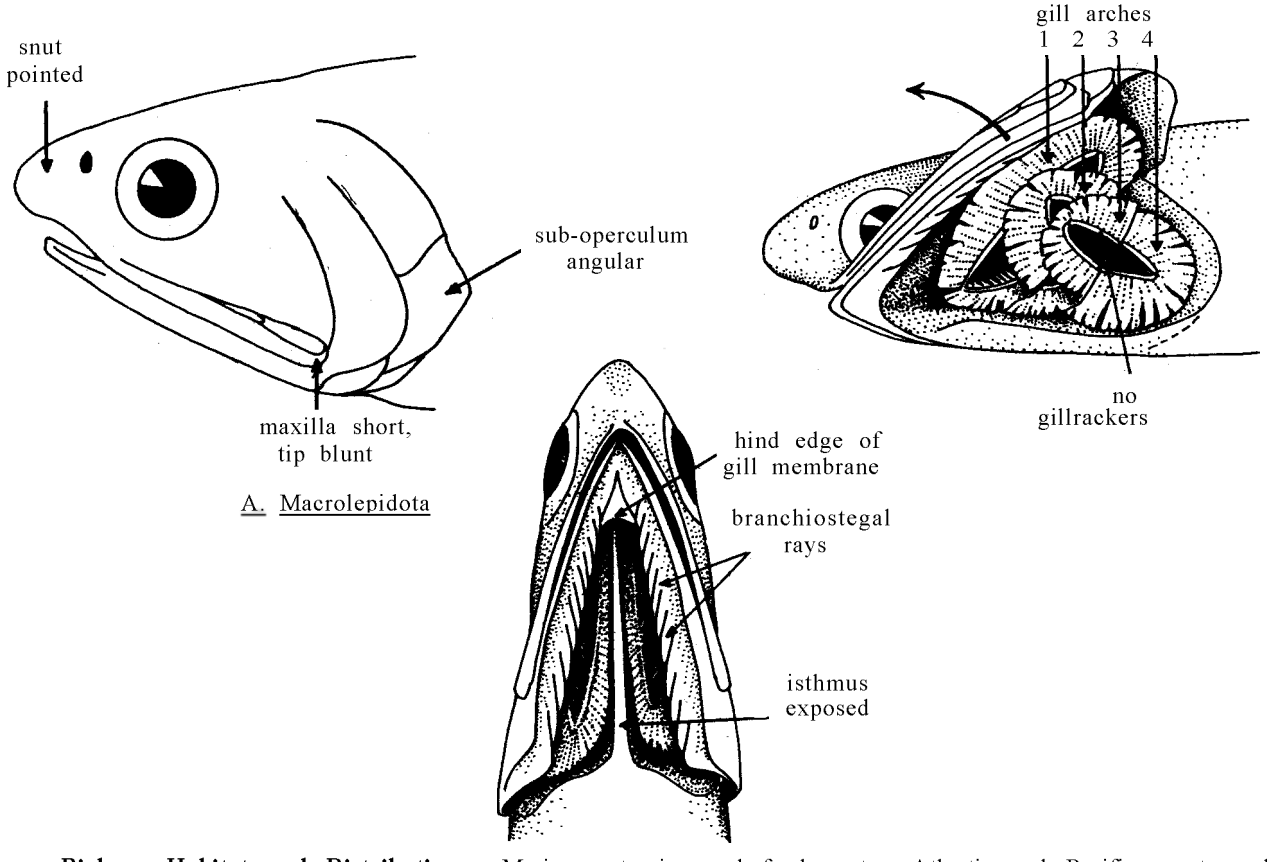
Remarks : Extension of the range of A. walkeri to the south of Panama is possible, but Peruvian records of 'panamensis' (Hildebrand, 1946:99 and Chirichigno, 1963: 17, Fig.9) could equalli apply to A. spinifer (see Remarks under that species).

Anchovia Jordan & Evermann, 1895

ENGR Anchov

Anchovia Jordan & Evermann, in Jordan, 1895, Proc.Acad.nat.Sci., (2)5:411, footnote; more fully in Jordan & Evermann, 1896, Bull.U.S.natn.Mus., 46(1):499 (type: Engraulis macrolepidota Kner & Steindachner, 1865).

Diagnostic Features : Moderate-sized, rather strongly compressed anchovies (to 20 cm standard length). snout pointed; maxilla short or moderate (to or a little beyond front margin of pre-operculum); very fine denticulations on lower jaw; gillrakers fine and slender, increasing in larger fishes (lower gillrakers to 135 in some species); no gillrakers on hind face of third epibranchial. Dorsal fin origin at about midpoint of body; anal fin long 20 to 29 branched finrays), its origin below front or middle of dorsal fin base. Resemble species of Cetengraulis, but gill membrane normal (not broadly joined over isthmus) and branchiostegal rays 9 or more.



Biology, Habitat and Distribution : Marine, estuarine and fresh water; Atlantic and Pacific coasts and lower parts of rivers of North, central and South America. Filter-feeders on plankton.

Species : Whitehead (1973a:96) recognized 5 species, but magdalenae and rastralis seem to be synonyms of the Pacific A. macrolepidota:

Atlantic :

A. clupeoides (Swainson, 1839) Caribbean to Brazil
A. surinamensis (Bleeker, 1866) Trinidad to Amazon

Pacific :

A. macrolepidota (Kner & Steindachner, 1865) Gulf of California to Peru.

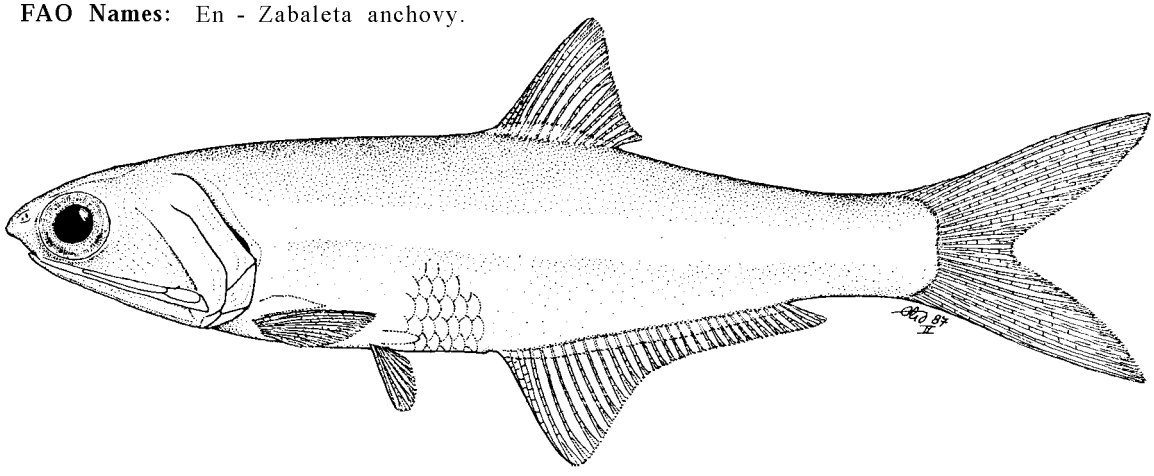
Anchovia clupeoides (Swainson, 1839)

ENGR Anchov 1

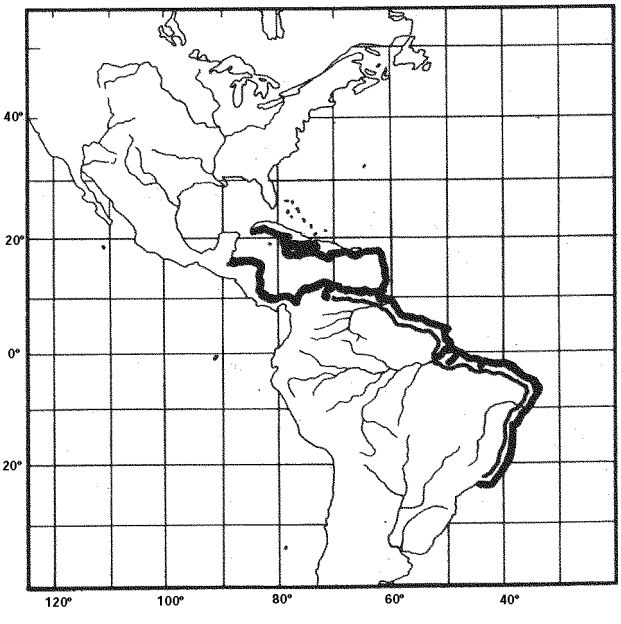
Engraulis clupeoides Swainson, 1839, Nat.hist.anim., 2:388 (Pernambuco, Brazil).

Synonyms : Engraulis productus Poey, 1866:380 (Matanzas, Cuba); Anchovia nigra Schultz, l949:39 (Lake Maracaibo only); FWNA, 1964:158, fig.26 (Lake Maracaibo); Cervigón,1969:202 (Lake Maracaibo); Greenfield & Greenfield, 1977:102, figs l-2, tab.1 (compared with A. clupeoides); Anchovia nattereri:Jordan & Seale, l926:413 (Pará Brazil); Stolephorus clupeoides:Eigenmann,1910:45 (Surinam to Rio Grande do Sul, Brazil); Anchovia clupeoides-Jordan & Seale, 1926:412 (Cuba, Puerto Rico, Pernambuco); Fowler, 1931b:393 (Quaima River, Trinidad); Idem., 1941b:134 (listed); Campos, 1942:208, fig.20 (compiled, A. surinamensis included in synonymy, but not description); Hildebrand, 1943:27, fig.9 (Puerto Rico to Brazil); Fowler, 1948:18, fig.9 (compiled); Nomura & Menezes, 1964:352 (compiled); FWNA, 1964:155, fig.25 (synopsis); Cervigón,1969:200, fig.1 (Venezuela; Brazil south to Rio de Janeiro); Dahl, 1971:162, fig.l98 (Colombia); Eskinazi, l971:29O (Santa Cruz canal, Pernambuco); Whitehead, 1973a:97, fig.34 (Trinidad); Roux, 1973:53, fig..10 (Anchieta beach, Brazil - about 21°S); Perez et al., 1975:228 et seq., figs l-4 (electrophoretograms), tab.1 (analysis of proteins, relationships, Venezuela); Figueiredo & Menezes, 1978:27, fig. 34 (compiled; to Sào Paulo, but rare); Cervigón, 1980:223, fig.2.74 (photo) (synopsis of biology). Note: a number of additional early references are included in FWNA, 1964:157.

FAO Names: En - Zabaleta anchovy.



Diagnostic Features: Body rather deep and compressed, its depth 3 to 4 times in standard length. Snout short and pointed, its tip at about eye centre; maxilla moderate, tip pointed and reaching onto pre-operculum (but not beyond), extending beyond end of second supra-maxilla; sub-operculum with angular hind margin, but not formed into a triangular projection; lower gillrakers increasing in larger fishes, about 40 at 5 cm standard length, 100 to 116 at 13 to 17 cm standard length. Anal fin long, with iii 25 to 32 finrays, its origin below front few dorsal finrays. A silver stripe along flank, disappearing in larger fishes. Resembles A. surinamensis, which has a shorter and blunt maxilla not reaching to pre-operculum, nor beyond end of second supra-maxilla; also, branched anal finrays 20 to 25. Confused with Cetengraulis edentulus, which has the gill membranes united across the isthmus and only 8 branchiosteoal rays (13 in A. clupeoides). Atlantic species of Anchoa have a pointed maxilla, but gillrakers not more than 30. See ENGR Anchov 1, Fishing Area 31.



Geographical Distribution: Western central and South Atlantic (Antilles, from Cuba and perhaps throughout; Guatemala south and east to Venezuela and Trinidad, south to just north of Rio de Janeiro, Brazil).

Habitat and Biology : Inshore and estuarine, schooling; enters mangrove and other lagoons, estuaries and penetrates into almost fresh water (salinities of 4.9 to 32.25°/oo in Santa Cruz canal, Pernambuco fide Eskinazi, 1972:290). Feeds on plankton filtered by the numerous and fine gillrakers. No data on spawning.

Size : To about 20 cm standard length.

Interest to Fisheries : Forms quite large schools and is locally abundant and exploited, but rarely in great quantities.

Local Names : BRAZIL: Boca torta.

Literature:

Remarks :Whitehead (1973a:99-100) concluded that the Lake Maracaibo nigra of Schultz (1949) did not merit separation as a distinct species. Greenfield & Greenfield (1977) re-examined the question, with 11 Lake Maracaibo fishes and 92 from elsewhere; the former had 40 vertebrae and the latter (40 or 41) 42 mostly (43 some). If this is confirmed in more specimens, and if clupeoides also occurs in Lake Maracaibo, then probably two species are present.

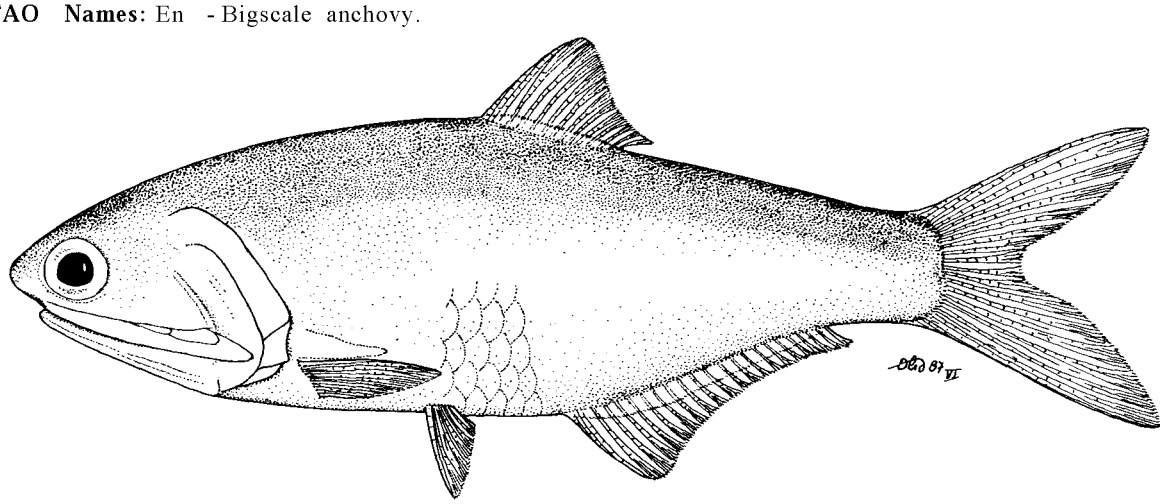
Anchovia macrolepidota (Kner & Steindachner, 1865)

ENGR Anchov 3

Engraulis macrolepidotus Kner & Steindachner, 1865, Abh.Bayer Akad.Wiss., 10:21, p1.3, fig.2 (Rio Bayano, Panama); Steindachner, 1876, Sber.Akad.Wiss.Wien, 72:587 (Panama).

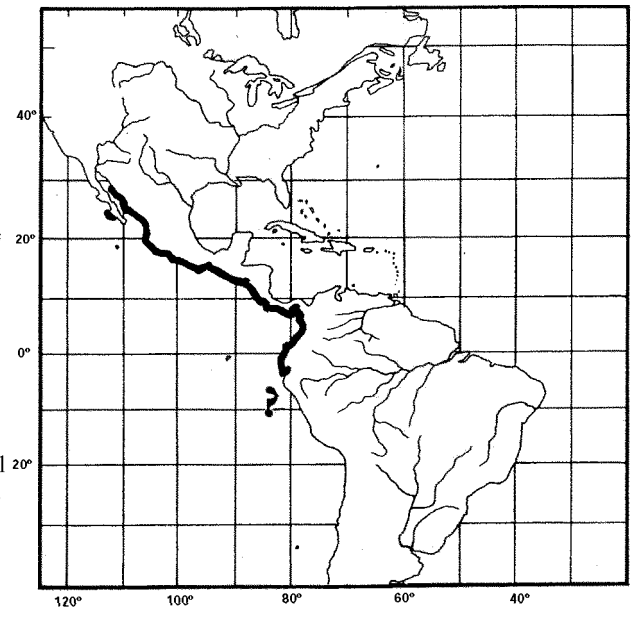
Synonyms : Stolephorus rastralis Gilbert & Pierson, l398:2811 (Panama); Anchovia rastralis:Meek & Hildebrand, 1923:209 (tide streams at Corozal and Balboa, Panama); Hildebrand, 1943:25, fig.8 (El Salvador, Panama,Colombia); Chirichigno, 1963:16, fig.8 (photo) (Puerto Pizarro, Puerto Rico, Peru); Stolephorus branchiomelas Eigenmann, 1917:682 (mouth of Rio Dagua, Colombia); Idem., 1922:179, pl. 28, fig.1 (same); Anchovia magdalenae Hildebrand, 1943:23, fig.7 (Magdalena Bay, Pacific coast of Baja California); Anchovia macrolepidota-Jordan & Evermann, 1896:449 (compiled); Gilbert & Starks, 1904:47 (Panama); Meek & Hildebrand, 1923:2ll (tide streams at Balboa and Panama market); Fowler, 1939:2 (Guayaquil, Ecuador); Hildebrand, 1943:21, fig.6 (Gulf of California to Ecuador); Peterson,1956:152 (Gulf of Nicoya, Costa Rica); Cobo & Massay, 1969:8 (Ecuador, listed); Whitehead, 1970:39, fig.4 (gill cover), p1.3b (macrolepidotus-type); Chirichigno, 1976:60, fig.19 (3°41'S, 80°40'W, off Zorritos, Gulf of Guayaquil, Peru).

FAO Names: En - Bigscale anchovy.



Diagnostic Features :Body rather deep and compressed, its depth about 2.5 to 3 times in standard length (the young more slender). Snout moderate and pointed, the tip at or just above eye centre; maxilla moderate, tip pointed and reaching onto pre-operculum (but not beyond), extending beyond end of second supra-maxilla; sub-operculum with a distinct triangular projection on hind margin (near base of first pectoral finray); lower gillrakers increasing in larger fishes, about 70 at 5 cm standard length, about 100 at 8 to 13 cm, and about 120 to 135 in large fishes, fine and slender. Anal fin long, with iii 26 to 29 finrays, its origin below about middle of dorsal fin base. A silver stripe along flank, probably disappearing in larger fishes. Closely resembles Cetengraulis mysticetus, which has the gill membranes united across the isthmus and only 8 branchiostegal rays (14 in A. macrolepidota). Pacific species of Anchoa have a pointed maxilla, but gillrakers not more than 32.

Geographical Distribution : Eastern central and South Pacific (Gulf of California at San Felipe Bay; Pacific coast of Baja California at Magdalena Bay; south to Panama, Colombia, Ecuador and northern Peru, i.e. Gulf of Guayaquil).



Habitat and Biology: Marine, inshore, along sandy beaches, also in tide streams (Hildebrand, 1943), forming large schools (Peterson, 1956); juveniles to about 7 cm occur on beaches and in bays, thereafter further from the shore (Peterson, loc.cit.). Feeds on a mixture of plant and animal plankton filtered by the numerous and fine gill-rakers. Probably spawns throughout year, mainly February to October (Gulf of Nicoya, Costa Rica); mature at 10.5 to 11 cm standard length. Eggs oval.

Size : To about 15 cm standard length.

Interest to Fisheries : May contribute to artisanal fisheries, but of neglible use as a baitfish (Peterson, 1956).

Local Names : ECUADOR: Chuhueco, Carduma.

Literature: Peterson (1956 - habitat, food, growth, spawning).

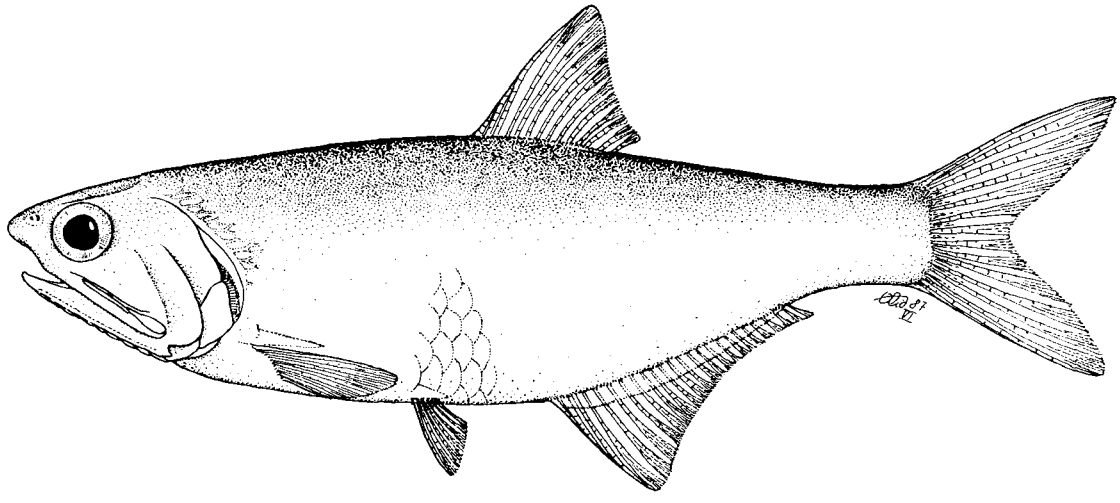
Anchovia surinamensis (Bleeker, 1866)

ENGR Anchov 2

Stolephorus surinamensis Bleeker, 1866, Ned.Tijdschr.Dierk., 3:178 (Surinam).

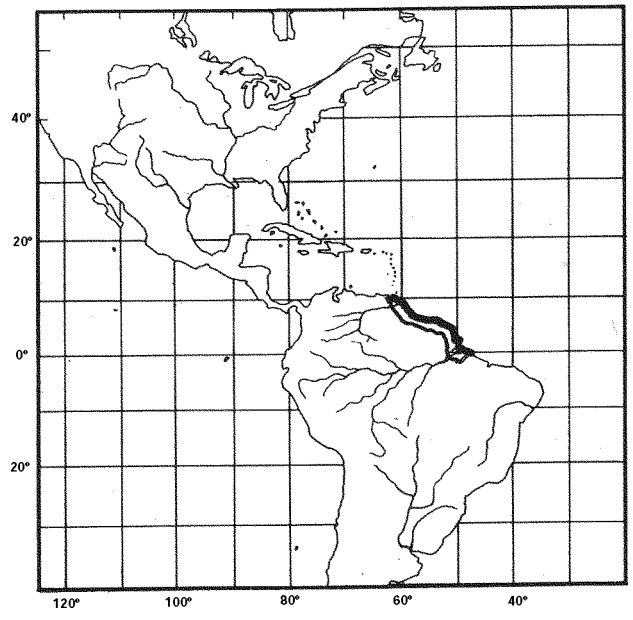
Synonyms : Anchovia pallida Starks, 1913:9, pl.1 (Pará, Brazil); Anchoviella pallida:Fowler, 1941b:126 (Ceará, Brazil); Hildebrand, 1943:134, fig.56 (pallida-type only); Fowler,1948:22, fig.15 (compiled); Schultz, 1949:48 (Venezuela); Carvalho, 1951:59, pl.2, fig.2 (Pará); FWNA, 1964221, fig.48 (synopsis); Cervigón, 1966:146 (Caño de Guanoco, mouth of Rio San Juan, Venezuela); Anchoviella venezuelae Fowler, 1931b:406, fig.2 (Caño de Guanoco, mouth of Rio San Juan, Venezuela); Anchoviella potiana Schultz & Menezes, 1951:235 (Poti and Parnaiba Rivers, Brazil); Stolephorus surinamensis:Eigenmann,1912:448 (Bartica Rocks, Guyana); Puyo, 1945:103, fig.2 (French Guiana); Idem, 1949:155, fig.78 (repeat); Engrantis surinamensis (misspelt):Kappler, 1887:157 (Surinam, compiled);? Anchoviella surinamensis:Fowler, 1931b:392 (Icacos Beach,Trinidad); Anchovia surinamensis-Whitehead, 1973a:100, figs 36, 37 (head, fontanelles) (Trinidad, Guyana,Surinam, French Guiana); Cervigon, 1982:214 (Pedernales and Caño Mánamo, Orinoco delta).

FAO Names: En - Surinam anchovy.



Diagnostic Features: Body rather deep and compressed, its depth 3 to 3.5 times in standard length. Snout moderate and pointed, its tip well above centre of eye; maxilla short, tip blunt, failing to reach articulation of lower jaw by about 1/3 eye diameter, not extending behind end of second supra-maxilla; sub-operculum with angular hind margin, but not formed into a triangular projection; lower gillrakers (47) 51 to 62, fine and slender. Anal fin moderate, with iii 20 to 25 finrays, its origin below about middle of dorsal fin base. A silver stripe along flank, up to 1.5 eye diameters at widest. Resembles A. clupeoides, which has a longer and pointed maxilla reaching onto pre-operculum and beyond end of second-supra-maxilla; also, branched anal finrays 25 to 32. Confused with Cetengraulis edentulus, which has the gill membranes united across the isthmus and only 8 branchiostegal rays (10 to 13 in A. surinamensis). Species of Anchoviella have a short, blunt maxilla, but usually a less deep body, also gillrakers not more than 35.

Geographical Distribution: Western central and South Atlantic drainage (lower parts of rivers from Trinidad and eastern Venezuela south to Para, Brazil).



Habitat and Biology: Estuarine (no data on salinities tolerated) and riverine (to above Manaus and into Rio Janaperi at least 80 km above its junction with the Rio Negro).

Size: To 12.4 cm standard length.

Interest to Fisheries: Presumably contributes to artisanal river catches, but no special fishery.

Local Names:

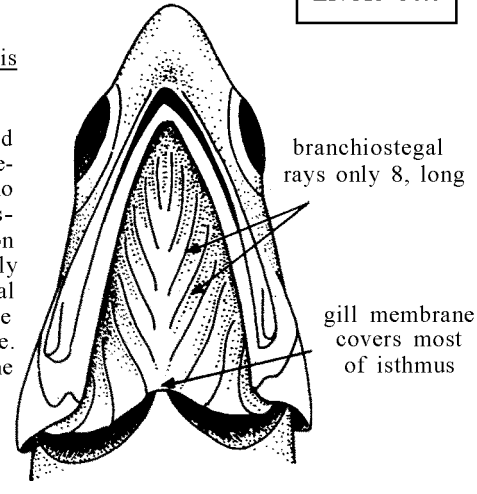
Literature:

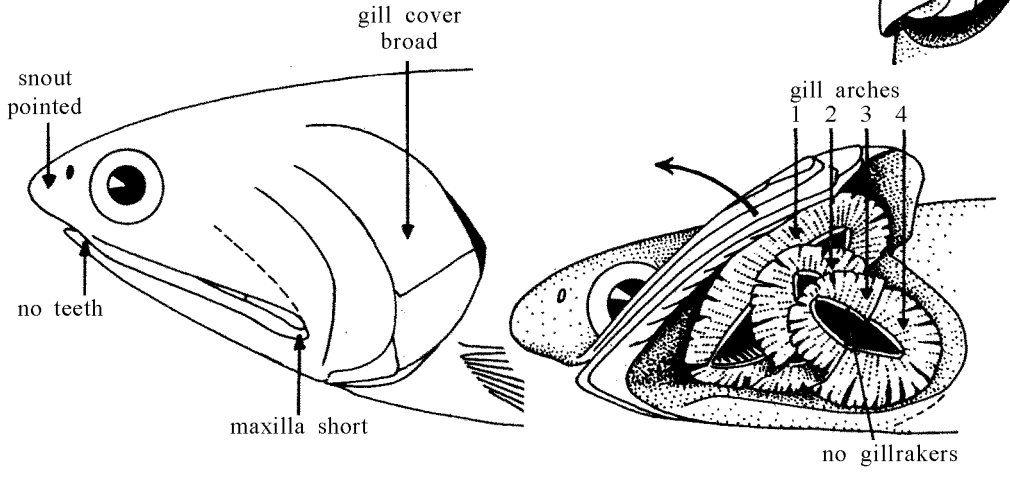
Cetengraulis Günther, 1868

ENGR Cete

Cetengraulis Günther, 1868, Cat.fish.Brit.Mus., 7:383 (type: Engraulis edentulus Cuvier, 1829).

Diagnostic Features: Moderate-sized, rather strongly compressed anchovies (to 17 cm standard length). Snout rather pointed; maxilla moderate, tip blunt, not reaching to beyond front margin of pre-operculum; no teeth or denticulations on lower jaw; gillrakers fine and numerous, increasing in larger fishes (lower gillrakers to 105 in one species); no gillrakers on hind face of third epibranchial. Branchiostegal (gill) membrane broadly joined across isthmus and almost completely covering it; branchiostegal rays 8, long. Dorsal fin origin at about midpoint of body; anal fin moderate (17 to 24 branched finrays), its origin under last third of dorsal fin base. Resemble species of Anchovia, but in no other anchovy genus does the branchiostegal membrane cover the isthmus in this manner.





Biology, Habitat and Distribution : Marine, pelagic, forming quite large schools, but tolerating brackish water; Atlantic and Pacific coasts of North, central and South America. Filter-feeders, with well-developed epibranchial organs.

Species : Only two species are recognized:

Atlantic :

C. edentulus (Cuvier, 1829) - Caribbean to Brazil

Pacific :

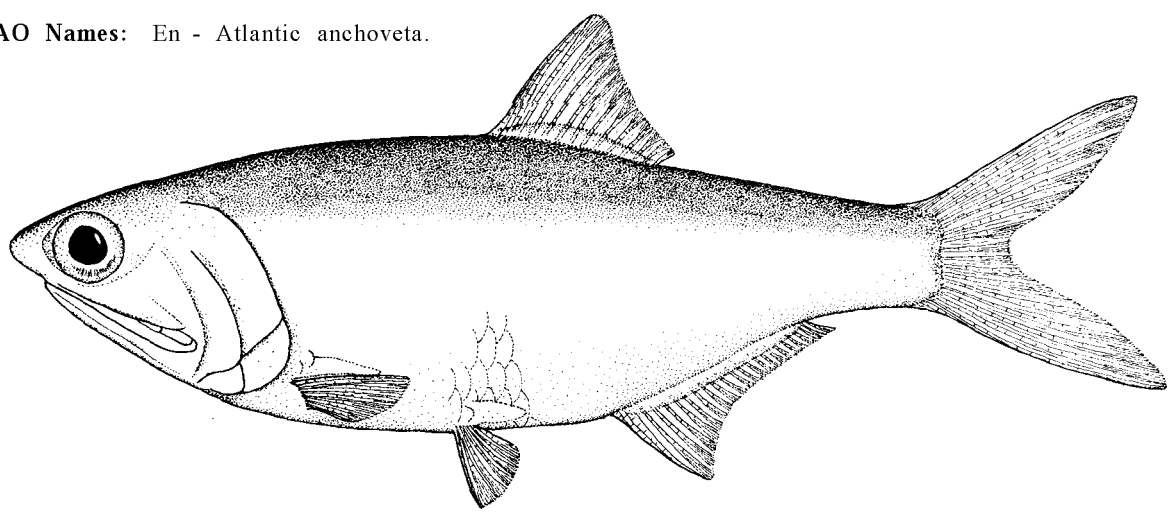
C. mysticetus Günther, 1866 Gulf of California to Peru.

Cetengraulis edentulus (Cuvier,1829) | ENGR Cete 1

Engraulis edentulus Cuvier, 1829, Régne anim.,2nd ed., 2:323 (Jamaica, on Sloane's Harengus minor).

Synonyms : Harengus minor Sloane, 1725:282, p1.250, fig.2(1) (Jamaica - pre-Linnaean); Engraulis brevis Poey, 1866:379 (Cuba); Howell-Rivero, 1938:172 (type of brevis); Stolephorus robertsi Jordan & Rutter, 1897:95 (Jamaica); Jordan & Evermann, 1898:2815 (on Jordan & Rutter); Stolephorus gilberti Evermann & Marsh, 1900:352 (Palo Seco, Puerto Rico) and Idem.,1902:90, fig.15 (same); Jordan & Evermann, 1900:3146 (on Jordan & Rutter); Stolephorus garmani Evermann & Marsh, 1900:352 (Puerto Real, Puerto Rico) and 1902:89, fig.4 (same); Jordan & Evermann, 1900:3146 (on Evermann & Marsh); ? Stolephorus manjuba Ribeiro, 1908:unpaged (Rio de Janeiro; description inadequate); Anchoviella surinamensis:Fowler, 1931:392 (Trinidad); Lowe (McConnell), 1962:693 (Guyana); Hildebrandichthys setiger Schultz, 1949:49, fig.7 (Caño de Sagua, Sinamaica, Venezuela); FWNA, 1964:231, fig.53 (the type); Cetengraulis edentulus-Günther, 1868:383 (Jamaica); Jordan & Evermann, 1896:450 (synopsis); Meek & Hildebrand, 1923:214 (Colon Market and Fox Bay, Panama, also Jamaica and Rio de Janeiro); Jordan & Seale, 1926:414 (Cuba, Brazil); Fowler,1942:135 (Brazilian records); Hildebrand, 1943:155 (Cuba, Jamaica, Puerto Rico, Panama,Venezuela, Brazil); Boeseman,1956:185 (Surinam); FWNA, 1964:245, fig.59 (synopsis, refs); Simpson, 1965:l et seq. (early life history); Silva, 1967:333 et seq. (meristics); Cervigón, 1966:147, fig.59 (Venezuela); Dahl, 1971:162 (Colombia); Gilbert & Kelso, 1971:23 (Tortuguero lagoon, Costa Rica); Eskinazi, 1972:29l (Santa Cruz canal, Pernambuco, Brazil); Whitehead, 1973a:107, fig.39 (Trinidad, Guyana, Surinam); Anon.,1976:70 (Mexico); Palacio, 1974:23 (Gulf of Urabá, Colombia); Perez et al., 1975:228 et seq., figs l-4 (electrophoretograms), tab.1 (analysis of proteins, relationships,Venezuela); figueiredo & Menezes, 1978:27 (Brazil, compiled); Cervigón, 1980:233, fig.2.82 (synopsis); Nelson, 1984b:422, fig.lA,B, tabs 1,2 (Hildebrandichthys setiger = edentulus; gut, anal finrays, vertebrae).

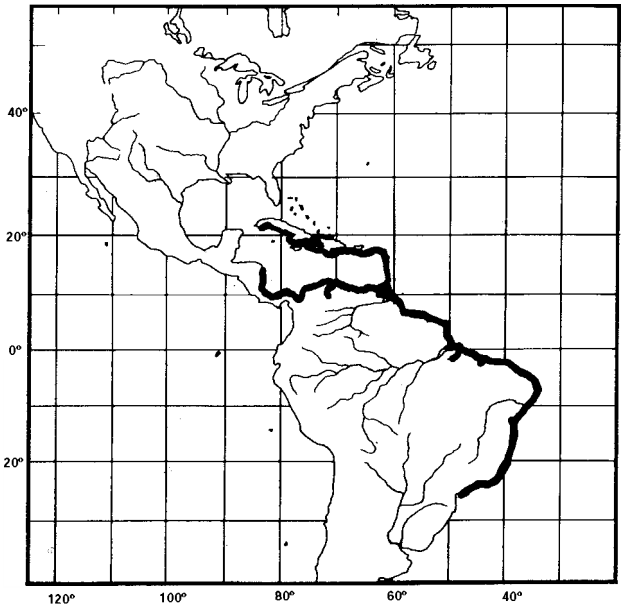
FAO Names: En - Atlantic anchoveta.



Diagnostic Features : Body compressed and fairly deep, its depth a little over 3 times in standard length; head large and deep. Snout short and pointed, about 2/3 eye diameter; maxilla moderate, tip blunt, just failing to reach lower jaw articulation; lower gillrakers fine and numerous, increasing in large fishes, about 45 to 55 in fishes of 10 to 13 cm standard length (total to 105 in specimens of 13 cm - regression plotted by Silva, 1967:fig.5); no gillrakers on posterior face of 3rd epibranchial. Branchiostegal membrane broad, covering entire isthmus; branchiostegal rays 8, long and slender. Anal fin moderate, with iii 18 to 24 finrays, its origin under last third of dorsal fin base. A silver stripe along flank in smaller fishes, disappearing at about 10 cm standard length. Similar to Anchovia surinamensis in general appearance, but distinguished by the broad branchiostegal membrane (if split,

can still be found with forceps); this distinguishes it from all other Atlantic anchovies (which are usually more slender, have less deep heads, a longer maxilla, fewer gillrakers). See ENGR Cete 1, Fishing Area 31).

Geographical Distribution : Western central and South Atlantic (Antilles from Cuba southward; Costa Rica south and east to Colombia and Venezuela, Trinidad south to Itapema, Santa Catarina, Brazil).



Habitat and Biology: Marine, pelagic, inshore and forming quite large schools; also entering brackish waters of lagoons and estuaries and tolerating salinities of 10.32 to 31.00‰ (Santa Cruz canal, Pernambuco - see Eskinazi, 1972:291). A filter feeder (fine and close-set gillrakers, large epibranchial organs), presumably on both plant and animal plankton. Spawns off the Araya Peninsula (opposite Margarita Island), Venezuela from October to January, with a distinct peak in mid-November; eggs oval (Simpson, 1965:figs 5,6), spawned at 02.30 to 05.00 hours along shore-line out to about 1.5 km, hatching about 20 to 24 hours later. The biology of this species is almost certainly very similar to that of the better known A. mysticetus of the eastern Pacific.

Size : To about 13 cm standard length, usually 10 to 12 cm.

Interest to Fisheries : Caught with beach seines, May to November (Venezuela). Fresh fishes little used for human consumption, but valued as a source of fishmeal for domestic animals (Venezuela). Total catch in 1982 was 5 930 t (Venezuela only).

Local Names : CUBA: Bocón; VENEZUELA: Rabo amarillo (yellow tail).

Literature : Simpson (1965 - early development, fishery in Venezuela), Silva (1967 - meristics).

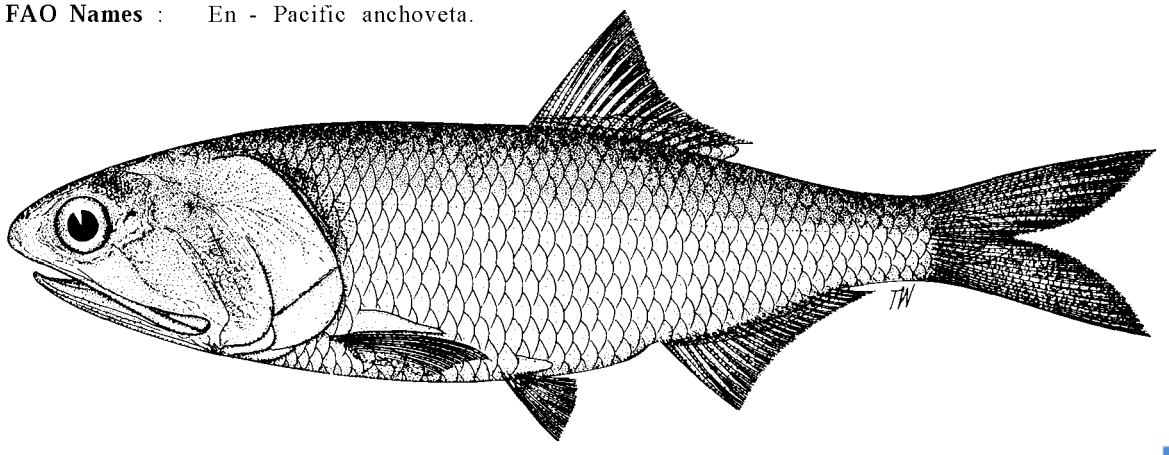
Cetengraulis mysticetus (Günther, 1867)

ENGR Cete 2

Engraulis mysticetus Günther, 1867, Proc.zool.Soc.Lond., (3):604 (Panama).

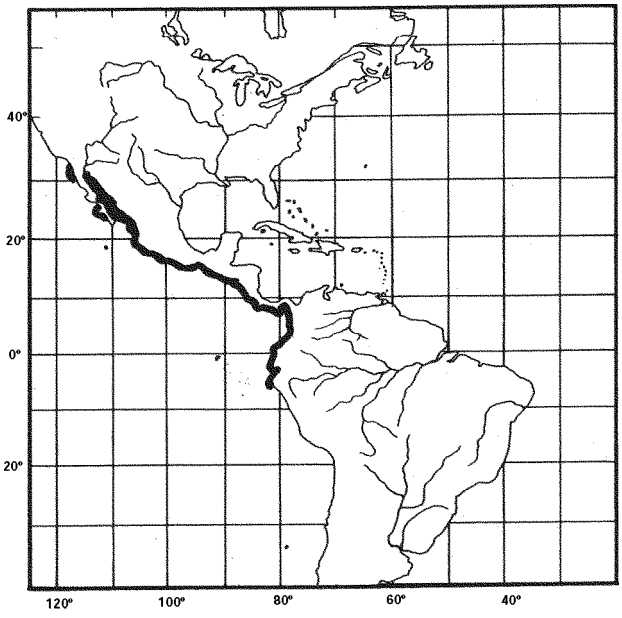
Synonyms : Stolephorus opercularis Jordan & Gilbert, 1882:275 (Punta San Felipe, Gulf of California); Anchovia opercularis Gilbert & Starks, 1904:42 (Panama Bay); Cetengraulis engymen Gilbert & Pierson, 1898:2815 (PanamaBay); Cetengraulis mysticetus:Günther, 1868:383 (Panama); Meek & Hildebrand, 1923212 (Panama); Jordan & Seale, 1926:416 (Panama); Hildebrand, 1943: 157, fig.72 (Panama, Guayamas, Mexico and Rio Piura, Peru); Idem., 1946:104 (Rio Piura); Howard, 1954:1 et seq. (populations); Peterson, 1956:172 (Gulf of Nicoya, Costa Rica - biology); Berdegué, 1958:1 et seq. (populations); Howard & Landa, 1958:1 et seq. (Panama - biology); Harder, 1958:365 et seq. (intestine); Simpson, 1959:447 et seq., figs 1-40, tabs 1-7 (breeding, eggs, larvae illustrated); Bayliff, 1969:1.1 et seq. (complete synopsis of biology); Cobo & Massay, 1969:8 (Mexico, listed); Erdman, 1971:62 (Gulf of Nicoya - decline in numbers); Miller & Lea, 197256 (California; to Los Angeles); Eschmeyer, Herald & Hamman, 1983:74 (compiled).

FAO Names : En - Pacific anchoveta.



Diagnostic Features: Body compressed and fairly deep, its depth 3 to 3.5 times in standard length; head large and deep. Snout short and pointed, about 2/3 eye diameter; maxilla moderate, tip blunt, just failing to reach lower jaw articulation; lower gillrakers fine and numerous, increasing in larger fishes, about 25 at 5 cm standard length, 60 at 12 cm; no gillrakers on posterior face of third epibranchial. Branchiostegal membrane broad, covering entire isthmus; branchiostegal rays 8, long and slender. Anal fin moderate, with iii 17 to 24 finrays (usually 20 to 22), its origin under last third of dorsal fin base. A silver stripe along flank in smaller fishes, disappearing at about 8 to 10 cm standard length. Similar to Anchovia macrolepidota in general appearance, but distinguished by the broad branctiiostegal membrane (if split. can still be found with forceps); this distinguishes it from all other Pacific anchovies (which are usually more slender, have less deep heads, a longer maxilla, fewer gillrakers).

Geographical Distribution : Eastern central Pacific (apparently as far north as Los Angeles, but these are perhaps releases from bait tanks of tuna boats; southern Pacific coast of Baja California, Gulf of California south to Panama, Cobombia, Ecuador and northern Peru to Bay of Sechura at 5°30' S).



Habitat and Biology: Marine, pelagic, inshore (down to 9 m depth) and forming quite large schools which seem to break up and reform rather rapidly; found principally over mud flats, apparently not making long migrations along sandy or rocky areas to other suitable mud flats, although other migrations occur. Juveniles feed principally on diatoms, also silica-flagellates, dinoflagellates and small crustaceans; adults also subsist mainly on diatoms (most stomachs contain mud as well as benthic diatoms). Spawning, at least in the Gulf of Panama, occurs over shallow mud flats in October to January, with a peak in November and December (slightly earlier to the north and to the south as well); eggs oval (Simpson, 1959:figs 35, 36), spawned at 01.00 to 04.30 hours, hatching about 20 hours later.

Size : To 17 cm standard length, usually about 14 or 15 cm.

Interest to Fisheries : A small amount eaten fresh or canned, but used chiefly as fishmeal and as a tuna baitfish; caught with cast nets for local consumption, but with lampara nets for the bait fishery and purse seines for the reduction fishery, mainly within 8 km of the shore. Most abundant in Gulf of Panama, but other important fishing areas in Alemjas Bay (Pacific coast of Baja California), Guayamas Bay and Ahome Point (Gulf of California) and Gulf of Guayaquil (Ecuador, Peru). The total catch in 1982 was only 64 133 t (171 916 t in 1980); Bayliff (1969:tab.XIII) showed the rise in catches by the tuna-bait fleet from 1946 to 1956 and the sudden decline after that, due to a switch to purse seining and decline of the tuna-bait fishery.

Local Names : COLOMBIA: Cardume, Anchoveta; COSTA RICA: Anchoveta; ECUADOR: Anchoveta, Chuhueco, Esmeraldas, Ojito; MEXICO: Anchoveta (north), Sardin, Sardina (south); PANAMA: Anchoveta, Cardume, Sardina; USA: Anchoveta (fishermen and AFS list).

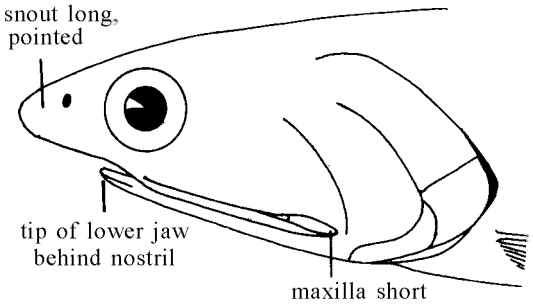
Literature: Bayliff (1969 - complete synopsis of biology and fishery); important papers summarized there are Howard (1954), Simpson (1959), Howard & Landa (1958).

Remarks: Closely resembles the Atlantic C. edentulus, but has a rather larger head, more slender body, smaller eye and longer cheek. However, the provenance makes separation simple.

Jurengraulis Whitehead gen.nov.

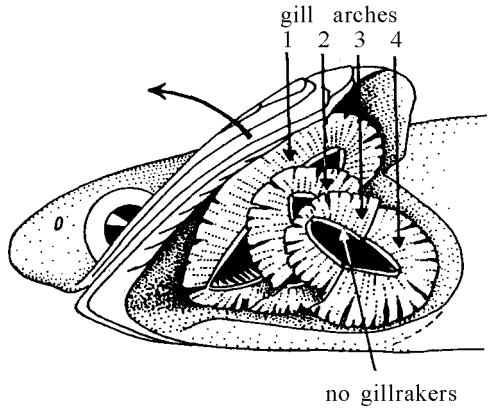
ENGR Juren

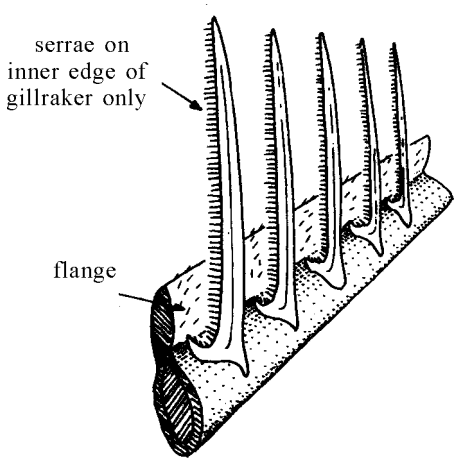
Jurengraulis gen.nov. (type: Cetengraulis juruensis Boulenger).

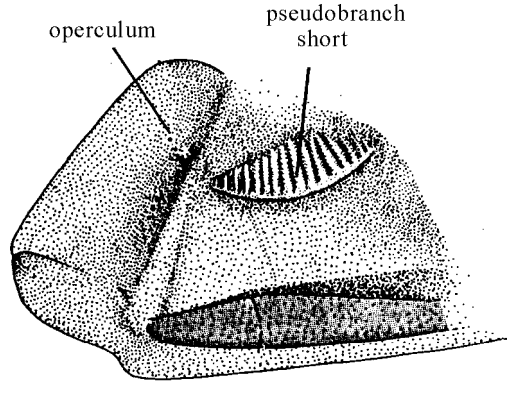


Diagnostic Features : Moderate-sized, rather round-bodied and slender anchovies (to 16 cm standard length), oval in cross-section and little compressed. Head very long (about 3.5 times in standard length); maxilla short, not reaching front margin of pre-operculum, not extending beyond tip of second supra-maxilla; jaw teeth minute or absent; tip of lower jaw behind nostril. Gillrakers fine and numerous (lower gillrakers 53 to 58), serrae present only along inner edge, a distinct flange present behind gillraker bases on first three arches forming a

groove; no gillrakers on hind face of third epibranchial. Pseudobranch short, less than eye diameter, not reaching onto inner face of operculum. Branchiostegal rays 9 or more, the membrane not broadly covering the isthmus. Dorsal fin at about midpoint of body; anal fin short, with 20 to 22 branched finrays, its origin under base of last dorsal finray. Resembles the marine Cetengraulis, which has only 8 but long branchiostegal rays and a broad branchiostegal membrane that covers most of the isthmus; in general body shape resembles Engraulis (sensu stricto, i.e. the encrasicolus-group), which has pseudobranch longer than eye, gillrakers present on hind face of third epibranchial, branched anal finrays 13 to 15, lower gillrakers only 27 to 43; similar to the New World Engraulis (anchoita, ringens, mordax), but either pseudobranch longer or maxilla reaching onto pre-operculum, lower gillrakers not more than 45, and all are marine.







Biology, Habitat and Distribution : Fresh water only, in Amazon system.

Species :A single species recoynized:

J. juruensis (Boulenyer, 1898) Amazon system.

Remarks : Nelson (1984b) argued for retention of this species in the genus Cetengraulis, but the specialized and unique branchiostegal rays and membrane of Cetengraulis, as well as its essentially marine habit, do not suggest any closer ancestry than that between Cetengraulis and Anchovia.

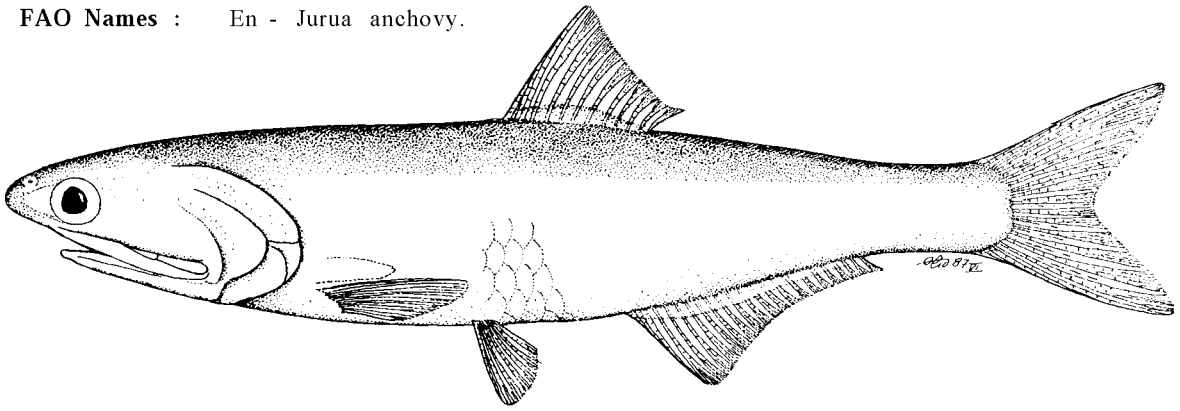
Jurengraulis juruensis (Boulenger, 1898)

ENGR Juren 1

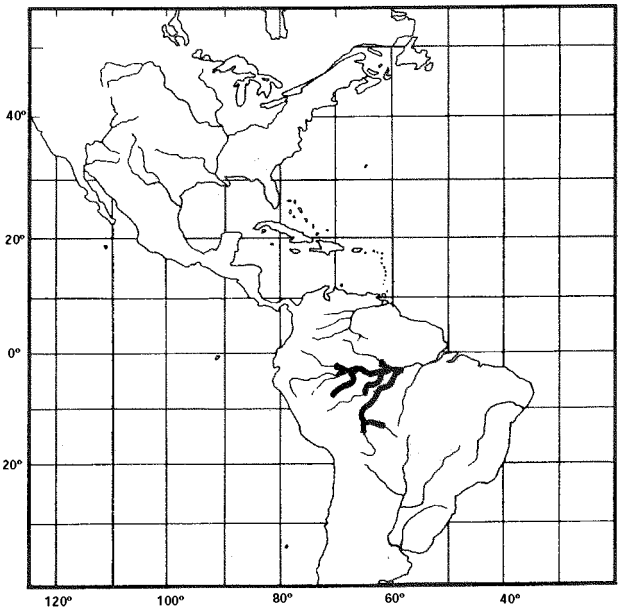
Cetengraulis juruensis Boulenger, 1898, Trans.zool.Soc.Lond., 14(7):421-8.

Synonyms : Cetengraulis juruensis:Fowler,1941c:236 (Engraulis iquitensis wrongly placed in synonymy); Campos, 1942:202, fig.15 (on Boulenyer); Hildebrand, 1943:158 (on Boulenyer); Fowler, 194824, fig.16 (refs); Whitehead, 1973a:89, fiy.30d (maxilla) (relationships); Nelson, 1984b:423 (Rio Mamoré in Bolivia and Manaus, Amazon system; relationships).

FAO Names : En - Jurua anchovy.



Diagnostic Features: Body slender, little compressed, oval in cross-section, its depth about 5.5 times in standard length. Head long, about 3.5 times in standard length; snout long and pointed; maxilla short, tip bluntly rounded, not reaching to front border of pre-operculum, not projecting beyond tip of second supra-maxilla; teeth in jaws minute or absent. Lower gillrakers 53 to 58, long and slender; no gillrakers on hind face of third epibrancial. Dorsal fin origin at about midpoint of body; anal fin moderate, with iii 20 to 22 **finrays**, its origin under last dorsal **finray**. Apparently without a silver stripe along flank (although this may be present in juveniles). Of similar freshwater South American anchovies, Pterengraulis has the dorsal fin origin behind the anal fin origin, Lycengraulis has canine-like teeth and Anchoviella as well as the previous two have fewer gillrakers; the very long head and long pointed snout of J. juruensis are quite distinctive.



Geographical Distribution: Western central Atlantic drainage (Amazon system, from Rio Mamoré in Bolivia to Manáus, including the Jurua and probably other tributaries).

Habitat and Biology: Riverine in middle and upper reaches. The numerous and rather long gillrakers armed with fine setae, together with the very long and highly coiled gut (Nelson, 1984b:pl.lD and fig. 2B) suggest a microplanktonic diet. More data needed.

Size : To at least 16 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature:

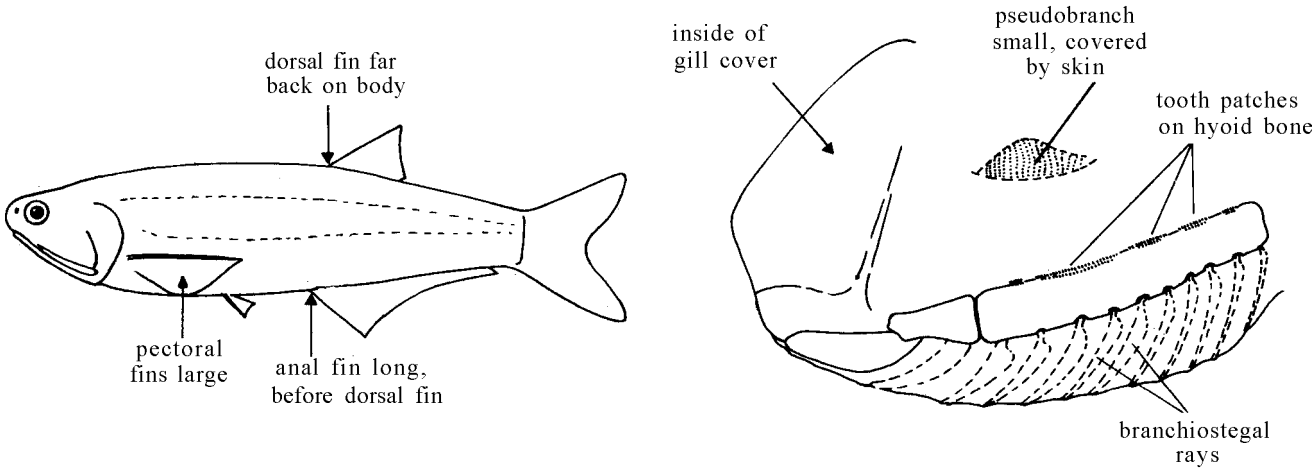
Remarks: Engraulis iguitensis Nakashima, 1941 of the Peruvian Amazon is not J. juruensis (anal fin origin too advanced, teeth in jaws, head too short, etc.); its short maxilla suggests a species of Anchoviella, but the anal fin is too long for A. alleni, A. carrikeri or A. jamesi. With reservations it is identified as Lycengraulis batesii.

Pterengraulis Günther 1868

ENGR Pter

Pterengraulis Günther, 1868, Cat.fish.Brit.Mus., 7:384, 398 (type: Clupea atherinoides Linnaeus, 1766).

Diagnostic Features: Fairly large and strongly compressed anchovies (to at least 20 cm standard length). Teeth in jaws short and even; lower gillrakers few (12 to 14); small patches of teeth on upper edge of hyoid bones. Pectoral fins large, to beyond pelvic fin base; dorsal fin far back on body; anal fin long (28 to 32 branched finrays), its origin before that of dorsal fin. Somewhat resembles Lycengraulis, which has canine-like teeth.



Biology, Habitat and Distribution : Euryhaline; Atlantic coasts and lower parts of rivers of northeastern South America. Predators on small fishes, crustaceans, etc.

Species : Only a single species has ever been recognized:

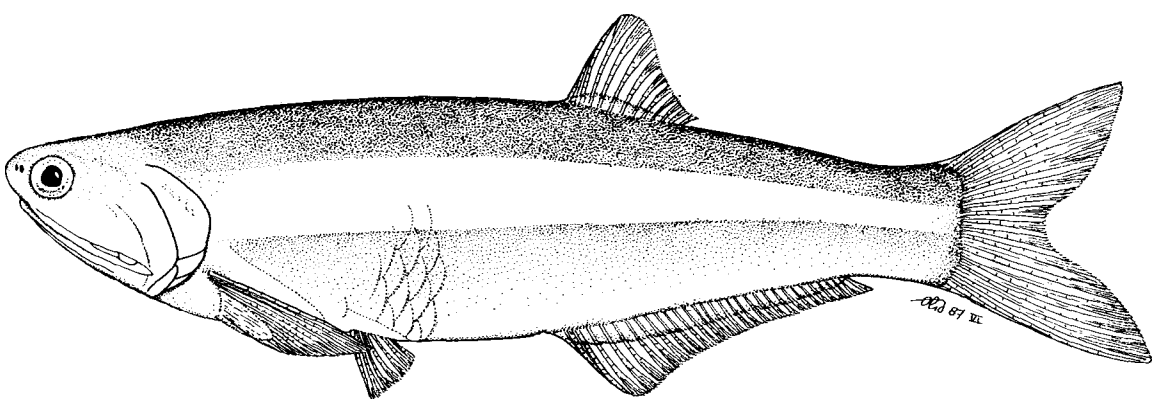
P. atherinoides (Linnaeus, 1766) Atlantic coasts and drainage of northeastern South America.

Pterengraulis atherinoides (Linnaeus,1766) | ENGR Pter 1

Clupea atherinoides Linnaeus, 1766, Syst.nat., 12th ed., 1:535 (Surinam).

Synonyms : Engraulis atherinoides:Valenciennes, 1848:31 (Surinam); Günther, 1868:398 (Surinam, Guyana, also Rio Capin); Steindachner, 1880:177(Pará, Cametá, Garupá in Amazon system); Pterengraulis atherinoides: Jordan & Evermann, 1896:450 (compiled); Schreiner & Ribeiro, 1903:94 (Guianas to Brazil); Starks, 1913:lO (Pará market); Jordan & Séale, 1926:386 (Pará Cametá, Gurupá, Arary, Brazil); Fowler, 1931:407 (Caño de Guanoca, Venezuela); Puyo, 1936:170, fig.36 (French Guiana); Fowler, 1941b:126 (Rio Jaguaribe, Ceará, Brazil); Idem., 1942:135 (Brazil refs); Campos, 1942:2OO (Brazil, compiled); Hildebrand, 1943:139, fig.63 (Caño de Guanoco, Rio Apure, San Fernando de Apure, Venezuela, also Amazon, Pará, Fortaleza, Cametá and Arary); Fowler, 1948:26, fig.20 (Brazil, synonymy); Schultz, 1949:48 (San Fernando de Apure); Puyo, 1949:158, fig.81 (French Guiana); Boeseman, 1952:193 (Surinam); Idem., 1956:185 (Suriname River, 17 km from mouth); Lowe (McConnell), 1962:693 (Guyana coast); FWNA, 1964:229, fig.52 (synopsis); Whitehead, 1973a:181, figs 71, 72 (branchiostegals, hyoid teeth) (Guyana, Surinam); Cervigón, 1980:234, fig.283 (synopsis); Idem., 1982:223 (Orinoco delta).

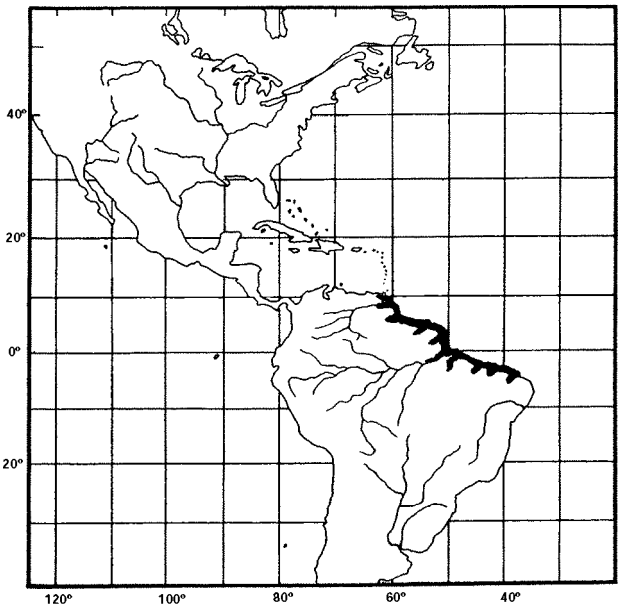
FAO Names : En - Wingfin anchovy.



Diagnostic Features : : Body strongly compressed, fairly elongate, its depth about 3.5 to 4.5 times in standard length. Snout short, about 2/3 eye diameter; maxilla moderate, tip bluntly rounded, not quite or just reaching lower jaw articulation; lower gillrakers 12 to 14, short, with often a single rudimentary raker in front. Pectoral fins large, reaching beyond pelvic fin base; anal fin long, with iii 28 to 32 finrays, its origin in front of

dorsal fin origin. A silver lateral stripe along flank, broad anteriorly, narrowing over anal fin. Lycengraulis species are similar in appearance, but have large canine-like jaw teeth; in addition, the dorsal fin origin is before the anal fin origin (as in all other Atlantic anchovies).

Geographical Distribution : Western central and South Atlantic coasts and drainage (Orinoco delta, the Guianas, south to Ceará, Brazil).



Habitat and Biology : Estuarine and fresh water, reaching some distance inland (at least 17 km up the Suriname River; to above Santarem on the Amazon). The short and few gillrakers suggest predatory feeding on small fishes, etc. No data on breeding.

Size : To at least 20 cm standard length (reported to 30 cm total length, or about 25 cm standard length, in FWNA, 1964:230).

Interest to Fisheries : Of local importance in artisanal fisheries, very common in Belém market (Starks, 1913).

Local Names : FWNA: Hareng gras, sardinha (no locality).

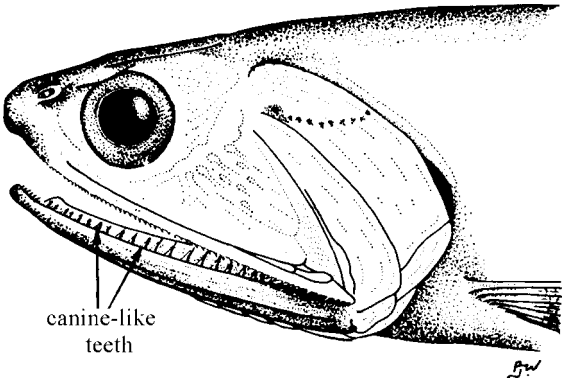
Literature :

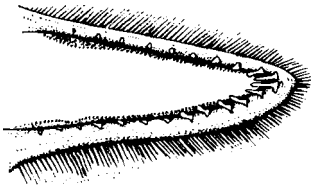
Lycengraulis Günther, 1868

ENGR Lycen

Lycengraulis **Günther**, 1868, Cat.fish.Brit.Mus. , 7:385, 399 (type: Engraulis grossidens Agassiz, 1829).

Diagnostic Features : Fairly large and rather compressed anchovies (to 26 cm standard length, mostly about 20 cm). Teeth enlarged, canine-like and well-spaced, especially in lower jaw; lower gillrakers few or moderate (12 to 27), the anterior gillrakers becoming rudimentary in some species. Pectoral fins moderate, not or just reaching to pelvic fin base; dorsal fin origin only a little behind midpoint of body; anal fin long (21 to 30 branched finrays), its origin below about midpoint of dorsal fin base. The canine-like teeth distinguish it from all other New World genera.





first gill arch

Biology, Habitat and Distribution : Euryhaline or fresh water; Atlantic and Pacific coasts and rivers of South and central America. Predators, feeding on fishes and crustaceans.

Species: Three species are recognized here, following Whitehead (1973a), but the two Atlantic species may each be a complex of subspecies or even species:

L. batesii (Günther, 1868) Atlantic drainage of northeastern South America

L. grossidens (Agassiz, 1829) Atlantic coasts and drainage of northeastern South America

L. poeyi (Kner & Steindachner, 1865) Pacific coasts and drainage of southern Central America.

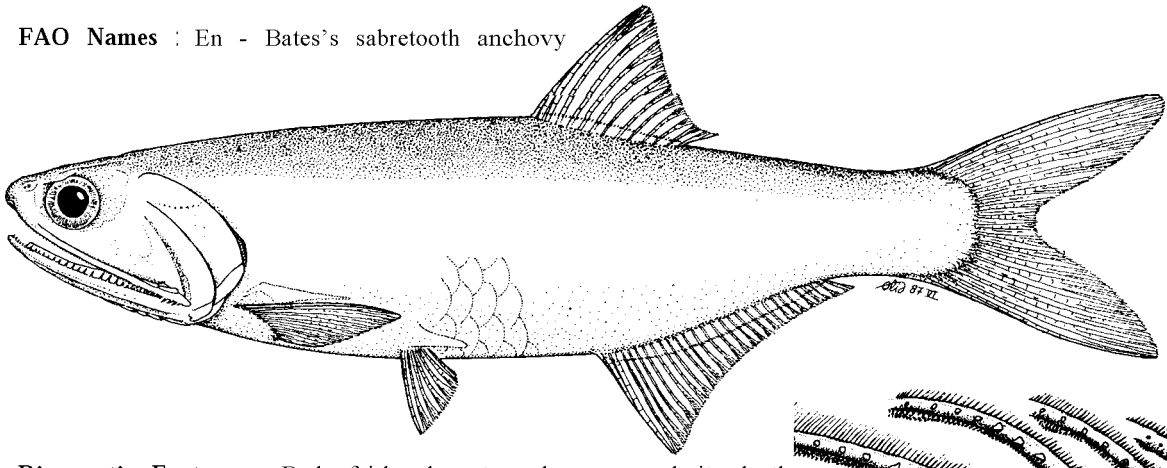
Lycengraulis batesii (Günther, 1868)

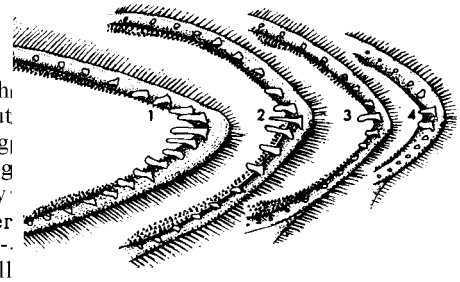
ENGR Lycen 2

Engraulis batesii **Günther**, 1868, Cat.fish.Brit.Mus., 7:399 (Pará River, Brazil).

Synonyms : ? Engraulis iquitensis Nakashima, 1941:62, fig. (PeruvianAmazon); Lycengraulis barbouri Hildebrand, 1943:151, fig.69 (Rio Poti, tributary of Rio Paranhyba, also Pará Brazil); Fowler, 1948:24 (Brazil records); FWNA, 1964243, fig.58 (same); Cervigón, 1966:148 (Orinoco delta); Lycengraulis batesii:Jordan & Seale, 1926:385 (Brazil, but some specimens grossidens, i.e.,gillrakers 23 in Rio Doce specimen and 21 in description); Fowler, 1942:135 (Brazil records); Campos, 1942:211, p1.9, fig.24 (Iguapé, Brazil); Hildebrand, 1943:148, fig.67 (Rio Apuré, tributary of Orinoco; Pará Teffe and Rio Jutahi, Brazil); Fowler, 1948:25 (Brazil records); FWNA, 1964:240 fig.56 (synopsis); Boeseman, 1952:1913 (Suriname River, as grossidens); Gines & Cervigón, 1969:31, 40 (Guianas coasts); Lüling, 1969:577, fig.3d (as barbouri) (Rio Ucayali, Rio Huallaga); Alcantara, 1973:13, fig.2 (middle and lower Amazon); Whitehead, 1973a:166, figs 63, 64 (jaws), 65 (gillrakers) (Guyana, Surinam; batesii syntypes); Cervigón, 1982:221 (Orinoco delta).

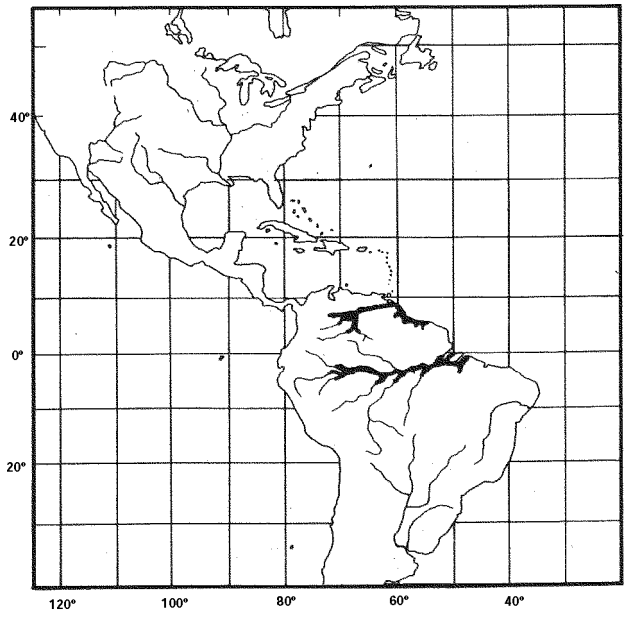
FAO Names : En - Bates's sabretooth anchovy





gillrakers on the four arches

Diagnostic Features : Body fairly elongate and compressed, its depth about 4 to 5 times in standard length (small fishes more slender). Snout moderate, about 3/4 eye diameter, maxilla moderate, tip pointed, reaching almost to or just beyond front margin of pre-operculum, teeth becoming larger toward tip of jaw; lower jaw with small teeth at front, followed by larger canine-like teeth, especially around midpoint of jaw. Lower gillrakers 12 to 15, short and stumpy, the anterior 1 to 3 rakers rudimentary in fishes over about 10 cm standard length. Dorsal fin origin well behind midpoint of body: anal fin long, with iii 26 to 30 finrays, its origin below first to fourth branched dorsal finrays. A broad silver stripe along flank, twice eye diameter at widest, but disappearing in fishes over about 10 to 12 cm standard length; a curve of black dots on upper part of operculum. Closely resembles L. grossidens, which has 16 to 27 gillrakers. No other. Atlantic New World anchovies have canine-like teeth.



Geographical Distribution : Western central and South Atlantic drainage (Orinoco, as far up as the Rio Manacacias in Colombia, rivers of the Guianas, and Amazon at least as far up as Teffe and the Jutahi River - if specimens were identified correctly - and even as far as the Ucayali, Huallago and Morona Rivers of the upper Amazon).

Habitat and Biology : Freshwater, riverine, far up rivers, but apparently reaching down to river mouths (Marowijne and Coppename in Surinam - Whitehead, 1973a:167; Orinoco delta - Cervigón, 1982), but with no indication of salinity tolerance. Carnivorous, feeding on small fishes and probably crustaceans. Cervigón (1982) recorded a ripe female of 17.2 cm standard length at Tucupita, Orinoco delta.

Size : To about 26 cm standard length, usually about 15 to 20 cm.

Interest to Fisheries : Probably of some value to artisanal river fisheries, but not forming large schools.

Local Names :

Literature :

Remarks : The figure and vertebral counts for Nakashima's Peruvian Engraulis iquitensis suggest Lycengraulis batesii, in which case the canine-like teeth were overlooked; body shape and dorsal fin position exclude Pterengraulis, while maxilla shape excludes Anchoa.

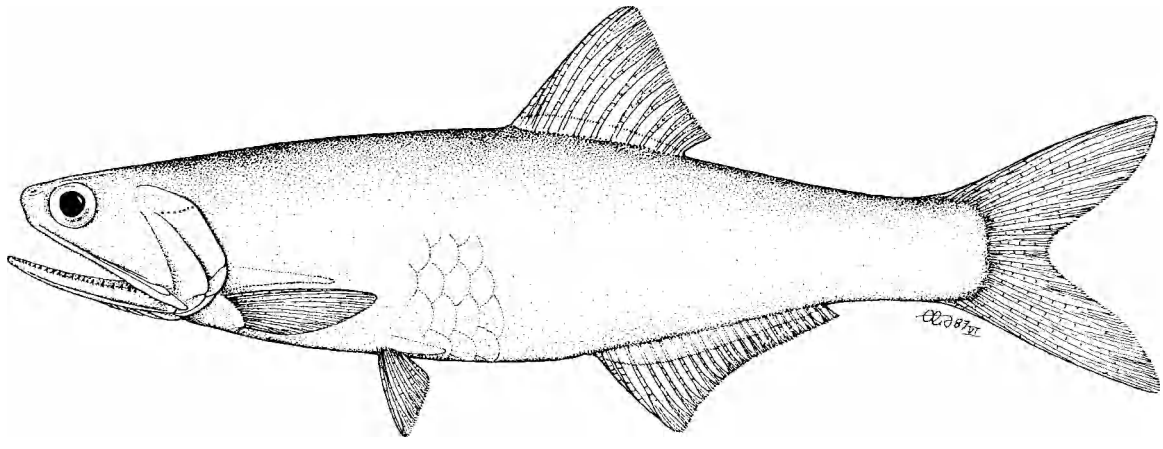
Lycengraulis grossidens (Agassiz, 1829)

ENGR Lycen 1

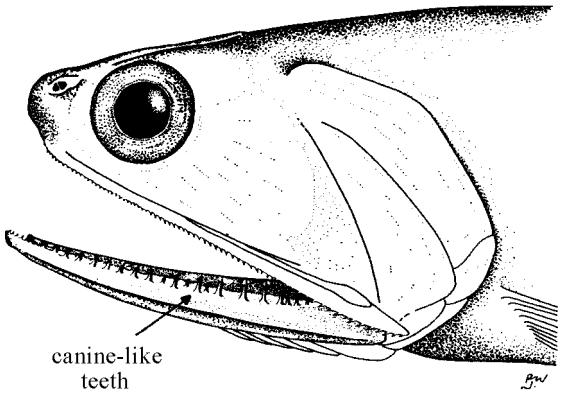
Engraulis grossidens Agassiz, 1829 (May or June), in Spix and Agassiz, Select.gen.spec.pisc.Bras., 1:50 (Rio de Janeiro; name and brief description preceding Engraulis janeiro Spix on same page).

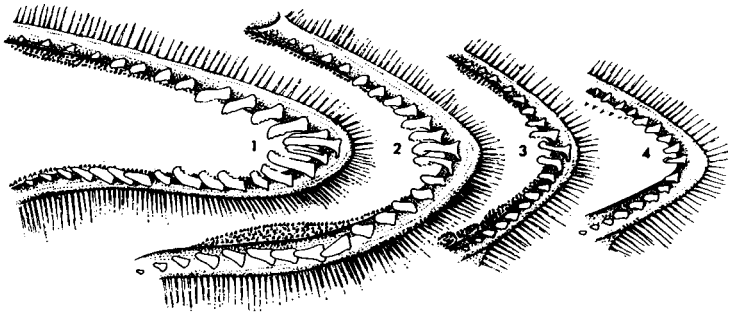
Synonyms : Engraulis janeiro Spix, in Spix & Agassiz, 1829:p1.24, fig.1 (proposed in synonymy, thus invalid - Art 11(d) and 16(b) (ii) of International Code); Engraulis dentex Valenciennes, 1848:28 (Rio de Janeiro); Engraulis olidus Günther, 1874:455 (Paraná River, Brazil); Stolephorus olidus Eigenmann,1907:453 (Buenos Aires, Argentina); Devincenzi, 1924:189 (Uruguay); Lycengraulis olidus:Hildebrand, 1943:144, fig.65 (Rio Grande do Sul, Brazil, 'Paraguay', Uruguay, Buenos Aires, Argentina); Fuster de Plaza & Boschi, 1961:8, figs 1,7 and 8 (gillrakers), 10 visceral organs) (Argentina, migration, ecology); FWNA, 1964:234, tab.8 (compared with grossidens); Ringuelet, Arámburu & Aramburu, 1967:63, fig.2A (Argentina, fresh water); Weiss & Krug, 1977:84, figs 2, 3, 4 (eggs, larvae) (Lagoa dos Patos estuary, Rio Grande do Sul, Brazil); Castello, 1977:9, 63 (Lagoa dos Patos, eggs post-larvae); Castello, 1978:8, 47 (Lagoa dos Patos, post-larvae); Anchovia abbotti Fowler,1915:522, fig.1 (Port-of-Spain, Trinidad); Anchoviella abbotti:Jordan, Evermann & Clark, 1930:50 (compiled); Lycengraulis abbotti:Hildebrand, 1943:150, fig.68 (the type only); FWNA, 1964242, fig.57 (synopsis); Lycengraulis schroederi Hildebrand, 1943:153, fig.70 (Rio Doce, Brazil); Lycengraulis polymera Marini, 1935:446 (Rio de la Plata, nomen nudum); Lycengraulis limnichthys Schultz, 1949:51, fig.8 (Rio Aqua Caliente, above Lake Maracaibo, Venezuela); FWNA, 1964:237, fig.55 (synopsis); Lycengraulis simulator Fuster de Plaza, 19622, figs 1, 2, 3 (gillrakers, maxilla) (Bela Vista, Paraná River, Argentina); Ringuelet, Aramburu & Aramburu, 1967:62 (Argentina); Engraulis grossidens:Günther, 1868:399 (Guyana); Lycengraulis grossidens-Jordan & Seale, 1926:383 (Brazil from Para to Rio Grande do Sul, also Uruguay); Fowler, 1942135 (Brazil, refs); Campos, 1942210, P1.9, figs 22, 23 (head) (Ubatuba, Brazil); Hildebrand, 1943:143, fig.64 (Gulf of Venezuela to Santos, Brazil; olidus, abbotti and schroederi kept distinct); Fowler, 1948:25, fig.18 (Brazil, compiled); Boesernan,1956:185 (Surinam River, 17 km frorn mouth); FWNA, 1964:234, fig.54 (synopsis); Whitehead, 1967a:134 (types of dentex); Whitehead & Myers, 1971:487, 495, 496 (grossidens, janeiro-nomenclature); Eskinazi,1972291 (Santa Cruz canal, Pernambuco, food); Roux, 1973:54 (Brazil, compiled); Whitehead, 1973a:173, figs 67, 68 and 69 (jaws, gillrakers) (Trinidad, Gulf of Paria, Guyana, Surinam); Perez et al., 1975:228 et seq., figs 1-4 (electrophoretograms) (protein analysis, relationships; compared with L. limnichthys); Figueiredo & Menezes, 1978:29, fig.37 (Ubatuba, Brazil); Cervigón, 1980:233, fig.2.81A (compiled) Cervigón, 1982:222 (Orinoco delta); Whitehead & Bauchot, 1986:32 (types of dentex). Note: this rather extended synonymy is given in order to assist future workers who may raise some or all the junior synomyms to subspecific or even specific status. Alcàntara (1973) proposed the new species 'amazonensis' in her Master's thesis, but this does not qualify as a valid publication of the name.

FAO Names : En - Atlantic sabretooth anchovy.



Diagnostic Features : Body fairly elongate and compressed, but varying rather widely in depth (even in the same sample, e.g., 19 to 25% at 14.6 cm standard length). Snout moderate, about 2/3 eye diameter; maxilla moderate, tip pointed, reaching onto sub-operculum, teeth becoming larger toward tip of jaw; lower jaw with small teeth in front, followed by larger canine-like teeth, especially around midpoint of jaw. Lower gillrakers 16 to 27, short but the longest not less than pupil diameter in adults, few or none of the anterior rakers rudimentary. Dorsal fin origin behind midpoint of body; anal fin long, with iii 21 to 26 finrays, its origin below 6th to 8th branched dorsal finrays. A broad silver stripe along flank, up to twice eye diameter at widest, disappearing in fishes over about 10 cm standard length; a curve of black dots on upper part of operculum. Closely resembles L. batesii, which has only 12 to 15 lower gillrakers, the anterior 1 to 3 rudimentary in larger fishes. No other Atlantic New World anchovies have canine-like teeth.





gillrakers on the four arches

Geographical Distribution : Western central and South Atlantic and drainage (Belize, but no southerly records until Lake Maracaibo, Gulf of Venezuela, Trinidad and south to Argentina at Carmen de Pataoones or 41°S: also in lower and sometimes middle parts of the Orinoco, the Amazon to above Manáus, and the Paraná to about Corrientes, as well as in smaller rivers along this Atlantic coastline).

Habitat and Biology : Marine, pelagic, inshore (down to 38 m depth), forming moderate schools, but also in estuaries and in freshwater, usually migrating from estuaries or the sea, but possibly the limnichthys of Lake Maracaibo and the 'amazonensis' of Alcàntara (1973) represent purely freshwater forms. In freshwater, feeds principally on small fishes, prawns and copepods, also insect larvae; in the sea, on fishes and various crustaceans (Fuster de Plaza & Boschi, 1961). Spawns in freshwater, migrating up rivers (in the La Plata system found in fresh water in May to November, with spawning in the stretch from Rosario to Corrientes in October and November; females grow larger and have a longer head than males (Fuster de Plaza and Boschi, loc.cit.); eggs occur in the estuarine Lagoa dos Patos, Rio Grande do Sul, Brazil, throughout the year, but mainly in spring and summer (September to December), believed to have been spawned in coastal waters and brought into the lagoon; larvae appear to prefer shallower and almost fresh water within the lagoon (Weiss & Krug, 1977). The eggs are oval, without an oil drop, the yolk segmented.

Size : To 23.5 cm standard length, usually 15 to 18 cm.

Interest to Fisheries : Caught frequently and abundantly with seine nets off Mar del Plata, Argentina, also caught in the Paraná River; probably contributes elsewhere to artisanal catches.

Local Names : ARGENTINA: Anchoa; BRAZIL: Manjubao, Sardinha prata.

Literature : Fuster de Plaza & Boschi (1961 -excellent synopsis of biology in Argentine waters, as olidus), Ringuelet, Arámburu & Arámburu (1967 - synopsis of biology for olidus and simulator in Argentine waters), Weiss & Krug (1977 - eggs and larvae in southern Brazil).

Remarks : Nine names have been proposed for this species (including 'amazonensis' of Alcàntara, 1973 not yet formally published), of which janeiro, dentex, abbotti, schroederi and polymera seem to be synonyms of grossidens sensu stricto. The other four names may apply to forms, subspecies or even species distinct from grossidens in body form, meristics, ecological requirements and spawning habits. Dr Gareth Nelson has compiled the following data:

	branched anal rays	lower gillrakers	vertebrae	habitat
grossidens	21-26	16-22	42,43,44	anadromous
limnichthys	21-24	19-23	39,41,42	? freshwater
'amazonensis'	23-28	18-21	42, 43, 44	? freshwater
olidus	23-25	19-22	46,47,48	anadromous
simulator	22-26	23-27	44,45,47	anadromous

The high gillraker count of simulator (of Argentina) sets it apart from olidus (Argentina, southern Brazil) and indeed from all the others. Protein analyses suggests a clear distinction between limnichthys (Lake Maracaibo) and grossidens (widespread). According to Alcàntara (1973), 'amazonensis' differs from grossidens in having a longer maxilla, larger eye, longer snout and shorter pre-anal distance. It can also be noted that olidus of southern Brazil is believed to spawn along the coast, whereas Argentinian olidus spawns in fresh water. Much more work is needed to reach a conclusion on the true number of species, subspecies or forms.

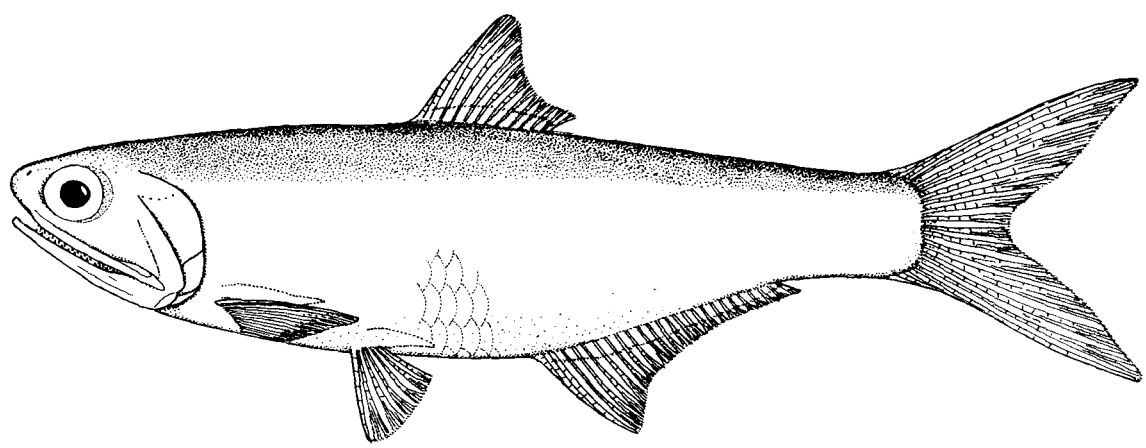
Lycengraulis poeyi (Kner & Steindachner, 1865)

ENGR Lycen 3

Engraulis poeyi Kner & Steindachner, 1865, Abh.bayer.Akad.Wiss., 10:23, pl.3, fig.3 (Rio Bayano, Panama).

Synonyms : Lycengraulis poeyi-Meek & Hildebrand, 1923:211 (tide streams and sandy beach at Balboa, also Panama market); Campos, 1942:211 (compiled, but southern Brazil erroneously included); Hildebrand, 1943:146, fig.66 (Panama); Peterson, 1956:171 (Gulf of Nicoya, Costa Rica); Whitehead, 1970:41, pl.3C (Steindachner's fig.) (type of poeyi lost).

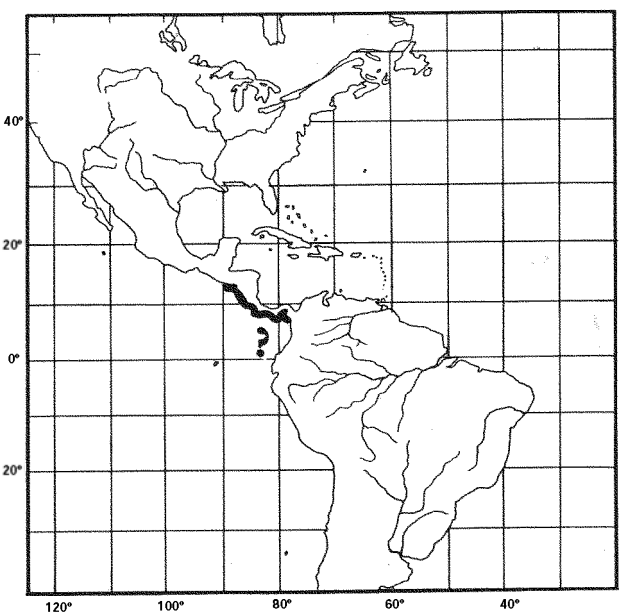
FAO Names: En - Pacific sabretooth anchovy.



click for next page

Diagnostic Features : Body fairly elongate and compressed, its depth about 4 to 4.5 times in standard length. Snout moderate, about 2/3 eye diameter; maxilla moderate, tip somewhat bluntly rounded, reaching almost to sub-operculum, teeth becoming larger after first third of jaw; lower jaw with small teeth at front, followed by only moderately large canine-like teeth, especially around midpoint of jaw. Lower gillrakers 18 to 23, fairly short, few or none of the anterior ones rudimentary. Dorsal fin origin behind midpoint of body; anal fin long, with iii 21 to 24 finrays, its origin under anterior third of dorsal fin base. A silver stripe along flank, disappearing in larger fishes; a curve of black dots on upper part of operculum. No other Pacific anchovy has canine-like teeth, although these teeth are much smaller in young fishes (about 5 cm standard length) and separation from species of Anchoa is difficult (A. chamensis, A. curta, A. lucida, A. naso and A. walkeri are all sympatric with L. poevi and overlap in gillraker and anal finray counts).

Geographical Distribution : Eastern central Pacific (El Salvador to Panama Bay, possibly northern Ecuador).



Habitat and Biology : Marine, pelagic, inshore, but entering brackish if not fresh water (thus probably similar to L. grossidens). Feeds on fishes (including other anchovies Peterson, 1956:172), perhaps also crustaceans. Nearly ripe females occurred in the Gulf of Nicoya in June, August and September, and juveniles of 3.3 to 4.5 cm in January and October (Peterson, loc.cit., who describes the ovarian eggs as round - but oval in L. grossidens, as indeed in all other New World anchovies so far reported).

Size : To 20.5 cm standard length (to 23 cm total length fide Hildebrand, 1923 = 18.3 cm standard length), usually about 15 to 17 cm.

Interest to Fisheries : Perhaps contributes to local artisanal catches.

Local Names :

Literature : Peterson (1956 - maturity, food).

Remarks : Very similar to the Atlantic L. grossidens, except for less well developed teeth, and perhaps could be regarded as merely a subspecies.

Amazonsprattus Roberts, 1984

ENGR Amaz

Amazonsprattus Roberts, 1984, Proc.Calif.Acad.Sci., 43(20):317 (type: Amazonsprattus scintilla Roberts).

Diagnostic Features : Pygmy anchovies (to about 2 cm standard length), much resembling the juveniles of larger species. Snout short; maxilla very short and only just to front of eye; lower jaw short, its articulation at hind border of eye. Gillrakers few (18 or 19). Dorsal fin far back, well behind midpoint of body; anal fin short (12 to 14 branched finrays); pelvic finrays i 5; this low pelvic finray count probably distinguishes Amazonsprattus from the juveniles of other anchovies (i 6 in adults, presumably also in juveniles).

Biology, Habitat and Distribution : Freshwater; Amazon drainage. A pygmy species that has mature gonads at about 1.4 to 1.5 cm standard length.

Species : A single species recognized:

A. scintilla Roberts, 1984. Amazon drainage.

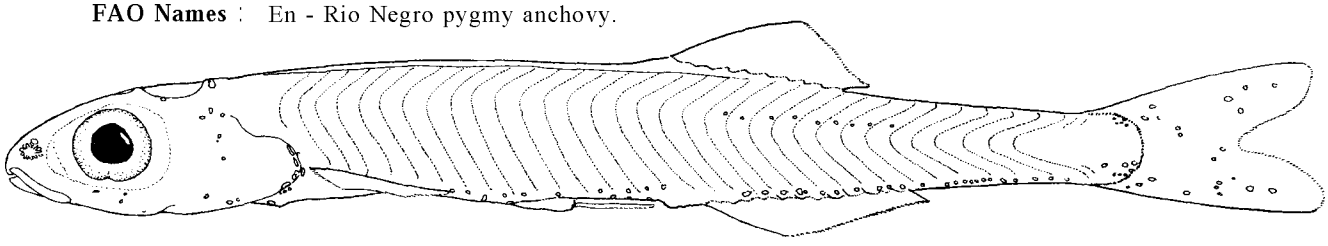
Amazonsprattus scintilla Roberts, 1984

ENGR Amaz 1

Amazonsprattus scintilla Roberts, 1984, Proc.Calif.Acad.Sci., 43(20):317 (Rio Negro, Amazon system).

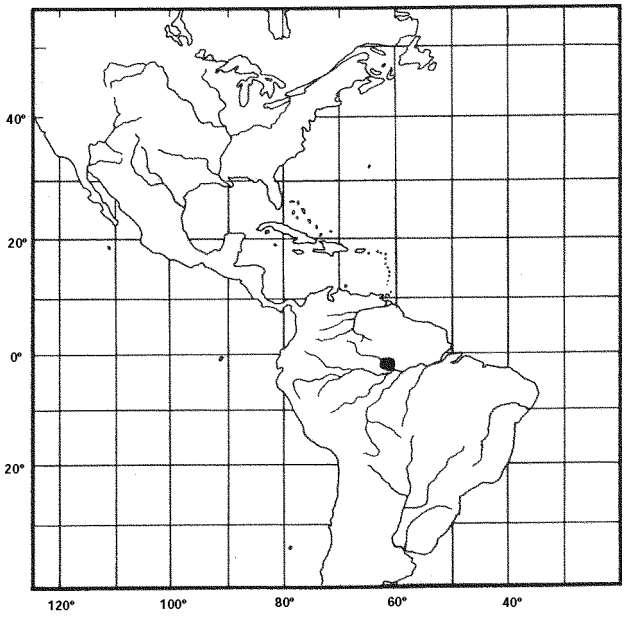
Synonyms : Amazonsprattus scintilla:Nelson, 1986:899 (an engraulid, not a clupeid species).

FAO Names : En - Rio Negro pygmy anchovy.



Diagnostic Features : A slender dwarf species easily mistaken for a juvenile clupeoid. Mouth small, premaxillae absent or minute and toothless; maxilla very short, just reaching to front border of eye, with two supramaxillae; articulation of lower jaw under hind border of pupil or just behind. Total gillrakers 18 or 19, elongate. Dorsal fin origin well behind midpoint of body; anal fin short, with ii 12 to 14 finrays, its origin under first quarter of dorsal fin base. In life translucent or even transparent, without scales on body. Juvenile anchovies probably always have i 6 pelvic finrays (i 5 in A. scintilla).

Geographical Distribution : Amazon system (Rio Jufari between Castanheiro Grande and Santa Fé, also Rio Negro at Santa Isabel).



Habitat and Biology : Riverine, collected some distance up a low-gradient swampy tributary of the Rio Negro (the Rio Jufari) and in the main river, in both cases the water generally darkly tinted, acid (pH 4 to 5) and low in dissolved ions. Mature males at 14.3 to 16.2 mm standard length, mature females at 15.9 to 18.2 mm; ovarian eggs creamy or pale orange, a female of 17.3 mm having 20 eggs in the single ovary in January. Feeds on dipteran larvae and pupae, also cladocerans.

Size : To 1.95 cm standard length.

Interest to Fisheries : Nil.

Local Names :

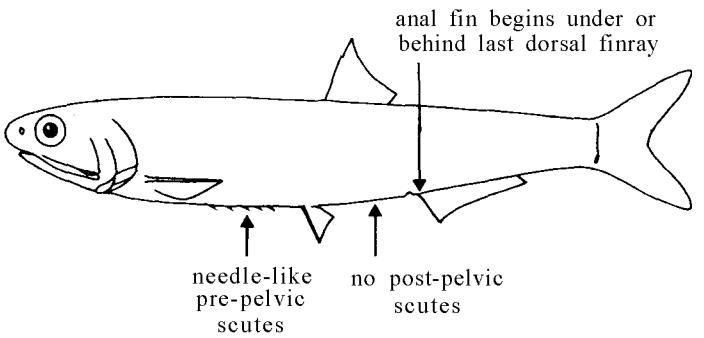
Literature : Roberts (1984 habitat, food, maturity).

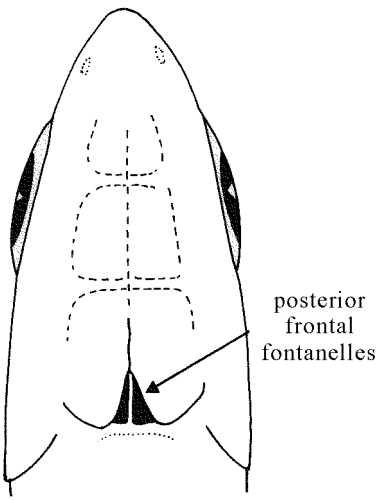
Encrasicholina Fowler, 1938

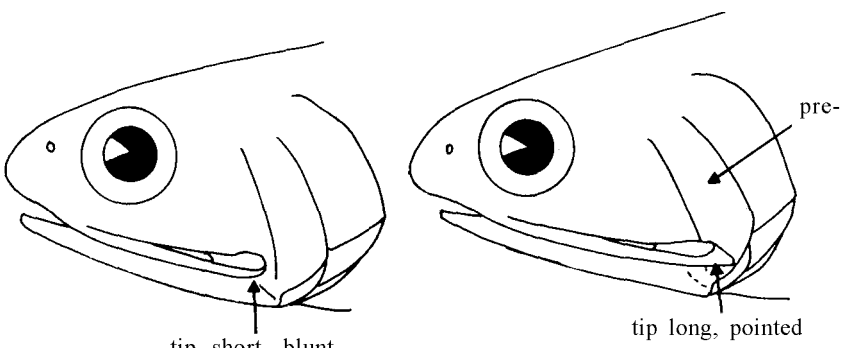
ENGR Encras

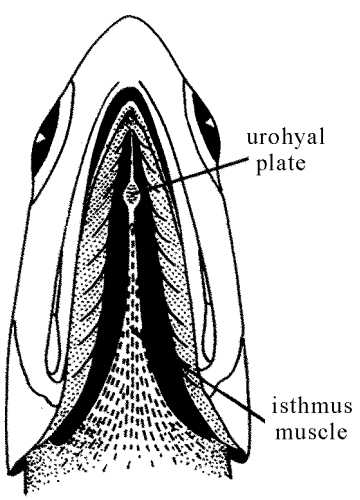
Encrasicholina Fowler, 1938, Monogr.Acad.nat.Sci.Philad., 5:157 (type: Encrasicholina punctifer Fowler, 1938). Stolephorus (part): until recently, authors have included species of Encrasicholina in Stolephorus before the two were clearly separated by Nelson (1983).

Diagnostic Features : Small and rather round-bodied anchovies (to 8.5 cm standard length), the belly rounded, with 0 to 6 (rarely 7) sharp needle-like pre-pelvic scutes, but no post-pelvic scutes; no pre-dorsal scute, no spine on pelvic scute. Posterior frontal fontanelles (on top of head near occiput) remain open in adults. Maxilla tip pointed in some and reaching past front border of pre-operculum (E. heterolobus, E. devisi, E. oligobranchus), blunt and shorter in others (E. punctifer, E. purpureus). Isthmus muscle not reaching forward to hind border of branchial membrane, leaving a portion of the urohyal bone exposed, this portion mostly bearing a little bony or membranous plate. Gillrakers slender,21 to 30 on lower part of arch. Anal fin short, usually with 13 to 17 branched finrays, its origin under or usually behind base of last dorsal finray. Scales moderate, about 39 to 43 in lateral series. A silver stripe along flank in some species (gold in E. devisi). Eggs oval, without a knob at one end.









Biology, Habitat and Distribution : Marine, pelagic and schooling, mostly inshore, but E. punctifer oceanic. Indo-West Pacific only, from western shores of Indian Ocean to Hawaii, Samoa and Society Islands (Tahiti).

Species : In the most recent revision, Wongratana (1980) recognized four species, later adding a fifth (Appendix and Wongratana, 1983), all at that time placed in Stolephorus:

(maxilla short, its tip blunt)

E. punctifer Fowler, 1938 Widespread (Africa to Tahiti)
E. purpurea (Fowler, 1900) Central Pacific (Hawaii)

(maxilla long, its tip pointed)

E. devisi (Whitley, 1940) Widespread (Aden to Caroline Islands and Samoa)
E. heteroloba (Rüppell, 1837) Widespread (Africa to Fiji)
E. oligobranchus (Wongratana, 1983) the Philippines.

Remarks : Nelson (1983) was the first to resurrect Fowler's genus Encrasicholina, pointing out that the five species included (already separated as a group in all keys to Stolephorus) shared a suite of characters that allied them more closely with Engraulis (and some New World genera) than with the remaining species of Stolephorus.

	Encrasicholina and Engraulis	Stolephorus
Isthmus	Short, urohyal exposed	Long, urohyal covered
Pre-opercular canal	On pre-operculum only	A branch onto opercullum
Epibranchial 1	Toothplate fused to bone	Not fused
Ural centrum (Ul)	Fused to pre-ural centrum 1 (i.e. Ul-PUl)	Not fused (i.e. Ul//PUl)

Encrasicholina devisi (Whitley, 1940)

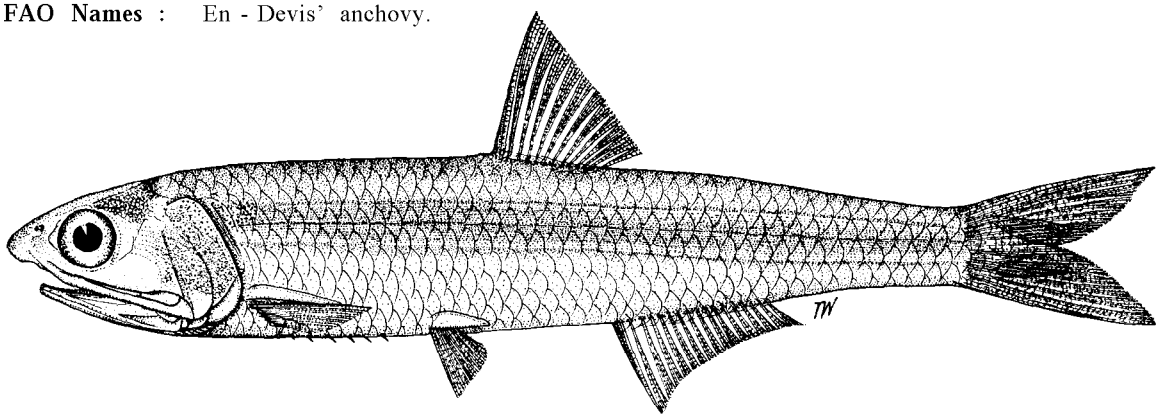
ENGR Encras 4

Formerly ENGR Stol 7

Amentum devisi Whitley, 1940, Aust.Zool., 9(4):404 (Cape York).

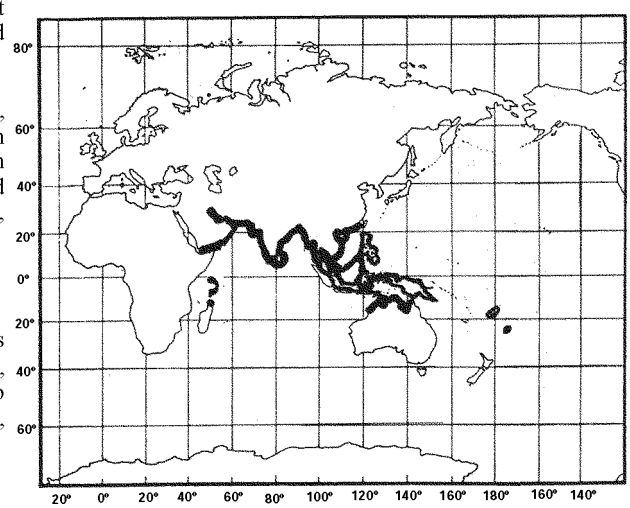
Synonyms : Stolephorus Species A:Whitehead, 1968a:17 (northern Arabian Sea, Bay of Bengal; a new species recognized by Ronquillo); Idem., 1969a:253, fig. 35 (Singapore); Idem., 1973b:221, fig.43 (synopsis; devisi suspected as the correct name); Stolephorus devisi:Dalzell & Wankowsky, 1980:21 et seq., figs 2,3,5,7,8,17,19(New Ireland, biology); Wongratana, 1980:228, pls 192,193 (revision); Wongratana, 1985:27, fig.9 (key); Encrasicholina devisi-Nelson, 1983:53 (relation to Engraulis; first placement in Encrasicholina).

FAO Names : En - Devis' anchovy.



Diagnostic Features : Body rather cylindrical, belly rounded, with 5 or 6 (rarely 3 or 4) sharp needle-like pre-pelvic scutes. Maxilla tip pointed, projecting beyond second supra-maxilla and reaching to sub-operculum. Isthmus short, preceded by a small bony plate on urohyal between branchial membranes. Lower gillrakers 20 to 27 (usually 23 or 24). Unbranched dorsal and anal finrays iii, anal fin short, with usually iii 15 to 17 finrays. In life, a bright silver band on flank, with a thin blue line above, back blue/grey. Closely resembles E. heteroloba, which has only ii unbranched dorsal and anal finrays a dull silver/grey band on flank, and the back beige; E. oligobranchus has only 17 or 18 gillrakers. Other species of Encrasicholina have a fleshy urohyal plate and a maxilla tip blunt and not projecting beyond the second supra-maxilla. Species of Stolephorus have a long isthmus reaching to the margin of the branchial membrane. See ENGR Stol 7, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in northern part of Indian Ocean (the "Gulf", Gulf of Aden, but apparently not the Red Sea and not to the Kenya coast: coasts of India, Andaman Islands) and in the western central Pacific (Indonesia, Thailand, north to at least Taiwan Island, south to northern Australia; also, eastward to Fiji and Tonga).



Habitat and Biology : Marine, pelagic, schooling, inshore. Like other species, probably feeds mainly on planktonic crustaceans. Breeds throughout the year, with peaks in New Ireland waters during May to June/July and possibly also in September to November. Eggs oval, without a knob at one end.

Size : To 7.7 cm standard length.

Interest to Fisheries : At least in some areas (e.g. Micronesia) almost as abundant as E. heteroloba, thus presumably makes a significant contribution to "Stolephorus" catches. An excellent baitfish (Lewis, Smith & Ellway, 1983:16 - as heteroloba).

Local Names : JAPAN: Tarekuchi, katekuchi.

Literature : Tham (1972-fishery, South China Sea), Tiews, Ronquillo & Santos (1975-biology in the Philippines); Daly & Richardson (1980 - enzymes to distinguish populations), Dalzell & Wankowski (1980 - biology, population and fishery dynamics), Wongratana (1982 - as baitfish), Baldwin (1984 - Fijian baitfish).

Remarks : Very close to E. heteroloba (see Remarks under that species). Wongratana (1980:229) tentatively included Stolephorus Species K of Kearney, Lewis & Smith (1972:86, p1.3.2) in the synonymy of devisi, and its well defined lateral stripe and gillaker count (22 to 24) seem to confirm this. They referred to it as the 'blue morph' of devisi; their 'golden morph' seems to have been heteroloba. As a result, heteroloba of Lewis, Smith & Ellway (1983) was probably devisi, and vice versa.

Encrasicholina heteroloba (Rüppell, 1837)

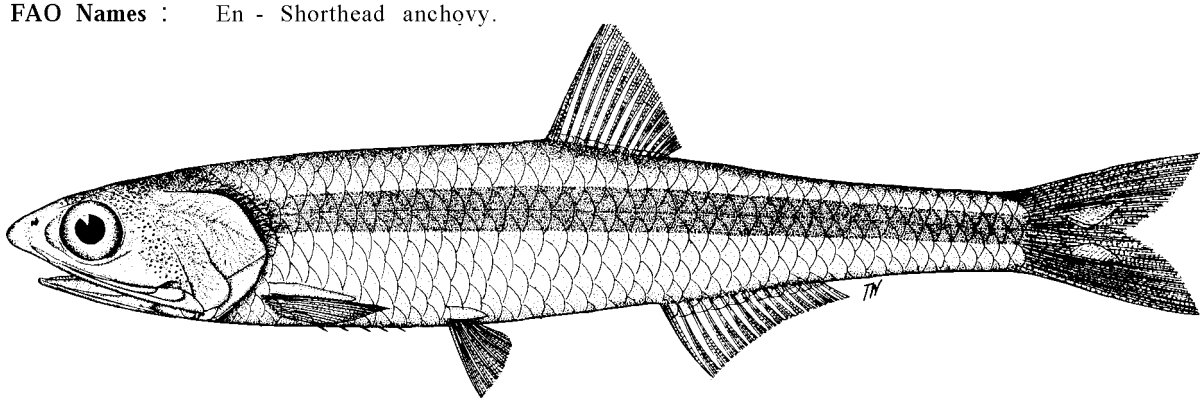
ENGR Encras 1

Formerly ENGR Stol 1

Engraulis heteroloba Rüppell, 1837, Neue Wirbelth., Fische:79, pl. 21, fig.4 (Massawa, Red Sea).

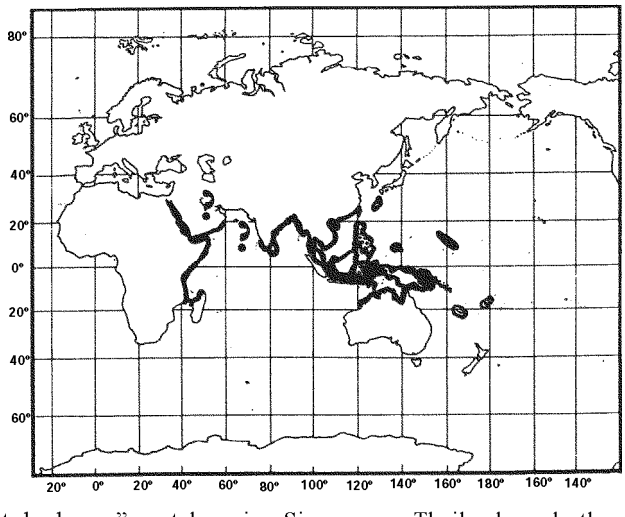
Synonyms : Stolephorus pseudoheterolobus Hardenberg, 1933261 (Riau, Lingga Archepelago); Tham, 1965: 24, fig.1 (egy to adult) (Singapore, biology); Idem, 1968:unp. fig.1 (synopsis); Anchoviella heteroloba:Fowler, 1941d:698 (the Philippines, Bouru); Stolephorus heterolobus: Munro,195627, fig.186 (north Queensland); Whitehead, 1965b:266, fig.4a (isthmus)(Red Sea); Losse, 1968:107 (Mombasa, Zanzibar Channel); Whitehead, 196Ya:254, fig.34 (Singapore); Idem, 1973b:220, fig.42 (synopsis); Tiews, Ronquillo & Santos, 1975:95 et seq. (the Philippines, biology); Dalzell & Wankowski, 198O:2O et seq., figs 2-4, 7-9, 16,l9 (New Ireland; biology); Wongratana, 1980:226, pls l90,l9l (revision); Wongratana, 1985:27, fig.8 (key); Dor, 1984:43 (Red Sea); Encrasicholina heteroloba - Nelson,1983:53, table 2 (vertebrae) (relation to Engraulis; first placement in Encrasicholina).

FAO Names : En - Shorthead anchovy.



Diagnostic Features : Body rather cylindrical, belly rounded, with 4 to 6 (usually 5) sharp needle-like pre-pelvic scutes. Maxilla tip pointed, projecting beyond second supra-maxilla and reaching to sub-operculum. Isthmus short, preceded by a small bony plate on urohyal between branchial membranes. Lower gillrakers 22 to 30 (usually 23 to 27). Unbranched dorsal and anal finrays only ii; anal fin short, with usually ii 14 to 16 finrays. In life, a dull silver/grey band on flank, the back beige. Closely resembles E. devisi, which has iii unbranched dorsal and anal finrays, a bright silver band on flank, with a thin blue line above, and the back blue/grey; E. oligobranchus has only 17 or 18 gillrakers. Other species of Encrasicholina have a fleshy urohyal plate and a maxilla tip blunt and not projecting beyond the second supra-maxilla. Species of Stolephorus have a long isthmus reaching to the margin of the branchial membrane. See ENGR Stol 1, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean (Red Sea, East African coast to at least northern Madagascar, eastward to Bay of Bengal) and equally widespread in western Pacific (Indonesia, Thailand north to southern Japan; southward to northern coasts of Australia; eastward to Solomon Islands, New Caledonia, Fiji, Tonga, Samoa, also Palau to Kosrae).



Habitat and Biology : Marine, pelagic and schooling, inshore. Like other species, probably feeds mainly on planktonic crustaceans. Breeds throughout the year, with a peak, during the first part of the northeast monsoon in Manila Bay (October to January) or in New Ireland waters in May to June/July and again in September to November (especially this latter period); eggs oval, without a knob at one end.

Size : To at least 8 cm standard length, but probably not much more.

Interest to Fisheries : Forms the bulk of the "Stolephorus" catches in Singapore, Thailand and the Philippines. A delicate baitfish and probably less robust than E. devisi (Lewis, Smith & Ellway, 1983 - as devisi).

Local Names : CHINA: Kang hu (Hokkien), Kong Yue (Canton), Oh jiau (Teochew).

Literature : Tham (1965, 1968, 1972 - biology and general synopsis), Dalzell & Wankowski (1980 - biology, Population and fishery dynamics), Daly & Richardson (1980 - enzymes to distinguish populations), Wongratana (1982 - as baitfish), Baldwin (1984 - Fijian baitfish).

Remarks : The great similarity to E. devisi, which has virtually the same wide geographical range, makes identification difficult. Wongratana (1980:pls 190, 192) showed a slightly more pointed tip to the maxilla in S. heterolobus (longer than deep; the reverse in S. devisi); separation of the species on number of unbranched dorsal and anal finrays requires a scalpel since the first ray is a tiny splinter and can be easily missed.

Hardenberg's pseudoheterolobus is heterolobus, but his heterolobus is devisi, at least to judge by his descriptions, since his types are either not present in Jakarta (Marine Fisheries Research Institute, LPPL) or are so poorly documented and preserved that they are now unrecognized as such.

The blue morph of Stolephorus devisi, described as Species K by Kearney, Lewis & Smith (1972:86, pl.3.2) was devisi, but their golden morph was heteroloba judging by its colour and higher gillraker count (24 or 25). Wongratana (1982) diagnosed colour differences that support this conclusion and are used here. The devisi of Lewis, Smith & Ellway (1983) was probably heteroloba, and vice versa.

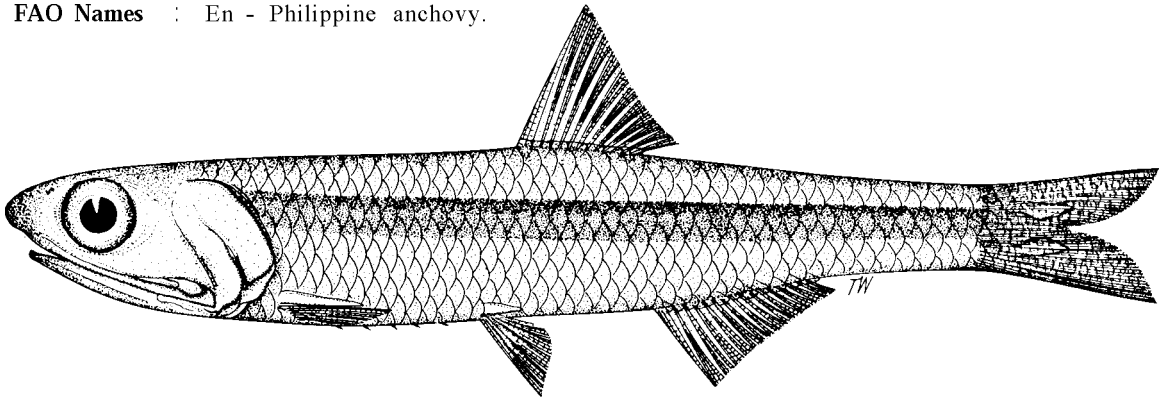
Encrasicholina oligobranchus (Wongratana, 1983)

ENGR Encras 5

Stolephorus oligobranchus Wongratana, 1983, Japan J.Ichthyol., 29(4):397 fig.15 (Manilla Bay, the Philippines).

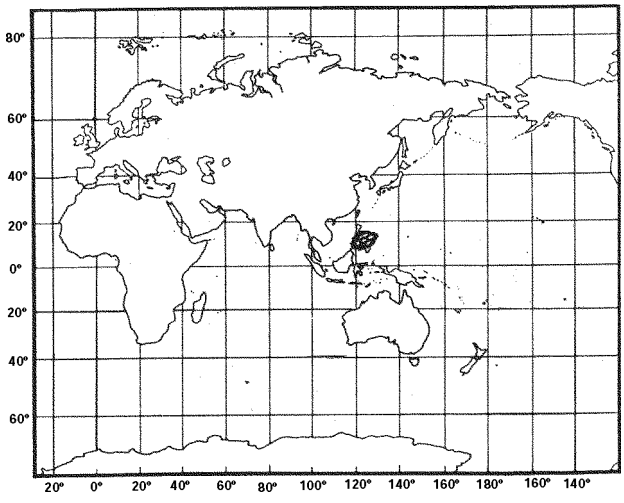
Synonyms : Stolephorus Species B:Ronquillo, 1970:16 (the Philippines, also Taiwan - incorrect); Stolephorus oligobranchus:Wongratana, 1980:430, fig. (revision; name not validly published); Idem., 1985:27, fig.10 (key).

FAO Names : En - Philippine anchovy.



Diagnostic Features : Body rather cylindrical, belly rounded, with 5 sharp needle-like pre-pelvic scutes. Maxilla tip pointed, projecting beyond second supra-maxilla and not suite reaching to sub-operculum. Isthmus short, preceded by a small bony plate on urohyal between branchial membranes. Lower gillrakers 17 or 18. Anal fin short, with iii 15 finrays. No other species has so few gillrakers (cf. 20 to 30); otherwise it most closely resembles E. devisi.

Geographical Distribution : Manila Bay, the Philippines. The Taiwan record of Ronquillo (1970) was perhaps based on Anchoviella zollingeri of Fowler (1941d), which seems to have been E. punctifer.



Habitat and Biology : Marine, pelagic and presumably schooling, although the three type (and only known) specimens were caught after 20 months of sampling; evidently rare.

Size : To 6.2 cm standard length.

Interest to Fisheries : Apparently none.

Local Names :

Literature : Baldwin (1984 - Fijian baitfish).

Encrasicholina punctifer Fowler, 1938

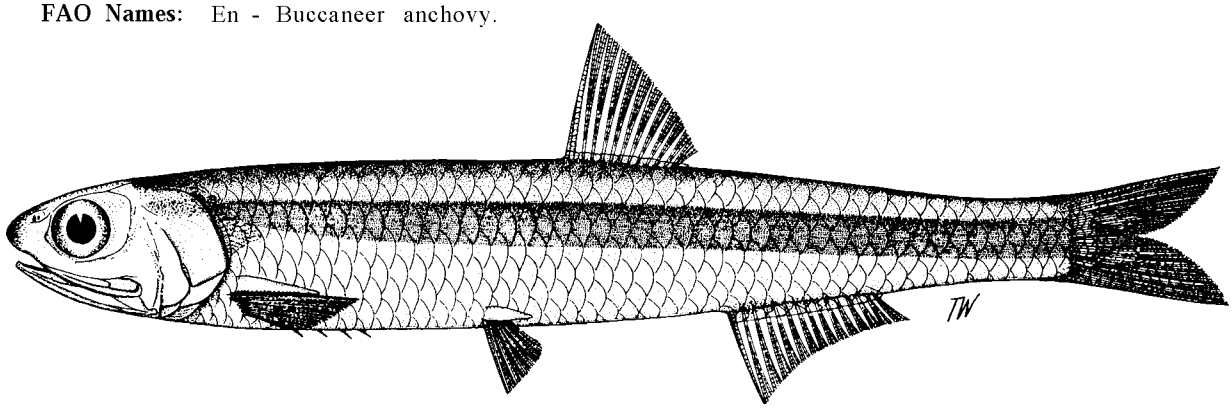
ENGR Encras 2

Formerly ENGR Stol 2

Encrasicholina punctifer Fowler, 1938, Monogr.Acad.nat.Sci.Philad., 2:158, fig.13 (Fare Bay, Society Islands).

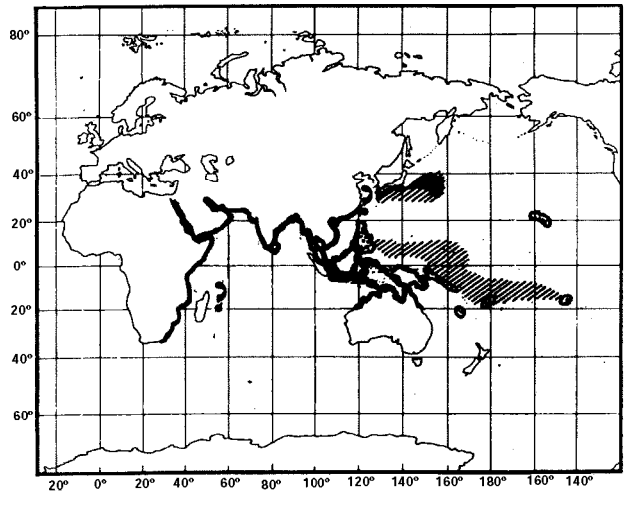
Synonyms : Stolephorus buccaneeri Strasburg, 1960, Pacific Sci.,14:396 (Hawaii); Whitehead, 1965b:268 (Suez, the "Gulf"); Losse, 1968:105 (East Africa); Whitehead, 1968a:17 (Comoro Islands); Idem, 1973b:222, fig.44 (synopsis); Ozawa & Tsukuhara, 1973:151 (western Pacific, biology); Tiews, Ronquillo & Santos, 1975:97 et seq. (the Philippines, biology); Wongratana,1980224, pls 188,189 (revision); Stolephorus punctifer:Lewis, Smith & Ellway, 1983:16 (Papua New Guinea to Tahiti); Wongratana, 198527, fig.7 (key); SFSA, 1986206, fig.55.4 (south to St. Lucia, perhaps to Durban); Stolephorus zollingeri:Weber & de Beaufort, 1913:44 (Lombok, Nusa Laut); Hardenberg, 1934:326, fig.8 (Ambon, Manado, Puger); Fowler, 1941d:700 (the Philippines); Shen, 1959:29 (Taiwan); Hayashi & Tadokoro, 1962a:26 (Japan); Idem, 1962b:30 (catches; compared with Engraulis); Encrasicholina punctifer-Nelson, 1983:53, table 2 (vertebrae) (relation to Engraulis; first placement in Encrasicholina).

FAO Names: En - Buccaneer anchovy.



Diagnostic Features : Body rather cylinderical, belly rounded, with 3 to 6 (usually 4 or 5, rarely 2 or 7) sharp needle-like pre-pelvic scutes. Maxilla tip blunt, scarcely projecting beyond second supra-maxilla, not reaching to front border of pre-operculum. Isthmus short, preceded by small fleshy plate on urohyal between branchial membranes. Lower gillrakers usually 23 to 26. Anal fin short, with usually iii 13 or 14 finrays, its origin behind base of last dorsal finray. Resembles E. purpurea of Hawaii, which has more gillrakers (usually 26 to 29), a longer maxilla and either lacks scutes or has them very poorly developed. Other species of Encrasicholina have a hard, bony urohyal plate and a maxilla tip projecting beyond the second supra-maxilla. Species of Stolephorus have a long isthmus reaching to the margin of the branchial membrane; also, anal fin origin below dorsal fin base. See ENGR Stol 2, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in the Indian Ocean (entire coast of East Africa, from the "Gulf" and Red Sea south to perhaps Durban, but not yet Madagascar; coasts of Pakistan and India, probably also Burma) and equally widespread in western Pacific (Indonesia, Thailand, the Philippines,China north to southern Japan; northern and eastern coasts of Australia southward to at least Brisbane; eastward from Japan to at least 155°W, southward to Hawaii,. and as far east as the Solomons, Fiji, Samoa and Tahiti).



Habitat and Biology : Marine, pelagic and schooling, inshore but also oceanic and hundreds of miles from land. A detailed biological study is needed.

Size : To 8.5 cm standard length (to 13 cm total length fide Tiews, Ronquillo & Santos, 1971:112).

Interest to Fisheries : Said to comprise up to 22% of the Philippine "Stolephorus" catch (Tham, 1972) and probably makes a significant contribution elsewhere in its wide range. Considered "arguably the most attractive anchovy for bait" by Lewis, Smith & Ellway (1983:16).

Local Names : JAPAN: Taiyo tarekuchi, Taiwan ainoko iwashi; TAIWAN ISLAND: Taiwan'ainoko.

Literature : Strasburg (1960 - separation from E. purpurea), Hayashi & Tadokoro (1962b - Separatlon from Engraulis), Tham (1970 - fisheries), Ozawa & Tsukahara (1973 - larvae, brain, variation), Miller, Watson & Leis, 1979 (Hawaii, larvae), Baldwin (1984 - Fijian baitfish).

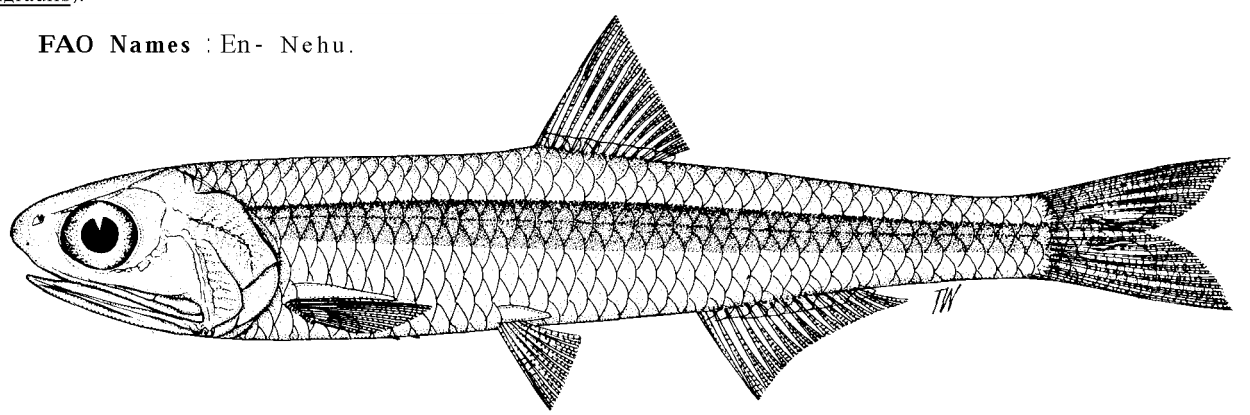
Remarks : It is unfortunate that this well-known and widely distributed anchovy should now acquire a completely different name, both for the genus and the species.

Encrasicholina purpurea (Fowler, 1900) ENGR Encras 3

Engraulis purpurea **Fowler**, 1900, Proc.Acad.nat.Sci.Philad.: 497, fig.1 (Hawaiian Islands).

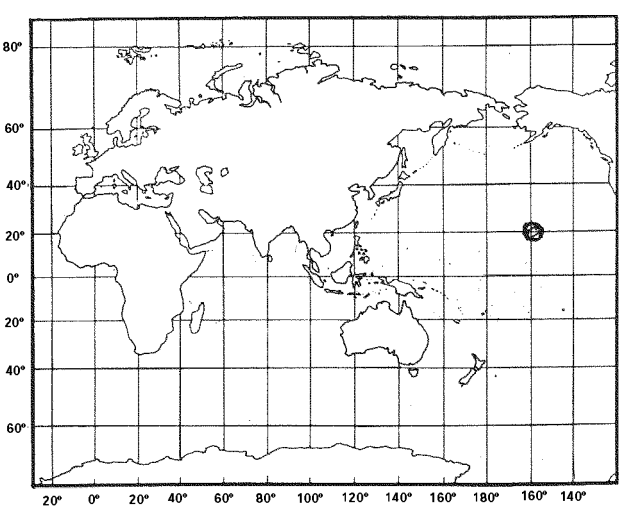
Synonyms : Anchovia purpurea:Jordan & Evermann, 1903:49, fig.12 (Honolulu, Hilo, Kailua); Anchoviella purpurea:Fowler, 1941d:699 (Hawaiian Islands); Stolephorus purpureus:Gosline & Brock, 1960:96, fig.54 (synopsis); Nakamura, 1970:425 et seq. (biology); Tinker, 1978:69, photo (synopsis); Miller, Watson & Leis, 1979:17, figs 19-26, 28 (larvae illustrated, references); Wongratana,1980:223, pls 186,187 (revision); Idem, 1985:27, fig.6 (key); Encrasicholina purpurea-Nelson, 1983:52,53, table 2 (vertebrae) (first placement in Encrasicholina; relation to Engraulis).

FAO Names : En- Nehu.



Diagnostic Features : Body rather cylindrical, belly rounded, most specimens without pre-pelvic scutes, but some with 1 to 5 thin needle-like scutes. Maxilla tip blunt, reaching to front border of pre-operculum, but scarcely projecting beyond second supra-maxilla. Isthmus short, preceded by a small fleshy plate on urohyal between branchial membranes. Lower gillrakers usually 26 to 29. Anal fin short, with usually iii 13 to 15 finrays, its origin behind base of last dorsal finray. Resembles E. punctifer (sympatric in Hawaii), which has fewer gillrakers (23 to 26), a shorter maxilla (not to pre-operculum) and 3 to 6 well developed scutes. Other species of Encrasicholina have a hard, bony urohyal plate and a maxilla tip projecting beyond the second supra-maxilla. Species of Stolephorus have a long isthmus reaching to the margin of the branchial membrane; also, anal fin origin below dorsal fin base.

Geographical Distribution : Central Pacific (Hawaiian Islands only; its use as a baitfish may spread its range).



Habitat and Biology : Chiefly marine, pelagic and schooling, living close inshore and entering bays, inlets, estuaries, canals and even penetrating into fish ponds, thus able to tolerate a wide range of salinities (unlike E. punctifer). Feeds mainly on planktonic crustacean larvae. Breeds throughout the year, with a peak in summer, spawning at night (between 22:00 and 02:00 hours) in bays and estuaries.

Size : To 6 cm standard length (Wongratana, 1980) or 7.5 cm (Nakamura, 1970).

Interest to Fisheries : Principally used as a baitfish, caught in small-mesh (5 mm bar width) surrounding nets (day) or liftnets with a light (night). Nakamura (1970) cited an estimate of 18 620 buckets as an annual sustained yield from Pearl Harbour. The fish are subject to significant mortality through handling (over 20% within a day of capture).

Local Names : HAWAII: Nehu.

Literature : Gosline & Brock (1960) claimed that the life history of the nehu was better known than for any other Hawaiian fish. All previous data were reviewed and expanded by Nakamura (1970). See Leary, Murphy & Miller (1975 -fecundity and maturity), Struhsaker & Uchiyama (1976 - age and growth) and Miller, Watson & Leis (1979 - larvae illustrated, distinguished from those of E. punctifer).

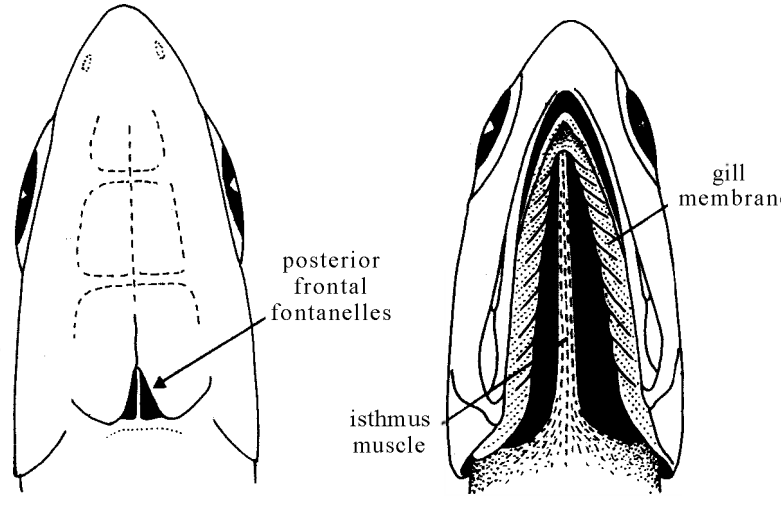
Remarks : Possible hybrids with E. punctifer were suspected by Matsui (1963).

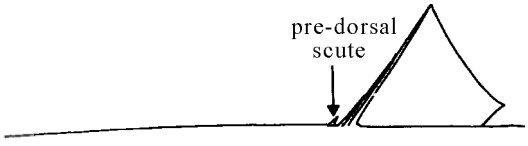
Stolephorus Lacepéde, 1803

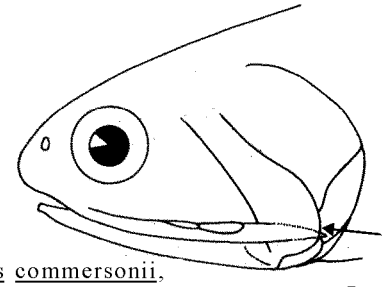
ENGR Stol

Stolephorus Lacepéde, 1803, Hist.nat.poiss 5:381 (type: Stolephorus commersonii Lacepède, 1803). Amentum Whitley, 1940, Aust.Zool., 9 4):402 (type: Stolephorus commersonii Lacepède). Anchoviella:Fowler, 1941d, Bull.U.S.natn.Mus., 13(100):696 (not Anchoviella Fowler, 1911, which is a New World genus). Jordan & Gilbert (18832.72) designated Atherina japonica Houttuyn, 1782 as type of Stolephorus, but this was overruled in favour of S. commersonii by Opinion 93 of the International Commission in 1926. However, this was sometimes ignored and/or Houttuyn's japonicus identified as a species of Engraulis (correct) or Spratelloides (incorrect), hence Whitley's proposal of Amentum and Fowler's use of Anchoviella. The problem was resolved by Whitehead (1963b) and Opinion 749 of 1965 by making Atherina japonica a nomen dubium and suppressing it.

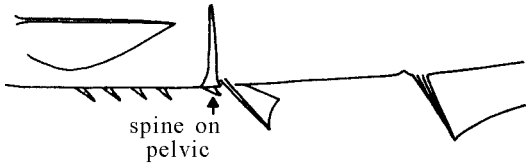
Diagnostic Features : Small and moderately compressed anchovies (to 15 cm standard length, usually 8 to 10 cm), the belly more or less rounded, with 1 to 8 sharp needle-like pre-pelvic scutes, but no post-pelvic scutes; a small spine-like scute just before the dorsal fin in some species. Posterior frontal fontanelles (on top of head near occiput) remain open in adults. Maxilla tip pointed and projecting beyond second supra-maxilla, reaching to gill opening in some species (rarely beyond). Isthmus muscle reaching forward to hind border of branchial membrane. Gillrakers slender, about 18 to 35 on lower part of arch. Anal fin short, usually with 18 to 20 branched finrays, its origin below dorsal fin base. Scales moderate, about 34 to 42 in lateral series. 4 silver stripe along flank in some species. Eggs oval, with or without a knob at one end.



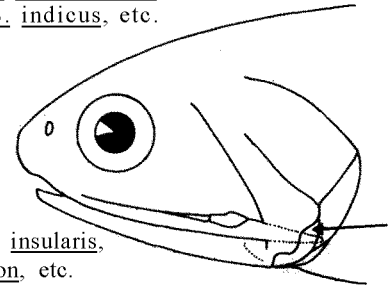




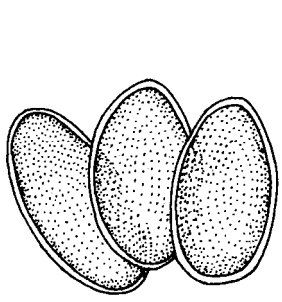
Stolephorus commersonii, S. indicus, etc.



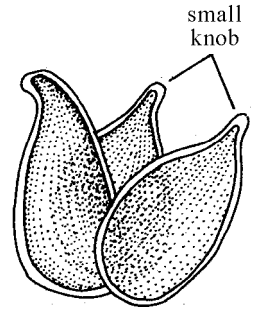
Stoiephorus dubiosus, S. tri, S. baganensis



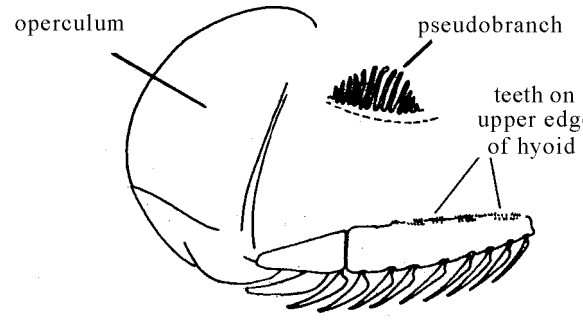
Stolephorus insularis, S. holodon, etc.



oval eggs
S. insularis,
S. baganensis,etc.



eggs with knob
S. indicus
S. commersonii, etc.



S. commersonii, S. insularis, etc.

Biology, Habitat and Distribution : Marine, pelagic and schooling, mostly inshore, some perhaps entering river mouths. Indo-West Pacific only, from western shores of Indian Ocean eastward to the Society Islands (Tahiti).

Species : In the most recent revision, Wongratana (1980) recognized 13 species (excluding five species here placed in Encrasicholina following resurrection of this generic name by Nelson, 1983). He has since recognized two others and described three more (Wongratana, 1987a, b); a further species will be described by Dr Gareth Nelson. To aid identification, the 19 species are listed here geographically.

Widespread

S. indicus (van Hasselt, 1823) Western Indian Ocean to Society Islands
S. commersonii Lacepède, 1803 Western Indian Ocean to Fiji
S. insularis Hardenberg, 1933 Western Indian Ocean to Taiwan

S. andhraensis Babu Rao, 1966 Eastern Indian Ocean to northern Australia
S. waitei Jordan & Seale, 1926 Eastern Indian Ocean to northern Australia
S. dubiosus Wongratana, 1983 Eastern Indian Ocean to Indonesia

Western Indian Ocean

S. holodon (Boulenger, 1900) southern Africa

Western Pacific

S. chinensis (Gunther, 1880) Taiwan to Java Sea
S. ronquilloi Wongratana, 1983 the Philippines
S. baganensis Hardenberg, 1933 Indonesia
S. tri (Bleeker, 1852) Indonesia to Thailand
S. multibranchus Wongratana, 1987 Caroline Islands
S. brachycephalus Wongratana, 1983 Papua New Guinea
S. carpenteriae (de Vis, 1883) Papua New Guinea to northern Australia
S. advenus Wongratana, 1987 Northern Australia
S. nelsoni Wongratana, 1987 Northwestern Australia
S. apiensis Jordan & Seale, 1906 Fiji, Samoa
S. pacificus Baldwin, 1983 Guam, Kosrae
Stolephorus Species A Eastern Australia

Remarks : Identification of Stolephorus is not easy and it should be remembered that the species punctifer (formerly buccaneeri), heteroloba, devisi, purpurea and oligobranchus are now placed in the genus Encrasicholina. Among true species of Stolephorus the following characters will help to identify certain species (or groups of species), although it is advisable to check the diagnoses also; they should be combined with geographical distribution. See also keys by Wongratana (1985 - species illustrated and 1987b).

Body round, maxilla short (to front margin of pre-operculum): S. indicus (scutes 2 to 6): S. advenus (scutes 7)

Pre-dorsal spine, also spine on pelvic scute: S. dubiosus, S. baganensis, S. tri (a pre-dorsal spine only in some S. insularis)

Hind border of pre-operculum rounded (not indented): S. indicus, S. commersonii, S. apiensis, S. brachycephalus, S. chinensis, S. waitei, S. advenus, S. nelsoni, S. multibranchus, Stolephorus Species A

Hyoid bones with tooth patches on upper edge: S. commersonii, S. insularis, S. carpenteriae, S. baganensis (a few in some specimens), S. nelsoni

Pelvic fin tips beyond dorsal fin origin: S. commersonii, S. apiensis, S. brachycephalus (also in some S. holodon, S. andhraensis)

Black spots on lower part of "face" : S. waitei

Double pigment lines before dorsal fin: S. commersonii, S. brachycephalus, S.tri

Egg with small knob: S: indicus, S. commersonii, ? S. waitei (= S. insularis of Babu Rao, 1966b), S. pacificus and possibly in all other species with a rounded pre-opercular border (see above).

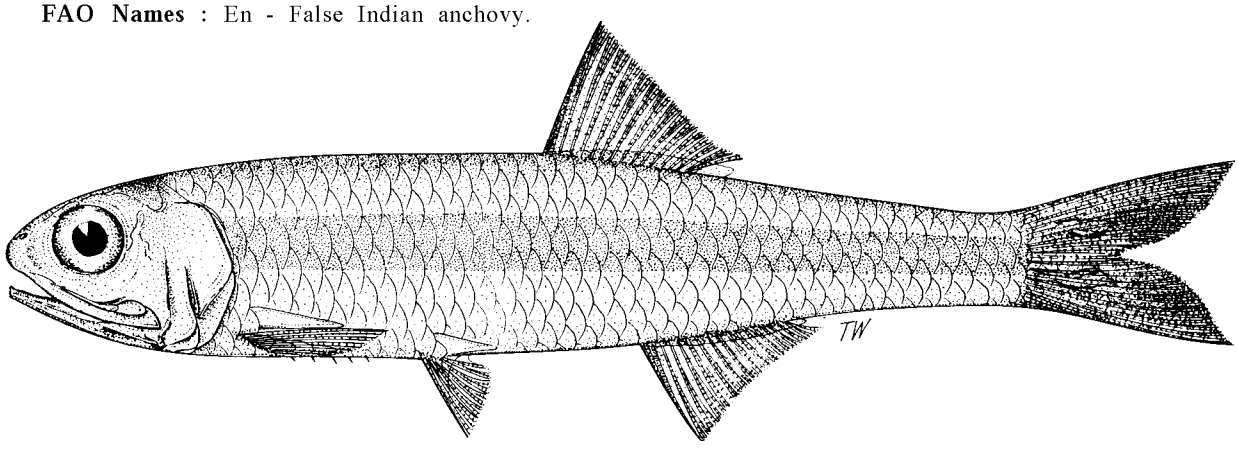
Stolephorus advenus Wongratana, 1987

ENGR Stol 19

Stolephorus advenus Wongratana, 1987, Proc.biol.Soc.Wash., 100(1):106, fig.2 (Coburg Peninsula, Northern Territory, Australia).

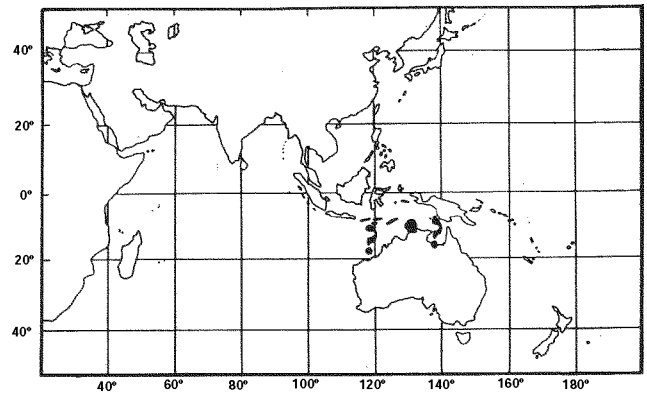
Synonyms : None (unless misidentified as S. indicus).

FAO Names : En - False Indian anchovy.



Diagnostic Features : Body slender, elongate, rather round in cross-section, belly rounded, with 7 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching only just to front border of pre-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 24. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Pelvic fin tips presumably not reaching to below dorsal fin origin (fins missing in type); anal fin short, with iii 16 finrays, its origin below about midpoint of dorsal fin base. A silver stripe down flank; no dark pigment lines on back between head and dorsal fin. Only S. indicus has such a short maxilla (but 2 to 6, usually 3 to 5 scutes).

Geographical Distribution : Northern Australia (a single specimen from Saulte Point, Coburg Peninsula, Northern Territory, Australia).



Habitat and Biology : Presumed coastal, pelagic and schooling, but more material and data needed. Egg presumed to be oval with a knob (as in S. indicus).

Size : 7.2 cm standard length (the type).

Interest to Fisheries : Nil.

Local Names :

Literature :

Remarks : Although described from a single specimen, Wongratana (1986) felt justified in separating it from S. indicus, of which he had examined more than a hundred individuals.

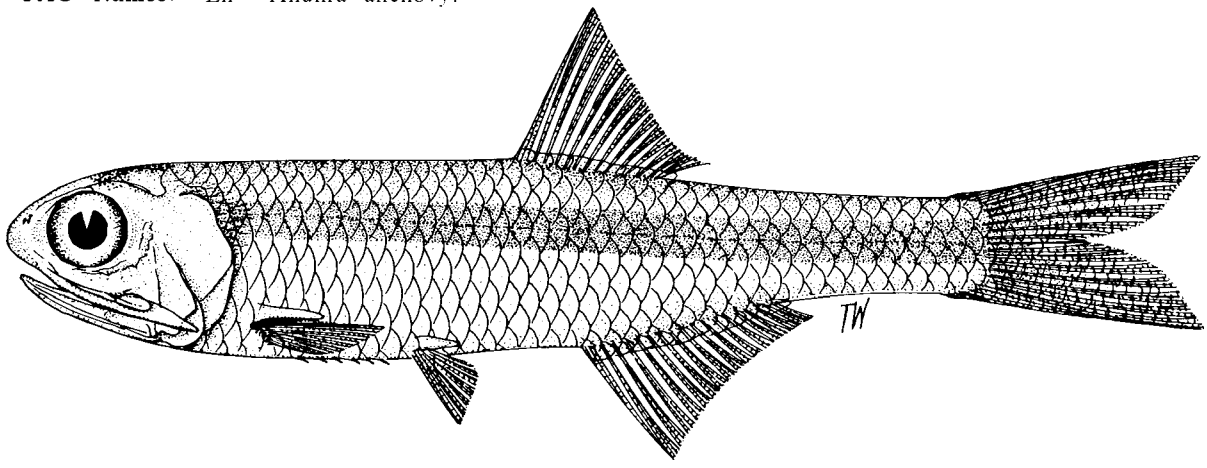
Stolephorus andhraensis Babu Rao, 1966

ENGR Stol 12

Stolephorus andhraensis Babu Rao, 1966, Ann.Mag.nat.Hist., 9(13):103, pl.3, 4 (egg) (Waltair, Kakinada).

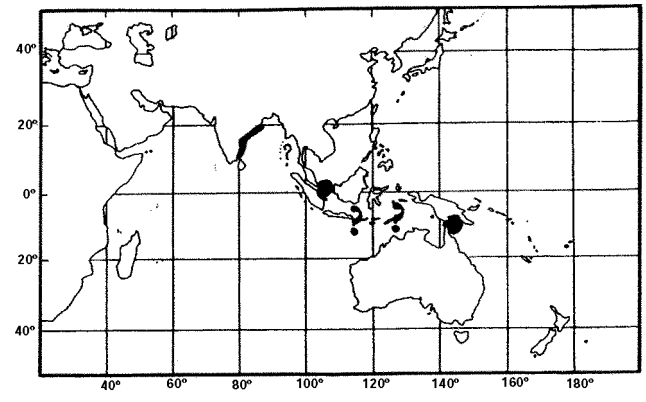
Synonyms : Stolephorus andhraensis-Whitehead, 1969a:261 (synonymy, distribution); Whitehead, 1973b:224, fig.47 (key, synopsis); Wongratana, 1980:246, pls 206,207 (revision); Idem, 1985:29, fig.17 (key).

FAO Names: En - Andhra anchovy.



Diagnostic Features : Body somewhat compressed, belly with 6 or 7 (usually 6) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers 20 or 21. Anal fin short, usually with iii 17 or 18 finrays, its origin below about middle of dorsal fin base. Of species with an indented pre-operculum, there is a pre-dorsal spine in S. dubiosus, S. baganensis and S. tri, while S. ronquilloi and S. insularis usually have 23 or more gillrakers; S. carpenteriae has tooth patches on the upper edge of the hyoid bones

Geographical Distribution : Eastern Indian Ocean (eastern coasts of India around Waltair, but perhaps along most of coast), western Pacific (Singapore and Gulf of Papua, but presumably between).



Habitat and Biology : Coastal, pelagic and schooling; egg oval, without knob; more material and data needed.

Size : To about 5 cm standard length.

Interest to Fisheries : Judging by museum collections, this species appears not to be very abundant.

Local Names :

Literature :

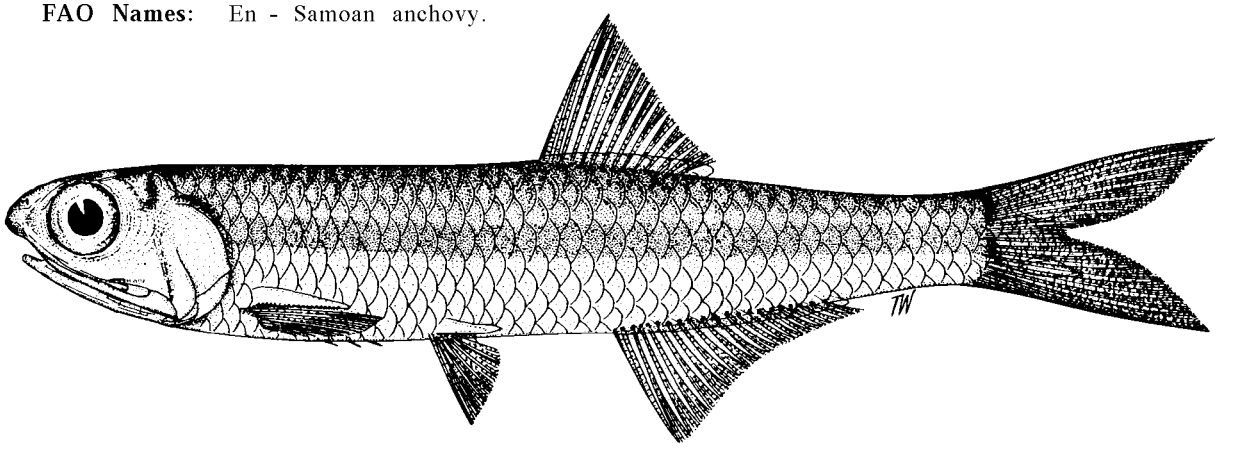
Stolephorus apiensis (Jordan & Seale, 1906)

ENGR Stol 18

Anchovia apiensis Jordan & Seale, 1906, Bull.Bur.Fish.Wash., 25:187 (Apia, Samoa).

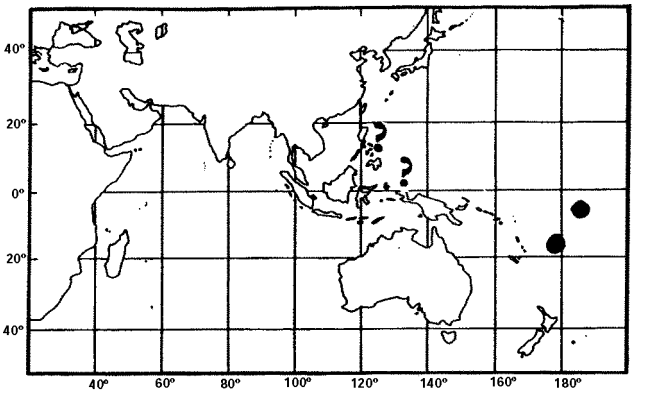
Synonyms : Stolephorus commersonii (part):Wongratana, 1980:236 (two Fiji specimens, possibly also his nine Caroline Island specimens; apiensis placed in synonymy); Stolephorus apiensis-Lewis, Smith & Ellway, 1983:17,19 (Fiji, western Samoa; distinct from commersonii).

FAO Names: En - Samoan anchovy.



Diagnostic Features : Very closely resembling S. commersonii, but lacking paired dark patches behind occiput and paired dark lines before dorsal fin. Lower gillrakers 30 or 31 (Wongratana), or 27 to 30 (Lewis et al.), thus higher than in S. commersonii (usually 23 to 28). For distinctions from other species, see S. commersonii.

Geographical Distribution : Western Pacific (Fiji and Samoa; possibly also Caroline Islands and the Philippines - see Remarks).



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

Size : To at least 6 cm standard length.

Interest to Fisheries : Recorded as a tuna baitfish but rare in bait catches in Fiji and Samoa (Lewis, Smith & Ellway, 1983).

Local Names :

Literature : Baldwin (1984 - Fijian baitfish).

Remarks : Perhaps distinct from S. commersonii, replacing it to the east of Papua New Guinea. If it is characterized by a slightly higher gillraker count, then it may also extend to the Caroline Islands and the Philippines, unless this is merely a clinal phenomenon as suggested by Wongratana (1980:239). See also under S. commersonii.

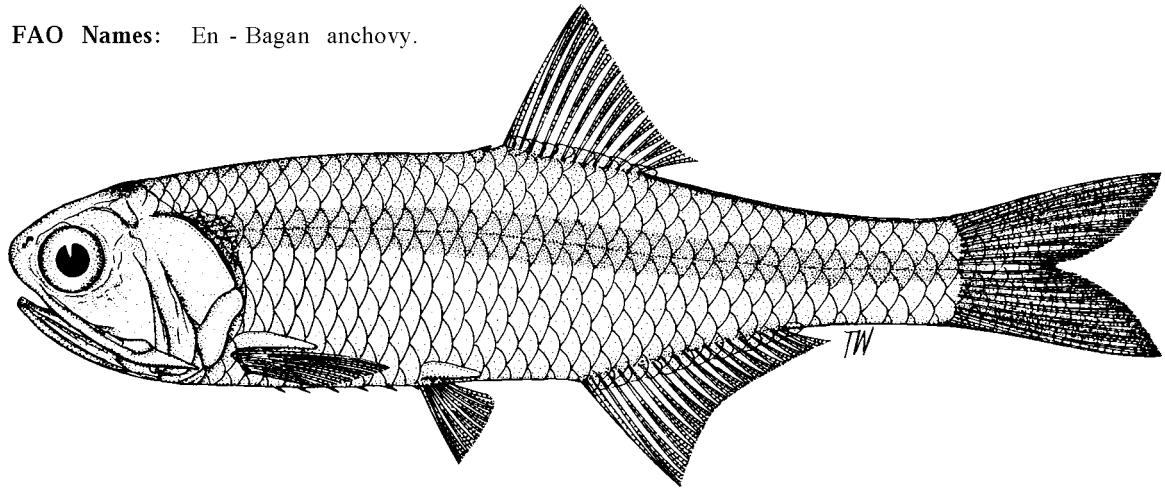
Stolephorus baganensis Hardenberg, 1933

ENGR Stol 17

Stolephorus baganensis Hardenberg, 1931, Treubia, 13(1):107 (Rokan River mouth, name only); Hardenberg, 1933, Natuurk.Tijdschr.Ned.-Indie, 93(2):260 (Indragiri River mouth, Sumatra). The name must date from 1933, its use in 1931 being a nomen nudum (Article 13(a)(i) of the International Code).

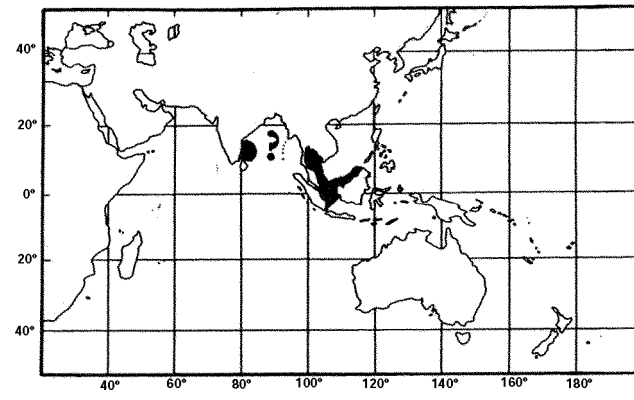
Synonyms : Stolephorus baganensis macrops Hardenberg,1933a:260 (Indragiri River mouth, Sumatra); Anchoviella baganensis:Fowler,1941d:711 (compiled); Stolephorus baganensis bengalensis Dutt & Babu Rao, 1959:160 (Waltair, Kakinada, east coast of India); Stolephorus tri:Whitehead, 1969a:258 (most of the Singapore specimens); Stolephorus macrops: Idem, 1973b:223, fig.45 (compiled); Stolephorus baganensis-Wongratana, 1980: 256, pls 216.217 (revision); Idem, 1985:29, fig.22 (key).

FAO Names: En - Bagan anchovy.



Diagnostic Features : Body somewhat compressed, belly with 6 or 7 (rarely 8) small needle-like pre-pelvic scutes; a small pre-dorsal spine and another spine on the pelvic scute. Maxilla pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers usually 20 to 23 (rarely 18, 19 or 24). A few small teeth on upper edge of hyoid bones in some specimens. Anal fin short, usually with iii 18 or 19 finrays, its origin below about middle of dorsal fin base. A double pigment line on back behind dorsal fin. Of species with a spine on the pelvic scute, S. dubiosus has more gillrakers (25 to 31) and S. tri has the double pigment line also in front of the dorsal fin.

Geographical Distribution : Eastern Indian Ocean (Waltair and Kakinada, if the sub-species bengalensis is truly this species) and western Pacific (Gulf of Thailand, Singapore, Sumatra, Sarawak).



Habitat and Biology : Coastal, pelagic and schooling, but perhaps able to tolerate lowered salinities (e.g. in mouth of Indragiri River). More data needed.

Size : To 6.8 cm standard length.

Interest to Fisheries : Presumably contributes to artisanal fisheries, but perhaps not to any great extent.

Local Names :

Literature : Because of past confusions in the identification and naming of this species, previous studies cannot be relied upon.

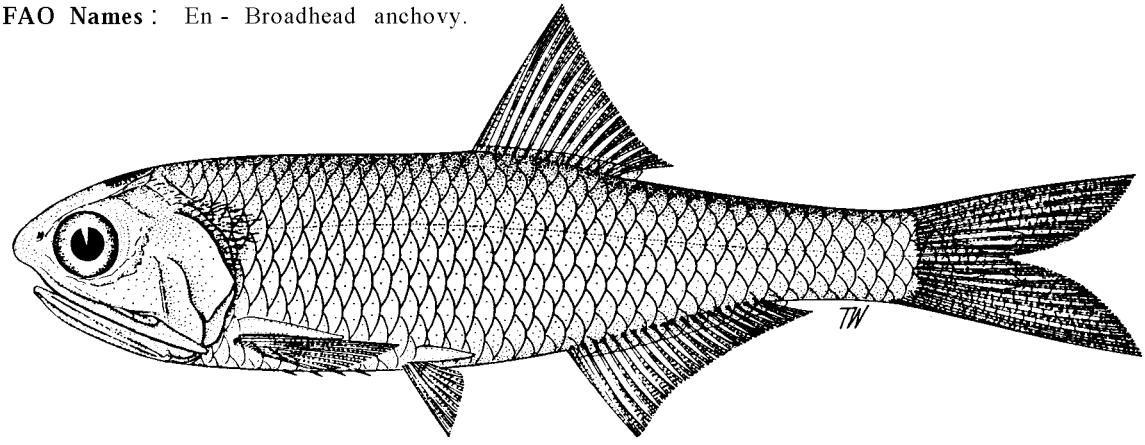
Stolephorus brachycephalus Wongratana, 1983

CLUP Stol 9

Stolephorus brachycephalus Wongratana, 1983, Japan J.Ichthyol., 29(4):401, fig.19 (Gulf of Papua).

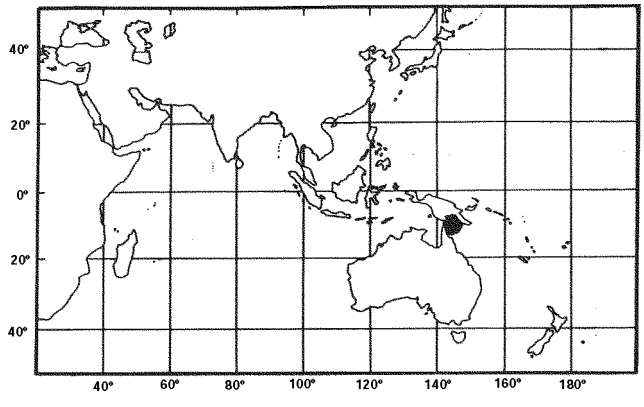
Synonyms : Stolephorus brachycephalus:Wongratana, 1980:239, pls 198, 199 (revision; name not validly published); Idem, 1985:28, fig.13 (key).

FAO Names : En - Broadhead anchovy.



Diagnostic Features : Body somewhat compressed, belly a little rounded, with 4 or 5 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or beyond hind edge of sub-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 20 to 22. No tooth patches on upper edge of hyoid bones. Anal finrays iii 19 to 22 (usually 20 or 21). Closely resembles S. commersonii, which has a shorter maxilla (to or just beyond hind border of pre-operculum), fewer scutes (mostly 2 or 3), fewer anal finrays (usually 18 or 19) and a dark line (or paired lines) before dorsal fin.

Geographical Distribution : Gulf of Papua.



Habitat and Biology : Presumably coastal, pelagic and schooling. More specimens and data needed.

Size : To 4.2 cm standard length (juveniles; adults not yet known).

Interest to Fisheries : Probably little or none.

Local Names :

Literature :

Remarks : Although the types are juveniles, Wongratana (1983) believed that the characters distinguishing them from S. commersonii must persist in adults.

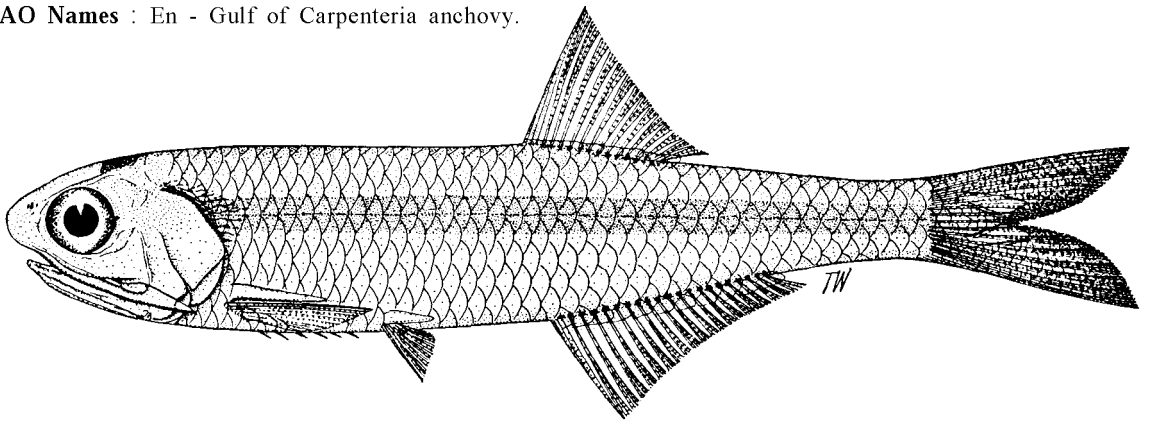
Stolephorus carpenteriae (de Vis, 1883)

ENGR Stol 13

Engraulis carpenteriae de Vis, 1883, Proc.Linn.Soc.N.S.W., 7:320 (Norman River, Gulf of Carpenteria).

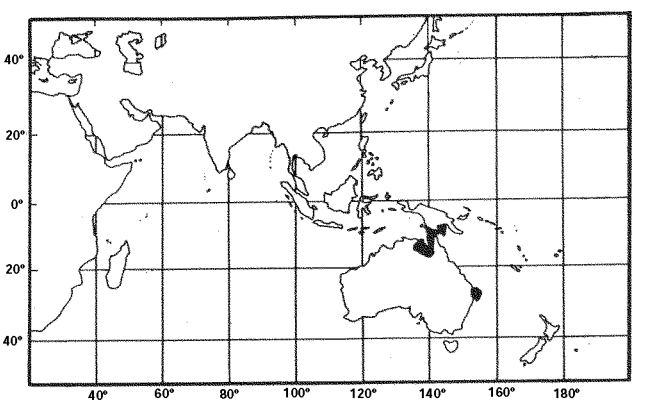
Synonyms : Stolephorus tysoni Wongratana, 1983:398, fig.16 (Gulf of Papua); see also Wongratana, 1980:247, pls 208, 209 (revision; name not validly published); Stolephorus carpenteriae - Munro, 1956:26, fig. 184 (Australia, compiled); Wongratana, 1985:29, fig.18 (key).

FAO Names : En - Gulf of Carpenteria anchovy.



Diagnostic Features : Body somewhat compressed, belly with 5 to 7 (usually 6) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers 22 to 25 (rarely 21). Fine teeth on upper edge of hyoid bones. Anal fin short, usually with iii 19 or 20 finrays, its origin rather far forward, below the second to sixth dorsal finray bases. The advanced anal and the presence of hyoid teeth distinguish this species from others in the area; similar hyoid teeth occur in S. commersonii (but only 1 to 4 scutes) and in S. insularis (but no double pigment line on back behind dorsal fin).

Geographical Distribution : Western Pacific (Gulf of Carpenteria, southern coast of Papua New Guinea; also Moreton Bay near Brisbane, Queensland).



Habitat and Biology : Presumed coastal, pelagic and schooling, but more material needed; probably tolerates lowered salinities, judging from the type locality and its occurrence in bays and inlets.

Size : To about 5 cm standard length.

Interest to Fisheries : Apparently not abundant.

Local Names :

Literature :

Remarks : Wongratana subsequently examined the types of Engraulis carpenteriae, of which the lectotype is his Stolephorus tysoni, but the paralectotypes are S. commersonii.

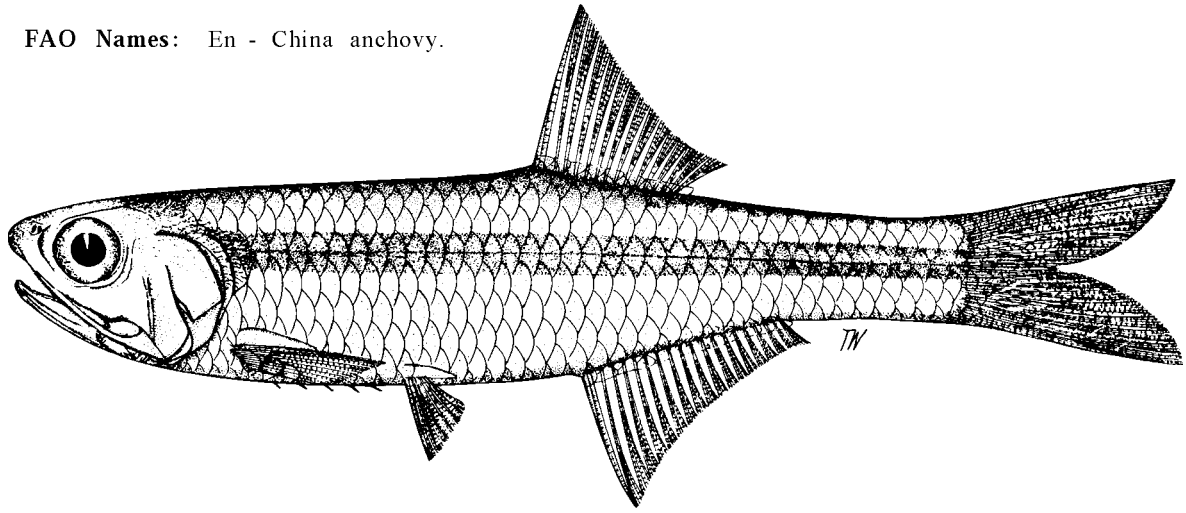
Stolephorus chinensis (Günther 1880)

ENGR Stol 10

Engraulis chinensis Günther, 1880, Rep.Voy.Challenger, 1:73 (Amoy = Xiamen).

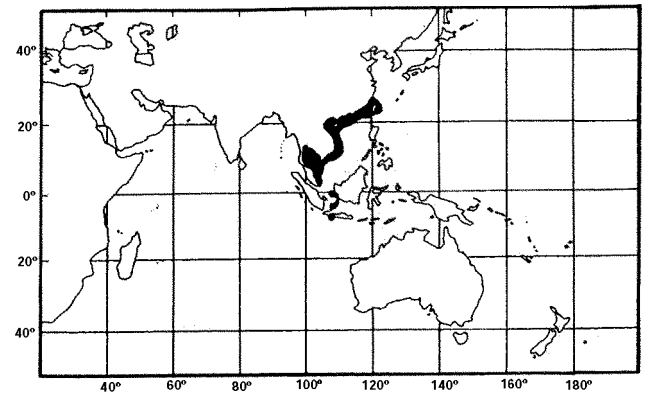
Synonyms : Anchoviella chinensis:Fowler, 1941d:706 (compiled); Chu, Tchang & Chen, 1963:108, fig. 82 (Chinese records); Stolephorus commersonii:Whitehead, 1966a:37 (types of chinensis, Reeves specimens); Stolephorus chinensis-Whitehead, 1968a:17 (in key); Idem, 1969a:260 (Singapore, Thailand, Hong Kong, China); Idem, 1973b:220 (in key); Wongratana, 1980240, pls 200,201(revision); Idem, 1985:28, fig.14 (key).

FAO Names: En - China anchovy.



Diagnostic Features : Body somewhat compressed, belly with 4 to 7 (usually 5 or 6) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to hind border of pre-operculum, the latter convex, rounded. Lower gillrakers 24 to 28 (usually 26 or 27): Small teeth present on upper edge of hyoid bones. Pelvic fin tips not reaching to below dorsal fin origin; anal fin short, with usually iii 18 to 20 finrays, its origin under front half of dorsal fin base. Resembles S. commersonii, which has fewer scutes (usually 1 to 4) and pelvic fin tips reaching beyond dorsal fin origin; also S. insularis, which has a distinctly indented, concave hind border of the pre-operculum. Of species with a rounded, convex pre-opercular margin, S. indicus is round-bodied and S. waitei has fewer gillrakers (19 to 24).

Geographical Distribution : Western Pacific (Singapore northward to Amoy = Xiamen).



Habitat and Biology : Presumably coastal, pelagic and schooling, but more data needed.

Size : To 9 cm standard length.

Interest to Fisheries : Contributes to Stolephorus catches, but to an unknown extent.

Local Names :

Literature : Almost certainly misidentified as S. commersonii, thus data not retrievable.

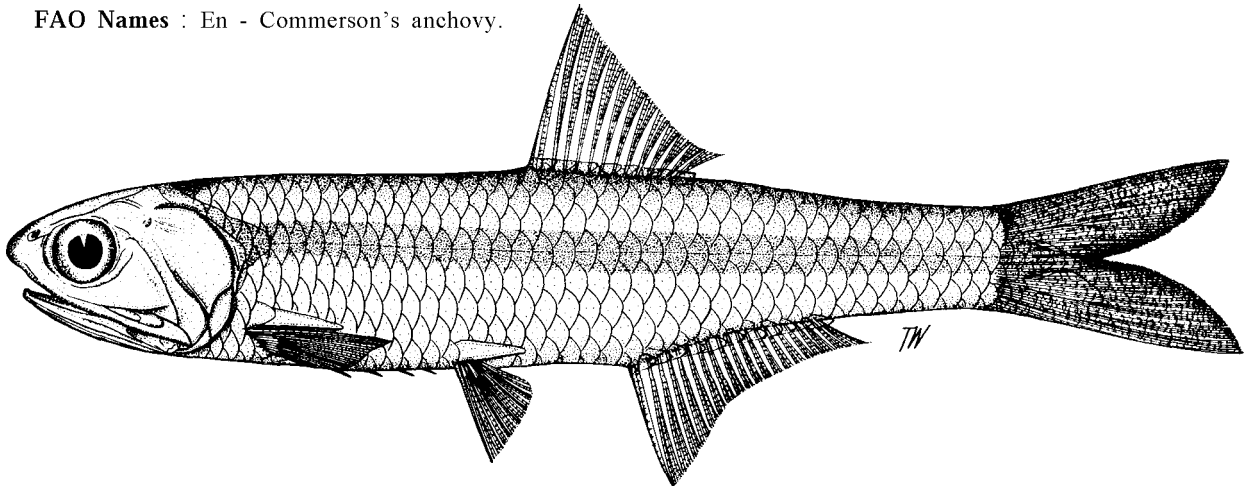
Stolephorus commersonii Lacepede, 1803

ENGR Stol 6

Stolephorus commersonii Lacepède, 1803, Hist.nat.Poiss.,5:381, 382, pl.12, fig.1 (Mauritius; based on notes by Commerson and a drawing).

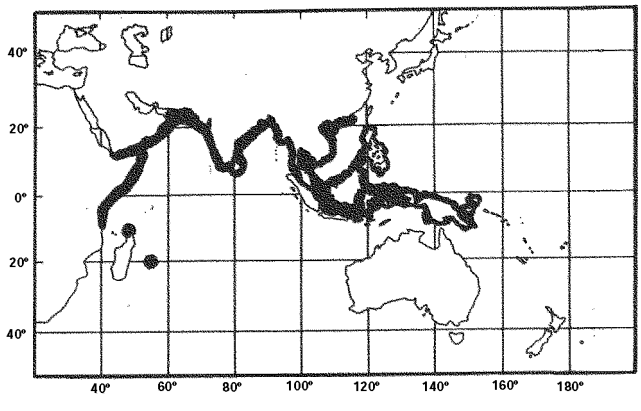
Synonyms : Stolephorus commersonianus: Bleeker, 1872:128, pl.259, fig.1 (misspelling); Stolephorus rex Jordan & Seale, 1926:380 (Canara); Anchoviella commersonii:Fowler, 1941:703 (the Philippines, Borneo); Chu, Tchang & Chen, 1963:107, fig.81; Stolephorus commersonii-Losse,1968:109 (East Africa); Whitehead, 1968a:18 (Mombasa, Madagascar, Thailand); Idem, 1973b:226, fig.50 (synopsis); Wongratana, 1980236, pls 196, 197 (revision); Lewis, Smith & Ellway,1983: 17, 19 (Papua New Guinea); S. apiensis considered distinct contra Wongratana); Wongratana, 198528, fig.12 (key); Whitehead & Bauchot, 1986:50 (basis for commersonii; Clupea vittargentata not a synonym - see Engraulis capensis).

FAO Names : En - Commerson's anchovy.



Diagnostic Features : Body somewhat compressed, belly a little rounded, with 0 to 5 (usually 1 to 4 and mostly 2 or 3) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or a little beyond hind border of pre-operculum, the latter convex, rounded. Lower gillrakers usually 23 to 28. Small teeth present on upper edge of hyoid bones. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Pelvic fin tips reaching to below anterior dorsal finrays; anal fin short, with usually iii 18 or 19 finrays, its origin below second half of dorsal fin base. Body light transparent fleshy brown, with a silver stripe down flank; a pair of dark patches behind occiput, followed by a pair of dark lines to dorsal fin origin. Closely resembles S. apiensis of Fiji and Samoa, which lacks pigment lines before the dorsal fin; and S. brachycephalus of Papua New Guinea, which has more anal finrays (usually iii 20 or 21), no hyoid teeth, and more scutes (usually 4 or 5). Stolephorus waitei has characteristic spots on the lower part of the head, and the pelvic fins do not reach to the dorsal fin origin (as also in S. chinensis). Other Stolephorus species have the hind border of the pre-operculum concave near the maxilla tip. See ENGR Stol 6, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean and western Pacific (eastern coast of Africa, from Gulf of Aden - but not Red Sea or the "Gulf" - to Zanzibar, northern Madagascar, Mauritius, eastward to Hong Kong, Papua New Guinea, but apparently replaced by S. apiensis in Fiji and Samoa). Winterbottom (1976:61) recorded this species as far south as the Umtata River, Transkei, but his specimen was S. holodon.



Habitat and Biology : Coastal, pelagic, schooling, apparently entering brackish water (Whitehead, 1968a:18 - Madagascar, Comoro Islands); present in Godavari estuary February to June in salinities of 19.6 to 32.0°/oo, but almost absent in subsequent flood season (Babu Rao, 1967:370). Feeds on surface plankton, mainly copepods and prawn larvae (Bapat & Bal, 1950). Egg oval with a knob (Babu Rao, 1966b:p1.4).

Size : To 10 cm standard length, mostly to 8 or 9 cm.

Interest to Fisheries : Not separately recorded, but undoubtedly part of the total catch of Stolephorus (231 344 tons in 1982).

Local Names : INDIA: Maya machi (Andaman Islands), Phansa (Calcutta - general term).

Literature : Babu Rao (1967 - bionomics, Andhra coast of India).

Remarks : Wongratana (1980:239) recorded a much higher gillraker count for nine specimens from Ponape, Caroline Island (32 to 35; cf. 23 to 28 in other specimens of S. commersonii), and found high counts also from Fiji (30 or 31) and the Philippines (to 30); he suggested a clinal increase. See also under S. apiensis.

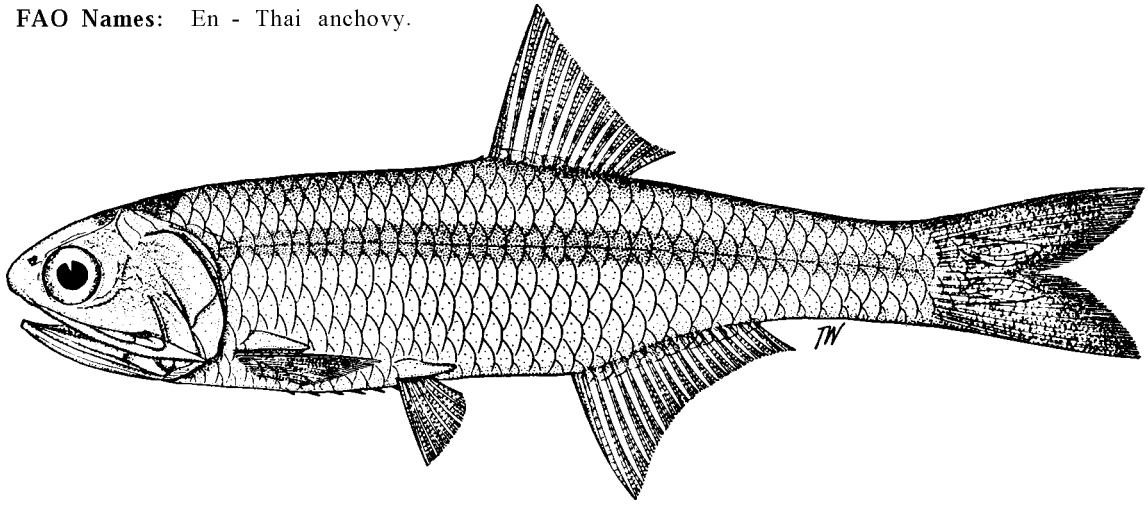
Stolephorus dubiosus Wongratana, 1983

ENGR Stol 16

Stolephorus dubiosus Wongratana, 1983, Japan J.Ichthyol., 29(4):400, fig.18 (Songkla Lake, Paknam, Bangkok and Samutsakorn, Thailand; Gulf of Thailand; Barito River, Kalimantan; and Orissa, India).

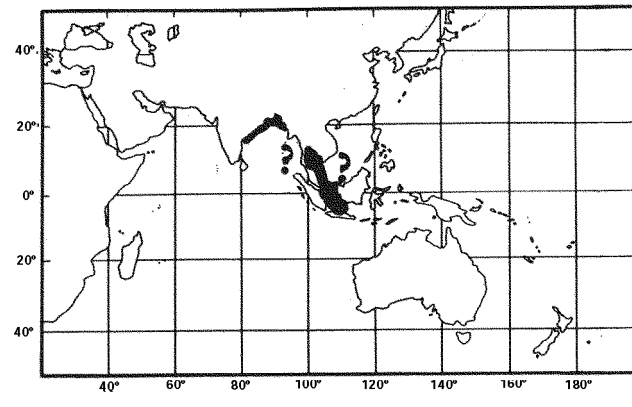
Synonyms : Stolephorus dubiosus-Wongratana, 1980:253, pls 214,215 (revision; name not validly published); Wongratana, 1985:29, fig.21 (key).

FAO Names: En - Thai anchovy.



Diagnostic Features : Body somewhat compressed, belly with 4 to 7 (usually 6 or 7) small needle-like pre-pelvic scutes; a small pre-dorsal spine and another on the pelvic scute. Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Gillrakers 25 to 31, usually 26 to 28. Anal fin short, usually with iii 18 or 19 finrays, its origin below about middle of dorsal fin base. A double pigment line on back behind dorsal fin. Of species with a spine on the pelvic scute, both S. baganensis and S. tri have fewer gillrakers (18 to 24 and 18 to 22).

Geographical Distribution : Eastern Indian Ocean (northern part of Bay of Bengal) and western Pacific (Gulf of Thailand, Java Sea to at least Kalimantan).



Habitat and Biology : Presumed coastal, pelagic and schooling, but evidently tolerates lowered salinities (e.g., in the Godavari, Songkla Lake and Barito River estuary) and possibly such places are its main habitat. More data needed.

Size : To 7.5 cm standard length.

Interest to Fisheries : Evidently contributes to artisanal fisheries, but perhaps not to any great extent.

Local Names :

Literature : Certainly misidentified in the past.

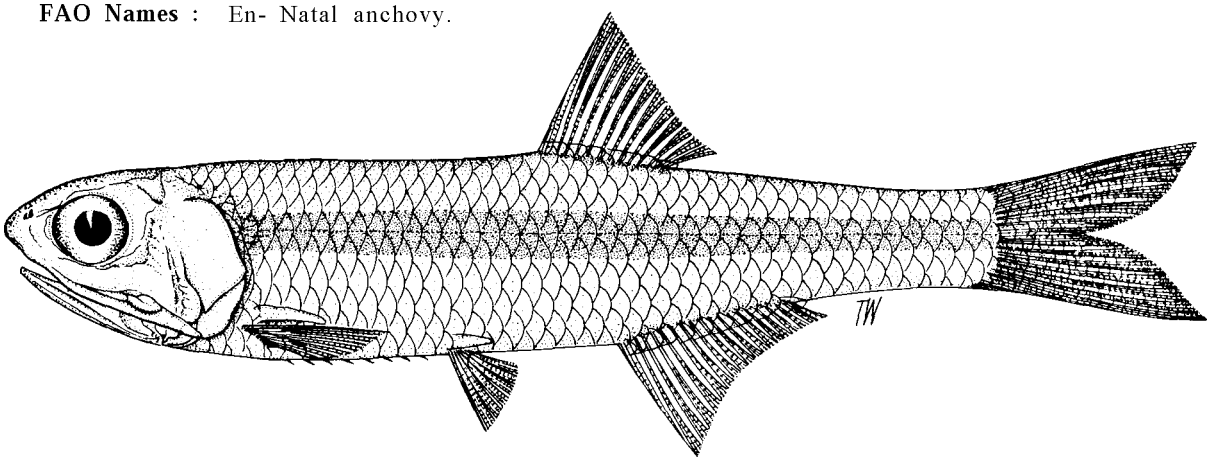
Stolephorus holodon (Boulenger, 1900)

ENGR Stol 11

Engraulis holodon Boulenger, 1900, Mar.Invest.S.Afr., (8):12, fig. 3 (Swartkops River, Algoa Bay, South Africa).

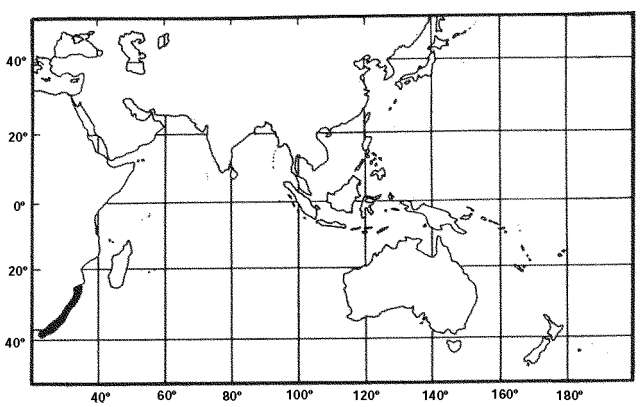
Synonyms : Anchoviella holodon:Fowler, 1941d:701 (compiled); Stolephorus commersonii:Winterbottom, 1976:61 (Umtata River, Transkei); Stolephorus holodon-Whitehead, 1973bb:220 in key); Wongratana,1980:245,pls 204, 205 (revision); Idem, 1985:29, fig.16 (key); SFSA, 1986:205, fig.55.2 (northern Mozambique to at least Swartkops estuary).

FAO Names : En- Natal anchovy.



Diagnostic Features : Body somewhat compressed, belly with 6 to 8 (usually 7) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers 24 to 29. Anal fin short, usually with iii 18 or 19 finrays, its origin below about middle of dorsal fin base. Of similar species in the area, Stolephorus indicus is round-bodied and has a shorter maxilla (not to hind border of pre-operculum); Encrasicholina punctifer has the anal fin origin behind tne dorsal fin base (as also in Engraulis).

Geographical Distribution : Southwestern Indian Ocean (from northern Mozambique south to Port Elizabeth).



Habitat and Biology : Coastal, pelagic and schooling; records from the estuaries of the Swartkops and Kei Rivers suggest that it can tolerate brackish water. More data needed.

Size : To 8 cm standard length.

Interest to Fisheries : Probably little.

Local Names : SOUTH AFRICA: Doring ansjovis, Thorny anchovy.

Literature :

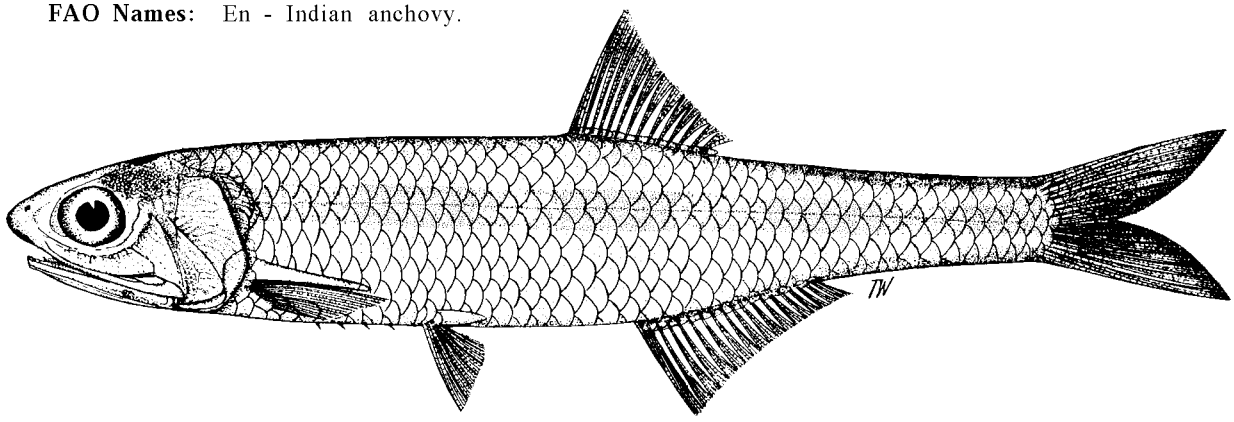
Stolephorus indicus (van Hasselt, 1823)

ENGR Stol 5

Engraulis indica van Hasselt, 1823, Algemeene Konst- en Letter-bode, 1(23):329 (Java, on Nattoo of Russell, 1803:71, pl.187).

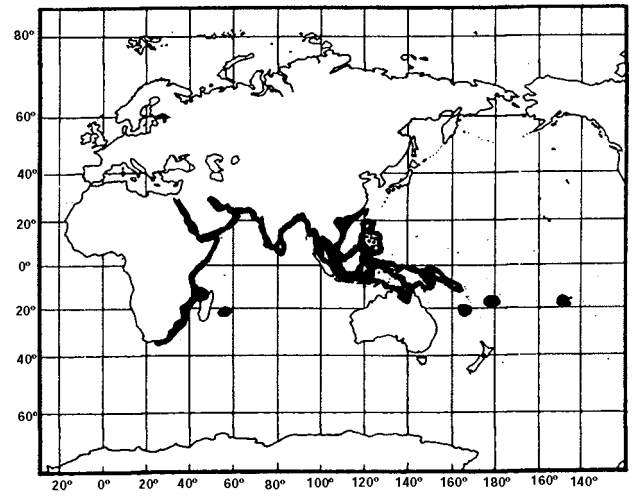
Synonyms : Engraulis albus Swainson, 1839:293 (on Nattoo of Russell); Engraulis balinensis Bleeker, 1849:ll (Boleling, Bali - in synonymy of S. indicus); Engraulis brownii:Cantor, 1850:1285 (Malay Peninsula and islands - not Atherina brownii Gmelin, 1789 = Anchoa hepsetus fide Whitehead, 1973a:132); Engraulis russellii Bleeker, 1852:472 (Rio, Indonesia - name only); Engraulis samaminan Montrouzier,1857:208 (Woodlark = Moiou I.); Engraulis carpenteriae (part) de Vis, 1882:320 (Norman River, Gulf of Carpenteria - paralectotypes only); Anchoviella scitula Fowler, 1911:211, fig.2 (claimed from San Diego, California; evidently untrue - see Nelson, 1983:49); Stolephorus insularum Jordan & Seale,1926:381 (Tahiti); Stolephorus extensus Jordan & Seale, 1926:382 (Mauritius); ? Stolephorus indicus nanus Hardenberg, 1933:263 (no locality, types lost); Anchoviella indica:Fowler, 1941d:706 (the Philippines, Kowloon; large synonymy); Stolephorus indicus-Munro, 1956:27, fig.185 (Queensland); Whitehead, 1965a:270 (Red Sea, the "Gulf"); Whitehead, Boeseman & Wheeler, 1966:114,115, pl.14, fig.4 (Bleeker's figure of russellii) (types of russellii and balinensis); Losse, 1968:107 (East Africa); Whitehead, 1973b:225, fig.49 (synopsis); Wongratana, 1980:231, pls 194,195 (revision); Lewis, Smith & Ellway, 1983:17,19 (New Guinea to Society Islands); Dor, 1984:43 (Red Sea, refs); Sainsbury, Kailola & Leyland, 1985:66,67 (good colour photo) (N.W. shelf of Australia); Wongratana,1985:28, fig.11 (key); SFSA,1986:206,fig.55.3(south to Natal).

FAO Names: En - Indian anchovy.



Diagnostic Features : Body slender, elongate, rather round in cross-section, belly rounded, with 2 to 6 (usually 3 to 5, mostly 4) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to or only just beyond front border of pre-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 20 to 28. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Pelvic fin tips not reaching to below dorsal fin origin; anal fin short, with usually iii 16 to 18 finrays, its origin below centre of dorsal fin base. Body light transparent fleshy brown, with a silver stripe down flank; no dark pigment lines on back between head and dorsal fin. Species with such a short maxilla are: S. advenus (7 scutes) and S. pacificus (35 to 38 gillrakers); maxilla to or almost to hind border of pre-operculum in other Stolephorus species. See ENGR Stol 5, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean and western Pacific (entire eastern coast of Africa from the "Gulf" and the Red Sea south to Natal, Madagascar, Mauritius; eastward to Hong Kong, northern and eastern coasts of Australia south to Brisbane and further east to Samoa and Tahiti).



Habitat and Biology : Coastal, pelagic, schooling (but probably less so than other Stolephorus species); appears to enter at least the estuarine parts of rivers and perhaps tolerates brackish water. Feeds most likely on zooplankton, but more data needed. In Manila Bay, migrates out into deeper and more saline water to breed (at about 9 cm standard length and above), returning immediately after; the eggs are oval, with a small knob at one pole (Babu Rao, 1966b: pl.4).

Size : To 15.3 cm standard length, usually 10 to 12 cm.

Interest to Fisheries : Appears not to form very large schools, thus of minor interest although the largest of Stolephorus species; fragile and unsuitable as a tuna baitfish (Lewis, Smith & Ellway, 1983:17).

Local Names : INDIA: Maya machi (Andaman Islands), Phansa (Calcutta - general term).

Literature : Tiews, Ronquillo & Santos (1975 - breeding in Manila Bay), Baldwin (1984 -Fijian baitfish).

Stolephorus insularis Hardenberg, 1933

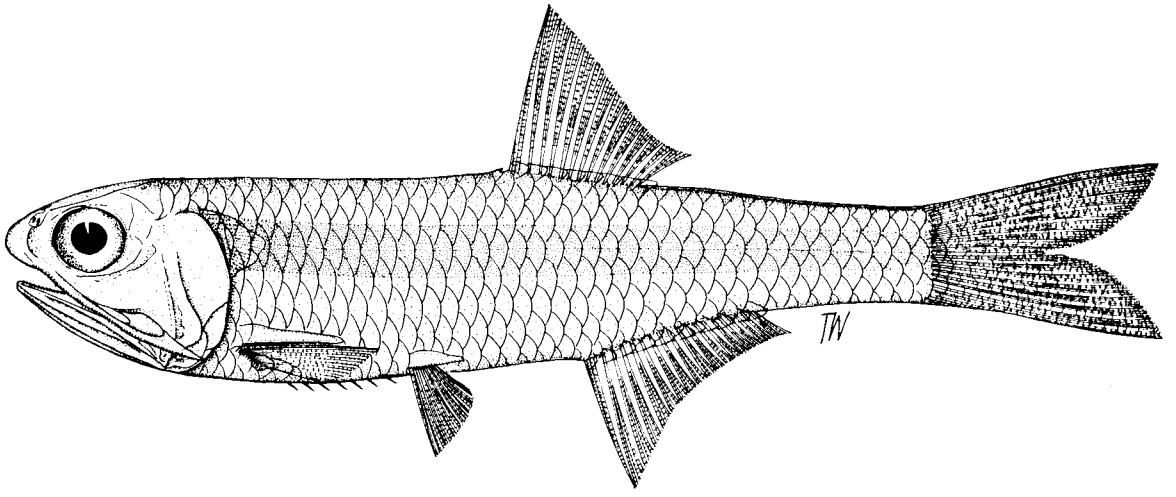
ENGR Stol 15

Stolephorus insularis Hardenberg, 1933a, Natuurk.Tijdschr.Ned.-Indie, 93(2):260 (Java, Lingga, Bawean, Kangean, Moluccas; excluding S. insularis bataviensis=S. waitei).

Synonyms : Stolephorus baweanensis Hardenberg,1933a:261 (Bawean, Java Sea); Stolephorus insularis oceanicus Hardenberg, 1933a:261 (south coast of Java); Anchoviella bataviensis:Fowler, 1942d:708 (compiled; excluding S. insularis bataviensis itself); Anchoviella baganensis: Dutt & Babu Rao, 1958a:160 (east coast of India); Stolephorus macrops:Whitehead, 1968a:19 (Gulf of Aden, Bay of Bengal); Idem, 1969a:257 (Penang, Singapore); Idem, 1973b:223, fig.45 (key, compiled); Stolephorus bataviensis: Whitehead,1969a:261 (the batch of 14 Singapore

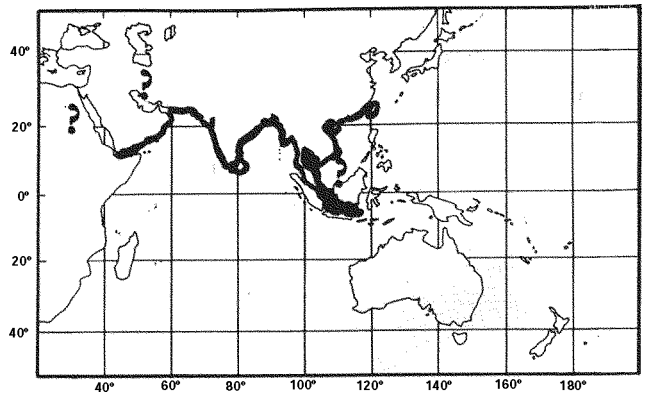
fishes only); Idem, 1973b:227 (in part only); Stolephorus insularis-Wongratana,1980250, pls 212,213 (revision); Idem, 1985:29, fig.20 (key). Note:as pointed out by Fowler(1941d:708) and Whitehead (1968a:20), Hardenberg's name insularis appears to be a junior primary homonym of Stolephorus insularum Jordan & Seale, 1926 = S. indicus. Authors, including Wongratana, have ignored this and there seems good reason to preserve the Hardenberg name.

FAO Names : En - Hardenberg's anchovy.



Diagnostic Features : Body somewhat compressed, belly with 4 to 8 (usually 6 or 7) small needle-like scutes; a small pre-dorsal spine in some specimens. Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers 21 to 28 (usually 23 to 27). Fine teeth on upper edge of hyoid bones. Anal fin short, usually with iii 14 to 17 finrays, its origin below about middle of dorsal fin base. A double pigment line on back behind dorsal fin; tail deep yellow (at least in Indian specimens). Of species with an indented pre-operculum, S. andhraensis has fewer gillrakers (20 or 21 only) and S. ronquilloi has more (28 to 30, rarely 27); other species with a pre-dorsal spine also have a spine on the pelvic scute S. dublosus, S. baganensis, S. tri). Hyoid tooth patches are present in S. commersonii (but pre-operculum rounded, scutes usually 1 to 4) and in S. carpenteriae (but no pigment lines on back, anal origin under anterior part of dorsal fin base).

Geographical Distribution : Northern part of Indian Ocean (Gulf of Aden, not Red Sea or the "Gulf", eastward to Burma) and western Pacific (Gulf of Thailand, Java Sea, also Hong Kong, Fujian and Taiwan Island; if correctly identified, then reaches to Fiji and Samoa fide Lewis, Smith & Ellway, 1983).



Habitat and Biology : Coastal, pelagic and schooling; more data needed, based on correct identifications. Babu Rao (1965b, 1966a) recorded specimens from the Godavari estuary, thus implying tolerance of lowered salinities, but the identity of his material is not certain (perhaps S. waitei). Egg oval without a knob (if S. baganensis of Babu Rao, 1966b:pl.4 is S. insularis).

Size : To 6.4 cm standard length.

Interest to Fisheries : Appears to be fairly common throughout its range and probably contributes a significant proportion to Stolephorus catches. If correctly identified by Lewis, Smith & Ellway (1983), then of some interest as a baitfish, although rather fragile.

Local Names :

Literature : Previous identifications have not always been secure, but possibly the following refer to this species: Dutt & Babu Rao, 1958a (as Anchoviella baganensis, description), Idem 1958b (as A. insularis, description), Babu Rao, 1965b, 1966a, (as Stolephorus insularis, biometrics, subspecies, but perhaps S. waitei), Baldwin (1984 - Fijian baitfish).

Remarks : The occasional presence of a pre-dorsal spine (apparently lost in larger individuals) led to the identification of this species as S. baganensis, while the probable loss of Hardenberg's type specimens clouded the true identity of his bataviensis (= S. waitei). Wongratana (1980) finally resolved this problem. As a result, very few fishery or biological studies can be relied upon.

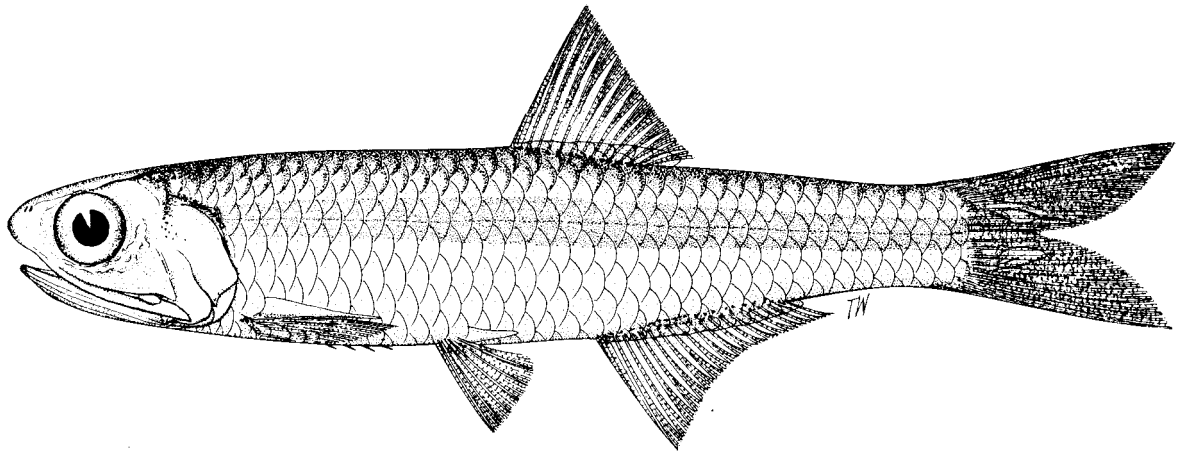
Stolephorus multibranchus Wongratana, 1987

ENGR Stol 22

Stolephorus multibranchus Wongratana, 1987, Am.Mus.Novit., (2876):3, fig.1 (Metalanim Harbour, Panape, Caroline Is.).

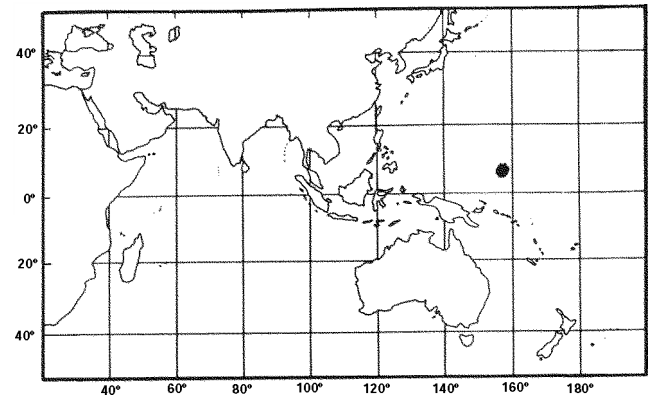
Synonyms : Stolephorus commersonii:Wongratana, 1980:237 (batch 36 only, now the types of S. multibranchus).

FAO Names : En - Caroline anchovy.



Diagnostic Features : Body fairly elongate, belly rounded, with 2 to 4 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching lower hind margin of pre-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 32 to 35. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Pelvic fin tips reaching to below anterior dorsal finrays anal fin short, with iii 18 to 20 finrays, its origin below middle of dorsal fin base. Body with a silver stripe down flank; a pair of dark lines along back from head to dorsal fin origin. Closely resembles S. commersonii, which has fewer lower gillrakers (only 23 to 28); S. apiensis of Fiji and Samoa has 29 to 30 gillrakers, but no double pigment line on back; S. pacificus of Guam and Kosrae has 33 to 38 gillrakers, but maxilla much shorter (to front margin of pre-operculum). Species of Encrasicholina have the anal fin origin behind the dorsal fin base.

Geographical Distribution : Western central Pacific (Ponape, Caroline Islands).



Habitat and Biology : Coastal, pelagic, schooling, but more data needed.

Size : To 6 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature :

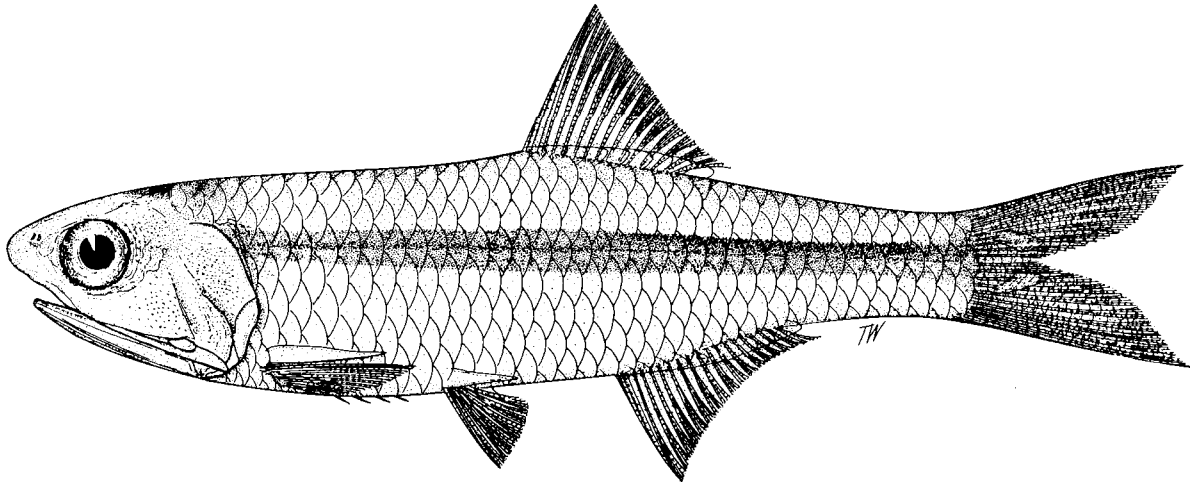
Stolephorus nelsoni Wongratana, 1987

ENGR Stol 23

Stolephorus nelsoni Wongratana, 1987, Am.Mus.Novit., (2876):4, fig.2 (near Wallal, Eighty Mile Beach, Western Australia).

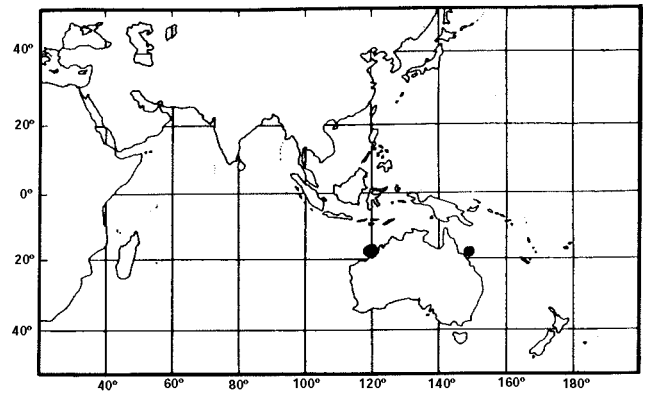
Synonyms None.

FAO Names : En - Nelson's anchovy.



Diagnostic Features : Body moderately deep and compressed (depth about 23 to 24 percent of standard length), belly rounded, with 4 or 5 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to about hind border of inter-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 24; knob-like tooth patches at bases of anterior epibranchial gillrakers. Small teeth present on upper edge of hyoid bones. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Anal fin short, with iii 20 finrays, its origin below about middle of dorsal fin base. The knob-like epibranchial tooth patches occur also in S. carpenteriae (also has hyoid tooth patches, but hind edge of pre-operculum indented below maxilla tip), in S. chinensis (but lower gillrakers 25 to 28) and in S. tri (but a small pre-dorsal scute and another on the pelvic scute). Resembles S. commersonii (also with hyoid teeth, but lower gillrakers 23 to 28 and a pair of pigment lines on back before dorsal fin), also S. waitei (branched anal finrays 21 to 23).

Geographical Distribution : Northwestern Australia (Eighty Mile Beach just north of Wallal, West Australia and Townsville, Queensland).



Habitat and Biology : Coastal, pelagic, schooling, but more data needed.

Size : To 7.4 cm standard length.

Interest to Fisheries : None.

Local Names :

Literature :

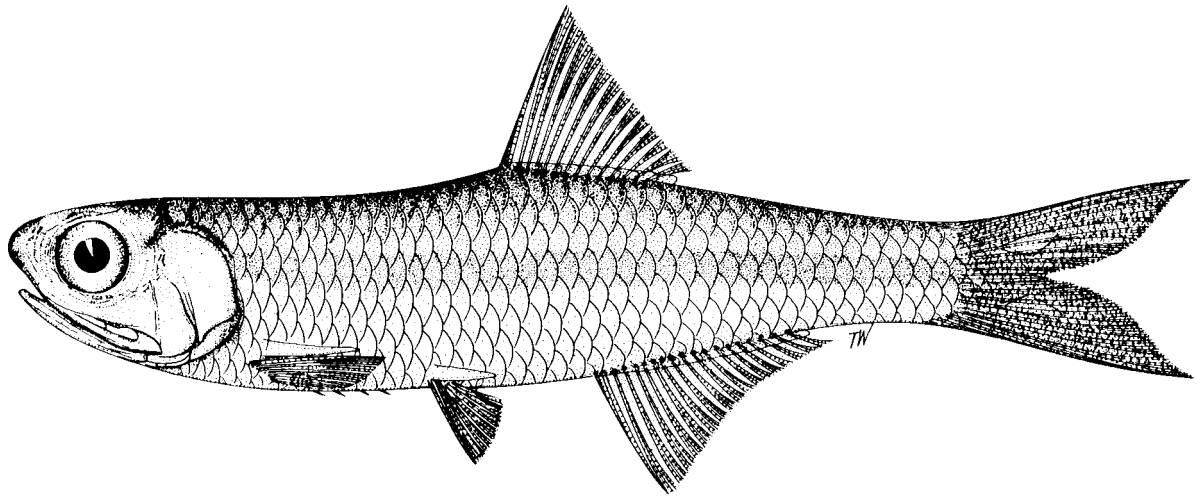
Stolephorus pacificus Baldwin, 1983

ENGR Stol 20

Stolephorus pacificus Baldwin, 1983, Micronesica, 19(1-2):152, fig.1 (Guam and Kosrae).

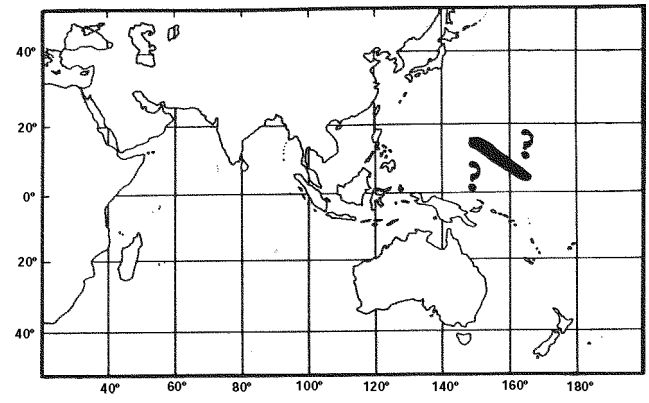
Synonyms : None (unless misidentified as S. indicus).

FAO Names : En - Pacific anchovy.



Diagnostic Features : Body somewhat compressed, belly a little rounded, with 1 to 4 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching just to front border of pre-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 35 to 38. Isthmus muscle tapering evenly forward to hind border of branchial membrane. Pelvic fin tips reaching to beyond dorsal fin origin; anal fin short, with iii 17 to 19 finrays, its origin below midpoint of dorsal fin base. A silver stripe along flank, not strongly demarcated; no distinct dark lines on back from head to dorsal fin. Only S. indicus and S. advenus have such a short maxilla (but gillrakers not more than 26; only S. multibranchus has more than 31 lower gillrakers, but maxilla longer).

Geographical Distribution : Western central Pacific (Guam and Kosrae).



Habitat and Biology : Presumed coastal, pelagic and schooling; recorded only from bays. Eggs oval with a small knob.

Size : To 7.7 cm standard length.

Interest to Fisheries : Perhaps of use as a baitfish if available in sufficient quantities.

Local Names :

Literature :

Remarks : The very high gillraker count sets this species apart from all other members of Stolephorus except S. multibranchus (32 to 35).

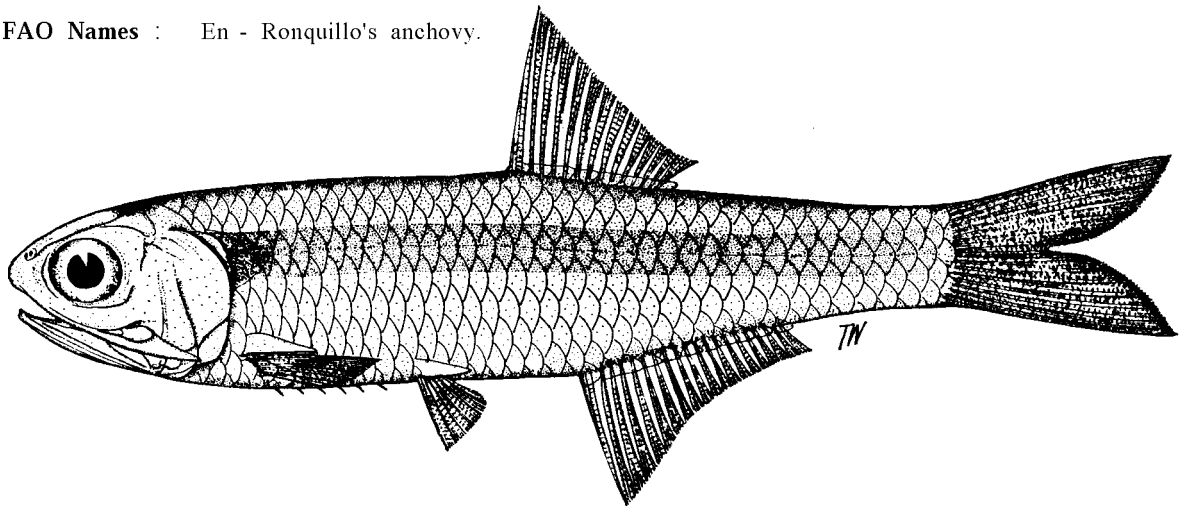
Stolephorus ronquilloi Wongratana, 1983

ENGR Stol 14

Stolephorus ronquilloi Wongratana, 1983, Japan J.Ichthyol., 29(4):399, fig.17 (Manila Bay, Mindanao, the Philippines).

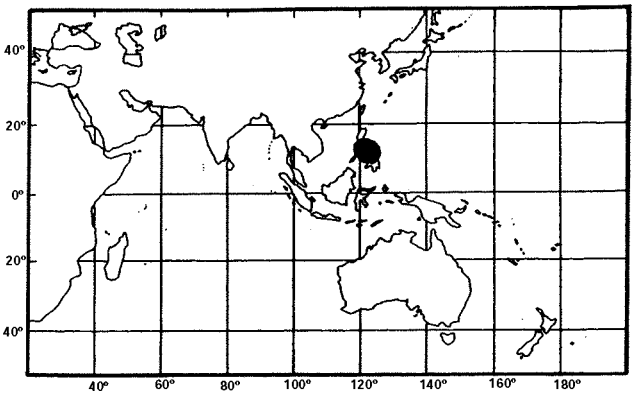
Synonyms : Stolephorus Species C:Ronquillo, 1970; Whitehead, 1973b:223, fig.46 (key; but the Madagascar specimens reported by Whitehead,1968:18 are S. insularis); Stolephorus ronquilloi-Wongratana, 1980:248, pls 210,211 (revision; name not validly published); Idem, l-fig.19 (key).

FAO Names : En - Ronquillo's anchovy.



Diagnostic Features : Body somewhat compressed, belly with 4 to 7 (usually 6) small needle-like pre-pelvic scutes Maxilla tip pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers numerous, 28 to 30. Anal fin short, usually with iii 17 or 18 finrays, its origin below anterior part of dorsal fin base. Closely resembles the widespread S. insularis, which has small tooth patches on the upper edge of the hyoid bones, also fewer gillrakers (22 to 28, usually 23 to 27). Of other species with an indented pre-operculum, none has so many gillrakers.

Geographical Distribution : Western Pacific (the Philippines only; the Indian Ocean, Thailand and Singapore records given by Whitehead, 1973b:224 were based on S. insularis).



Habitat and Biology : Coastal, pelagic and schooling; more specimens and data needed.

Size : To 5.3 cm standard length.

Interest to Fisheries : Not common in museum collections, so perhaps not very abundant.

Local Names :

Literature :

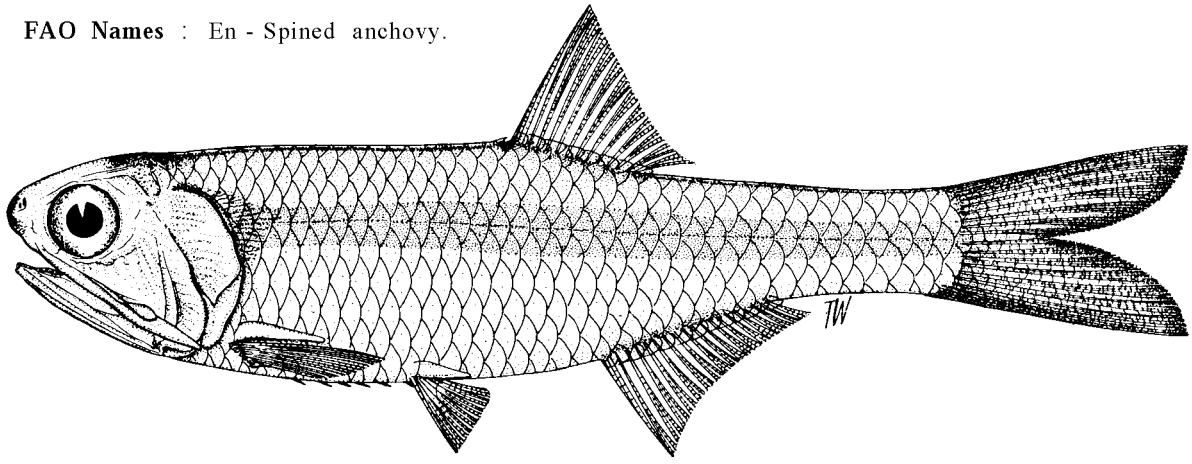
Stolephorus tri (Bleeker, 1852)

ENGR Stol 4

Engraulis tri Bleeker, 1852, Verh.batav.Genoot.Kunst.Wet.,24:40 (Jakarta); Idem, 1852, Natuurk.Tijdschr. Ned.-Indië., 3:435, 446 (3 Sampit, Borneo, specimens added).

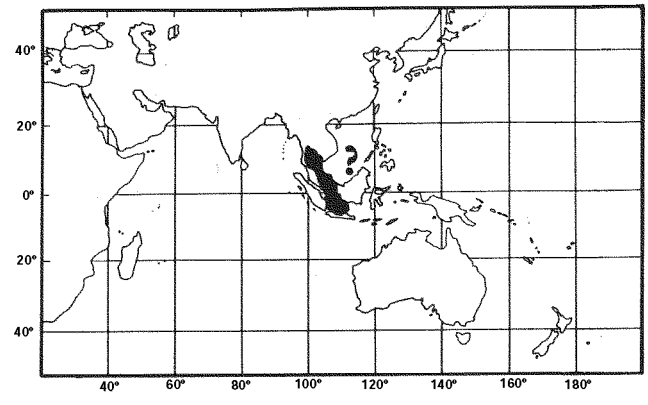
Synonyms : Stolephorus tri-Weber & de Beaufort, 1913:47 (Sumatra and compiled); Fowler, 1941d:709 (the Philippines); Whitehead, Boeseman & Wheeler,1966:113, pl.14, fig.3 (Bleeker's Atlas figure) (Bleeker types); Whitehead, 1973b:224, fig.48a,b (but excluding references to baganensis and to rex, the latter being S. commersonii); Wongratana, 1980:257, pls 218,219 (revision); Idem, 198529, fig.23 (key).

FAO Names : En - Spined anchovy.



Diagnostic Features : Body compressed, belly with 6 or 7 (rarely 8) small needle-like pre-pelvic scutes; a small pre-dorsal spine and another spine on the pelvic scute. Maxilla pointed, reaching to or beyond hind border of pre-operculum, the latter concave, indented near maxilla tip. Lower gillrakers 19 to 22 (rarely 18). Anal fin short, usually with iii 17 or 18 finrays, its origin below about middle of dorsal fin base. A double pigment line on back both before and behind dorsal fin. Of species with a spine on the pelvic scute, S. dubiosus has more gillrakers (20 to 23) and shares with S. baganensis the absence of a double pigment line before the dorsal fin. See ENGR Stol 4, Fishing Areas 57/71.

Geographical Distribution : Western Pacific (Gulf of Thailand and Java Sea). Indian Ocean records seem to have been based on S. baganensis (if it truly occurs there) or on specimens of S. insularis possessing a pre-dorsal spine.



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

Size : To 9.5 cm standard length.

Interest to Fisheries : One of the larger species of Stolephorus, but museum collections imply that it is not very abundant.

Local Names : INDONESIA: Teri (a Malay name, from which Bleeker derived tri).

Literature : Much confused with S. baganensis, so that all previous studies are unreliable.

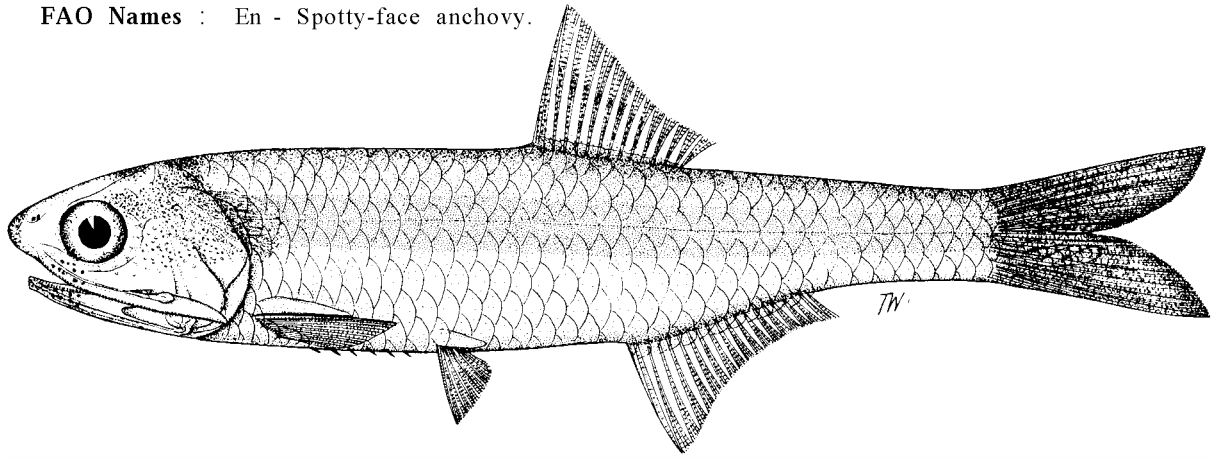
Stolephorus waitei Jordan & Seale, 1926

ENGR Stol 8

Stolephorus waitei Jordan & Scale, 1926, Bull.Mus.comp.Zool. Harvard, 67(11):380 (Queensland).

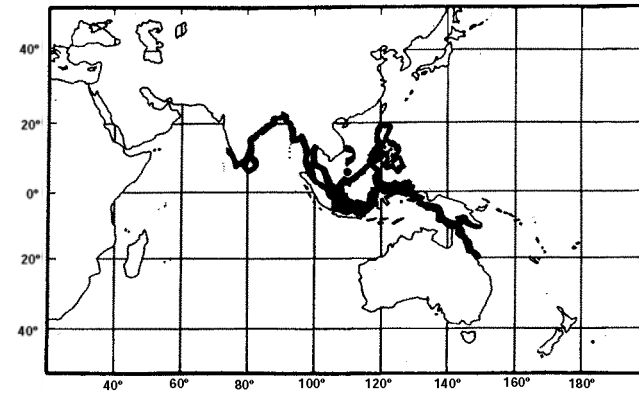
Synonyms : Stolephorus insularis bataviensis Hardenberg,1933a:261 (Jakarta - but not his S. insularis insularis, baweanensis and oceanicus = S. insularis); Stolephorus bataviensis:Whitehead, 1968a:19 (Bay of Bengal); Idem, 1973b:226, fig.51 (synopsis - but insularis insularis included); Anchoviella waitei: Fowler, 1941d:702 (compiled); Stolephorus waitei-Wongratana, 1980:242, pls 202, 203 (revision); Idem, 198528, fig.15 (key).

FAO Names : En - Spotty-face anchovy.



Diagnostic Features : Body somewhat compressed, belly with 5 to 7 (rarely 4) small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching to hind border of pre-operculum, the latter almost always convex, rounded. Lower gillrakers 19 to 25 (usually 20 or 21). Pelvic fin tips only rarely reaching to below dorsal fin origin; anal fin short, with usually iii 18 to 20 finrays, its origin below about middle of dorsal fin base. Numerous black spots below level of eye and on tip of lower jaw; a dark patch behind occiput. The spots on the "face" generally distinguish it from other species. Of those with the hind margin of the pre-operculum rounded and not indented, S. commersonii has fewer scutes (usually 1 to 4), S. chinensis has more gillrakers (usually 26 or 27). Frequently confused with the very similar S. insularis, which has an indented pre-opercular margin, a double pigment line behind the dorsal fin and the caudal fin deep yellow. See ENGR Stol 8, Fishing Area 51, also ENGR Stol 3 of Fishing Areas 57/71 (as S. bataviensis).

Geographical Distribution : Eastern Indian Ocean (from Cochin and southern tip of India to Burma) and western Pacific (Thailand, Java Sea, the Philippines, probably Irian Jaya if not also Papua New Guinea, south to Queensland; perhaps even more widespread).



Habitat and Biology : Coastal, pelagic and schooling. Its geographical overlap and similarity to S. insularis casts doubts on the several Indian studies of "insularis".

Size : To 9.4 cm standard length, usually to 6 or 7 cm.

Interest to Fisheries : One of the commonest species of this genus (at least in museum collections), so probably makes a major contribution to Stolephorus catches.

Local Names :

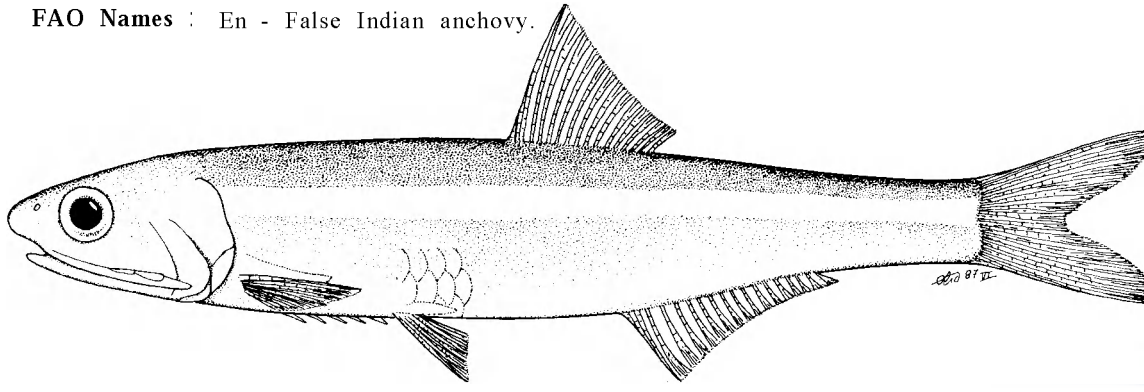
Literature : Too often confused with S. insularis for previous data to be reliable.

Stolephorus Species A

ENGR Stol 21

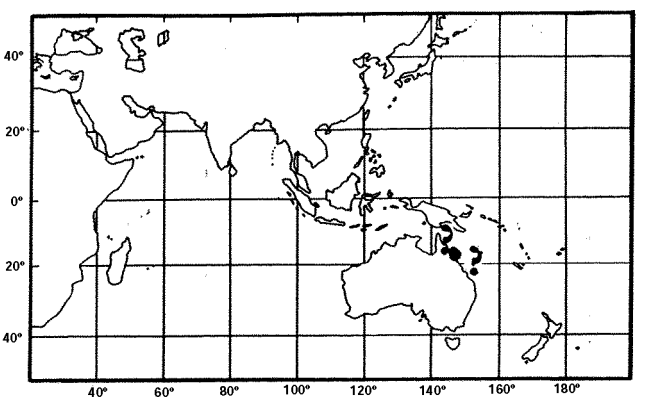
Synonyms : None (unless misidentified as S. indicus).

FAO Names : En - False Indian anchovy.



Diagnostic Features : Body slender, elongate, rather round in cross-section, belly rounded, with 5 or 6 small needle-like pre-pelvic scutes. Maxilla tip pointed, reaching about halfway across pre-operculum; hind border of pre-operculum convex, rounded. Lower gillrakers 25. Isthmus muscle tapering evenly forward to hind border of branchial membrane; pseudobranch longer than eye, reaching onto inner face of operculum; toothplates fused to epibranchial. Pelvic fin tips just reaching to dorsal fin origin; anal fin short, with iii 16 to 18 finrays, its origin below final third of dorsal fin base. A silver stripe along flank. Strongly resembles S. indicus in body form, but the latter has a shorter maxilla (to front margin of pre-operculum), shorter pseudobranch (not onto operculum) and shorter pelvic fins (well short of dorsal fin origin). Other Stolephorus species with a rounded pre-operculum and pelvic fins reaching to dorsal fin origin are: S. commersonii scutes usually only 2 or 3; also, no epibranchial toothplates), S. brachycephalus (only 20 to 22 gillrakers) and S. apiensis (gillrakers not less than 27).

Geographical Distribution : Western central Pacific (a little south of Cooktown, Queensland, Australia).



Habitat and Biology : Presumed coastal, pelagic and schooling; more material and data needed. Known from three specimens taken at 9 m depth by prawn trawl.

Size : To 10 cm standard length.

Interest to Fisheries : Nil.

Local Names :

Literature :

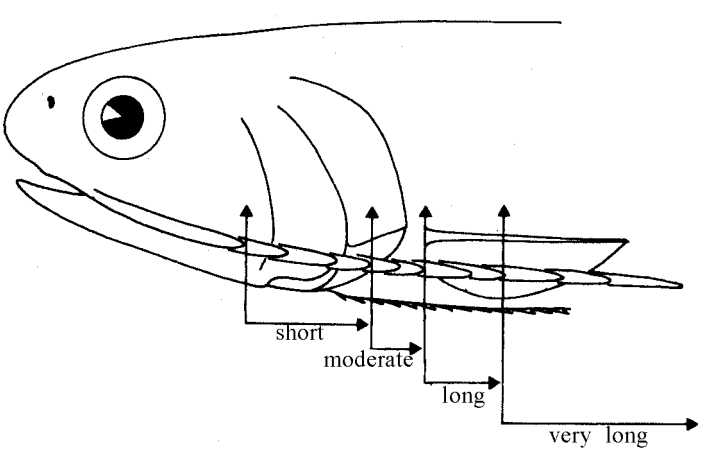
Remarks : The long pseudobranch and fused epibranchial toothplates are characters otherwise found in Encrasicholina.

Thryssa Cuvier, 1829

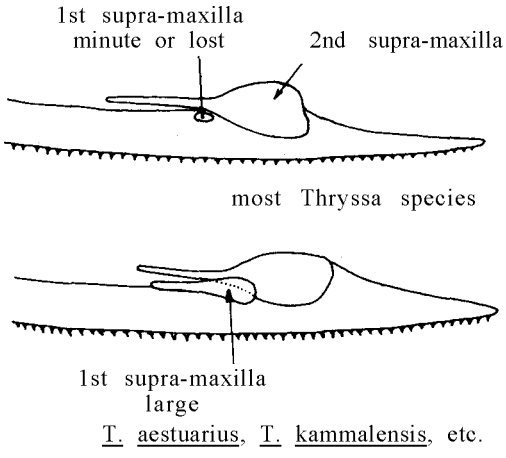
ENGR Thrys

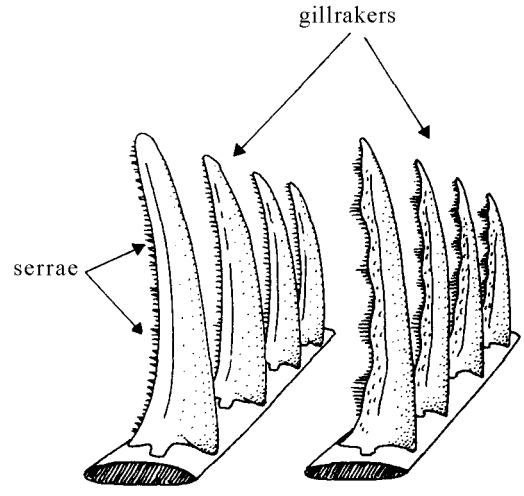
Thrissa Cuvier, 1816, Regne anim.,1st ed., 2:176 (type: Clupea mystus Linnaeus, 1758 = Coilia mystus, designated by Bory St Vincent, 1823:231 - overlooked except by Whitley, 1935; Clupea setirostris Broussonet, 1782 designated by Jordan & Evermann, 1917:98 - not Thrissa Rafinesque,1815, which pre-dated Cuvier's name and applies to Clupanodon, but is a nomen nudum; see,. discussion in Whitehead, 1967a:141). Thryssa Cuvier, 1829, Règne anim., 2nd ed., 2:323 (type: Clupea setirostris Broussonet, 1782, since Thryssa an (unjustified) emendation for Thrissa). Thryssus Swainson, 1838, Nat.hist.anim., 1:279,280 (type: Clupea setirostris Broussonet, 1782). Trichosoma 'Swainson, 1839, Ibid., 2:292 (type: Thrissa hamiltonii Gray, 1835). Thrissocles Jordan & Evermann, 1917, Genera of fishes, (1):98 (type: Clupea setirostris Broussonet,1782, since Thrissocles a replacement name for Thrissa). Xenengraulis Jordan & Seale, 1925, Copeia, (141):29 (type: Xenengraulis spinidens Jordan & Seale, 1925). Scutengraulis Jordan & Seale, 1925, Ibid.:30 (type: Clupea hamiltonii Gray, 1835), Thrissina Jordan & Scale, 1925, Ibid.:30 (type: Clupea baelama Forsskal, 1775).

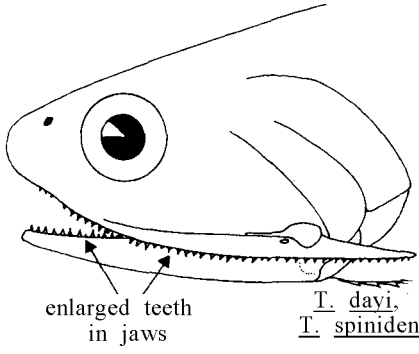
Diagnostic Features : Medium-sized compressed or strongly compressed anchovies (mostly to about 8 to 14 cm standard length, but T. scratchlevi to 37 cm), the belly fairly sharply keeled, with 21 to 32 scutes from isthmus to anus (absent before pectoral fin base or only 1 or 2 in two species); a small spine-like scute just before dorsal fin origin. Maxilla tip pointed, reaching beyond front border of pre-operculum, often to gill opening, sometimes to pectoral fin base or beyond (to pelvic fin base or beyond in T. setirostris); jaw teeth usually small, a little enlarged in some species. Gillrakers stout or slender, 11 to 32 in most species (but to 61 in T. rastrosa). Anal fin long, usually with 25 to 45 branched finrays, its origin usually behind base of last dorsal finray.



extent of maxilla







Scales moderate, usually 34 to 46 in lateral series. In most species the branches of the cephalic **lateralis** sensory canal bear black pigment, forming a distinct blotch behind the upper part of the gill opening; dorsal and caudal fins are often yellow, with dark tips or margins.

Biology, Habitat and Distribution : Marine, pelagic and probably always schooling fishes, although perhaps not forming very large schools; mostly inshore, along beaches and entering river mouths; some temporary or even permanent residents in rivers. Indo-West Pacific only, from western shores of Indian Ocean eastward to Papua New Guinea (exceptionally to the New Herbrides or even Tonga).

Species : In the most recent revision, Wongratana (1980) recognized 21 species, placed in three subgenera; Nelson (1983) recognized another species, as also Wongratana (1987a), who also described a new one (total 24 species):

Subgenus Thryssa (maxilla to beyond pectoral fin tip)

T. setirostris (Broussonet, 1782) Widespread, Indo-West Pacific

Subgenus Thrissina (only 4 to 9 pre-pelvic scutes)

T. baelama (Forsskal, 1775) Widespread, Indo-West Pacific
T. encrasicholoides (Bleeker, 1852) Less widespread, Indo-West Pacific

Subgenus Scutengraulis

Widespread

T. hamiltonii (Gray, 1835) Arabian Sea to Taiwan Island and Australia
T. dussumieri (Valenciennes, 1848) Arabian Sea to Taiwan Island
T. mystax (Schneider, 1801) India to Indonesia

Indian Ocean

T. dayi Wongratana, 1983 West coasts of India
T. gautamiensis Babu Rao, 1970 East coasts of India
T. kammalensoides Wongratana, 1983 East coasts of India
T. malabarica (Bloch, 1795) India
T. polibranchialis Wongratana, 1983 India
T. purava (Hamilton-Buchanan, 1822) India
T. spinidens Jordan & Seale, 1925 Bay of Bengal
T. stenosoma Wongratana, 1983 East coasts of India
T. whiteheadi Wongratana, 1983 the "Gulf"
T. vitrirostris (Gilchrist & Thompson, 1908) Southern Africa to India

West Pacific

T. adelae (Rutter, 1897) China
T. aestuaria (Ogilby, 1911) Papua New Guinea and Australia
T. brevicauda Roberts, 1978 Papua New Guinea
T. chefuensis (Günther, 1874) China
T. kammalensis (Bleeker, 1849) Indonesia
T. marasriae Wongratana, 1987 Northern Australia
T. rastrosa Roberts, 1978 Papua New Guinea
T. scratchleyi (Ramsey & Ogilby, 1886) Papua New Guinea, Australia

Remarks : Until the revision by Wongratana (1980), virtually all recent authors have placed baelama in the genus Thrissina because of its lack of a full complement of pre-pectoral scutes (also, its short maxilla, rather low anal finray count of (usually) iii 26 to 29, and not strongly compressed body); Thrissina appeared to be intermediate between Stolephorus and Thryssa.

The placing of setirostris in a separate subgenus seems justified; the very long maxilla, although striking, merely continues the trend leading to T. dussumieri, but setirostris differs from all other Thryssa species in having a very high coronoid process, the lower jaw rising steeply in the mouth (Wongratana, 1980:pl. 261d).

The identification of species of Thryssa is still very difficult, even using such a thorough key as that given by Wongratana (1980:70-6). To simplify comparisons, distinctions are only given for species actually or likely to be found in the same area. Thereafter, major separations are made between species with short, medium, long or very long maxillae (not to gill cover, just beyond it, to pectoral fin base, or well beyond it); between those with or without a first supra-maxilla; and between those with the tip of the snout distinctly above the midline of the eye. Numbers of gillrakers and anal finrays also help in identification, as also the enlargement of the jaw teeth.

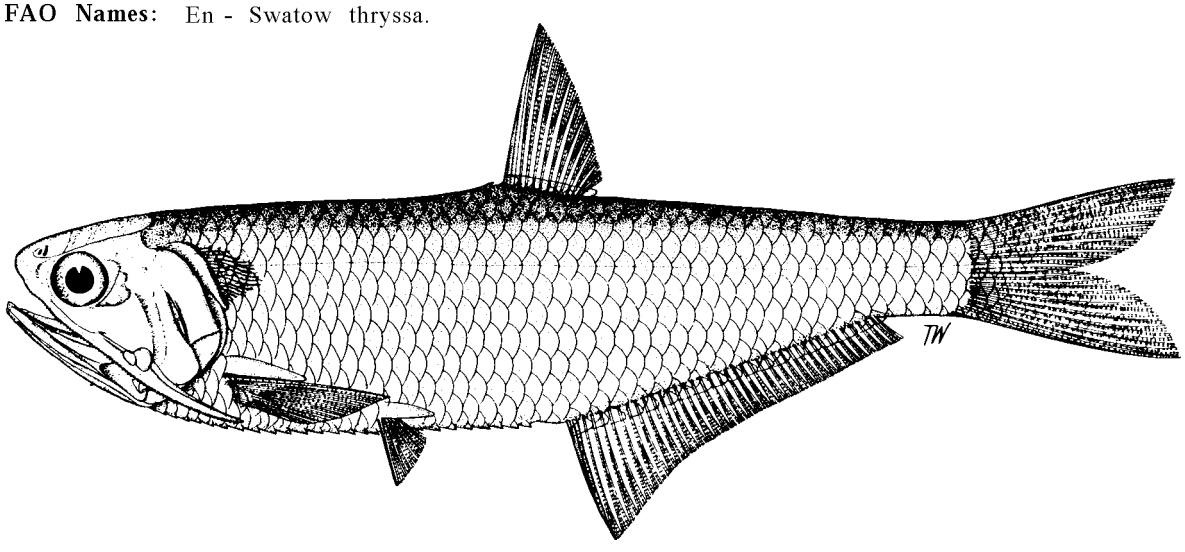
Thryssa adelae (Rutter, 1897)

ENGR Thrys 14

Trichosoma adelae Rutter, 1897, Proc.Acad.nat.Sci.Philad. : 65 (Swatow).

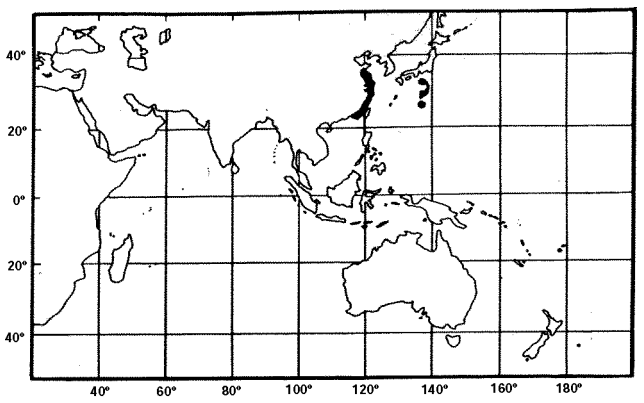
Synonyms : Setipinna adelae:Fowler, 1931a:80 (on Rutter); Thryssa adelae-Wongratana, 1980:272, pl. 238 (revision).

FAO Names: En - Swatow thryssa.



Diagnostic Features : Body compressed, belly with 17 (rarely 18) plus 9 (rarely 10 or 11) =26 or 27 (rarely 28) keeled scutes from isthmus to anus. Maxilla long, reaching beyond base of first pectoral finray; first supra-maxilla small, oval. Lower gillrakers 20 to 22. Anal fin with iii (rarely iv) 34 to 41 finrays. A dark blotch behind upper part of gill opening. Of species found in Chinese waters, T. chefuensis has a short maxilla (tip not reaching beyond gill cover; also, 27 to 30 gillrakers), while T. dussumieri and T. setirostris have much longer maxillae (to at least midpoint of pectoral fin); T. hamiltonii has fewer gillrakers (only 11 to 15).

Geographical Distribution : West Pacific (Taiwan Island and northern waters of China, but exact northern extent not known).



Habitat and Biology : Marine, pelagic, presumably schooling, perhaps mainly in inshore waters. More data needed, based on correct identifications.

Size : To 11 cm standard length, perhaps more.

Interest to Fisheries : Presumably contributes to artisanal fisheries, but extent unknown.

Local Names :

Literature :

Remarks : The species is probably hidden in various synonymies, chiefly those of hamiltonii, which it resembles superficially.

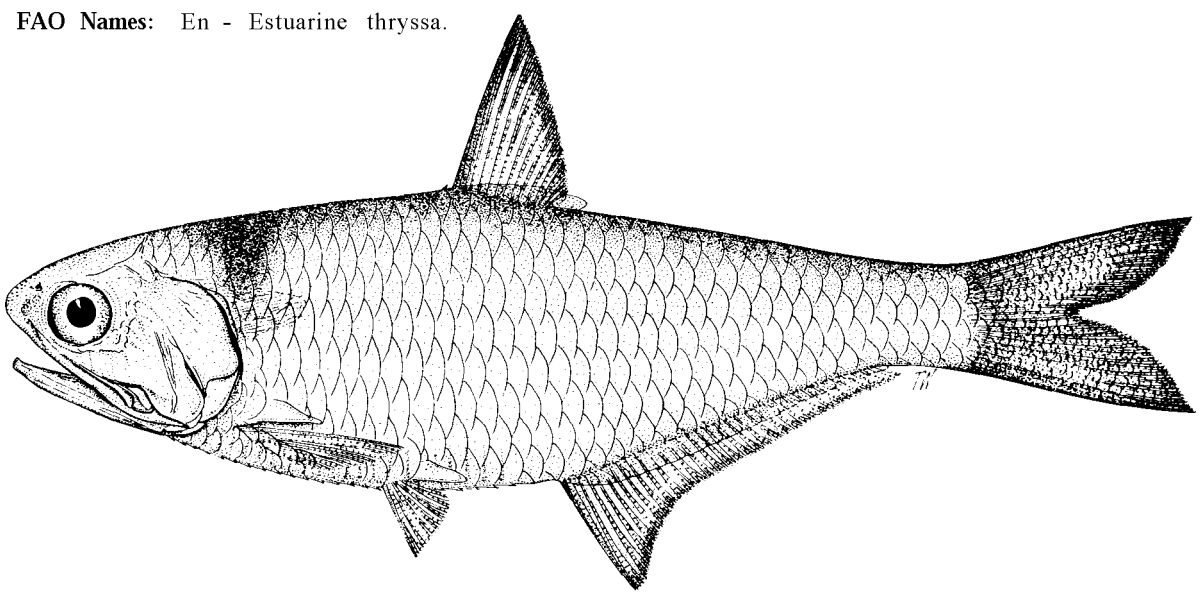
Thryssa aestuaria (Ogilby, 1911)

ENGR Thrys 10

Anchovia aestuaria Ogilby, 1911, Proc.R.Soc.Qd., 23(1):4 (Brisbane River, Queensland, Australia).

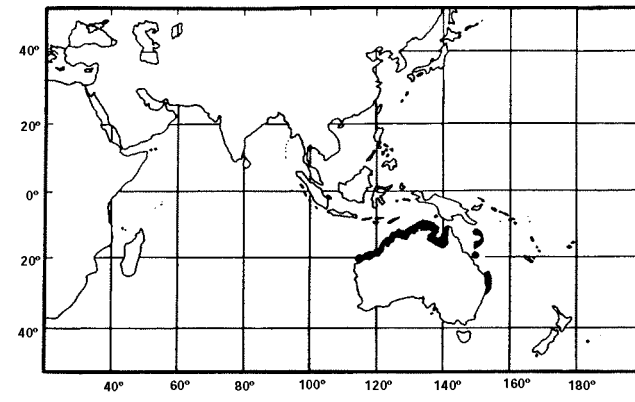
Synonyms : ? Thrissina aestuaria:Munro, 1956:27, fig.187 (but scutes only 5 plus 8); Thryssa aestuaria: Wongratana, 1980:265 (Brisbane River, Queensland; part only, the figures and some of description based on T. brevicauda).

FAO Names: En - Estuarine thryssa.



Diagnostic Features : Body fairly compressed, belly with 14 to 16 plus 8 or 9 = 22 to 25 keeled scutes from isthmus to anus. Maxilla short, reaching to hind border of pre-operculum; first supra-maxilla short, about half length of second. Lower gillrakers 26 to 29; pseudobranch very short. Anal finrays iii to iv 30 to 34. A diffuse dark saddle on nape; no dark blotch behind gill opening. Closely resembles T. brevicauda (very long pseudobranch) and T. marasriae (saddle blotch near to dorsal fin origin, branched anal finrays 26 to 28); of other species in the area, neither T. rastrosa (gillrakers 55 to 61) and T. scratchleyi (gillrakers 18 to 22) nor T. hamiltonii (maxilla to gill opening) have a dark saddle on back. Species of Setipinna have a filamentous first pectoral finray, while Papuengraulis has a tiny dorsal fin (5 or 6 finrays).

Geographical Distribution : Australia (northern coasts from Onslow east to Gulf of Carpenteria; and eastern coasts from Brisbane south to 30° S; but presumably to the north also).



Habitat and Biology : Presumed marine, pelagic, coastal, but also estuarine, thus tolerating lowered salinities. More data needed.

Size : To 13.8 cm standard length.

Interest to Fisheries : Probably little.

Local Names :

Literature :

Remarks : See under T. brevicauda for further separation of these two species.

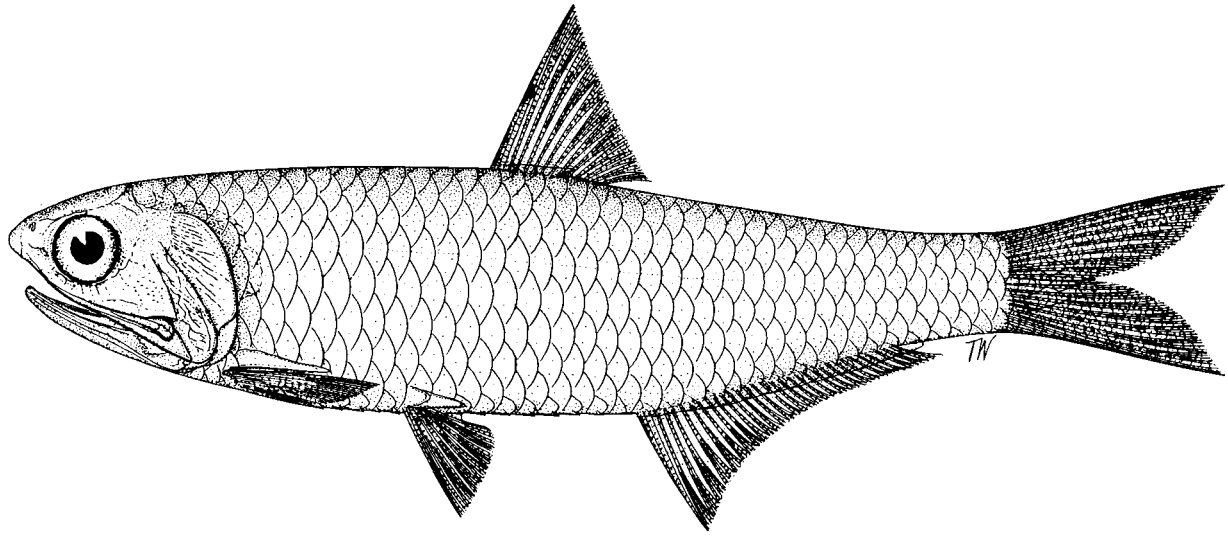
Thryssa baelama (Forsskål, 1775)

ENGR Thrys 6

Clupea baelama Forsskål,1775, Descript.anim.:72 (Djidda, Red Sea).

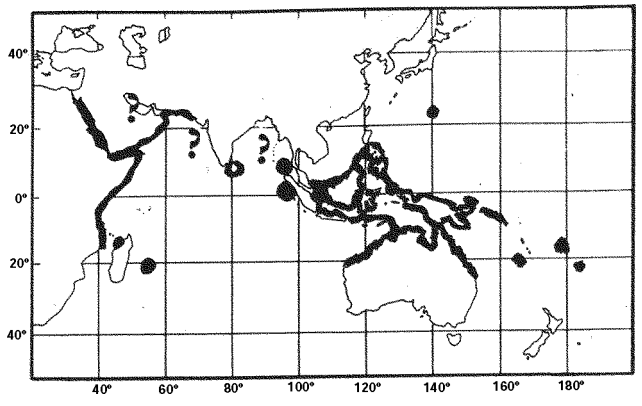
Synonyms : Clupea tuberculosa Lacepède, 1803, Hist.nat.poiss.,5:425,460 (on Commerson's description, Mauritius); Engraulis nesogallicus Bennett, 1832:162 (Mauritius; perhaps this species); Engraulis samam Montrouzier, 1857:209 (Woodlark Island or Moiou); Engraulis polynemoides Günther, 1868:394 Madagascar); Anchovia apiensis evermanni Jordan & Seale, 1906:188, fig.4 (Apia, Samoa); Engraulis macrops Kishinouye, 1911:385, fig.3 (as micropus) (Hahajima, Bonin Islands); Thrissina aestuaria:Munro, 1956:27, fig.187 (southern Queensland, northern New South Wales; not Anchovia aestuaria Ogilby = Thryssa aestuaria). Thrissocles baelama:Fowler, 1941d:683 (the Philippines, Mauritius; large synonymy); Thrissina baelama:Whitehead, 1965b:271 (Red Sea); Idem, 1967a:140 (basis for tuberculosa of Lacepède); Losse, 1968:110 (East Africa); Kami, Idehara & DeLeon, 1968:96 (Guam); Whitehead, 1973b:227, fig.52 (synopsis); Lewis, Smith & Ellway, 1983:18 (New Guinea to Tonga); Thryssa baelama-Wongratana, 1980:258, pls 223,224 (revision).

FAO Names : En - Baelama anchovy.



Diagnostic Features : Body not strongly compressed, belly rounded before pelvic fins, with 4 to 9 (usually 5 to 7, mostly 6) plus 7 to 10 (usually 9) = 12 to 18 (usually 14 to 17) keeled scutes, the pre-pelvic scutes ending below the pectoral fin base or behind it. Maxilla short, reaching to just beyond front border of pre-operculum, tip pointed. Gillrakers 18 to 26 (mostly 20 to 24). Closely resembles T. encrasicholoides, which has 1 or 2 small but armless keeled scutes immediately behind the isthmus; also, maxilla tip blunter. Other species of Thryssa have a complete series of pre-pelvic scutes from isthmus to pelvic fin base; Stolephorus species lack post-pelvic scutes; Lycothrissa has canine teeth. See ENGR Thrys 6, Fishing Area 51, also ENGR Thris 1, Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean (perhaps the "Gulf", certainly the Red Sea, coasts of East Africa to Madagascar and Mauritius; also Sri Lanka, Andaman Islands, but no Indian specimens), and in western central Pacific (Indonesia, the Philippines, Papua New Guinea, northern and eastern coasts of Australia, eastward to Tonga; no records from South China Sea or to the north, but the Ogasawara (Bonin Islands) record of Kishinouye (1911 - as Engraulis macropus) seems reliable.



Habitat and Biology : Marine, pelagic, presumably schooling, mostly inshore in bays, lagoons, harbours, mangrove pools and estuaries, thus apparently able to tolerate lowered salinities. More data needed.

Size : To 10.8 cm standard length.

Interest to Fisheries : Contributes to general clupeoid catches, but no special fishery. Used as a **baitfish** in the Pacific; does not loose its scales easily, thus more hardy than Stolephorus species.

Local Names : INDONESIA: Kendui (Madura), Ligoh, Merah (Batjan), Lompeh (Manado), Lungrah (Saparua), Puri merah (Ambon), Teri (Malay at Jakarta), Tjangkok (Sundanese); JAPAN: Ainoko iwashi or "half-caste sardine" (by bait fishermen). The Indonesian names are taken from Weber & de Beaufort (1913:34); most of them are general words used for small anchovies.

Literature : Sadasivan (1965 - notes on biology), Marichamy (1970 - abnormalities), Lewis, Smith & Ellway (1983 - suitability as baitfish).

Remarks : Since T. encrasicholoides was included in E. baelama by most authors until separated by Nelson (19831, some of the previous distributional and other data must be questioned.

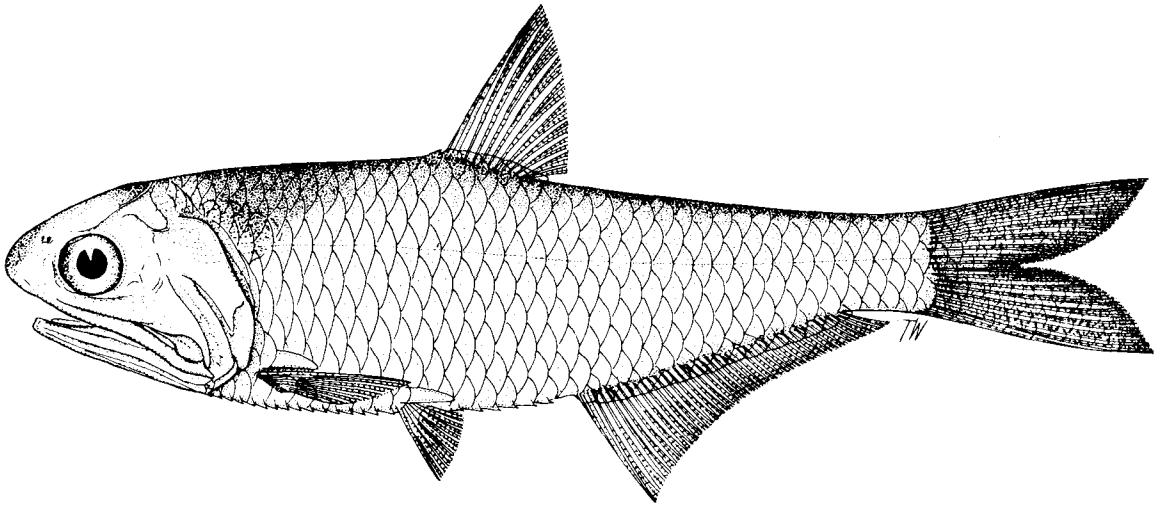
Thryssa brevicauda Roberts, 1978

ENGR Thrys 23

Thryssa brevicauda Roberts, 1978, Smithson.Contr.Zool., (281):29, fig.10c (mangrove creek, lower Fly River, Papua New Guinea).

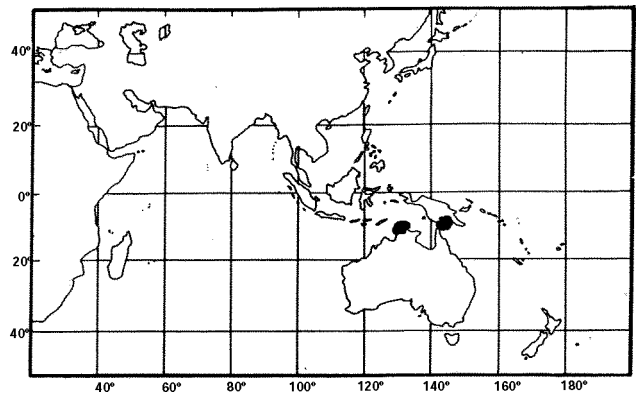
Synonyms : Thryssa aestuaria: Wongratana, 1980:265, pls 231, 232 (brevicauda element only; on which the drawings were based).

FAO Names : En - Short-tail thryssa.



Diagnostic Features : Body fairly compressed, belly with 14 to 16 plus 9 = 23 to 25 keeled scutes from isthmus to anus. Maxilla short, reaching to hind border of pre-operculum; first supra-maxilla short, about half length of second. Lower gillrakers 27; pseudobranch long. Anal finrays iii to iv 29 to 32. A diffuse dark saddle on nape; no dark blotch behind gill opening. Closely resembles T. aestuaria (very short pseudobranch) and T. marasriae (saddle blotch near to dorsal fin origin, branched anal finrays 26 to 28); of other species in the area, neither T. rastrosa (gillrakers 55 to 61) and T. scratchlevi (gillrakers 18 to 20), nor T. hamiltonii (maxilla to gill opening) have a dark saddle on the back. Species of Setioinna have a filamentous first pectoral finray, while Papuengraulis has a tiny dorsal fin (5 or 6 finrays).

Geographical Distribution : Papua New Guinea (Fly River) and northern Australia (near Darwin).



Habitat and Biology : Presumed marine, pelagic, coastal, but at least the juveniles entering mangrove creeks of rivers, thus tolerating lowered salinities. More data needed.

Size : To 7.5 cm standard length, but presumably bigger.

Interest to Fisheries : Probably little.

Local Names :

Literature :

Remarks : Very close to T. aestuaria, with which it occurs in northern Australia. It also differs from that species in having fewer scales (34 to 35 in lateral series; cf. 37 to 38) and the striae on the scales forming a reticulate pattern (cf. regular vertical striae in T. aestuaria, as also in the closely related T. marasriae).

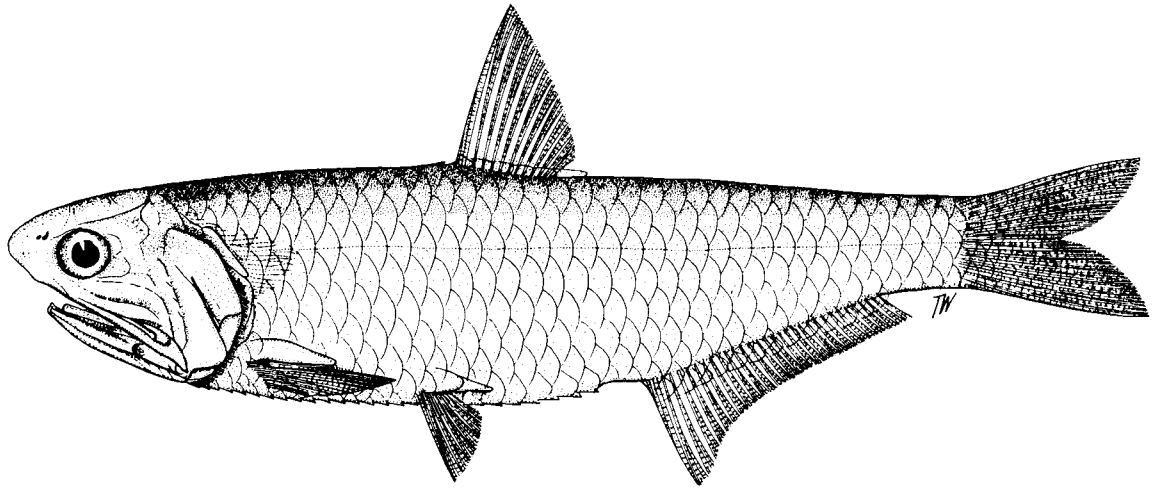
Thryssa chefuensis (Günther, 1874)

ENGR Thrys 8

Engraulis chefuensis Günther, 1874, Ann.Mag.nat.Hist., (4)13:158 (Chefoo, China).

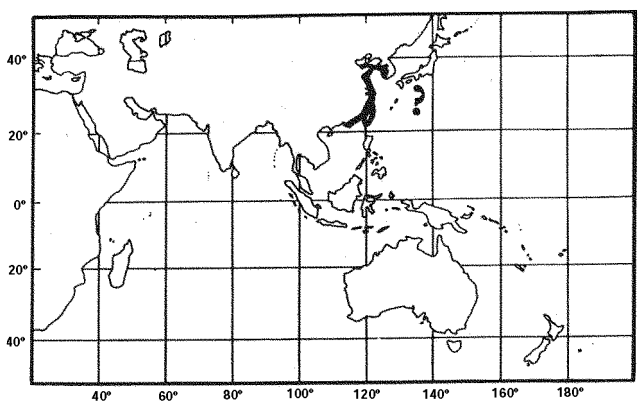
Synonyms : ? Engraulis koreanus Kishinouye, 1907:101, pls 20, fig.2 and 21, fig.6 (Kinshu Peninsula, South Korea; types lost, possibly could be T. hamiltonii); ? Thrissa kammalensis:Shen, 1959:26 (Taiwan; maxilla short, gillrakers 28 to 32); Thryssa chefuensis-Wongratana, 1980:262, pls 225,226 (revision).

FAO Names : En - Chefoo thryssa.



Diagnostic Features : Body compressed, belly with 16 to 18 plus 9 or 10 = 25 to 28 keeled scutes from isthmus to anus. Maxilla short, not reaching back beyond hind border of pre-operculum; first supra-maxilla long, at least half length of second. Lower gillrakers 27 to 30, the serrae not distinctly clumped. Anal finrays iii 25 to 31. Of species found in Chinese waters, T. hamiltonii, T. adelae, T. dussumieri and T. setirostris all have a longer maxilla (beyond or well beyond gill opening). Species of Setipinna have a filamentous first pectoral finray.

Geographical Distribution : Western Pacific (Hong Kong to Korea).



Habitat and Biology : Presumably marine, pelagic and schooling, but more data needed (based on correct identifications).

Size : To 10.7 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature : Not recorded by Chu, Tchang & Chen (1963) for the East China Sea, but perhaps mixed with T. hamiltonii.

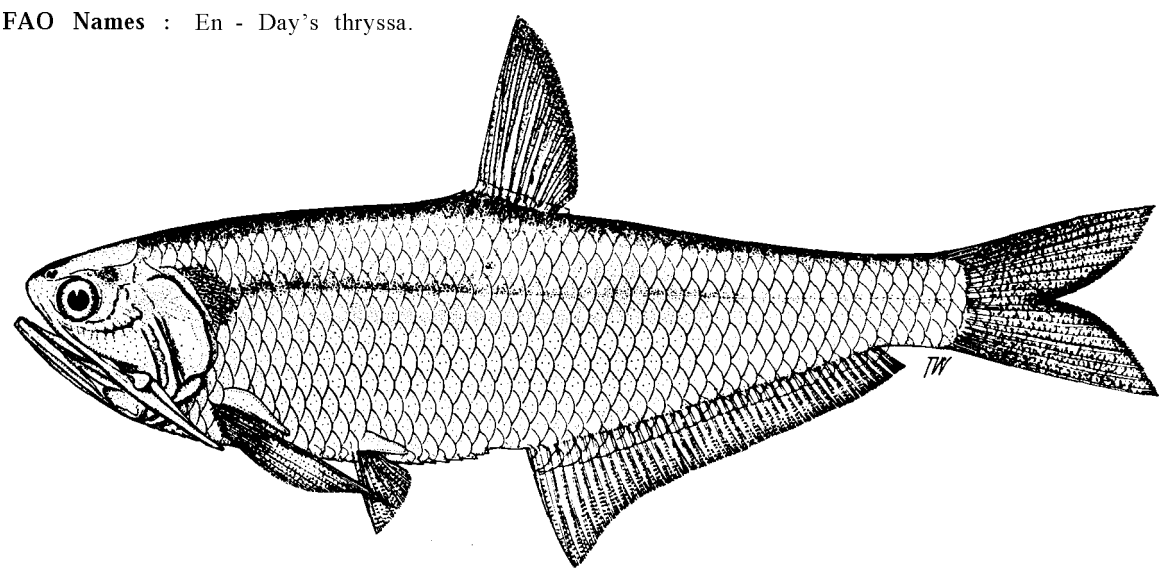
Thryssa dayi Wongratana, 1983

ENGR Thrys 20

Thryssa (Scutengraulis) dayi Wongratana, 1983, Japan J.Ichthyol., 29(4):404, fig.24 (Bombay, Karachi).

Synonyms : Thryssa purava or T. mystax: perhaps identified as such by earlier authors; Thryssa dayi:Wongratana, 1980:290, pls 257,258 (revision; name not validly published).

FAO Names : En - Day's thryssa.



Diagnostic Features : Body compressed, belly with 15 or 16 plus 10 or 11 = 25 to 27 keeled scutes from isthmus to anus. Tip of snout a little above level of eye centre, nearly to upper rim of eye. Maxilla long, reaching to pectoral fin base; first supra-maxilla minute, oval; teeth in jaws enlarged, especially in lower jaw. Gillrakers 14 to 18. Tip of first pectoral finray elongated into a short filament (about equal to eye diameter) in some specimens; anal fin rays iii 41 to 46 (mostly 42 to 44). A dark blotch indistinct or absent behind upper part of gill opening; gill arches pinky orange, basibranchials black, inside of gill cover pale yellow or golden; a pair of dark lines along back. Of Arabian Sea species with a long maxilla (to pectoral fin base), T. mystax and T. vitrirostris have not more than 40 (usually not more than 35 and 38) branched anal finrays; T. purava has a shorter maxilla (not to base of pectoral fin), but otherwise overlaps T. dayi in many characters. In no other species of Thryssa is the first pectoral finray filamentous (cf. Setipinna, where the filament is usually at least half the fin length).

Geographical Distribution : Indian Ocean (entire western coast of India north to Pakistan, possibly to Gulf of Oman).

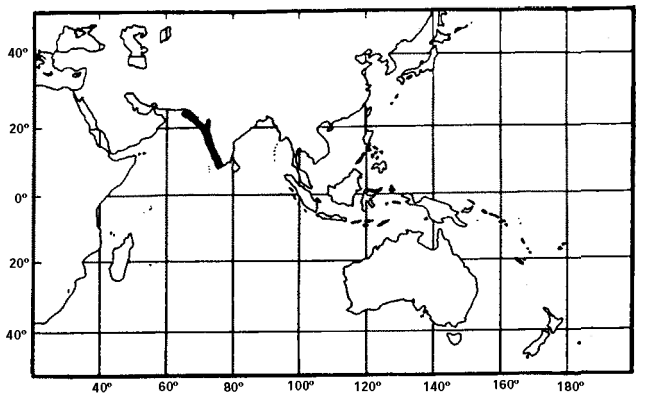
Habitat and Biology : Marine, pelagic, presumably schooling and inshore. More data needed.

Size : To 21.5 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature :



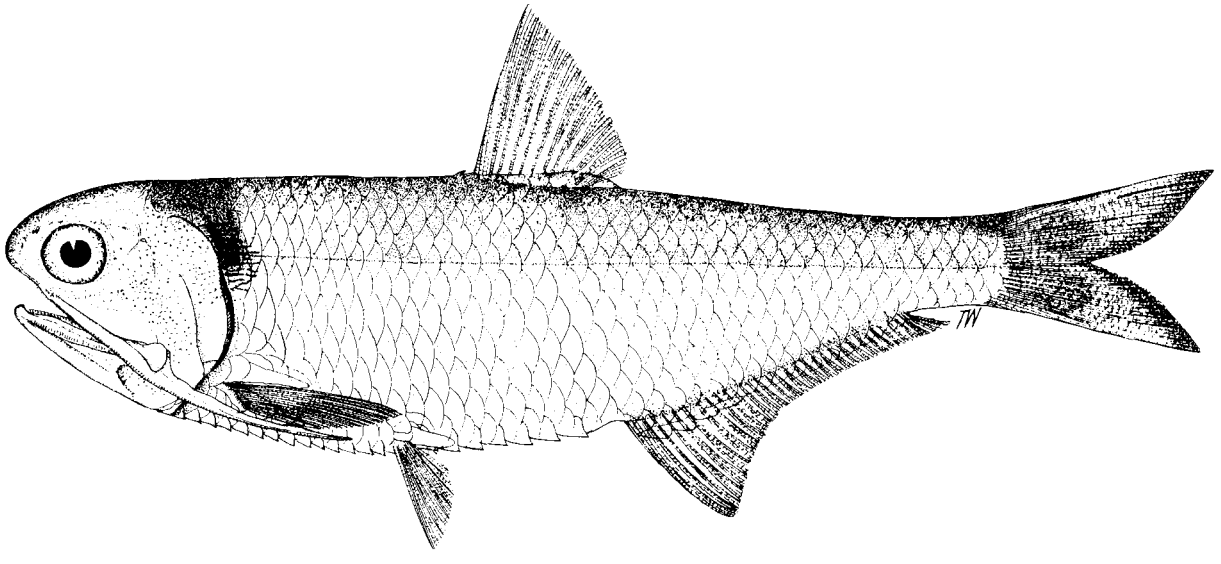
Thryssa dussumieri (Valenciennes, 1848)

ENGR Thrys 7

Engraulis dussumieri Valenciennes, 1848, Hist.nat.poiss., 21:69 (no locality).

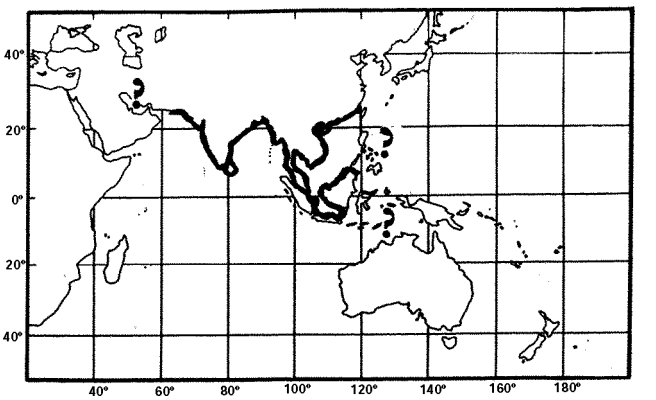
Synonyms : Engraulis auratus Day, 1865:312 (Cochin, India); Whitehead & Talwar, 1976:118-119, 121, No. 15 (auratus types); Engraulis dussumieri:Weber & de Beaufort, 1913:41 (Bleeker specimen); Thrissocles dussumieri: Fowler, 1941d:681 (Bombay, Calicut); Thrissa dussumieri:Chu, Tchang & Chen, 1963:112, fig.8 (East China Sea, but excluding adelae); Thrysa dussumieri-Whitehead,1967a:142, fig.14c (jaw) (putative neotype); Idem, 1968a:23 (Arabian Sea, Bay of Bengal); Idem, 1969a:265, fig.47 (Singapore, Merbok estuary); Talwar & Whitehead, 1971:77 (types of auratus); Whitehead, 1973b:232, fig. 56 (synopsis); Wongratana,1980:273, pls 239, 240 (revision); Whitehead & Bauchot, 1986:48 (no Valenciennes type in Paris).

FAO Names : En - Dussumier's thryssa.



Diagnostic Features : Body compressed, belly with 15 or usually 16 (rarely 14) plus 6 to 9 (usually 7 or 8) = 21 to 24 (usually 22 or 23) keeled scutes from isthmus to anus. Maxilla very long, reaching at least halfway along pectoral fin and to pelvic fin base in adults; first supra-maxilla absent; lower jaw slender. Gillrakers 17 to 19 (rarely 20), the serrae on the inner edge in distinct clumps. Anal finrays iii '29 to 37 (usually 31 to 35). A dark blotch behind upper part of gill opening, sometimes joined to a dark saddle on nape. Only T. setirostris has such a long maxilla, but lower jaw rises steeply within mouth, gillrakers only 10 to 12 and their serrae not clumped. See ENGR Thrys 7, Fishing Area 51.

Geographical Distribution : Indian Ocean (coasts of Pakistan, India, Burma and south to Penang; apparently not yet found in Gulf of Oman or the "Gulf") and western Pacific (Malaysia, Indonesia north to Taiwan, but no records from Papua New Guinea or northern coasts of Australia).



Habitat and Biology : Marine, pelagic, presumably schooling, mostly inshore, perhaps tolerating estuarine conditions. Feeds on diatoms when young and prawn larvae, copepods and cypris when larger (Bapat & Bal, 1950). The number of museum specimens suggest that it is fairly common (but not in Bombay waters - Bapat & Bal, 1950).

Size : To 11 cm standard length, perhaps more.

Interest to Fisheries : Probably one of the commonest of Thryssa species, thus perhaps of some significance in artisanal catches.

Local Names :

Literature : Chacko (1950 - juveniles, presumably this species), Bapat & Bal (1950 - food), Dharmamba (1960 - breeding).

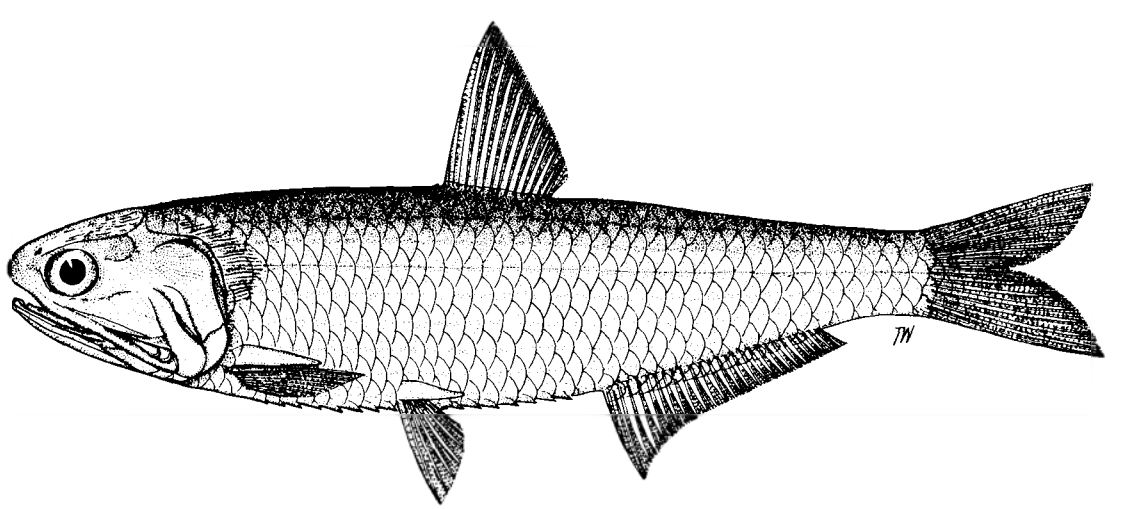
Thryssa encrasicholoides (Bleeker, 1852)

ENGR Thrys 22

Engraulis encrasicholoides Bleeker, 1851, Natuurk.Tijdschr.Ned.-Indië, 2:214 (Sulawesi; name only, thus a nomen nudum); Idem, 1852, Ibid., 3:173 (Jakarta, Surabaya, Kammal, Kupang); Idem, 1852, Verh.batav.Genoot. Kunst.Wet.,24:37 (Timor; presumed to post-date the previous publication).

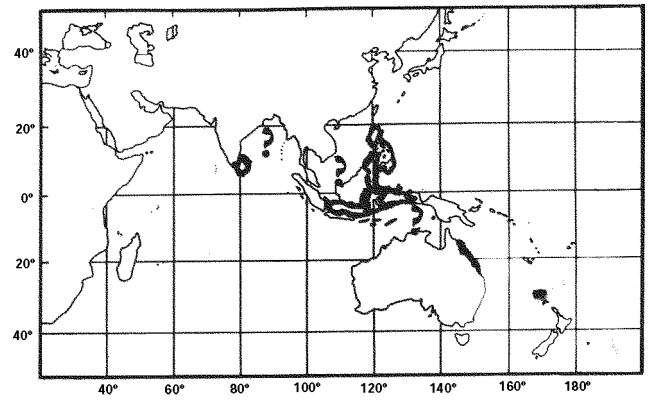
Synonyms : Anchoa duodecim Cope, 1869:405 (claimed Beesley's Point, New Jersey; evidently untrue - see Nelson, 1983); Engraulis baelama (part):Weber & de Beaufort,1913:33 (mixed material); Thrissocles baelama (part):Fowler, 1941d:683 (at least the Jakarta specimen); Thrissina baelama (part):Whitehead, Boeseman & Wheeler, 1966:116 (Bleeker's Celon specimen); Whitehead,1973b:228 (Ceylon); Thryssa baelama (part): Wongratana, 1980:258 (at least the Bleeker Sulawesi and Amboina specimens); Thrissina encrasicholoides:Nelson, 1983:99, fig.1 (upper jaw) (the Philippines, Sulawesi, "Indonesia", Queensland).

FAO Names : En - False baelama anchovy.



Diagnostic Features : Almost identical to E. baelama except in the following: 1 or 2 keeled scutes (lacking arms) immediately behind the isthmus, first and second supra-maxilla relatively longer, tip of maxilla blunter and perhaps not always reaching to front border of pre-operculum; also, fewer branched anal finrays (24 to 28; cf. 26 to 31 in T. baelama) and fewer pre-caudal but more caudal vertebrae (15 to 17 and 23 to 25 = 39 to 41; cf. 12 to 14, rarely 15 and 26 to 28, rarely 25 = 39 to 41 in T. baelama). Other species of Thryssa have a complete series of pie-pelvic scutes from isthmus to pelvic fin base; Stolephorus species lack post-pelvic scutes; Lycothrissa has canine teeth.

Geographical Distribution : Indian Ocean (Ceylon, India) and western Pacific (Java, Sulawesi, Timor, Ambon, the Philippines, northern Queensland). Presumably more widespread in Indian Ocean, but not previously separated from T. baelama.



Habitat and Biology : Probably similar to T. baelama, but not separated from it in previous records.

Size : To 10.7 cm standard length.

Interest to Fisheries : Presumably less than for E. baelama , but more data needed.

Local Names : See T. baelama.

Literature : Confused with T. baelama.

Remarks : The presence of 1 or 2 pre-pectoral scutes in some specimens of E. baelama was noted by Whitehead, Boeseman & Wheeler (1966:118) and Whitehead (1973b:ZZII). Nelson (1983) added differences in maxilla and supra-maxilla shape, as well as numbers of branched anal finrays and pre-caudal and caudal vertebrae, concluding that two species are present.

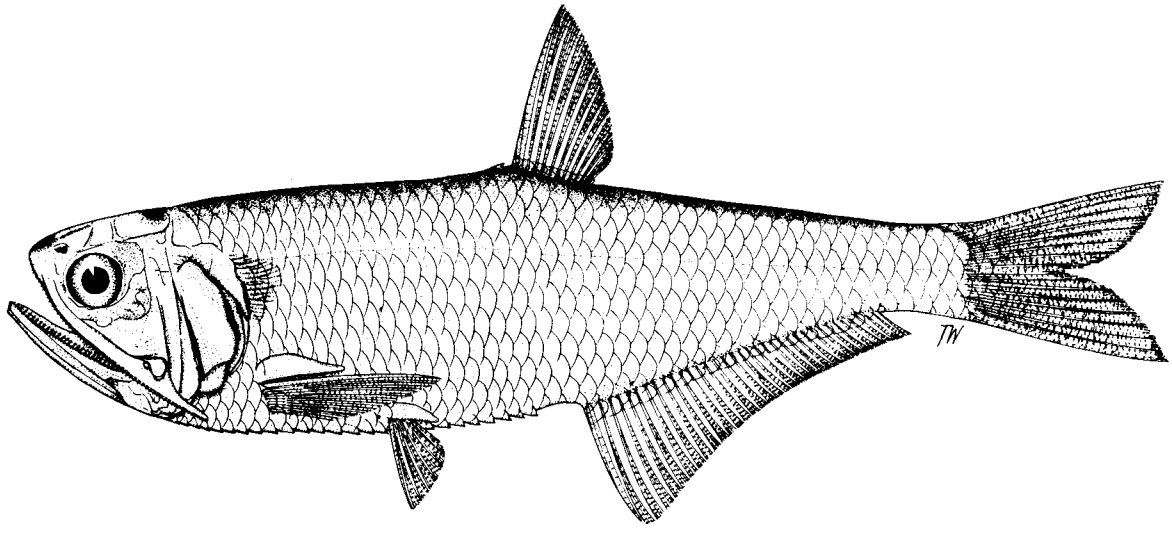
Thryssa gautamiensis Babu Rao, 1971

ENGR Thrys 16

Thryssa gautamiensis Babu Rao, 1970, Adv.Abstr.Contr.Fish.aquat.Sci.India, 4(1):63 (Godavari River; name only); Idem, 1971, Copeia, (3):479, fig.1 (Godavari and Hooghly Rivers).The name must date from 1971, its use in 1970 being a nomen nudum (Article 13(a)(i) of the International Code).

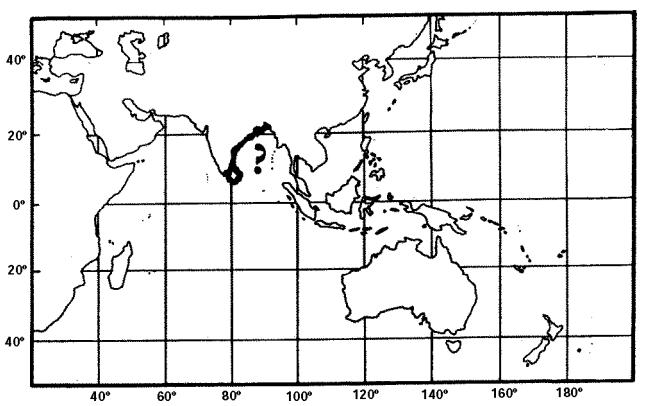
Synonyms : Thryssa gautamiensis-Wongratana, 1980:279, pls 245,246 (revision).

FAO Names: En - Gautama thryssa.



Diagnostic Features : Body compressed, belly with 14 to 17 (usually 16, rarely 14) plus 10 (rarely 11) = 25 to 27 (usually 26, rarely 24) keeled scutes from isthmus to anus. Tip of snout at about level of upper rim of eye, well above eye centre. Maxilla moderate, projecting slightly beyond edge of gill cover; first supra-maxilla minute, oval; jaw teeth slightly enlarged compared with other species. Lower gillrakers 17 to 20, usually 18 or 19. Anal with iii (rarely iv) 34 to 37 (rarely 33) finrays. A dark blotch behind upper part of gill opening; a pair of dark lines on back, from nape to caudal fin. Closely resembles T. malabarica, which has a deeper body (depth 34 to 37% of standard length; cf. only 23 to 28% in T. gautamiensis), smaller jaw teeth and small spots on cheek, gill cover, maxilla and paired fins. Other Indian species have a longer or shorter maxilla, or a higher or lower gillraker count.

Geographical Distribution : Indian Ocean (eastern coasts of India, possibly also Burma).



Habitat and Biology : Marine, pelagic and presumably schooling, mostly inshore and entering estuaries. More data needed.

Size : To 21.5 cm standard length.

Interest to Fisheries : Contributes to artisanal clupeoid catches in the Godavari estuary (Babu Rao, 1971).

Local Names :

Literature :

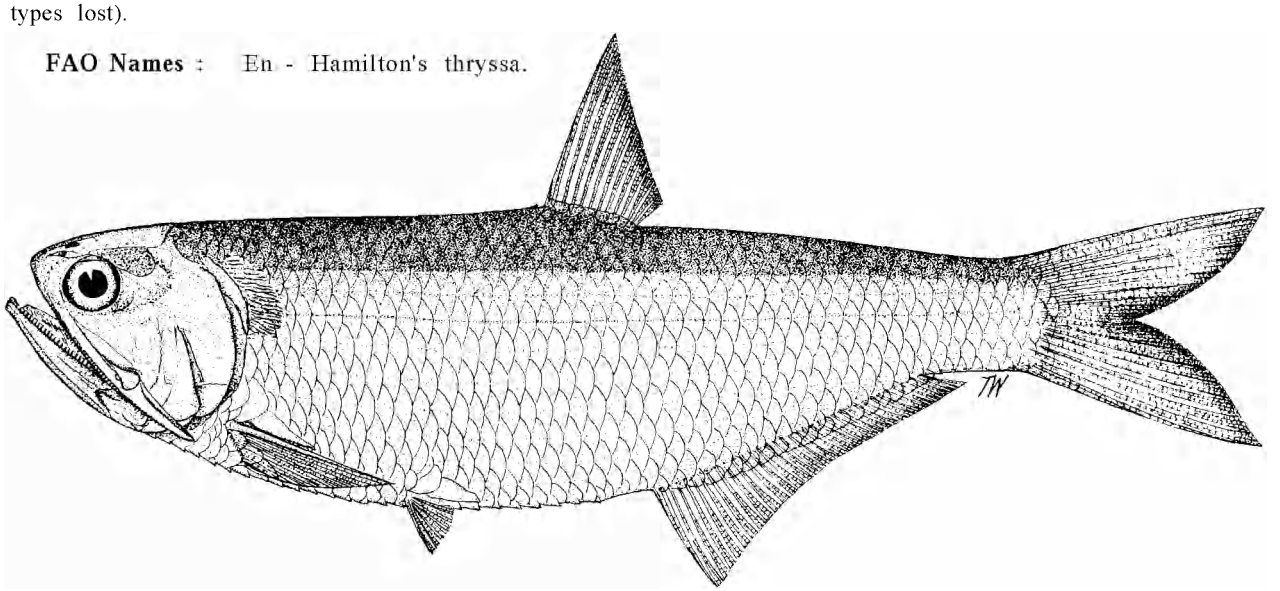
Thryssa hamiltonii (Gray, 1835)

ENGR Thrys 4

Thrissa hamiltonii Gray, 1835, Illustr.Ind.Zool., Hardwicke, 2:pl.92 fig.3 (no locality).

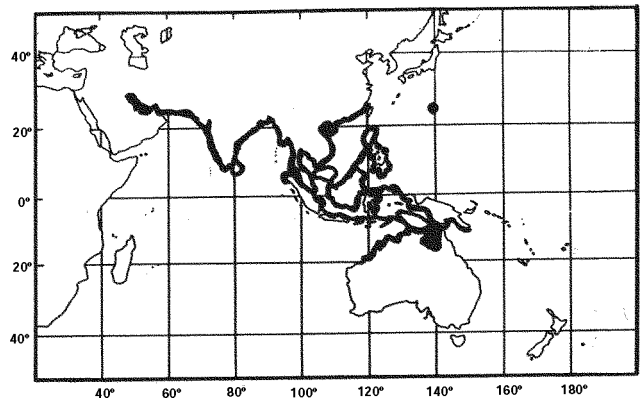
Synonyms : Engraulis gravi Bleeker, 1851:492 (Jakarta, Riau); Weber & de Beaufort, 1913:37, fig.17 (Sumatra); ? Engraulis nasuta Castelnau, 1878:51 (Norman River, Gulf of Carpenteria); Thrissocles hamiltonii: Fowler, 1941d:673 the Philippines, Kalimantan, Korea, Bombay; large synonymy, but probably many references not this species); Thryssa mystax:Chu, Tchang & Chen, 1963:111, fig.85 (East China Sea); Whitehead, 1966a:42 (Canton, Reeves specimens; misidentified); Scutengraulis hamiltonii:Munro, 1956:27, fig.191 (northern Australia); Idem, 1964: Papua New Guinea; Idem, 1967:46, pl.3, fig.39 (same); Thrissa hamiltonii:Shen, 1959:26 (Taiwan); Thryssa hamiltonii-Tortonese, 1964:22 (Fly River, Papua New Guinea); Whitehead, 1965b:273 (the "Gulf"); Whitehead, Boeseman & Wheeler, 1966:122, pl.15, fig.3 (Bleeker's figure) (lectotype for gravi); Whitehead, 1969a:266, fig.48 (Singapore); Idem, 1973b:234, fig.58 (synopsis); Roberts, 1978:29 (Fly River mouth; also his specimen of T. spinidens); Wongratana, 1980:282, pls 249,250 (revision); Whitehead & Bauchot, 1986:49 (nasuta, types lost).

FAO Names : En - Hamilton's thryssa.



Diagnostic Features : Body compressed, belly with 16 to 19 (rarely 15 or 20) plus 8 or 9 (rarely 10) = 23 to 26 (mostly 24) keeled scutes from isthmus to anus. Tip of snout above level of eye centre, usually at about level of upper rim of eye. Maxilla short or moderate, reaching to edge of gill cover or projecting slightly beyond; first supra-maxilla small, oval. Lower gillrakers 12 to 14 (less often 11 or 15). Anal with iii (rarely iv) 32 to 39 (mostly 35 to 37) finrays. A dark blotch behind upper part of gill opening; pigment lines along back. Overlaps the geographical ranges of 17 other Thryssa species, but most of these have more gillrakers and/or a longer or much longer maxilla. Most closely resembles T. mystax, in which the maxilla reaches the pectoral fin base and the tip of the snout is much lower (about level with eye centre); T. spinidens is also similar, but has much larger jaw teeth and more anal finrays (iii 41 to 45). See ENGR Thrys 4, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean (from the "Gulf" and Pakistan eastward to Burma, the Andamans and Pinang) and western Pacific (Indonesia south to Papua New Guinea and northern coasts of Australia, but perhaps not eastward to the New Hebrides, etc.; northward to Thailand, Sarawak, presumably the Philippines and certainly to Taiwan Island; also a record from the Bonin Islands).



Habitat and Biology : Marine, pelagic and presumably schooling, inshore and entering estuaries. More precise data needed, based on correct identifications; if referring to this species, then Bapat & Bal (1950) found its principle food to be prawns and copepods, supplemented by polychaetes and amphipods.

Size : To 20 cm standard length.

Interest to Fisheries : Contributes to artisanal catches of clupeoids and appears to be a rather common species of Thryssa (if identificatons are correct).

Local Names :

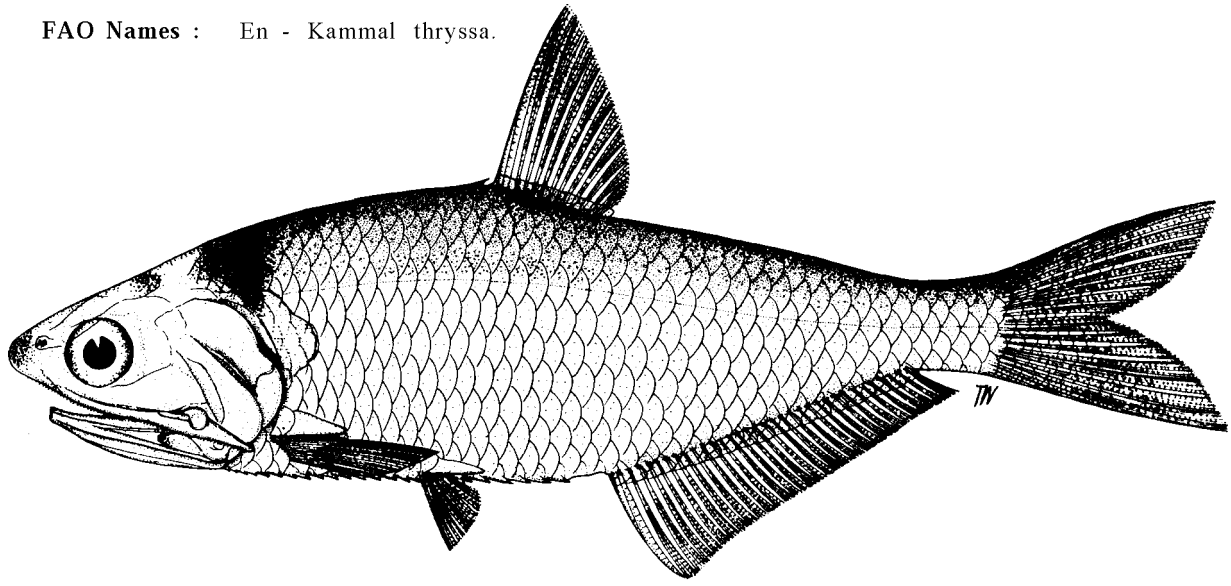
Literature : Devanesen & Varadarajan (1942 - eggs), Mookerjee & Mookerjee (1950 - general biology), Bapat & Bal (1950 - food), Vijayaraghavan, 1957 - as gravi, eggs), Masurekar & Rege (1960 - breeding). It is not certain, however, that the identifications were correct.

Thryssa kammalensis (Bleeker, 1849) | ENGR Thrys 12

Engraulis kammalensis Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., 22:13 (Madura Strait near Kammal and Surabaya).

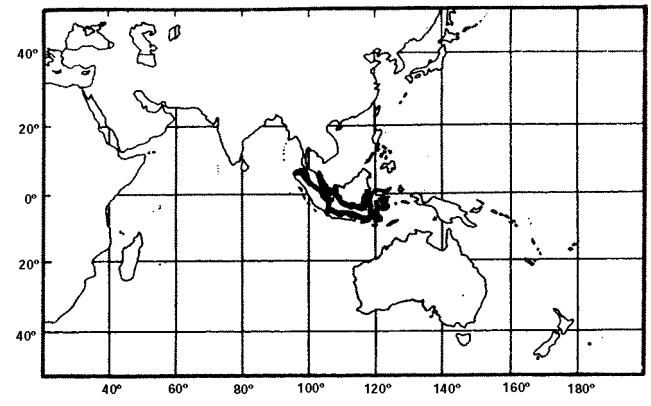
Synonyms : Engraulis rhinorhynchos Bleeker, 1852a:434 (Sampit, Jakarta, Surabaya, Kammal; replacement name for kammalensis); Idem, 1852b:40 (Jakarta, Surabaya, Kammal; repeat); Weber & de Beaufort, 1913:35 (Bleeker specimen); Thrissocles kammalensis:Fowler, 1941d:672 (large synonymy, but many non-Indonesian records included, some being T. kammalensoides; compiled); Scutengraulis kammalensis:Munro, 1964:149 (Papua New Guinea); Thryssa kammalensis-Whitehead, Boeseman & Wheeler, 1966:116,121, pl. 15, fig.2 (Bleeker figure) (types of kammalensis and rhinorhynchos); Whitehead, 1969a:207, fig.49 (Penang, Singapore); Wongratana, 1980:267, pls 233,234 (revision).

FAO Names : En - Kammal thryssa.



Diagnostic Features : Body compressed, belly with 15 or 16 (rarely 17) plus 8 or 9 (rarely 7) = 23 to 25 (rarely 24 or 26) keeled scutes from isthmus to anus. Maxilla moderate, reaching just to gill opening or a little beyond in large fishes; first supra-maxilla about half of second. Lower gillrakers 26 to 32 (usually 29 or more). Anal finrays usually iii 30 to 33. A diffuse dark "saddle" on nape. The latter is shared with T. aestuaria, which has a less pointed maxilla tip and more filaments in the pseudobranch (14 to 23; cf. only 4 to 10). All marine species of Thryssa in the area have a long maxilla, reaching distinctly beyond the gill opening. Species of Setipinna have a filamentous first pectoral finray.

Geographical Distribution : Indian Ocean (Penang only), western Pacific (southern Thailand to Singapore, southern Kalimantan, Java and Sulawesi).



Habitat and Biology : Marine, pelagic, presumably schooling and mostly inshore. More data needed, based on correct identifications.

Size : To 8.3 cm standard length, perhaps to 10 cm.

Interest to Fisheries : Presumably contributes to artisanal catches in Indonesia.

Local Names :

Literature :

Remarks : Records of this species from India refer to the rather similar T. kammalensoides, which lacks a first supra-maxilla, has more scutes and fewer gillrakers.

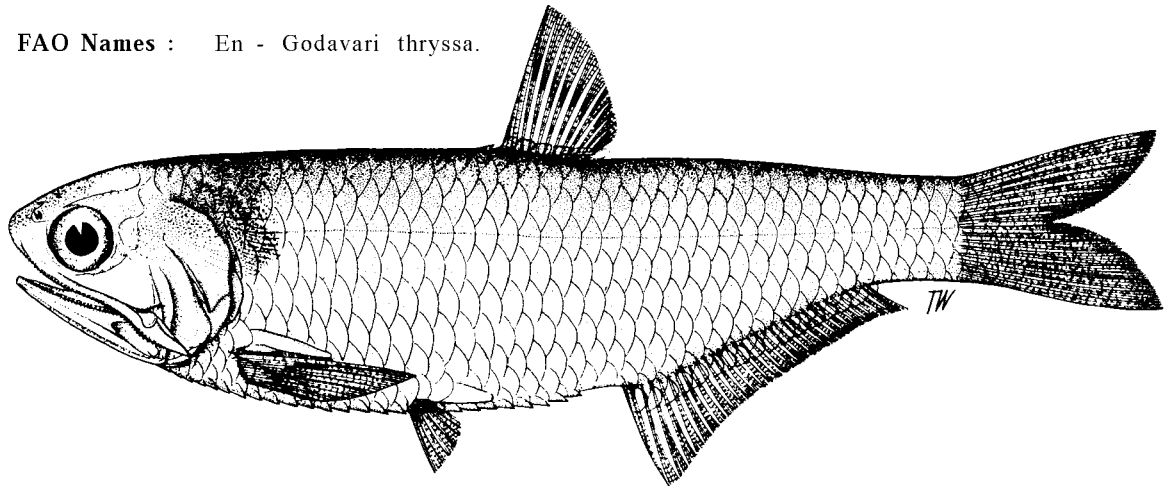
Thryssa kammalensoides Wongratana, 1983

ENGR Thrys 13

Thryssa (Scutengraulis) kammalensoides Wongratana, 1983, Japan J.Ichthyol., 29(4):401, fig.20 (Godavari estuary, eastern coast of India).

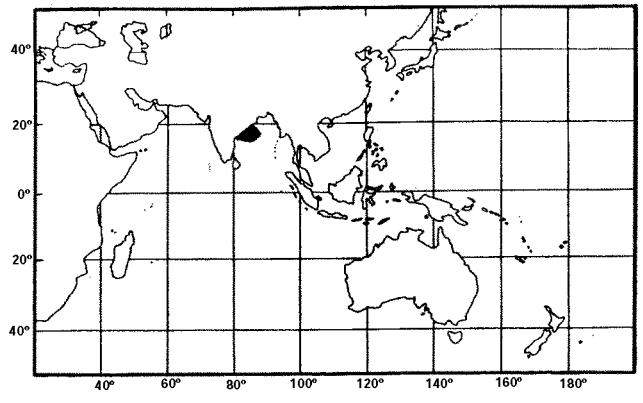
Synonyms : Thryssa kammalensoides:Wongratana, 1980:268, pl. 235 (revision; name not validly published).

FAO Names : En - Godavari thryssa.



Diagnostic Features : Body compressed, belly with 16 to 18 plus 10 or 11 = 26 to 29 keeled scutes from isthmus to anus. Maxilla moderately short, tip pointed and reaching just to edge of gill cover; first supra-maxilla absent. Lower gillrakers 24 or 25, their serrae not clumped. Tip of pelvic fin falling short of vertical from dorsal origin; anal finrays iii 31 or 32.A dark "saddle" on nape, extending to area behind upper part of gill opening. Of species in the area with a maxilla reaching or only slightly surpassing the edge of the gill cover, only T. polybranchialis has more than 20 gillrakers (25 to 27), but a much higher anal finray count (iii 35 to 39) and the tip of the snout above the level of the eye. Species of Setipinna have a filamentous first pectoral finray.

Geographical Distribution : Indian Ocean (Godavari estuary on eastern coast of India only, but presumably more widespread).



Habitat and Biology : Estuarine, but no indication if this signifies a marine or a riverine fish.

Size : To 11.2 cm standard length (the two types; other specimens not yet recorded).

Interest to Fisheries : Probably contributes to artisanal catches.

Local Names :

Literature :

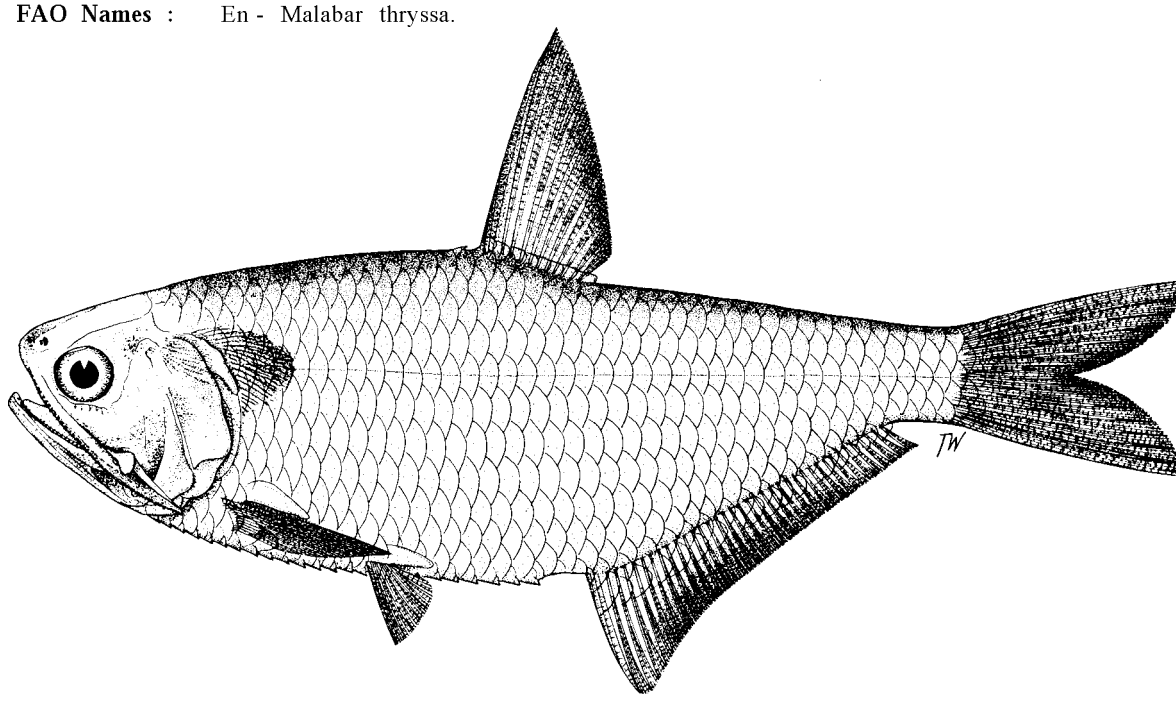
Thryssa malabarica (Bloch, 1795)

ENGR Thrys 5

Clupea malabarica Bloch, 1795, Naturg.ausländ.Fische, 9:115, pl. 432 (Tranquebar).

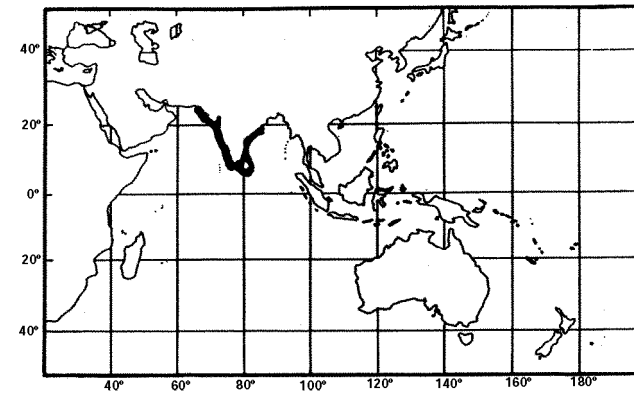
Synonyms : Thryssa cuvieri Swainson, 1839:293 (on Poorwa of Russell, 1803:75, p1.194); Fowler, 1941d:671 (compiled); Whitehead, 1968a:22 (Bay of Bengal); Idem, 1969b:274, fig.2 (head), pl.36 (the figure from Schneider, 1801); Idem, 1973b:235, fig.59 (synopsis; kempi, rambhae, scratchleyi and gautamiensis wrongly included in synonymy); Wongratana, 1980:281, pls 247,248 (revision).

FAO Names : En - Malabar thryssa.



Diagnostic Features : Body compressed, belly with 15 or 16 (rarely 14 or 17) plus 9 (rarely 8 or 10) = 23 to 26 (mostly 24) keeled scutes from isthmus to anus. Tip of snout at about level of upper rim of eye, well above eye centre. Maxilla moderate, projecting a little beyond edge of gill cover, but not to pectoral fin base; first supramaxilla small, oval; jaw teeth small. Lower gillrakers 17 to 19. Anal finrays iii 34 to 38. A dark blotch behind upper part of gill opening; small spots on cheek, gill cover, maxilla and paired fins; gill arches pinky orange, inside of gill cover yellow and gold; inner part of anal fin deep yellow, the margin milky white. Closely resembles T. gautamiensis, which is more slender (depth 23 to 28% of standard length; cf. 34 to 37% in T. malabarica), has larger teeth, and lacks dark spots on the "face". Other Indian species have a longer or shorter maxilla, or a higher or lower gillraker count. See ENGR Thrys 5, Fishing Area 51, also Fishing Areas 57/71 (but excluding Papua New Guinea).

Geographical Distribution : Indian Ocean (coasts of India, perhaps reaching to Pakistan in the west, but not recorded from the "Gulf" or the Red Sea, its place in the "Gulf" being taken by T. whiteheadi).



Habitat and Biology : Marine, pelagic and schooling, mostly inshore and perhaps entering estuaries.

Size : To 17.5 cm standard length.

Interest to Fisheries : Contributes to artisanal clupeoid catches.

Local Names :

Literature : Although the name malabarica features in the literature, there can be no certainty that it refers to the present species.

Remarks : The pectoral fins are sometimes black (specimens from Tuticorin, Mangalore, Gulf of Manar, Porto Novo); perhaps this occurs in breeding fishes. As noted by Wongratana (1980:282, pl.246), this is the only anchovy known to have an extension of the swimbladder as a small conical pocket behind the exit to the anus.

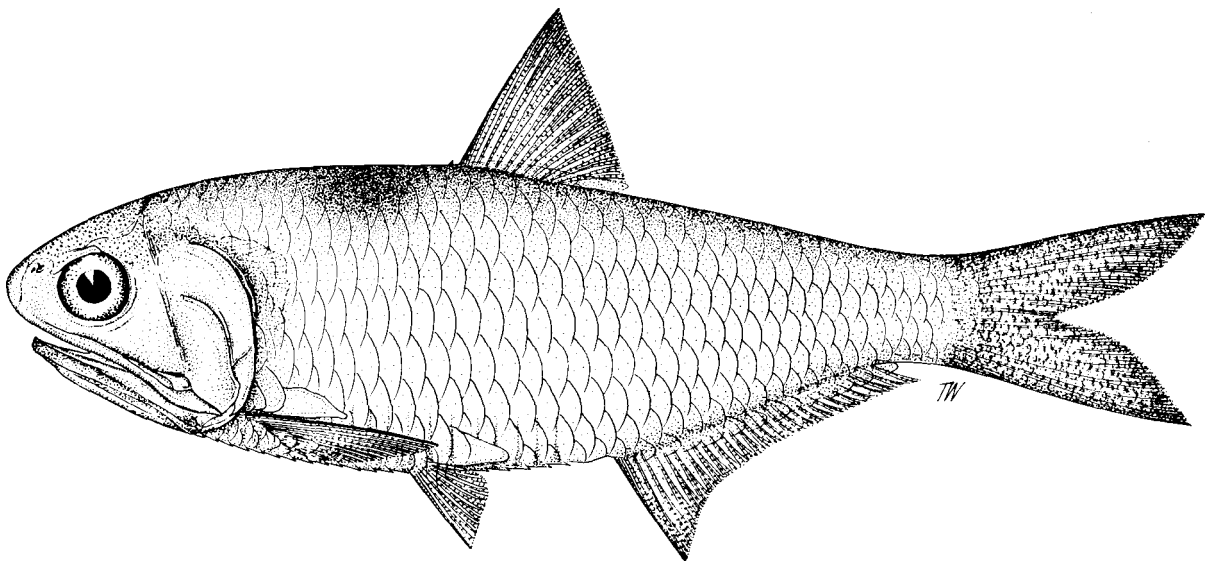
Thryssa marasriae Wongratana, 1986

ENGR Thrys 24

Thryssa marasriae Wongratana, 1986, Proc.biol.Soc.Wash., 100(1):108, fig.4 (King Creek, Shoal Bay, also Chambers Bay, near Darwin, Australia).

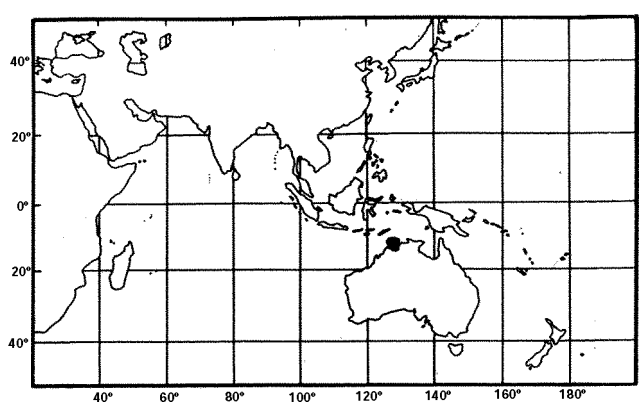
Synonyms : None.

FAO Names : En - Marasri's thryssa.



Diagnostic Features : Body fairly compressed, belly with 15 or 16 plus 8 or 9 = 23 to 25 keeled scutes from isthmus to anus. Maxilla short, reaching to hind border of pre-operculum; first supra-maxilla short, about half length of second. Lower gillrakers 25 to 28; pseudobranch moderate. Anal finrays iii to iv 26 to 28. A diffuse dark saddle just before dorsal fin origin; no dark blotch behind gill opening. Closely resembles T. aestuaria and T. brevicauda (dark saddle at nape, branched anal finrays 29 or more); of other species in the area, neither T. rastrosa (gillrakers 55 to 61) and T. scratchleyi (gillrakers 18 to 20) nor T. hamiltonii (maxilla to gill opening) have a dark saddle on back. Species of Setipinna have a filamentous first pectoral finray, while Papuengraulis has a tiny dorsal fin (5 or 6 finrays).

Geographical Distribution : Australia (northern coast around Darwin, but perhaps enters Gulf of Carpenteria).



Habitat and Biology : Presumably marine, pelagic and coastal, but its very close similarity to T. aestuaria and T. brevicauda suggests that it may also enter estuaries. More data needed.

Size : To at least 6.9 cm standard length, probably more.

Interest to Fisheries : Probably little or none.

Local Names :

Literature :

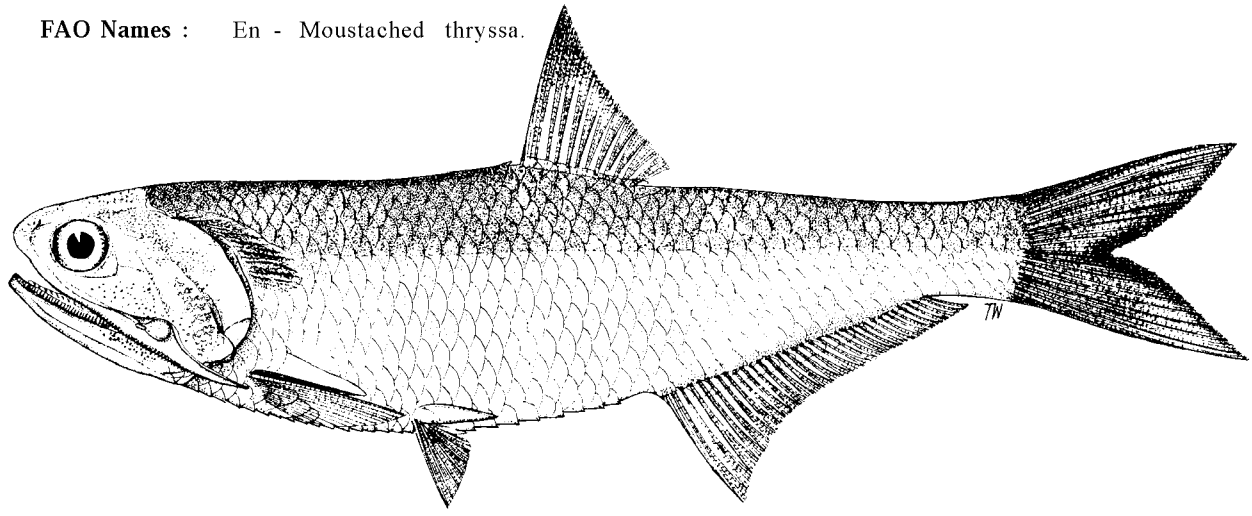
Thryssa mystax (Schneider, 1801)

ENGR Thrys 1

Clupea mystax Schneider, 1801, Syst.Ichthyol.Bloch.:426, pl.83 (Malabar).

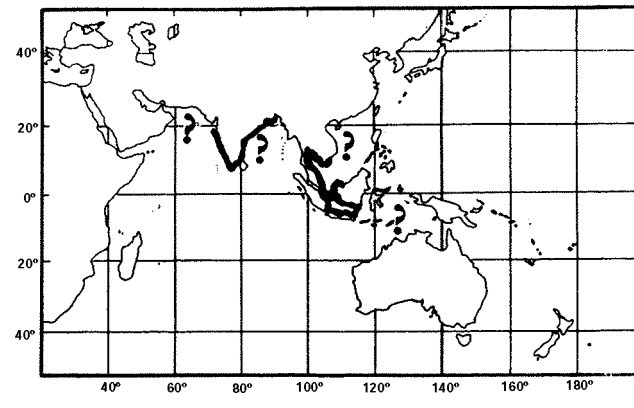
Synonyms : ? Thryssa subspinosa Swainson, 1839:293 (on Poorawah of Russell, 1803:72, pl.189); ? Thryssa poorawah Jerdon, 1851:145 (same); Engraulis mystacoides Bleeker, 1852b:42 (Jakarta, Surabaya, Samarang, Pasuruan, etc.); Stolephorus (Thryssa) valenciennesi Bleeker,1866:306 (Java, Sumatra, Singapore, Kalimantan); Engraulis hornelli Fowler, 1924:41 (Calicut); Thrissocles mystax:Fowler, 1941d:675 (Java, but presumably not Hong Kong or Bonin Islands specimens); Thryssa mystax-Whitehead, Boeseman & Wheeler, 1966:123,125, pl.16, fig.1 (Bleeker figure) (types of mystacoides and valenciennesi); Whitehead, 1969b:276 (type of mystax); Idem, 1973b:231 (synopsis); Wongratana, 1980:275, pls 241,242 (revision). Note: the unpublished name Thryssa vanamensis was proposed by Babu Rao, based on Godavari specimens ZSI. 4599/2.

FAO Names : En - Moustached thryssa.



Diagnostic Features : Body compressed, belly with 17 to 19 (rarely 16 or 20) plus 8 to 13 (most often 11) = 24 to 32 (usually 28 or 29) keeled scutes from isthmus to anus. Tip of snout on a level with eye centre. Maxilla long, reaching to or almost to base of first pectoral finray; first supra-maxilla oval, minute. Lower gillrakers 14 to 16 (rarely 13 or 17), the serrae on the inner edge even and not clumped. Anal finrays iii 29 to 37 (usually 33 to 35). A dark blotch behind upper part of gill opening. Of species in the area with a maxilla more or less reaching the pectoral fin base, and with an overlapping range of gillrakers, T. gautamiensis, T. malabarica, T. hamiltonii and T. davi all have the tip of the snout above the level of eye centre, usually level with the upper rim of the eye; in addition, the first two have more than 16 gillrakers. See ENGR Thrys 1, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Indian Ocean (western and eastern coasts of India, also Burma south to Pinang) and western central Pacific (Indonesia south to Java).



Habitat and Biology : Marine, pelagic and schooling, mostly inshore and entering estuaries. Confusions in identification make all previous biological studies suspect.

Size : To 15.5 cm standard length.

Interest to Fisheries : Enters artisanal catches along Indian coasts and is one of the commonest species of Thryssa (if identifications have been correct).

Local Names : INDIA: Khoira (Andaman Islands).

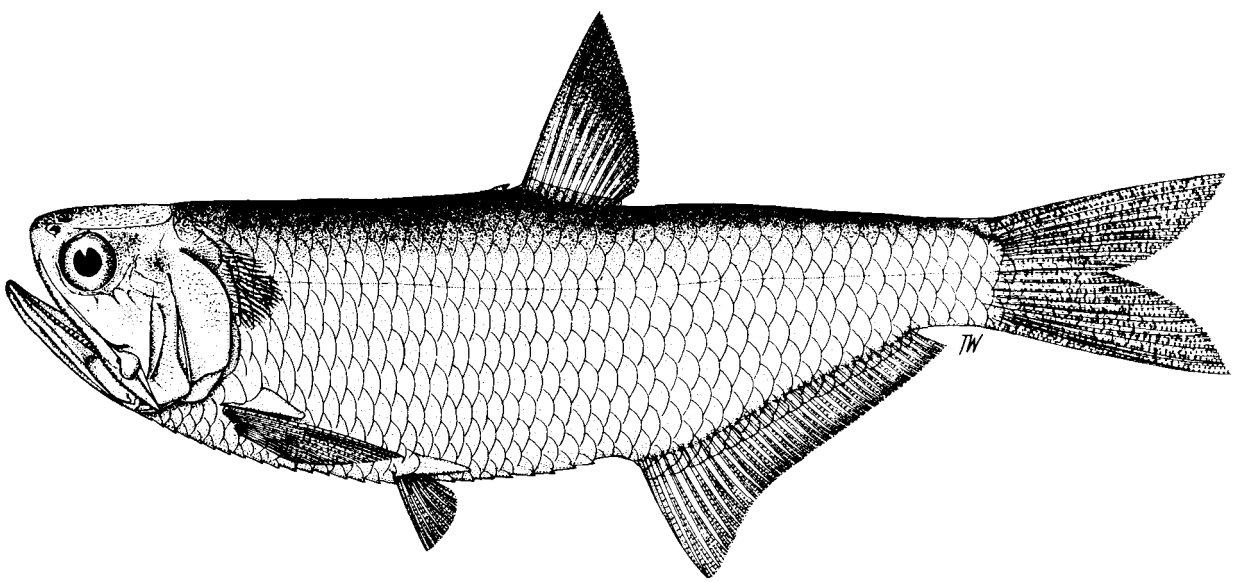
Literature : Gopinath (1946 - larvae), Venkatamaran (1956 - general biology), Dharmamba (1960 - breeding), Basheerudin & Nayar (1962 - juveniles), Ganapati & Rao (1962 -feeding), Rao (1967 - larval abundance in Mahanadi estuary). There is no certainty that the identifications were correct, however. The very useful paper by Hoda (1983) on T. mystax catches off Pakistan may not necessarily refer to this species.

Thryssa polybranchialis Wongratana, 1983 | ENGR Thrys 15

Thryssa (Scutengraulis) polybranchialis Wongratana, 1983, Japan J.Ichthyol., 29(4):402, fig.21 (Canara, Cochin, and Porto Novo and Waltair, India).

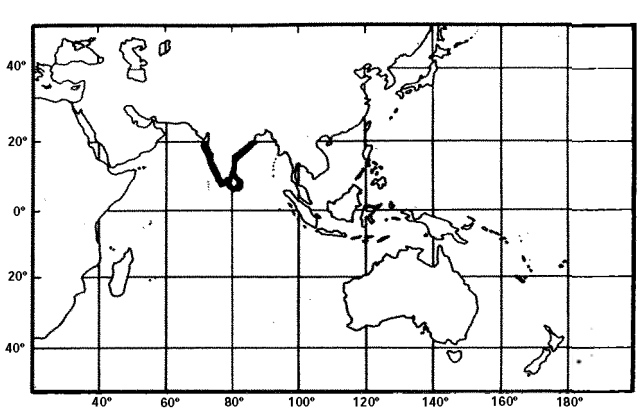
Synonyms : Thryssa polybranchialis: Wongratana, 1980:278, pls 243,244 (revision; name not validly published).

FAO Names : En - Humphead thryssa.



Diagnostic Features : Body compressed, belly with 15 to 17 plus 9 or 10 = 25 to 27 keeled scutes from isthmus to anus. A distinct hump at nape; tip of snout above upper rim of eye. Maxilla short, not quite or only just reaching to edge of gill cover; first supra-maxilla minute, oval. Lower gillrakers 25 to 27. Anal finrays iii (rarely iv) 35 to 39. A dark blotch behind upper part of gill opening. Of Indian species, only T kammalensoides has a similar short maxilla and such a high gillraker count (24 or 25). but anal finrays only iii 31 or 32. no blotch behind gill cover, and tip of snout at about level of eye centre.

Geographical Distribution : Indian Ocean (eastern and western coasts of India).



Habitat and Biology: Marine, pelagic and presumably schooling. Undoubtedly confused with other species in the past. More data needed.

Size : To 17 cm standard length.

Interest to Fisheries : Presumably contributes to artisanal clupeoid catches.

Local Names :

Literature :

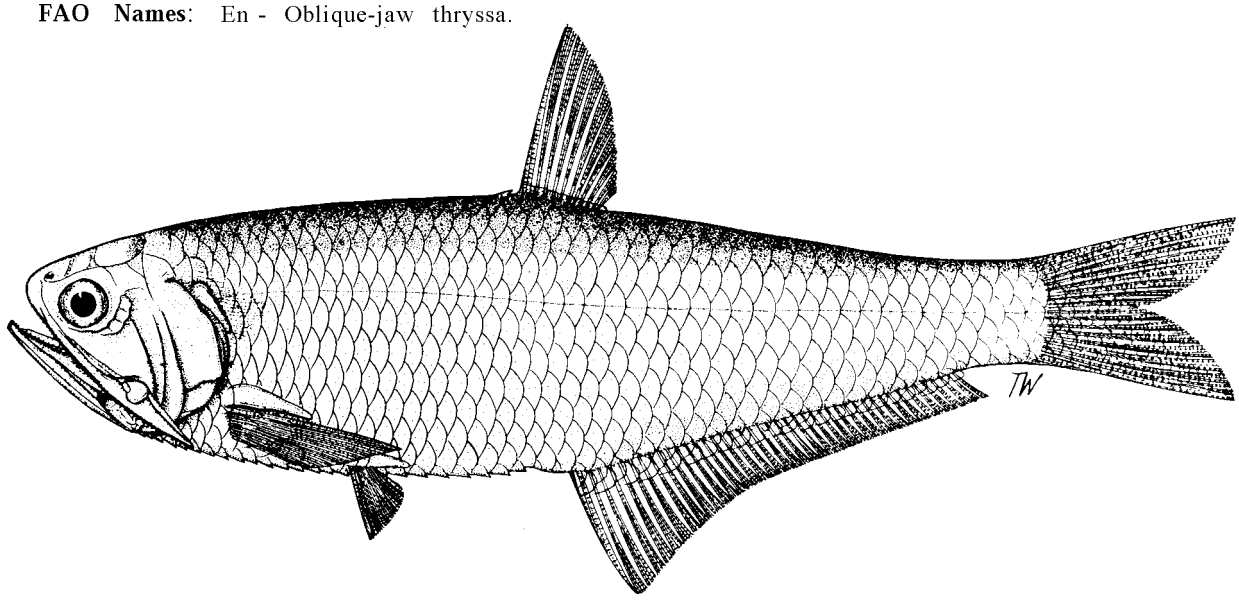
Thryssa purava (Hamilton-Buchanan, 1822)

ENGR Thrys 18

Clupea purava Hamilton-Buchanan, 1822, Fishes of the Ganges:238,382 (Ganges estuaries).

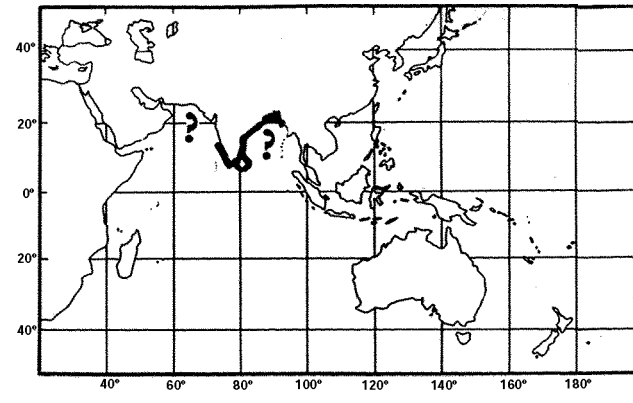
Synonyms : Thryssa megastoma Swainson, 1839293 (on Pedda poorwah of Russell, 1803:73, pl.190); Engraulis annandalei Chaudhuri, 1916:419, fig.3 (Chilka Lake); Engraulis kempi Chaudhuri, 1916:421, fig.4 (Chilka Lake); Engraulis rambhae Chaudhuri, 1916:423, fig. 5 (Chilka Lake); Thryssa purava-Whitehead, 1973b:231, fig.55 (synopsis; excluding references to saman and hornelli); Wongratana, 1980:286, pls 253,254 (revision). The types of annandalei, kempi and rambhae were documented by Babu Rao, 1971:482.

FAO Names: En - Oblique-jaw thryssa.



Diagnostic Features : Body compressed, belly with 15 to 17 (usually 16) plus 10 or 11 (rarely 9 or 12) = 26 or 27 (less often 25 or 28) keeled scutes from isthmus to anus. Tip of snout a little above level of eye centre. Maxilla moderate, projecting slightly beyond edge of gill cover, or at most to halfway to pectoral fin base; first supra-maxilla small; angle of mouth rather oblique, teeth of lower jaw slightly enlarged. Lower gillrakers 17 to 21, most often 18 or 19. Anal with iii (rarely iv) 38 to 44 (usually 41 or more) finrays. An indistinct dark blotch behind upper part of gill opening and a faint dark line along back. Of Indian Ocean species with a moderate maxilla (to beyond gill cover, but not to pectoral fin base), T. hamiltonii and T. spinidens have not more than 15 gillrakers, and T. gautamiensis and T. malabarica have fewer anal finrays (usually iii 34 to 37, sometimes 38); T. whiteheadi of the "Gulf" differs mainly in having enlarged teeth also in the upper jaw, and no first supra-maxilla; T davi of the Arabian Sea is extremely similar, but the maxilla reaches to the pectoral fin base.

Geographical Distribution : Indian Ocean (eastern coasts of India, possibly also Burma).



Habitat and Biology : Marine, pelagic, presumably schooling, mostly inshore and entering estuaries, also Chilka Lake (thus able to withstand lowered salinities). More data needed, based on correct identifications; if referring to this species, then Bapat and Bal (1950) considered it a surface plankton feeder, chiefly on prawn larvae, also small fishes (e.g. Stolephorus) and cypris).

Size : To 15.5 cm standard length.

Interest to Fisheries : Apparently common, thus presumably contributing to artisanal catches of clupeoids.

Local Names :

Literature : Palekar & Karandikar (1952 -breeding), Rao (1967 - larvae), Moona (1968 -skull). These should be treated with caution since the identification is not certain.

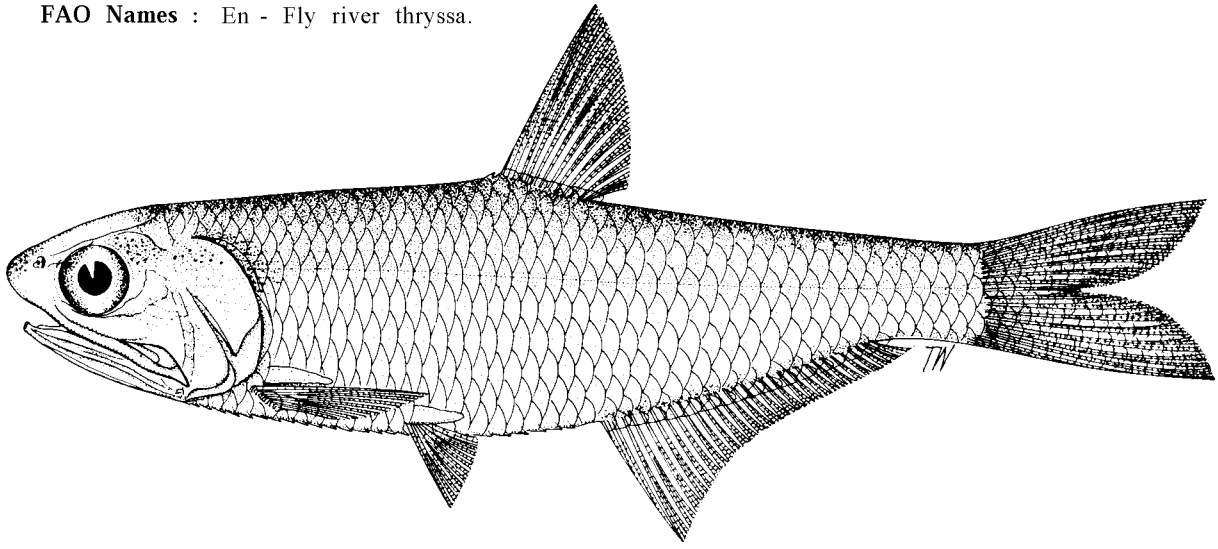
Thryssa rastrosa Roberts, 1978

ENGR Thrys 9

Thryssa rastrosa Roberts, 1978, Smithson.Contr.Zool., (281):29, fig.10b (Fly River, New Guinea).

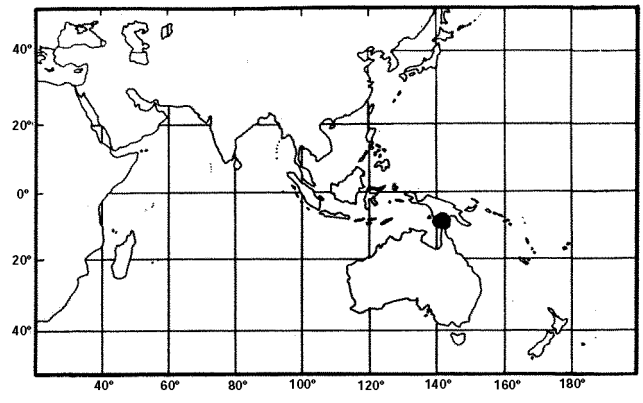
Synonyms : Thryssa rastrosa-Wongratana, 1980:263, pls 227,228 (revision).

FAO Names : En - Fly river thryssa.



Diagnostic Features : Body compressed, belly with 17 to 19 plus 10 or 11 = 27 to 29 keeled scutes from isthmus to anus. Maxilla short, not quite reaching to hind border of pre-operculum; first supra-maxilla short, not more than half length of second. Lower gillrakers very numerous, 55 to 61. Anal finrays iii or iv 29 to 32. No black area behind upper part of gill opening. Of species found in Papua New Guinea or adjacent areas, T. scratchleyi, T. aestuarius and T. kammalensis also have a short maxilla, but the lower gillrakers are not more than 32 (in fact no other species of Thryssa has more than 32); species of Setipinna have a filamentous first pectoral finray, and Papuengraulis has a tiny dorsal fin (5 or 6 finrays only) and neither has so many gillrakers.

Geographical Distribution : Fly River, Papua New Guinea.



Habitat and Biology : Known only from the upper and middle reaches of the Fly River, i.e. up to 850 km from the mouth, thus perhaps a wholly riverine species. The very high number of gill-rakers suggests filter feeding; a specimen from the upper parts of the Fly River had fed on planktonic calanoid copepods.

Size : To 11.6 cm standard length.

Interest to Fisheries : Perhaps contributes to local artisanal catches.

Local Names :

Literature : Roberts (1978 - ecological data).

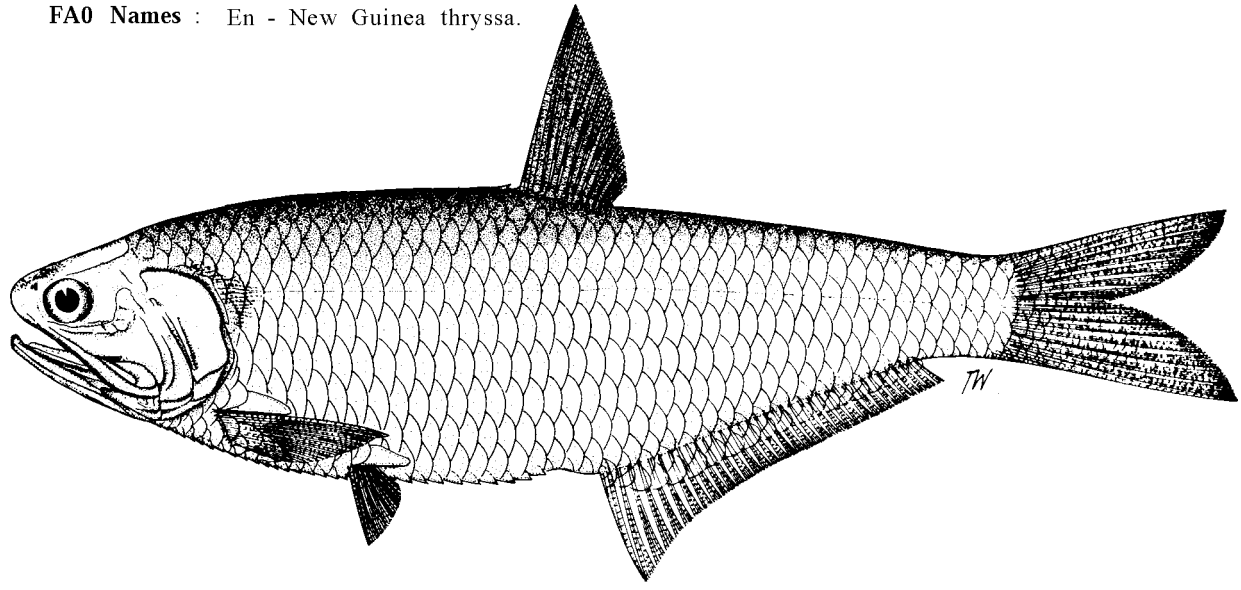
Thryssa scratchleyi (Ramsay & Ogilby, 1886)

ENGR Thrys 11

Engraulis scratchleyi Ramsay & Ogilby, 1886, Proc.Linn.Soc.N.S.W., (2)1:18 (Strickland River, Papua New Guinea).

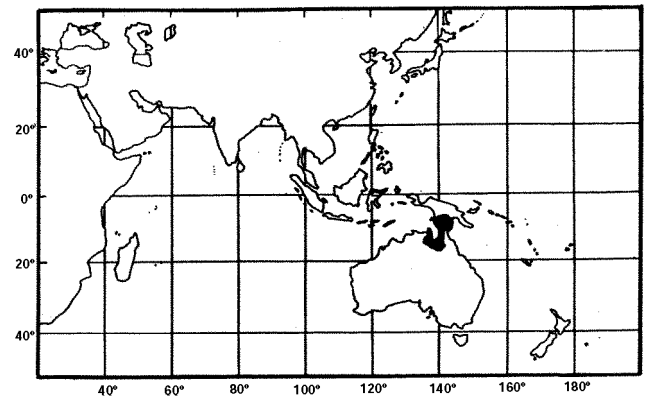
Synonyms : Engraulis scratchleyi:Weber & de Beaufort, 1913:34 (Lorentz and Strickland Rivers, compiled); Thrissocles scratchleyi:Fowler, 1941d:670 (compiled); Scutengraulis scratchleyi:Munro, 1967:47, pl.3, fig.41 (Strickland River); Thryssa scratchleyi-Taylor, 1964:68, pl.2 (above Roper River Mission, Gulf of Carpenteria); Roberts, 1978:28, fig.10a (Fly River, Papua New Guinea); Wongratana, 1980:264, pls 229,230 (revision).

FAO Names : En - New Guinea thryssa.



Diagnostic Features : Body compressed, belly with 19 plus 12 = 31 keeled scutes from isthmus to anus. Maxilla short, only reaching to front border of pre-operculum; first supra-maxilla about two thirds of second. Lower gillrakers 18 to 23. Anal finrays iii 35 to 39. No dark blotches on nape or behind upper part of gill opening. Of species in the area, T. rastrosa has more gillrakers (55 to 61), as also T. aestuaria (27 to 29), which also has a distinct dark blotch on nape, while T. hamiltonii has a longer maxilla (reaching beyond gill opening). Species of Setipinna have a filamentous first pectoral finray, and Papuengraulis has a tiny dorsal fin (5 or 6 finrays).

Geographical Distribution : Papua New Guinea (Strickland, Lorentz and Fly Rivers) and in rivers entering the Gulf of Carpenteria.



Habitat and Biology : Riverine, reaching nearly 900 km up the Fly River, but also down to the estuary; possibly catadromous. Piscivorous (at least as large adults), recorded as feeding on Clupeoides papuensis and Melanotaenia nigra in the Fly River (Roberts, 1978:14).

Size : To 37 cm standard length (Roberts, 1978:28), thus by far the largest anchovy known.

Interest to Fisheries : Its large size implies that it makes a useful contribution to artisanal riverine catches.

Local Names :

Literature : Roberts (1978 - food, ecology).

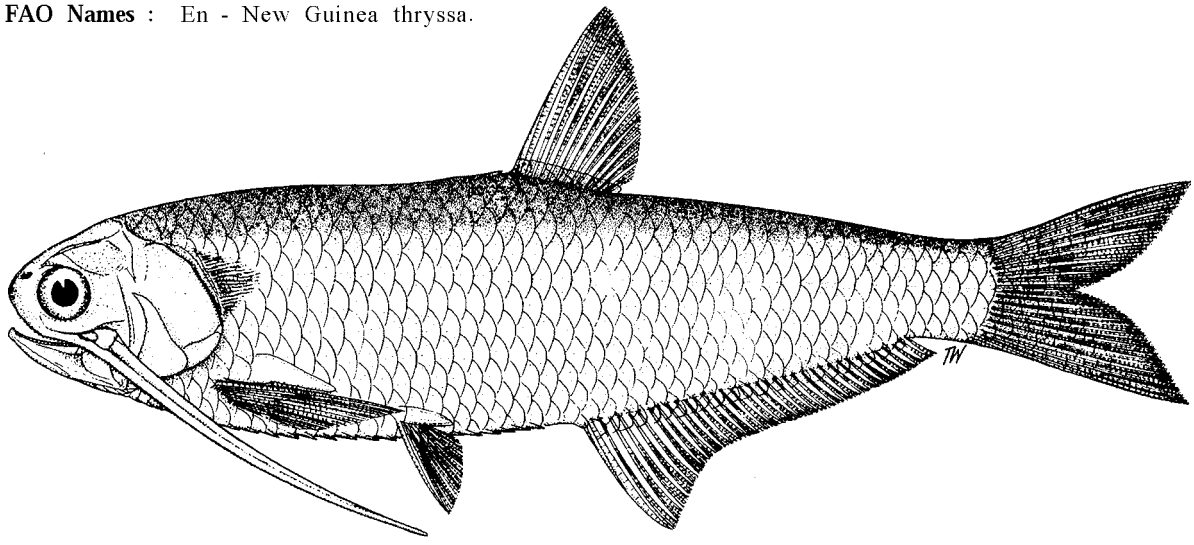
Thryssa setirostris (Broussonet, 1782)

ENGR Thrys 3

Clupea setirostris Broussonet, 1782, Ichthyol.:unpaged, pl.2 (Tana Island, New Herbrides).

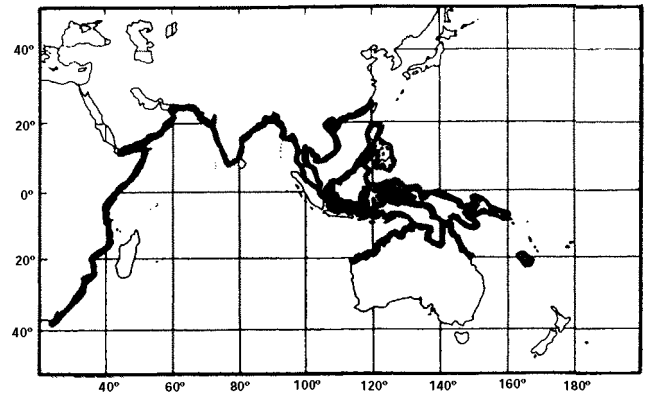
Synonyms : Clupea mystacina Schneider, 1801:428 (on J.R. Forster ms name, Tana Island); **Lichtenstein**, 1844:295 (same); Clupea seticornis Rees,1807:unpaged (under Clupea); Thryssa macrognathos Bleeker, 1849a:14 (Madura near Bangkallang, Kammal, Surabaya); Thrissocles setirostris:Fowler, 1941d:679 (Durban, Thailand, the Philippines); Thrissa setirostris:Chu, Tchang & Chen, 1963:112, fig.87 (China); Thryssa setirostris-Taylor, 1964:69 (near Darwin, Australia); Whitehead, 1965a:275 (Red Sea (?), Gulf of Aden); Idem, 1968a:22(Arabian Sea, Bay of Bengal); Losse, 1968:11, pl.4c (East Africa); Whitehead, 1973b:230, fig.53 (synopsis); Wongratana, 1980:293, pls 261,262 (revision); SFSA, 1987:206, fig.55.5 (south to perhaps East London).

FAO Names : En - New Guinea thryssa.



Diagnostic Features : Body fairly compressed, belly with 16 to 18 plus 9 or 10 = 25 to 28 keeled scutes. Distinguished from all other Thryssa species (in fact all other anchovies) by the very long maxilla, reaching at least to tip of pectoral fin, usually to pelvic fin base or even to anal fin origin (to middle of pectoral fin in T. dussumieri); also unique is the high coronoid process of the lower jaw, the jaw rising steeply in the mouth (found also in species of Coilia). Lower gillrakers 10 to 12 (usually 17 to 19 in T. dussumieri). Head with gold tints; anal and caudal fins deep yellow; a black area behind upper part of gill opening. See ENGR Thrys 3, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Widespread in Indian Ocean (eastern coasts from Gulf of Oman south to Port Alfred, but not yet in Red Sea or off Madagascar; coasts of Pakistan, India and probably Burma) and in western Pacific (Indonesia, Thailand, the Philippines to Taiwan Island; also, northern Australia, Papua New Guinea, Solomon Islands and New Hebrides).



Habitat and Biology : Marine, pelagic, presumably schooling, mostly (or always ?) close inshore, entering bays and estuaries. More data needed, including some functional explanation for the extraordinarily long maxillae. Feeds mainly on crustaceans (amphipods, zoae larvae, Acetes, fide Basheerudin & Nayar, 1962).

Size : To at least 15 cm standard length.

Interest to Fisheries : Contributes to general clupeoid catches, but no special fishery.

Local Names : INDONESIA: Puger (Bangkok - fide Weber & de Beaufort, 1913:41).

Literature : Basheerudin & Nayar (1962 - juveniles).

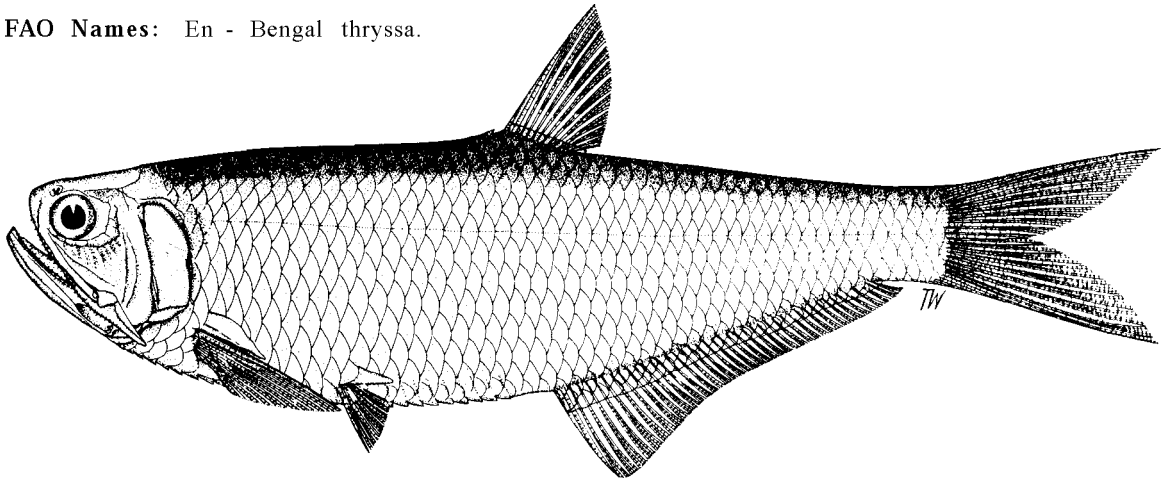
Thryssa spinidens (Jordan & Seale, 1925)

ENGR Thrys 21

Xenengraulis spinidens Jordan & Seale, 1925, Copeia, (141):29 (Calcutta, Rangoon, Thailand).

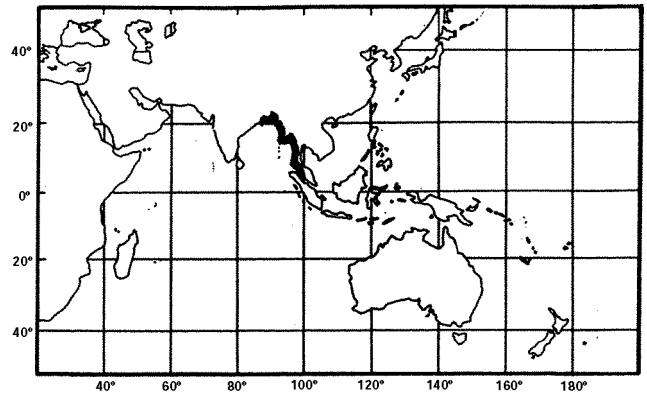
Synonyms : Xenengraulis spinidens Jordan & Seale, 1926:369 (repeat); Fowler, 1941d:668 (compiled); Thryssa spinidens-Wongratana, 1980:292, pls 259,260 (revision).

FAO Names: En - Bengal thryssa.



Diagnostic Features : Body compressed, belly with 16 (rarely 17) plus 11 to 13 (mostly 12) = 27 to 29 keeled scutes from isthmus to anus. Tip of snout on level with upper rim of eye, well above eye centre. Maxilla moderate, projecting a little beyond gill cover; first supra-maxilla minute, usually absent; teeth in jaws enlarged, especially in lower jaw. Lower gillrakers 13 to 15. Anal with iii (rarely iv) 41 to 45 finrays. A dark blotch indistinct or absent behind upper part of gill opening; no dark lines along back. Of Bay of Bengal species with a moderate maxilla, T. malabarica, T. purava and T. gautamiensis have more gillrakers (17 to 21); T. hamiltonii has smaller jaw teeth and fewer anal finrays (iii 32 to 39).

Geographical Distribution : Indian Ocean (northeastern Bay of Bengal, from Calcutta south to the Indian Ocean coast of Thailand, perhaps to Pinang).



Habitat and Biology : Marine, pelagic, presumably schooling and inshore. More data needed.

Size : To 16.5 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature :

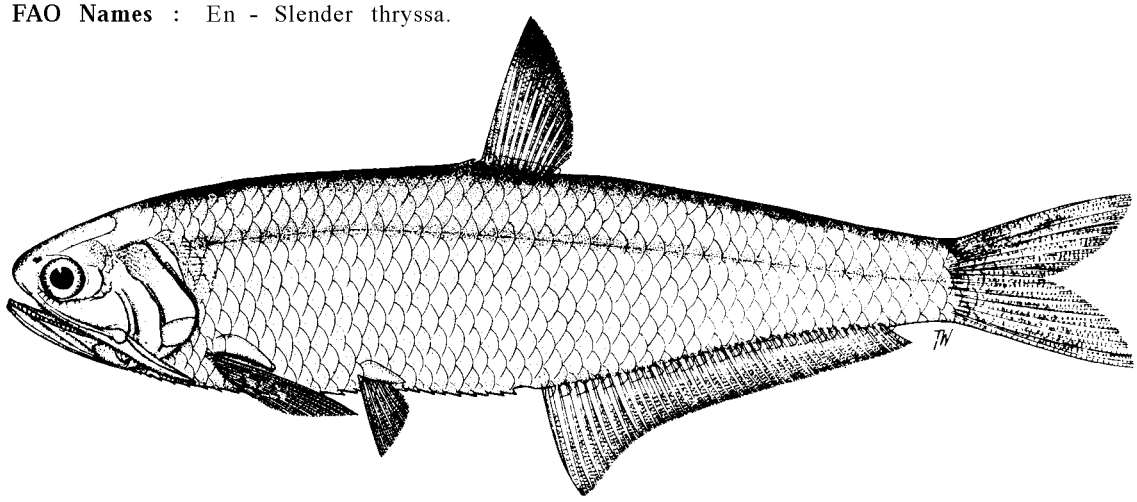
Thryssa stenosoma Wongratana, 1983

ENGR Thrys 19

Thryssa (Scutengraulis) stenosoma Wongratana, 1983, Japan J.Ichthyol., 29(4):404, fig.23 (Godavari estuary eastern coast of India, also Ganges).

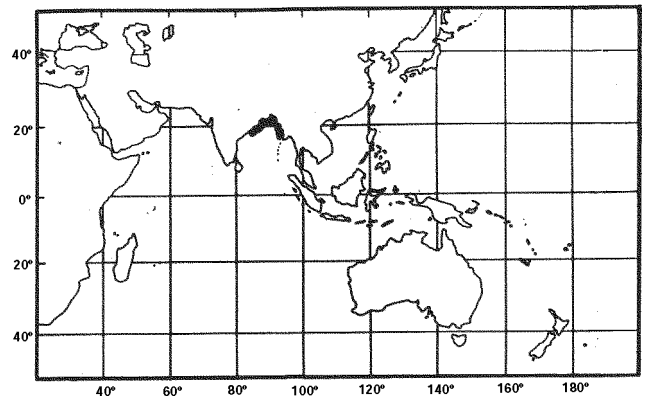
Synonyms : Thryssa purava: probably misidentified as such by earlier authors; Thryssa stenosoma: Wongratana, 1980:289, pls 255, 256 (revision; name not validly published).

FAO Names : En - Slender thryssa.



Diagnostic Features : Body somewhat compressed, fairly slender, its depth 23 to 27% of standard length, belly with 15 to 17 plus 10 to 12 = 26 to 28 keeled scutes from isthmus to anus. Tip of snout at about level of eye centre or just a little higher. Maxilla long, reaching to pectoral fin base or slightly beyond; first supra-maxilla minute, oval; teeth in lower jaw slightly enlarged. Lower gillrakers 17 to 19. Anal with iii 40 to 45 finrays. No blotch behind upper part of gill opening; a pair of dark lines along back. Of Indian Ocean species with a similar maxilla, T. mystax has fewer gillrakers (usually 15 or 16, rarely 17) and anal finrays (not more than 37), and T. dayi and T. vitrirostris are not known from the Bay of Bengal (both are deeper-bodied); T. purava has a shorter maxilla (not to pectoral fin base) and is also deeper-bodied.

Geographical Distribution : Indian Ocean (northern part of Bay of Bengal, in Godavari and Ganges estuaries).



Habitat and Biology : Estuarine, but presumably also found inshore. More data needed.

Size : To 15 cm standard length.

Interest to Fisheries : Unknown.

Local Names :

Literature : Perhaps included in studies of T. purava.

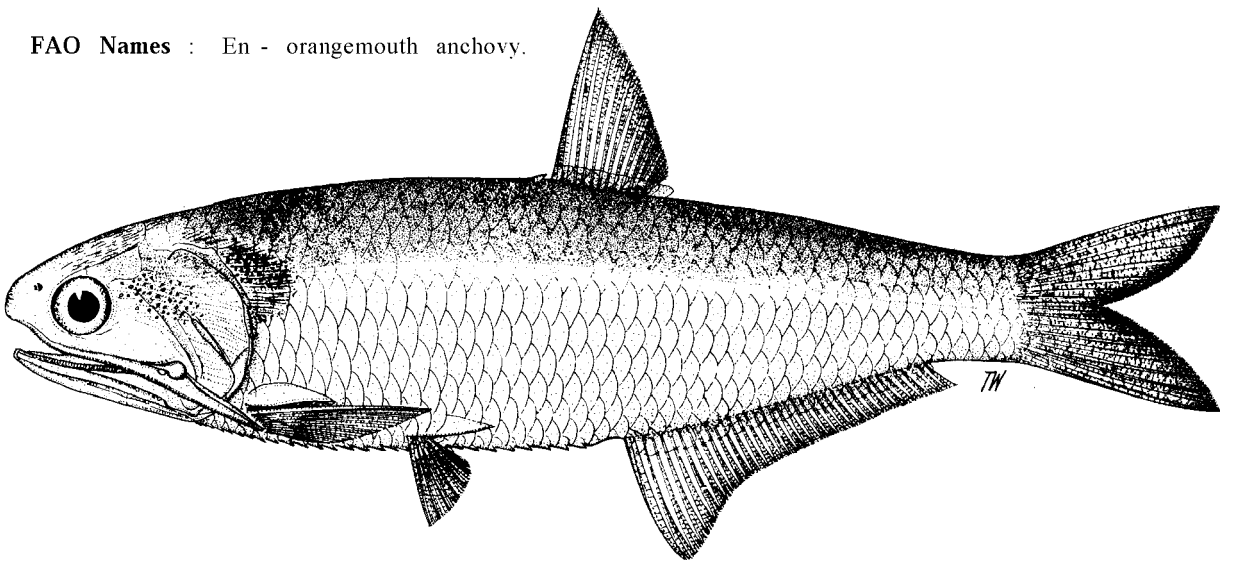
Thryssa vitrirostris (Gilchrist & Thompson, 1908)

ENGR Thrys 2

Engraulis vitrirostris Gilchrist & Thompson, 1908, Ann.S.Afr.Mus., 6:201 (Durban).

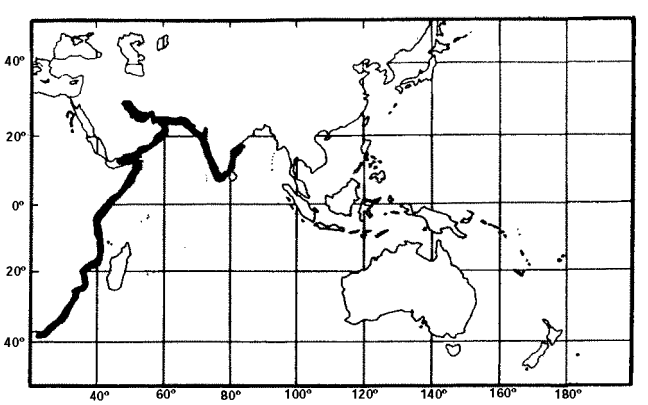
Synonyms : Thrissocles vitirostris (misspelt):Fowler, 1941d:678 (Delagoa Bay); Thrissocles malabaricus: Smith, 1949:95, pl.5, fig.121 (south to Port Alfred); Losse, 1968:111, p1.4b (Dar-es-Salaam north to Formosa Bay); Thryssa vitrirostris-Whitehead, 1965a:274 (the "Gulf"); Idem, 1973b:233, fig.57 (synopsis); Wongratana, 1980:269, pls 236, 237 (revision); SFSA, 1987:206, fig.55.6 (south to Port Alfred).

FAO Names : En - orangemouth anchovy.



Diagnostic Features : Body compressed, belly with 16 to 19 (usually 17 or 18) plus 8 to 12 (usually 10 or 11) = 24 to 30 (usually 27 to 29) keeled scutes from isthmus to anus. Maxilla long, reaching beyond base of first pectoral finray; first supra-maxilla a minute oval. Lower gillrakers 18 to 24 (mostly 20 to 23), the serrae on the inner edge in distinct clumps in larger fishes. Anal fin with iii (rarely iv) 31 to 40 (mostly 32 to 38) finrays. A dark blotch behind upper part of gill opening; inside of gill cavity bright orange. Overlaps the range of 13 other species of Thryssa, of which five have a similar maxilla, very small first supra-maxilla and overlapping gillraker counts. However, T. gautamiensis, T. malabarica, T. purava and T. whiteheadi all have the tip of the snout at or above the level of the centre of the eye, and the last two, plus T. stenosoma, have at least 38 (but usually 40 or more) branched anal finrays. Difficulties are most likely to arise on the eastern coast of India; the clumped gillraker serrae in larger fishes will further help to separate the species. See ENGR Thrys 2, Fishing Area 51, also Fishing Areas 57/71.

Geographical Distribution : Indian Ocean (Madagascar, coasts of Africa from Port Alfred at about 33° 3O'S, northward to the "Gulf" (but not Red Sea), coasts of Pakistan and India, perhaps to Calcutta and off Burma, but no records).



Habitat and Biology : Marine, pelagic, presumably schooling, inshore, entering estuaries and lagoons (perhaps used as nursery areas), but found further out in rainy seasons when coastal waters are freshened by rivers. More data needed.

Size : To 17.8 cm standard length.

Interest to Fisheries : A fairly common species,thus presumably making a significant contribution to clupeoid catches by artisanal fishermen.

Local Names : THE "GULF": Kawa (at Bendar Abbas), Lacheh; SOUTH AFRICA: Orangebek-glasneus.

Literature : Dutt (1961 - deep orange gill cavity, cf. light orange in T. mystax)

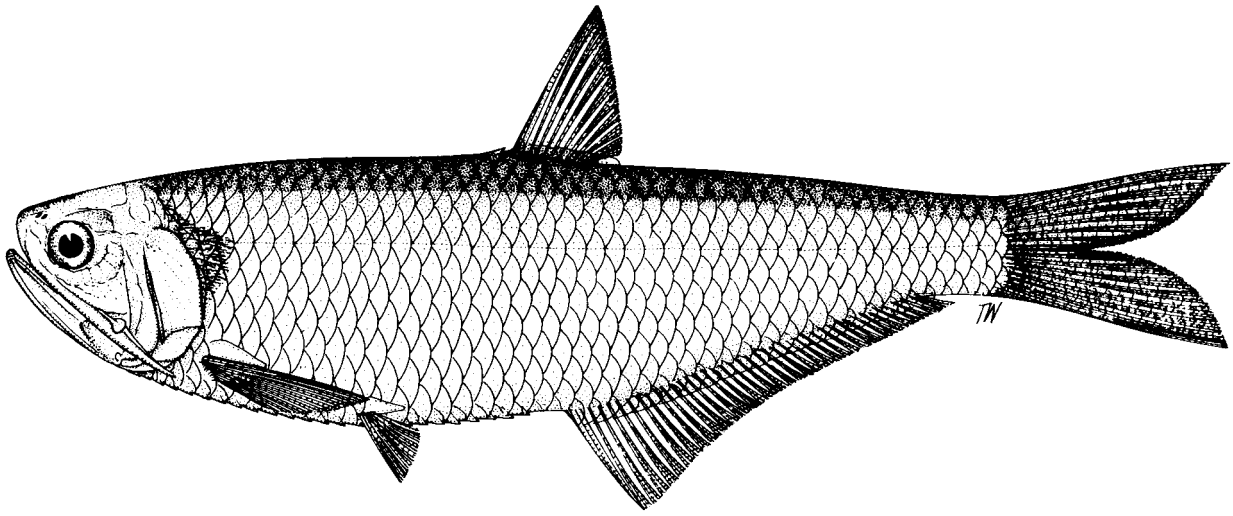
Thryssa whiteheadi Wongratana, 1983

ENGR Thyrs 17

Thryssa (Scutengraulis) whiteheadi Wongratana,1983, Japan J.Ichthyol., 29(4):403, fig.22 (Basra, Bushire, Persiske, Hanbugt, the "Gulf").

Synonyms : Thrissocles purava:Misra, 1947:117 (Hor-el-Hammar); Engraulis vitrirostris: Blegvad & Loppenthin, 1944:60 (Bushire Roads); Thryssa purava:Whitehead, 1965a:273 (Blegvad's specimen No.4 only); Thryssa mystax:Kuronuma & Abe, 1972:48, p1.2 (the"Gulf"); Thryssa whiteheadi-Wongratana, 1980:285, pls 251,252 (revision; name not validly published).

FAO Names : En - Whitehead's thryssa.



Diagnostic Features : Body compressed, belly with 15 or 16 (rarely 17) plus 10 or 11 (rarely 12) = 25 to 27 (rarely 28) keeled scutes from isthmus to anus. Tip of snout above level of eye centre, usually at about level of upper rim of eye. Maxilla moderate, its tip projecting just a little beyond edge of gill cover; first supra-maxilla absent; jaw teeth slightly enlarged compared with other species. Lower gillrakers 18 to 21 (usually 19). Anal with iii 40 to 43 (rarely 42) finrays. Blotch behind upper part of gill opening absent or very indistinct. Of species recorded from the "Gulf", it most closely resembles T. hamiltonii, which has only 11 to 15 gillrakers, small jaw teeth and fewer anal finrays (usually iii 32 to 38); in T. vitrirostris and T. setirostris the maxilla tip reaches to the pectoral fin base or further. Of species outside the "Gulf", T. purava is extremely close, differing mainly in having enlarged teeth only in the lower jaw, and a small first supra-maxilla present.

Geographical Distribution : The "Gulf" only, but perhaps reaches into the Gulf of Oman.

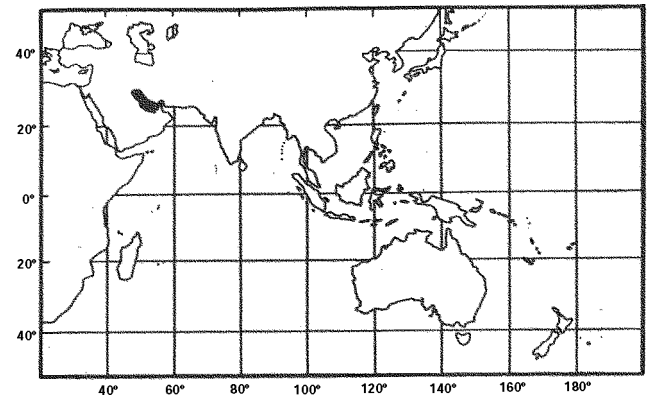
Habitat and Biology : Marine, pelagic, presumably schooling. More data needed.

Size : To 15.8 cm standard length.

Interest to Fisheries : Apparently common, but seldom seen in the market at Kuwait (Kuronuma & Abe, 1972).

Local Names : KUWAIT: Boefchah.

Literature :

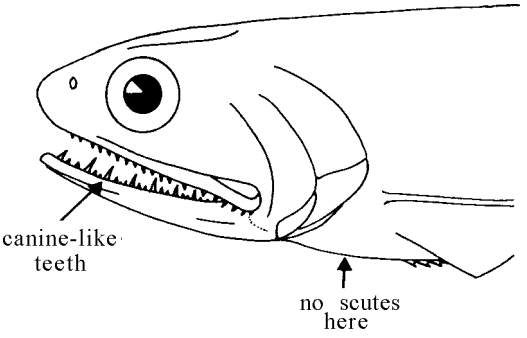


Lycothrissa Güther, 1868

ENGR Lyco

Lycothrissa Günther, 1868, Cat.Fish.Brit.Mus., 7:399 (type: Engraulis crocodilus Bleeker, 1851). In a list of specimens sent to Günther in late 1867, Bleeker used the subgeneric name Odontengraulis (Whitehead, Boeseman & Wheeler, 1966:12; see also Norman & Whitehead, 1984:307).

Diagnostic Features : Rather elongate, not strongly compressed anchovies (to about 25 cm standard length), the belly without scutes before the pectoral fin base; a small spine-like scute just before the dorsal fin origin. Maxilla short, its tip just reaching to edge of pre-operculum; enlarged canine-like teeth among smaller ones in each jaw. Gillrakers few (10 or less). Anal fin long, with up to 48 branched finrays, its origin in advance of dorsal fin origin. Scales moderate, 45 to 49 in lateral series.



Biology, Habitat and Distribution : Recorded from rivers and lakes, but perhaps also found in the sea. Known only from Indonesia north to Thailand and Cambodia.

Species : Since Bleeker's discovery of this anchovy, only a single species has ever been recognized:

L. crocodilus (Bleeker, 1851) Western central Pacific.

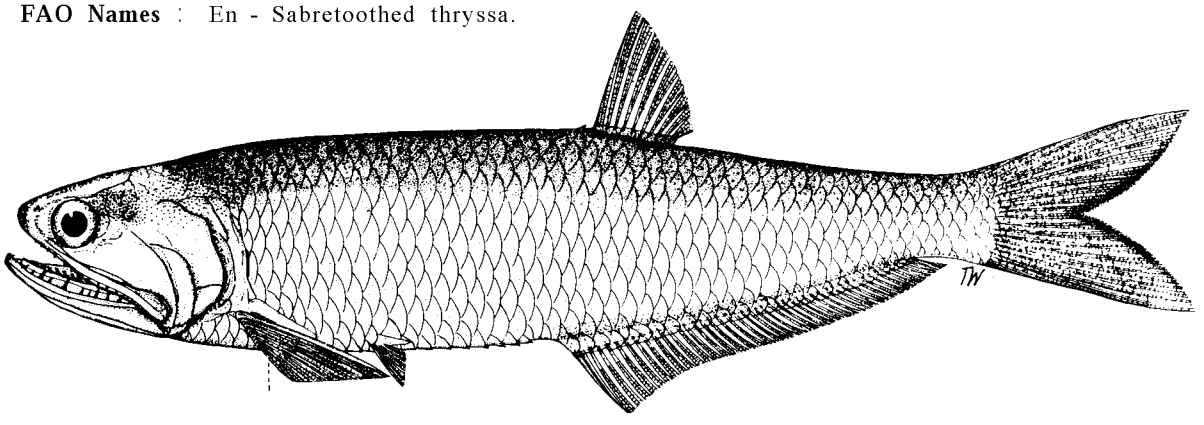
Lycothrissa crocodilus (Bleeker, 1851)

ENGR Lyco 1

Engraulis crocodilus Bleeker, 1851, Natuurk.Tijdschr.Ned.-Indië, 1:15 (Banjermasin, southern Kalimantan).

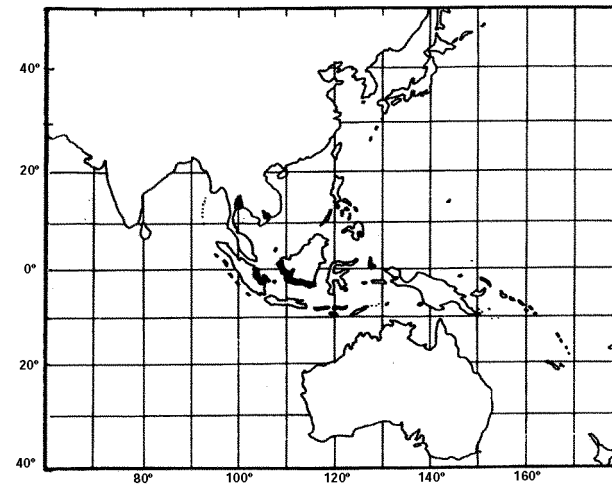
Synonyms : Lycothrissa crocodilus - Weber & de Beaufort, 1913:31, fig.16 (Sumatra); Fowler, 1941d:667 ("Cochin-China"); Smith, 1945:54(Menam Chao Phya up to Koh Yai, Thailand); Whitehead, Boeseman & Wheeler, 1966:134, pl.17, fig.3 (Bleeker's figure) (type of crocodilus); Wongratana, 1980298, pls 265,266 (revision).

FAO Names : En - Sabretoothed thryssa.



Diagnostic Features : Body elongate, not strongly compressed, belly with scutes absent from isthmus to below pectoral fin base, 7 or 8 (rarely 9) plus 9 or 10 (rarely 8 or 11) = 16 to 19 keeled scutes from pectoral base to anus. Maxilla short, reaching only to anterior margin of pre-operculum, tip blunt; first supra-maxilla absent; teeth in jaws moderate, but interspersed with large canine-like teeth. Lower gillrakers 8 to 10 (usually 9), short, with large tooth-like serrae. Anal fin with iii (rarely iv) 44 to 48 finrays, its orgin before origin of dorsal fin by about an eye diameter; pelvic fins very small. Pectoral fins wholly or partly black, caudal yellow with a black edge. The enlarged jaw teeth distinguish it from any other Indo-West Pacific anchovy; bears a superficial resemblance to Thryssa baelama and T. encrasicholoides, which have the anal fin origin behind the dorsal fin base (also smaller teeth, etc.).

Geographical Distribution : Rivers, lakes and estuaries of western central Pacific area (Banjermasin, Pontianak, Sinkawang, middle part of Kapuas River, Kalimantan; Banjuasin, Palembang, Djambi, Sumatra; Chao Phya River as far up as Lake Bueng-borapet or 210 km from the sea, Thailand; Tonle Sap, Cambodia).



Habitat and Biology : Riverine and lacustrine, but perhaps passing from estuaries into the sea. The large teeth suggest a diet of fishes or shrimps. More data needed; rather few specimens are in museum collections.

Size : To 23 cm standard length, perhaps to 25 cm.

Interest to Fisheries : Unknown, but perhaps slight considering the few specimens recorded.

Local Names : THAILAND: **Pla** meo = Cat fish (Smith, 1945:55).

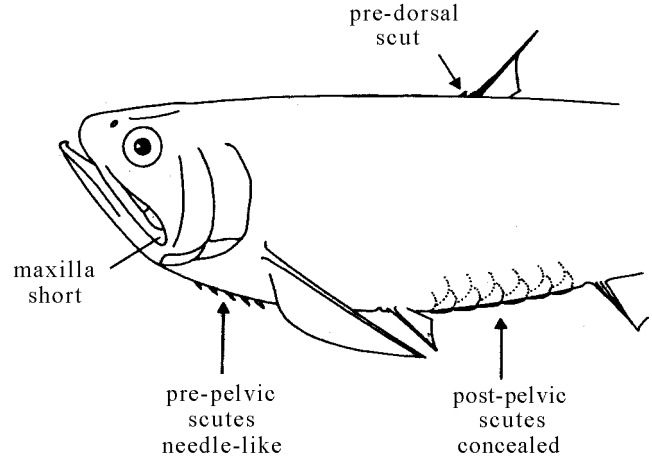
Literature : Chevey (1932), Chevey & Poulain (1940), Hardenberg (1936), Smith (1945).

Papuengraulis Munro, 1964

ENGR Papu

Papuengraulis Munro, 1964, Papua New Guin.agric.J., 16(4):150 (type: Papuengraulis micropinna Munro, 1964).

Diagnostic Features : Moderate-sized, strongly compressed anchovies (to about 12 cm standard length), the pre-pelvic scutes reduced to 5 or 6 needle-like scutes from isthmus to pectoral fin base only, the post-pelvic scutes reduced to thin plates hidden by scales; a small spine-like scute just before the dorsal fin origin. Maxilla short, its tip just reaching to edge of pre-operculum; jaw teeth small. Pectoral fins large, pelvic fins small, dorsal fin minute, second finray filamentous, anal fin long. Scales moderate, 50 or 51 in lateral series.



Biology, Habitat and Distribution : Estuarine, perhaps entering rivers. Known from the Gulf of Papua and Arafura Sea.

Species : A single species known:

P. micropinna Munro, 1964 Gulf of Papua.

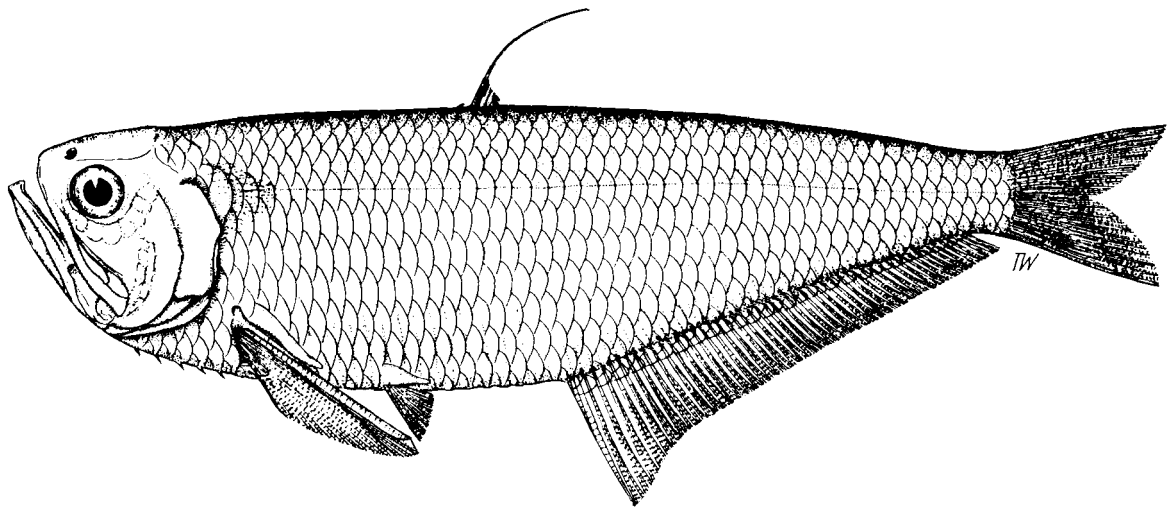
Papuengraulis micropinna Munro, 1964

ENGR Papu 1

Papuengraulis micropinna Munro, 1964, Papua New Guin.agric.J., 16(4):151, fig.2 (off Port Romilly, Gulf of Papua).

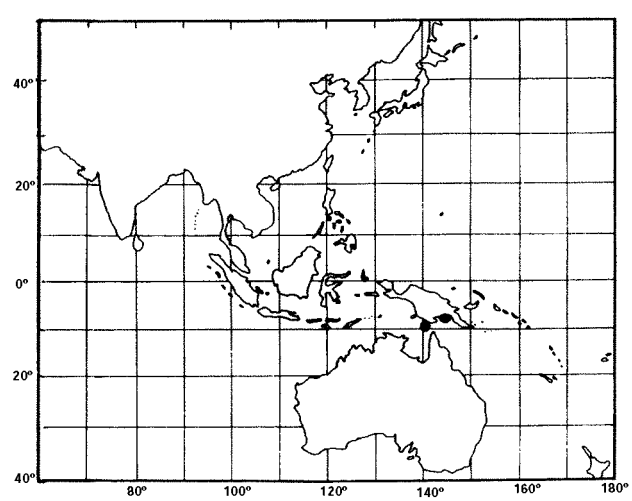
Synonyms : Papuengraulis micropinna-Munro, 1967:45, pl.3, fig.35 (repeat); Wongratana, 1980:296, pls 263,264 (revision); Sainsbury, Kailola & Leyland, 1985:66,67 (colour plate), 332 (Arafura Sea).

FAO Names : En - Littlefin anchovy.



Diagnostic Features : Body somewhat elongate, but strongly compressed, belly with 5 or 6 needle-like scutes in front of pectoral fin base, none behind, and a series of membrane-like post-pelvic scutes more or less concealed by the scales. Maxilla short, just reaching to anterior margin of pre-operculum, tip blunt; first supra-maxilla large, elongate, more than twice length of second. Lower gillrakers 25 to 27. Pectoral fins wing-like, pelvic fins small, dorsal fin minute (only ii 3 or 4 finrays, the second unbranched finray a long filament, about equal to head length, but often broken), anal fin long and broad (iii 51 to 57 finrays). A distinct dark blotch behind upper part of gill opening. The minute dorsal fin distinguishes it from any other Indo-West Pacific anchovy and the absence of a fully keeled belly also separates it from superficially similar species of Thryssa or Setipinna.

Geographical Distribution : Gulf of Papua (off Port Romilly; in mouths of rivers flowing into the Gulf fide Munro, 1967); Arafura Sea (Sainsbury et al., but no indication if Australian or Irian Jaya coasts).



Habitat and Biology : Only four specimens appear to be preserved (Wongratana, 1980:296), so that the species is probably uncommon. Presumed to be estuarine, but perhaps ascends rivers or migrates into coastal waters. The minute teeth and rather numerous gillrakers suggest a diet of small planktonic animals.

Size : To 12 cm standard length, perhaps more.

Interest to Fisheries : Probably little, considering its rarity.

Local Names : PAPUA NEW GUINEA: Bareback anchovy (Munro, 1967).

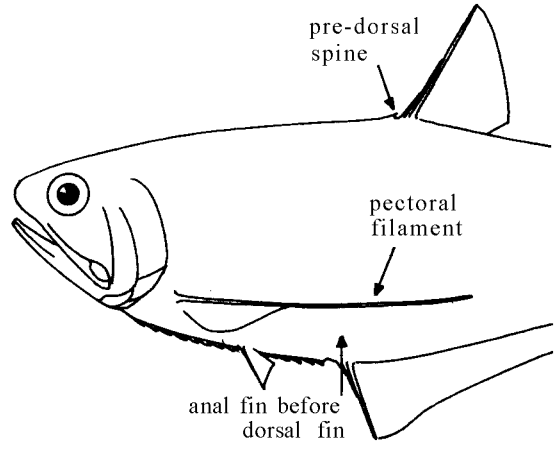
Literature :

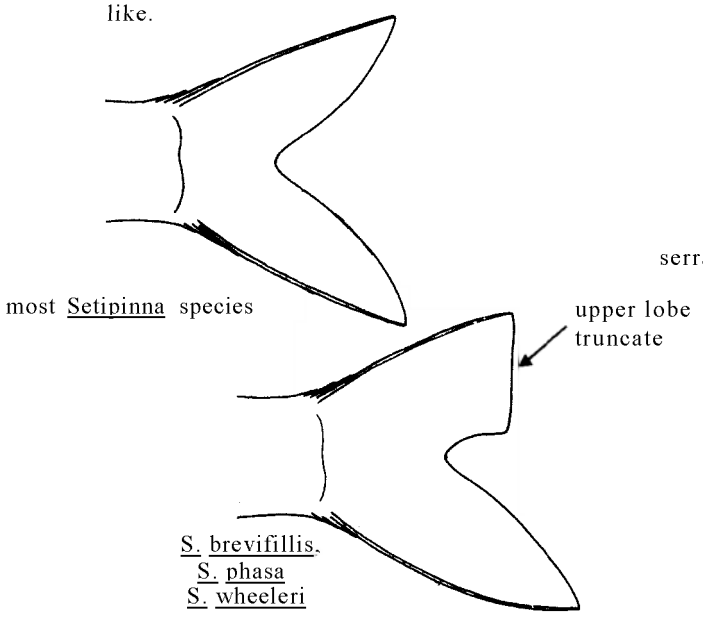
Setipinna Swainson, 1839

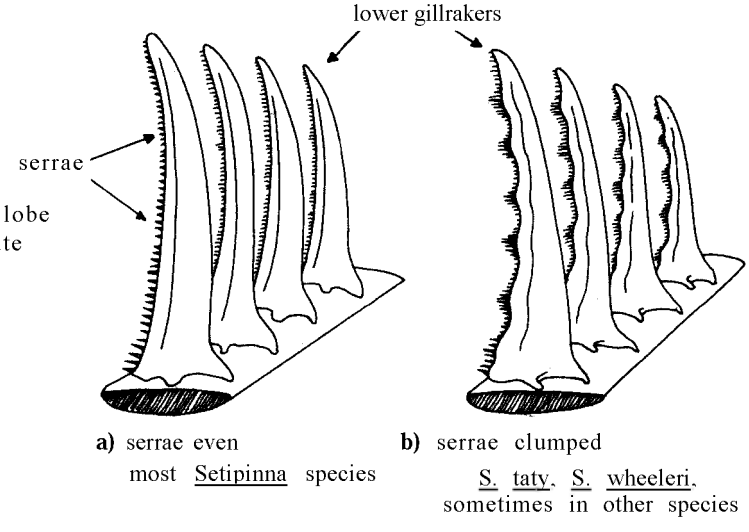
ENGR Seti

Setipinna Swainson, 1839, Nat.hist.anim., 2:292 (type: Setipinna **megalura** Swainson, 1839 = Clupea phasa Hamilton-Buchanan, 1822). **Telara** Valenciennes, 1848, Hist.nat.poiss., 21:54 (type: Clupea **telara** Hamilton-Buchanan, 1822 = Clupea phasa). Heterothrissa **Günther**, 1868, Cat.fish.Brit.Mus., 7:401 (type: Engraulis breviceps Cantor, 1850).

Diagnostic Features : Medium-sized compressed or strongly compressed anchovies (mostly about 15 to 20 cm standard length, one to 28 cm), the belly sharply keeled, with 21 to 40 scutes from isthmus to anus; a small **spine**-like **scute** just before dorsal fin origin. Maxilla short, reaching to middle of pre-operculum or almost to edge of gill cover; first supra-maxilla absent; jaw teeth small, even. Lower gillrakers fairly stout, 9 to 22, their serrae sometimes clumped. Pectoral fin with first **finray** produced as a filament that usually exceeds or well exceeds head length (short in S. melanochir and S. brevifilis); anal fin long, with 45 to 78 branched finrays, its origin before dorsal fin origin. Scales moderate, 40 to 57 in lateral series. Swimbladder very slender, at times almost thread-like.







Biology, Habitat and Distribution : Marine, pelagic and probably schooling, mostly inshore, some entering estuaries; also riverine, probably permanently so. Indo-West Pacific only, from eastern coasts of India to Papua New Guinea; not known from the western Indian Ocean.

Species : Wongratana (1980) **recognized** seven species, placing breviceps in Heterothrissa (not adopted **here**-see Remarks) and described one new species (Wongratana, 1987a):

(**Indian Ocean** area only; more than 64 branched anal **finrays**, less than 25 scutes, upper caudal lobe truncate)
- S. brevifilis (Valenciennes, 1848) Lower Ganges system
- S. phasa (Hamilton-Buchanan, 1822) Lower Ganges system and Orissa
- S. wheeleri Wongratana, 1983 Burma

(**Widespread or western central Pacific** area only; less than 62 branched anal **finrays**, more than 23 scutes, caudal lobes symmetrical)
- S. breviceps (Cantor, 1850) Malaysia, Indonesia
- S. melanochir (Bleeker, 1849) Thailand to Java
- S. paxtoni Wongratana, 1987 Northern Australia
- S. taty (Valenciennes, 1848) Eastern Indian Ocean to Indonesia
- S. tenuifilis (Valenciennes, 1848) Bay of Bengal, Australia to Japan

Remarks : Although Thryssa dayi has a short pectoral filament, the advanced anal fin origin in Setipinna easily distinguishes the genus from Thryssa. Wongratana placed S. breviceps in the separate genus Heterothrissa, but the characters either overlap gillrakers, dorsal finrays, epurals) or merely continue trends seen in the remaining species (oblique mouth, lengthening of first and third **suborbitals**, increase in branchiostegal rays and pyloric **caeca**).

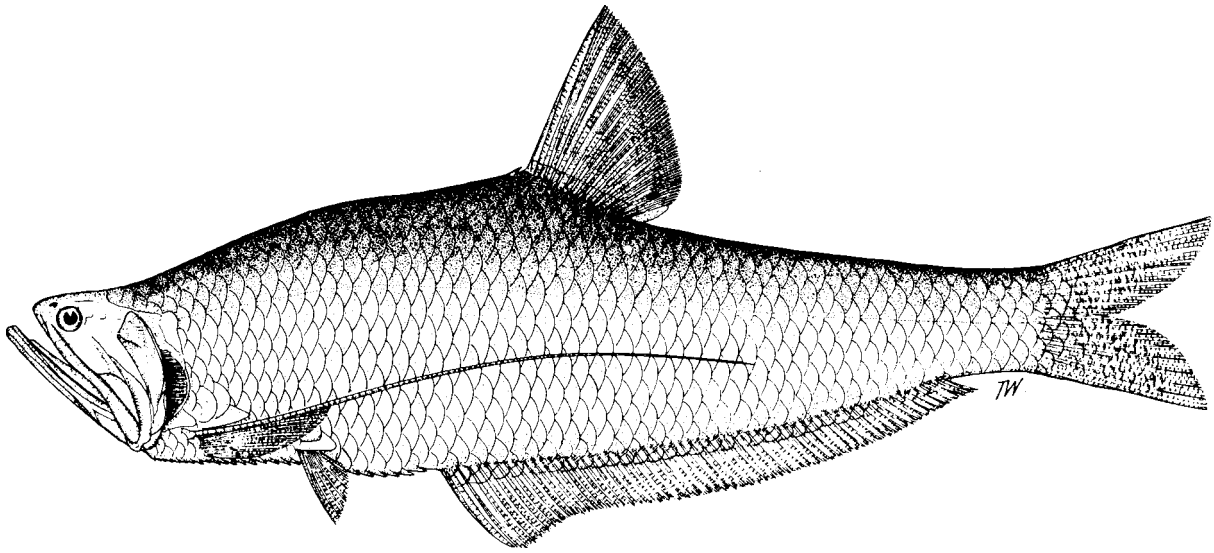
Setipinna breviceps (Cantor, 1850)

ENGR Seti 8

Engraulis breviceps Cantor, 1850, J.Asiatic.Soc.Beng., 18(2):1288 (Penang).

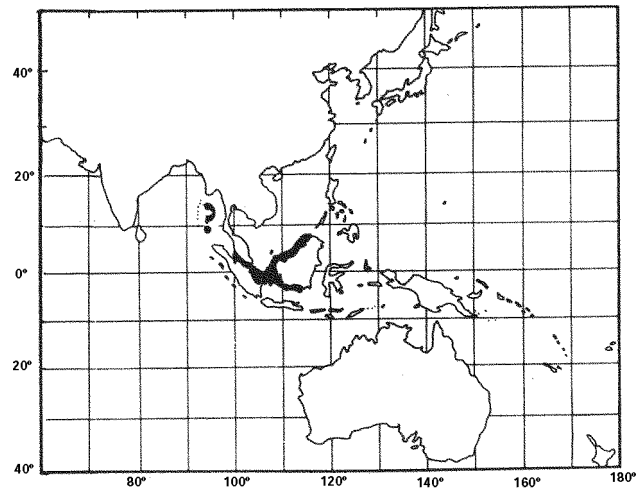
Synonyms : Engraulis pfeifferi Bleeker, 1852a:433 (Kapuas River at Pontianak, Kalimantan); Heterothrissa breviceps:Günther, 1868:401 (type of breviceps; Bleeker figured specimen); Wongratana, 1980:310, pls 280,281 (revision); Setipinna breviceps-Weber & de Beaufort, 1913:29 (Sumatra); Fowler, 1941d:691 ("Cochin China"; in subgenus Stethochaetus Gray, 1854 = Trichogaster, an anabantid fish); Hardenberg, 1931:101 (Bagan Si Api Api); Whitehead, 1969a:270, fig.52 (compiled).

FAO Names : En - Shorthead hairfin anchovy.



Diagnostic Features : Body compressed, head (snout to occiput) very short, belly with 17 to 23 plus 9 to 11 = 27 to 32 keeled scutes from isthmus to anus. Mouth strongly oblique, jaws slender, second supra-maxilla almost half length of maxilla, lower jaw projecting beyond tip of snout. Lower gillrakers 11 or 12, serrae enlarged and spiky at either end of each raker. Pectoral filament long, reaching to base of 35th to 41st anal finray; anal with iii 56 to 61 finrays. The very low gillraker count and characteristic shape of head and jaws distinguish it from all other species of Setipinna, as also the high number of anal finrays in the group of species with more than 23 scutes.

Geographical Distribution : Indian Ocean (Penang, Selangor; Wongratana, 1980:311 saw no Indian specimens, but accepted the records of Day, 1878 and Nair, 1953; also that of Lloyd, 1907 for Burma) and western central Pacific area (river mouths of Sumatra, Kalimantan and Sarawak, presumably also Java).



Habitat and Biology : Marine or estuarine, perhaps also ascending into fresh water. More data needed.

Size : To 24 cm standard length.

Interest to Fisheries : Apparently a highly esteemed foodfish at the Rokan River mouth, Sumatra (Hardenberg, 1931), thus presumably also in similar localities elsewhere in Indonesia, Malaysia and Sarawak.

Local Names :

Literature :

Remarks : In spite of its rather distinctive appearance, there seems to be no strong reason to place this species in a separate genus Heterothrissa (see under genus).

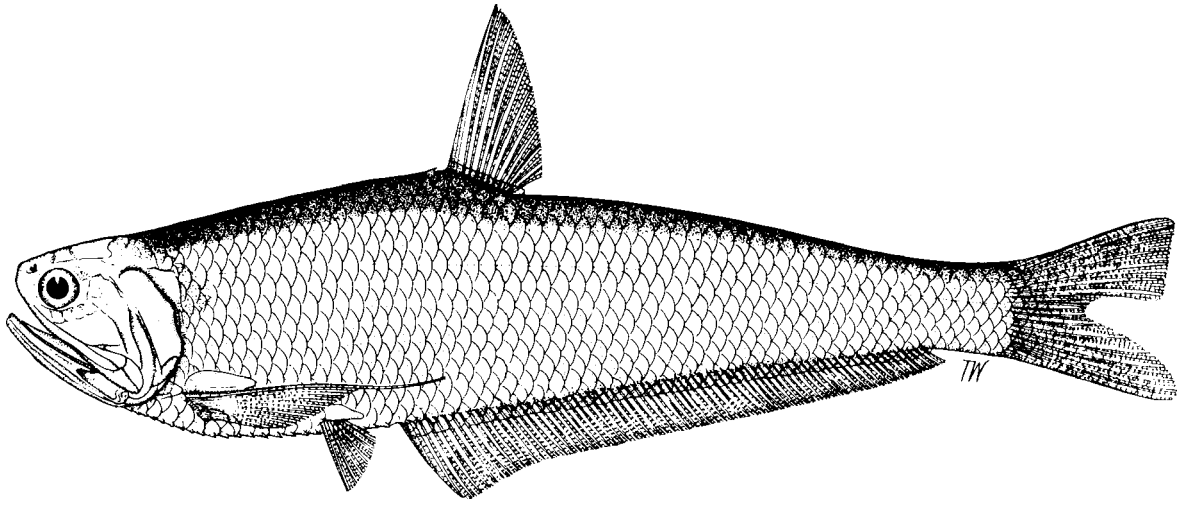
Setipinna brevifilis (Valenciennes, 1848)

ENGR Seti 5

Engraulis brevifilis Valenciennes, 1848, Hist.nat.poiss., 21:54 (Bengal).

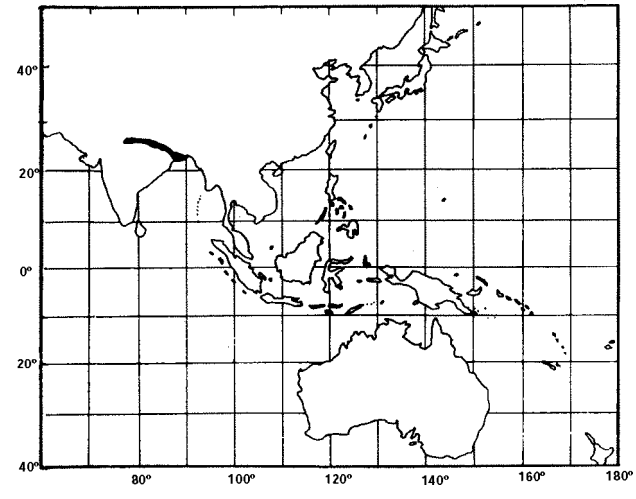
Synonyms : Engraulis telara:Day, 1876:308 (Calcutta, Delhi specimens); Setipinna phasa:Fowler, 1941d:688 (the Ganges specimen); Whitehead, 1967a:145 (holotype of brevifilis); Idem, 1973b:238 (in synonymy of phasa misspelt phase); Whitehead & Bauchot, 1986:32 (same). Setipinna brevifilis-Wongratana, 1980:309, pls 278,279 (revision, separation from phasa).

FAO Names : En - Short-hairfin anchovy,



Diagnostic Features : Body compressed, belly with 15 to 17 plus 6 or 7 = 22 or 23 keeled scutes from isthmus to anus. Lower gillrakers 17 (rarely 18), the serrae enlarged near the tip and sometimes show clumping of larger ones along the raker. Pectoral filament short, reaching to base of first to 15th anal finray; anal fin with iii 65 to 72 finrays; upper caudal fin lobe truncated, shorter than lower. Pectoral fins with no dark markings, even in large fishes. Very close to S. phasa, which has a slightly shorter head (15.6 to 18.1% of standard length; cf. 18.0 to 19.7%), a longer pectoral filament (to base of 15th to 39th anal finray), the pectoral fin black in adults over 13.6 cm standard length, and more gillrakers (18 or 19, rarely 17); S. wheeleri has more gillrakers (21 or 22). Other species of Setipinna have fewer anal finrays, but more scutes.

Geographical Distribution : Indian fresh waters (Ganges system, from at least Delhi to Calcutta).



Habitat and Biology : Apparently purely riverine. More data needed, based on separation from S. phasa.

Size : To 26 cm standard length.

Interest to Fisheries : Presumably contributes to local artisanal fisheries in the Ganges.

Local Names : INDIA: Phansa (Calcutta).

Literature : Not distinguished from S. phasa, but some of the biological work on the latter probably refers to S. brevifilis.

Remarks : Until the revision by Wongratana (1980), authors had considered brevifilis a synonym of phasa. The distinctions made by Wongratana (and used here) were based on 8 and 10 specimens, respectively, and more should be examined. If two species, then they appear to occur together in the Ganges from Alahabad to Calcutta, but are not yet known to overlap in the rivers of Orissa.

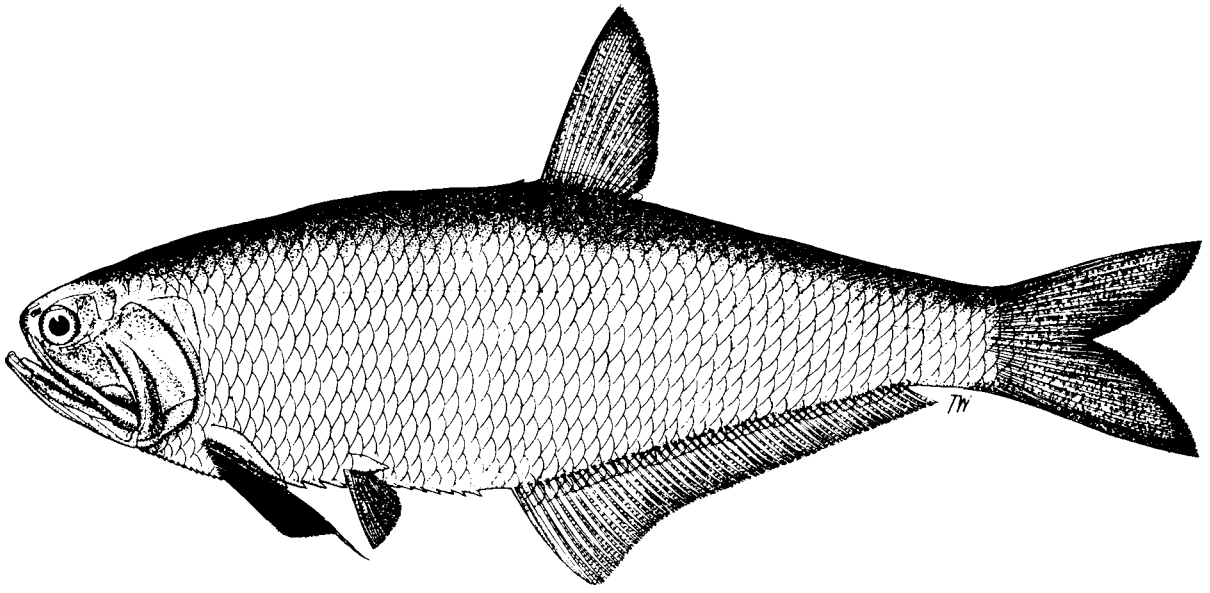
Setipinna melanochir (Bleeker, 1849)

ENGR seti 2

Engraulis melanochir Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., 22:13 (Kammal, Surabaya).

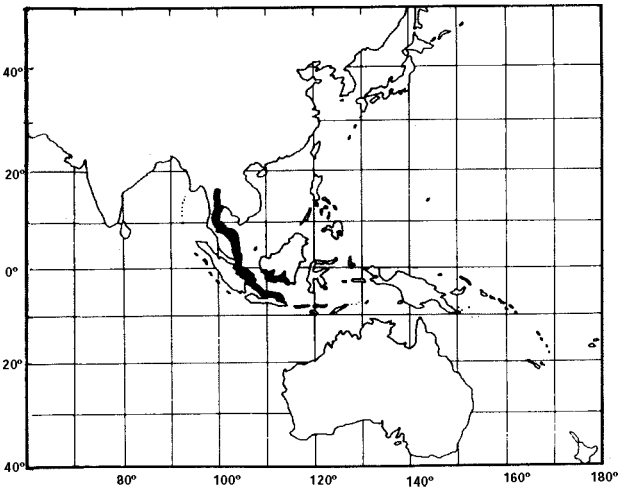
Synonyms : Setipinna melanochir -Weber & de Beaufort, 1913:28, fig.15 (Sumatra); Fowler, 194ld:687 (Kalimantan, Cochin China); Hardenberg, 1931:10l (Rokan River mouth); Idem, 1936:227 (Kapuas River, Kalimantan); Smith, 1945:55, p1.2 (Chao Praya River at Loburi, Thailand); Whitehead, Boeseman & Wheeler, 1966:130, p1.17, fig.1 (Bleeker's figure) (putative neotype of melanochir); Whitehead, 1969a:269, fig.51 (compiled); Wongratana, 1980:303, pls 271,272 (revision).

FAO Names : En - Dusky-hairfin anchovy.



Diagnostic Features : Body compressed, belly with 21 to 26 plus 8 to 10 = 30 to 35 keeled scutes from isthmus to anus. Lower gillrakers 9 to 12, their serrae rather large, spiky, but not distinctly clumped. Pectoral filament short or even absent, never reaching even to anus, total finrays usually 14 or 15; anal finrays iii 45 to 50. Gill cover and main part of pectoral fin often dusky or jet black; other fins pale to bright yellow. The very low gillraker count and short pectoral filament separates it from all other species of Setipinna. Similar species of Thryssa with a short maxilla (T. scratchleyi, T. aestuaria, T. rastrosa) all have more than 18 gillrakers.

Geographical Distribution : Western central Pacific area (Thailand south to Java, including rivers, e.g., the Chao Praya in Thailand and the Rokan, Kapuas and Barito in Indonesia).



Habitat and Biology : Marine, estuarine and fresh water; Wongratana (1980:304) noted records of this species in rivers 90, 150 and 210 km from the sea, but it is not known if these are permanent freshwater populations or migrants from the estuaries or the sea.

Size : To 11 cm standard length.

Interest to Fisheries : At least small numbers enter artisanal river and lake fisheries.

Local Names :

Literature :

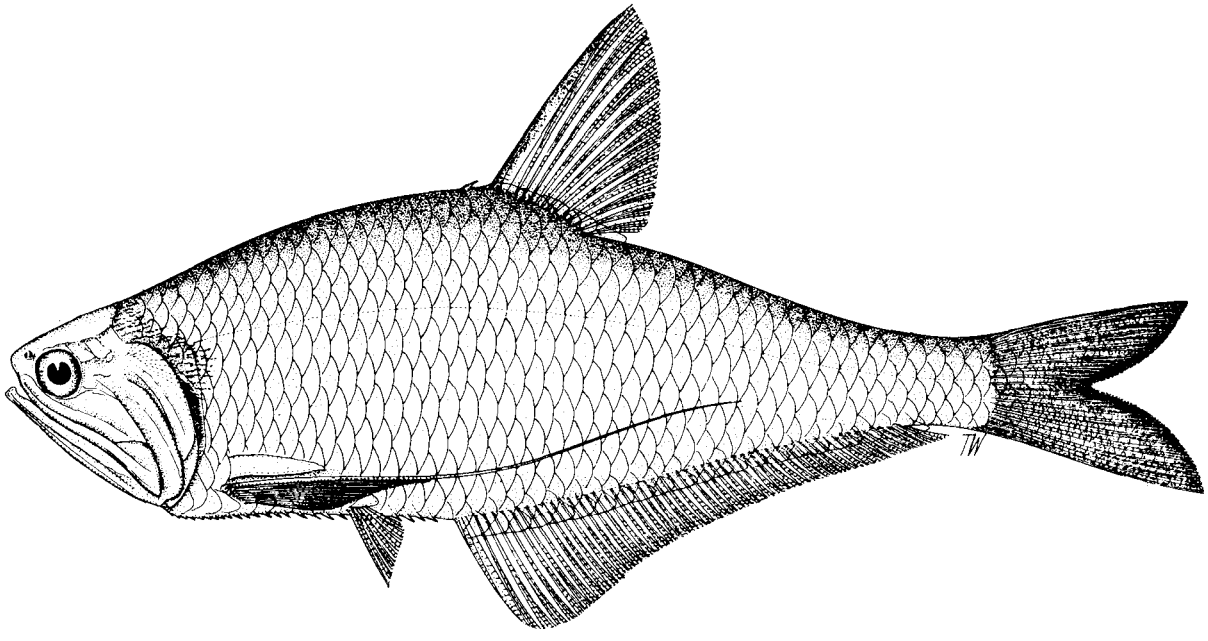
Setipinna paxtoni Wongratana, 1986

ENGR seti 4

Setipinna paxtoni Wongratana, 1986, Proc.biol.Soc.Wash., 100(1):109, fig.5 (Medusa Bank, Cambridge Gulf, Western Australia).

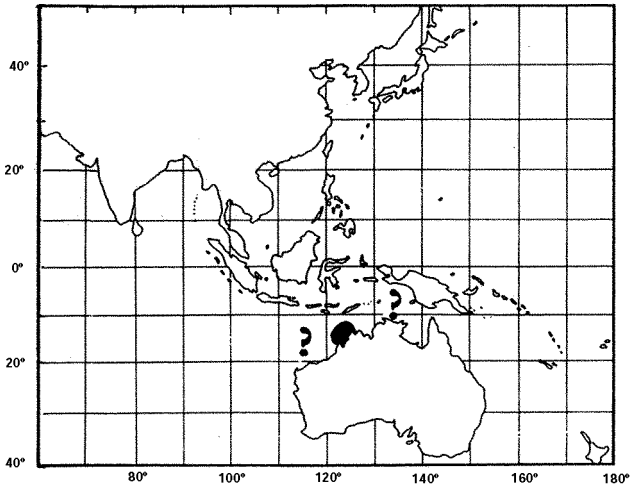
Synonyms : Setipinna papuensis:Wongratana, 1980:302, pl.270 (Western Australia).

FAO Names : En - Humpback hairfin anchovy.



Diagnostic Features : Body compressed, rather hump-backed, belly with 18 or 19 plus 7 or 8 = 25 to 27 keeled scutes from isthmus to anus. Lower gillrakers 14 or 15, their serrae not distinctly clumped. Pectoral filament long, reaching to base of 27th to 41st anal finray; anal fin with 51 to 54 finrays. Closely resembies S. tenuifilis, which has a smoother dorsal profile, a more slender body (depth 27 to 33% of standard length; cf. 33 to 35%), and a shorter pectoral filament (only to base of 9th to 21st anal finray). No other species of Setipinna occurs in the area.

Geographical Distribution : Indian Ocean (northern coast of Western Australia at Medusa Bank, Cambridge Gulf, but presumably elsewhere along that coast).



Habitat and Biology : No data, but presumably marine, coastal, perhaps entering estuaries.

Size : To 11 cm standard length, perhaps more.

Interest to Fisheries : Nil.

Local Names :

Literature :

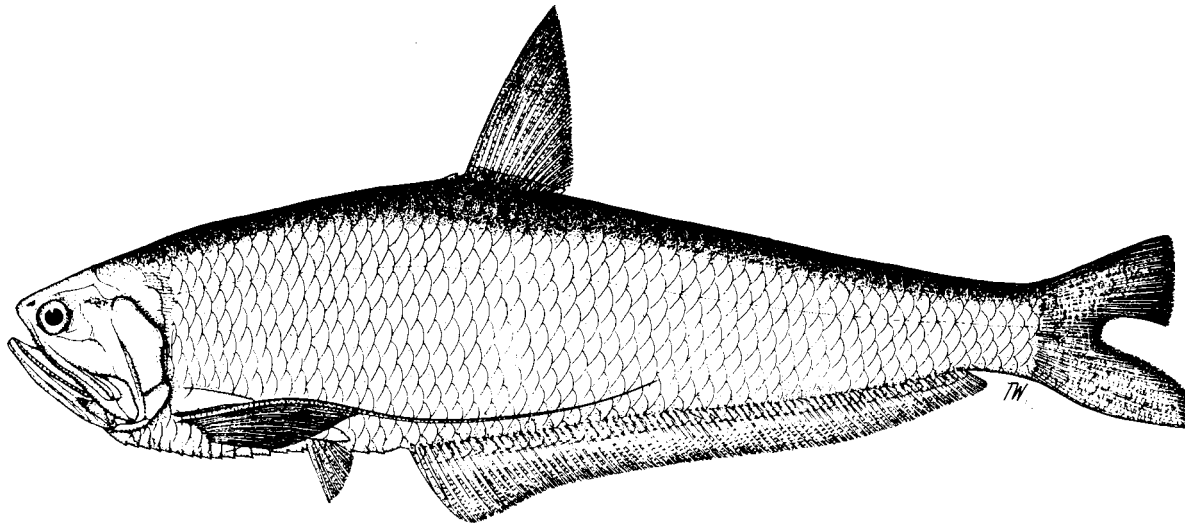
Setipinna phasa (Hamilton-Buchanan, 1822)

ENGR seti 6

Clupea phasa Hamilton-Buchanan, 1822, Fishes of the Ganges:240,382 (brackish rivers of Bengal).

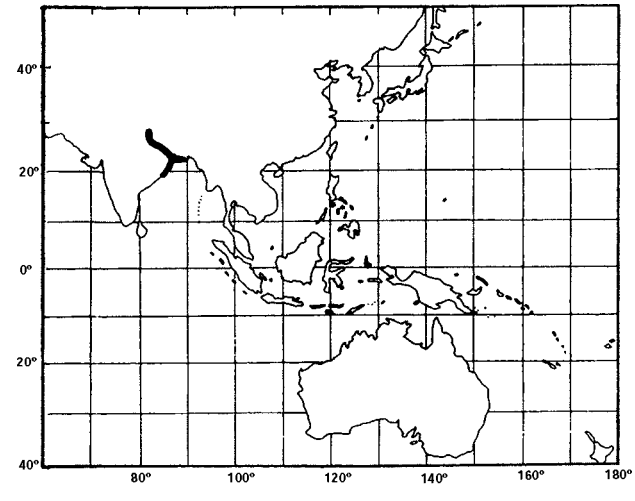
Synonyms : Clupea telara Hamilton-Buchanan,1822:241,382, pl.2, fig.72 (high up the Ganges); Day, 1878:627, pl.158, fig.2 (Calcutta and Orissa specimens only); Setipinna truncata Swainson, 1839:292 (on telara); Setipinna megalura Swainson, 1839:292 (on phasa); Setipinna phasa-Jones & Menon, 1950:25 (Barrackpore, breeding); Idem, 1951:323 et seq., figs 2-5 (eggs, larvae, juvenile) (Hooghly, breeding, fishery); Jhingran, 1963:291 et seq., fig.1 (gonads)(Allahabad, breeding); Babu Rao & Jogelkar, 1968:39 (Hooghly, description); Whitehead, 1973b:238, fig.2 (misspelt phase; synopsis; brevifilis wrongly included); Wongratana, 1980:308, pls 276,277 (revision).

FAO Names: En - Gangetic hairfin anchovy.



Diagnostic Features : Body compressed, belly with 15 plus 6 or 7 = 21 or 22 keeled scutes from isthmus to anus. Lower gillrakers 18 or 19 (rarely 17), the serrae even or becoming clumped in some specimens. Pectoral filament long, reaching to base of 15th to 39th anal finray; anal fin with iii 66 to 78 finrays; upper caudal lobe truncated, shorter than lower. Pectoral fins hyaline, but dark in fishes over 13.6 cm standard length. The separation of S. brevifilis from S. phasa is given under that species; if distinct, the two occur together in the Ganges sytem. Setipinna wheeleri of Burma is also similar, but has more gillrakers (21 or 22). Other species of Setipinna have fewer analfinrays, but more scutes.

Geographical Distribution : Indian fresh and brackish waters (Ganges system, from Diamond Harbour on the Hooghly to as far up as Allahabad on the Ganges, perhaps further; also rivers and estuaries of Orissa).



Habitat and Biology : Riverine, but found in estuaries and presumably tolerating some salinity. Adults feed mainly on mysids and small prawns (reduced feeding in breeding season), juveniles mainly on copepods. Extended breeding season, possibly thoughout year, but peaks in October/November (Hooghly at Barrackpore) or March to May (Ganges at Allahabad).

Size : To 20.9 cm standard length (Wongratana, 1980), but to 32.4 cm total length (about 28 cm standard length) fide Jhingran (1963). Day (1878) gave 16 inches (about 40 cm), presumably total length.

Interest to Fisheries : A major item in artisanal catches in the Hooghly estuary from November to March/April, and dominating the Setipinna fishery there from about January (Jones & Menon, 1951); substantial catches also at Allahabad (Jhingran, 1963). Its large size makes it an attractive foodfish.

Local Names : INDIA: Phasa, but also Phansa (Calcutta) and Patara = leaf-like (Allahabad).

Literature : Nair (1940 - early stages), Mookerjee & Mookerjee (1950 - biology), Jones & Menon (1950, 1951 - breeding, eggs and larvae, fishery), Sathyanesan (1961 - pituitary, as telara), Jhingran (1963 - breeding), Chandra (1964 - early stages), Babu Rao & Jogelkar (1968 - meristics and morphometrics).

Remarks : More work is needed on the separation of S. brevifilis from S. phasa (see under the former species). If the two are distinct, then some of the biological and fishery studies listed above may in part apply to S. brevifilis. Day's telara material was certainly mixed, but Babu Rao & Jogelkar's specimens agree with the diagnosis given here.

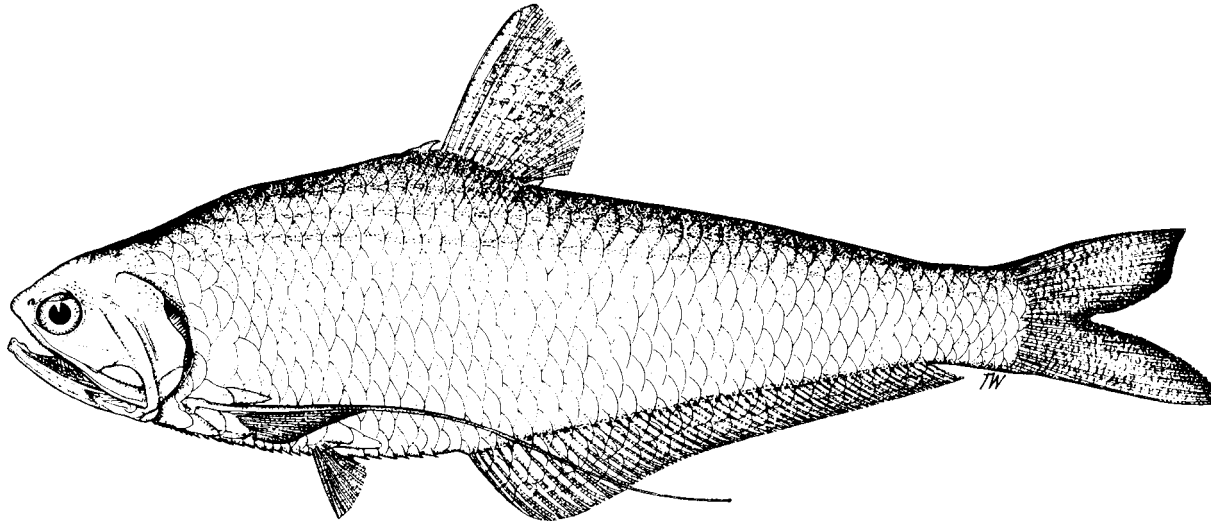
Setipinna taty (Valenciennes, 1848)

ENGR seti 1

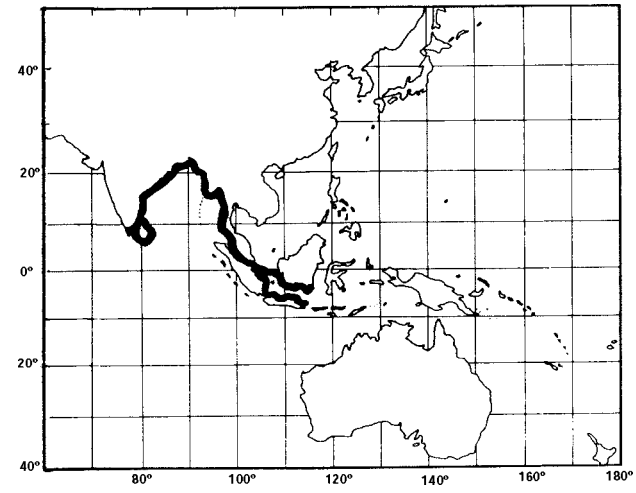
Engraulis taty Valenciennes, 1848, Hist.nat.poiss., 21:60 (Pondicherry).

Synonyms : Engraulis telaroides Bleeker, 1849a:13 (Madura near Sampang, Kammal, Surabaya); Setipinna taty-Weber & de Beaufort, 1913:30 (Jakarta, Kalimantan); Whitehead, Boeseman & Wheeler, 1966:128, pl.16, fig.3 (Bleeker's figure)(putative neotype of telaroides); Whitehead, 1967a:146 (types of taty); Idem, 1968:27 (Bay of Bengal); Idem, 1969:268 (Penang, Singapore); Idem, 1973b:237 (synopsis, but tenuifilis wrongly included); De & Datta, 1974:285 (Hooghly estuary); Wongratana, 1980:304, pls 273,274 (revision); Whitehead & Bauchot, 1986:33 (types of taty).

FAO Names : En- Scaly hairfin anchovy .



DiagnosticFeatures : Body strongly compressed, belly with20 to29 (mostly 22 to 27) plus 9 to 14 (mostly 11or12) = 32 to 40 (mostly34 to 37) keeled scutes fromisthmus toanus. Lower gillrakers 17 to 21 (mostly 18 to 20), their serrae distinctly clumped. Pectoral filament long, reaching to base of 23rd to last anal finray; anal finrays iii 45 to 55. Scales present on dorsal and anal fins (a unique feature in Indo-Pacific engraulid). Closely resembles S. tenuifilis and S. paxtoni, which have fewer scutes and gillrakers (24 to 28 and 13 to 17); other species of Setipinna either have fewer gillrakers or fewer scutes. Clumped gillraker serrae also occur in S. wheeleri and in some S. phasa, S. tenuifilis and S. melanochir. See ENGR Seti 1, Fishing Areas 57/71.



Geographical Distribution : Indian Ocean (Bay of Bengal south to Penang), western central Pacific (Thailand south to Java and southern Kalimantan, but no certain records from the Philippines, Sulawesi or Papua New Guinea).

Habitat and Biology : Marine, pelagic and schooling, mainly coastal, but also entering estuaries (e.g. the Hooghly). More data needed, based on certain identifications, since at least some records must be based on S. tenuifilis.

Size : To 13.6 cm standard length, perhaps more.

Interest to Fisheries : One of the commonest species of Setipinna and thus making a significant contribution to artisanal Setipinna catches (e.g. in the Hooghly estuary - see Babu Rao & Jogelkar, 1968).

Local Names: INDIA: Phansa (Calcutta).

Literature : De & Datta (1974 - size groups), De & Mitra (1981 - fecundity).

Remarks : Records of this species from about Hong Kong northward refer to S. tenuifiis, while at least some of the records from further south or in the Bay of Bengal will also be misidentifications. The rather wide range in scute and anal finray counts has not yet been correlated with geographical distribution or ecological differences on which subspecies might be based.

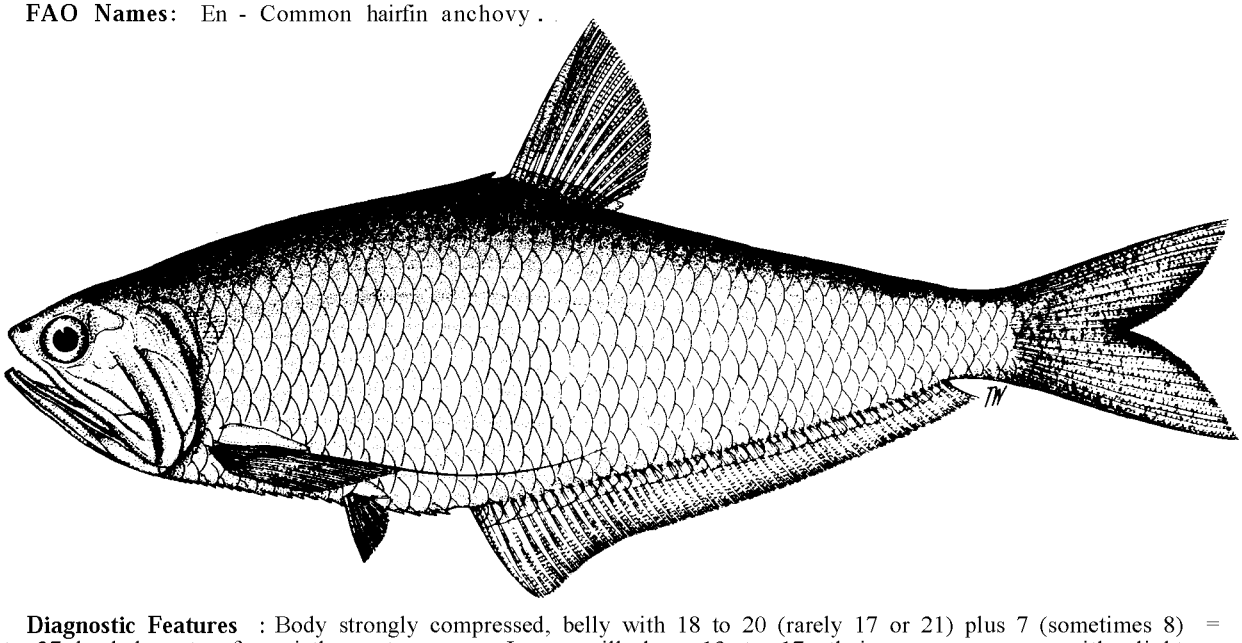
Setipinna tenuifilis (Valenciennes, 1848)

ENGR Seti 3

Engraulis tenuifilis Valenciennes, 1848, Hist.nat.poiss., 21:62 (Rangoon).

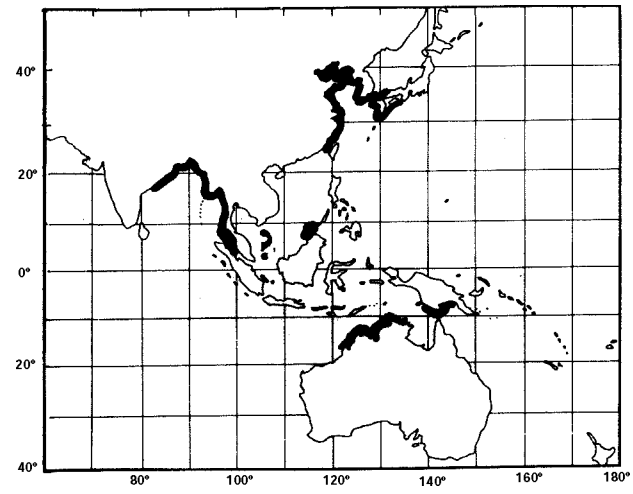
Synonyms : Setipinna gilberti Jordan & Starks, 1905:194, fig.1 (Chemulpo, Korea); Lindberg & Legeza, 1965:76, figs 93,94 (Sea of Japan, Yellow Sea); Idem, 1969:72, figs 93,94 (English translation of 1965 edition); ? Setipinna lighti Wu (on Herre), 1929:26, fig.20 (Amoy = Xiamen); Setipinna taty (part):Fowler, 1941d:689 (type of gilberti and Hong Kong specimen); Shen, 1959:25 (Taiwan Island); Chu, Tchang & Chen, 1963:114, fig.88 (East China Sea); Whitehead, 1967a:147 (types of tenuifilis); Setipinna godavari Babu Rao, 1962367 (Godavari estuary, India); Whitehead, 1968a:28, fig.3b (gillraker)(Bay of Bengal); Idem, 1973b:239, fig.63 (synopsis); Setipinna godavariensis Babu Rao & Jogelkar,1968:38 (unjustified emendation of godavari; biology); Setipinna papuensis Munro, 1964:150, fig.1 (Port Romilly, Gulf of Papua); Idem, 1967:45, p1.3, fig.34 (same); Setipinna tenuifilis-Wongratana, 1980:229 and 301, pls 267,268 and 269 (revision; subspecies tenuifiis and gilberti); Sainsbury, Kailola & Leyland, 1985:66, 67 (colour photo), 332 (Timor and Arafura Seas off northern coasts of Australia); Whitehead & Bauchot, 1986:34 (types of tenuifilis).

FAO Names: En - Common hairfin anchovy .



Diagnostic Features : Body strongly compressed, belly with 18 to 20 (rarely 17 or 21) plus 7 (sometimes 8) = 25 to 27 keeled scutes from isthmus to anus. Lower gillrakers 13 to 17, their serrae uneven, with slight or sometimes distinct clumps of larger serrae. Pectoral filament moderate, reaching back to base of 9th to 21st anal finray, total pectoral finrays 11 to 13 (mostly 12); anal finrays iii 46 to 56. Of species with less than 62 branched anal finrays and more than 23 scutes, it resembles S. taty, which has more scutes and gillrakers (32 to 40 and usually 18 to 20); it is also close to Setipinna paxtoni, which is rather hump-backed, deeper (depth 33 to 35% of standard length; cf. 27 to 33%), with a longer pectoral filament (to base of 27th to 41st anal finray) and a longer pelvic fin (reaching to anus); S. melanochir and S. breviceps have less than 13 gillrakers.

Geographical Distribution : Indian Ocean (northern and eastern coasts of Bay of Bengal, including Burma and the Andaman Islands; perhaps southward from the Godavari river, but no certain records) and western Pacific (northern coast of Australia, Gulf of Papua, Sarawak, presumably the Philippines and Hong Kong, certainly China coast from around Taiwand Island north to Yellow Sea and to southern part of Sea of Japan). Since only a single species of Setipinna occurs off China and Japan, the references to it and its distribution given by Lindberg & Legeza (1965, 1969) must refer to it.



Habitat and Biology : Marine, pelagic, presumably schooling and mostly coastal, but also entering estuaries (e.g. the Hooghly and Godavari) and penetrating at least 20 km up (Godavari), tolerating salinities as low as 8.7‰ (Babu Rao, 1962). Feeds on prawns, copepods, crustacean larvae, molluscs and fishes.

Size : To about 14 cm standard length, perhaps more (Chu, Tchang & Chen, 1963:114 give 16.3 cm, while Lindberg & Legeza, 1965, 1969:73 give 22 cm, but possibly mean total length).

Interest to Fisheries : Fairly common (at least in Museum collections) and certainly makes a significant contribution to artisanal Setipinna catches in the Hooghly and Godavari estuaries (Babu Rao & Jogelkar, 1968 - as godavariensis).

Local Name s :

Literature : Lindberg & Legeza (1965, 1969 - China and Japan: references, as gilberti and lighti); Babu Rao & Jogelkar (1968 - as godavariensis, fecundity, food, length/weight in Godavari and Hooghly estuaries).

Remarks : Long confused with S. taty and perhaps impossible to disentangle from the Indian Ocean and southeast Asian literature; however, all references to S. taty north of about Hong Kong must surely refer to S. tenuifilis.

Subspecies: Wongratana (1980:301) recognized two subspecies, based on gillraker numbers, pectoral filament length and body depth:

(a) S. tenuifilis tenuifilis: lower gillrakers 13 or 14; pectoral finrays usually 12, the filament reaching to base of 11th to 21st anal finray; body depth 28 to 33% of standard length; Bay of Bengal, South China Sea.

(b) S. tenuifilis gilberti: lower gillrakers 16 or 17; pectoral finrays 13, the filament reaching to base of 9th anal finray; body depth 27 to 30% of standard length; East China Sea to Japan.

Wongratana (1980:302) gave the name papuensis to four specimens from Medusa Bank, Cambridge Gulf, Western Australia, but subsequent examination of the type of papuensis showed that it is clearly tenuifilis. These Australian specimens represent a new species (see Setipinna paxtoni).

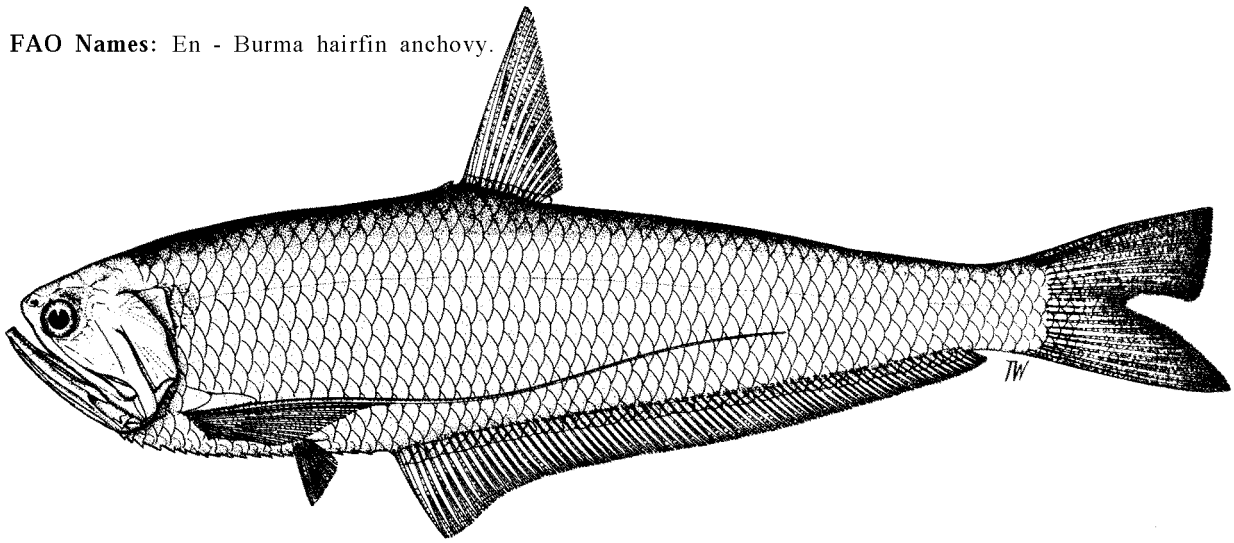
Setipinna wheeleri Wongratana, 1983

ENGR Seti 7

Setipinna wheeleri Wongratana, 1983, Japan J.Ichthyol., 29(4):405, fig.25 (Sittang River and Rangoon, Burma).

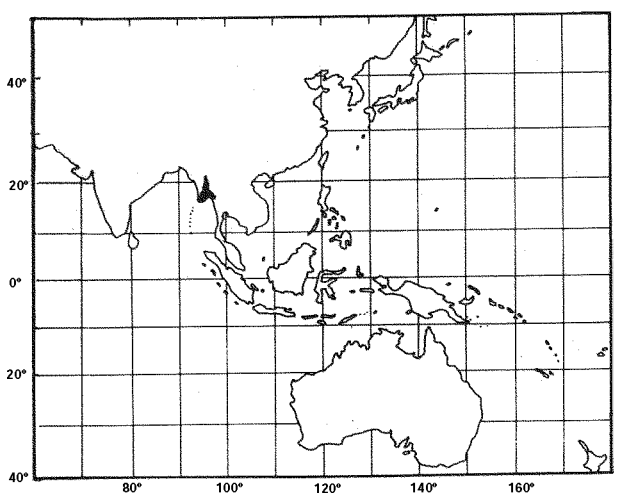
Synonyms : Engraulis telara:Day, 1878:627 (Rangoon specimens, now paratypes of wheeleri); Setipinna telara: Jordan & Seale, 1926:365 (Rangoon); Setipinna wheeleri-Wongratana, 1980:307, pl.275 (revision; name not validly published).

FAO Names: En - Burma hairfin anchovy.



Diagnostic Features : Body compressed, belly with 15 plus 6 or 7 = 21 or 22 keeled scutes from isthmus to anus. Lower gillrakers 21 or 22, their serrae in distinct clumps. Pectoral filament long, reaching to base of 45th to 51st anal finray; anal fin with iii 69 to 74 finrays; upper caudal lobe truncated, shorter than lower. In scutes, anal finrays and caudal fin shape it closely resembles S. phasa and S. brevifilis of Indian fresh waters, but these have fewer gillrakers (17 to 19). Other species of Setipinna have fewer anal finrays, but more scutes.

Geographical Distribution : Burma (Irrawady River at Rangoon and probably as far up as Mandalay, also Sittang River).



Habitat and Biology : Riverine, but probably tolerating some salinity in estuaries, thus not unlike S. phasa, but more data needed.

Size : To 18.5 cm standard length (Wongratana, 1980), but perhaps growing as large as S. phasa (about 28 cm standard length).

Interest to Fisheries : No data, but presumably similar to S. phasa.

Local Names :

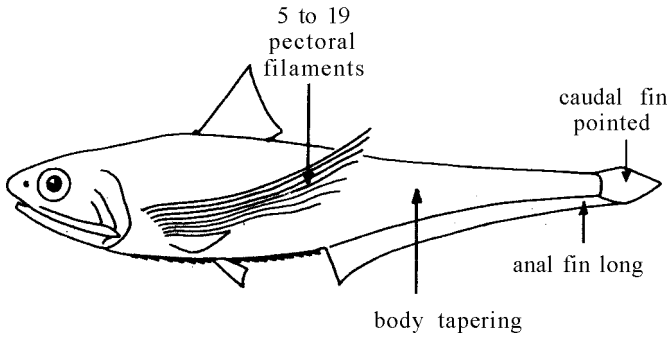
Literature :

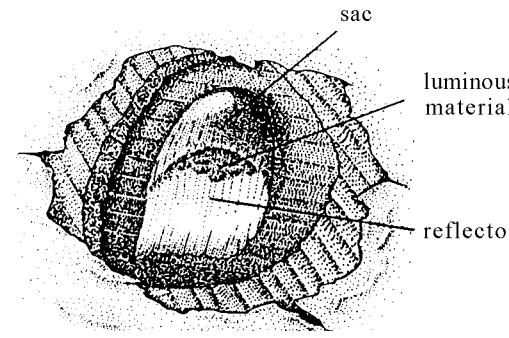
Remarks : References to Setipinna in Burmese fresh waters, e.g. by Day (1878) and later authors, most likely concern S. wheeleri.

Coilia Gray, 1831

ENGR Coil

[Mystus Linnaeus, 1754, Chinensis Lagerströmiana-Dissertatio:26, fig.12 (type: Mystus ensiformis Linnaeus = Clupea mystus Linnaeus). Pre-1758, thus inadmissible]. Mystus Lacepède, 1803, Hist.nat.poiss., 5:466 (type: Mystus clupeoides Lacepède, 1803 = Clupea mystus Linnaeus; pre-occupied by Mystus of Gronovius, 1763, Klein, 1775 and Scopoli, 1777 = a catfish). Coilia Gray, 1830, Illustr.Indian zool., Hardwicke, l(l):pl.85, fig.2 (caption only; this part of Gray's Illustrations was issued 6 January 1830 fide Sawyer, 1953); Idem, 1831, Zool.misc.:9 (type: Engraulis (Coilia) hamiltonii Gray, 1830 = Mystus ramcarati Hamilton-Buchanan). Choetomus McClelland, 1843, Calcutta J.nat.Hist.,4:405 (type: Choetomus playfairii McClelland, 1844 = Clupea mystus Linnaeus). Leptonurus Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., 22:14 (type: Leptonurus chrysostigma Bleeker, 1849 = Coilia dussumieri Valenciennes). Demicoilia Jordan & Seale, 1925, Copeia, (141):28 (type: Coilia quadragesimalis Valenciennes, 1848 = Mystus ramcarati Hamilton-Buchanan).





light organ in Coilia dussurnieri

Diagnostic Features : Medium-sized "rat-tailed" anchovies (mostly to 15 to 20 cm standard length, but some to 25 or even 35 cm), characterized by a long tapering body; belly rather rounded before pelvic fin base. A total of 11 to 61 scutes (usually with a complete series before pelvic fin base, but beginning behind pectoral fin base in some and very few or even no pre-pelvic scutes in others); a small spine-like scute just before dorsal fin origin. Maxilla short in some, reaching to or beyond edge of gill-cover, or even beyond pectoral fin base in others; first supra-maxilla present, elongate; jaw teeth small. Lower gillrakers fairly short, 21 to 36, their serrae not clumped. Pectoral fin with upper 5 to 19 finrays filamentous and reaching at least to anal fin origin; dorsal fin far forward, beginning in first third of body length; anal fin long with 80 or more finrays, the final finray joined to the caudal fin; the latter very small, pointed. Specimens with damaged tails (presumably bitten off by a predator) are not infrequent, the caudal fin regenerating. In one species (C. dussumieri) small light organs are developed on the body, the only case known among clupeoid fishes.

Biology, Habitat and Distribution : Marine, pelagic and coastal, often frequenting estuaries and tolerating lowered salinities (but probably not fully fresh waters). Although the body form parallels that of the macrourids, species of Coilia are not deep-water fishes. Feed on small fishes, crustaceans, etc. Indo-West Pacific only; not along western shores of Indian Ocean, but from about Karachi to Indonesia (Bali), not to the Philippines, Papua New Guinea or Australia, but northward to China and Japan.

Species: Wongratana (1980) recognized 13 species, which can be placed in two main groups:

(1) Scutes 11 to 23, maxilla not to edge of gill cover

(a) Pectoral filaments 6 (rarely 5)

C. dussumieri Valenciennes, 1848 Indian Ocean, Thailand, Indonesia
C. neglecta Whitehead, 1968 Indian Ocean, Indonesia
C. ramcarati (Hamilton-Buchanan, 1822) India (Ganges)

(b) Pectoral filaments 10 to 14 (or 16 to 19 in C. rebentischii)

C. borneensis Bleeker, 1851 Indonesia (Kalimantan, ? Java and Sumatra)
C. coomansi Hardenberg, 1934 Indonesia (Kalimantan)
C. rebentischii Bleeker, 1859 Viet Nam, Kalimantan
C. reynaldi Valenciennes, 1848 Bay of Bengal

(2) Scutes 34 to 61, maxilla to edge of gill cover or beyond, pectoral filaments 6 (or 7 in C. gravii)

C. brachygnathus Krayenberg & Pappenheim, 1908 China (freshwater)
C. gravii Richardson, 1845 China, also southern India
C. lindmani Bleeker, 1858 Indonesia to Viet Nam
C. macrognathos Bleeker, 1852 Andaman Sea, Kalimantan, Sarawak
C. mystus (Linnaeus, 1758) Andaman Sea, China
C. nasus Schlegel, 1846 China

Remarks : The genus Demicoilia was based on mutilated specimens lacking the end of the body; that a superficially normal caudal fin can be regenerated around a vertebra (with or possibly without migration of anal finrays) is well shown by Menon (1951) and discussed by Jones & Menon (1952).

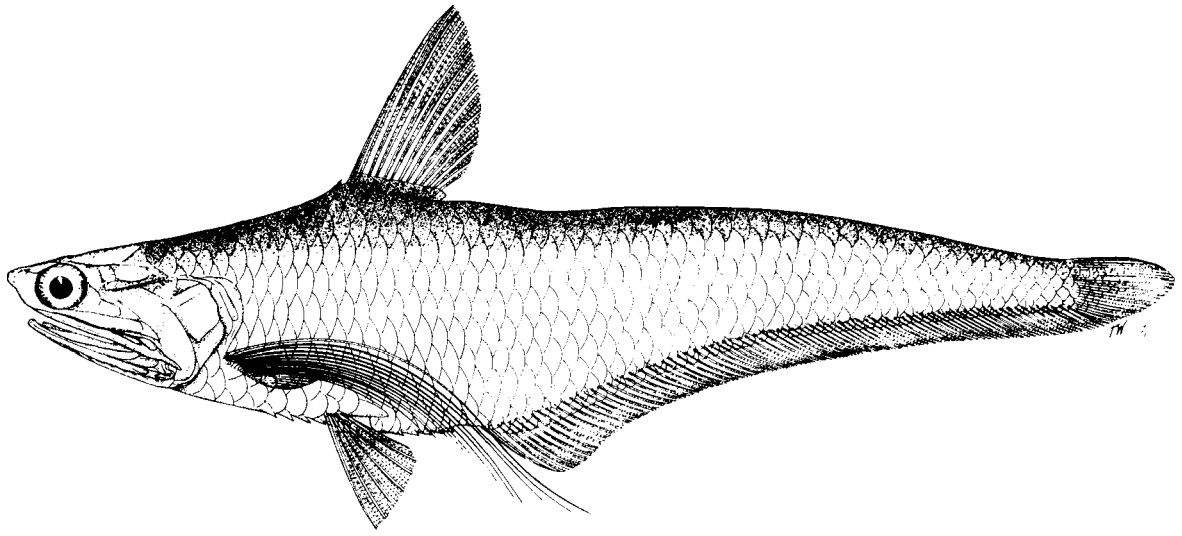
Coilia borneensis Bleeker, 1852

ENGR Coil 5

Coilia borneensis Bleeker, 1851, Natuurk.Tijdschr.Ned.-Indie, 258 (Banjermasin, Kalimantan; name only, thus a nomen nudum); Idem, 1852, Ibid., 3:437 (Banjermasin, also Pamangkat).

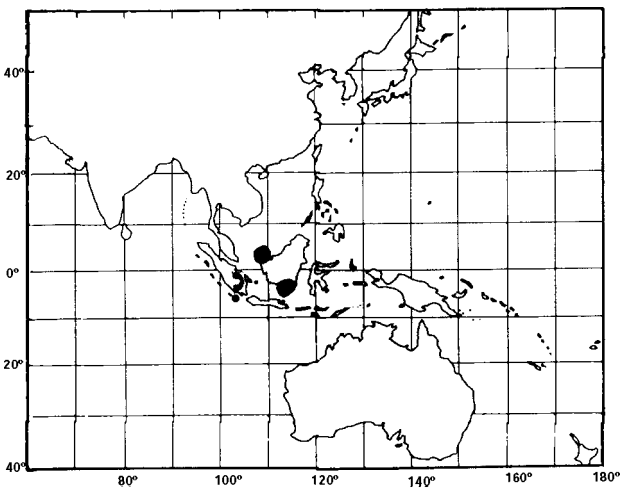
Synonyms :? Coilia polyfilis Volz, 1903, Zool.Anz.,26:559 (Banjuasin, Palembang, southeastern Sumatra); Coilia borneensis-Weber & de Beaufort, 1913:52 (Bleekerrspecimens in Leiden); Fowler, 1941:717 (compiled); Whitehead, Boeseman & Wheeler,1966:139, pl.18, fig.2 (types of borneensis); Wongratana, 1980:313, pl.286 (revision). Note: Indian records of C. borneensis probably refer to C. reynaldi, a very similar species (see Remarks).

FAO Names : En - Bornean grenadier anchovy.



Diagnostic Features: Body tapering, belly rounded before pelvic fins, with 4 or 5 plus 7 or 8 = 11 to 13 keeled scutes from just behind pectoral fin base to anus. Maxilla short, not reaching to edge of gill cover. Lower gillrakers 32. Pectoral fin with 13 or 14 long filaments and 5 to 7 branched finrays, much shorter than those of pelvic fin, the latter with i 6 finrays. Of species with more than 7 pectoral filaments, C. reynaldi occurs only in the Indian Ocean; of Indonesian species, C. rebentischii has more pectoral filaments (16 to 19), while C. coomansi has fewer (10 or ll), but more pre-pelvic scutes (11 or 12).

Geographical Distribution : Indonesia (Kalimantan at Pamangkat on the western coast and Banjermasin on the Barito River to the south).



Habitat and Biology : Evidently riverine, or at least estuarine, but perhaps also in the sea. More data needed.

Size : To 12.4 cm standard length, but perhaps larger.

Interest to Fisheries : Unknown.

Local Names :

Literature : Uncertainty over identifications makes previous literature suspect.

Remarks : Whitehead (1967a:152 and 1969a:272) considered borneensis a synonym of C. reynaldi Wongratana (1980:314) acknowledged the similarity, but kept them distinct species on the following characters:

	C. reynaldi	C. borneensis
Scutes	6 to 9 plus 7 to 11 = 13 to 19	4 to 5 plus 7 or 8 = 11 to 13
Pectoral filaments	10 to 13	13 or 14
Scales on isthmus	covering half of isthmus	none or at most 1 or 2 on base of isthmus
Striae on front part of scales	reticulated	horizontal lines

These differences are not very trenchant and further study may well bring the two species together again, possibly as subspecies, reynaldi from the Indian Ocean and borneensis from Indonesia.

Coilia polyfilis Volz is tentatively included here. The holotype has 4 plus 8 scutes and 31 lower gillrakers, but 11 pectoral filaments plus 8 branched finrays, thus slightly outside the recorded range for C. borneensis.

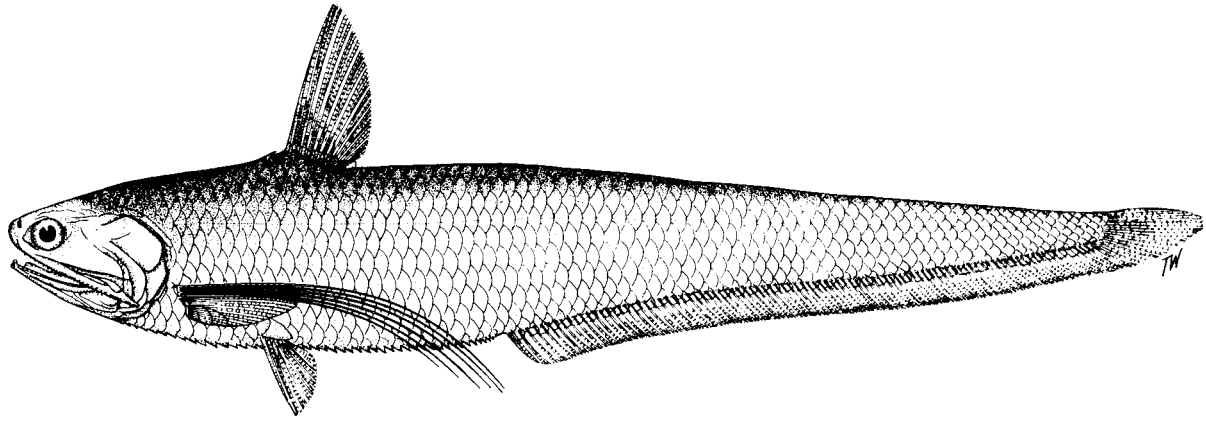
Coilia brachygnathus Kreyenberg & Pappenheim, 1908

ENGR Coil 9

Coilia brachygnathus Kreyenberg & Pappenheim, 1908, Sber.Ges.naturf.Freunde Berl., (4):96 (Tung Ting Lake and Hankow).

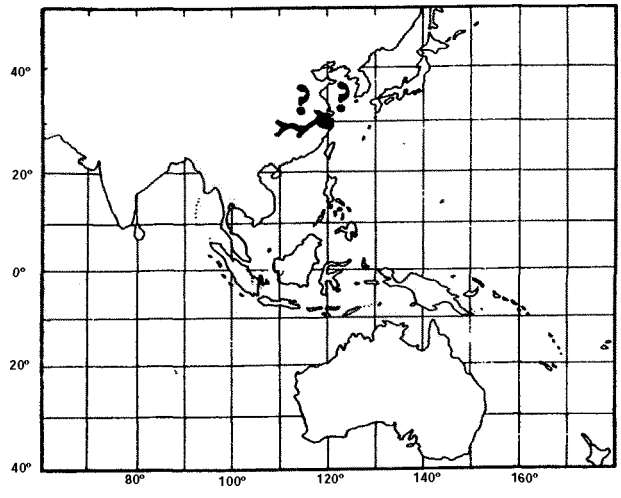
Synonyms : Coilia rendahli: Jordan & Seale, 1926:362 (Shanghai); Fowler, 1931a:83 (compiled); Wongratana, 1980:323, pl.293 (revision); Coilia brachygnathus-Yuen, Lin, Qin & Liu, 1976:9, tabs 5,6 (Yangtse River, meristics); Anon., 1977:122, p1.2 upper, fig.8 (distributional map) (Yangtse River, description, etc.); Yuen, Qin, Liu & Lin, 1980:71, tab.5 (Yangtse River, synopsis); Qin & Yuen, 1980:2 (Taihu Lake, biol.); Zhou & Lin, 1985:107, figs 1-3 (electrophoretograms) (protein analysis, cf. nasus); Qin, Yuen & Gu, 1986:108, figs 56, 57, 58-59 (otoliths) (Taihu Lake populations).

FAO Names : En - Yangtse grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 18 to 20 plus 34 to 36 = 54 or 55 keeled scutes from isthmus to anus. Maxilla short, not reaching to edge of gill cover. Lower gillrakers 21 to 24. Pectoral fin with 6 long filaments and 11 (rarely 12) branched finrays, longer than those of pelvic fin. All other species in Chinese and Japanese waters have the maxilla reaching well past the edge of the gill cover, also C. grayii and C. mystus have more gillrakers (25 to 31) and these and C. nasus have about 3 scales on the base of the isthmus (naked in C. brachygnathus).

Geographical Distribution : Freshwater in Yangtse system (from near mouth to beyond Tung Ting Lake, thus at least 1 000 km up river), perhaps in Yellow River also, but not in sea.



Habitat and Biology : Purely freshwater in tributaries and associated lakes.

Size : To 27 cm standard length.

Interest to Fisheries : An important commercial fish in the Yangtse River system.

Local Names :

Literature : Numerous papers from Dr Yuen Chuan-fu and his colleagues in Nanjing University (see Synonymy).

Remarks : Wongratana (1980) believed C. brachygnathus to be C. nasus, but the latter has a long maxilla (to well beyond gill cover); the maxilla in C. brachygnathus was described as at most reaching the gill cover in adults as well as juveniles (as also in C. rendahli) and Yangtse River specimens can be distinguished from sympatric C. nasus on this character.

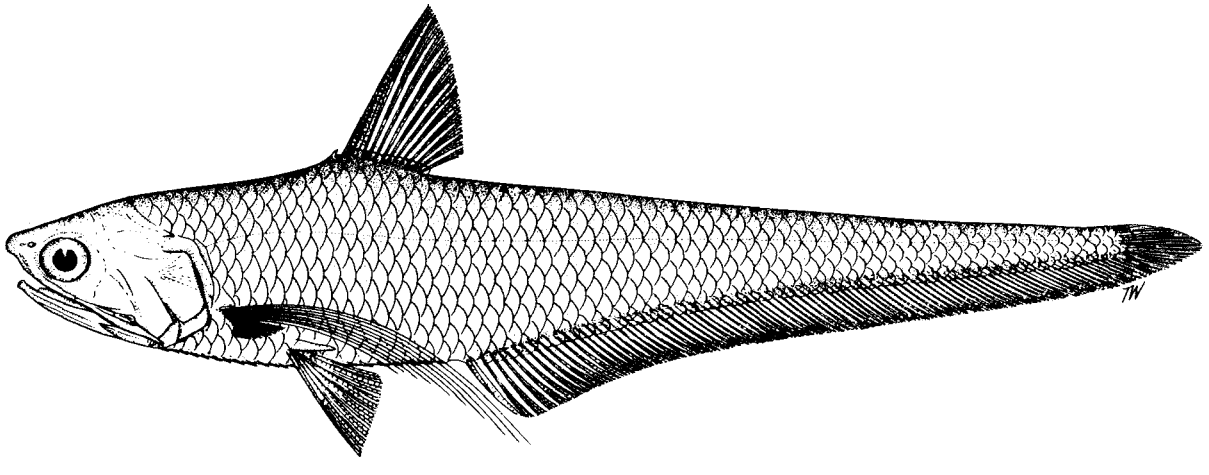
Coilia coomansi Hardenberg, 1934

ENGR Coil 7

Coilia coomansi Hardenberg, 1934, Treubia, 14(3):294 (lower part of Kapuas River, western Kalimantan).

Synonyms : Coilia coomansi: Hardenberg, 1936:228 (Peniti River, Pontianak, Telok Pekadai, western Kalimantan); Fowler, 1941d:717 (compiled); Wongratana, 1980:316, pl.286 (Banjermasin on Barito River and Djungkat, Kapuas system, Kalimantan; revision).

FAO Names: En - Cooman's grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded in front of pelvic fins, with 11 or 12 plus 9 to 11 = 20 to 23 keeled scutes from isthmus to anus. Maxilla short, not reaching beyond edge of gill cover. Lower gillrakers 31 to 33. Pectoral fin with 10 or 11 long filaments and 7 or 8 branched finrays, much shorter than those of pelvic fin. Of species with more than 7 pectoral filaments, C. reynaldi occurs only in the Indian Ocean; of Indonesian species, C. borneensis and C. rebentischii have more pectoral filaments (11 to 13 and 16 to 19) and fewer scutes (11 to 13).

Geographical Distribution : Indonesia (south-western coast of Kalimantan from Pontianak to the Barito River: also Palembang on the Musi River, Sumatra).

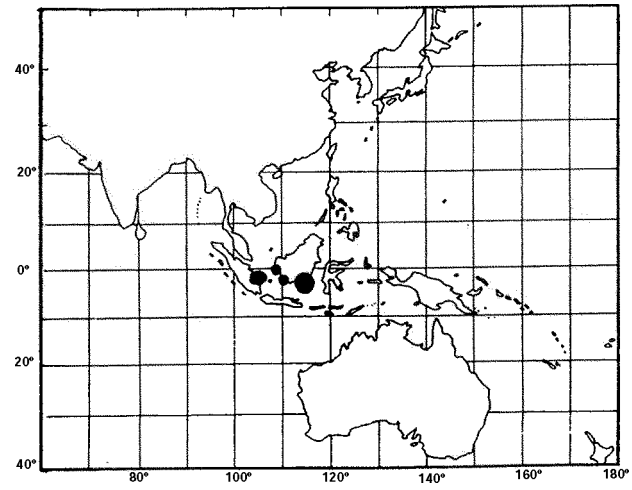
Habitat and Biology : Coastal and estuarine, but the extent of its movements into the sea or up rivers is not known.

Size : To 12.3 cm standard length (Wongratana, 1980), but perhaps larger.

Interest to Fisheries : Unknown, but its rarity in museum collections may not reflect its actual abundance.

Local Names :

Literature : As noted by Wongratana (1980: 316), perhaps all records since description of the species have been either compilations or misidentifications.



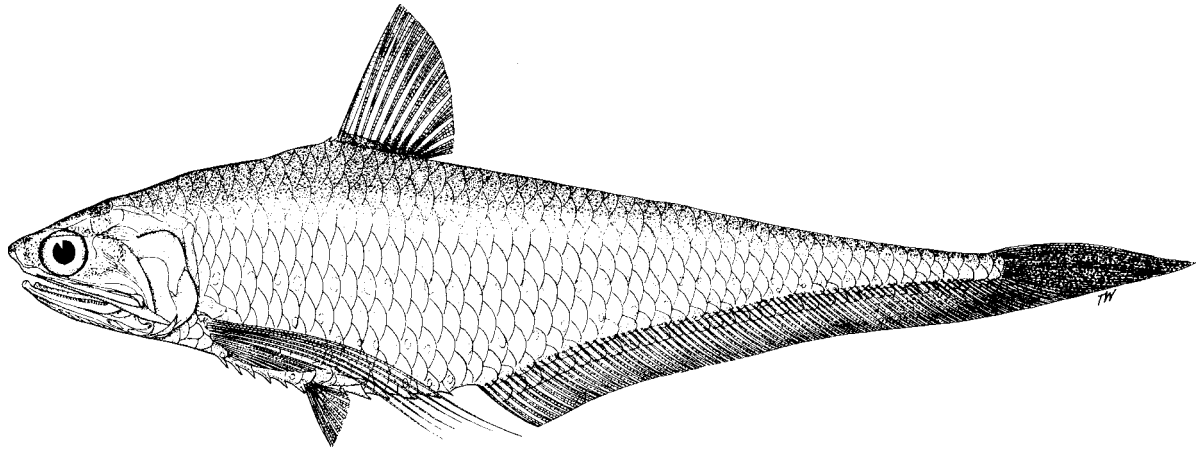
Coilia dussumieri Valenciennes, 1848

ENGR Coil 2

Coilia dussumieri Valenciennes, 1848, Hist.nat.poiss., 21:81, pl.610 (Bombay).

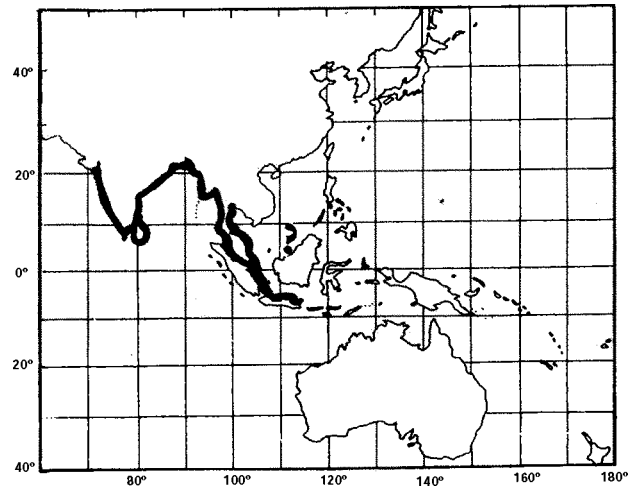
Synonyms: Leptonurus chrysostigma Bleeker, 1849c:14 (Madura, near Kammal and Surabaya); Coilia quadrifilis Günther, 1868:403 (Penang, Singapore); Weber & de Beaufort,1913:51 (compiled); Demicoilia margaratifera Jordan & Seale, 1926:363 (Colombo, Ceylon); Coilia dussumieri-Day, 1878:631, pl.158, fig.8 (Bombay, Orissa, estuaries and the sea); Fowler, 1941d:714 (Bombay, but Seychelles an error); Jones & Menon, 1952:24, figs 5,6a-e (larvae, tail) (Jaunput, Chandipur, Burhabalang estuary); Bal & Joshi, 1956:91 et seq. (Bombay, biology); Moona, 1960:313 et. seq. (Bombay, skull); Haneda, 1961:46, figs 1,2 (light organs); Whitehead, Boeseman & Wheeler, 1966:144, pl.19 fig.2 (Bleeker's figure) (lectotype of chrysostigma); Whitehead, 1967a:154 (lectotype off dussumieri); Idem, 1969a:275, fig.58 (compiled) Idem, 1973b244, fig.68 (synopsis); Seshagiri Rao, 1975:736 (Gollapalem, Masulipatam); Wongratana, 1980:320, pls 291,292 (revision); Whitehead, 1985:15, figs 15,16 (light organs); Whitehead & Bauchot, 1986:30 (lectotype of dussumieri).

FAO Names: En - Goldspotted grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 5 or 6 (rarely 4) plus 7 to 9 = 12 to 15 keeled scutes from just behind pectoral fin base to anus. Maxilla short, not quite reaching to edge of gill cover. Lower gillrakers 23 to 26. Pectoral fin with 6 long filaments and 9 to 11 (rarely 8) branched finrays, longer than those of pelvic fin, which has i 6 finrays. Flanks and belly with golden or pearly spots in rows below scales, also along isthmus, along edge of lower jaw and a few on cheek and gill cover (light organs, with a pocket for luminous material and a silvery reflector below - see Whitehead, 1985:fig.16), the disposition of the light organs varying a little between individuals; their terminology was illustrated by Haneda (1961:fig.l). The presence of light organs distinguishes this species from all other species of Coilia. Otherwise it is virtually identical to C. neglecta (see under that species). Of other species with not more than 7 pectoral filaments, C. ramcarati has i 8 or 9 pelvic finrays, and all others have over 30 scutes. See ENGR Coil 2, Fishing Area 51.

Geographical Distribution : Indian Ocean (coasts of India from Bombay to Calcutta, probably also Burma, Thailand and Malaysia) and western central Pacific area (Thailand to Java, presumably also Kalimantan). The Seychelles record given by Fowler (1941d:715) and Smith & Smith (1963:8, pl.4 J) was based on a Mahe specimen listed by Valenciennes (1848:83), but there is no such specimen in Paris and Coilia is quite unknown along the coast of Africa; in fact, Mahé is to the south of Cannanore, India.



Habitat and Biology : Coastal and estuarine, in fully saline water, but also able to tolerate lowered salinities, perhaps almost fresh water. Feeds on copepods, prawn and fish larvae, various unidentified crustaceans and cypris, also stomatopod larvae, mysids, polychaete larvae, isopods and Sagitta. Breeding season perhaps extended; probably enters estuaries to breed (larvae about 5 km up Burhabalang estuary, Orissa in May and June - Jones & Menon, 1952).

Size : To 16.4 cm standard length (Wongratana, 1980), but perhaps to 20 cm total length (Bal & Joshi, 1956).

Interest to Fisheries : Found in appreciable numbers in Indian coastal waters and at the mouths of estuaries, where it is caught by bagnet (dol, Bombay area) and forms an important food item locally.

Local Names : INDIA: Mandeli (Bombay).

Literature : In addition to works given in the synonymy, see also Delsman (1932 - eggs, if correctly identified), Bapat & Bal (1950 - food), Joshi & Bal (1953 - skeleton), Palekar & Karandikar (1953 -maturity).

Remarks : The presence of light organs in C. dussumieri is unique amongst clupeoid fishes, but occurs in a genus that has departed more than any other from the typical clupeoid form.

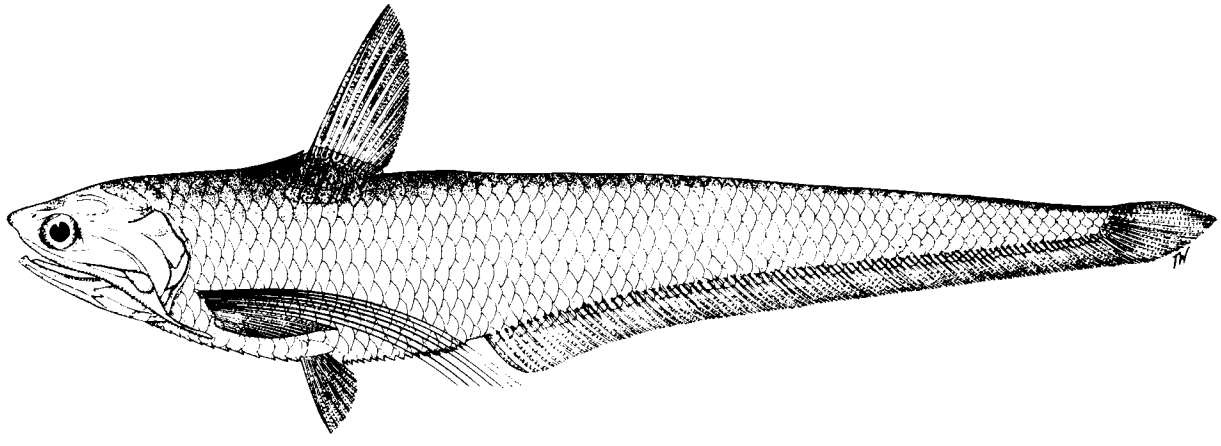
Coilia grayii Richardson, 1845

ENGR Coil 13

Coilia grayii Richardson, 1845, Ichthyol.voy.Sulphur:99, pl.54, figs 1,2 (China Seas); Idem, 1846, Ichthyol. seas China Japan:309 (type and a Reeves drawing, the latter from Canton).

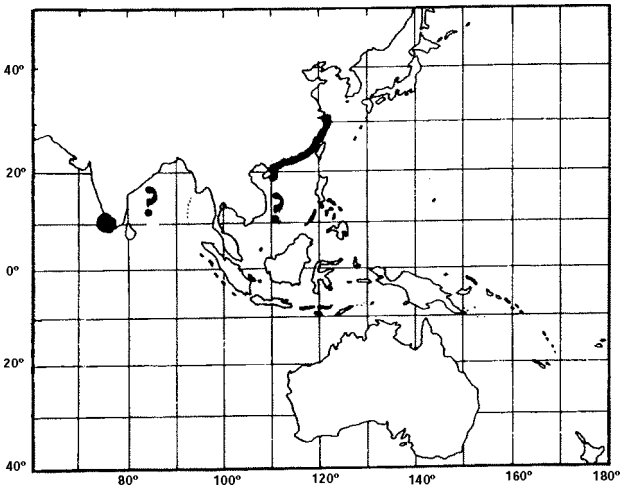
Synonyms : Coilia mystus:Whitehead, 1966a:39 (type of grayii); Talwar, 1973 (Kerala, India); Coilia grayii-Jordan & Seale, 1926:361 (Hong Kong); Fowler, 1931a:82, fig.22 Hong Kong, compiled); Idem, 1941d:722 Viet Nam, Suchow); Chu, Tchang & Chen, 1963:115 (East China Sea); Wongratana, 1980:324, pls 294,295 (revision); Yuen, Qin, Liu & Lin, 1Y80:74 (China coasts); Chen 1986:101, fig.1 (Pearl River, larvae, juveniles).

FAO Names : En - Gray's grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 12 to 15 plus 22 to 29 = 36 to 44 keeled scutes from isthmus to anus. Maxilla long, reaching to or beyond base of first pectoral finray. Lower gillrakers 28 to 31. Pectoral fin with 7 filaments and 10 or 11 (rarely 12) branched finrays, longer than those of pelvic fin, which has i 6 finrays All other species with a long maxilla have only 6 pectoral filaments; otherwise it very closely resembles C. mystus.

Geographical Distribution : East and South China Seas (from at least Suchow south to Hainan and most likely to Viet Nam), also Indian Ocean (Kerala - see Remarks).



Habitat and Biology : Coastal and estuarine, presumably with a biology similar to that of other members of the genus. More specimens and data needed.

Size : To 25 cm standard length.

Interest to Fisheries :

Local Names : HONG KONG: Fung mi, Fung ne, Fung we.

Literature : Probably incuded in references to C. mystus.

Remarks : Among the species with a low number of pectoral filaments, C. gravii is the only one with a count of 7 (6 in all the rest). At present, this extra filament is the sole distinction from C. mystus. Whitehead (1966a:40) doubted the significance of an extra filament; Wongratana (1980:325) was hesitant, but preferred to keep gravii separate. One of the types of C. mystus has 7 filaments (see under that species). Talwar (1971) reported four specimens of C. mystus from the southeastern coast of India. Wongratana (1980524) identified one of these as C. gravii, thus well out of the normal range of the species (the provenance and identification seem secure).

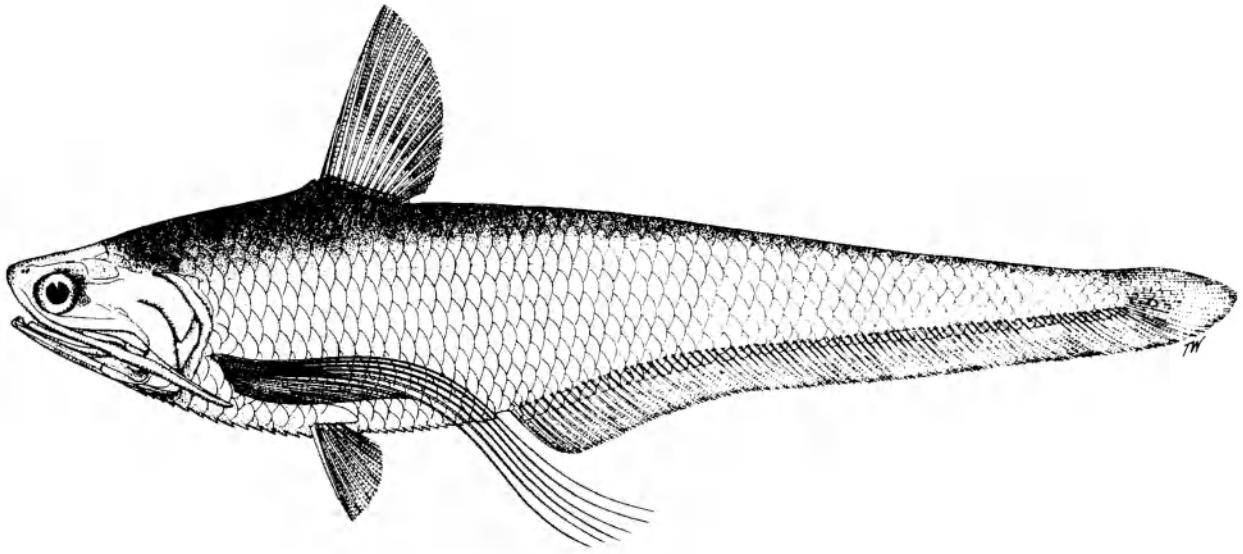
Coilia lindmani Bleeker, 1858

ENGR Coil 10

Coilia lindmani Bleeker, 1858, Act.Soc.sci.Indo-Neerl., 3:48 (Palembang, southeastern Sumatra).

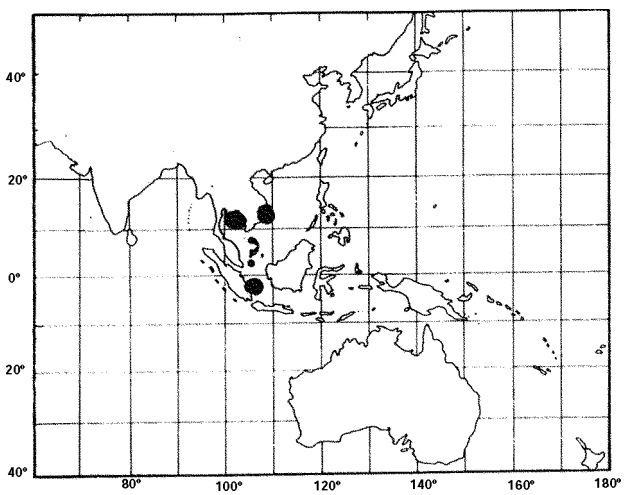
Synonyms : Coilia macrognathos aequidentata Chabanaud, 1924:59 (Saigon River mouth, Viet Nam); Coilia lindmani-Weber & de Beaufort, 1913:49 (compiled); Fowler, 1941d:723 (same); Whitehead, Boeseman & Wheeler, 1966:142, pl.19, fig.1 (Bleeker's figure) (type of lindmani); Wongratana, 1980:325, pls 296.297 (revision); Whitehead & Bauchot, 1986:30 (types of aequidentata).

FAO Names: En - Lindman's grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 13 to 15 plus 20 to 25 = 34 to 40 keeled scutes from isthmus to anus. Maxilla long, reaching to or beyond base of first pectoral finray. Lower gillrakers 30 to 34 (rarely 29). Pectoral fin with 6 long filaments and 9 to 11 (usually 10) branched finrays, longer than those of pelvic fin. Of species in the area with a long maxilla and more than 30 scutes, both C. mystus and C. macrognathos have more scutes (41 to 50 and 47 to 54; also only 21 to 24 gillrakers in C. macrognathos), while C. gravii has seven pectoral filaments.

Geographical Distribution : Western central Pacific area (rivers of Viet Nam, Thailand and southeastern Sumatra, perhaps also eastern Malaysia and western Kalimantan).



Habitat and Biology : Riverine, but insufficient data to show if this species also occurs along coasts or whether it is estuarine and not freshwater.

Size : To 20 cm standard length.

Interest to Fisheries : Unknown, but presumlably enters artisanal catches.

Local Names :

Literature :

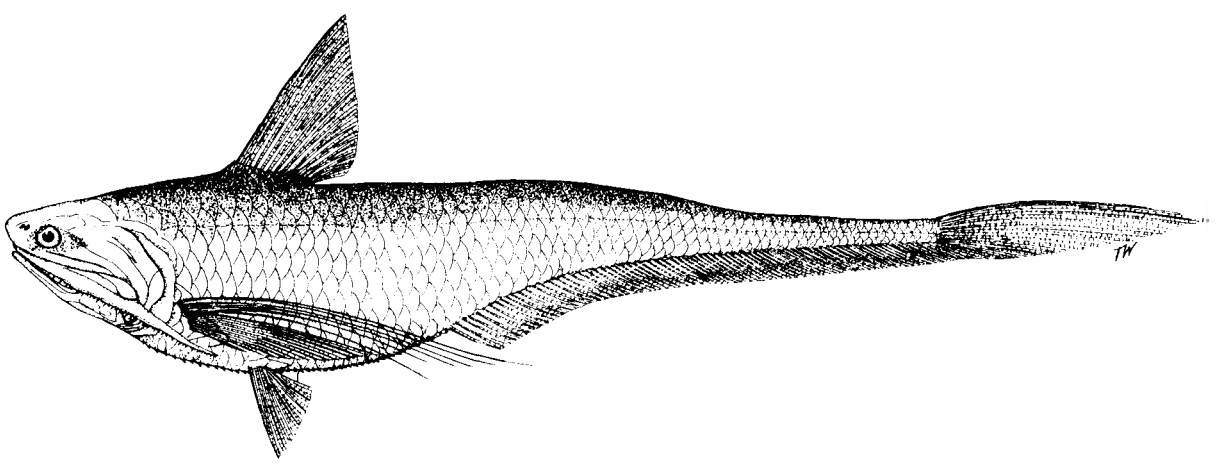
Coilia macrognathos Bleeker, 1852

ENGR Coil 1

Coilia macrognathos Bleeker, 1852, Natuurk Tijdschr.Ned.-Indië, 3:436 (Pamangkat, western Kalimantan).

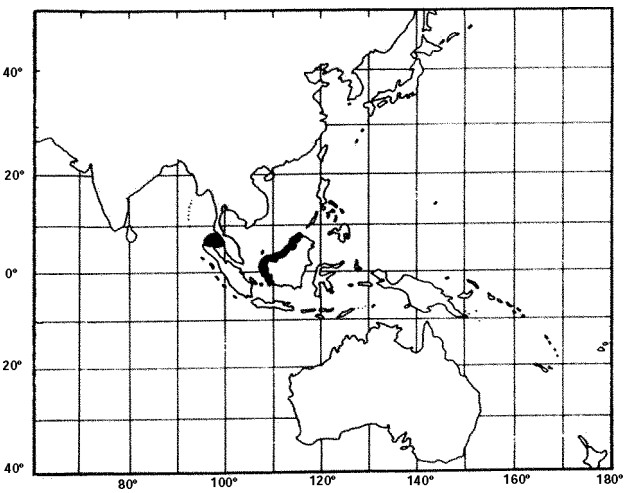
Synonyms : Coilia macrognathos- Weber & de Beaufort, 1913:49 (Bleeker's type); Hardenberg, 1933b:217 (Kumai River); Idem,1936:228 (Pontianak, Padang Tikarbay, Kalimantan); Fowler, 1941d:721 (same); Whitehead, Boeseman & Wheeler, 1966:141, p1.18, fig.3 (Bleeker's figure)(lectotype of macrognathos); Whitehead, 1969a:274, fig.57 (Sarawak); Wongratana, 1980:327, pls 298,299 (revision; aequidentatus not a synonym, but C. lindmani).

FAO Names: En - Longjaw grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 14 to 16 plus 31 to 39 = 47 to 54 keeled scutes from isthmus to anus. Maxilla long, reaching to beyond pectoral fin base. Lower gillrakers 21 to 24. Pectoral fin with 6 filaments and 10 to 12 branched finrays, longer than those of pelvic fin. Of species in the area with a long maxilla and more than 30 scutes, C. lindmani and C. mystus have more gillrakers (29 to 34 and 25 to 31; also, 34 to 40 scutes in C. lindmani), while C. gravi has 7 pectoral filarnents. See ENGK Coil 1, Fishing Areas 57/71.

Geographical Distribution : Western central Pacific area (Sarawak and western coast of Kalimantan), also two specimens from Phuket Island, Thailand, i.e. Andaman Sea (Wongratana, 1980:327).



Habitat and Biology : Presumably estuarine, like other Coilia species, but more data needed.

Size : To 18.5, cm standard length.

Interest to Fisheries :

Local Names :

Literature :

Remarks : The true provenance of the Phuket specimens is open to doubt.

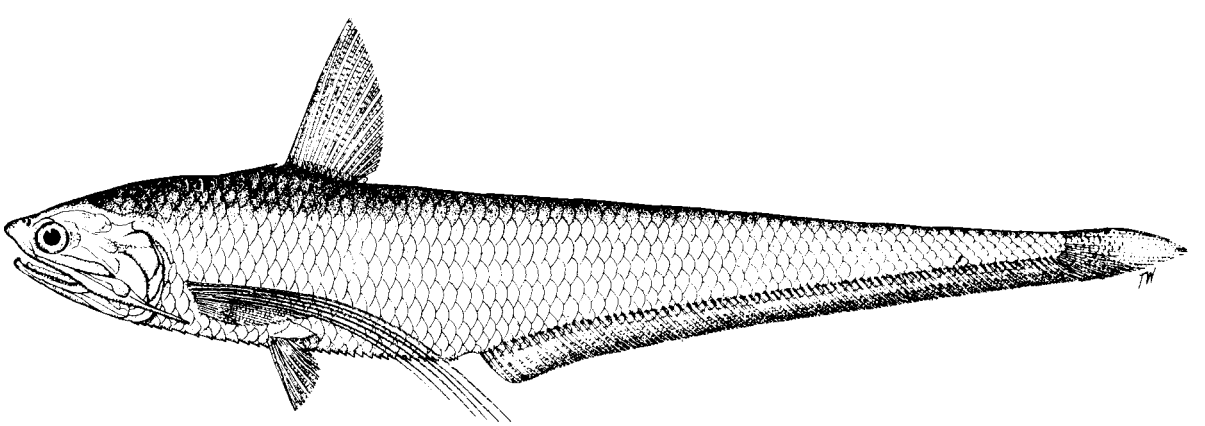
Coilia mystus (Linnaeus, 1758)

ENGR Coil 12

Clupea mystus Linnaeus, 1758, Syst.nat.,10th ed.:319 (name from Osbeck, 1757:256, description on Layerström and perhaps Osbeck specimens, China); Idem, 1759, Amoen.Acad.,4(61):252, fig.12 (repeat of his Mystus ensiformis description and figure of 1754 - see below).

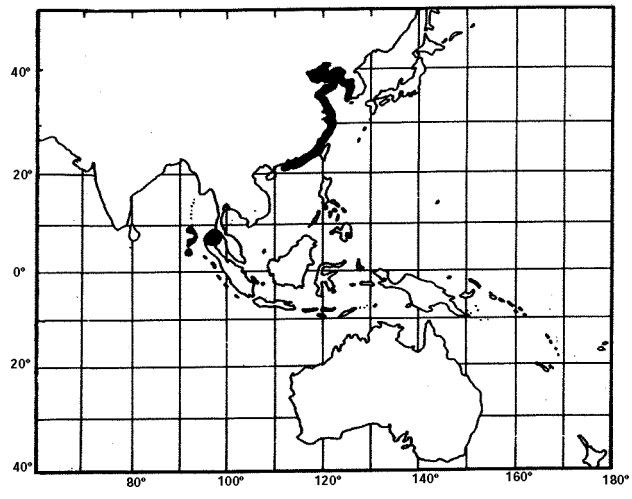
Synonyms : [Mystus ensiformis Linnaeus,1754:26, fig.12 (China, on Lagerström material); Clupea mystus Osbeck, 1757:256 (Canton area)]; Linnaeus, 1764:106 (China specimen(s) in the King's collection; meristic data repeated from Linnaeus, 1758:319); Mystus clupeoides Lacepède, 1803:466 (mainly, perhaps wholly, on Osbeck); Choetorrrus playfairii McClelland, 1844:405, p1.24, fig.3 (China); Osteoglossum prionostoma Basilewsky, 1855:244 (Gulf of Tschiliensis, China); Coilia mystus-Jordan & Seale,1926:359 (Hong Kong); Fowler, 1931a:8l (compiled); Idem, 1941d:719 (Japan; Port Arthur China; large synonymy, but nasus, ectenes, brachygnathus wrongly included); Chu, Tchang & Chen, 1963:115 (East China Sea; nasus wrongly included); Lindberg & Legeza, 1965:67, fig.86 (Foochow, Nampo Bunge, China); Whitehead, 1967a:149 (status of clupeoides; no type); Lindberg & Legeza, 1969:64, fig.86 (English translation of 1965 edition); Whitehead, 1973b:243, fig.67 (China, Japan specimens only; grayii, brachygnathus wrongly included); Wongratana,1980:327, pls 300,301 (revision); Fernholm & Wheeler, 1983:210 (Linnaean types of mystus in Stockholm and Uppsala); Yuen,Qin, Liu & Lin, 1980:72 (coasts of China, ecotypes); Whitehead & Bauchot, 1986:49 (status of clupeoides); Chen & Wei, 1986:105, fig.2 (Pearl River, larvae, juveniles).

FAO Names : En - Osbeck's grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 16 to 19 plus 24 to 32 = 41 to 50 keeled scutes from isthmus to anus. Maxilla long, reaching to or almost to base of first pectoral finray. Lower gillrakers 25 to 31 (usually 27 or 28). Pectoral fin with 6 filaments and 11 or 12 (rarely 13 or 14) branched finrays, longer than those of pelvic fin. Of species in the area with a long maxilla and more than 30 scutes, the very similar C. grayii has 7 pectoral filaments, C. lindmani has fewer scutes (34 to 40), C. macrognathus has fewer gillrakers and usually more scutes (21 to 24 and 47 to 54), while C. nasus has only 10 to 14 pre-dorsal scales, about 9 to 12 pyloric caeca and usually 11 or 12 branchiostegal rays (cf. 17 to 24, 15 to 18 and 10 in C. mystus).

Geographical Distribution : Western Pacific (East China Sea from about Hainan north to Port Arthur (Lu-shun) and perhaps to Korea, although the more northerly records could apply to C. nasus); also a single specimen from Phuket Island, Thailand, i.e. the Andaman Sea (Wongratana, 1980:328), but the provenance seems doubtful. The records of four specimens from Kerala, southern India (Talwar, 1973) refer to C. grayii.



Habitat and Biology : Coastal and estuarine, but very few data based on reliable identifications.

Size : To 20 cm standard length. Lindberg & Legeza (1965,1969) give 27.5 cm and more, but perhaps this refers to C. nasus (which they included in their synonymy).

Interest to Fisheries : Presumably contributes to artisanal catches in estuaries.

Local Names :

Literature :

Remarks : Two specimens have been recognized as types of Clupea mystus Linnaeus (Fernholm & Wheeler, 1983 :210):

1. Uppsala Linnaeus Collection No. 108 (151.6 mm standard length), labelled Clupea encrasicolus, almost certainly collected by Lagerström, thus basis for Mystus ensiformis of Linnaeus (1754). It has 6 pectoral filaments, thus C. mystus.

2. Naturhistoriska Rijksmuseet, Stockholm No. LP74 (123.5 mm standard length), labelled Clupea mystus, formerly in the collection of Adolf Frederik at Ulriksdal. It has 7 pectoral filaments, thus C. grayii.

To avoid nomenclatural confusion it would be best to designate the Uppsala specimen (with 6 pectoral filaments) as lectotype of Clupea mystus Linnaeus, 1758. This would prevent substitution of the name mystus for grayii, and the name clupeoides for mystus.

On Wongratana's data, specimens with more than 26 gillrakers are C. mystus, and ones with less than 2.6 gillrakers are C. nasus; those with 25 or 26 gillrakers must be separated on other characters, which are not easy to see in the field (pre-dorsal scales,branchiostegal rays, pyloric caeca) and the two species will certainly continue to be confused in fishery and other literature. Their ranges overlap from perhaps Shanghai northward (if indeed the northern records are C. mystus - see also under C. nasus).

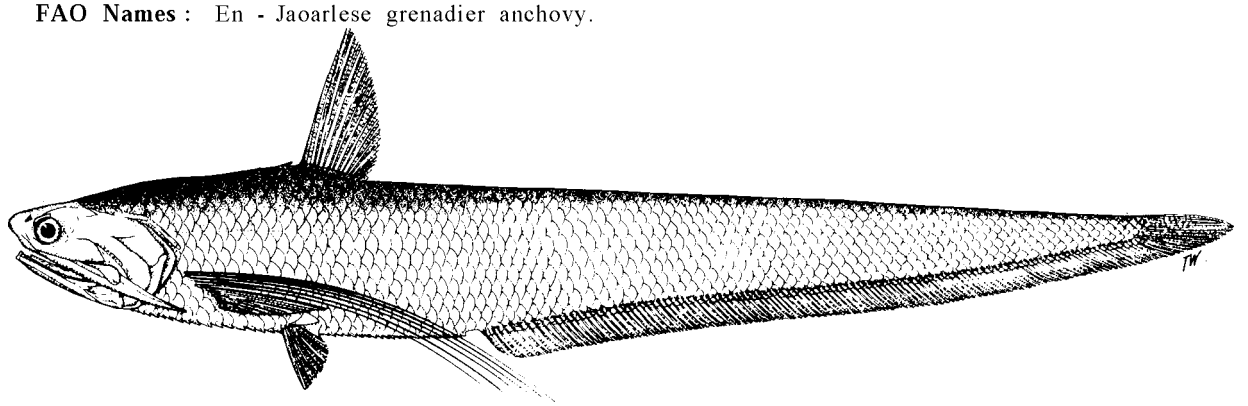
Coilia nasus Schlegel, 1846

ENGR Coil 11

Coilia nasus Schlegel, 1846, Fauna Japonica, pt.13:243, p1.109, fig.4 (Japan; dated 22 November 1846 by Bauchot-Whitehead and Monod, 1982:67; presumed Nagasaki, but claimed as Ariake Sound by Takita, 1967a:450).

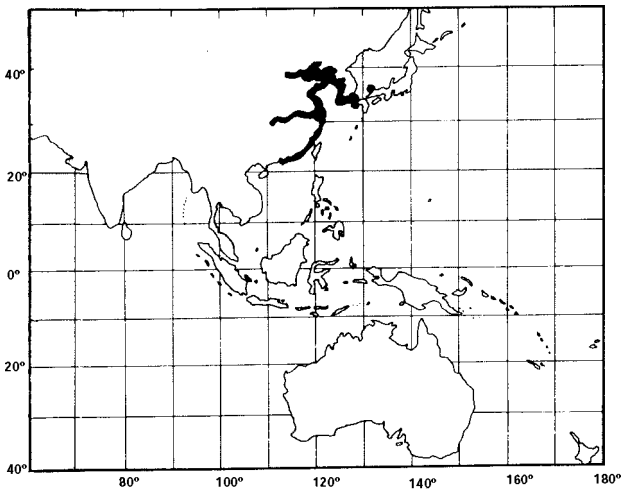
Synonyms : Coilia ectenes Jordan & Seale, 1905:517, fig.1 (Shanghai); Fowler, 1931:83 (Shanghai; Hong Kong record presumably C. mystus); Yoshida, 1935:788 (Ariake Sound, Japan); Chu, Tchang & Chen, 1963:116 (East China Sea); Lindberg & Legeza, 1965:69, fig.87 (Pusan, Sea of Japan, also Yellow Sea, Yangtze river and Shanghai); Idem, 1969:65, fig.87 (English translation of 1965 edition); Yuen, Lin, Liu & Qin, 1978285 (Yangtse River, age and growth); Coilia ectenes taihuensis: Idem, 1977:135 (Taihu, Kiangsu Province); Coilia species:Takita, 1967a:45 et seq., fig.1 (Ariake Sound, Japan); Idem, 1967b:107 et seq., figs 3,4 (embryo, larvae, juveniles)(Ariake sound, breeding, development); Coilia mystus: numerous authors who included nasus in the synonymy; Coilia nasus-Wongratana, 1980:330, pls 302,303 (revision); Masuda et al., 198420, p1.23 D (colour)(southern Japan, compiled).

FAO Names : En - Jaoarlese grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 16 to 26 (mostly 18 to 22) plus 25 to 36 (mostly 27 to 34) = 43 to 61 (mostly 46 to 52) keeled scutes from isthmus to anus. Maxilla long, reaching to or almost to base of first pectoral finray. Lower gillrakers 23 to 26 (usually 24 or 25). Pectoral fin with 6 filaments and 10 to 14 (mostly 10 or 11) branched finrays, longer than those of pelvic fin. Of species in the area with a long maxilla and more than 30 scutes, C. gravii has 7 pectoral filaments, while C. mystus has 17 to 24 predorsal scales, about 15 to 18 pyloric caeca and 10 branchiostegal rays (cf. 10 to 14, 9 to 12 and usually 11 or 12).

Geographical Distribution : Western Pacific (Canton north to Ariake Sound, southwestern Japan, including throughout Yellow Sea and off western coasts of Korea; penetrates over 1000 km up the Yangtse River). Takita (1967b) claimed that this species is known only from Ariake Sound in Japan, the more southerly forms being C. ectenes (see Remarks).



Habitat and Biology : Coastal waters, estuaries and to middle parts of rivers, apparently able to tolerate freshwater. In Ariake Sound it breeds from May to August, the fishes running about 15 km up the Chikugo River and spawning in fresh water, the spherical eggs floating down and hatching near the river mouth (Takita, 1967b).

Size : To 35 cm standard length (Wongratana, 1980), to 41 cm (Yuen et al., 1980), but only 7.6 cm in Taihu Lake (Liu, Yuen & Gu, 1981).

Interest to Fisheries : Caught in abundance with gillnets in the lower reaches of the Chikugo River and near its rnouth in Ariake Sound during the spawning season. Of great importance in the Yangtse River and its associated lakes (catches of 2000 to 5 000 t, but C. brachygnathus perhaps included). Its relatively large size makes it rnore esteemed as a foodfish than most Coilia.

Local Names : JAPAN: Etsu.

Literature : Dr Yuen Chuan-fu of Nanjing University and his colleagues have made a particular study of Coilia, especially in the Yangtse River. As C. ectenes, see Yuen, Lin, Qin & Liu (1976), Anon. (1977 - distribution, biology), Yuen, Lin, Qin & Liu (1977a), Yuen, Lin, Liu & Qin (1977 - subspecies taihuensis), Yuen, Lin, Qin & Liu (1977b - larvae), Yuen, Lin, Liu & Qin (1978 - age and growth), Yuen, Qin, Liu & Lin (1980), Qin, Yuen & Gu (1981 - biology), Liu, Yuen & Gu (1981 - breeding), Yuen & Qin (1984 - China coasts), Yuen & Qin (1985 - Japanese Coilia), Zhou & Lin (1985 - proteins, comparison with C. brachynathus), Qin, Yuen & Gu (1986 - growth in Taihu Lake), Liu, Yuen & Gu (1986 - Taihu Lake), Chen & yuen (1986- same) and Zhou, Lin, Wang & Hou (1986- enzymes, myogen, comparison with C. brachygnathus). For Japanese literature, see Takita (1967a,b - systematics, early development).

Remarks : The great similarity of C. nasus to C. mystus is discussed under that species; as noted, most C. nasus have less than 25 gillrakers, while most C. mystus have more than 26 (Wongratana's data; for Ariake Sound specimens, Takita (1967a) gave 21 to 25 - as Coilia sp.). Geographical overlap between the two species may occur as far south as Shanghai and certainly the vertebral, scute and scale counts given by Yoshida (1935) for Korean fishes suggest that two species are present there; Takita (1967a) showed that his Ariake Sound fishes were intermediate and believed them to be true nasus, the Korean fishes being mystus and ectenes. See also Yuen & Win (1985).

Yuen et al. (1977) distinguished a smaller and lacustrine subspecies, C. ectenes taihuensis, from the lakes of the lower and middle Yangtze River, with 75 to 78 vertebrae (cf. 78 to 82), a slightly larger eye, a smaller liver, and the back paler. Their vertebral counts seem to confirm the presence of C. nasus in this area (75 to 82 but only 65 to 69 in C. mystus fide Yoshida (1935), based on Korean specimens).

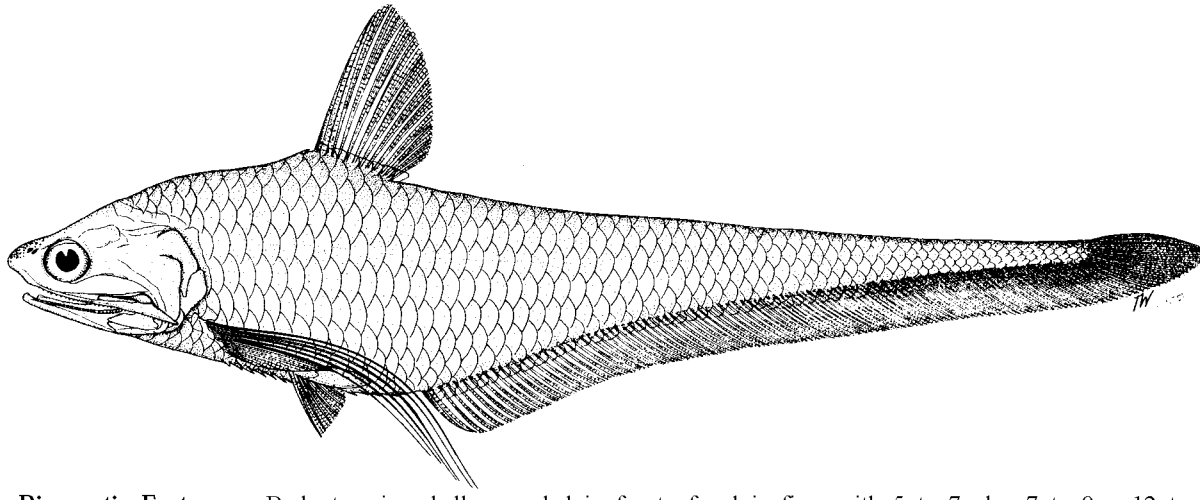
Coilia neglecta Whitehead, 1968

ENGR Coil 3

Coilia neglecta Whitehead, 1968, J.mar.biol.Ass.India, 9(1):33, fig.4 (Arabian Sea, northwest of Bombay; also off deltas of Indus, Ganges and Irrawady).

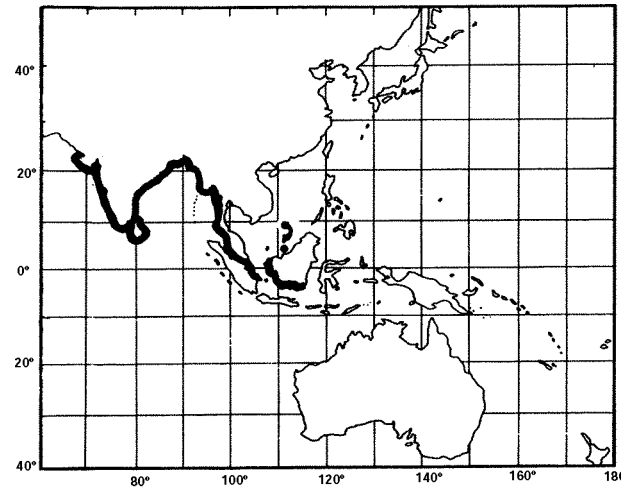
Synonyms : ? Coilia mystus of Indian authors (misidentified); Coilia neglecta-Whitehead, 1969a:272, fig.54 (Singapore); Idem, 1973b:241, fig.65 (synopsis); Dutt & Seshagiri Rao, 1975:316 resemblance to C. dussumieri); Seshagiri Rao, 1975:737 (same); Wongratana, 1980:318, pls 289,290 (revision).

FAO Names : En - Neglected grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded in front of pelvic fins, with 5 to 7 plus 7 to 9 = 12 to 15 keeled scutes from just behind pectoral fin base to anus. Maxilla almost or just reaching to edge of gill cover. Lower gillrakers 23 to 27. Pectoral fin with 6 long filaments and 9 to 11 branched finrays, longer than those of pelvic fin, which has i 6 finrays. Of Indian Ocean species with 6 pectoral filaments, C. dussumieri has golden or pearly spots on the lower part of the flank (light organs; not always easy to see in preserved material, and no other distinctions yet found), while C. ramcarati has more pelvic finrays (i 8 or 9); if C. gravii truly occurs off the Kerala coast, then it differs in having 7 pectoral filaments and many more pre-pelvic scutes (12 to 15). See ENGR Coil 3, Fishing Area 51.

Geographical Distribution : Indian Ocean (from Karachi eastward to the Andaman Sea and Penang) and western central Pacific area (Singapore south to Barito River, Kalimantan).



Habitat and Biology : Coastal and estuarine, certainly in fully saline water but able to tolerate at least some degree of freshening (e.g. at Aluhaluh on Barito River, Kalimantan).

Size : To 17 cm standard length, perhaps more.

Interest to Fisheries : Museum collections suggest that the species is common and perhaps contributes to artisanal clupeoid catches, presumably mainly in estuaries.

Local Names :

Literature : This species may well feature in biological and fishery studies, but one cannot be certain that references to C. mystus by Indian authors truly apply to C. neglecta.

Remarks : The very close similarity of C. neglecta to C. dussumieri led Dutt & Seshagiri Rao (1975) to suppose that neglecta specimens were merely those in which the light organs characteristic of C. dussumieri had become hidden during formalin fixation and preservation. Wongratana (1980:319) showed that the two species could still be separated on this character in identically fixed and preserved formalin specimens from the Java Sea.

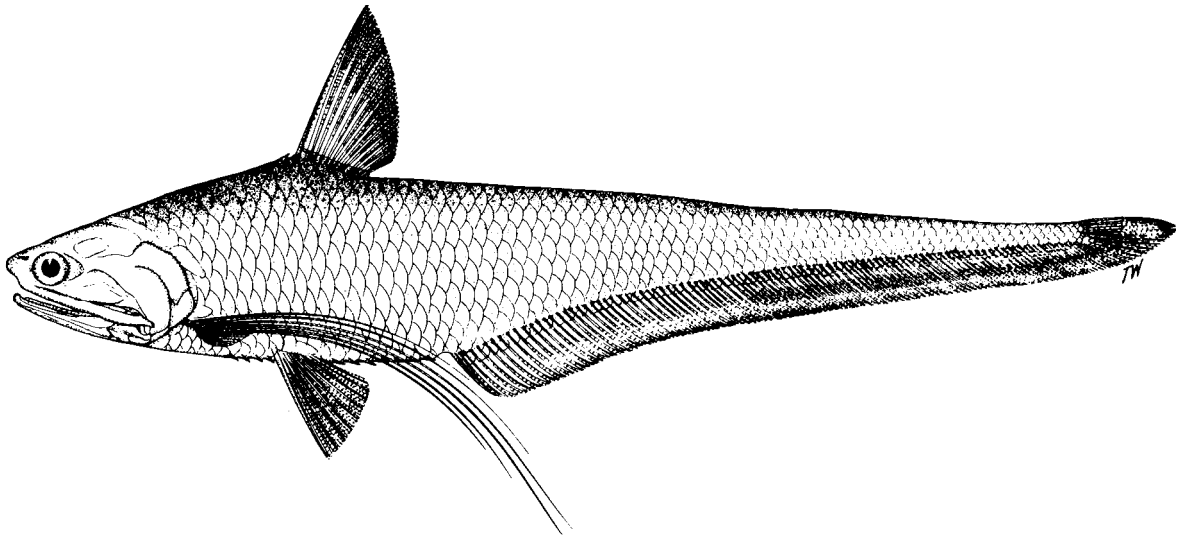
Coilia ramcarati (Hamilton-Buchanan, 1822)

ENGR Coil 4

Mystus ramcarati Hamilton-Buchanan, 1822, Fishes of the Ganges:233,382 (Ganges estuaries).

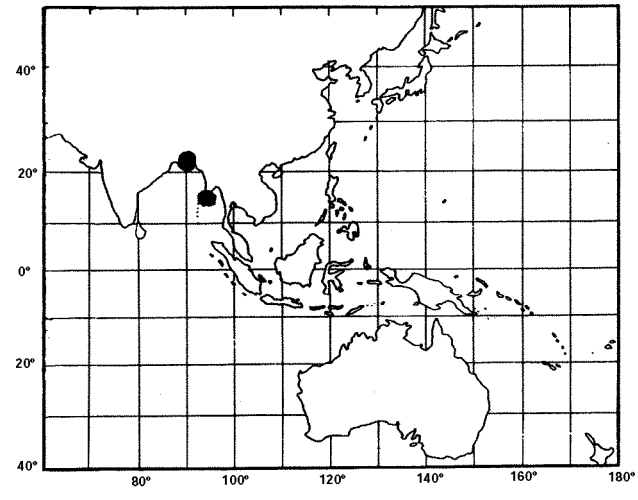
Synonyms : Engraulis (Coilia) hamiltonii Gray,183O:p1.85, fig.3 (Bengal rivers); Coilia quadragesimalis Valenciennes, 1848:83 (Ganges delta); Fowler, 1941d:713 (compiled); Coilia cantoris Bleeker, 1853a:148, p1.6, fig.2 (Calcutta); Day, 1878:631 (Calcutta specimen); Fowler, 1941d:715 (compiled); Coilia ramcarati-Jones & Menon, 1952:26, fig.69 (regenerated tail); Whitehead, Boeseman & Wheeler,1966:136 (type of cantoris); Whitehead, 1967a:152 (type of quadragesimalis); Idem, 1968a:31 (Andaman Sea off Burma; neotype of ramcarati described); Idem, 1973b:241, fig.64 (synopsis); Wongratana, 1980:311, pls 282,283 (revision); Whitehead & Bauchot, 1986:32 (type of quadragesimalis).

FAO Names: En - **Ramcarat** grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 6 plus 10 or 11 = 15 or 16 keeled scutes from just behind pectoral fin base to anus. Maxilla short, not reaching to edge of gill cover. Lower gillrakers 29 or 30. Pectoral fin with 6 long filaments and 5 or 6 branched finrays, much shorter than those of pelvic fin, the latter with i 8 or 9 finrays All other species of Coilia have only i 6 pelvic finrays (as do all other anchovies); of sympatric species with 6 pectoral filaments and less than 17 scutes, C. neglecta and C. dussumieri also have less than 28 gillrakers.

Geographical Distribution : Indian Ocean (Ganges delta and Andaman Sea south of Rangoon - Whitehead, 1968a).



Habitat. and Biology : Marine, pelagic, schooling, but also entering estuaries (although its tolerance to lowered salinities seems not to have been recorded).

Size : To at least 16 cm standard length, probably more (Seshagiri Rao (1975) gives 25 cm).

Interest to Fisheries : Forms an element in artisanal fisheries, but probably not important.

Local Names :

Literature :

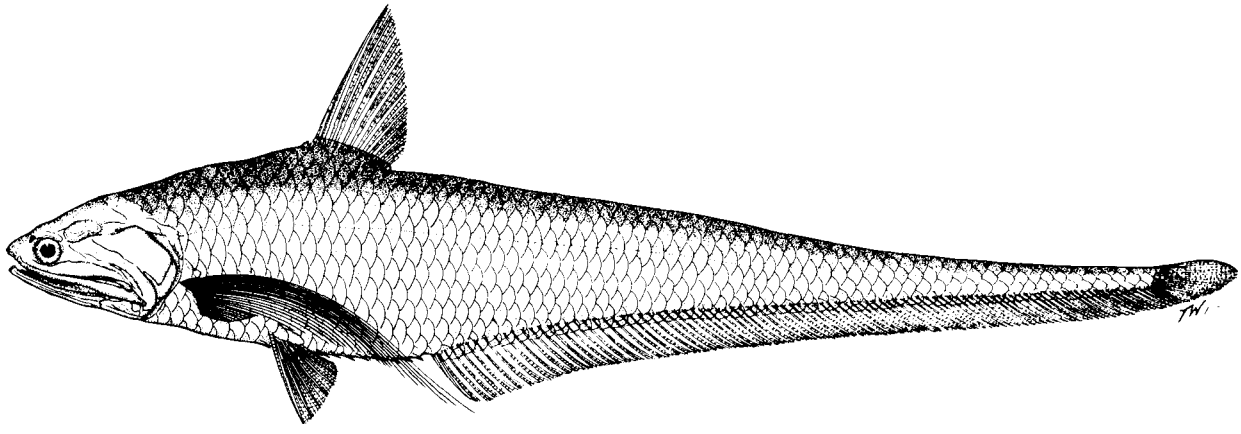
Coilia rebentischii Bleeker, 1849

ENGR Coil 8

Coilia rebentischii Bleeker,1859, Act.Soc.scient.Indo-Néerl., 5(7):5 (Sinkawang, Kalimantan; misspelt bebentischii).

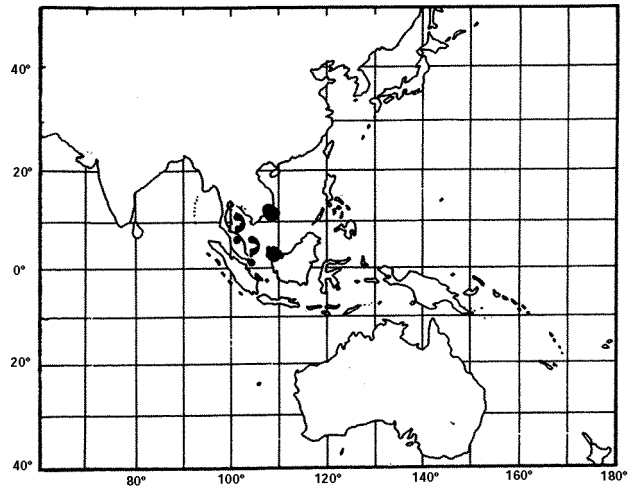
Synonyms : Coilia rutherfordi Fowler, 1939, Notul.Nat., (8):1, fig.1 (Saigon); Coilia rebentischii-Weber & de Beaufort, 1913:51 (compiled); Fowler, 1941d:719 (compiled); Whitehead, Boeseman & Wheeler, 1966:138, pl.18, fig.1 (Bleeker's figure)(holotype of rebentischii); Wongratana, 1980:317, pls 287,288 (revision).

FAO Names : En - Many-fingered grenadier anchovy.



DiagnosticFeatures : Body tapering, belly rounded in front of pelvic fins, with at most a single pre-pelvic scute plus 10 to 12 = 11 to 13 keeled scutes from just before pelvic fin base to anus. Maxilla short, not reaching beyond edge of gill cover. Lower gillrakers 25 to 27. Pectoral fin with 16 to 19 long filaments and 7 to 10 branched finrays, much shorter than those of pelvic fin. Of species with more than 7 pectoral filaments, C. rendahli occurs only in the Indian Ocean; C. borneensis and C. coomansi have fewer pectoral filaments (13 or 14, and 10 or 11), more gillrakers (31 to 33) and more pre-pelvic scutes (4 or 5, and 11 or 12).

Geographical Distribution : Indonesia (western coast of Kalimantan) and Viet Nam (Saigon).



Habitat and Biology : Coastal and estuarine, but the extent of its movements into the sea or up rivers is unknown.

Size : To 15.2 cm standard length.

Interest to Fisheries : Unknown, but its scarcity in museum collections may not reflect its actual abundance.

Local Names :

Literature :

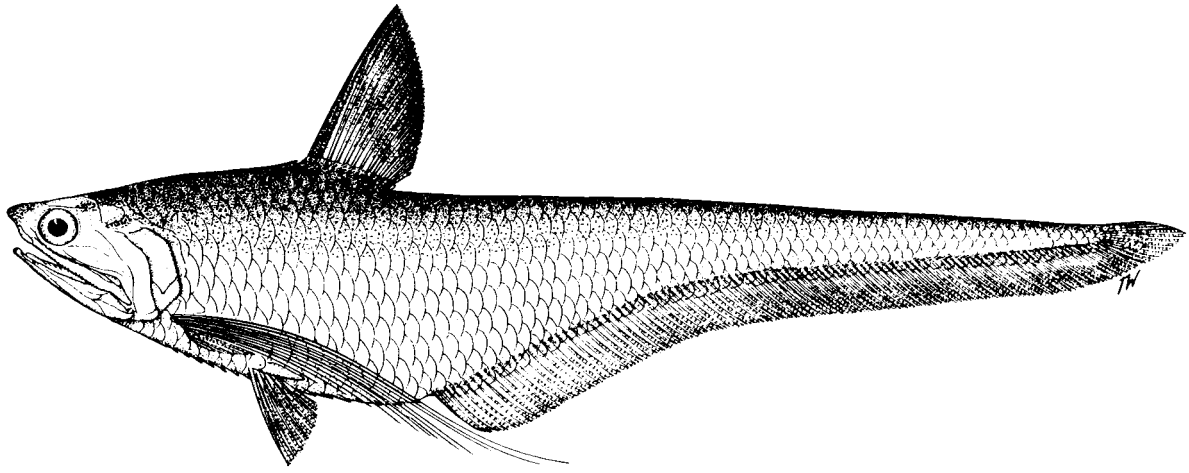
Coilia reynaldi Valenciennes, 1848

ENGR Coil 6

Coilia reynaldi Valenciennes, 1848, Hist.nat.poiss., 21:81 (Irrawady River at Rangoon).

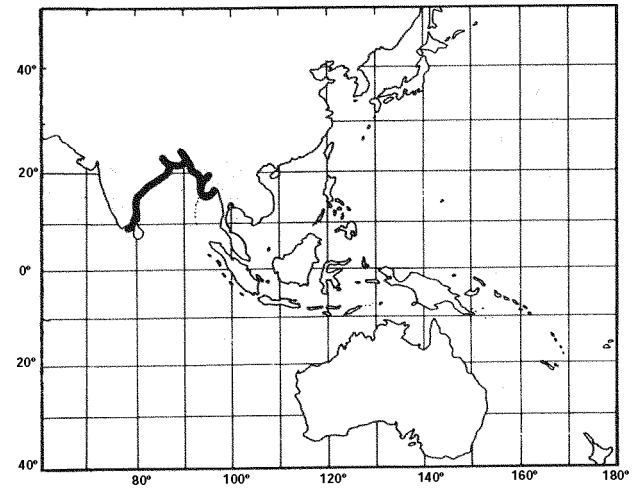
Synonyms : Coilia borneensis:Day, 1878:632, pl.159, fig.1 (Madras, Irrawady); Varghese, 1963:312 et seq. (biology); Coilia coomansi:Babu Rao & Jayaswal, 1968:2 (Hooghly estuary); Coilia korua Dutt & Seshagiri Rao, 1972:136 (Gollapalem, Andhra coast); Whitehead, 1973b:242 (synopsis); Seshagiri Rao, 1975:735 (Kakinada); Coilia reynaldi-Fowler, 1941d:718 (compiled); Jones & Menon, 1952:18, figs 1-4 (larval development, Hooghly River); Whitehead, 1967a:150, fig.15a (upper jaw)(lectotype of reynaldi); Talwar & Whitehead, 1971:83 (Day specimens in Calcutta, Sydney and Leiden); Wongratana, 1980:314, pls 284,285 (revision); Whitehead & Bauchot, 1986:31 (lectotype of reynaldi).

FAO Names : En - Reynald's grenadier anchovy.



Diagnostic Features : Body tapering, belly rounded before pelvic fins, with 6 to 9 plus 7 to 11 = 13 to 19 keeled scutes from just behind pectoral fin base to anus.Maxilla short, not reaching to edge of gill cover. Lower gillrakers 28 to 36. Pectoral fin with 10 to 13 long filaments and 6 or 7 branched finrays, much shorter than those of pelvic fin, the latter with i 6 finrays. Of species with more than 7 pectoral filaments, C. borneensis occurs only in Indonesia; other Indian Ocean species all have 6 or 7 pectoral filaments.

Geographical Distribution : Indian Ocean (eastern coasts and estuaries of India. also Irrawady Kiver at Rangoon).



Habitat and Biology : Coastal and in tidal stretches of rivers, but apparently no data on salinity tolerances, although the presence of the fish above Barrackpore on the Hoogly suggests that it can live in freshwater, while Jones & Menon (1952) record it from "coastal waters". The larvae feed on copepods, thereafter mainly on copepods, but also on prawns, larval decapods and other crustaceans. Breeds in the lower parts of estuaries, from end of March to a peak in July in the Malta and Rupnarayan estuaries (Varghese, 1961), from November or December to June (even August) in the Hooghly (Varghese, also Jones & Menon, who illustrate the larval and juvenile stages).

Size : To 11.6 cm standard length (Wongratana, 1980) or 15 cm total length (Jones & Menon, 1952).

Interest to Fisheries : Although the commonest species of Coilia in Bengal rivers, the generally small size (mostly below 6.5 cm standard length) and numerous bones detract from its value. Mostly caught with bagnet (beenjal, behundijal, thorjal), but also in barrier nets (chorpatajal) and shore-seines (berjal), chiefly from about November to May in Bengal estuaries.

Local Names : INDIA: Amadi.

Literature : Menon (1951 - regeneration of tail), Jones & Menon (1952 - larval development), Varghese (1963 - length frequency, food, spawning).

Remarks : The very close resemblance of C. reynaldi to C. borneensis and distinctions from it are noted under that species. All Indian references to a species with over 7 pectoral filaments must apply to C. reynaldi.

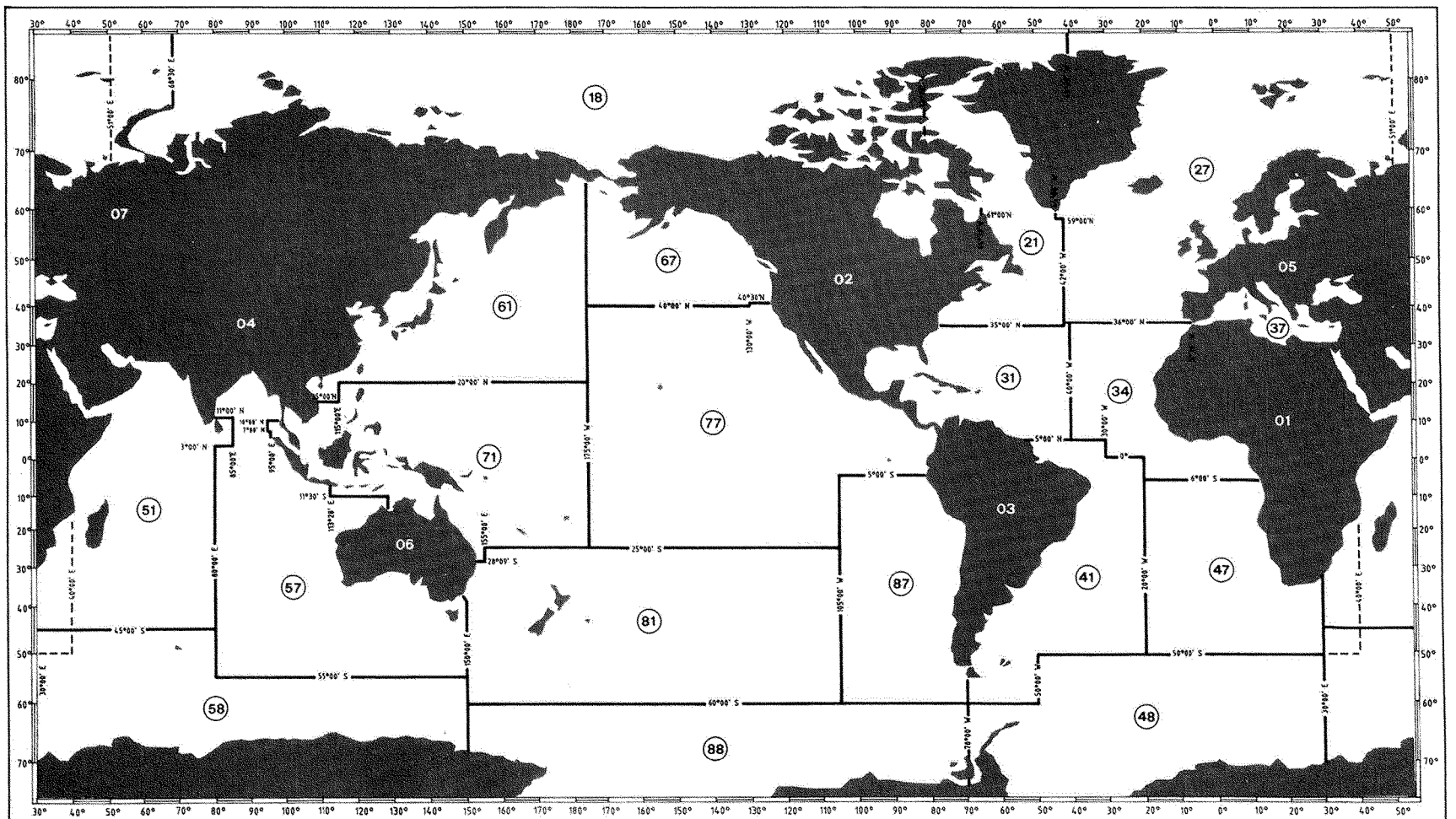
3. LIST OF SPECIES BY MAJOR FISHING AREAS

For those working in a particular Fishing Area, the listing of the species that occur there will greatly simplify identifications by eliminating extra-limital taxa. Where a species occurs in a relatively small part of the Fishing Area, this is indicated by a half-circle (◓ north, ◒ south, ◖ east, ◗ west)

● **Marine species** : Some can also be expected in freshwater (for spawning or feeding). This is indicated in the column "Freshwaters" by the FAO freshwater Area Number (01 to 07)

○ **Freshwater species** : Since many occur in the lower reaches of rivers, the distribution is here shown as the marine area with which the river system is associated, e.g. Mississippi and Orinoco = Area 31; Amazon = Area 41; Congo = Area 47; for convenience, the Caspian drainage is associated with that of the Mediterranean = Area 37. In addition, the FAO freshwater Area Number is given in the column "Freshwater"

MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES



3. LIST OF SPECIES BY MAJOR FISHING AREAS

(Map of Major Fishing Areas on page)

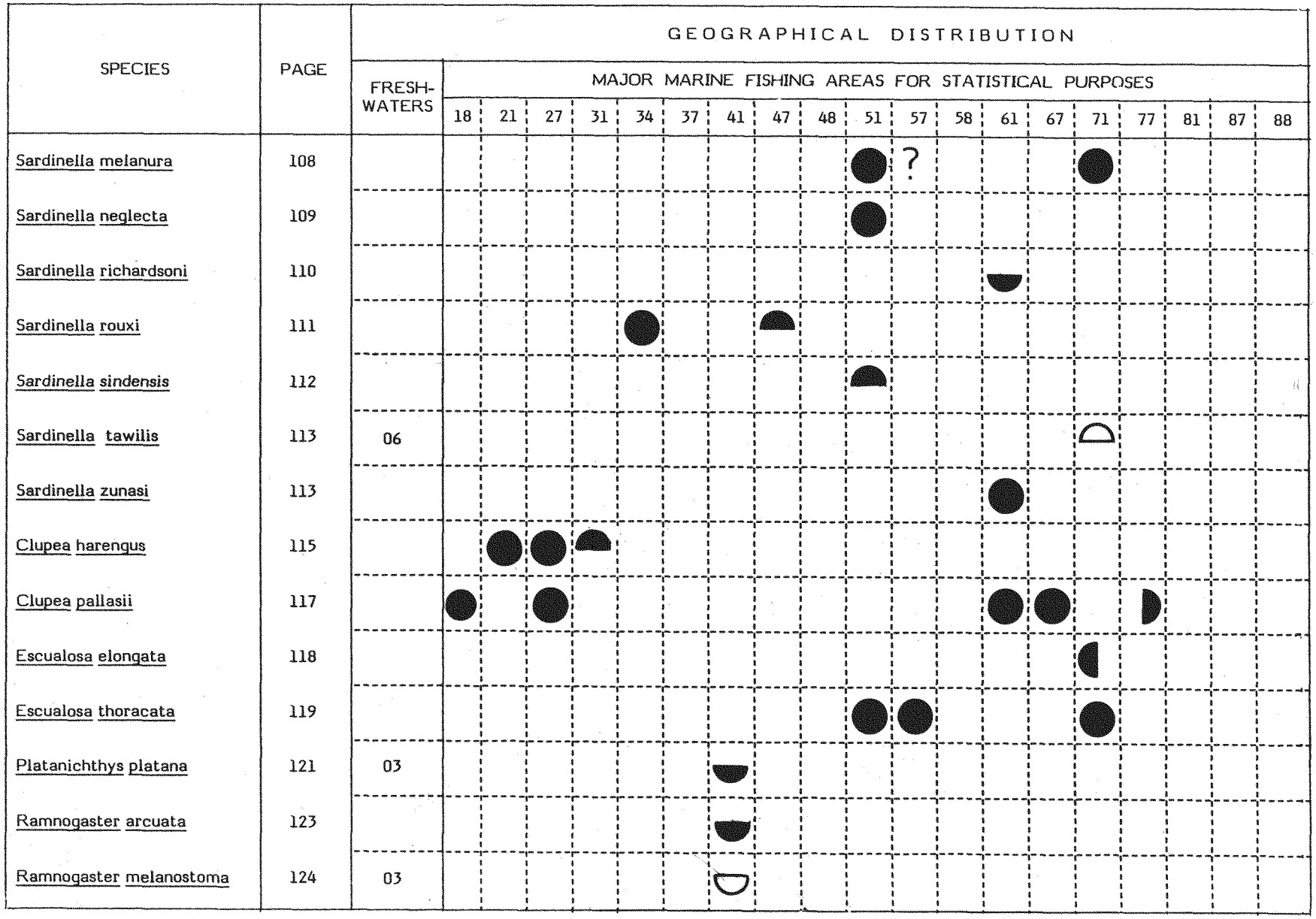
SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
CHIROCENTRIDAE																					
Chirocentrus dorab	23											●	●		●		●				
Chirocentrus nudus	24											◒	●		●		●				
CLUPEIDAE																					
Dussumieria acuta	28											●	●				●				
Dussumieria elopsoides	29							◗				●	●		◒		●				
Etrumeus teres	30			●		●		◗	◒			●	◒		◒			◒		◒	
Etrumeus whiteheadi	32									◒		◒									
Spratelloides delicatulus	33							◗				●	●		◒		●	◗			
Spratelloides gracilis	34											◒	●		◒		●	◗			
Spratelloides lewisi	35																●				
Spratelloides robustus	36												◒						◗		
Jenkinsia lamprotaenia	37					●															

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Jenkinsia majua	39					●															
Jenkinsia parvula	40					◒															
Jenkinsia stolifera	41					●															
Sprattus antipodum	45																		●		
Sprattus fuegensis	46								◒											◒	
Sprattus muelleri	47																		●		
Sprattus novaehollandiae	48												◒								
Sprattus sprattus	49				●		◒	●													
Clupeonella abrau	51	05						○													
Clupeonella cultriventris	52	05						○													
Clupeonella engrauliformis	53	05						○													
Clupeonella grimmi	54	05						○													
Sardina pilchardus	55				●		◒	●													
Sardinops caeruleus	57															◒		◒			

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Sardinops melanostictus	58														●						
Sardinops neopilchardus	59												◗						●		
Sardinops ocellatus	60									◗		◗									
Sardinops sagax	61																	◗		●	
Harengula clupeola	63					●			◗												
Harengula humeralis	64					●															
Harengula jaguana	65			◗		●			●												
Harengula thrissina	66																	●		◗	
Opisthonema berlangai	68																	◗			
Opisthonema bulleri	69																	●		?	
Opisthonema libertate	70																	●		?	
Opisthonema medirastre	71																	●		?	
Opisthonema oglinum	72			◗		●			●												
Herklotsichthys blackburni	74												◗								

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Herklotsichthys castelnaui	75																◒		◓		
Herklotsichthys dispilonotus	76																●				
Herklotsichthys gotoi	77																◒				
Herklotsichthys koningsbergeri	78												◒								
Herklotsichthys lossei	79											◒									
Herklotsichthys punctatus	80								◗			◒									
Herklotsichthys quadrimaculatus	81											●	●		◒		●				
Herklotsichthys spilurus	83											●									
Herklotsichthys Species A (= H. lippa)	83												◒				◒				
Herklotsichthys Species B (= H. collettei)	84												◒								
Herklotsichthys Species C (= H. castelnaui)	85 (75)																◒		◗		
Amblygaster clupeoides	86											◗	●				●				
Amblygaster leiogaster	87											●	●		◒		●				
Amblygaster sirm	88											●	●		◒		●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Sardinella albella	91											●	●		◡		●				
Sardinella atricauda	92																●				
Sardinella aurita	93			◡		●	●	●	●	●											
Sardinella brachysoma	95											●	◡				●				
Sardinella brasiliensis	96					●			●												
Sardinella fijiense	97																◡				
Sardinella fimbriata	98											◗	●				●				
Sardinella gibbosa	100											●	●		◡		●				
Sardinella hualiensis	101														◡						
Sardinella jussieui	102											●									
Sardinella lemuru	103												◗		●		●				
Sardinella longiceps	104											◗	◗								
Sardinella maderensis	106						●	●		●											
Sardinella marquesensis	107																	◗			


SPECIES
PAGE
GEOGRAPHICAL DISTRIBUTION
FRESH-WATERS
MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES
18 21 27 31 34 37 41 47 48 51 57 58 61 67 71 77 81 87 88
Sardinella melanura 108
Sardinella neglecta 109
Sardinella richardsoni 110
Sardinella rouxi 111
Sardinella sindensis 112
Sardinella tawilis 113
06
Sardinella zunasi 113
Clupea harengus 115
Clupea pallasii 117
Escualosa elongata 118
Escualosa thoracata 119
Platanichthys platana 121
03
Ramnogaster arcuata 123
Ramnogaster melanostoma 124
03

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Rhinosardinia amazonica	126	03							◗												
Rhinosardinia bahiensis	127	03							○												
Lile piquitinga	128					◒			●												
Lile stolifera	129																	●			
Strangomera bentincki	130																			◒	
Cynothrissa ansorgii	136	01					◗				○										
Cynothrissa mento	137	01					◗														
Cynothrissa Species	138	01					◗														
Odaxothrissa losera	139	01					◗			◗											
Odaxothrissa vittata	140	01								◗											
Pellonula leonensis	142	01					○			◗											
Pellonula vorax	144	01					◗			◗											
Nannothrissa parva	145	01								◗											
Nannothrissa stewarti	146	01								◗											

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Poecilothrissa centralis	148	01								D											
Poecilothrissa congica	149	01								D											
Poecilothrissa moeruensis	150	01								D											
Microthrissa minuta	151	01								D											
Microthrissa royauxi	152	01								D											
Microthrissa Species A (= M. normanae)	153	01					D														
Potamothrissa acutirostris	155	01								D											
Potamothrissa obtusirostris	156	01								D											
Potamothrissa whiteheadi	157	01								D											
Stolothrissa tanganicae	158	01								D											
Limnothrissa miodon	160	01								D		D									
Limnothrissa stappersii	161	01								D											
Sierrathrissa leonensis	162	01					D														
Thrattidion nootivagus	163	01					D														

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Laeviscutella dekimpei	165	01					◗														
Congothrissa gossei	166	01								◗											
Gilchristella aestuarius	168	01								◗		◗									
Sauvagella madagascariensis	169	01										◗									
Spratellomorpha bianalis	170											●									
Ehirava fluviatilis	172											◗	◗								
Dayella malabarica	173											◗									
Clupeoides borneensis	174	04,06															○				
Clupeoides hypselosoma	175	06															○				
Clupeoides papuensis	176	06															◗				
Clupeoides venulosus	177	06															◗				
Corica laciniata	179	04,06															○				
Corica soborna	180	04,06											◗				○				
Clupeichthys aesarnensis	182	04															◗				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Clupeichthys bleekeri	183	06															○				
Clupeichthys goniognathus	183	04,06															◗				
Clupeichthys perakensis	184	06															◗				
Potamalosa richmondia	186	06											◗						◗		
Hyperlophus translucidus	188	06															◗				
Hyperlophus vittatus	188	06											◗				◗		◗		
Alosa aestivalis	192	02		●		◗															
Alosa alabamae	193	02				●															
Alosa alosa	194	05,01			●		●	●													
Alosa brashnikovi	195	05						◗													
Alosa caspia	197	05						◗													
Alosa chrysochloris	198	02				●															
Alosa fallax	199	05,01			●		◗	●													
Alosa kessleri	201	05						◗													

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Alosa maeotica	202	05						●													
Alosa mediocris	203	02		●		●															
Alosa pontica	204	05						●													
Alosa pseudoharengus	205	02		●																	
Alosa sapidissima	206	02,04		●		●									●	●		●			
Alosa saposhnikovi	208	05						●													
Alosa sphaerocephala	209	05						●													
Brevoortia aurea	210								●												
Brevoortia gunteri	211					●															
Brevoortia patronus	212					●															
Brevoortia pectinata	213								●												
Brevoortia smithi	214			●		●															
Brevoortia tyrannus	215			●		●															
Ethmidium maculatum	217																	●		●	

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Ethmalosa fimbriata	219	03					●			◓											
Hilsa kelee	220											●	●		◒		●				
Tenualosa ilisha	222	04										◓	◓								
Tenualosa macrura	223	06															●				
Tenualosa reevesii	224	04											?		●						
Tenualosa thibaudeaui	225	04															◗				
Tenualosa toli	226	04,06										◗	●				●				
Gudusia chapra	228	04											◗								
Gudusia variegata	229	04											◗								
Dorosoma anale	232	02				○															
Dorosoma cepedianum	233	02		○		◗															
Dorosoma chavesi	234	02				◗															
Dorosoma petenense	236	02				○												◗			
Dorosoma smithi	237	02																◗			

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Clupanodon thrissa	239	?04											?								
Konosirus punctatus	240	04																			
Nematalosa arabica	242																				
Nematalosa come	243												?								
Nematalosa erebi	244	06																			
Nematalosa flyensis	245	06																			
Nematalosa galatheae	246	04																			
Nematalosa japonica	247																				
Nematalosa nasus	248																				
Nematalosa papuensis	250	06																			
Nematalosa vlaminghi	251	06																			
Anodontostoma chacunda	252																				
Anodontostoma selangkat	254																				
Anodontostoma thailandiae	255																				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Gonialosa manmina	256	04																			
Gonialosa modesta	257	04																			
Gonialosa whiteheadi	258	04																			
PRISTIGASTERIDAE																					
Ilisha africana	263	?01																			
Ilisha amazonica	264	03																			
Ilisha elongata	265																				
Ilisha filigera	266																				
Ilisha furthii	267																				
Ilisha kampeni	268																				
Ilisha macrogaster	269																				
Ilisha megaloptera	270																				
Ilisha melastoma	272																				
Ilisha novacula	273																				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Ilisha obfuscata	274											●	●								
Ilisha pristigastroides	275																●				
Ilisha sirishai	276											◗	●				●				
Ilisha striatula	277											●	●								
Pellona castelnaeana	279	03							D												
Pellona dayi	280												◗								
Pellona ditchela	281											●	●				●				
Pellona flavipinnis	282	03				D			○												
Pellona harroweri	283					◗			●												
Pliosteostoma lutipinnis	284																	●			
Chirocentrodon bleekerianus	286					●			◗												
Neoopisthopterus cubanus	288					●															
Neoopisthopterus tropicus	288																	◗			
Opisthopterus dovii	290																	●			

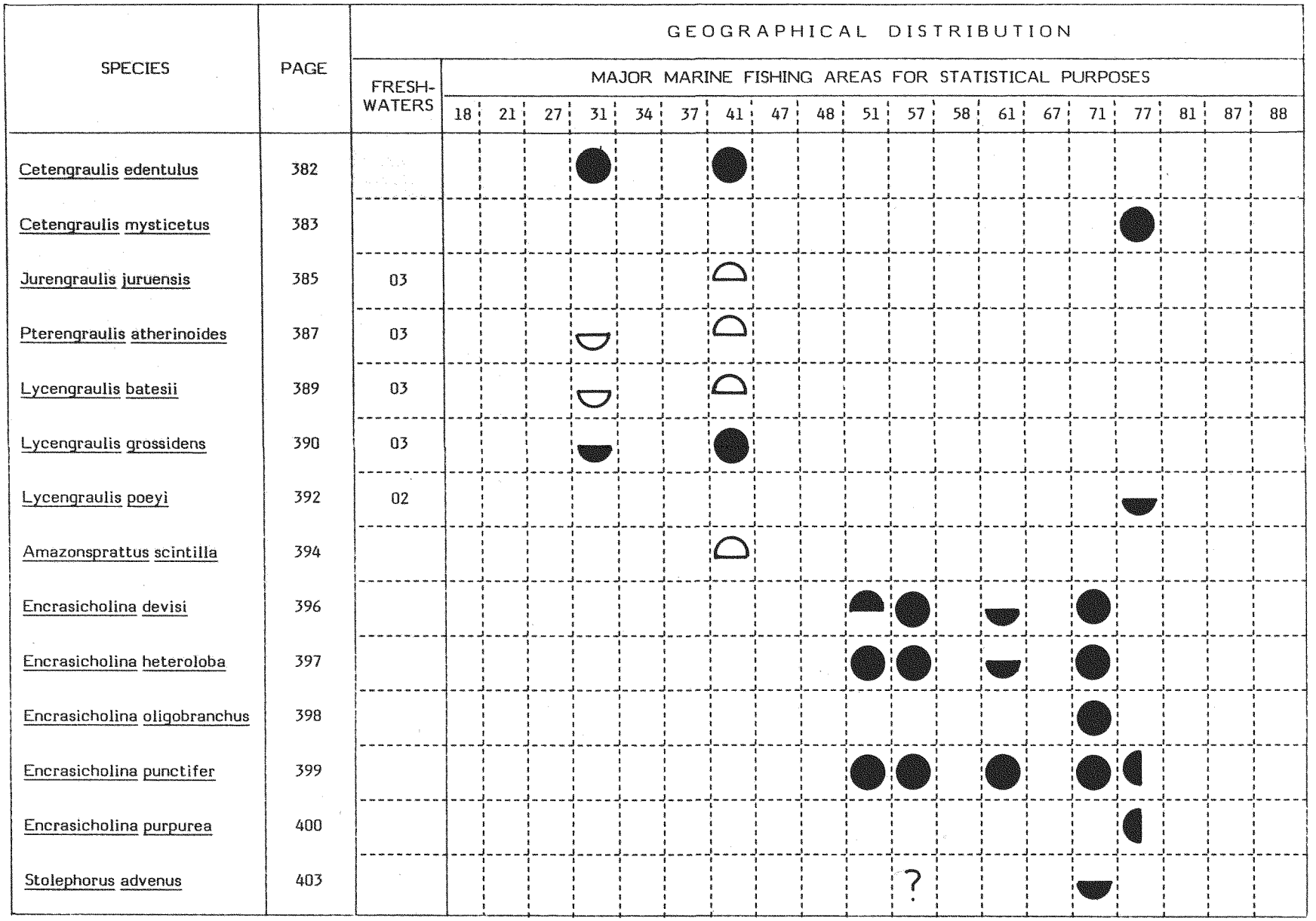
SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																		
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Opisthopterus effulgens	291	?03																●			
Opisthopterus equitorialis	292																	●			
Opisthopterus macrops	293																	●			
Opisthopterus tardoore	294											◗	●				●				
Opisthopterus valenciennesi	296														◗		●				
Odontognathus compressus	297	?03				◗															
Odontognathus mucronatus	298	03				◗			●												
Odontognathus panamensis	300																	◗			
Pristigaster cayana	301	03							◗												
Raconda russeliana	303											?	◑				●				
ENGRAULIDIDAE																					
Engraulis anchoita	312								◗												
Engraulis australis	314												◗				◗		◗		
Engraulis capensis	315									◗		●									
Engraulis encrasicolus	316				●		●	◑		◗											

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Engraulis eurystole	317			◗		●			◗												
Engraulis japonicus	318														●		●				
Engraulis mordax	320															◗		◗			
Engraulis ringens	322																			●	
Anchoviella alleni	324	03							D												
Anchoviella analis	325	?02																◗			
Anchoviella balboae	326																	◗			
Anchoviella blackburni	327	?03				◗															
Anchoviella brevirostris	328	03				◗			●												
Anchoviella carrikeri	329	03							D												
Anchoviella cayennensis	330	?03				◗			●												
Anchoviella elongata	331	?02				◗															
Anchoviella guianensis	332	03				D			D												
Anchoviella jamesi	333	03				D			D												

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																				
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																			
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88	
Anchoviella lepidentostole	334	03																				
Anchoviella manamensis	335	03																				
Anchoviella nattereri	336	03																				
Anchoviella perfasciata	337																					
Anchoviella vaillanti	338	03																				
Anchoa argentivittata	341																					
Anchoa belizensis	342	02																				
Anchoa cayorum	343																					
Anchoa chamensis	344																					
Anchoa choerostoma	345																					
Anchoa colonensis	345																					
Anchoa compressa	346																					
Anchoa cubana	347																					
Anchoa curta	348	02,03																				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Anchoa delicatissima	349																	●			
Anchoa eigenmannia	350																	◗			
Anchoa exigua	351																	●			
Anchoa filifera	352					●			●												
Anchoa helleri	354																	◗			
Anchoa hepsetus	355			◗		●			●												
Anchoa ischana	356																	●			
Anchoa januaria	357					?			●												
Anchoa lamprotaenia	358					●			?												
Anchoa lucida	359																	●			
Anchoa lyolepis	360					●			●												
Anchoa marinii	362								◗												
Anchoa mitchilli	363	?02		◗		◗															
Anchoa mundeola	364																	●			

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Anchoa mundeoloides	365																	◗			
Anchoa nasus	366																	●		◗	
Anchoa panamensis	367																	◒			
Anchoa parva	368	?02,03				●															
Anchoa pectoralis	369								●												
Anchoa scofieldi	370																	◗			
Anchoa spinifer	371	03				◒			●									◒			
Anchoa starksi	372																	◒			
Anchoa tricolor	373								●												
Anchoa trinitatis	374					◒															
Anchoa walkeri	376	?02																●			
Anchovia clupeoides	378	03				●			●												
Anchovia macrolepidota	379																	●			
Anchovia surinamensis	380	03				D			D												


SPECIES
PAGE
GEOGRAPHICAL DISTRIBUTION
FRESH-WATERS
MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES
18 21 27 31 34 37 41 47 48 51 57 58 61 67 71 77 81 87 88
Cetengraulis edentulus 382
Cetengraulis mysticetus 383
Jurengraulis juruensis 385 03
Pterengraulis atherinoides 387 03
Lycengraulis batesii 389 03
Lycengraulis grossidens 390 03
Lycengraulis poeyi 392 02
Amazonsprattus scintilla 394
Encrasicholina devisi 396
Encrasicholina heteroloba 397
Encrasicholina oligobranchus 398
Encrasicholina punctifer 399
Encrasicholina purpurea 400
Stolephorus advenus 403
?

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Stolephorus andhraensis	404												●				●				
Stolephorus apiensis	404																◗	◖			
Stolephorus baganensis	405												●				◖				
Stolephorus brachycephalus	406																◡				
Stolephorus carpenteriae	407																◡				
Stolephorus chinensis	408														◗		●				
Stolephorus commersonii	409											●	●		◗		●				
Stolephorus dubiosus	411												●				◖				
Stolephorus holodon	411											◡									
Stolephorus indicus	412											●	●				●	◗			
Stolephorus insularis	413											◖	●		◗		●				
Stolephorus multibranchus	415																◗				
Stolephorus nelsoni	415												◡								
Stolephorus pacificus	416																◗				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Stolephorus ronquilloi	417																●				
Stolephorus tri	418																◗				
Stolephorus waitei	419											◗	●				●				
Stolephorus Species A	420																◗				
Thryssa adelae	423														●						
Thryssa aestuaria	424												◗				◗				
Thryssa baelama	425											●	●		◗		●	◗			
Thryssa brevicauda	426																◗				
Thryssa chefuensis	427														●						
Thryssa dayi	428											◗									
Thryssa dussumieri	429											◗	●		◗		●				
Thryssa encrasicholoides	430											◗	●				●				
Thryssa gautamiensis	431											◗	●								
Thryssa hamiltonii	432											◗	●		◗		●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																				
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																			
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Thryssa kammalensis	433																●				
Thryssa kammalensoides	434												◗								
Thryssa malabarica	435											◗	◗								
Thryssa marasriae	437																◗				
Thryssa mystax	438											◗	●				◗				
Thryssa polybranchialis	439											◗	◗								
Thryssa purava	440											◗	◗								
Thryssa rastrosa	441	06															D				
Thryssa scratchleyi	442	06															D				
Thryssa setirostris	443											●	●		◗		●				
Thryssa spinidens	444												◗								
Thryssa stenosoma	444												◗								
Thryssa vitrirostris	445											●	◗								
Thryssa whiteheadi	446											◗									

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Lycothrissa crocodilus	448	04,06															○				
Papuengraulis micropinna	450	?06															◒				
Setipinna breviceps	452	?06											?				◐				
Setipinna brevifilis	453	04											◑								
Setipinna melanochir	454	?06															◐				
Setipinna paxtoni	455												◒								
Setipinna phasa	456	04											◑								
Setipinna taty	457											◗	●				◐				
Setipinna tenuifilis	458												●		◒		●				
Setipinna wheeleri	459	04											◑								
Coilia borneensis	462	06														◗					
Coilia brachygnathus	463	04													◒	•					
Coilia coomansi	463	?06														◐					
Coilia dussumieri	464											◗	●			◐					

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION																			
		FRESH-WATERS	MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																		
			18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Coilia grayii	465											●			●						
Coilia lindmani	466	04,06															○				
Coilia macrognathos	467	?06															◐				
Coilia mystus	468														●		?				
Coilia nasus	469	04													●						
Coilia neglecta	471											●	●				◐				
Coilia ramcarati	472												◐								
Coilia rebentischii	473																◐				
Coilia reynaldi	474	?04										●	◐								

4. BIBLIOGRAPHY

As noted in the Introduction to Part 1 of this Catalogue, the literature on clupeoid fishes is enormous; if about five hundred references have been made to just the 11 marine clupeoids of West Africa, then one might expect as many as sixteen thousand articles, papers and books on all the 355 species of clupeoid fishes in the world (noting that for Clupea alone there were 288 references for 1968-69 in Dean's Bibliography). The present Bibliography contains 883 titles, many of which are included simply because they locate the first use of a generic, specific or subspecific synonym (journal or book references for senior synonyms are not included since given in the text). It is hoped, however, that the Bibliography contains at least the principal contributions to the biology of clupeoids or works where more complete bibliographies are given. Major gaps are in the Chinese, Japanese and Russian literature, the latter due in part to the absence of a full bibliography in Svetovidov's otherwise superb study of Russian clupeoids.

Since Part 1 was published before Part 2 was begun, certain citations were not then seen to require the suffix a,b,c etc. (especially for the numerous papers by Pieter Bleeker in the period 1849-54). However, the actual paper referred to is usually clear from the title and/or the pagination given in the Bibliography. In a few cases the dating of a work was later found to be incorrect; this is adjusted in the Bibliography, as for example "Steindachner, F. 1869 (error, see 1870)", thus an assurance that the reference was not overlooked. Where the correct dating of an early work has been in doubt and may have nomenclatural consequences, as with Gray's Illustrations of Indian Zoology, Temminck & Schlegel's Fauna japonica, or Cuvier's Règne animal, reference is made to authors who have resolved the bibliographic problems. Thus, the clupeoid names in the second edition of the Règne animal (March 1829) just predate those in Agassiz's 'Brazilian fishes' (May 1829), while the clupeoids in the Fauna Japonica (22 November 1846) were published after those in Richardson's Ichthyology of China and Japan (June/Juli 1846); whether Bennett's clupeoid fishes in the Memoir of the life of Raffles appeared before 15 July 1830, when Gray published Pl.96 of his Illustrations of Indian zoology, remains a puzzle. Such niceties of bibliography may be a luxury in other scientific disciplines, but not in taxonomy, for which the key to efficient retrieval of information is the unique and correct name of the taxon.

The Bibliography of this Catalogue was compiled using the Library of the British Museum (Natural History), which is probably the largest and most complete collection of books and journals ever assembled for taxonomic purposes. The Library's printed catalogue of serial publications, containing more than twelve thousand entries, employs the abbreviations and title arrangement of the World List of Scientific Periodicals (or adapts its usage). This conflicts with FAO practice,which conforms to the rules of the International Periodical Title Word Abbreviations prepared for the UNISIST/ICSU-AB Working Group on Bibliographic Description (1971). Nevertheless, the World List abbreviation system is used here because of its relative simplicity and its usage in many scientific journals.

Abbot, C.C., 1861 — Description of a new species of Chatoëssus Cuv. from New Jersey. Proc.Acad.nat.Sci.Philad., (1860):365-6

Abbot, J-F., 1899 — The marine fishes of Peru. Proc.Acad.nat.Sci.Philad.:324-64

Acuña, A.A. and J.P. Castello, 1986 — Estructura de la poblacion, crecemiento y reproduccion de Engraulis anchoita (Hubbs & Marini, 1935) en el sur de Brazil. Revta Biol.mar., **22**(1):31-60

Agassiz, L., 1829 — (see Spix & Agassiz, 1829)

Ahlstrom, E.H., 1956 — Eggs and larvae of anchovy, jack mackerel, and Pacific mackerel. Prog.Rep.Calif.Coop.ocean. Fish.Invest., (1 April 1955-30 June 1956):33-42

_____, 1960 — Synopsis of the biology of the Pacific sardine (Sardinops caerulea). FAO Proc.Wld.scient.Meet. Biol.Sardines, **2**:415-51 (FAO Fish.Synop., No.171

Alberti, B.V., 1960 — Datos sobre las pesquerias y poblaciones de sardinas (Sardinops sagax ,Jenyns) en el litoral norte de Chile. FAO Proc.Wld.scient.Meet.Biol.Sardines, **3**:1095-1104

Alcântara, A.V., 1973 — Espécies amazônicas do gênero Lycengraulis Günther (Pisces, Engraulidae). Master's thesis, Instituto Biociências, University of São Paulo, Brazil, 58 pp.

Aleksandrov, A., 1927 — Anchois de la mer d'Azoff et de la mer Noire. Trudy kerch.nauch.rybokhoz.Sta., **1**(2-3):33-99

Alfred, E.R., 1961 — The Javanese fishes described by Kuhl and van Hasselt. Bull.natn.Mus.St.Singapore, (30):80-8

Alvarez, del Villar, J., 1970 — Peces mexicanos (claves). Ser.Invest.Pesquera, Inst.Nac.Invest.Biol.Pesqueras, (1):166 pp.

Anders, A., 1965 Preliminary observations on anchovy spawning off the South African coast. S.Afr.Shipping News Fishg Indust.Rev., (November):103, 105, 107

Andriyashev, A.P., 1964 Fishes of the Northern seas of the USSR. Israel Program for Scientific Translations, Jerusalem, 617 pp. (translation from Ryby severnykh morei CCCP, Academy of Sciences, Moscow and Leningrad, 1954)

Anon., 1960 (Tokai Regional Fisheries Research Laboratory, Tokyo). Synopsis on the biology of Sardinops melanosticta (Temminck and Schlegel). FAO Proc.Wld.scient.Meet.Biol.Sardines, 2:213-44 (FAO Fish.Synop., No.11)

_____, 1976 Catálogo de peces marinos Mexicanos. Secretaria de Industria y Comercio, Instituto National de Pesca, Mexico, 462 pp.

_____, 1977 (Analysis of populations and biology of Coilia in the Yangtse River region - in Chinese), pp.101-32 in (Yangtse River region Coilia resources investigational report), Chanjiang (Yangtse River) Fisheries Institute, Nanjing, 179 pp.

_____, 1979 Report of the Ad hoc working group on West African coastal pelagic fish from Mauretania to Liberia (26°N to 5°N). Dakar-Thiaroye, 19-24 June 1978, CECAF/ECAF Ser. 78/10 (En), UNDP/FAO, Rome, 161 pp.

Antipa, G., 1906 Die Clupeinen des westlichen Teiles des schwarzen Meeres und der Donaumündungen. Denkschr. Akad.Wiss.Wien, 78:1-56

_____, 1909 Fauna ichtiologicâ a Romaniei. Publnile Fond.Vasilie Adamachi, 16:i-ix plus 1-294

Antony Raja, B.T. and Y. Hiyama, 1974 On Sardinella sirm (Waibaum) from Okinawa. Rec.oceanogr.Wks Japan, 10(1):105-7

Antony Raja, B.T. and S. Lazarus, 1975 A description of Sardinella davi Regan (Pisces:Clupeidae) of Indian seas with remarks on its close similarity with Sardinella maderensis (Lowe) and Sardinella jussieui (Valenciennes). Indian J.Fish., 22(1-2):113-25

Arámburu, A.S. Alonso de, 1961 Una nueva subespecie de clupeido (Clupea melanostoma limnoica n.sbsp.) de aquas interiores bonaerenses. Notas Mus.La Plata, 20(186):1-V

Astorqui, I., 1971 Peces de la cuenca de los grandes lagos de Nicaragua. Revta Biol.trop., 19:7-57

Ayling, T., 1982 Collins guide to the sea fishes of New Zealand. Collins, Auckland, Sydney and London, 343 pp.

Babu Rao, M., 1962 On the species of the genus Setipinna Swainson of the Godavari estuary. Proc.1st all-India Congr.Zool., (1959)(2):364-9

_____, 1964 Some observations on the biology of Hilsa kanagurta (Bleeker) (Fam: Clupeidae). Ichthyologica Kanpur, 3(1-2):63-76

_____, 1965a Biological studies on the gizzard shad Anodontostoma chacunda (Hamilton)(Fam.Clupeidae). J. mar.biol.Ass.India, 7(1):89-101

_____, 1965b Biometric studies of Stolephorus insularis Hardenberg. 1. Comparison of the two subspecies S. insularis insularis Hard. and S. insularis baweanensis Hard. Ichthyologica, Kanpur, 4(1-2):13-21

_____, 1966 (error, see 1964)

_____, 1966a Biometric studies on Stolephorus insularis Hardenberg. 2. Comparison of S. insularis insularis Hardenberg from Waltair, Godavari estuary and Pamban on the east coast of Inda . Ichthyologica, Kanpur, 5(1-2):29-44

_____, 1966b A new species of Stolephorus Lacépède from the east coast of India (Pisces:Engraulidae). Ann.Mag.nat.Hist., (13)9:101-10

_____, 1967 Biometric studies on Anchoviella commersonii (Lacépède) (Engraulidae:Pisces) from Andhra coast. J.mar.biol.Ass.India, 7(2):369-75

Babu Rao, M. and K.S. Jayaswal, 1968 A new record of Coilia coomansi Hardenberg (Pisces:Engraulidae) from India. Adv.Abstr.Contr.Fish.aquat.Sci.India, 2(4):2

Babu Rao, M. and A. Joglekar, 1968 Comparative studies of Setipinna godavariensis Rao (Pisces:Engraulidae) from Godavari and Hooghly estuaries. J.mar.biol.Ass.India, 9(1):38-60

Bailey, R.M., 1951 The authorship of names proposed in Cuvier and Valenciennes "Histoire naturelle des poissons". Copeia, (3):249-51

Bainbridge, V., 1963 The food, feeding habits and distribution of the bonga, Ethmalosa dorsalis (Cuvier & Valenciennes). J.Cons.perm.int.Explor.Mer., 28(2):270-84

Baird, D. and N.D. Geldenhuys, 1973 Biology and fishery of the anchovy in South Africa. S.Afr.Shipping News Fishg Indust.Rev., 28(10):4 pages, unnumbered

Baker, A.N., 1972 Reproduction, early life history. and age-growth relationships of the New Zealand pilchard, Sardinops neopilchardus (Steindachner). Fish:Rei.Bull.N.Z., (5):1-64

Bal, D.V. and M.S. Joshi, 1956 Studies on the biology of Coilia dussumieri (Cuv. and Val.). Indian J.fish., 3:91-100

Baldwin, W.J., 1984a The identification of commercially important baitfishes in the Fijian skipjack tuna factory. Sea Grant Cooperative Report, Univ.Hawaii, UNIHI-SEAGRANT-CR-84-03 (mimeo 47 pp.)

_____, 1984b A note on the occurrence of the gold spot herring, Herklotsichthys quadrimaculatus (Rüppell) in Hawaii. Pac.Sci., 38(2):123-6

Baldwin, W.J. and N.H.C. Chang, 1970 A new engraulid fish, Anchoa walkeri, from the eastern Pacific Ocean, with a note on the validity of Anchoa schultzi Hildebrand. Pacif.Sci., 24(1):139-43

Bănărescu, P., 1964 Fauna Republicii Populare Romine, 13. Pisces-Osteichthyes (Pestiganoizi si ososi). Editura Academiei Republicii Populare Romine, Bucharest, 959 pp.

_____, 1968 Lista revizvita a pestilor din România. Bul.Inst.Cerc.pisc., 27(3):53-62 (additions to Bânârescu, 1964 - listed only)

Bapat, S.V. and D.V. Bal, 1950 The food of some young clupeids. Proc.Indian Acad.Sci., 32B(1):39-58

Barbour, T., 1905 Notes on Bermudian fishes. Bull.Mus.comp.Zool.Harv., 46:109-35

Barbieri, C., 1907 Le alose del Mediterraneo e gli agoni dei laghi lombardi. Studio preliminare. Revta mens.Pesca Milano, 9(6):69-82, 125-43

Barnard, K.H., 1925 A monograph of the fishes of South Africa, part 1. Ann.S.Afr.Mus., 21:1-418 (part 2, pp. 419 to end published October 1927)

Basheerudin, S. and K.N. Nayar, 1962 A preliminary study of the juvenile fishes of the coastal waters off Madras city. Indian J.Fish., 8(1):169-88

Basilewsky, S., 1855 Ichthyographia Chinae Borealis. Nouv.Mem.Soc.imp.Nat.Mosc., 10:215-64

Bauchot, M.-L. and A. Pras, 1980 Guide des poissons marins d'Europe. Delachaux and Niestlé, Lausanne and Paris, 427 pp.

Bauchot, M.-L., P.J.P. Whitehead and T. Monod, 1982 Date of publication and authorship of the fish names in Eydoux and Souleyet's zoology of La Bonite, 1841-1852. Cybium, 6(2):59-73

Bayliff, W.H., 1969 Synopsis of biological data on the anchoveta Cetengraulis mysticetus Günther, 1866. FAO Fisheries Synopsis , (43):pag.var.

Bean, T.H., 1890 Notes on fishes collected at Cozumel, Yucatan, by the U.S. Fish Commission, with descriptions of new species. Bull.U.S.Fish Commn., 8:193-206

_____, 1906 A catalogue of the fishes of Bermuda. with notes on a collection made in 1905 for the Field Museum. Pubis Field Mus., (Zool.), (2)7:21-89

Bean, T.H., 1912 Description of new fishes of Bermuda. Proc.biol.Soc.Wash., **25**:121-6

Beebe, W. and G. Hollister, 1935 The fishes of Union Island, Grenadines, British West Indies, with the description of a new species of star-gazer. Zoologica, N.Y., **19**(6):209-24

Beebe, W. and J. Tee Van, 1928 The fishes of Port-au-Prince Bay, Haiti. Zoologica, N.Y., **10(1)**:1-279

Bellisio, N.B., R.B Lopez and A. Torno, 1979 Peces marinos patagonicos. Secretaria de Estado de Intereses Maritimos, Ministerio de Economia, Buenos Aires, 279 pp.

Bennet, P.S., 1965 On Sardinella clupeoides (Bleeker) from the coasts of India. J.mar.biol.Ass.India, **7**(1):1-3

Bennett, E.T., 1831 (Characters of new genera and species of fishes of the Atlantic coast of Northern Africa presented by Capt. Belcher, R.N. ...). Proc.zool.Soc.Lond., (l)(xii):146-8 (for dating of early Proceedings see Waterhouse, 1937)

_____, 1832 Observations on a collection of fishes from the Mauritius, with characters of new genera and species. Proc.zool.Soc.Lond., (l)(xiv):165-9 (not 1831, but 2 March 1832; see above)

_____, 1835 Characters of several previously undescribed fishes from Trebizond. Proc.zool.Soc.Lond., **3:**91-2

Bensam, P., 1968 The embryonic and early larval development of the long-finned herring Opisthopterus tardoore (Cuvier). J.mar.biol.Ass.India, **9**(1):76-83

Ben-Tuvia, A., 1960a Synopsis of biological data on Sardinella aurita of the Mediterranean and other waters. FAO Proc.Wld.scient.Meet.Biol.Sardines, **2:**287-312 (FAO Fish.Synop., No. 14)

_____, 1960b Synopsis of the systematics and biology of Sardinella maderensis (Lowe). FAO Proc.Wld.scient. Meet.Biol.Sardines, **2:**497-519 (FAO Fish.Synop., No.19)

_____, 1963 Systematics and ecology of Indo-Pacific fishes recently established in the eastern Mediterranean. broc.XVI Int.Congr.Zool., (Washington, DC.), **1:**115

Berdequé, J.A., 1958 Biometric comparison of the anchovieta, Cetengraulis mysticetus (Günther), from ten localities of the Eastern Tropical Pacific Ocean. Bull.inter-Am.trop.Tuna Commn., **3**(1):1-76

Berg, L.S., 1913 (The Caspian herring collected during the expedition of 1912 along the western shore of the sea - in Russian). Mater.Pozn.Russ.Rȳb., **2**(3):1-50

_____, 1915 (A preliminary report on the herrings collected in the Caspian Sea by the Caspian expedition of 1913 - Russian). Mater.Pozn.Russ.Rȳb., **4**(6):3-8

Berry, F.H., 1958 Age and growth of the gizzard shad (Dorosoma lacepedi) (LeSueur), in Lake Newnan, Florida. Proc.llth ann.Conf.S.East.Ass.Game Fish. Commners:318-31

_____, 1964 Review and emendation of: Family Clupeidae. Copeia, (4):720-30 (clupeoid volume of FWNA dated 1 March 1964)

Berry, F.H. and I. Barrett, 1963 Gillraker anaylsis and speciation in the thread herring genus Opisthonema. -Bull.inter-Am.trop.Tuna Commn., **7:**113-90 (English and Spanish)

Berry, F.H. and P.J.P. Whitehead, 1968 A new species of sardine (Sardinella:Clupeidae) from the Marquesas Islands. Proc.biol.Soc.Wash., **81**:209-22

Bertin, L., 1940 Catalogues des types de poissons du Museum Nationale d'Histoire Naturelle. (2^{e} partie), dipneustes, chondrostéens, holostéens, isospondyles. Bull.Mus.natn.Hist.nat., Paris, (2)**12**(6):244-322

_____, 1943 Revue critique des dussumierides actuels et fossiles. Description d'un genre nouveau. Bull.Inst.oceanogr.Monaco, (853):1-32

Bini, G., 1970 Atlante dei pesci delle coste Italiane, **2.** Osteitti. Mondo Sommerso, Rome, 308 pp.

Blackburn, M., 1941 The economic biology of some Australian clupeoid fish. Bull.Coun.scient.ind.Res.Melb., **138**(242):1-152

_____, 1949 Age, rate of growth and general life-history of the Australian pilchard (Sardinops neopilchardus) in New South Wales waters. Bull.Coun.scient.ind.Res.Melb., (242):1-86

_____, 1950a A biological study of the anchovy, Engraulis australis (White), in Australian waters. Aust.J.mar.freshwat.Res., **l**(l):l-84

_____, 1950b Studies on the age, growth and life-history of the pilchard, Sardinops neopilchardus (Steindachner), in southern and Western Australia. Aust.J.mar.freshwat.Res., **1**:221-58

_____, 1951 Races and populations of the Australian pilchard, Sardinops neopilchardus (Steindachner). Aust.J.mar.freshwat.Res., **2**:179-92

_____, 1960 Synopsis of biological information on the Australian and New Zealand sardine Sardinops neopilchardus (Steindachner). FAO Proc.Wld.scient.Meet.Biol.Sardines, **2**:245-64 (FAO Fish.Synop., No.12)

Blaxter, J.H.S. and J.R. Hunter, 1982 The biology of clupeoid fishes. Adv.mar.Biol., **20**:1-223

Bleeker, P., 1848 A contribution to the ichthyology of Sumbawa. J.Indian Archipel.& E.Asia, **2**(9):632-9

_____, 1849a Bijdrage tot de kennis der ichthyologische fauna van het eiland Madura,. met beschrijving van eenige nieuwe species. Verh.batav.Genoot.Kunst.Wet., **22**:1-16

_____, 1849b Bijdrage tot de kennis der ichthyologische fauna van het eiland Bali, met beschrijving van eenige nieuwe species. Verh.batav.Genoot.Kunst.Wet., **22**:1-11

_____, 1849c A contribution to the knowledge of ichthyological fauna of Celebes. J.Indian Archipel. & E.Asia, **3**:65-74

_____, 1850 (error, see 1851a)

_____, 18351a Over eenige nieuwe soorten van Megalops, Dussumieria, Notopterus en Astronesthes. Natuurk.Tidschr.Ned.-Indie, **1**:417-24

_____, 1851b Vijfde bijdrage tot de kennis der ichthyologische fauna van Borneo, met beschrijving van eenige meuwe soorten van zoetwatervisschen. Natuurk.Tijdschr.Ned.-Indië, 2:415-42

_____, 1851c Bijdrage tot de kennis der ichthyologische fauna van Riouw. Natuurk.Tidschr.Ned.-Indië, 2:469-97

_____, 1852a Bijdrage tot de kennis der ichthyologische fauna van Singapore. Natuurk.Tijdschr.Ned.-Indië, **3**:51-86

_____, 1852b Zesde bijdrage tot de kennis der ichthyologische fauna van Borneo. Visschen van Pamangat, Bandjermassing, Pradoekarta en Sampit. Natuurk.Tijdschr.Ned.-Indië, **3**:407-42

_____, 1852c Bijdrage tot de kennis der ichthyologische fauna van het eiland Banka. Natuurk.Tijdschr.Ned.-Indië, **3**:443-60

_____, 1852d Bijdrage tot de kennis der Haringachtige visschen van den Soenda-Molukschen Archipel. Verh.batav.Genoot.Kunst.Wet., **24**:1-52

_____, 1853a Nalezingen op de ichthyologische fauna van Bengalen en Hindostan. Verh.batav.Genoot.Kunst. Wet., **25**:1-164

_____, 1853b Nieuwe bijdrage tot de kennis der ichthyologische fauna van Ternate en Halmaheira (Gilolo). Natuurk.Tijdschr.Ned.-Indië, **4**:595-610

_____, 1853c Derde bijdrage tot de kennis der ichthyologische fauna van Ceram. Natuurk.Tijdschr.Ned.-Indië, **5**:233-48

_____, 1853d Nieuwe tientallen diagnostische beschrijvingen van nieuwe of weinig bekende vischsoorten van Sumatra. Natuurk.Tijdschr.Ned.-Indië, **5**:495-534

Bleeker, P., 1854a Faunae ichthyologicae japonicae species novae. Natuurk.Tijdschr.Ned.-Indië, 6:395-426

_____, 1854b Vijfde bijdrage tot de kennis der ichthyologische fauna van Celebes. Natuurk.Tijdschr.Ned .-Indië, 7:225-60

_____, 1855 Zesde bijdrage tot de kennis der ichthyologische fauna van Amboina. Natuurk.Tijdschr.Ned.-Indië, **8:**391-434

_____, 1856 Achtste bijdrage tot de kennis der ichthyologische fauna van Ternate. Natuurk.Tijdschr.Ned.-Indië, **12:**191-210

_____, 1862 Bijdrage tot de kennis der haringachtige visschen van den Soenda-Molukschen Archipel. Verh.batav.Genoot.Kunst.Wet., **24:**1-52

_____, 1863 Mémoire sur les poissons de la côte de Guinée. Natuurk.Verh.holland.Maatsch.Wet.Haarlem, (2)**18:**1-136

_____, 1866 Description de quelques espbces inédites ou peu connues de Clupéoides de I'Inde archipélagique. Ned.Tijdschr.Dierk., **3:**293-308

_____, 1868 Notice sur la faune ichthyologique de I'Ple de Waijiou. Versl.Meded.K.Akad.Wet.Amst., (2)**2:**295-301

_____, 1872 Atlas ichthyologiques des Indes Orientales Néberlandaises, **6**. Frederic Muller, Amsterdam (Les Clupées pp. 79-143; pls 259-274 - probably of 1870)

Blegvad, H. and B. Loppenthin, 1944 The fishes of the Iranian Gulf. Danish Scientific Investigations in Iran, (3), Einar Munksgaard, Copenhagen, 247 pp.

Bloch, M.E., 1795 Naturgeschichte der ausländischen Fische, part 9. J. Morino Kunsthandlung, Berlin, 192 pp. (the complete work is in 9 parts plus atlas of 432 pls, 1783-95; being parts 4-12 of his Allgemeine Naturgeschichte der Fische in 12 parts, 1782-95)

Bloch, M.E. and J.G. Schneider, 1801 M.E. Blochii . . . Systema ichthyologiae iconibus CX illustratum. Sander, Berlin, 584 pp. (reprint 1967, Historiae naturalis classica, **55**, J.Cramer, Lehre)

Boely, T. and P. Freon, 1980 Coastal pelagic resources, pp. 13-76 in J.P. Troadec and S. Garcia (eds). The fish resources of the eastern central Atlantic. Part one: the resources of the Gulf of Guinea from Angola to Mauritania. FAO Fish.Tech.Pap., (186.1):1-166

Boeseman, M., 1952 A preliminary list of Surinam fishes not included in Eigenmann's enumeration of 1912. Zool.Meded.Leiden, **31**(17):179-200

_____, 1956 On recent accessions of Surinam fishes. Zool.Meded.Leiden, **34**(12):183-99

_____, 1962 Triodon macropterus versus Triodon bursarius: an attempt to establish the correct name and authorship. Zool.Meded.Leiden, **38**(4):77-85

_____, 1963 Notes on new or rare fishes from Surinam. Zool.Meded.Leiden, **38**(18):295-301

Böhlke, E.B., 1984 Catalogue of type specimens in the ichthyological collection of the Academy of Natural Sciences of Philadelphia. Spec.Publs Acad.nat.Sci.PhiIad., (14):1-246

Bonaparte, C.L.J.L., 1845 Catalogo metodico dei pesci Europei. Atti Sci.Ital.:1-95

Boré R.D. and C. Martinez F., 1981 Chilean fisheries resources catalogue. Instituto de fomento Pesquero, Santiago, 44 fols (unpaged)

Borodin, N.A., 1904 (Investigations on the habits and reproduction of the Caspian herrings - in Russian). Vest.Ryboprom., **19**(3):167-98

_____, 1928 Scientific results of the yacht 'Ara' Expedition during the years 1926 to 1928, while in command of William K. Vanderbilt. Fishes. Bull.Vanderbilt oceanogr.Mus., **1**(l):1-37

Bory de Saint-Vincent, J.B.J.M., Dictionnaire classique d'histoire naturelle, **4**. Paris, in 14 vols, 1822-31
1823

Boulenger, G.A., Contributions to the ichthyology of the Congo. II. On a collection of fishes from the Lindi
1902 river. Proc.zool.Soc.Lond., **1**(2):265-71

_____, Fourth contribution to the ichthyology of Lake Tanganyika. Report on the collection of fishes
1906 made by Dr W.A. Cunningham during the third Tanganyika expedition 1904-1905. Trans.zool.Soc. Lond., **17**:537-619

_____, Catalogue of the freshwater fishes of Africa, 1. Trustees, British Museum (Natural History),
1909 London, XI plus 373 pp.

_____, Catalogue of the freshwater fishes of Africa, 4. Trustees, British Museum (Natural History),
1916 London, XXVII plus 392 pp.

Boyd, A.J. and J.D. Hewitson, Distribution of anchovy larvae off the west coast of southern Africa between
1983 32°30' and 26°30'S, 1979-1982. S.Afr.J.mar.Sci., **1**:71-5

Branson, B.A., C.J. McCoye and M.E. Sisk, Notes on the freshwater fishes of Sonora with an addition to the
1960 known fauna. Copeia, (3):217-220

Bravo de Laguna, J. Cabrera and E. Santaella Alvarez, Observaciones biologico-pesqueras en elbanco pesquero
1973 sahariano. Boln Inst.esp.Oceanogr., (171):1-79

Brock, V.E., The introduction of aquatic animals into Hawaiian waters. Int.Rev.Hydrobiol., 45(4):463-80
1960

Browne, P., The civil and natural history of Jamaica. For the author, London, viii plus 503 pp.
1756

Brownell, C.L., Laboratory rearing of Cape anchovy Engraulis capensis and South African pilchard Sardinops
1983 ocellata through metamorphosis. S.Afr.J.mar.Sci., 1:181-8

Budamshin, B.I., (not seen). Ryb.Khoz.Volgo-kasp.Raiona, (10):36
1938

Buen Lozano, F. de, Contribuciones a la ictiologia. IV. Los clupeidos uruguayos del genero Spratella Cuv.& Val.
1952 con descripción de Spratella pallida nov.sp. Comun.zool.Mus.Hist.nat.Montev., **4**(67):1-13

_____, Peces de la superfamilia Clupeoidae en aguas de Chile. Revta Biol.mar., **8**(1-3):83-110
1958

_____, La sardina y sardina española (Sardinops sagax) en la costa sur de America del Oceano Pacifico
1960 (Chile, Peru e Islas Galapagos). FAO Proc.Wld.scient.Meet.Biol.Sardines, **2**:265-86 (FAO Fish. Synop., No.13)

Bulgakov, G.P., (On the study of Caspian herrings. Description of a new genus Caspialosa - in Russian).
1926 Bull.Univ.Asie cent., (13):27-39

Caldwell, D.K., L.H. Ogren and L. Giovannoli, Systematic and ecological notes on some fishes collected in the
1959 vicinity of Tortuguero, Caribbean coast of Costa Rica. Revta Biol.trop., **7**(1):7-33

Campos, A. do A., Contribuçâo âo estudo dos clupeóides das águas brasileiras. Archos Zool.Est.S.Paulo, **3**:185-
1942 218

Cantor, T., Catalogue of Malayan fishes. J.Asiat.Soc.Beng., **18**(2):xii plus 983-1443
1850

Carvalho, J. de P., Engraulideos brasileiros, do gênero Anchoa. Bolm Inst.paul.Oceanogr., **1**(2):43-69
1950a

_____, Anchoviella hiidebrandi n.sp. Engralulideo do Rio Paraguacu - Bahia. Bolm Inst.paul.Oceanogr.,
1950 **1**(2):77-81

_____, Engraulideos brasileiros do gênero Anchoviella. Bolm Inst.paul.Oceanogr., 2(1):41-66
1951

Castello, J.P. (ed.), 1977 Projeto lagoa (10th and 11th cruise reports). Série Relat., Base oceanogr.Atlant., Fundaçâo Univ.Rio Grande, (6):1-68

_____, 1978 Projeto lagoa (14th and 15th cruise reports). Série Relat., Base oceanogr.Atlânt., Fundaçâo Univ.Rio Grande, (9):1-49

Castelnau, F.L. de Laporte de, 1861 Mémoire sur les poissons de l'Afrique australe. J.-B.Baillière, Paris, 78 pp.

_____, 1872 Contribution to the ichthyology of Australia. Proc.zool.acclim.Soc.Vict., **1**:30-247

_____, 1873 Contribution to the ichthyology of Australia. Proc.zool.acclim.Soc.Vict., **2**:37-158

_____, 1878 Notes on the fishes of the Norman river. Proc.Linn.Soc.N.S.W., **3**(1):41-54

Cequea R., H. and J.E. Perez, 1974 Especies sibilinas del genero Anchoa confirmadas por electroforesis en gel de almidon. Boln Inst.oceanogr., Cumana, **13**(1-2):3-10

Cervigón, F., 1966 Los peces marinhos de Venezuela. Fondo de Cultura Cientifica, Caracas, Venezuela, 2 vols, 951 pp.

_____, 1969 Las especies de los géneros Anchovia y Anchoa (Pisces:Engraulidae) de Venezuela y areas adyacentes del Mar Caribe y Atlantico hasta 23°S. Mems Soc.Cienc.nat.La Salle, **29**(84):193-251

_____, 1980 Ictiología marina. Con atención especial a la fauna del Continente Americano, **1**. Impresión Editorial Arte, Caracas, 360 pp.

_____, 1982 Los recursos pesqueros del río Orinoco y su exploitación. Corporación Venezolana de Guyana, División de Desarrolo Agricola, Caracas, 386 pp.

_____, 1983 (error, see 1982)

Cervigón, F. and W. Fischer, 1979 INFOPESCA. Catálogo de especies marinas de interes economico actual o potencial para America Latina Parte 1. Atlántico centro y suroccidental. FAO/UNDP, SIC/79/1, Rome, 372 pp. (Part 2. Central and southeastern Pacific, by N. Chirichigno, W. Fischer and C.E. Nauen, 1982)

Cervigón, F. and E. Velasquez, 1978 Revision sistematica y estudio osteologico de las especies del genero Jenkinsia de las costas de Venezuela (Osteichthyes:Clupeiformes). Cuad.oceanogr.Univ.Oriente., (7):3-54

Chabanaud, P., 1924 Description de deux poissons de mer nouveaux d'Indo-chine. Bull.Mus.natn.Hist.nat.Paris, **30**:57-60

_____, 1933 Sur diverses poissons de la Mer Rouge et du Canal Suez. Descriptions de deux espèces nouvelles. bull.Inst.oceanogr.Monaco, (627):1-12

Chacko, P.I., 1950 Marine plankton from the waters around Krusadi Island. Proc.Indian Acad.Sci., **31**B:162-74

_____, 1954 Marine fisheries research in Madras. Ind.-Comm.J.(Madras), **9**(2):2-8

_____, 1956 (see Chacko and Gnanamekelai, 1963)

Chacko, P.I. and A.G. Gnanamekalai, 1963 Preliminary observations on the age, growth, maturity and spawning of Sardinella sirm occurring in the Gulf of Mannar off Tuticorin. Proc.50th Ind.Sci.Congr.(Delhi) (3)(Abstracts):506

Chan, W.L., 1963 A systematic revision of the Indo-Pacific clupeoid fishes of the genus Sardinella (family Clupeidae). Jap.J.Ichthyol., **12**(3-6):104-18 and Ibid., **13**(1-3):1-39

Chandra, R., 1964 A preliminary account of the distribution and abundance of fish larvae in Hooghly estuary. Indian J.Fish., **9**(1):48-70

Chapman, W. McL., 1944 The osteology of the Pacific deep-bodied anchovy, Anchoa compressa. J.Morph., **74**(2):311-29

Chaudhuri, B.L., 1912 Description of some new species of freshwater fishes from north India. Rec.Indian mus., **7**:437-444

Chen, W.-m. and C.-f. Yuen, 1986 (Biology of Coilia in Guchenfu Lake - in Chinese). Oceanologia Limnologia Sinica: 126-33

Chen, Z.-r. and S.-z. Wei, 1986 (A study on the larvae of grenadier anchovies, Coilia grayii Richardson and Coilia mystus (Linnaeus), in the waters off Zhujiang (Pearl River) mouth-in Chinese, English summary). Trans.Chinese Ichthyol.Soc., (5):101-9

Chevey, P., 1932 Inventaire de la faune ichthyologique de l'Indochine. Notes Stn.marit.Cauda, (19):1-31

Chevey, P. and F. le Poulain, 1940 La pêche dans les eaux douces du Camboge. Mem.Inst.océanogr.Indoch., (5):1-193

Chirichigno, F.N., 1962 Algunos peces nuevos y poco conocidos de la fauna rnarina del Peru. Serie Divulg.cient.Peru, (17):1-29

_____, 1963 Estudio de la fauna ictiológica de los esteros y parte baja de los ríos del Departamento de Tumbes (Perú). Serie Divulg.cient., (22):1-87

_____, 1968 Nuevos registros para la ictiofauna marina del Peru. Boln Inst.Mar.Peru, **1**(8):379-503

_____, 1976 Nuevas adiciones a la ictiofauna del Peru. Ser.Inf.Esp., lM-174. Inst.Mar., Peru, 155 pp.

Chu, Y.-t., T.-l. Tchang and H.-t. Chen, 1963 (Fishes of the East China Sea - in Chinese). Scientific Publishing House, Peking, 642 pp.

Christmas, J.Y. and G. Günther, 1960 Distribution of menhaden, genus Brevoortia, in the Gulf of Mexico. Trans.Am.Fish.Soc., **89**(4):338-343

Chyung, M.K., 1961 Illustrated encyclopedia. The fauna of Korea, (2). Fishes. Ministry of Education, Seoul, 861 pp.

Ciechomski, J. Dziekonska de, 1965 Observaciones sobre la reproducción desarrollo embrionario y larval de la anchoita (Engraulis anchoita). Boln Inst.Biol.mar., (9):1-29

_____, 1967a Present state of the investigations on the Argentine anchovy Engraulis anchoita (Hubbs, Marini). Rep.Calif.coop.oceanic Fish.Invest., **11**:58-66

_____, 1967b Influence of some environmental factors upon the embryonic development of the Argentine anchovy Engraulis anchoita (Hubbs, Marini). Rep.Calif.coop.oceanic Fish.Invest., **11**:67-71

_____, 1967c Investigations of food and feeding habits of larvae and juveniles of the Argentine anchovy Engraulis anchoita. Rep.Calif.coop.oceanic Fish.Invest., **11**:72-81

_____, 1968 Huevos y larvas de tres especies de peces marinos. Anchoa marinii, Brevoortia aurea y Prionotus nudigula de la zona de Mar del Plata. Boln Inst.Biol.mar, (17):1-28

Clarke, F.N. and J.C. Marr, 1955 Population dynamics of the Pacific sardine. Rep.Calif.coop.oceanic Fish.Invest., (1953-1955):11-8

Clemens, W.A. and G.V. Wilby, 1967 Fishes of the Pacific coast of Canada, 2nd ed., 1st reprint. Bull.Fish.Res.Board Can., (68):1-443

CLOFETA, (in press) Check-list of the fishes of the eastern tropical Atlantic. For Clupeidae and Engraulidae, see Whitehead, in press

CLOFFA, 1984 Check-list of the freshwater fishes of Africa. 1. For Congothrissidae, see Poll and Teugels, 1984; for Clupeidae, see Poll, Teugels and Whitehead, 1984

CLOFNAM, 1973 Check-list of the fishes of the north-eastern Atlantic and of the Mediterranean. For the Clupeidae and Engraulidae, see Svetovidov, 1973; for the Dussumieriidae, see Whitehead and Ben-Tuvia, 1973

CLOFRES, 1984 Check-list of the fishes of the Red Sea. For the Clupeidae and Engraulidae, see Dor & Whitehead, 1984

Coad, B.W., 1980 Environmental change and its impact on the freshwater fishes of Iran. Biol.Conserv., 19:51-80

Cobo, M. and S. Massay, 1969 Lista de los peces marinos de1 Ecuador. Boln cient.tech.Inst.nac.Pesc.Ecuador, **2**(1):1-68

Colenso, W., 1879 (No title; item 4 of 7th meeting, 14 October 1878). Trans.N.Z.Inst., **11**:572

Conand, F., 1979 Systématique des larves de clupéidés de I'Atlantique oriental entre 20°N et 15°S (eaux marines et saumâtres). Cah.Off.Rech.Sci.Tech.Outre-Mer, (océanogr.), **16**(1):3-8

Cope, ED. 1869 Supplement on some new species of American and African fishes. Trans.Am.Phil.Soc., 13(2):400-7

_____, 1872 On the fishes of the Ambyiacu river. Proc.Acad.nat.Sci.Philad., (16 January 1872):250-94

_____, 1873 A contribution to the ichthyology of Alaska. Proc.Am.Phil.Soc., **13:**24-32

_____, 1877 Synopsis of the cold blooded vertebrata procured by Professor Orton during his expeditions of 1873 and 1877. Proc.Am.Phil.Soc., **17**:18-67

Cornide, J., 1788 Ensayo de una historia de los peces y otras producciones marinas de la costa de Galicia, arreglado al sistema de1 caballero Cárlos Linnes; con una tratado de las diversas pescas, y de las redes y aparejos con que se practican. (Coruña), 263 pp.

Cowan, C.F., 1969 Cuvier's Règne animal, first edition. J.Soc.Biblphy nat.Hist., **5**:219

_____, 1971 On Guérin's Iconographie: particularly the insects. J.Soc.Biblphy nat.Hist., **6**(1):18-29

_____, 1973 Proc.zool.Soc.Lond., publication dates. J.Soc.Biblphy nat.Hist., **6**(4):293-4 (see also Duncan, 1937)

Cuvier, G.L.C.F.G., 1816 Le régne animal distribué d'après son organisation,pour servir de base à I'histoire naturelle des animaux et d'introduction a I'anatomie comparée, 1st ed., 2. Deterville, Paris, 532 pp. (pl.12 in vol.4 of same date)(correct dating by Whitehead, 1967c; Cowan, 1969; and Roux, 1969)

_____, 1829 Le règne animal . . . 2nd ed., 2. Deterville, Paris, 406 pp. (dated October 1828 in the preface, but fide Boeseman, 1962 it should be 15 February to 31 March 1829, thus before Spix and Agassiz's Brazilian fishes)

Daget, J., 1954 Les poissons du Niger supérieur. Mém.Inst.fr.Afr.noire, (36):1-391

_____, 1962 Les poissons du fouta Dialon et de la Basse Guinée. Mém.Inst.fr.Afr.noire, (65):1-210

Daget, J. and A. Iltis, 1965 Poissons de Côte d'Ivoire (eaux douces et saumâtres). Mém.Inst.fr.Afr.noire, (74):1-385

Dahl, G., 1971 Los peces de1 norte de Colombia. Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA), Ministerio de Agricultura, Bogotá, 391 pp.

Dahlberg, M.D., 1970 Atlantic and Gulf of Mexico menhadens, genus Brevoortia (Pisces:Clupeidae). Bull.Fla St.Mus. biol.Sci., **15**(3):91-16

Daly J.C. and B.J. Richardson, 1980 Allozyme variation between populations of baitfish species Stolephorus heterolobus and St. devisi (Pisces:Engraulidae) and Spratelloides gracilis (Pisces:Dussumieriidae) from Papua New Guinea waters. Aust.J.mar.Freshwat.Res., **31**:701-11

Daly, R.J., 1970 Systematics of southern Florida anchovies (Pisces:Engraulidae). Bull.mar.Sci., **20**(1):70-104

Dalzell, P.J. and J.W.J. Wankowski, The biology, population dynamics,and fisheries dynamics of exploited 1980 stocks of three baitfish species, Stolephorus heterolobus, S. devisi and Spratelloides gracilis in Ysabel Passage New Ireland: Province Papua New Guinea. Res.bull.Dept.Prim.Indust.(Port Moresby), (2):1-124

Davies, D.H., The South African pilchard (Sardinops ocellata) and maasbanker (Trachurus trachurus). Young 1957 fish survey, 1955-56. Investl.Rep.Div.Fish.Un.S.Afr., (29):1-36

Day, F., On the fishes of Cochin, on the Malabar coast of India. Part 2. Anacanthini. Proc.zool.Soc.Lond., 1865 (1):286-318

_____, (error, see 1870)
1869

_____, On the freshwaterfishes of Burma, Part 1. Proc.zool.Soc.Lond., (3):614-23 (April 1870; for
1870 hating see Duncan, 1937)

_____, (error, see 1878)
1875

_____, The fishes of India; being a natural history of the fishes known to inhabit the seas and
1878 freshwaters of India, Burma and Ceylon, Part IV. William Dawson and Sons, London, pp. XX plus 553-778, and pls 134-195 (for dating of the parts, see Whitehead and Talwar, 1976:54, fn.)

De, D.K. and P. Datta, A note on the analysis of size frequencies of Setipinna taty (Valenciennes) of the lower
1974 Sunderbans region (Hooghly-Matlah estuary). Indian J.Fish., **21**(1):285-9

De, D.K. and P.M. Mitra, Studies on the fecundity of Setipinna taty (Valenciennes) and Trichiurus pantului Gupta
1981 of the Hoogly estuarine system. Indian J.Fish., **28**(l-2) :272-5

Dehadrai, P.V., On the swim bladder and its posterior communication with the exterior in an Indian clupeoid
1960 fish, Ilisha indica. Copeia, (2):125-30

De Jager, B. van D., Synopsis on the biology of the South African pilchard Sardinops ocellata (Pappé).
1960 FAO Proc.Wild.scient.Meet.Biol.Sardines, 2:97-114 (FAO Fish.Synop., No.7

DeKay, J.E., Natural history of New York, Part 1, Zoology. Part 4, Fishes. White and Visscher, New York, xiv
1842 plus 415 pp.

Dekhtyareva, A.I., (The characteristics of herring fry-of-the-year in the north Caspian Sea - in Russian).
1940 Trudy vses.nauchno-issled.Inst.morsk.ryb.Khoz.Okeanogr., **14**:47-76

Delfin, F.T., Catálogo de los peces de Chile. Revta chil.Hist.nat., **4**(1):4-6, 21-5 (complete work reprinted
1901 1901, Gillet, Valparaiso, 133 pp.)

Delsman, H.C., Fish eggs and larvae from the Java Sea, 20. The genus Coilia. Treubia, **14**(1):114-6
1932

Demir, N., Synopsis of biological data on anchovy Engraulis encrasicolus (Linnaeus) 1758 (Mediterranean and
1963 adjacent seas). FAO Fish.Synop., (26) (41 pp., mimeo - provisional draft)

_____, Idem. (revision of 1963 Engraulis encrasicolus Synopsis, 42 pp.)
1965a

_____, Synopsis of biological data on sprat Sprattus sprattus (Linnaeus, 1758) (Mediterranean and
1965b Adjacent seas). FAO Fish.Synop., (27)Rev.l (40 pp., mimeo)

Derscheid, J.M., Note sur certains Clupeidae de la côte W. de l'Afrique. Revue zool.afr., (**12**)(2):278-82
1924

Devanesen, D.W. and S. Varadarajan, On the hatching of fish eggs in 1940-41 in the laboratory of the West Hill
1942 Biological Station, Calicut. Proc.29th Indian Sci.Congr. (Baroda), (3), Abstracts:157-8

Devincenzi, G.J., Peces del Uruguay. An.Mus.nac.Montevideo, (2)(5):139-93
1924

Devincenzi, G.J. and L.P. Barattini, Album ictiológico del Uruguay. An.Mus.Hist.nat.Montevideo, Suppl.,
1928 (2)2:24 pls (no text)

Dharmamba, M., 1960 Studies on the maturation and spawning habits of some common clupeoids of Lawson's Bay, Waltair. Indian J.Fish., **6**(2):374-88

Dodson, J.J., 1974 Behaviour of adult American shad (Alosa sapidissima) homing to the Connecticut River from Long Island Sound. J.Fish.Res.Board Can., **30**:1847-60

Dor, M. and P.J.P. Whitehead, 1984 Clupeiformes, pp. 39-44 in M.Dor, Checklist of the fishes of the Red Sea. Israel Academy of Sciences and Humanities, Jerusalem, 437 pp.

Drensky, P., 1934 (Alosa bulgarica nov.sp. a hitherto unknown river fish from the Bulgarian Black Sea coast south of Burgas - in Bulgarian, German summary). Izv.tsarsk.prirodonauch.Inst.Sof., 7:79-87

Duharnel du Monceau, H.L., 1772 Traité general des pêsches et histoire des poissons qu'elles fournissant, tant pour la substance des hommes, que pour plusieurs autres usages qui ont rapport aux arts et au commerce, 2 (2nd part). Saillant and Nyon, also Desaint, Paris, 579 pp.

Dulzetto, F., 1940 Su una particolare forma di Engraulis della "Plaia" di Catania e del Simeto. Atti R.Accad.Ital. (Memoire), **11**:325-400

_____, 1947 L'Engraulis dei laghi di Ganzirri e del Faro. Memorie Soc.ital.Sci.XL, (3)**26**:5-28

Duméril, A., 1861 Poissons de la côte occidentale d'Afrique. Archs Mus.Hist.nat., Paris, **10**:241-64 (volume dated 1858-61, but livraisons 1-2 of 1858, livraisons 3-4 of 1861)

Duncan, F.M., 100 On the dates of publication of the Society's 'Proceedings', 1859-1926. Proc.zool.Soc.Lond., **107**(A):71-77 (correct dates for 1872 and 1874 supplied by Cowan, 1973; pre-1859 dates by Waterhouse, 1937)

Du Plessis, C.G., 1960 Trends in the pilchard fishery of the Union of South Africa 1943-58. FAO Proc.Wld.scient. Meet.Biol.Sardines, **3**:631-66

Durand, J., 1940 Notes sur quelques poissons d'espèces nouvelles ou peu connues des eaux douce cambogiennes. Notes Stn.marit.Cauda, (36):1-40

Dutt, S., 1961 A new record of the anchovy Thrissocles vitirostris Gilchrist and Thompson from Indian waters. Curr.Sci., **30**:104

Dutt, S. and M. Babu Rao, 1958a Occurrence of Anchoviella baganensis Hardenberg off east coast of India. Curr.Sci., **28**:160-1

Dutt, S. and B. Seshagiri Rao, 1972 On a new species of anchovy of the genus Coilia Gray, 1835. J.Bombay nat.Hist. Soc., **69**(1):136-8

_____, 1975 On the identity of rat-tailed anchovy Coilia neglecta Whitehead, 1967. J.Bombay nat.Hist.Soc., **71**(2):316-9

Economidis, P.S., 1973 (Catalogue of Greek fishes - in Greek). Hellenic Oceanol.Limnol., 421-598

Economidis, P.S. and A.I; Sinis, (in press) Taxonomical situation and comparison of shads (Pisces, Clupeidae) from the lakes Volvi and Vistonis (Greece)

Eigenmann, C.H. and W.R. Allen, 1942 Fishes of western South America. I. The Intercordilleran and Amazonian lowlands of Peru. II. The high pampas of Peru, Bolivia and northern Chile. With a revision of Peruvian Gymnotidae and the genus Orestias. University of Kentucky, Lexington, 494 pp.

Eigenmann, R.S., 1891 New California fishes. Am.Nat., **25**:153-6

_____, 1893 The fishes of San Diego, California. Proc.U.S.natn.Mus., **15**:123-78

_____, 1894 V. Notes on some American fishes. Ann.N.Y.Acad.Sci., 7:625-37

_____, 1907 On a collection of fishes from Buenos Aires. Proc.Wash.Acad.Sci., **8**:449-58

Eigenmann, R.S., 1910 Catalogue and bibliography of the fresh water fishes of the Americas south of the tropic of Cancer. Rep.Princeton Univ.Exped.Patagonia, 1896-1899, **3**(4):375-777

_____, 1912 The freshwater fishes of British Guiana, including a study of the ecological grouping of species, and the relation of the fauna of the plateau to that of the lowlands. Mem.Carneg.Mus., **5**:1-578

_____, 1917 Eighteen new species of fishes from northwestern South America. Proc.Am.phil.Soc., 54:673-89

_____, 1922 The fishes of western South America. Mem.Carneg.Mus., **9**(1):1-350

Eigenmann, R.S. and Bray, 1849 (error, see Eigenmann, 1894)

Einarsson, H. and B. Rojas de Mendiola, 1963 Descripción de huevos y larvas de anchoveta peruana (Engraulis ringens J.). Boln Inst.Invest.Recurs.mar., Callao, **1**(1):1-23

Eiras, J. da C., 1980 Alosa fallax from north and south of Portugal: study of its numerical characters. Publçoes Inst.Zool.Dr.Augusto Nobre, (155):1-15

_____, 1983 Some aspects on the biology of a landlocked population of anadromous shad Alosa alosa L. Publçoes Inst.Zool.Dr.Augusto Nobre, (180):1-16

Erdman, D.S., 1971 Notes on fishes from the Gulf of Nicoya, Costa Rica. Revta Biol.trop., **19**(1-2):59-71

Eschmeyer, W.N., E.S. Herald and H. Hammann, 1983 A field guide to Pacific coast fishes of North America from the Gulf of Alaska to Baja California. Peterson Field Guide Series, Houghton Mifflin, Boston, 336 pp.

Eskinazi, A.M., 1972 Peixes do Canal de Santa Cruz - Pernambuco - Brazil. Trabhs oceanogr. Univ.Fed.Pernamb., **13**:283-315

Evermann, B.W., 1902 The American species of shad. Abstr.Sci., (new ser.)**15**:1032

Evermann, B.W. and W.C. Kendall, 1898 Descriptions of new or little known genera and species of fishes from the United States. Bull.U.S.Fish Commn., **17**:125-33

Evermann, B.W. and M.C. Marsh, 1900 Descriptions of new genera and species of fishes from Puerto Rico. Rep.U.S.Fish Commn., (1899):351-62

_____, 1902 The fishes of Puerto Rico. Bull.U.S.Fish Commn., **20**(1):49-350

Evermann, B.W. and L. Radcliffe, 1917 The fishes of the west coast of Peru and the Titicaca basin. Bull.U.S.natn.Mus., 9X1-166

Fage, L., 1920 Engraulidae, Clupeidae. Rep.Dan.oceanogr.Exped.Mediterr., **2**(Biol.,A.9):1-140

Fagetti, E. and R. Marak, 1972 Ichthyoplankton studies in West Africa - a review. FAO Fisheries Circular, (137)(11 pp. mimeo)

Fatio, V., 1890 Faune des vertébrés de la Suisse, 5. Histoire naturelle des poissons, 2. Physostomes (suite et fin), anacanthiens, chondrostiens, cyclostomes. Geneva and Basle, lxxx plus 576 pp.

Fernholm, B. and A.C. Wheeler, 1983 Linnaean fish specimens in the Swedish Museum of Natural History, Stockholm. Zool.J.Linn.Soc.Lond., **78**:199-286

Figueiredo, J.L. and N.A. Menezes, 1978 Manual de peixes marinhos do sudeste do Brasil, II. Teleostei (1). Museu de Zoologia, Universidade de Sâo Paulo, Sâo Paulo, Brazil, 110 pp.

Fineran, B.A. and J.A.C. Nicol, 1976 Novel cones in the retina of the anchovy (Anchoa). J.Ultrastruct.Res., **54**(2):296-303

_____, 1977 Studies on the eyes of anchovies Anchoa mitchilli and A. hepsetus (Engraulidae) with particular reference to the pigment epithelium. Phil.Trans.R.Soc., (B)**276**(947):321-50

Fischer, J.G., 1885 Ichthyologische und herpetologische Bemerkungen. Jb.Hamb.Wiss.Anst., **2**:49-119

Fischer, W., 1958 Huevos, crias y primeras prelarvas de la "anchoveta" (Engraulis ringens) Jenyns. Revta Biol.mar., **8**(1-3):111-24

Fitch, J.E. and R.J. Lavenberg, 1971 Marine food and game fishes of California. California Natural History Guides (28), University-of California Press, 179 pp.

FNAM, 1984 Fishes of the north-eastern Atlantic and Mediterranean, **1**. For Clupeidae and Engraulidae, see Whitehead, 1984

Fowler, M.W., 1906 The fishes of New Jersey. Rep.N.J.Mus., (1905):35-477

Fowler, H.W., 1911 Notes on clupeoid fishes. Proc.Acad.nat.Sci.Philad., **63**:204-21

_____, 1915 The fishes of Trinidad, Grenada, and St Lucia, British West Indies. Proc.Acad.nat.Sci.Philad., **67**:520-46

_____, 1924 Notes and descriptions of Indian fishes. J.Bombay nat.Hist.Soc., **30**(1):36-41

_____, 1928a Fishes from Florida and the West Indies. Proc.Acad.nat.Sci.Philad., **80**:451-73

_____, 1928b The fishes of Oceania. Mem.Bernice P.Bishop Mus., **10**:1-540

_____, 1930 Notes on tropical American fishes. Proc.biol.Soc.Wash., **43**:145-8

_____, 1931a A synopsis of the fishes of China, Part II. The herrings and related fishes. Hong Kong Nat., **2**(1):49-59

_____, 1931b Fishes obtained by the Barber Asphalt company in Trinidad and Venezuela, in 1930. Proc.Acad.nat.Sci.Philad., **83**:391-410

_____, 1934 Descriptions of new fishes obtained 1907 to 1910 chiefly in the Philippine Islands and adjacent seas. Proc.Acad.nat.Sci.Philad., **85**:233-367

_____, 1935 Zoological results of the third DeSchauensee Siamese Expedition, part 1, Fishes. Proc.Acad. nat.Sci.Philad., **86**:67-163

_____, 1936 The marine fishes of West Africa, based on the collection of the American Museum Congo Expedition 1909-15. Bull.Am.Mus.nat.Hist., **70**(l):i-vii, l-606 plus 607-1493

_____, 1939 Fishes from the Pacific slope of Colombia, Ecuador and Peru. Notul.Nat., (33):1-7

_____, 1941a Zoological results of the second Bolivian expedition for the Academy of Natural Sciences of Philadelphia, 1936-37. I. Fishes. Proc.Acad.nat.Sci.Philad., **92**:43-103

_____, 1941b A collection of freshwater fishes obtained in eastern Brazil by Dr Rudolpho von Ihering. Proc.Acad.nat.Sci.Philad., **93**:123-99

_____, 1941c Los peces del Perú Catalogo sistemático de los peces que habitan en aquas peruanas. Boln Mus.Hist.nat.Javier Prado, **5**(17):218-36, and (18):363-91

_____, 1941d Contributions to the biology of the Philippine archepelago and adjacent regions. The fishes of the groups Elasmobranchii, Holocephali, Isospondyli, and Ostariophysi obtained by the United States Bureau of Fisheries steamer "Albatross" in 1907 to 1910, chiefly in the Philippine islands and adjacent seas. Bull.U.S.natn.Mus., **13**(1OO):i-x plus l-879 pp.

_____, 1942 A list of the fishes known from the coast of Brazil. Archos Zool.Est.S.Paulo, **3**:115-84

Fowler, H.W., Notes and descriptions of new or little known fishes from Uruguay. Proc.Acad.nat.Sci.Philad., 1943 **95**:311-34

_____, Fishes of Chile. Systematic catalog. Part 2. Revta chil.Hist.nat., 46:15-11 6 (Par t 1 in vol. 1944 **45**:22-5 7 of 1943; Part 3 in Vol. 47X75-342 of 1944)

_____,A study of the fishes of the Southern Piedmont and coastal plain Monagr.Acad.nat.Sci.Philad., 1945a 7:1-408

_____, Fishes of Chile. Systematic catalog. Reprinted from Revta Chil.Hist.nat., 45-47, of 1943, 1944 1945b and 1944 (new pagination)

_____, Os peixes de água doce do Brasil. Archos Zool.Est.S.Paulo, 6:l-204 1948

_____, Result of the two Carpenter African expeditions, 1946-48. Pt.2 The fishes. Proc.Acad.nat. 1949 Sci.Philad., **101**:233-75

_____, Fishes of the Red Sea and southern Arabia, Branchiostomida to Polynemida. Weizmann Science 1956 Press, Jerusalem, 240 pp.

_____, Fishes of Fiji. Govt. of Fiji, Suva, 670 pp. 1959

_____, A catalogue of world fishes (xix). Q.Jl Taiwan Mus., 26(3-4):217-346 (or pp. 349-478 in overall 1973 numbering of catalogue)

Fowler, H.W. and B.A. Bean, Descriptions of eighteen new species of fishes from the Wilkes Exploring 1923 Expedition, preserved in the United States National Museum. Proc.U.S.natn.Mus., **63:**1-27

Freon, P. and B. Stequert, Note sur la presence de Sardina pilchardus (Walb.) au Sénégal. Symposium Canaries 1978 Current: Upwelling and living resources (11-14 April 1978, Las Palmas). Doc.Sci.Prov.Centre Rech. Océanogr.Dakar-Thiaroye, (67)(12 pp., mimeo)

Furnestin, J. and A. Vincent, Variation des branchiospines dans le genre Alosa. C.r.hebd.Séanc.Acad.Sci., Paris, 1958 **246**(24):3376-9

Fuster de Plaza, M.L., Algunos datos sobre la biologia de la anchoita del sector bonaerense (resultados 1964 preliminares). FAO, 2nd Reunion, CARPAS 2, Tech.Doc.12 (11 pp., mimeo)

Fusta de Plaza, M.L. and E.E. Boschi, Areas de migración y ecologia de la anchoa Lycengraulis olidus (Günther) 1961 en las aguas argentinas (Pisces, fam. Engraulidae). Contrnes cient.Fac.Cienc.exact.fis.nat.Univ.B. Aires, **1**(3):127-83

FWNA, Fishes of the Western North Atlantic. For Clupeidae and Engraulidae, see Hildebrand, 1964; but 1964 Harengula by Rivas, 1964 and Dorosoma by Miller, 1964

Ganapati, P.N. and K.S. Rao, Observations on the breeding and spawning of Thrissocles mystax (Schn.) off 1962 Waltair coast. Proc.lst all-Indian Congr.Zool., (Jabalpur), (2):231-3

Gaspar, A.G., Osteologia de Lile piquitinga (Schreiner y Miranda Ribeiro, 1903) (Pisces:Clupeidae). Boln 1976 Mus.Mar Bogota , (8):3-52

Geoffroy Saint-Hilaire, E.F., Poissons du Nil, de la Mer rouge et de la Méditerranée, in Description de l'Egypt . . . 1808 Histoire naturelle, l(l), Poissons, pls 1-17. Paris

Gilbert C.H., A preliminary report on the fishes collected by the steamer "Albatross" on the Pacific coast of 1841 North America during the year 1889, with descriptions of twelve new genera and ninety-two new species. Proc.U.S.natn.Mus., **13**:49-126

_____, Scientific results of exploration of the U.S. Fish Commissioner Steamer "Albatross". No.22. 1892 Descriptions of thirty-four new species of fishes collected in 1888 and 1889, principally among the Santa Barbara Islands and in the Gulf of California. Proc.U.S.natn.Mus., **l4**:539-66

Gilbert, C.R. and D.P. Kelso, Fishes of the Tortuguero area, Caribbean Costa Rica. Bull.Fla St.Mus.biol.Sci., 1971 **16**(1):1-54

Gilbert, C.H. and C.J Pierson, p. 2815 in Jordan and Evermann, 1898
1898

Gilbert, C.H. and E.C. Starks, The fishes of Panama Bay. Mem.Calif.Acad.Sci., **4**:1-304
1904

Gilchrist, J.D.F. and W.W. Thompson, Description of fishes from the coast of Natal. Ann.S.Afr.Mus., **6**:145-206
1908

Gill, T.N., Synopsis of the subfamily of Clupeinae, with descriptions of new genera. Proc.Acad.nat.Sci.Philad.,
1862 (1861):33-8

Gines,H. and F. Cervigón, Exploración pesquera en las costas de Guayana y Surinam, año 1967.
1968 Mems.Soc.Cient.nat.La Salle, **28**(79):5-96

Girard, C., (error, see 1856a)
1854

_____, Descriptions of new fishes, collected by Dr A.L. Heermann, naturalist attached to the survey of
1856a the Pacific railroad route, under Lieut. R.S. Williamson, USA. Proc.Acad.nat.Sci.Philad., **7**:129-40

_____, Abstract of a report to Lieut. Jas. M. Gilliss, U.S.N., upon the fishes collected during the U.S.N.
1856b astromical expedition to Chile. Proc.Acad.nat.Sci.Philad., **7**:197-9

_____, Pacific railroad routes, 1857. Fishes. U.S. Senate Misc.Doc., (78)(4):1-400
1858

Gmelin, J.F., C. a Linne Systema naturae . . . Editio decimatertia . . . cura J.F. Gmelin, **1**(3):1033-516 (fishes often
1789 wrongly dated 1788 - see Hopkinson, 1907)

Gnanamekelai, A.G., (error, see 1964)
1962

_____, Studies on the age and growth of the keerimeen chalai, Sardinella sirm. Madras J.Fish., **1**:25-33
1964

Gómez Larrañeta, M., Synopsis of biological data on Sardina pilchardus of the Mediterranean and adjacent seas.
1960 FAO Proc.Wld.scient.Meet.Biol.Sardines, **2**:137-73 (FAO Fish.Synop.,No.9)

Gonzalez. D.R.. M. Padrón and L.E. Subero. Analisis electrophoretico de hemoglobina, lactato deshidrogenasa,
1974 esterases y proteinas no enzimaticas de dos especies del genero Anchoa (Pisces:Engraulidae). Boln Inst.oceanogr., Cumana, **13**(1-2):47-52

Goode, G.B., (error, see Goode and Bean, 1880a)
1879

Goode, G.B. and T.H. Bean, Catalogue of a collection of fishes sent from Pensacola, Florida, and vicinity, by Mr
1880a Silas Stearns, with descriptions of six new species. Proc.U.S.natn.Mus., **2**:121-56

_____, Catalogue of a collection of fishes obtained in the Gulf of Mexico by Dr J.W. Velie with
1880b descriptions of seven new species. Proc.U.S.natn.Mus., **2**:333-45

_____, Descriptions of twenty-five new species of fish from the southern United States, and three new
1883 genera, Letharcus, Ioglossus and Chriodorus. Proc.U.S.natn.Mus., **5**:412-37

Gopinath, K., Notes on the larval and postlarval stages of fishes found along the Trivandrum coast.
1946 Proc.natn.Inst.Sci.India, **12**(1):7-21

Gosline. W.A. and V.E. Brock, Handbook of Hawaiian fishes. University of Hawaii Press, Honolulu, 372 pp.
1960

Gosse, J.P., Le milieu aquatique et l'écologie des poissons dans la region de Yangambi. Annls Mus.r.Afr.cent.,
1963 (116):111-252

Gosse, P.H., A naturalist's sojourn in Jamaica. Longman, Brown, Green and Longman, London, 508 pp.
1851

Grande, L., Recent and fossil clupeomorph fishes with materials for revision of the subgroups of clupeoids.
1985 Bull.Am.Mus.nat.Hist., **181**(2):231-372

Grande. L. and G.J. Nelson. Interrelationships of fossil and recent anchovies (Teleostei:Engrauloidea) and 1985 description of a new species from the Miocene of Cyprus. Am.Mus.Novit., (2826):1-16

Grant, E.M., Guide to fishes. Dept.Harbours & Marine, Brisbane, 768 pp. 1978

Gray, J.E., Illustrations of Indian zoology; chiefly selected from the collection of Major-General Hardwicke, 20 1830-34 parts in 2 vols., 200 pls (clupeoids in Vol.1, part 1 (pl.85) and 3 (pl.96) both of 1830). London (for dating of parts, see Sawyer, 1953)

_____, Catalogue of fish collected and described by Laurence Theodore Gronow, now in the British 1854 Museum. Trustees, British Museum, London, 196 pp.

Greenfield, D.W. and T. Greenfield, The status of the Lake Maracaibo anchovy Anchovia nigra Schultz 1977 (Pisces:Engraulidae). Brenesia, (10/11):101-7

Grimm, O., (Azov shads - in Russian). Vest.Ryboprom., **16**(2):57-70 1901

Gronovius, L.T., Zoophylacii Gronoviani fasciculus primus exhibens animalia quadrupeda, amphibia atque Pisces, 1763 quae in museo suo adservat, rite examinavit, systematice disposuit, descripsit, atque iconibus illustravit. T. Haak, S. Samuel and J. Luchtmans, Leyden, 136 pp.

Guérin-Méneville, F.E., Iconographie du Régne animal de G. Cuvier, ou representation d'après nature de l'une des 1844 espèces les plus remarquables et souvent non figurées de chaque genre d'animaux. Avec un texte descriptif mis au courant de la science. Ouvrage pouvant servir d'atlas à tous les traitès de Zoologie. Paris, 450 pls in 45 livraisons (1829-1837) and Texte (7 September 1844). See Cowan (1971) for dating

Günther, A.C.L.G., (error, see 1867) 1866

_____, (On the fishes of the states of Central America, founded upon the specimens collected in the 1867 fresh and marine waters of various parts of the country by Messrs. Salvin, Godman and Capt. J.M. Dow). Proc.zool.Soc.Lond., (3):600-4 (April 1867, not 1866; for dating see Duncan, 1937).

_____, Catalogue of the fishes in the British Museum, **7.** Trustees, British Museum, London, 512 pp. 1868

_____, On some new species of reptiles and fishes collected by J. Brenchley, Esq. Ann.Mag.nat.Hist., 1872 (4)10:418-26

_____, Descriptions of new species of fishes in the British Museum. Ann.Mag.nat.Hist. (4)**14**:453-5 1874

Hamilton-Buchanan, F., An account of the fishes found in the River Ganges and its branches. Archibald 1822 Constable, Edinburgh and London, 405 pp. plus 39 pls in separate vol.

Haneda, Y., A preliminary report on two luminous fishes from Bombay and Hong Kong. Sci.Rep.Yokosuka 1961 Cy Mus., **6**:45-50

Hansen, J.E., M.B. Cousseau and D.L. Gru, Caracteristicas poblacionales de la anchoita (Engraulis anchoita). 1984 Parte I. El largo medio al primer año de vida, crecemiento y mortalidad. Revta Invest. Des.pesq.Mar del Plata, (4):21-48

Hardenberg, J.D.F., The fish fauna of the Rokan mouth. Treubia, **13**(1):81-168 1931

_____, New Stolephorus species of the Indo-Australian seas. Natuurk.Tijdschr.Ned.-Indië, **93**(2):258-63 1933a

_____, Some new or rare fishes of the Indo-Australian Archipelago, II. Treubia, **14**(2):215-26 1933b

_____, Some remarks on the genus Stolephorus Lacépède in the Indo-Australian Archipelago. Treubia, 1934 **14**(3):313-75

_____, On a collection of fishes from the estuary and the lower middle course of the river Kapuas (W. 1936 Borneo). Treubia, **15**(3):225-54

Hardenberg, J.D.F., 1941 Fishes of New Guinea. Treubia, **18**(2):217-31

Harder, W., 1958 The intestine as a diagnostic character in identifying certain clupeoids (Engraulidae, Clupeidae, Dussumieriidae) and as a morphometric character for comparing anchoveta (Cetengraulis mysticetus) populations. Bull.inter-Am.trop.Tuna Commn., **2**(8):365-88

Hart, J.L., 1973 Pacific fishes of Canada. Bull.Fish.Res.Board Can., (180):1-740

Hasselt, J.C. van, 1823 Uittreksel uit een' brief van Hasselt, aan den Heer C.J. Temminck. Alg.Konst- en Letter-bode voor het Jaar 1823, **2**(21)329-31

Hastings, R.W., 1977 Notes on the occurrence of the silver anchovy, Engraulis eurystole, in the northern Gulf of Mexico. N.East Gulf Sci., **1**(2):116-8

Hayashi, S., 1960 Recent fluctuations in the sardine stocks off the east coast of Honshu. FAO Proc.Wld.scient. Meet.Biol.Sardines, **3**:989-1001

_____, 1967 A note on the biology and fishery of the Japanese anchovy Engraulis japonica (Houttuyn). Rep.Calif.coop.oceanic Fish.Invest., **11**:44-57

Hayashi, S. and A. Tadokoro, 1962a The occurrence of the Taiwan-ainoko, Stolephorus zollingeri (Bleeker), in Japan. Bull.Jap.Soc.scient.Fish., **28**(1):26-9

_____, 1962b Catch of the Taiwan'ainoko in the anchovy fishing area around Japan. Bull.Jap.Soc.scient.Fish., **28**(1):30-3

Heath, K.L., 1980 Comparative life histories of two species of anchovies, Anchoa compressa and A. delicatissima (F. Engraulidae) from Newport Bay, California. M.A. thesis, California State University, Fullerton, 71 pp.

Herre, A.W., 1940 On a collection of littoral and freshwater fishes from the Andaman Islands. Rec.Indian Mus., **42**:1-8

Herre, A.W. and G.S. Myers, 1931 Fishes from south eastern China and Hainan. Lingnan Sci.J., **10**(2-3):233-54

_____, 1937 Contribution to the ichthyology of the Malay Peninsula. Bull.Raffles Mus., **13**:5-75

Hewitt, R., 1980 Distributional atlas of fish larvae in the California current region: northern anchovy, Engraulis mordax Girard, 1966 through 1979. CalCOFI Atlas, (28):1-101

Hida, T.S. and R.A. Morris, 1963 Preliminary report on the Marquesan sardine, Harengula vittata, in Hawaii. Pac.Sci., **17**:431-7

Hildebrand, S.F., 1925 Fishes of the Republic of El Salvador, Central America. Bull.Bur.fish.Wash., **41**:237-87

_____, 1941 An annotated list of salt and brackish water fishes, with a new name for a menhaden, found in North Carolina since the publication of "The fishes of North Carolina" by Hugh M. Smith in 1907. Copeia, (4):220-32

_____, 1943 A review of the American anchovies (family Engraulidae). Bull.Bingham oceanogr.Coll., **8**(2):1-165

_____, 1946 A descriptive catalogue of the shore fishes of Peru. Bull.U.S.natn.Mus., (189):1-530

_____, 1948a A review of the American menhaden, genus Brevoortia, with a description of a new species. Smithson.misc.Collns, **107**(18):1-39

_____, 1948b A new genus and five new species of American fishes. Smithson.misc.Collns, 110(9):1-15

_____, 1964 Family Engraulidae, pp. 152-249 and Family Clupeidae (excluding Harengula and Dorosoma), pp. 257-454 in Bigelow, H.B. et al. (eds), Fishes of the Western North Atlantic. Mem.Sears Fdn.mar. Res., New Haven, (1)(3):1-630

Hildebrand, S.F. and J. de P. Carvalho, Notes on some Brazilian anchovies (family Engraulidae) with descriptions
1948 of four new species. Copeia, (4):285-96

Hoda, S.M. Shamsul Some observations on the distribution, maturity stages and length-weight relationship of
1983 the Anchovy Thyssa mystax in the northern Arabian Sea. Indian J.Fish., **30**(2):278-86

Holthuis, L.B. and M. Boeseman, Notes on C.S. Rafinesque-Schmaltz's (1810) Caratteri di alcuni nuovi generi e
1977 nuove specie di animali e piante della Sicilia. J.Soc.Biblphy nat.Hist., **8**(3):231-4

Hopkinson, J., (error, see 1908)
1907

_____, Dates of publication of the separate parts of Gmelin's edition (13th) of the 'Systema naturae' of
1908 Linnaeus. Proc.zool.Soc.Lond., (**4**):1035-7

Horn, M.H. and L.G. Allen, Ecology of fishes in upper Newport Bay, California: seasonal dynamics and
1981 community structure. Mar.Resourc.tech.Rep., Calif.Fish Game, (45):1-102 (mimeo)

Houde, E.D. and P.L. Fore, Guide to identity of eggs and larvae of some Gulf of Mexico clupeid fishes.
1973 Leafl.Fla Dep.nat.Res.Mar.Res.Lab., **4**(1)(23):1-14

Houde, E.D. and L.J. Swanson, Description of eggs and larvae of yellowfin menhaden, Brevoortia smithi.
1975 Fish.Bull., **73**(3):666-73

Houde, E.D., W.J. Richards and V.P. Saksena, Description of eggs and larvae of scaled sardine, Harengula
1974 jaguana. Fish.Bull., **72:**1106-22

Houttuyn, M., Beschryving van eenige Japanse visschen en andere Zee-Schepzelen. Verh.holland.Maatsch.Wet.,
1782 **20:**311-50

Howard, G.V., A study of populations of the anchoveta, Cetengraulis mysticetus, based on meristic characters.
1954 Bull.inter-Am.trop.Tuna Commn., **l**(l):l-24

Howard, G.V. and A. Landa, A study of the age, growth, sexual maturity, and spawning of the anchoveta
1958 (Cetengraulis mysticetus) in the Gulf of Panama. Bull.inter-Am.trop.Tuna Commn., **2**(9):389-467

Howell-Rivero, L., List of the fishes, types of Poey, in the Museum of Comparative Zoology. Bull.Mus.Comp.
1938 Zool.Harv., **82:**169-227

Hubbold, G. and M.V. Mazzetti, Growth, morphometry and aspects of life history of the scaled sardine
1982 Harengula jaguana Poey, 1865 in the Guanabara Bay (Brazil). Meersforsch., **29**(2):80-8

Hubbs, C.L., Racial and seasonal variation in the Pacific herring, California sardine and California anchovy.
1925 Fish.Bull.Calif., (8):1-23

_____, The generic relationships and nomenclature of the Californian sardine. Proc.Calif.Acad.Sci.,
1929 **18**(11):261-5

_____, Identification and relationships of the anchovy described from California as Anchovia scitula.
1953 Copeia, (3):193-4

Hubbs, C.L. and C. Hubbs, An improved graphical analysis and comparison of series of samples. Syst.Zool.,
1953 2(2):49-57

Hubbs, C.L., W.I. Follett and L.J. Dempster, List of fishes of California. Occ.Pap.Calif.Acad.Sci., (133):1-51
1979

Hubrecht, A.A.W., Catalogue des collections formées et laissées par M.P. Bleeker. De Breuk and Smit, Leiden,
1879 iv plus 71 pp.

Hutchins, B. and M. Thompson, The marine and estuarine fishes of south-western Australia. A field guide for
1983 anglers and divers. Western Australian Museum, Perth, 103 pp.

Hutton, F.W., Index faunae Novae Zealandiae. Dulau, London, 372 pp.
1904

Hyrtl, C.J., Über die accessorischen Kiemenorgane der Clupeaceen, nebst Bemerkungen Über den Darmcanal
1855 derselben. Denkschr.Akad.Wiss.Wien, **10**(1):47-58

Irvine, F.R., 1947 The fishes and fisheries of the Gold Coast. Crown Agents, London, 352 pp.

Il'in (or Iljin), B.S., 1927 (A new species of herring from the southern Caspian - in Russian), pp. 69-75 in Festschrift für Knipowitsch, Moscow (not seen)

Isachenko (or Issatschenko), V.L., 1925 (An investigation of the herrings belonging to the genus Caspialosa from the northwestern part of the Black Sea basin - in Russian). Trudy vseuk.Chernom.-Azovsk.nauch-noprom.opyt.st., **1**:103-31

Jager, B. van D. de, 1960 (see De Jager, B. van D., 1960)

Janssen, J., 1976 Feeding modes and prey size selection in the alewife (Alosa pseudoharengus). J.Fish.Res.Board Can., **33**:1972-5

_____, 1978 Will Alewives (Alosa pseudoharengus) feed in the dark? Env.Biol.Fish., **3**(2):239-40

Jarocki, F.P., 1822 Zoologiia czyli zwiérzetopismo ogó1ne podlug návnowszego Systematu, **4.** Drukarni Latkiewicza, Warsaw, 464 pp.

Jayaram, K.C., 1981 The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka - a handbook. Zoological Survey of India, Calcutta, xxii plus 475 pp.

Jhingran, V.G., 1963 Studies on the maturity and fecundity of the Gangetic anchovy, Setipinna phasa (Hamilton). Indian J.Fish., **8**(2):291-311

_____, 1975 Fish and fisheries of India. Hindustan Publishing Corporation (India), Delhi, xv plus 954 pp.

Jiang, S.-f. and X.-y. Zheng, 1984 The morphological characters of eggs and larvae of Engraulis japonicus Temminck et Schlegel and its spawning areas in the fishing ground of the South Fujian and Taiwan Bank. Taiwan Strait, **3**(2):224-31

John, M.A., 1951 Pelagic fish eggs and larvae of the Madras coast. J.zool.Soc.India, **3**(1):38-66

Johnels, A.G., 1954 Notes on fishes from the Gambia River. Ark.Zool., **6**(17):327-411

Jones, S. and P.M.G. Menon, 1950 Spawning habits and development of the Gangetic anchovy Setipinna phasa (Ham.). Curr.Sci., **19**(1):25

Jones, S. and P.M.G. Menon, 1951 Observations on the bionomics, development and fishery of the Gangetic anchovy Setipinna phasa (Ham.). J.zool.Soc.India, 3(2):323-33

_____, 1952 Observations on the development and systematics of the fishes of the genus Coilia Gray. J.zool.Soc.India, 4(1):17-36

Jordan, D.S., 1885 List of fishes collected at Key West, Florida, with notes and descriptions. Proc.U.S.natn.Mus., **7**:103-12

_____, 1917 The genera of fishes, from Linnaeus to Cuvier, 1758-1833, seventy-five years, with the accepted type of each, part 1. Leland Stanford Junior University Publications, University Series, California, 161 pp.

_____, 1920 Idem., part 4, pp. 411-576 plus xviii (index)

Jordan, D.S. and B.W. Evermann, 1896, 1898, 1900 The fishes of North and Middle America: a descriptive catalogue of the species of fish-like vertebrates found in the waters of North America, north of the isthmus of Panama. Bull.U.S.natn.Mus., (47), Part 1 (1896):LX plus 1240; Part 3(1898):XXIX plus 2183-3136; Part 4(1900):CI plus 3137-313

_____, 1905 The aquatic resources of the Hawaiian islands. 1. The shore fishes of the Hawaiian islands, with a general account- of the fish fauna. Bull.U.S.Fish Commn., 23:i-xxvii plus l-574 (reprinted 1973, Charles E. Tuttle, Rutland, Vermont and Tokyo, 392 pp.)

Jordan, D.S. and C.H. Gilbert, List of fishes collected by Lieut. Henry E. Nichols, U.S.N., in the Gulf of 1882 California and on the west coast of Lower California with descriptions of four new species. Proc.U.S.natn.Mus., **4:**273-9

_____, Synopsis of the fishes of North America. Bull.U.S.natn.Mus., (16):i-lvi plus l-1018 1883

Jordan, D.S. and C. Rutter, A collection of fishes made by Joseph Seed Roberts in Kingston, Jamaica. 1897 Proc.Acad.nat.Sci.Philad.:91-133

Jordan, D.S. and A. Seale, List of fishes collected by Dr Bashford Dean on the island of Negros, Philippines. 1905 Bull.U.S.natn.Mus., **28:**769-803

_____, The fishes of Samoa. Description of the species found in the archipelago, with a provisional 1906 check-list of the fishes of Oceania. Bull.Bur.Fish., Wash., **25:**173-455

_____, Analysis of the genera of anchovies or Engraulidae. Copeia, (141):27-32 1925

_____, Review of the Engraulidae, with descriptions of new and rare species. Bull.Mus.comp.Zool.Harv., 1926 **67**(11):353-418

Jordan, D.S. and J.O. Snyder, A preliminary check-list of the fishes of Japan. Annotnes.zool.jap., **3:**1-159 1901

Jordan, D.S. and E.C. Starks, On a collection of fishes made in Korea by Pierre Louis Jouy, with descriptions of 1905 new species. Proc.U.S.natn.Mus., **28:**193-211

Jordan, D.S. and J.C. Thompson, The fish fauna of the Tortugas archipelago. Bull.Bur.Fish., Wash., **24:**231-56 1905

Jordan, D.S., B.W. Evermann and H.W. Clark, Check list of the fishes and fish-like vertebrates of North and 1930 Middle America, north of the boundary of Venezuela and Colombia. Appendix to Rep.U.S.Commnr. Fish., (1928-2):1-670

Jordan, R., Un analisis del número de vertebras de la anchoveta peruana (Engraulis ringens J.). Boln Inst. 1963 Invest.Recurs.mar., Callao, **1**(2):25-43

Jordan, R. and A. Chirinos de Vildosa, La anchoveta (Engraulis ringens J.). Conocimiento actual sobre su 1965 biologia, ecología y pesqueria. Inf.Inst.Mar.Peru-Callao, (6):1-52

Joseph, J., Contribution to the biology of the engraulid Anchoa naso (Gilbert & Pierson) from Ecuadorian 1963 waters. Bull.inter-Am.trop.Tuna Commn., **8**(1):1-30

Joshi, M.S. and D.V. Bal, The skeleton of Coilia dussumieri, 1. The skull; 2. The vertebral column and 1953 appendicular skeleton. J.Univ.Bombay, **21**(5):93-105 and **22**(3):53-63

Kamal, M.Y. and S.N. Ahsan, Corica biharensis, sp.nov. (Pisces:Clupeidae) from the River Ganga in Bihar (India). 1978 J.Inland Fish.Soc.Ind., **10:**28-31

Kami, H.T., I.I. Ikehara and F.P. Oe Leon, Check-list of Guam fishes. Micronesica, 4(1):93-131 1968

Kappler, A., Surinam, sein Land, seine Natur, Bevölkerung und seine Kultur-Verhaltnisse mit Bezug auf 1887 Kolonisation. J.G. Cotta'schen, Stuttgart, 383 pp.

Kawasaki, T., Fluctuation in the abundance of the Far Eastern sardine (Sardinops melanosticta) and the 1979 Kuroshio, pp. 806-817 in The Kuroshio IV, Proceedings of the fourth symposium for the co-operative study of the Kuroshio and adjacent regions (14-17 February 1979; Japan Academy, Tokyo). Saikon Publishing Company, Tokyo, 1029 pp.

Kearney, R.E., A.D. Lewis and B.R. Smith, Cruise report Tagula 71-1. Survey of skipjack tuna and bait 1972 resources in Papua New Guinea waters. Res.Bull.Dept.prim.Indust. (Port Moresby), (8):1-145

King, D.P.F. and P.R. Macleod, Comparison of the food and the filtering mechanism of pilchard Sardinops 1976 ocellata and anchovy Engraulis capensis off South West Africa, 1971-1972. Invest.Rep.Sea Fish. Brch S.Afr., (lll):l-29

Kirtland, J.P., 1838 Report on the zoology of Ohio. Rep.geol.Surv.Ohio, **2**:157-97

Kishinouye, K., 1907 Notes on the natural history of the sardine (Clupea melanostica Schlegel). J.Imp.Fish.Bur. Tokyo, **14**(3):71-105 (Japanese version, 1908, Suisan Chosa Hokuku, Tokyo, pp.72-111)

_____, 1911 Description of the clupeoid fishes from Ogasawara or Bonin Islands. J.Coll.Agric.imp.Univ. Tokyo, **2**(7):383-6

Kisselevich, K.A., 1923 (Volga-Caspian herrings. Part 1. Taxonomy - in Russian). Trudy astrakh.nauch.-prom.Eksped.(1914-1915), **1**:1-155 (English summary)

Klunzinger, C.B., 1870-71 Synopsis der Fische des Rothen Meeres, part 2 (1871). Verh.zool.bot.Ges.Wien, **21**:441-688, 1352-68 (part 1, **20**:669-834 of 1870; the two parts in one volume issued separately, 1871; reprint, Weinheim, 1964)

Kner, R. and F. Steindachner, 1866 Neue Fische aus dem Museum der Herren Joh.C.Godeffroy and Sohn in Hamburg. Sber.Akad.Wiss.Wien, **54**:356-95

Kottelat, M., 1984 Catalogue des types du Musée d'Histoire Naturelle de Neuchâtel. I. Pisces. Bull.Soc.neuchâtel. Sci. nat., **107**:143-53

Kow, T.A., (see Tham, A.K.)

Kowtal, G.V., 1970 A note on the early development of balangi, Nematalosa nasus (Bloch), from Chilka Lake. J.Inland Fish.Soc.India, **11**:155-7

Kroyer, H.N., 1846 Danmarks fiske, **3.** S. Trier, Copenhagen, 320 pp. (dated 1846-53 on title page; first part, to p. 704, assumed 1846)

Krzelj, S., 1971 Note sur les stades larvaires d' Harengula rouxi (Poll, 1953). UNDP(SF)/FAO, Results Regional Fisheries Survey West Africa, Abrdjan Sci.Rem12 pp. mimeo)

Kurita, S., 1960 Causes of fluctuations in the sardine population off Japan. FAO Proc.Wld scient.Meet.Biol.Sardines, **3**:913-35

Kuronuma, K. and Y. Abe, 1972 Fishes of Kuwait. Kuwait Institute for Scientific Research, Kuwait, 123 pp.

Lacepède, B.G.E., 1803 Histoire naturelle des poissons, **5.** Plassan, Paris, xlviii plus 803 pp.

Larrañeta, M.G., 1960 (see Gomez Larrañeta, M., 1960)

Last, P.R., E.O.G. Scott and F.H. Talbot, 1983 Fishes of Tasmania. Tasmanian Fisheries Development Authority, Hobart, 563 pp.

Leary, D.F., G.I. Murphy and M. Miller, 1975 Fecundity and length at first spawning of the Hawaiian anchovy or Nehu (Stolephorus purpureus Fowler) in Kaneohe Bay, Oahu. Pacif.Sci., **29**(2):171-80

Leggett, W.C. and R.R. Whitney, 1972 Water temperature and the migrations of American shad. Fishery Bull.Fish Wild.Serv.U.S., 70(3):659-**70**

Leible, M. and E. Alveal, 1982 Catálogo depeces que habitan las aguas costeras y dulceacuicolas en la provincia de Concepción. Pont.Univ.Catol.Chile, Talcahuano, Chile, 104 pp.

LeSueur, C.A., 1818 Descriptions of several new species of North American fishes. J.Acad.nat.Sci.Philad., **1**(2):359-68

Lewis, A.D., 1983 B.R. Smith and C.P. Ellway, A guide to the common tuna baitfishes of the South Pacific Commission Area. South Pacific Commn, Noumea, Handbook, (23):82 pp.

Lichtenstein, M.H.K., 1844 Descriptiones animalium quae in itinere ad maris australis terras per annos 1772, 1773 et 1774 suscepto colleget observavit et delineavit Johannes Reinoldus Forster. Dummler, Berlin, xvi plus 424 pp.

Liem, A.H. and W.B. Scott, 1966 Fishes of the Atlantic coast of Canada. Bull.Fish.Res.Board Can., (155):1-485

Linnaeus, C., 1754 Chinensia Lagerströmiana, Joh.Laur.Odhelius, W.G. 5.c. (dissertation), Stockholm, 36 pp. (Linnaeus acted as president or praeses for 186 dissertations and is accorded authorship; see Steam, 1957:51-5)

_____, 1758 Systema naturae, 10th ed., **1.** Laurentii Salvii, Stockholm, 824 pp. (Nantes and Pisces pp, 230-338)(fascimile of vol.1, Trustees, British Museum (Natural History), 1939; reprinted 1956)

_____, 1759 Chinensia Lagerstromiana. Amoen.Acad., Stockholm, **4**(61):230-60 (the so-called Linnaeus edition of the Amoenitates Academicae or reprinting of dissertations; see 'Whitehead, 1973a:138, fn and Stearn, 1957:62-3)

_____, 1761 Fauna Svecica, sistens animalia Sveciae regni, 2nd ed., Laurentii Salvii, Stockholm, xlvi plus 578 pp.

_____, 1766 Systema naturae, 12th ed., **1.** Laurentii Salvii, Stockholm, 1327 pp. (Nantes and Pisces, pp. 394-532)

Lindberg, G.V. and M.I. Leyeza, 1965 (1969) (Fishes of the Sea of Japan and the adjacent areas of the Sea of Okhotsk and the Yellow Sea. Part 2. Teleostomi, XII. Acipenseriformes - XXVIII. Pol nemiformes - in Russian). Zoological Institute, Academy of Sciences of the USSR, Leningrad, 391 pp. English translation, 1969. Israel Program for Scientific Translations, Jerusalem, 389 pp.)

Liu, F.H. and S.C. Shen, 1957 A preliminary report on the activity of wen-fishes (herring-like fishes) along the Coast of Taiwan. Rep.Inst.Fish.Biol., Taipei, **1:**24-32

Liu, J.-h., C.-f. Yuen and Q.-y. Gu, 1981 (A preliminary study of the gonadal development of the anchovy (Coilia ectenes taihuensis Yuen et Lin - in Chinese) Scient.Res.invest.Rept. (Biol.Dept., Nanjing Univ.), (4):1-8(English summary)

_____, 1986 (Studies on Coilia - in Chinese). Oceanologia Limnologia sinica:113-4

Lloris i Samo, D. et al., 1984 Tots els peixos del mar Català. 1: - Llista de cites i de referències. Societat Catalana d'lctiologia i Herpetologia, Barcelona, 224 pp.

Lloyd, R.E., 1907 Notes on a collection of marketable fish from Akyab, with descriptions of new species of Lactarius. Rec.Indian Mus. , **1:**219-31

Löhnberg, A.J.E. and H. Rendahl, 1920 On some freshwater fishes from lower Congo. Ann.Mag.nat.Hist., (9)6:167-76

Longhurst, A.R., 1971 The clupeoid resources of tropical seas. Oceanogr.mar.Biol., **9:**349-85

Losse, G.F., 1968 The elopoid and clupeoid fishes of East African coastal waters. Jl. E.Afr.nat.Hist.Soc.natn.Mus., 27(2):77-115

Loukashkin, A.S. and N. Grant, 1965 Behaviour and natural reactions of the northern anchovy, Engraulis mordax Girard, under the influence of light of different wave lengths and intensities and total darkness. Proc.Calif.Acad.Sci., **31**(24):631-92

Lowe, R.T., 1837 (error, see 1838)

_____, 1838 A synopsis of the fishes of Madeira; with the principal synonyms, Portuguese names, and characters of the new genera and species. Trans.zool.Soc.Lond., **2**(3):173-200 (dated 5 December 1838 by Peavot, 1937:83; June 1839 by C.D. Sherborn in BMNH copy; 1841 in CLOFNAM)

Lowe (McConnell), R.H., 1962 The fishes of the British Guiana continental shelf, Atlantic coast of South America, with notes on their natural history. J.Linn.Soc.Lond.(Zool.), **44**(301):669-700

Lozano y Rey, L., 1929 Las clupeidas de la peninsula ibérica y del rif. Mems R.Soc.esp.Hist.nat., 15:647-66

_____, 1950 Etude systematique des **clupéidés** et des **engraulidés** de I'Espagne, du Maroc et du Sahara espagnols. Rapp.P.-v.Réun.Cons.perm.int.Explor.Mer, **126:**7-20

Lüling, K.H. 1969 Setsame Fischwelt in Amazonien. Natur Mus., Frankf., **99**(12):571-9

Luther, G., 1968 On the little known fish, Chirocentrus nudus Swainson from the Indian seas, and its comparison with Chirocentrus dorab (Forsskal). J.mar.biol.Ass.India, **8**(1):193-201

Macleay, W., 1879 Descriptions of some new fishes frorn Port Jackson and King George's Sound. Proc.Linn.Soc. N.S.W., **3**:33-7

_____, 1883 (error, see 1884))

_____, 1884 Notes on a collection of fishes from the Burdekin and Mary rivers, Queensland. Proc.Linn.Soc.N.S.W., **8**:199-213

McClelland, J., 1844 Description of a collection of fishes made at Chusan and Ningpo in China, by G.R. Playfair. J.nat.Hist.Calcutta, **4**:390-413

McCulloch, A.R., 1911 Report on the fishes obtained by the F.I.S. 'Endeavour' on the coasts of New South Wales, Victoria, South Australia and Tasmania, pp. l-87 in Zoological results of the fishing experiments carried out by the F.I.S. "Endeavour" 1909-1910, **1**(1), Australian Museum, Sydney

_____, 1929 Check-list of the fishes recorded from Australia, Part I (pp. l-144). Memoir 5, Trustees, Australian Museum, Sydney, 534 pp. (published 29 June 1929; parts II and III 1929, part IV 1930)

Majorowa, A.A., 1934 Position taxonomique de l'anchois, pêche auprès de la Géorgie. Trav.Stat.Piscic.Biol.Géorgie, 1(1):7-20 plus 20a plus 20b (not seen)

Makushok, M.E., 1935 Za rybnuyu industrializatsiyu Severa, **1**:23 (not seen)

Malm, A.W., 1877 Göteborg och Bohusläns fauna, Ryggradsdjvren. Göteborg, 674 pp.

Mann, F.G., 1954 Vida de los peces en aguas Chilenas. Ministerio de Agricultura and University of Chile, Santiago, 339 p.

Mansuetti, R., 1955 Natural history of the American shad in Maryland waters. Md Tidewat.News, **11**(ll)(supp1.4):1-2

_____, 1962 Eggs, larvae, and young of the hickory shad, Alosa mediocris, with comments on its ecology in the estuary. Chesapeake Sci., **3**(3):173-205

Marcgrave, G., 1648 (see Piso and Marcgrave, 1648)

Marchal, E.G., 1967 Clé provisoire de determination des oeufs et larves des clupeidés et engraulidés ouest-africains. Doc.sci.prov.Centre Rech.océanogr. Abidjan, (014 S.R.)(8 pp., mimeo)

Marichamy, R., 1970 On certain abnormalities in the short-jawed anchovy Thrissina baelama (Forsskal) (Fam:Engraulidae). J.mar.biol.Ass.India, **10**(2):445-58

_____, 1974 A note on the length weight relationshop and relative condition in Herklotsichthys punctatus (Ruppel). Indian J.Fish., **21**(2):582-4

Marini, T.L., 1935 l-a anchoita Argentina. Physis B.Aires, **11**:445-58

Marlier, G., 1958 Recherches hydrobiologiques au lac Tumba (Congo Belg. Province de I'Equateur). Hydrobiologia, **10**:352-85

Marr, J.C., 1960 The causes of major variations in the catch of the Pacific sardine Sardinops caerulea (Girard). FAO Proc.Wld.scient.Meet.Biol.Sardines, **3**:667-791

Masuda, H., C. Araga and T. Yoshino, 1975 Coastal fishes of southern Japan. Tokai University Press, Tokyo, 379 pp. (2nd ed., 1980, 382 pp.)

Masuda, H. et al., 1984 The fishes of the Japanese archipelago. Tokai University Press, Tokyo, 2 vols, xxii plus 437 pp. and 370 pls

Masurekar, V.B. and M.R. Rege, 1960 Observations on the maturity and spawning of Thrissocles hamiltonii (Gray) in Bombay waters. J.mar.biol.Ass.India, 2(1):17-23

Mathews, J.P., 1960 Synopsis on the biology of the South West African pilchard (Sardinops ocellata Pappé). FAO Proc.Wild.scient.Meet.Biol.Sardines, 2:115-35 (FAO Fish.Synop., No.8)

Matsui, T., 1963 Populations of anchovy baitfish (Stolephorus) in the vicinity of Maui, Hawaiian Islands. M.Sc.thesis, University of Hawaii, (June 1963), 98 pp.

Matsuura, Y., 1972 Egg development of scaled sardine Harengula pensacolae Good & Bean (Pisces, Clupeidae). Bolm Inst.oceanogr.S.Paulo, 21:129-35

_____, 1973 Morphological studies of two Pristigasterinae larvae from southern Brazil, pp. 685-701 in J.H.S. blaxter, The early life history of fish, Spinger-Verlag, Berlin, Heidelberg, New York, 765 pp.

Matsuura, Y. and K. Nakatani, 1980 Variability in quantity of zooplankton, fish eggs and larvae associated with two different mesh sizes in bongo nets. Atlântica, Rio Grande, 4:43-52

Matthes, H., 1964 Les poissons du lac Tumba et de la region de I'Ikela. Annls Mus.r.Afr.cent., (series Sci.zool.), (126):1-204

Meek, S.E. and S.F. Hildebrand, 1923 The marine fishes of Panama, 1. Publs Field Mus.nat.Hist., (zool.Ser.), 15(215):1-X1 plus l-330

Meisner, V.I., 1932 (Preliminary data on the herring migrations in the Caspian Sea - in Russian). Byull.vsek.Nauch.-ryb.Eksped., (1-2)(not seen)

Menezes, N.A., 1974 Current status of Joào de Paiva Carvalho's fish types. Papés avuls.Zool.S.Paulo, 27 (16):215-7

Menni, R.C.,R.A. Ringuelet and R.A. Arámburu, 1984 Peces marinhos de la Argentina y Uruguay. Editorial Hemisferio Sur, Buenos Aires, 359 pp.

Menon, A.G.K. and P.K. Talwar, 1974 Taxonomy and distribution of Sardinella leiogaster Valenciennes, 1847 (Pisces:Clupeidae) from Indian Seas. J.Bombay nat.Hist.Soc., 71(1):41-5

Menon, P.M.G., 1951 Regeneration of the caudal fin in Coilia reynaldi Cuv. & Val., Jl R.Asiat.Soc., 16(2):123-6

Meric, N., 1984 The biology and taxonomy of Clupeonella Kessler, 1877 (Clupeidae, Pisces) in Kücükcekmece Lake, Turkey. Istanb.Univ.Fen Fak.Mecm., (B)45:63-82

Messerschmidt, J.D. (ed.), 1969 Symposium on the living resources of the California current system: their fluctuating magnitude, distribution and susceptibility to use for the benefit of the state of California. Rep.Calif.coop.oceanic Fish.Invest., 13:17-128

Mikhailovskaya, A.A., 1941 (Structural development of the marine Caspian herring, Caspialosa brashnikovi (Borodin) - in Russian). Dokl.Akad.Nauk SSSR, 30(6):5559-61

Miller, D.J., 1956 Anchovy. Prog.Rep.Calif.coop.oceanic.Fish.Invest., (1 April 1955 - 30 June 1956):20-6

Miller, D.J. and R.N. Lea, 1972 Guide to the coastal marine fishes of California. Fish Bull.Calif., (157):1-235

Miller, J.M., W. Watson and J.M. Leis, 1969 An atlas of common nearshore marine fish larvae of the Hawaiian Islands. University of Hawaii Sea Grant College Program, Honolulu, MR-80-02, 179 pp.

Miller, R.R., 1950 A review of the American clupeid fishes of the genus Dorosoma. Proc.U.S.natn.Mus., 100:387-410

_____, 1960 Systematics and biology of the gizzard shad (Dorosoma cepedianum) and related fishes. Fish.Bull., 60(173):367-92

_____, 1960 Variation, distribution, and ecology of Anchoviella analis an engraulid fish from the Pacific slope of Mexico. Copeia, (3):250-3

_____, 1964 Genus Dorosoma Rafinesque, 1820, pp. 443-451 In Hildebrand, 1964

Minano, J.B., 1968 Estudio de la fecundidad y ciclo sexual de la anchoveta (Engraulis ringens) en Ia zona de Chimbote. Boln Inst.Mar Peru, 1(9):505-52

Minckley, W.L. and L.A. Krumholz, 1960 Natural hybridization between the clupeid genera Dorosoma and Signalosa, with a report on the distribution of S. petenensis. Zoologica, N.Y., **44**(4):171-180

Miranda-Ribeiro, A. de, 1908 (see Ribeiro, A. de M., 1908)

Miranda-Ribeiro, P. de, 1961 (see Ribeiro, P. de M., 1961)

Mitchill, S.L., 1814 Report in part of Samuel L. Mitchill, M.D., on the fishes of New York. New York, 28 pp. (reprinted, 1898 with an introduction and concordance of species by T.N. Gill)

_____, 1815 The fishes of New York, described and arranged. Trans.lit.phil.Soc.N.Y., **1**:355-492

Monod, T. and J.C. Hureau, 1977 Essai de bibliographie de Risso. Annls Mus.Hist.nat.Nice, **5**:159-63

Monteiro, R., 1960 On the occurrence of Sardinops ocellata (Pappé) in the waters of Central Angola. FAO Proc.Wld scient.Meet.Biol.Sardines, **3**:1105-18

Montrouzier, Père, 1857 (see Thiolliere, 1856)

Mookerjee, H.K. and P.S. Mookerjee, 1950 On some aspects of the natural history of Engraulis hamiltonii and Engraulis telara. Proc.37th Indian Sci.Congr. (Poona), (3)Abstracts:251

Moona, J.C., 1960 Studies on the cranial osteology of the Indian clupeoid fishes. 2. The skull of Coilia dussumieri C.V. Agra Univ.J.Res., **9**:313-22

_____, 1968 Studies on the cranial osteology of the Indian clupeoid fishes. 3. Skull of Thrissocles purava (Ham.). proc.natn.Inst.Sci.India, (B)**34**:227-43

Morosov, A.V., 1928 (Studies in the taxonomy of Caspian herrings. I. Application of Heincke's method of character complexes to the identification of Volga-Caspian herrings. II. Herrings of the southeastern coast of the Caspian Sea. III. Biometric analysis of the taxonomic relations between Volga-Caspian herrings - in Russian). Trudjy nauch.Inst.ryb.Khoz., **2**(4):47-94

Morrow, J.E. and G.S. Posner, 1957 Studies in ichthyology and oceanography off coastal Peru. Bull.Ringham oceanogr.Coll., **16**(2):1-55

Miller, J. and F.H. Troschel, 1847 (Fishes), pp. 665-678 in R.H. Schomburgk, 1847 (reprinted, see Schomburgk, 1848)

_____, 1849 Fische, pp. 618-644 in R.H. Schomburgk, 1849. Dating of this part is 13 March 1849 fide the Börsenblatt für den deutsche Buchhandel, (21) (and 18 July 1848 for part 2 of Schomburgk's Reisen)

Munro, I.S.R., 1938 (error, see Munro, 1956)

_____, 1955 The marine and freshwater fishes of Ceylon. Departrnent of External Affairs, Canberra, 349 pp.

_____, 1956 Handbook of Australian fishes. Fish.Newsl.Sydney,N.S.W., (5-6):21-8

_____, 1964 Additions to the fish fauna of New Guinea. Papua New Guin.agric.J., **16**(4):141-86

_____, 1967 The fishes of New Guinea. Dept. Agriculture, Stock and Fisheries, Port Moresby, Papua New Guinea, 650 pp.

Murphy, G.I., 1960 Introduction of the Marquesan sardine, Harengula vittata (Cuvier and Valenciennes), to Hawaiian waters. Pac.Sci., **14**(2):185-7

Myers, G.S., 1940 The neotropical anchovies of the genus Amplova. Proc.Calif.Acad.Sci., **23**(29):437-42

_____, 1950 Systematic notes on some Amazonian clupeid fishes of the genus Ilisha. Copeia, (1):63-4

Nair, K.K., 1940 On some early stages in the development of the, Gangetic anchovy, Engraulis telara (Ham.). Rec.Indian Mus., **42**(2):277-88

Nair, R.V., 1953 Key for the field identification of the common clupeoid fishes of India. J.zool.Soc.India, **5**(l):10838

_____,1973 Indian sardines. CSIR zoological Monograph, (2), CSIR New Delhi, 107 pp.

Nakai, Z., 1960 Changes in the population and catch of the Far East sardine area. FAO Proc.Wld scient.Meet.Biol. Sardines, **3:**807-53

Nakamura, E.L., 1970 Synopsis of biological data on Hawaiian species of Stolephorus, pp. 425-446 in The Kuroshio (Symposium on the Japanese Current), East-West Center Press, Honolulu

Nakamura, E.L. and R.C. Wilson, 1970 The biology of the Marquesan sardine, Sardinella marquesensis. Pac.Sci., **24:**359-76

Nakashima, S., 1941 Algunos peces de1 Oriente peruano. Boln Mus.Hist.nat.Javier Prado, **5**(16):61-78

Nelson, G.J., 1967 Gill arches of teleostean fishes of the family Clupeidae. Copeia, (2):389-99

_____, 1983 Anchoa argentivittata, with notes on other eastern Pacific anchovies and the Indo-Pacific genus Encrasicholina. Copeia, (1):48-54

_____, 1984a Notes on the rostral organ of anchovies. Jap.J.Ichthyol., **31**(1):86-7

_____, 1984b Identity of the anchovy Hildebrandichthys setiger with notes on relationships and biogeography of the genera Engraulis and Cetengraulis. Copeia, (2):422-7

_____, 1986 Identity of the anchovy Engaulis clarki with notes on the species-grops of Anchoa. Copelia, (4):891-902

Nelson, G.J. and M.N. Rothman, 1973 The species of gizzard shads (Dorosomatinae) with particular reference to the Indo-Pacific region. Bull.Am.Mus.nat.Hist., **150**(2):131-206

Nelson, G.J. and P.M. Sonoda, 1987 Anchoa mundeola (Gilbert and Pierson): a valid species of Engraulidae from the Gulf of Panama. Copeia,(2):521-4

Neu, W., 1934 (see Woltereck and Neu, 1934)

Nichols, J.T., 1929 The fishes of Puerto Rico and the Virgin Islands. Branchiostomidae and Sciaenidae. Scient.Surv.P.Rico, **10**(2):161-295

Nichols, J.T. and C.M. Breder, 1927 The marine fishes of New York and southern New England. Zoologica, N.Y., **9**(1):1-192

Nichols, J.T. and L. Griscom, 1917 Freshwater fishes of the Congo basin obtained by the American Museum Congo Expediton, 1909-1915. Bull.Am.Mus.nat.Hist., **37:**653-756

Nikolski, A.M., (What is the sardine and sprat of the shakov fisherrnen - in Russian). 1923a Byull.gos.Chernom.-Azovsk.nauchnoprom.opyt.sta., (6-7):1-5

_____, 1923b (A new herring in the Black Sea - in Russian). Byull.gos.Chernom.-Azovsk.nauchnoprom.opyt.st., (8-9):4-6

Nilsson, S., 1832 Prodromus ichthyologiae Scandinaviae. Lund, iv plus 124 pp.

Nomura, H. and N.A. Menezes, 1964 Peixesmarinhos, pp. 343-385 in P.E. Vanzolini (ed.), História natural dos organismos aquáticos do Brasil. Fundaçâo de Amparo à Pesquisa do Estado de Sâo Paulo, 452 pp.

Nordmann, A. von, 1840 Observations sur la fauna pontique, in A. de Démidoff (ed.) Voyage dans la Russie méridionale et la Crimée . . . Paris

Norman, D.M. and P.J.P. Whitehead, 1984 The Bleeker/Günther letters and the sale of Bleeker specimens to the British Museum. Zoöl.Meded.Leiden, **58**(17):295-312

Norman, J.R., 1923 A revision of the genus Ilisha and allied genera. Ann.Mag.nat.Hist., (9)**11**:1-22

_____, 1937 Coast fishes. The Patagonian region. 'Discovery' Rep., **16**(2):1-150

_____, 1938 Notes on the dates etc. of the "Memorias", "Repertorio", "Synopsis", and "Enumeratio" of Felipe Poey. J.Soc.Biblphy nat.Hist., **1**(5):135-7

Ogilby, J.B., 1892 On some underscribed reptiles and fishes from Australia. Rec.Aust.Mus., **2:**23-6

Ogilby, J.D., 1897 On new genera and species of Australian fishes. Proc.Linn.Soc.N.S.W., **22:**62-95, 245-57

_____, 1898 On new species of Australian fishes. Proc.Linn.Soc.N.S.W., **22:**759-61

_____, 1954 The commercial fishes and fisheries of Queensland (revised and illustrated by T.C. Marshall from original of 1916). Fisheries Branch, Dept.Harbours and Marine, Brisbane, 121 pp.

Okera, W., 1970 An analysis of the features of Sardinella gibbosa (Bleeker) scales, with special reference to the problem of age determination. Jl E.Afr.nat.Hist.Soc.natn.Mus., **28:**35-46

_____, 1974 Morphometrics, 'condition' and gonad development of the East African Sardinella gibbosa and Sardinella albella (Valenciennes). J.Fish Biol., **6**(6):801-12

Osbeck, P., 1757 Dagbok öfver en Ostindisk resa aren 1750-52, med anmärkningar uti naturkunnigheten, främmande folkslags språk, Seder, hushållning, m.m. L.L. Grefing, Stockholm, vi plus 376 pp.

Oshirna, M., 1926 Notes on a collection of fishes from Hainan, obtained by Prof. S.F. Light. Annotnes zool.jap., **ll:**l-25

Ozawa, T. and H. Tsukahara, 1973 On the occurrence of the engraulid fish, Stolophorus buccaneeri Strasburg, in the oceanic region of the equitorial western Pacific. J.Fac.Agric.Kyushu Univ., **17:**151-71

Palacio, F.J., 1974 Peces colectados en el Caribe colombiano por la Universidad de Miami. Boln Mus.Mar.(Bogatá), (6):1-137

Palekar, V.C. and K.R. Karandikar, 1952 Maturity and spawning period of Thrissocles purava (Ham.) as determined by ova diameter measurements. Proc.Indian Acad.Sci., **35B**(4):143-54

_____, 1953 Maturity of Coilia dussumieri Cuv. and Val., in Bombay waters during different months of the year. J.zool.Soc.India, **5**(2):217-26

Pappe, L., 1853 Synopsis of the edible fishes at the Cape of Good Hope. L. Taats, Cape Town, 34 pp.

Pearson, N.E., 1925 The fishes of the eastern slope of the Andes. I. The fishes of the Rio Beni Basin, Bolivia, collected by the Mulford expedition. Indiana Univ.Stud., **11**(64):1-82

Peavot, H., 1937 List of dates of publication of the early parts of the Society's 'Transactions'. Proc.zool.Soc.Lond., **107:**83-84 (especially useful for dating papers by R.T. Lowe on Madeira fishes)

Pequeño, G. and C. Moreno, 1979 Peces, pp. 85-127 in Lorenzen, S. et al., Mariscos y peces de importancia comercial en el sur de Chile. Universidad Austral de Chile, Valdivia, 131 pp.

Perez, J.E. et al., 1975 Estudio de las relaciones taxonomica de algunos generos de la familia Engraulidae (Pisces) basado en caracteres bioquimicos. Bol.Inst.oceanogr., Cumana, **14**(2):227-32

Pestana, H.R., 1979 Rees's Cyclopedia (1802-1820) a sourcebook for the history of geology. J.Soc.Biblphy nat.Hist., **9**(3):353-61

Peters, W.C.H., 1877 Ubersicht der während der von 1874 bis 1876 unter dem Commando des Hrn. Capitän z.S. Freiherrn von Schleinitz ausgeführten Reise S.M.S. "Gazelle" gesammelten und von der Kaiserlichen Admiralität der königlichen Akademie der Wissenschaften übersandten Fische. Mber.K.preuss. Akad.Wiss., (1876):831-54

Peterson, C.L., 1956 Observations on the taxonomy, biology and ecology of the engraulid and clupeid fishes in the Gulf of Nicoya, Costa Rica. Bull.inter-Am.trop.Tuna Comm., **1**(5):137-211 (in English), 213-80 (in Spanish)

Petr, T. and J.D. Reynolds, 1969 Fish population changes in Volta Lake in 1968. Volta Basin Research Project, Tech.Rep. X32 (20 pp., mimeo)

Phillippi, .R.A., 1879 Ueber einige neue chilenische Thiere. i. Taenioptera australis Ph. & Ldb. ii. Phaenicopterus andinus Ph. iii. Spheniscus trifasciatus Ldb., und Spheniscus humboldti Meyen. iv. Clupea oder Alausa advena Ph. Arch.Naturgesch., **45:**158-64

Pillay, S.R. and H. Rosa, 1963 Synopsis of biological data on Hilsa Hilsa ilisha (Hamilton) 1822. FAO Fish.Synop., (25) (70 pp., mimeo)

Pinto, G.Y., 1972 Um novo Clupeidae da bacia do Parnaiba, Piava, Brasil (Actinoptergii, Clupeiformes). Bolm Mus. Hist.nat.U.F.M.G., (14):1-13

Piso, G. and G. Marcgrave, 1648 Historia naturalis Brasiliae auspicio et beneficio illustris. I.Mauritii Com. Nassau illius provinciae et maris summi praefecti adornata. In qua non tantum plantae et animalia, sed et indigenarum morbia, ingenia et mores describuntur et iconibus supra quingentas illustrantur. Frans Hack, Leiden and Ludovic Elsevier, Amsterdam, viii plus 122 plus (2) pp. (Medicina Brasiliensi by Piso) and iii plus 292 plus (2) pp. (Historia rerum naturalium Brasiliae By Marcgrave)

Plessis, C.G. du, 1960 (see Du Plessis, C.G., 1960)

Poey, F., 1860 XLIX. Poissons de Cuba, espèces nouvelles, pp. 115-356 in F. Poey, Memorias sobre la historia natural de la Isla de Cuba, acompañadas de sumarios latinos y extractos en frances, **2,** The widow of Barcina, Havana, Cuba (for dating see pp.449 of vol. **1** and p.427 of vol.**2;** clupeoids, pp.310-4 dated July 1860)

_____, 1865 Peces nuevos de la Isla de Cuba. Repertorio fisico-natural de la Isla de Cuba, **1** (fasc.7):181-92 (pp.161-92 dated October 1865 by Norman, 1938)

_____, 1866 Revista de los tipos Cuverianos y Valenciannos correspondientes á los peces de la isla de Cuba. Ibid., 1 (fasc.13, 14):369-83 (clupeoids in fasc.14 of August 1866 fide Norman, 1938)

Poll, M., 1933 Contribution á la faune ichthyologique de Katanga. Annls Mus.r.Congo Belge,(Sér.zool.), (1)**3**(1):101-52

_____, 1948 Poissons recueillis au Katanga par H.J. Bredo. Bull.Mus.r.Hist.nat.Belg., **24**(21):1-24

_____, 1964 Une famille dulcicole nouvelle de poissons africains:les Congothrissidae. Bull.Acad.r.Sci.Outre-Mer,Cl.Sci.nat.méd., (new series)**l5**(2):1-40

_____, 1974 Synopsis et distribution géographique des Clupeidae d'eau douce africains, descriptions de trois espèces nouvelles. Bull.Acad.r.Belg.Cl.Sci., (5)**60**(2):141-61

Poll, M. and T. Roberts, 1976 Nannothrissa stewarti, espèce nouvelle de Clupeidae du lac Mai-ndombe (Zaire). Rev.Zool.afr., **90**(1):235-9

Poll, M. and G.G. Teugels, 1984 Congothrissidae, p. 56 in J.Daget, J.P. Gosse and D.F.E. Thys van den Audenaerde (eds), Check-list of the freshwater fishes of Africa. Musée royale de l'Afrique Centrale, Tervuren and Office de la Recherche Scientifique et Technique Outre-Mer, Paris, 410 pp. (Bibliography in vol.3 of 1986)

Poll, M., G.G. Teugels and P.J.P. Whitehead, 1984 Clupeidae, pp. 41-55 (see previous reference)

Poll, M., P.J.P. Whitehead and A. Hopson, A new genus and species of clupeoid fish from West Africa. 1965 Bull.Acad.r.Belge CI.Sci., (5)**51**(3):277-92

Postel, E., Rapport sur la sardinelle (Sardinella aurita Valenciennes) (Atlantic africain). FAO Proc.Wld scient. 1960 Meet.Biol.Sardines, **2:**55-95

_____, Synopsis of the biology of the sardine (Sardinella aurita Valenciennes) - African Atlantic. UNDP 1969 (SF)/FAO, Results Regional Fisheries Survey W. Africa, Abidjan (Rep. 69/8) (unpaged, mimeo)

Pozzi, A.J. and L.F. Bordale, Cuadro sistematico de 1os peces marinos de la Republica Argentina. 1935 An.Soc.cient.argent., (4)**120:**145-89

Pusanov, J., (Unter Mitwirkung J.Zeeb. Uber die im Schwarzen und Azowschen Meere vorkommenden Anschove-1926 Rasen - in Russian, German summary and title). Trudy Krimsk.nauchno-issled Inst., **1:**87-95

Puyo, J., Contribution à 1'étude ichtyologique de la Guyane français. Bull.Soc.Hist.nat.Toulouse, 70(4):1-258 1936

_____, Les poissons du genre Stolephorus de la Guyane français. Bull.Soc.Hist.nat.Toulouse, **80**(1-1945 2):100-7

_____, Poissons de la Guyane français. Faune de 1'Empire français, 12. Off.Rech.Sci.Outre Mer 1949 (ORSTOM), Paris, 280 pp.

Qin, A.-l., C.-f. Yuen and Q.-y. Gu, (Population dynamics and biology of the anchovies (Coilia) in Taihu Lake - in 1981 Chinese). Scient.Res.invest.Rept. (Biol.Dept., Nanjing Univ.), (3):1-10 (English summary)

(Composition of Taihu Lake Coilia populations and the regulation in their abundance - in Chinese). 1986 Oceanologia Limnologia sinica:105-112

Radhakrishnan, N., Studies on some aspects of the biology of a few Indian marine food fishes. Ph.D.thesis, 1961 Aligarh Muslim University

_____, Notes on the maturity and spawning of Opisthopterus tardoore (Cuvier). Indian J.Fish., 1967 **10**(A):102-6

_____, On some aspects of the biology of the long-finned herring Opisthopterus tardoore (Cuvier) from 1968a the inshore regions at Karwar. Indian J.Fish., **l0**(A):634-41

_____, On sorne preliminary studies on raciation on the long-finned herring, Opisthopterus tardoor 1968b (Cuvier). Indian J.Fish., **11**(A):687-8

Radovich, J., Some causes of fluctuation in catches of the Pacific sardine (Sardinops caerulea Girard). 1969 FAO Proc.Wld scient.Meet.Biol.Sardines, **3:**1081-93

Rafinesque, C.S., Caratteri di alcuni nuovi generi e nuove specie di animali (principalment di pesci) e piante della 1810 Sicilia, con varie osservazione sopra i medisimi. Palermo (iv plus 2) 3-105 (106). Reprint by Asher, Amsterdam, 1967. Aborted 1809 edition (about 40 pp., similar title) discussed by Holthuis and Boeseman (1977)

_____, Analyse de la nature, ou tableau de l'universe et des corps organisés. Palermo, 224 pp. 1815

_____, Second decade of new North American fishes. Am.mon.Mag.Crit.Rev., **2**(3):204-6 1818a

_____, Discoveries in natural history made during a journey through the western region of the United 1818b States Am.mon.Mag.Crit.Rev., **3**(5):354-6

_____, Fishes of the River Ohio (continued). West.Rev.Misc.Mag., **2**(3):169-77 1820

Raja and Hiyama, (see Antony Raja and Hiyama, 1969) 1969

Raja and Lazarus, (see Antony Raja and Lazarus, 1975) 1975

Ramaiyan, V. and R. Natarajan, 1979 Systematic revision of the Indian species of Ilisha Richardson, 1846 (Pisces:Clupeiformes). Proc.Ind.Acad.Sci., (B)**46**(1):8-2

Ramaiyan, V. and P.J.P. Whitehead, (1975) 1979 Notes on Indian species of Ilisha (Pisces:Clupeidae). J.mar.biol.Ass.India, **17**(1):187-98 (dated 1975, but probably not published until about 1979)

Randall, J.E., G. Allen and W. Smith-Vaniz, 1978 Illustrated identification guide to commercial fishes. FAO Reg. Fish.Surv.Devel.Proj., (FI:DP/RAB/71/273/3), 221 pp.

Ranzani, C., 1842 De nonnullis novis speciebus piscium. Dpusculum tertium. Novi Comment.Acad.sci.Inst.bonon, **5**:307-38

Rao, N.G.S., 1967 On the distribution of larvae, postlarvae and juveniles of fishes in the Mahanadi estuary. Indian J.Fish., **11**(A):407-22

Rees, A., 1807 The cyclopedia; or, universal dictionary of arts, sciences and literature, **8**, unpaged. Longman, Hurst, Rees, Orme and Brown, London, 39 plus 6 vols (85 parts, the last 6 being plates; 1802-1820). Clupeoids under CLUPEA which is by Wilson in vol.9 of 1811 in American edition, Samuel F. Bradford, Philadelphia, 41 vols. For dating of English edition, see Pestana (1979)

Regan, C.T., 1906 Descriptions of new or little-known fishes from the coast of Natal. Ann.Natal Mus., **1**(4):1-6

_____, 1916 The British fishes of the subfamily Clupeinae and related species in other seas. Ann.May.nat. Hist., (8)**19:**1-19

_____, 1917a A revision of the clupeoid fishes of the genus Pellonula and of related genera in the rivers of Africa. Ann.Mag.nat.Hist., (8)**19:**198-207

_____, 1917b A revision of the clupeoid fishes of the genera Pomolobus, Brevoortia and Dorosoma and their allies. Ann.Mag.nat.Hist., (8)**19:**297-316

_____, 1917c A revision of the clupeoid fishes of the genera Sardinella, Harengula and their allies. Ann.Mag.nat.Hist., (8)**19:**377-95

_____, 1922 Fishes of the clupeid genera Clupeoides and Potamalosa and allied genera. Ann.Mag.nat.Hist., (9)**10:**587-90

Reintjes, J.W., 1969 Synopsis of biological data on the Atlantic menhaden, Brevoortia tyrannus. FAO Fish.Synop., (42):1-40

_____, 1962 Development of eggs and yolk-sac larvae of yellowfin menhaden. Fish.Bull., **62**(202):89-102

Reynolds, J.D., 1966 The clupeids of Lake Volta and their possible exploitation. Univ. Ghana, Volta Basin Research Project, Tech.Rep., X 15 (6 pp., mimeo)

_____, 1967 Notes on juveniles of commercial fish attracted to light on the Volta Lake, 1966-19671 Univ. Ghana, Volta Basin Research Project, Tech.Rep., X 21 (15 pp., mimeo)

_____, 1969 The biology of the clupeids in the New Volta Lake, pp. 195-203 in L.E. Obeng (ed.) Man-made lakes, the Accra Symposium. Ghana University Press, 398 pp.

_____, 1970 Biology of the small pelagic fishes in the New Volta Lake in Ghana. 1. The lake and the fish: feeding habits. Hydrobiologia, **35**(3-4):568-603

_____, 1971 Ibid., 2. Schooling-and migrations. Hydrobiologia, **38**(1):79-91

_____, 1974 Biology of small pelagic fishes in the New Volta Lake in Ghana. Part 3. Sex and reproduction. Hydrobiologia, **45**(4):489-508

Ribeiro A. de M., 1908 Piexes da Ribeira. Resultados de excursâo do Sr. Ricardo Krone, Membro Correspondente do Museum Nacional do Rio de Janeiro. Kosmos, (2 February) **5:**unpaged

Ribeiro, P. de M., 1961 Pescas do Toku Maru. Bolm Mus.nac.Rio de J., (228):1-18

Richards, W.J., R.V. Miller and E.D. Houde, 1974 Egg and larval development of the Atlantic thread herring, Opisthonema oglinum. Fish.Bull., **72**(4):1123-36

Richardson, J., 1846 Report on the ichthyology of the seas of China and Japan (pp. 187-320 of Rep.Brit.Ass.Adv.Sci., 1845). Richard and John E. Taylor, London (for dating see Bauchot, Whitehead and Monod, 1982)

Richardson, J. and J.E. Gray, 1843 List of fish . . . of New Zealand . . . with description . . . of the new species . . . . pp. 206-228 in E. Dieffenbach, Travels in New Zealand, with contributions to the geography, geology, botany and natural history of that country, **2.** Murray, London

Ringuelet, R.A., R.H. Arámburu and A.A. de Arámburu, 1967 Los peces argentinos de aqua dulce. Comision de Investigación Cientifica, La Plata, Argentina, 602 pp.

Risso, A., 1827 Histoire naturelle des principales productions de l'Europe méridionale et particulierèment de celles de Nice et des Alpes-Maritimes, **3.** E.G. Levrault, Paris and Strasburg, xvi plus 480 pp (for dating of this and other works see Monod and Hureau, 1977)

Rivas, L.R., 1959 A revison of the American clupeid fishes of the genus Harengula, with descriptions of four new species. Proc.U.S.natn.Mus., **100**(3263):275-309

_____, 1964 Harengula, pp. 386-96 in Hildebrand, 1964

_____, 1972 Opisthonema captivai, a new Western Atlantic clupeid fish from Colombia. Copeia, (l):l-4

Rivero, H.L., 1938 (see Howell-Rivero, 1938)

Roberts, T.R., 1972 Osteology and description of Thrattidion noctivagus, a minute, new freshwater clupeid fish from Cameroon, with a discussion of pellonulin relationships. Breviora, (382):1-25

_____, 1978 An ichthyological survey of the Fly River in Papua New Guinea with description of new species. Smithson.Contr.Zool., (281):i-vi plus l-72

Roberts, T.R. and D.J. Stewart, 1976 An ecological and systematic survey of fishes in the rapids of the lower Zaiire or Congo River. Bull.Mus.comp.Zool.Harv., **147**(6):239-317

Robinson, G.A., 1966 A preliminary report on certain aspects of the biology of the South African anchovy Engraulis capensis. M.Sc.thesis, University of Stellenbosch

Ronguillo, I.A., 1970 A review of the genus Stolephorus, with a key to species. FAO, Rome, 31 pp. (mimeo)

Rosa and Pillay, 1963 (see Pillay and Rosa, 1963)

Rossignol, M., 1959 Contribution à l'étude biologique des sardinelles. Etude de la variabilité d'un caractère méristique: le nombre de branchiospines. Revue Trav.Inst.Pêch.marit. , **23**(2):211-23

Rossignol, M. and J. Blache, 1961 Sur le statut spécifique de deux poissons pélagiques du Golfe de Guinée. Anchoviella guineensis nov.sp. (Clupeiformes, Engraulidae), Atherina lopeziana nov.sp. (Mugiliformes, Atherinidae). Bull.Mus.natn.Hist.nat.Paris, **33**(1):285-93

Roth, W.E., 1922-23 Richard Schomburgk's travels in British Guiana, 1840-44. Translated and edited by W.E. Roth. Georgetown, Guyana, 2 vols.

Roughly, T.C., 1916 Fishes of Australia and their technology. Technological Museum, Sydney, 296 pp.

Roule, L., 1924 Les aloses des eaux douces de la France. Bull.Soc.zool.Fr., **49:**265-6

Roux, C., 1969 On the dating of the first edition of Cuvier's Règne animal. J.Soc.Biblphy nat.Hist., **8**(1):31

_____, 1973 Poissons téléostéens du plateau continental brésilien, pp. 23-07 in Campagne de la Calypso au large des côtes atlantiques de l'Amérique du Sud (1961-1962). Part 1. Résuitats scientifiques des campagnes de la "Calypso", **10,** Masson, Paris

Roux, C. and J. Collignon, 1950 Clef de determination des principaux poissons marins des côtes de l'A.E.F. Bull.Inst.Etudes centrafr. Brazzaville, (num.hors serie), 27 pp.

Roxas, H., 1934 A review of Philippine isospondylous fishes. Philipp.J.Sci., **55**(3):231-295

Roy, J.M., 1968 Poissons du Quebec. Album No. 8, L'alose et le gaspereau. Minist.Indus.comm.Québec, Dir.Pêch., 24 pp.

Russell, P., 1803 Description and figures of two hundred fishes collected at Vizagapatnam on the coast of Coromandel, 2. W.Bulmer, London, 85 pp.

Sadasivan, V., 1965 Preliminary observations on the biology of some clupeids occurring in the Andaman waters. Proc.40th Indian Sci.Congr.(Lucknow), (3), Abstracts

Sadowsky, A., 1934 (Caspialosa tanaica paleostomi n.ssp., a new subspecies from the Paläeostom-Lagoon (Rion-mündung, West Georgia)- in Russian) Trudy zool.Inst.Tbilisi, 1:135-41

Saetersdal, G. and J.E. Valdivia, 1964 Un estudio del crecimiento, tamaño y reclutamiento de la anchoveta (Engraulis ringens J) basado en datos de frecuencia de longitud. Boln Inst.Invest.Recurs.mar., Callao, 1(4):85-136

Sainsbury, K.J., P.J. Kailola and G.G. Leyland, 1985 Continental shelf fishes of northern and north-western Australia. An illustrated guide. Clouston & Hall and Peter Pownall Fisheries Information Service, Canberra, for CSIRO Division of Fisheries Research, 375 pp.

Salaya, J. and L. Salazar, 1969 Una nueva cita de Engraulidae para las costas de Venezuela, Anchoa filifera. Mem.Soc.Cienc.nat.La Salle, **29**(84):253-6

Samuel, C.T., 1968 The marine fishes of India. University of Kerala, India, 254 pp.

Sanchez, R.P. and J. Dziekonska de Ciechomski, 1984 Estimación de la biomasa de adultos desovantes de la anchoita (Engraulis anchoita) en el área costera bonaerense durante la primavera de 1981 y análisis comparativo de los recuentos de ictioplancton con redes de diferentes mallas. Revta Inst.nac. Invest.Desarrollo pesq.Mar del Plata, (4):49-61

Sathyanesan, A.G., 1961 A comparative study of the pituitary of some fresh-water teleosts. Rec.Indian Mus., **59**:305-19

Sauvage, H., 1883 Descriptions de quelques poissons de la collection du Museum d'Histoire Naturelle. Bull.Soc. philomath.Paris, (7)**7**:156-61

_____, 1891 Histoire naturelle des poissons, in A. Grandidier (ed.), Histoire physique, naturelle et politique de Madagascar, 16. Imprimerie Nationale, Paris, 543 pp.

Sawyer, F.C., 1953 The dates of issue of J.E. Gray's "Illustrations of Indian Zoology" (London, 1830-1835). J.Soc.Biblphy nat.Hist., **3**(1):48-55

Schaefer, M-B., 1967 Dinamica de la pesqueria de la anchoveta, Engraulis rigens, en el Peru. Boln Inst.Invest. Recurs.mar.,Callao, **1**(5):265-304 (in Spanish), 265-304 (in English)

Scheffers, W.J. and F. Conand, 1976 A study on Ethmalosa fimbriata (Bowdich) in the Senegambian region. 3rd note: the biology of Ethmalosa in the Gambian waters. Doc.sci.prov.Centre Rech.océanogr.Dakar-Thiaroye, (59) (19 pp., mimeo)

Schinz, H.R., 1822 Das Thierreich eingetheiit nach dem Bau der Thiere als Grundlage ihrer Naturgeschichte und der vergieichenden Anatomie, von dem Herrn Ritter von Cuvier, aus dem Franzosischen frei übersetzt und mit vielen Zusätzen versehen, 2. Fishes pp. 189-553. J.G. Cotta'schen, Stuttgart and Tübingen, 833 pp.

Schlegel, H., 1846 (see Temminck and Schlegel, 1846)

Scnnakenbeck, W., 1931 Zum Rasenproblem bei den Fischen. Z.Morph.Okol.Tiere, **21**(3-4):409-566 (English summary in J.Cons.perm.int.Expior.Mer, 6:28-40)

Schneider, G., 1904 Zur Fischkunde in den Ostseeprovinzen. KorrespBl.NaturfVer.Riga, **47**:65-6

Schneider, J.G., 1801 (see Bloch and Schneider, 1801)

Schomburgk, R.H., 1847 The history of Barbados; comprising a geographical and statistical description of the island; a sketch of the historical events since the settlement; and an account of its geology and natural production. London, 722 pp. (title page 1847, Preface November 1847, new title page 1848; fishes pp. 665-678 - see Müller and Troschel, 1847)

_____, 1848 A description of some new species of fishes from the sea surrounding the island of Barbados. Ann.Mag.nat.Hist., (2)**2:**11-20 (descriptions from Müller and Troschel, 1847)

_____, 1849 Reisen in Britisch Guiana in den Jahren 1840-44 in Auftrag Sr. Majestät des Königs von Preussen ausgefürt von R. Schomburgk. Nebst einer fauna und flora Guianas nach vorlagen von J. Müller, Ehrenberg, Erichson, Klotzsch, Troschel, Cabanis und andern, part 3. Leipzig. For dating, see Müller and Troschel, 1849. English translation by Roth, 1922-23

Schreiner, C. and A. de M. Ribeiro, 1903 Colecçâo de peixes do Museu Nacional do Rio de Janeiro. Archos Mus.nac. Rio de J., **12:**71-107

Schultz, L.P., 1949 A further contribution to the ichthyology of Venezuela. Proc.U.S.natn.Mus., **99**:1-211

_____, 1943 Fishes of the Phoenix and Samoan Islands collected in 1939 during the expedition of the U.S.S. "Bushnell". Bull.U.S.natn.Mus., (180):1-316

Schultz, L.P. and R. de Menezes, 1951 A new anchovy of the genus Anchoviella from the Poti and Parnaiba rivers of Brazil. J.Wash.Acad.Sci., **41**(7):235-7

Scott, T.D., C.J.M. Glover and R.V. Southcott, 1974 The marine and freshwater fishes of South Australia. 2nd ed. (revised from original of 1962). Handbooks Committee, South Australian Government, 392 pp.

Scuderi, I., 1957 Sui caratteri morfologici dell' Engraulis del 'Lago Verde'. Boll.Pesca Piscic.Idrobiol., **12**(2):232-64

Seshagiri Rao, B.V., 1974 Ilisha whiteheadi, a new species of clupeid fish from the Bay of Bengal. Copeia, (4):861-4

_____, 1975a Systematic studies on fishes belonging to the genus Coilia Gray, 1831. J.Bombay nat.Hist.Soc., **72**(3):732-9

_____, 1975b Two new records of clupeid fishes, Ilisha kampeni and I. sirishai from the Arabian Sea. Curr,Sci. **44**(14):526-7

_____, 1976 Notes on the Indo-West Pacific species of the clupeid fish genus Ilisha, with a key to their identification. Copeia, (3):503-9

SFSA,(Sea fishes of southern Africa) Smiths'sea fishes. For Clupeidae and Engraulidae see Whitehead and Wongratana 1986

Sharp, G.D. and J. Csirke (eds), 1983 Proceedings of the expert consultation to examine changes in abundance and species of neritic fish resources. San José, Costa Rica, 18-29 April 1983. FAO Fish.Rep./FAO, Inf.Pesca, (291)**3:**557-1224

Shen, S.-C., 1959 Anchovies found in Taiwan. Rep.Inst.Fish.Biol.natn.Taiwan Univ., **1**(3):24-37

_____, 1969 Comparative study of the gill structure and feeding habits of the anchovy, Engraulis japonica (Hout.). Bull.Inst.Zool.Acad.Sinica, **8**:21-35

_____, 1971 Preliminary report on the study of wen-yü resources in Taiwan. Acta oceanogr.Taiwan., (1):101-26

Silva S. J.O., 1967 A study of some meristic characters of the "rabo amarillo", Cetengraulis edentulus (Cuvier, 1829), in eastern Venezuela. Boln Cent.Invest.Pesq.Venez. (Serie Recursos expl.Pesq.°),1(9):3287-2

Simpson, J.G., 1959 Identification of the egg, early life history and spawning areas of the anchoveta, Cetengraulis mysticetus (Günther), in the Gulf of Panama. Bull.inter-Am.trop.Tuna Commn, **3**(10):437-580

_____, 1965 A study of the early life history of the rabo amarillo, Cetengraulis edentulus (Cuvier), in eastern Venezuela. Boln Cent.Invest.Pesq.Venez. (Serie Recursos expl.Pesq.) **1**(1):1-24

_____, 1969 (error, see Simpson and Gonzalez, 1967)

Simpson, J.G. and G. Gonzalez G., 1967 Some aspects of the early life history and environment of the sardine, Sardinella anchovia, in eastern Venezuela. Boln Cent.Invest.Pesq.Venez. Serie Recurs.expl.Pesq., **1**(2):37-93

Sloane, H., 1725 A voyage to the islands of Madeira, Barbadoes, Nieves, St. Christophers, and Jamaica; with the natural history of the herbs and trees, four-footed beasts, fishes, birds, insects, reptiles, &c. of the last of those islands, **2**. For the author, London, xi plus 499 pp.

Smith, H.M., 1945 The freshwater fishes of Siam, or Thailand. Bull.U.S.natn.Mus., (188):1-622

Smith, J.L.B., 1949a Forty-two fishes new to South Africa, with notes on others. Ann.Mag.nat.Hist., (12)**2**:97-111

_____, 1949b The sea fishes of southern Africa. Central News Agency, Cape Town, 550 pp.

_____, 1953 Ibid., revised and enlarged edition, 564 pp. Further editions 1965, 1967 and fully revised 1986 (as M.M. Smith and P. Heemstra (eds), Smiths' sea fishes, Macmillan South Africa, Johannesburg, 1047 pp.)

Smith, J.L.B. and M.M. Smith, 1963 The fishes of the Seychelles. Dept.of Ichthyology, Rhodes University, Grahamstown, 215 pp.

Spix, J.B. and L. Agassiz, 1829 Selecta genera et species piscium quos in itinere per Brasiliam annis 1817-1820.. peracto. Collegit et pingendos curavit . . . J.B. de Spix . . . digessit, descripsit et observationibus anatomicis illustravit . . . L. Agissiz, prefatus est ed edidit . . .C.F.P. Martius (Memoriae J.B. de Spix). Munich, 82 pp., 45 pls (for dating of this and the second part of the book, see Whitehead and Myers, 1971)

Srivastava, G.J., 1968 Fishes of eastern Uttar Pradesh. Vishwavidyalaya Prakashan, Varanasi, xxii plus 163 pp.

Stark, J., 1828 Elements of natural history . . . containing the generic characters of nearly the whole animal kingdom and descriptions of the principal species, 1. William Blackwood, Edinburgh and T. Cadell, London, vi plus 527 pp.

Starks, E.C., 1913 The fishes of the Stanford Expedition to Brazil. Leland Stanford, Jr., Univ.Publs Univ.Ser.:l-77

Stearn, W.T., 1957 An introduction to the Species plantarum and cognate botanical works of Carl Linnaeus, pp. i-xiv, 1-176 in the facsimile reprint of Linnaeus, C. 1753, Species plantarum, **1.** Ray Society, London.

Steindachner, F., 1869 (error, see 1870)

_____, 1870 Uber einige neue order seltene Arten von Mazatlan, Lagos und Santos. Sber.Akad.Wiss.Wien, **60**(l):305-18

_____, 1875 Ichthyologische Beiträge (I). Sber.Akad.Wiss.Wien, **70:**335-90

_____, 1879 Ueber einige neue und seltene Fisch-Arten aus den k.k. Zoologischen Museen zu Wien, Stuttgart und Warschau. Denkschr.Akad.Wiss.Wien, 41:1-52

_____, 1880 Ichthyologische Beiträge (VIII). Sber.Akad.Wiss.Wien, **80**(1):119-91

Steindachner, F., 1908a (No title - über zwei neue Fischarten aus dem Stromgebiete des Rio San Francisco). Anz.Akad.Wiss.Wien, **45:**191-4

_____, 1908b Zur Fischfauna der Samoa-Inseln. Sber.Akad.Wiss.Wien, **115**(1):1369-1425

Steinitz, W., 1927 Beiträge zur Kenntnis der küstenfauna Palestinas. Pubbl.Staz.zool.Napoli, **8**(3-4):311-63

Steyskal, G.C., 1980 The grammar of family-group names as exemplified by those of fishes. Proc.biol.Soc.Wash., **93**(1):168-77

Storer, D.H., 1839 Reports on the ichthyology and herpetology of Massachusetts, pp. l-202 in Reports on the fishes reptiles and birds of Massachusetts. Boston, 426 pp. (also published in J.Boston Soc.nat.Hist., **2**(1839 and **3**(1840))

_____, 1848 Descriptions of two new species of Alosa and one of Platessa. Proc.Boston Soc.nat.Hist., **2:**242-3

Storey, M., 1938 West Indian clupeid fishes of the genus Harengula, with notes on H. thrissina from the Pacific coast. Stanf.Ichthyol.Bull., **1**(1):3-56

Struhsaker, P. and J.H. Uchiyama, 1976 Age and growth of the Nehu Stolephorus purpureus (Pisces:Engraulidae) from the Hawaiian Islands as indicated by daily growth increments of sagittae. Fish.Bull.natn.ocean. atmos.Adm., **74**(1):9-17

Sumner, F.B., R.C. Osborn and L.J. Cole, 1913 A biological survey of the waters of Woods Hole and vicinity. Part 1. Section 1. Physical and zoological (Pisces). Bull.Bur.Fish.Wash., **31**(2):160-9

Suttkus, R.D., 1956 Early life history of the Gulf menhaden, Brevoortia patronus in Louisiana. Trans.2lst N.Am. Wildl.Conf., 390-407

_____, 1958 Distribution of menhaden in the Gulf of Mexico. Trans.23rd N.Am.Wildl.Conf.:401-10

Suttkus, R.D. and B.I. Sundararaj, 1961 Fecundity and reproduction in the large scale menhaden, Brevoortia patronus Goode. Tulane Stud.Zool., **8**(6):177-82

Suvarov, E.K., 1907 (Study of the Caspian herrings: races, subspecies and species - in Russian). Trudy Kapiiskoi Eksped.1904, **1:**133-99

Svetovidov, A.N., 1952 (Clupeidae - in Russian). Fauna CCCP, Ryby (Fauna of the USSR, Fishes), **2**(l) (new series,48). Academy of Sciences, Moscow and Leningrad, 331 pp.

_____, 1963 Clupeidae. Fauna of USSR - Fishes, **2**(l) (new series, 48). Israel Program for Scientific Translations, Jerusalem, 374 pp. (English translation of 1952 original)

_____, 1964a (The fishes of the Black Sea - in Russian). Opredeliteli po faune CCCP (Fauna of the USSR), (86), Academy of Sciences, Moscow and Leningrad, 550 pp.

_____, 1946b Systematics of the North American anadromous fishes of the genera Alosa, Caspialosa and Pomolobus. Copeia, (1):118-30

_____, 1973 Clupeidae, pp. 99-109, and Engraulidae, pp. 111-2 in J.C. Hureau and T. Monod (eds), Check-list of the fishes of the north-eastern Atlantic and of the Mediterranean (CLOFNAM), **1.** Unesco, Paris, 683 pp.

Swain, J., 1883 A review of the species of Stolephorus found on the Atlantic coast of the United States. Bull.U.S.Fish.Commn, **2:**55-7

Swain, J. and SE. Meek, 1884 Notes on a collection of anchovies from Havana and Key West, with an account of a new species (Stolephorus eurystole) from Woods Hole. Proc.Acad.nat.Sci.Philad., **36:**34-6

Swainson, W., 1838 The natural history of fishes, amphibians and reptiles, or monocardian animals, **1.** Longman, Orme, Brown, Green and Longman, London, 368 pp.

_____, 1839 Ibid., **2,** 452 pp.

Swift, C., R.W. Yerger and P.R. Parrish, Distribution and natural history of the fresh and brackish water fishes
1977 of the Ochlockonee River, Florida and Georgia. Bull.tall Timb.Res.Stn, (20):l-111

Taki, Y., Fishes of the Lao Mekong basin. United States Agency for International Development, Mission to
1974 Laos, Agriculture Division, 232 pp.

_____, Systematics and distribution of Indochinese-Thai clupeid fishes in the subfamily Pellonulinae.
1975 Jap.J.Ichthyol., **22**(2):77-82

Takita, T., On the fish of the species Coilia distributed in Ariake Sound. Bull.Fac.Fish.Nagasaki Univ.,
1967a (22):45-56

_____, The spawning and the early life history of the engraulid fish Coilia sp. distributed in Ariake
1967b Sound. Bull.Fac.Fish.Nagasaki Univ., (23):107-22

_____, Reproductive ecology of a shad, Konosirus punctatus in Ariake Sound - I. Distribution, body
1978a condition and maturation. Bull.Fac.Fish.Nagasaki Univ., (45):5-10

_____, Idem. - II. Development and fate of the ovarian egg. Ibid., (45):11-9
1978b

Talwar, P.K., Status and distribution of Coilia mystus (Linnaeus, 1758) (Pisces:Engraulidae) in the Indo-West
1973 Pacific seas. J.mar.biol.Ass.India (claimed vo1.14, but not found)

_____, A taxonomic study of Chirocentrus from the Orissa fishery (Pisces:Chirocentridae). Sci.Cult.,
1976 **42:**324-6

Talwar, P.K. and P.J.P. Whitehead, The clupeoid fishes described by Francis Day. Bull.Brit.Mus.nat.Hist.
1971 (Zool.) **22**(2):57-58,

Tanasiichuk, N.P., (not seen). Ryb.Khoz.Voigo-kasp.Raiona, (11):33
1938

Tarasevich, V.M., (not seen). Izv.Akad.Nauk azerb.SSR, **1**(3)
1946

Taylor, W.R., 3. Fishes of Arnhem Land. Rec.Amer.-Aust.Scient.Exped.Arnhem Land, **4:**44-307
1964

Temminck, C.J. and H. Schlegel, Pisces, pp. l-325 in F.F. von Siebold (ed.). Fauna japonica sive descriptio
1846 animalium, quae in itinere per Japoniam jussu et auspiciis superiorum, qui summum in Indian Batavia imperium tenent suscepto annis 1823-1850 collegit, notis, observationibus et adumbrationibus illustravit. Arnz, Leiden 325 pp. plus 144 pls. Clupeoid fishes pp. 235-244, in part 13 of 22 November 1846. For dating of parts see Bauchot, Whitehead and Monod (1982)

Teugels, G.G. and D.F.E. Thys van den Audenaerde, A morphological and anatomical study of Pellonula afzeliusi
1969 Johnels, 1954 and Sierrathrissa leonensis Thys, 1969 (Pisces:Clupeidae). Rev.Zool.Bot.afr.,
93(3):523-38

Tham, A.K., Notes on the biology of the anchovy, Stolephorus pseudoheterolobus Hardenberg. Bull.natn.Mus.
1965 St.Singapore, (33)(4):23-6

_____, Stolephorus resources in the South China Sea. Indo-Pacific Fisheries Council, Symposium 18-27
1972 October 1972, Wellington, New Zealand, 15th Session (IPFC/72/SYM 16):lO pp. (mimeo)

_____, Synopsis of biological data on the Malayan anchovy Stolephorus pseudoheterolobus Hardenberg,
1968 1933. FAO Fishery Synopsis, No.37, Rome, 33 pp. (unnumbered, mimeo)

Thiollière, V.J. de I'Isle, (Fishes). Père Montrouzier (ed.), Essai sur l a faune de I'ile de Woodlark ou Moiou.
1856 Annls Sci.Phys.nat.Lyon, (2)**8:**393-504 (also 1857, same title, F. Dumoulin, Lyons, 226 pp.)

Tinker, S.W., Fishes of Hawaii. A handbook of the marine fishes of Hawaii and the central Pacific Ocean.
1978 Hawaiian Service Inc., Honolulu, 532 plus xxxvi pp.

Tirant, G., Mémoire sur les poissons de la rivière de Hué. Notes Serv.océanogr.Pêches Indochine, (6):5-32
1929

Tommazi, L.R., Sôbre tres especies de peces marinos del litoral de San Pablo (Brazil). Neotropica, **10**(31):29 -35
1964

Tortonese, E., 1964 Contributo allo studio sistematico e biogeografico dei pesci della Nuova Guinea. Annali Mus. civ.Stor.nat.Giacomo Doria, **75:**13-98

_____, 1967 Differenziazioni infraspecifichenelle Acciughe (Engraulis encrasicholus) L. : Pisces Clupeiformes) della Sicilia orientale. Atti Accad.gioenia Sci.nat. , **19:**57-65

Turner, J.L., 1970 Fish population of the newly impounded Kainji Lake in Nigeria. FAO, Report to the Government of Nigeria (published 1971, Jl W.Afr.Sci.Ass., **16**(1):49-55)

Uchida, K. et al., 1958 Studies on the eggs, larvae and juvenile of Japanese fishes, series 1. Second Laboratory of Fisheries Biology, Fisheries Department, Kyushu University, Fukuoka, Japan, 89 pp., 86 pls (text in Japanese)

Uda, M., 1960 The fluctuation of the sardine fishery in Oriental waters. FAO Proc.Wld scient.Meet.Biol.Sardines, **3:**937-48

Uyeno, T., K. Matsuura and E. Fujii, (eds), 1983 Fishes trawled off Suriname and French Guiana. Japan Marine Fishery Resource Research Center, Tokyo, 519 pp. (in Japanese and English)

Valenciennes, A., 1847 Histoire naturelles des poissons, **20.** P.Bertrand, Paris, 472 pp

_____, 1848 Histoire naturelle des poissons, **21.** P. Bertrand, Paris, 536 pp.

Varghese, T.J., 1962 Observations on the biology of Raconda russeliana (Gray). Indian J.Fish., **8**(1):96-106

_____, 1963 Some observations on the biology of Coilia borneensis (Blkr) Indian J.Fish., **8**(2):312-25

Venkatamaran, G., 1956 Studies on some aspects of the biology of the common anchovy Thrissocles mystax (Bloch & Schneider). Indian J.Fish, **3**(2):311-33

Vijayaraghavan, P., 1957 Studies on fish eggs and larvae of Madras coast. Univ.Madras, 79 pp.

Vinciguerra, D., 1921 Descrizione di tre nuove specie di pesci delle acque dolci di Grecia. Annali Mus.civ.Stor.nat. Genova, (3a)**9**(49):1-10

Vis, C. de, 1883 Description of three new fishes of Queensland (Oligorus goliath, Synaptura fitzroiensis, Engraulis carpenteriae). Proc.Linn.Soc.N.S.W., **7:**318-20

Walbaum, J.J., 1792 Petri Artedi sueci genera piscium. In quibus systema totum ichthyologiae proponitur com classibus, ordinibus, generum characteribus, specierum differentiis, observationibus plurimis, 3. A.F. Röse, Grypeswald, 723 pp.

Warburton, K., 1978 Community structure, abundance and diversity in a Mexican coastal lagoon system. Est.Coast.mar.Sci., **7:**497-519

_____, 1979 Growth and reproduction of some important species of fish in a Mexican coastal lagoon system. J.Fish.Biol., **14:**449-64

Watanabe, T., K. Honjo and T. Okutani, 1979 Fluctuation of population size of the Japanese sardine, Sardinops melanosticta (Temminck & Schlegel) and the Kuroshio, pp. 830-848 in The Kuroshio IV, Proceedings of the fourth symposium for the cooperative study of the Kuroshio and adjacent regions (14-17 February 1979: Japan Academy, Tokyo). Saikon Publishing Company, Tokyo, 1029 pp.

Waterhouse, F.H., 1937 List of the dates of delivery of the sheets of the 'Proceedings' of the Zoological Society of London, from the commencement in 1830 to 1859 inclusive. Proc.zool.Soc.Lond., **107**(A):78-83 (for post-1859 dates see Duncan, 1937)

Weber, M. and L.F. de Beaufort, 1913 The fishes of the Indo-Australian Archipelago, 2, Malacopterygii, Myctophoidea, Ostariophysi: 1 Siluroidea. E.J.Brill, Leiden, 404 pp.

Weed, A.C., 1925 A review of the fishes of the genus Signalosa. Publs Field Mus.nat.Hist.(Zool.), **12**(11):137-46

Weiss, G. and J.A. Feijo de Souza, 1977 Estudo comparativo preliminar de postlarvas e juvenis das três espécies de Engraulidae da costa sul do Brasil, Uruguai e Argentina. Atlântica, Rio Grande, **2**(1):1-20 -

Weiss, G. and L.C. Krug, 1977 Development and metamorphosis characteristics of Lycengraulis olidus (Engraulidae) and Brevoortia pectinata (Clupeidae) in the Lagoa dos Patos estuary. Atlântica, Rio Grande, **2**(1):83-117

Weiss, G., J.A. Feijó de Souza and A. Santos, 1976 Contribucâo ao conhecimento do ictioplancton marinho da plataforma sul do Brasil. Atlântica, Rio Grande, **1**(l-2):1-99

Wheeler, A.C., 1969 The fishes of the British Isles and north-west Europe. Macmillan, London etc., 613 pp.

_____, 1978 Key to the fishes of northern Europe. A guide to the identification of more than 350 species. Federick Warne, London, 380 pp.

Whitehead, P.J.P., 1962a A review of the Indo-Pacific gizzard shad genera Nematalosa, Clupanodon and Konosirus. Bull.Br.Mus.nat.Hist.(Zool. , **9**(2):87-102

_____, 1962b Abdominal scutes in the round herrings. Nature, **195:**511-2

_____, 1963a A revision of the recent round herrings (Pisces:Dussumieriidae). Bull.Br.Mus.nat.Hist.(Zool.), **10**(6):305-80

_____, 1963b Atherina japonica Houttuyn, 1782: proposed suppression as being a nomen dubium (Class Pisces). Z.N.(S.) 569. Bull.zool.Nomencl., **20**(4):281-4

_____, 1963c A contribution to the classification of clupeoid fishes. Ann.Mag.nat.Hist., (13)**5:**737-50

_____, 1964a Herklotsichthys Whitley, 1951 to replace Harengula Valenciennes, 1847 for Indo-Pacific species. Ann.Mag.nat.Hist., (13)**6:**273-84

_____, 1964b A redescription of the holotype of Clupalosa bulan Bleeker, and notes on the genera Herklotsichthys Sardinella and Escualosa (Pisces:Clupeidae). Ann.Mag.nat.Hist., (13):**7**:33-47

_____, 1964c (New data extending the range of the bipolar 'antitropical' anchovy genus Engraulis into the tropics - in Russian).Zool.Zh., **43**(6):879-88

_____, 1965a A preliminary revision of the Indo-Pacific Alosinae (Pisces:Clupeidae). Bull.Br.Mus.nat.Hist. (Zool.), **12**(4):115-56

_____, 1965b A review of the elopoid and clupeoid fishes of the Red Sea and adjacent regions. Bull.Br.Mus.nat.Hist., (Zool.), **12**(7):225-81

_____, 1965c The identity of Clupea sadina Mitchill 1814. Copeia, (2):228-30

_____, 1965d A new genus and subgenus of clupeid fishes and notes on the genera Clupea, Sprattus and Clupeonella. Ann.Mag.nat.Hist., (13)**7:**321-30

_____, 1966a The elopoid and clupeoid fishes in Richardson's "Ichthyology of the Seas of China and Japan" 1846. Bull.Br.Mus.nat.Hist.(Zool.), **14**(2):15-54

_____, 1966b Notes on the herring-like fishes of the I.S.R.S.E. (and some earlier collections). Israel South Red Sea Expedition, 1962 Reports, (19):7-16

_____, 1966c Application to suppress four Richardson fish names. Bull.zool.Nomencl., **23**(1):62-4

_____, 1967a The clupeoid fishes described by Lacepède, Cuvier and Valenciennes. Bull.Br.Mus.nat.Hist. (Zool.), suppl.2:1-180

_____, 1976b The West African shad, Ethmalosa fimbriata (Bowdich, 1825):synonymy, neotype. J.nat.Hist., **4:**585-93

_____, 1967c The dating of the first edition of Cuvier's Le règne animal distribué d'après son organisation. J.Soc.Biblphy nat.Hist., **4**(6):300-l

Whitehead, P.J.P., Indian Ocean anchovies collected by the Anton Bruun and Te Vega, 1963-64. J. mar.biol.Ass. India, 9(1):13-37
1968a

_____, A new genus for the South American clupeid fish. Lile platana Regan. J.nat.Hist., 2(4):477-86
1968b

_____, The clupeoid fishes of Malaya. J.mar.biol.Ass.India, 9(2):223-80
1969a

_____, The clupeoid fishes described by Bloch & Schneider. Bull.Br.Mus.nat.Hist.(Zool.), 17(7):261-79
1969b

_____, The clupeoid fishes described by Steindachner. Bull.Br.Mus.nat.Hist.(Zool.), 20(l):l-46
1970

_____, The clupeoid fishes of the Guianas. Bull.Br.Mus.nat.Hist.(Zool.), Supp1.5:1-227
1973a

_____, A synopsis of the clupeoid fishes of India. J.mar.biol.Ass.India, 14(1):160-256
1973b

_____, Families Chirocentridae, Clupeidae, Elopidae, Engraulidae, Megalopidae, (unpaged), in W. Fischer
1974 and P.J.P. Whitehead (eds), FAO species identification sheets for fishery purposes. Eastern Indian Ocean/Western Central Pacific, fishing areas 57/71. FAO, Rome, 4 vols, (unpaged)

_____, Families Albulidae, Clupeidae, Elopidae, Engraulidae,Megalopidae, Percichthyidae (unpaged), in
1978 W. Fischer (ed.), FAO species identification sheets for fishery purposes Western Central Atlantic fishing area 31. FAO, Rome, 6 vols (unpaged)

_____, Albulidae, Clupeidae, Elopidae, Engraulidae, Megalopidae (unpaged), in W. Fischer, G. Bianchi
1981 and W.B. Scott (eds), FAO species identification sheets for fishery purposes. Eastern Central Atlantic, fishing areas 34/47 (in part). FAO, Rome, 6 vols (unpaged)

_____, The treasures at Grüssau. New Scient., 94(1302):226-31
1982a

_____, Poland's Régne animal. Newsletter, Soc.Biblphy nat.Hist., (14):9-10
1982b

_____, Families Clupeidae, Engraulidae, pp. 268-83 in P.J.P. Whitehead, M.-L. Bauchot, J.C. Hureau, J.
1984 Nielsen and E. Tortonese (eds), Fishes of the northeastern Atlantic and Mediterranean, 1. Unesco, Paris, 510 pp.

_____, King herring: his place amongst the clupeoids. Can.J.Fish.aquat.Sci., 42(1):3-20
1985

_____, A new species of Microthrissa in West African freshwaters (Pisces:Clupeidae). Cybium,
1986 10(3):279-84

_____, Albulidae, Elopidae, Clupeidae, Engraulidae in J.-C. Quéro, J.C. Hureau, A. Post and L.
(in press) Saldanha (eds), Check-list of the fishes of the eastern tropical Atlantic (CLOFETA), UNESCO, Paris

Whitehead, P.J.P. and M.-L. Bauchot, Catalogue critique des types de poissons du Muséum national d'Histoire
1986 Naturelle. (Suite) Ordre des Clupéiformes (families des Clupeidae, Engraulididae et Denticipitidae). Bull.Mus.natn.Hist.nat.Paris, (4)7A(4 Suppl.):l-77

Whitehead, P.J.P. and A. Ben-Tuvia, Dussumieriidae, p.110 in J.C. Hureau and T. Monod (eds), Check-list of the
1973 fishes of the north-eastern Atlantic and of the-Mediterranean (CLOFNAM), 1. Unesco, Paris, 683 pp.

Whitehead, P.J.P. and G.S. Myers, Problems of nomenclature and dating of Spix and Agassiz's Brazilian fishes
1971 (1829-1831) J.Soc.Biblphy nat.Hist., 5(6):478-97

Whitehead P.J.P. and G.J. Nelson, Pellonula bahiensis Steindachner, 1879 (Pisces): proposed replacement of
1984 lectotype.Z.N.(S.) 2445. Bull.zool.Nomencl., 41:65-6

Whitehead, P.J.P. and P.K. Talwar, Francis Day (1829-1889) and his collections of Indian fishes. Bull.Br.Mus.
1976 nat.Hist.(hist.Ser.), 5(1):1-189

Whitehead, P.J.P. and G.G. Teugels, 1985 The West African pygmy herring Sierrathrissa leonensis: general features, visceral anatomy and osteology. Am.Mus.Novit., (2835):1-44

Whitehead, P.J.P. and T. Wongratana, 1984 Families Albulidae, Chanidae, Chirocentridae, Clupeidae, Elopidae, Engraulidae, Gonorhynchidae, Megalopidae (unpaged), in W. Fischer and G. Bianchi (eds), FAO species identification sheets for fishery purposes. Western Indian Ocean, fishing area 51. FAO, Rome, 6 vols (unpaged)

_____, 1986 Families Chirocentridae, Clupeidae, Engraulidae, pp.199-207 in M.M. Smith & P. Heemstra (eds), Smiths' sea fishes. Macmillian South Africa, Johannesburg, 1047 pp.

Whitehead, P.J.P., M. Boeseman and A.C. Wheeler, 1966 The types of Bleeker's Indo-Pacific elopoid and clupeoid fishes. Zool.VerhandLLeiden, (84):1-152

Whitehead, P.J.P., P.J. Smith and D.A. Robertson, 1985 The two species of sprat in New Zealand waters (Sprattus antipodum and S. muelleri). N.Z.Jl mar.freshw.Res., **19**:261-71

Whitley, G.P., 1931a New names for Australian fishes. Aust.Zool., **6**(4):310-34

_____, 1931b Studies in ichthyology, No.5. Rec.Aust.Mus., **18**(4):138-60

_____, 1935 Ichthyological genotypes. Aust.Zool., **8**(2):136-9

_____, 1936 More ichthyologia miscellanea. Mem.Qd Mus., **11**(1):23-51

_____, 1937 Further ichthyological miscellanea. Mem.Qd Mus., **11**:113-48

_____, 1948 New sharks and fishes from Western Australia. Aust.Zool., **11**:259-76

Williams, V.R. and T.A. Clarke, 1983 Reproduction, growth and other aspects of the biology of the gold spot herring, Herklostsichthys quadrimaculatus (Clupeidae),a recent introduction to Hawaii. Fish.Bull., **81**(3):587-97

Winterbottom, R., 1976 Additions to, and range extension of, the South African marine ichthyofauna. Zoologica Afr., **11**(1):59-73

Woltereck, R. and W. Neu, 1934 Untersuchungen an türkischen Seen. Int.Revue ges.Hydrobiol.Hydrog., **30**(5-6):440-52

Wongratana, T., 1980 Systematics of clupeoid fishes of the Indo-Pacific region. Ph.D. thesis. Faculty of Science, University of London, 2 vols, 432 pp., 334 pls,126 figs, 17 tables

_____, 1982 Bait fishes obtained from night light and lift net experiments in Phang-nga Bay, Andaman Sea, Thailand. Nat.Hist.Bull.Siam Soc., **30**(2):125-33

_____, 1983 Diagnosis of 24 new species and proposal of new narne for a species of Indo-Pacific clupeoid fishes. Jap.J.Ichthyol., **29**(4):385-407, fig.l-25

_____, 1985 An artificial key for the identification of the Indo-Pacific anchovies of the genus Stolephorus (Pisces:Engraulidae). J.scient.Res.Chulalongkorn Univ.Bangkok, **10**(1):25-45

_____, 1987a Four new species of clupeoid fishes (Clupeidae and Engraulidae) from Australian waters. Proc.biol.Soc.Wash., **100**(1):104-11

_____, 1987b Two new species of anchovies of the genus Stolephorus (Engraulidae), with a key to species of Engraulis, Encrasicholina, and Stolephorus. Am.Mus.Novit., (2876):1-8

Wray, T. (ed.), 1979 Commercial fishes of Saudi Arabia. Min.Agric.Water Resources, Riyadh, Saudi Arabia and White Fish Authority, England, 120 pp.

Wu, H.W., 1929 Study of the fishes of Amoy. Part 1. Contr.biol.Lab.Sci.Soc.China, **5**(4):1-90

Yabumoto, T. and T. Uyeno, Osteology of the clupeiform fish Hyperlophus (1). Bull.Kitakyushu Mus.nat.Hist., 1981 **3**:69-78

Yarrell, W., On the supposed identity of whitebait and shad. Zool.J.Lond., **4**:137-44 1829

_____, Notice of a new species of herring. Zool.J.Lond., **5**:277-9 1832

_____, A history of British fishes, illustrated by nearly 400 woodcuts, in two volumes. London, xxvi plus 1836 408 plus xxxvii pp. (clupeoids in parts 11, 12; issued monthly, thus January, February 1836)

Ye, C.-c., An estimate of the abundance of Yellow Sea herring. Chin.J.Zool., (2):3-7 1980

_____, The herring (Clupea harengus pallasi) and its fisheries in the Yellow Sea, pp. 85-94, in G.D. Sharp 1983 and J. Csirke (eds), Proceedings of the Expert Consultation to examine changes in abundance and species of neritic fish resources.San Jose, Costa Rica, 18-29 April 1983. A preparatory meeting for the FAO World Conference on fisheries management and development. FAO, Fish.Rep./FAO. Inf.Pesca, (291)**2**:1-553

Ye, C.-c., Q.-s. Tang and Y.-j. Qin, The Huang Hai (Yellow Sea) herring and their fisheries. J.Fish.China, **4**(4) 1981 (not seen)

Yoshida, H., (Taxonomic investigation on fishes of the genus Coilia in Japan and adjacent waters, with 1935 descriptions of their larvae and juveniles - in Japanese). Zool.Mag.Tokyo, **47**(566):784-9

Yuen, C.-f. and A.-l. Qin, (Ecology and distribution of Coilia along China coasts and variations in abundance -in 1984 Chinese). Ocean Sci., (5):35-7 (English summary)

_____, (On the classification of Coilia from Japan - in Chinese). J.Nanjing Univ. (nat.Sci.ed.), **21**(2):318- 1985 26 (English summary)

Yuen, C.-f., J.-b. Lin, J.-h. Liu and A.-l. Qin, On a new subspecies of Coilia from China - Coilia ectenes 1977 taihuensis ssp.nov.,pp.133-6 in (Yangtse River region Coilia resources investigational report), Chanjiang (Yangtse River) Fisheries Institute, Nanjing, 179 pp. (in Chinese and English)

_____, (On the age and growth of the Chinese anchovy, Coilia ectenes, from the Yangtze river - in 1978 Chinese). Acta hydrobiol.Sinica, **6**(3):285-96

Yuen, C.-f., J.-b. Lin, A.-l. Qin and J.-h. Liu, (Note on present and past research on classification of Coilia - in 1976 Chinese). Bull.Nanjing Univ.(nat.Sci.), (2):1-12

_____, (Taxonomic history of fishes of the genus Coilia - in Chinese), pp.95-100 in (Yangtse River Region 1977a Coilia resources investigational report), Chanjiang (Yangtse River) FishGies Institute, Nanjing, 179 pp.

_____, (How to identify the larvae and juveniles of Coilia - in Chinese). (Yangtse River region Coilia 1977b resources investigational report), Chanjiang (Yangtse River) Fisheries Institute, Nanjing, 179 pp.

Yuen, C.f-., A.-l. Qin, J.-h. Liu and J.-b. Lin, (Systematics of the anchovy genus Coilia from the lower Yangtse 1980 and southeast China coasts - in Chinese, English summary). Bull.Nanjing.Univ.(nat.Sci.), (3):67-82

Zeitz, A., Pisces.Horn Sci.Exped., **2**:176-80 1896

Zhou, Z.-g., J.-b. Lin, F.-s. Wang and Y.-t. Hou, (Electrophoretic studies on the lactate dehydrogenase enzymes 1986 and myogen in tissues of Coilia - in Chinese). J.Nanjing Univ. (nat.Sci.), 22(3):440-5 (English summary)

Zhou, Z.-h. and J.-b. Lin, (Comparative study on serum proteins of Coilia ectenes and Coilia brachygnathus by 1985 polyacrylamide gel electrophoresis - in Chinese). J.Nanjing Univ.(nat.Sci), **21**(1):107-11

Zugmayer, E., Die Fische von Balutschistan, mit einleitenden Bemerkenden über die Fauna des Landes. 1913 Wissenschaftliche Ergebnisse der Reise von Dr. Erich Zugmayer in Balutschistan 1911. Abh.bayer. Akad.Wiss., **26**(6):1.35

5. INDEX OF SCIENTIFIC AND VERNACULAR NAMES

EXPLANATION OF THE SYSTEM

The index applies exclusively to the genera and species accounts (Section 2) and the Addendum to Part I

Type faces used:

Italics (bold) :Valid scientific names (double entry by genera and species)

Italics :Synonyms (double entry by genera and species)

ROMAN (caps) : Family and Subfamily names

Roman (bold) : International **(FAO)** species names

Roman : Local species names

Page

A

C

F

J

K

L

M

N

P

Q

R

S

T

U

V

W

X

Y

Z