

BULLETIN OF THE BINGHAM OCEANOGRAPHIC COLLECTION

The *Bulletin of the Bingham Oceanographic Collection*, established by Harry Payne Bingham (Yale 1910) in 1927, published scientific articles and monographs on marine and freshwater organisms and oceanography for the Bingham Oceanographic Collection at Yale University.

The series ceased independent publication after Volume 19, Article 2, and was merged into the *Bulletin of the Peabody Museum of Natural History* monograph series after 1967.

See also the Bingham Oceanographic Collection Archives,
Invertebrate Zoology, Yale Peabody Museum, in the Archives at Yale:
<https://archives.yale.edu/repositories/15/resources/11140>



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.
<https://creativecommons.org/licenses/by-nc-sa/4.0/>

Yale PEABODY MUSEUM OF NATURAL HISTORY

P.O. Box 208118 | New Haven CT 06520-8118 USA | peabody.yale.edu

BULLETIN
OF
THE BINGHAM OCEANOGRAPHIC COLLECTION

PEABODY MUSEUM OF NATURAL HISTORY
YALE UNIVERSITY

VOL. VIII, ART. 2

A REVIEW OF THE AMERICAN ANCHOVIES
(FAMILY ENGRAULIDAE)

BY SAMUEL F. HILDEBRAND

Ichthyologist, Fish and Wildlife Service

Issued February, 1943

New Haven, Conn., U. S. A.

PUBLISHED BY
BINGHAM OCEANOGRAPHIC LABORATORY

"Founded for the Purpose
of Oceanographic Research"

DANIEL MERRIMAN
Director and Editor

A. E. PARR
Curator and Editor

M. D. BURKENROAD
Assistant Curator

C. M. BREDER
Research Associate

G. A. RILEY
Research Assistant

G. E. PICKFORD
Research Assistant

Y. H. OLSEN
Assistant

A REVIEW OF THE AMERICAN ANCHOVIES (FAMILY ENGRAULIDAE)

BY SAMUEL F. HILDEBRAND

Ichthyologist, Fish and Wildlife Service

CONTENTS

	PAGE
ABSTRACT	1
INTRODUCTION	2
Economic importance	3
Distribution of species:	
General comments	4
Table of distribution by geographical regions	6
New species and subspecies described	8
Explanation of enumerations, proportions and synonymy	8
Acknowledgments	9
FAMILY ENGRAULIDAE	10
Genus <i>Engraulis</i>	12
Genus <i>Anchovia</i>	20
Genus <i>Anchoa</i>	29
Genus <i>Anchoviella</i>	108
Genus <i>Pterengraulis</i>	139
Genus <i>Lycengraulis</i>	141
Genus <i>Cetengraulis</i>	154
BIBLIOGRAPHY	159

ABSTRACT

The review was undertaken because of the confused state of the classification, which first became evident to the author from his studies of the fishes of Panama. Many specimens, some of them in the author's collection, others sent by friends, and many borrowed from museums, have been available. Most of the American species are well represented in the collections studied, making it feasible to work

out their relationship in some detail. However, several species, for which only one, a few, or no specimens were available, remain obscure.

Seven genera are recognized. Four of them, *Engraulis*, *Anchovia*, *Anchoa*, and *Anchoviella*, are very closely related. Seventy-eight species and subspecies are recognized, of which 16 species and 2 subspecies are new. Descriptions and keys to the genera and species are offered, and 72 species are illustrated with simple pen and ink drawings.

Although the geographical range of several species extends well into the North or South Temperate Zone, and one into both Temperate Zones, the species are far more numerous in the Torrid Zone, where some of them ascend fresh water streams, or perhaps live in fresh water permanently, especially in the Amazon River system.

INTRODUCTION

The Engraulidae have been reviewed, in part, by Jordan and Seale (1926), the review being based to a large extent on collections in the Museum of Comparative Zoology. In that publication descriptions and a key to the genera of the world are offered, but the accounts of species are limited to "new and rare" ones. The desirability of a further study of the American anchovies became evident to me over a course of years and especially in 1935 when I endeavored to classify comparatively large collections from the two coasts of Panama and from Venezuela, and the study that has resulted in this review was therefore undertaken. The work was interrupted several times, because of duties that seemed more urgent, but the delays have been advantageous, in some respects, especially as many more specimens became available for study. This new and extra material was collected by me and by various friends, and many specimens were borrowed from museums. Acknowledgements of the help received are made elsewhere. Many species are well represented in the collections studied, others by only one or a few specimens, and a few, apparently valid ones, are not represented at all. This lack of adequate material for study of necessity leaves weak places in the review. It is hoped, nevertheless, that this work will be found useful, and that it may serve as a foundation on which firmer structures may be built. No special effort has been made to work out the finer subdivisions of species, though in a few instances sufficient material and data were obtained to justify the recognition of subspecies.

Every effort has been made throughout the review to make its interpretation and its use as easy as a technical treatise of its kind permits. Thus, the same term for any one structure is used through-

out the paper, and characters are mentioned in the same sequence in each description. Also no effort has been made to cite all the references to any one species. To do so would have made this paper considerably longer, without adding much to its intended use. Furthermore, in some instances it is utterly impossible to untangle the synonymy, as for example in *Anchoa hepsetus*. The different names that any one species has borne, as far as known to me, are cited, and often a few references either to a general work or to a paper containing important information, or both, are given.* For example, although this treatise is almost wholly taxonomic in scope, important works containing information on life histories are cited.

The anchovies are carnivorous, and typically pelagic shore fishes, usually moving about in schools, though sometimes taken singly and at depths as great as 20 to 30 fathoms. However, many of the anchovies ascend fresh water streams, especially in South America, where several species are found in the Amazon basin, a few of them in its upper tributaries.

Engraulidae are difficult to identify, because many species are extremely similar in appearance. In general, the dorsal rays are so uniform in number that their enumeration is of little value. The number of anal rays has proven much more useful. The number of pectoral rays, a character sparingly used heretofore, is also sometimes helpful in differentiating species. Perhaps the most important character of all is the number of gill rakers on the first arch. These enumerations, which frequently require the use of a binocular microscope, are often necessary to make positive identification. Sometimes proportional measurements are helpful. The size, shape and position of the teeth are quite uniform within a genus, and therefore the dentition is not mentioned in most of the specific descriptions.

ECONOMIC IMPORTANCE

Anchovies have not been utilized to any great extent as food for man in North America, largely because the species occurring there do not grow large. However, the quantity marketed is increasing rapidly. For example, the statistics collected by the Fish and Wild-

* No references to the works by N. A. Borodin (1928 and 1934) are included, because it is evident that either locality labels were badly mixed, or the identifications are unreliable. Therefore it seems advisable to omit further references to these papers.

life Service show that the quantity marketed in New York City increased from 9,600 pounds in 1938 to 21,695 pounds in 1939, and to 28,970 pounds in 1940. The species marketed chiefly is *Anchoa hepsetus*, which is common and grows larger than the other local forms. It is said to be used chiefly for making anchovy paste. In British Columbia *Engraulis mordax* has been utilized for canning during the past few years. According to an item in the *Commercial Weekly* (1941, 375) the catch increased from 2,174,000 pounds in 1939, when the fish were reduced to oil and meal, to 8,337,000 pounds in 1940 when the fish were canned. According to a letter received from Dr. R. E. Foerster, Director of the Pacific Biological Station, Nanaimo, B. C., this fish has been unusually common during the last few years on the west coast of Vancouver Island, and also in the Strait of Georgia.

On the west coast, at least as far south as Panama Bay, anchovies are used as bait in the tuna fisheries. In South America, where some of the species reach a length of 10 to 12 inches, or more, they are marketed much more extensively in the fresh state.

Anchovies are of economic importance, however, chiefly as forage fishes. In Chesapeake Bay, on the coast of North Carolina, and on both coasts of Panama, the author has found that anchovies constitute the most important single item of food of many of the larger predatory species, especially the sea trouts or weakfishes, bluefish, Spanish mackerel, bonito, and dolphin. Water birds, too, feed on them extensively.

DISTRIBUTION OF SPECIES

Insufficient collecting has been done to determine definitely the areas in which the American Engraulidae are most numerous. If the number of species recognized in this review is used as a criterion, the center of distribution on the Atlantic is northern Brazil, including the Amazon drainage, an area from which about 23 species are recorded, some of them having been taken only in fresh water. At least 10 species also occur in the West Indies. On the Pacific coast the center of distribution apparently is Panama Bay from which 18 species are recognized, although 16 species described in this review can be assigned to the Gulf of California. The species are not numerous on the coasts of the United States. Eight occur on the Atlantic and Gulf coasts (only 3 north of Florida) and only 4 definitely on the

Pacific. The species are few also in southern South America. Only 5 are known to occur on the Atlantic south of Brazil, and only 4 in the Pacific south of the Gulf of Guayaquil. As considerable stretches of both coasts of Central and South America have been only slightly, or not at all, sampled, the picture of the distribution of species as outlined here probably will be changed considerably when the anchovies from such areas become better represented in collections. It is obvious, however, that the chief home of the American Engraulidae is in tropical and subtropical regions, and that comparatively few species inhabit the temperate waters of the Americas. The number of species from the Pacific recognized in these studies is only about two-thirds as great as the number from the Atlantic. That proportion, of course, may be changed somewhat by future collecting, though in general the coasts of America seem to have been sampled about equally.

Meek and Hildebrand (1923, 10) have stated that several species of fish are common to both coasts of Panama, and that many are closely related, these observations being based on collections made prior to the opening of the Panama Canal. Among the anchovies herein recognized only one, *Anchoa spinifer*, apparently occurs on both coasts. The comparison of specimens of this species from the opposite coasts, however, was not entirely satisfactory, as those from the Atlantic were too few and mostly not in good condition, so that specific differences may yet be found.

Among the closely related species of anchovies from the opposite coasts of Panama the following pairs may be listed, in which the Atlantic species of each pair is named first: *Lycengraulis grossidens** and *L. poeyi*; *Cetengraulis edentulus* and *C. mysticetus*; *Anchovia clupeoides* and *A. rastralis*; and *Anchoa parva* and *A. curta*. The last two species named are so closely related that they probably should be considered as only subspecifically distinct. Some of the specimens of each species studied were collected before the completion of the Panama Canal. Therefore the close relationships are not the result of species crossing the Isthmus through the Canal. As more than a few of the anchovies enter fresh water freely the possibility that some species may have crossed, or eventually will cross the Isthmus through the Canal definitely exists. In fact, several species of anchovy have

* This species to date has not been recorded from north of the Gulf of Venezuela.

been taken in the upper flights of the locks (Hildebrand, 1939, 25, 30 and 35). Proof that any species actually has completed the transit, however, has not been found.

DISTRIBUTION OF SPECIES OF AMERICAN ANCHOVIES BY
GEOGRAPHICAL REGIONS

Atlantic

North Atlantic (Nova Scotia to Connecticut inclusive):

Anchoa hepsetus hepsetus *Anchoa mitchilli mitchilli* *Anchoviella eurystole*

Middle Atlantic (New York to Virginia inclusive):

Anchoa duodecim *Anchoa hepsetus hepsetus* *Anchoa mitchilli mitchilli*
Anchoviella eurystole

South Atlantic (North Carolina to Florida, east coast, inclusive):

Anchoa cayorum *Anchoa hepsetus hepsetus* *Anchoa lamprotaenia*
Anchoa cubana *Anchoa mitchilli mitchilli* *Anchoa mitchilli diaphana*
Anchoviella eurystole *Anchoviella perfasciata*

Bermuda:

Anchoa choerostoma

Gulf of Mexico (Florida, west coast, to Cabo Catoche, Peninsula of Yucatan, Mexico, inclusive):

Anchoa cayorum *Anchoa hepsetus hepsetus* *Anchoa hepsetus colonensis*
Anchoa lamprotaenia *Anchoa lyolepis* *Anchoa cubana*
Anchoa mitchilli diaphana *Anchoviella perfasciata*

West Indies:

Anchoa clupeioides *Anchoa cayorum* *Anchoa hepsetus hepsetus*
Anchoa hepsetus colonensis *Anchoa lamprotaenia* *Anchoa lyolepis*
Anchoa cubana *Anchoa parva* *Anchoa filifera*
Anchoviella perfasciata *Cetengraulis edentulus*

Central America:

Anchoa cayorum *Anchoa hepsetus hepsetus* *Anchoa lamprotaenia*
Anchoa cubana

South America, Panama to northern Brazil (to 5° south latitude):

Anchoa clupeioides *Anchoa spinifer* *Anchoa pectoralis*
Anchoa ginsburgi *Anchoa hepsetus hepsetus* *Anchoa hepsetus colonensis*
Anchoa lamprotaenia *Anchoa lyolepis* *Anchoa tricolor*
Anchoa januaria *Anchoa parva* *Anchoa trinitatis*
Anchoa filifera *Anchoviella estauquae* *Anchoviella brevisrostris*
Anchoviella guianensis *Anchoviella alleni* *Anchoviella elongata*

<i>Anchoiella lepidentostole</i>	<i>Anchoiella blackburni</i>	<i>Anchoiella nattereri</i>
<i>Anchoiella palladia</i>	<i>Anchoiella jamesi</i>	<i>Pterengraulis atherinoides</i>
<i>Lycengraulis grossidens</i>	<i>Lycengraulis batesii</i>	<i>Lycengraulis abbotti</i>
<i>Lycengraulis barbouri</i>	<i>Cetengraulis edentulus</i>	

South America, Brazil (5° south latitude) to Argentina inclusive:

<i>Engraulis anchoita</i>	<i>Anchoa spinifer</i>	<i>Anchoa hepsetus hepsetus</i>
<i>Anchoa tricolor</i>	<i>Anchoa januaria</i>	<i>Anchoa parva</i>
<i>Anchoa marinii</i>	<i>Anchoa howelli</i>	<i>Anchoiella vaillanti</i>
<i>Anchoiella hubbsi</i>	<i>Anchoiella brasiliensis</i>	<i>Lycengraulis grossidens</i>
<i>Lycengraulis olidus</i>	<i>Lycengraulis barbouri</i>	<i>Lycengraulis schroederi</i>
<i>Cetengraulis edentulus</i>	<i>Cetengraulis juruensis</i>	

Pacific

North Pacific (Queen Charlotte Islands to Oregon inclusive):

Engraulis mordax mordax

California:

<i>Engraulis mordax mordax</i>	<i>Engraulis mordax nanus</i>	<i>Anchoa compressa</i>
<i>Anchoa delicatissima</i>	<i>Anchoiella scitula</i>	

Mexico (Lower California to Chiapas inclusive):

<i>Engraulis mordax mordax</i>	<i>Anchovia macrolepidota</i>	<i>Anchovia magdalenae</i>
<i>Anchoa compressa</i>	<i>Anchoa schultzi</i>	<i>Anchoa panamensis</i>
<i>Anchoa mundeoloides</i>	<i>Anchoa schofieldi</i>	<i>Anchoa helleri</i>
<i>Anchoa ischana</i>	<i>Anchoa cultrata</i>	<i>Anchoa exigua</i>
<i>Anchoa curta</i>	<i>Anchoa lucida</i>	<i>Anchoa delicatissima</i>
<i>Anchoiella miarcha</i>	<i>Anchoiella parri</i>	<i>Cetengraulis mysticetus</i>

Central America (Guatemala to Costa Rica inclusive):

<i>Anchovia macrolepidota</i>	<i>Anchovia rastralis</i>	<i>Anchoa panamensis</i>
<i>Anchoa mundeoloides</i>	<i>Anchoa arenicola</i>	<i>Anchoa starksi</i>
<i>Anchoa curta</i>	<i>Anchoa lucida</i>	<i>Anchoa delicatissima</i>
<i>Anchoiella miarcha</i>	<i>Anchoiella balboae</i>	<i>Cetengraulis mysticetus</i>

South America, Panama to southern Peru (to 5° south latitude):

<i>Engraulis clarki</i>	<i>Anchovia macrolepidota</i>	<i>Anchovia rastralis</i>
<i>Anchoa spinifer</i>	<i>Anchoa panamensis</i>	<i>Anchoa mundeoloides</i>
<i>Anchoa eigenmannia</i>	<i>Anchoa schofieldi</i>	<i>Anchoa chamensis</i>
<i>Anchoa arenicola</i>	<i>Anchoa starksi</i>	<i>Anchoa tropica</i>
<i>Anchoa curta</i>	<i>Anchoa lucida</i>	<i>Anchoa naso</i>
<i>Anchoa nasus</i>	<i>Anchoiella miarcha</i>	<i>Anchoiella balboae</i>
<i>Lycengraulis poeyi</i>	<i>Cetengraulis mysticetus</i>	

South America, northern Peru (5° south latitude) to Chile inclusive:

<i>Engraulis ringens</i>	<i>Anchoa lucida</i>	<i>Anchoa nasus</i>
<i>Lycengraulis poeyi</i>		

NEW SPECIES AND SUBSPECIES DESCRIBED

<i>Atlantic</i>		<i>Pacific</i>	
	Page		Page
<i>Anchoa pectoralis</i>	52	<i>Engraulis clarki</i>	19
<i>Anchoa ginsburgi</i>	55	<i>Anchovia magdalanae</i>	23
<i>Anchoa hepsetus colonensis</i> n. subsp.	60	<i>Anchoa schultzi</i>	41
<i>Anchoa lamprotaenia</i>	62	<i>Anchoa chamensis</i>	54
<i>Anchoa mitchilli diaphana</i> n. subsp.	91	<i>Anchoa tropica</i>	80
<i>Anchoa marinii</i>	99	<i>Anchoviella parri</i>	131
<i>Anchoa howelli</i>	106		
<i>Anchoviella estauquae</i>	115		
<i>Anchoviella hubbsi</i>	128		
<i>Anchoviella blackburni</i>	129		
<i>Anchoviella brasiliensis</i>	138		
<i>Lycengraulis barbouri</i>	151		
<i>Lycengraulis schroederi</i>	153		

EXPLANATION OF ENUMERATIONS, PROPORTIONS
AND SYNONYMY

The number of fin rays given in descriptions always includes undivided rays as well as divided ones. The last ray of the dorsal and anal, even though nearly double but not quite separate at the base was counted as one. In the formulae of gill rakers on the first arch, the number above the angle is separated from that below it by the plus sign, the number above the angle being given first.

The number of scales in the lateral series, as given, is only approximately correct for the reason that most of them were lost from the specimens studied. Partly for the same reason no attempt was made to indicate scales in full in the illustrations. The enumerations given in the descriptions generally are based on scale pockets.

All proportions in the "length" apply to the standard length, that is, the distance from the tip of the snout to the base of the caudal fin, or end of the spinal column as nearly as determinable without dissection. The maxillary was not measured from the tip of the snout, but from the anterior rim of the premaxillaries, which may be felt, if not seen, underneath the skin, to its posterior rim or tip. Because the base of the axillary scale of the pectoral often is difficult to see, this appendage was measured from the base of the uppermost ray of the pectoral to its tip, and the fin itself was measured from the same point to the tip of the longest ray, not including the filament if present.

Statements as to the length of gill rakers pertain to the longest ones

on the first arch, which are near the angle. The width of the silvery lateral band if stated without explanation, is its greatest width, which usually is over the base of the anal fin.

The structure referred to repeatedly as the "cheek" is the more or less triangular area behind the eye and above the maxillary. Its length was measured from the posterior rim of the orbit to its lower posterior angle.

The vertebrae were exposed for enumeration by making an incision along the back, slightly to the right side of the median line. After such a count has been completed the anterior end of the side that has been cut away from the backbone may be reinserted under the opercle, and if the skin on the base of the tail has been left uncut the parts may be pressed together, scarcely showing a mutilation. In fact, the specimen, as an object for study, is improved, as not only the backbone is exposed, but the internal organs also may be examined without additional incisions. Each enumeration of vertebrae used in the descriptions and tables is based on the total number, including the hypural.

All measurements were made with vernier calipers, having sharp points. All the measurements of the smaller structures, such as the eye, snout, and maxillary, were made with the aid of a jeweler's glass, and occasionally with the aid of the binocular microscope if the specimens were very small.

ACKNOWLEDGMENTS

I am sincerely grateful to the many friends who have cooperated in various ways in this investigation. Among those who have been especially helpful I may mention Luis Howell Rivero of the University of Havana, who sent specimens from Cuba and Jamaica, Luis C. Bonnet of the Department of Agriculture and Commerce of Puerto Rico, who sent specimens from that island, Gordon Gunter, who sent many specimens from Texas, and Charles M. Breder, who furnished specimens from the west coast of Florida. To William C. Schroeder of the Museum of Comparative Zoology, I am indebted for the loan of a particularly fine collection of anchovies, especially rich in specimens from Brazil. Through the courtesy of Henry W. Fowler I was able to examine the material in the Academy of Natural Sciences in Philadelphia, and through the kindness of Leonard P.

Schultz I have had the use of all the specimens in the National Museum. I am indebted to Alfred C. Weed of the Field Museum, to Carl L. Hubbs of the University of Michigan, to George S. Myers of Stanford University, to A. E. Parr and Yngve H. Olsen of the Bingham Oceanographic Laboratory at Yale University, and to the late H. Walton Clark of the Museum of the California Academy of Sciences, all of whom made loans of specimens for study. To Daniel Merriman of the Bingham Oceanographic Laboratory I am indebted for useful suggestions and for reading the paper critically.

Family ENGRAULIDAE
AMERICAN SPECIES OF ANCHOVIES

Body elongate, more or less compressed; chest and abdomen compressed, often carinate (sometimes serrate in Old World species); snout pointed, usually projecting far beyond tip of mandible, mouth very large, nearly horizontal; maxillary long and slender, usually reaching far beyond posterior rim of orbit, frequently nearly or quite to gill opening (but not beyond it as in some Old World species); premaxillaries not protractile; teeth typically minute and even, although partly enlarged and uneven in some genera, present on jaws, vomer, palatines, pterygoids and hyoids; eye moderately large, placed well forward, generally in anterior half of head, sometimes with well developed adipose tissue in adults; gill membranes generally separate, joined across the isthmus by a transparent membrane in one American genus (*Cetengraulis*); branchiostegals slender, rather numerous; pseudobranchiae present; gill rakers typically slender, short and broad in a few species, denticulate; no lateral line evident; scales thin, cycloid, usually mostly lost in preserved material, an enlarged scale present in axil of pectoral and ventral fins (frequently lost); dorsal fin short (with about 12 to 16 rays in American species), more or less median in position; no adipose fin; caudal forked; anal generally longer than dorsal (with about 15 to 40 rays in American species), both fins having a scaly sheath of varying width in different species at their bases.

Some specimens have well developed adipose tissue on the eyes, whereas others of the same species have little or none. The development of such tissue apparently is not associated with age, sex or spawning condition, its significance, if any, remaining unknown.

The Engraulidae are closely related to the Clupeidae from which they differ chiefly in the structure of the mouth, and in the projecting, piglike snout. In general the anchovies are softer and more delicately constructed fish. Although almost all American ichthyologists have recognized the Engraulidae as distinct from the Clupeidae since the publication of Gill's

Arrangement of the Families of Fishes (1874), European ichthyologists have not followed this course. Regan in the *Encyclopaedia Britannica*, Fourteenth Edition, 1929, still placed the anchovies in the family Clupeidae, a procedure that has been maintained in the *Zoological Record* to the present time.

The grouping of the species into genera offers real difficulty. As a result authors often have not been in agreement in the recognition of genera. Jordan and Seale (1926) recognized 7 genera among recent American anchovies. The same genera were recognized by Jordan, Evermann and Clark (1930, 47-51). Fowler (1936, 181), on the other hand, placed three genera, namely, *Anchovia*, *Anchoviella* and *Amplova*, recognized by the authors named, in the synonymy of *Engraulis*. The present study of the American anchovies has not helped greatly to simplify the generic definitions.

Jordan and Seale (*loc. cit.*) were still able to say that *Engraulis* (known from both hemispheres) was the only genus of the family confined to the temperate seas, and that its numerous vertebrae (46 or 47), and numerous gill rakers (36 to 49), together with its subcylindrical body, fragile skeleton, and oily flesh, separated it from other genera. However, the writer took two specimens at Balboa, Canal Zone (Pacific), in 1937, that seem to belong to this genus, and are described as a new species in the following pages. These specimens from the tropics, as usual, have fewer vertebrae (41) than specimens from temperate regions (46 to 49), and they also have fewer gill rakers (26 on lower limb of first arch). This new species, nevertheless, has an elongate, subcylindrical body, and small anal fin (with 21 rays), as in previously described species of *Engraulis*.

The discovery of this new species, together with additional information as to the variability of characters, supposedly of generic value, has made the separation of the genera related to *Engraulis*, that is *Anchovia*, *Anchoviella* and *Amplova*, as recognized by Jordan and Seale, very difficult, if not untenable. It is evident from the present study that Fowler's procedure, of uniting several genera, as already stated, is not without merit. However, all the genera admitted by Jordan and Seale, exclusive of *Amplova*, which is given subgeneric rank, are retained herein although with considerable modification in definition, and *Anchoa* (proposed after the publication of Jordan and Seale's work) is given full generic rank.

KEY TO THE GENERA

- a. Gill membranes nearly or quite separate, never broadly united across the isthmus.
- b. Teeth in the jaws all small or minute and about equal in size.
- c. Origin of anal generally posterior to origin of dorsal, very rarely almost under it; gill rakers long, narrow, pointed, usually rather numerous, usually more than 15 on lower limb of first arch; species mostly small.
- d. Body thick, subcylindrical; vertebrae usually about 46 to 49, as few as 41 in one species; anal fin small, with about 20 to 24 rays, situated

- wholly behind base of dorsal; gill rakers about 36 to 46 (26 in one species) on lower limb of first arch. *Engraulis*, p. 12
- dd. Body thinner, more strongly compressed, generally deeper; vertebrae usually fewer, rarely as many as 46; anal fin large or small, its origin commonly somewhere under base of dorsal, occasionally wholly behind it.
- e. Maxillary long and slender, generally reaching well beyond joint of mandible, frequently nearly or quite to margin of opercle, more or less sharply pointed posteriorly.
- f. Gill rakers very close-set, numerous, increasing in number with age, about 60 to 130 on lower limb of first arch in adults, about 40 to 50 in young; body deep, strongly compressed, depth in adults about 2.6 to 3.8 in length; size often comparatively large, sometimes as great as 250 mm. *Anchovia*, p. 20
- ff. Gill rakers not very close-set, less numerous, not known to increase in number with the age, rarely as many as 32 on lower limb of first arch; body usually more elongate; size generally small, length generally well under 150 mm. *Anchoa*, p. 29
- ee. Maxillary shorter, often rather broad, usually failing to reach joint of mandible, never reaching beyond it, square or broadly rounded posteriorly, never pointed; size rather small, generally well under 150 mm. *Anchoviella*, p. 108
- cc. Origin of anal usually a little in advance of origin of dorsal; gill rakers short and broad, only about 14 on lower limb of first arch; size large, 250 mm. or more. *Pterengraulis*, p. 139
- bb. Teeth in the jaws, especially those in lower jaw, enlarged, usually unequal in size; origin of anal posterior to origin of dorsal, somewhere under base of dorsal; ventral inserted about midway between base of pectoral and origin of dorsal; size attained quite large, 250 mm. or more. *Lycengraulis*, p. 141
- aa. Gill membranes broadly united in adults by a thin transparent membrane, easily torn; gill rakers long and slender, close-set, increasing in number with age, about 25 to 60 on lower limb of first arch; ventral fin inserted under or only a little in advance of origin of dorsal; size attained rather large, 160 mm. or more. *Cetengraulis*, p. 154

Genus ENGRAULIS Cuvier

Engraulis Cuvier, 1817, 174 (type *Clupea encrasicholus* Linnaeus).

Body comparatively thick, subcylindrical; jaws with small teeth, none especially enlarged; gill rakers rather numerous, 26 or more on lower limb of first arch, apparently not increasing in number with age; vertebrae numerous, about 41 to 49 (most species with 46 to 49); maxillary sometimes failing to reach joint of mandible, never to gill opening; anal fin short in American species, with 20 to 23 rays, its origin under or sometimes well behind base of last ray of dorsal; ventral under or a little in advance of dorsal. The bones are feeble, and the flesh is said to be dark and oily.

KEY TO THE SPECIES

- a. Head large, its length 2.9 to 3.75 in length; postorbital part of head long, 5.0 to 6.0 in length; eye 4.3 to 5.0 in head; gill rakers numerous, 30 to 41 + 38 to 45 on first arch; dorsal with 15 to 18 rays.
- b. Maxillary tapering, rather pointed posteriorly, reaching to or a little beyond joint of mandible, usually 1.35 to 1.4 in head; origin of anal generally under base of last ray of dorsal; cheek long and narrow, longer than snout and eye in adults; mandible scarcely projecting in advance of eye, usually 4.3 to 5.4 in length..... *mordax*
- c. Vertebrae usually 45 or 46; body rather elongate, depth about 5.0 to 5.9 in length; head moderate, about 3.2 to 3.75; size attained large, about 165 mm..... *mordax mordax*, p. 14
- cc. Vertebrae usually 43 or 44; body rather deeper, depth about 4.75 in length; head larger, about 2.9; size smaller, generally under 100 mm.
mordax nanus, p. 15
- bb. Maxillary bluntly rounded posteriorly, failing to reach joint of mandible, usually 1.5 to 1.55 in head; origin of anal far behind base of dorsal, usually under tips of longest rays of dorsal; cheek shorter and broader, not exceeding length of snout and eye; mandible extending to midlength of snout, 4.8 to 6.1 in length..... *ringens*, p. 16
- aa. Head smaller, its length 3.6 to 3.9 in length; postorbital part of head shorter, 7.0 to 7.3 in length; eye 3.5 to 4.0 in head; gill rakers less numerous, 34 or fewer above and 40 or fewer below angle on first arch; dorsal with 13 or 14 rays.
- d. Body quite elongate, depth 5.3 to 6.5 in length, maxillary short, bluntly pointed, scarcely reaching opposite joint of mandible, 1.35 to 1.5 in head; gill rakers moderately numerous, 29 to 34 + 35 to 39 on first arch; vertebrae about 46..... *anchoita*, p. 18
- dd. Body deeper, the depth 4.0 in length; maxillary long and pointed, reaching beyond joint of mandible, almost to margin of opercle, 1.2 to 1.3 in head; gill rakers less numerous 24 + 26 on first arch; vertebrae about 41.
clarki n. sp., p. 19

TABLE 1.—FREQUENCY DISTRIBUTION OF ANAL RAYS IN *Engraulis*

Species	Number of anal rays					
	19	20	21	22	23	24
<i>mordax mordax</i>	2	8	6	6	.
<i>mordax nanus</i>	5	5	1	.
<i>ringens</i>	2	7	11	5	4	1
<i>anchoita</i>	2	.	2	.	.
<i>clarki</i>	2	.	.	.

TABLE 2.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN *Engraulis**

Species	Number of gill rakers on upper limb of first arch																						
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
<i>mordax mordax</i>	1	1	2	5	3	3	4	2	3	1	.	.	.	.	.	.
<i>mordax nanus</i>	1	2	1	.	.	5	3	1	.	.	.	.	.	.	.	.	.	.	.
<i>ringens</i>	1	6	5	2	1	2	3	5	1	1	1	1	.	.
<i>anchoita</i>	2	.	.	1	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>clarki</i>	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

* If the enumerations exceed the number of specimens reported in the text the gill rakers on both anterior arches in at least some of the specimens were counted.

Number of gill rakers on lower limb of first arch

Species	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
<i>mordax mordax</i>												1	2	2	9	4	2	2	2						
<i>mordax nanus</i>												1	4	1	5	1									
<i>ringens</i>													2	2	2	3	1	5	1	4	2	4	2	1	
<i>anchoita</i>												1	4	2	2	3									
<i>clarki</i>	2																								

***Engraulis mordax mordax* Girard (Fig. 1)**

Engraulis mordax Girard, 1856, 138, San Francisco, Cal. (not Shoalwater Bay, Wash., as stated in some current works); and 1858, 334; Hubbs, 1925, 14; Walford, 1931, 50, fig. 28; Barnhart, 1936, 16, fig. 48.
Stolephorus ringens Eigenmann (not of Jenyns), 1893, 137, pl. 12.

Head 3.2 to 3.75; depth 5.0 to 5.9. D. 15 or 16; A. 20 to 23; P. 15 to 17; scales mostly lost, about 45 to 50; vertebrae 46 or 47 (5 specimens dissected).

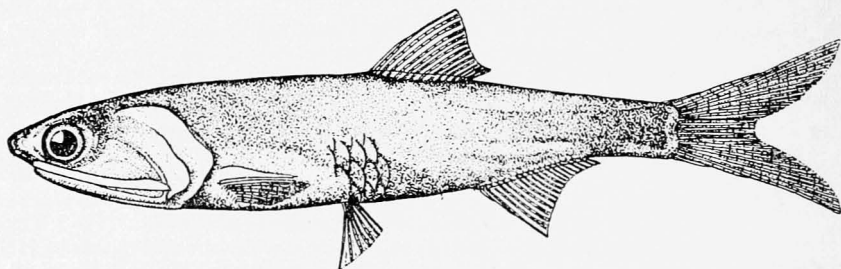


Fig. 1.—*Engraulis mordax mordax*. From a specimen 125 mm. long, San Pablo Bay, Cal. (U. S. N. M., No. 103575). (Drawing by Mrs. Alice C. Mullen.)

Body elongate, rather round in adults, more compressed in young, apparently not growing deeper with age; ventral outline scarcely more strongly convex than the dorsal; head long, its greatest depth at joint of mandible, generally less than postorbital length by diameter of pupil; snout pointed, projecting about two-thirds its length beyond tip of mandible, 6.0 to 7.2 in head; eye 4.3 to 5.0; maxillary narrow, fairly pointed posteriorly, reaching to or a little beyond joint of mandible, 1.25 to 1.5, usually 1.35 to 1.4 in head; cheek very long and narrow, longer than snout and eye in adults, its posterior angle very sharp, about 30°; postorbital part of head very long, 5.0 to 6.0 in length; mandible 4.3 to 5.4 in length; gill rakers slender, close-set, difficult to enumerate, fully as long as snout and one-third of eye at angle, 32 to 41 + 38 to 45 on first arch, apparently not increasing in number with age; dorsal fin rather small, with straight to slightly concave margin, the anterior rays scarcely reaching tip of posterior one if deflexed,

its origin usually about equidistant from base of caudal and anterior half of eye; anal fin rather small and low, its origin under or a little in advance of end of base of dorsal (rarely behind dorsal) often nearly an eye's diameter nearer base of caudal than base of pectoral, but sometimes equidistant, its base 5.0 to 6.25 in length; ventral small, often reaching scarcely more than half way to origin of anal, usually inserted about equidistant from base of pectoral and origin of anal, though sometimes a little nearer anal, and about an eye's diameter in advance of origin of dorsal; pectoral rather short, failing to reach base of ventral by diameter of eye, proportionately longer in young, 2.0 to 2.3 in head, 5.8 to 7.6 in length; axillary scale of pectoral long and slender, reaching about to beginning of distal fourth of longest pectoral rays, 2.4 to 3.0 in head.

Color of old alcoholic specimens brownish above, lower two-thirds of sides silvery; sides of head bright silvery. Young with a silvery lateral band, becoming more or less diffuse at a length of 80 to 90 mm.

The proportions and enumerations used in the description, unless otherwise stated, are based on 25 specimens, 70 to 165 mm. long, which more or less definitely belong to this slender, heavy-bodied subspecies in contrast with the rather deeper and apparently more strongly compressed *E. mordax nanus*. This fish has been taken in large quantities during recent years in British Columbia where it is canned. Southward it is used as bait for tuna.

Range.—Queen Charlotte Islands to Cape San Lucas, Lower California.

***Engraulis mordax nanus* Girard (Fig. 2)**

Engraulis nanus Girard, 1858, 335, San Francisco, Cal.

Engraulis mordax nanus Hubbs, 1925, 18.

According to Hubbs (*loc. cit.*) this subspecies differs from the typical form in the rather deeper body, slightly larger head, reduced number of vertebrae, and in the smaller size attained. Most of these differences are shown in

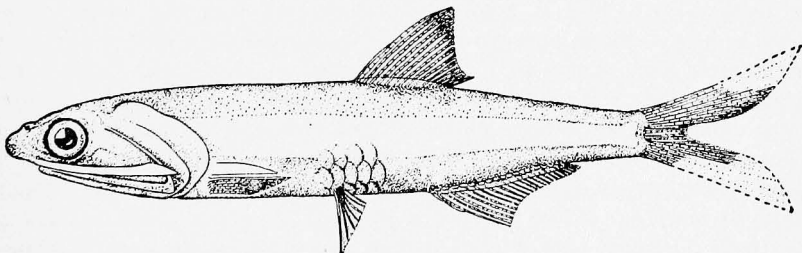


Fig. 2.—*Engraulis mordax nanus*. From a specimen 77 mm. long, probably the type, San Francisco, Cal. (U. S. N. M., No. 946). (Drawing by Mrs. Alice C. Mullen.)

the preceding key. He referred to it as "a typical brackish-water race," whereas *E. mordax mordax* was called an "ocean anchovy." The material at hand is insufficient to add much of value to the thorough study made by Hubbs. However, there is a specimen in the United States National Museum (No. 946), 87 mm. long, from San Francisco, Cal., which, according to Girard's account, seems to be the type of *E. nanus*. The proportions and enumerations given in the following paragraph are based on this specimen, which is the deepest and most strongly compressed of any I have seen, its greatest thickness being rather less than the depth of its caudal peduncle.

Head 2.9; depth 4.75; eye in head 4.45; snout 6.2; maxillary 1.45; mandible 1.45; postorbital part of head 1.8; pectoral 2.1. Anal base in length 5.6; postorbital part of head 5.2; mandible 4.1. D. 15; A. damaged; P. 16; gill rakers 35 + 40 on first arch.

Range.—Bays of California.

***Engraulis ringens* Jenyns (Fig. 3)**

Engraulis ringens Jenyns, 1842, 138, Callao, Peru; Steindachner, 1898, 331; Evermann and Radcliffe, 1917, 23; Jordan and Seale, 1926, 390 (In part not of Jenyns).

Engraulis pulchellus Girard, 1856, 199, Caldera Bay, Chile. (The inadequate description contains nothing inconsistent with specimens of *E. ringens*.)

Head 3.1 to 3.7; depth in adults 4.4 to 5.3, young under 90 mm. about 5.5 to 6.3; D. 15 to 18, usually 16 or 17; A. 19 to 24, usually 20 to 22; P. 15 to 18, usually 16 or 17; scales mostly lost, about 43 to 47; vertebrae 46 to 49 (7 specimens dissected).

Body elongate, not strongly compressed, chest and abdomen moderately compressed, not carinate; ventral outline scarcely more convex than the dorsal; head moderately long, its depth at joint of mandible a little less than postorbital length; snout quite pointed, projecting about half its length beyond tip of mandible, 6.7 to 8.0 in head; eye 4.3 to 4.8; maxillary distally rather bluntly rounded, failing to reach opposite joint of mandible, 1.45 to 1.6, usually 1.5 to 1.55, in head; cheek moderately long and fairly narrow, about as long as snout and eye in adults, proportionately shorter in young, its posterior angle about 40°; postorbital part of head long, 5.0 to 6.0 in length; mandible 4.8 to 6.1 in length; gill rakers long, slender, close-set, rather difficult to enumerate, apparently not increasing in number with age, about as long as snout and half the eye, 35 to 43 + 38 to 48 on first arch; dorsal fin moderately small, with slightly concave margin, longest rays usually failing to reach tip of the last one if deflexed, its origin about equidistant from base of caudal and anterior half of eye; anal rather small, its origin usually under the tips of the longest rays of dorsal if deflexed, nearer base of caudal than base of pectoral often by nearly an eye's diameter, its base

5.4 to 6.2 in length; ventral scarcely reaching half way to origin of anal in adults, rather farther back in young, inserted about equidistant from base of pectoral and origin of anal, and only about half an eye's diameter in advance of origin of dorsal; pectoral rather short, failing to reach base of ventral by half diameter of eye to diameter of eye and half the snout, 1.9 to 2.2 in head, 6.0 to 7.4 in length; axillary scale of pectoral very long, often shorter than longest rays of pectoral only by half diameter of eye, 2.3 to 3.0 in head.

Color bluish black above; sides of head and lower two-thirds of body bright silvery in adults, young under about 80 mm. in length with a silvery lateral band; caudal almost wholly black, other fins pale.

Many specimens, ranging from young, 40 mm. long (in which the body remains very slender and the mouth almost terminal) to adults, 150 mm.

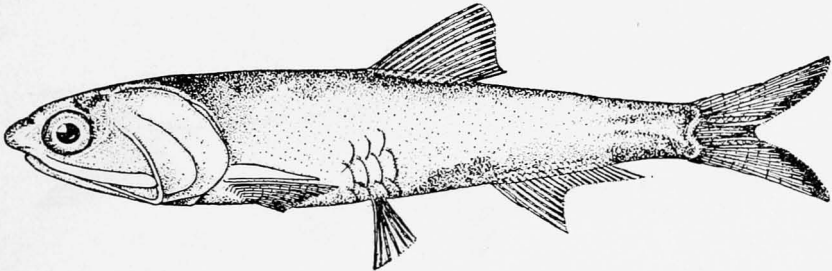


Fig. 3.—*Engraulis ringens*. From a specimen 115 mm. long, Lobos de Terra Island, Peru (U. S. N. M., No. 77522). (Drawing by Mrs. Alice C. Mullen.)

in length, have been studied. Collections were made at Lobos de Terra Island, Chimbota, Callao, and Cañete, Peru; and at Lota, Chile. The proportions and enumerations, unless otherwise stated are based on 30 specimens, 55 to 150 mm. long.

This species differs from *E. mordax mordax*, its apparently nearest relative, in the shorter and notably more bluntly rounded maxillary, notably shorter and broader cheek, in the farther forward projection of the mandible (opposite midlength of snout, whereas it extends only a little in advance of eye in *E. mordax mordax*), and in the more posteriorly placed anal fin. It is highly probable that *E. ringens* also has a higher average number of vertebrae, as shown by a very limited number of enumerations made.

Range.—Coasts of Peru and Chile. The Panama record by Jordan and Seale (*loc. cit.*) proves to be false, as the specimens on which it was based (M.C.Z. 30,797) were found to be *Anchoa arenicola*, and the San Diego, California, record by Eigenmann (1893, 137) undoubtedly was based on *Engraulis mordax*.

Engraulis anchoita Hubbs and Marini (Fig. 4)

Engraulis anchoita Hubbs and Marini, in Marini, 1935, 448, fig. 2, Mar del Plata, Argentina. (Type in Museo Argentina de Ciencias Naturales "Bernardino Rivadavia".)

Head 3.6 to 3.9; depth 5.3 to 6.5; D. 13 or 14; A. 20 to 22; P. 15 or 16; scales partly lost, about 33 to 37; vertebrae 46 (according to Hubbs and Marina) (*loc. cit.*).

Body rather round, subcylindrical, its greatest thickness generally exceeding half the depth; head large, its depth at joint of mandible scarcely greater than postorbital length; snout pointed, projecting about half its length beyond tip of mandible, notably shorter than the large eye, 5.8 to 6.0 in head; eye 3.5 to 4.0; maxillary moderately short, scarcely reaching joint of mandible, bluntly pointed, 1.35 to 1.5 in head; mandible sharply pointed, reaching slightly anterior to nostrils, scarcely curved upward an-

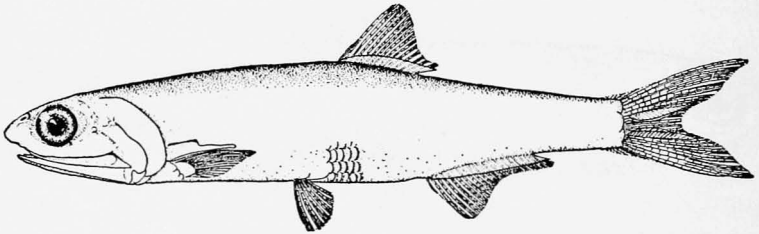


Fig. 4.—*Engraulis anchoita*. From a paratype 165 mm. long, Mar. del Plata, Argentina. (Drawing by Miss Louella E. Cable.)

teriorly; cheek moderately long, equal to eye and about half the snout in the larger specimens, not much longer than eye in the smaller ones; postorbital part of head rather long, 7.0 to 7.3 in length; gill rakers long, those at angle only a little shorter than eye, 29 to 34 + 35 to 39 on first arch; dorsal fin moderately elevated anteriorly, its margin slightly concave, the longest rays reaching to or a little beyond tip of last ray if deflexed, its origin about equidistant from tip of snout and base of caudal or a little nearer the latter; anal fin small, its origin slightly posterior to end of base of dorsal, its base 5.6 to 6.6 in length; ventral small, reaching scarcely half way to origin of anal, inserted equidistant from base of pectoral and origin of anal, or slightly nearer the latter, about an eye's diameter in advance of origin of dorsal; pectoral larger, reaching about two-thirds the distance to ventral, 1.7 to 1.9 in head, 6.6 to 7.1 in length; axillary scale of pectoral large, about three-fourths the length of fin.

Color of the larger specimens quite dark (probably due to method of preservation), without very distinct markings. Median line of back with an indefinite dark stripe; side with an indication of a dark band, presumably

silvery in life. Two small specimens, 69 and 73 mm. long, have a broad silvery lateral band, bounded above by a narrow dusky band, composed of punctulations; back with two rather distinct dark lines.

The description is based on the type and 5 paratypes, ranging from 85 to 160 mm. in length, kindly lent for study by Dr. Carl L. Hubbs of the University of Michigan, where some of the paratypes are deposited. These fish are characterized by the slender subcylindrical body, the large eye, small anal fin, and large number of gill rakers. These characters seem of sufficient importance to distinguish them generically from the other large anchovies of Argentina.

The synonymy given with the original description probably was mostly wrongly assigned to this species. The specimens identified by several authors as *Engraulis olidus* Günther (generally without giving a description), which Hubbs and Marini wrongly regarded as a *nomen nudum*, may very well be that common local species.

Range.—Known from the type material from the Mar del Plata, Argentina. Abundant along the coast of the Province of Buenos Aires, according to Hubbs and Marini (*loc. cit.*). It is the only species of its genus known from the Atlantic coast of the Americas.

***Engraulis clarki* n. sp. (Fig. 5)**

Head 3.9, 3.8; depth 4.0, 4.0; D. 13, 14; A. 20, 21; P. 16, 16; scales partly lost, 41, 38; vertebrae 41 (only the paratype dissected).

Body quite robust, not strongly compressed, its greatest thickness exceeding depth of caudal peduncle; chest and abdomen not carinate; ventral outline scarcely more strongly convex than the dorsal; head quite short, its depth at joint of mandible equal to postorbital part of head and two-thirds eye; snout moderately pointed, projecting about two-thirds its length beyond tip of lower jaw, 6.6, 6.4 in head; eye 3.6, 3.8; maxillary quite long and pointed, reaching nearly to margin of opercle, 1.2, 1.3 in head; cheek rather short and broad, scarcely longer than eye, its posterior angle about 45°; postorbital part of head rather short, 7.1, 7.3 in length; mandible 6.1, 6.1; gill rakers scarcely as long as eye, 24 + 26, 24 + 26 on first arch; dorsal fin small, low, with concave margin, the longest rays failing to reach tip of last one if deflexed, its origin about equidistant from base of caudal and tip of snout; anal small, its origin about under base of last ray of dorsal, slightly nearer base of caudal than base of pectorals, its base 4.9, 4.9 in length; ventral scarcely reaching half way to origin of anal, inserted slightly nearer base of pectoral than origin of anal and about an eye's diameter in advance of dorsal; pectoral rather short, failing to reach base of ventral by about half the diameter of eye, 1.5, 1.6 in head, 6.15, 6.25 in length; axillary scale of pectoral only a little shorter than the fin, 1.8, 1.9 in head.

Color of preserved specimens grayish above, median section of back darker; sides of head and lower parts of sides pale silvery; a dark (probably silvery in life) lateral band present, nearly as broad as eye; caudal fin dusky, the lobes distally nearly black.

This species is named in honor of Dr. Herbert C. Clark, director of the Gorgas Memorial Laboratory, Panama City, who made possible the expedition, on which these specimens and many others were collected. It is placed in this genus principally because of the comparatively thick, rounded body, and the small anal which is inserted posteriorly. In the number of gill rakers and vertebrae it overlaps with some species of *Anchoa*. The maxillary is longer and more pointed than in the other species of *Engraulis* studied. The teeth are exceedingly small.

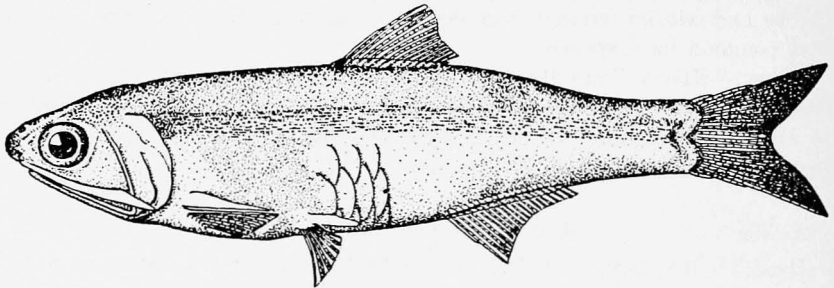


Fig. 5. *Engraulis clarki* n. sp. From the type, 108 mm. long, Balboa, C. Z. (U. S. N. M., No. 119797). (Drawing by Mrs. Alice C. Mullen.)

Range.—Known from only two specimens from Balboa, C. Z., the type (U. S. N. M., No. 119797) which is 108 mm. long, 86 mm. to the base of the caudal, and the paratype, 110 mm. long, 88 mm. to the base of the caudal, both taken under an electric light. The proportions and enumerations given first in the description pertain to the type.

Genus **ANCHOVIA** Jordan & Evermann

Anchovia Jordan & Evermann, 1896, 449 (type *Engraulis macrolepidotus*).

Body deep, compressed; chest and abdomen moderately carinate; gill rakers very numerous, close-set, increasing in number with the age and growth of the fish, about 40 on lower limb of first arch in young to about 130 (in some species) in adults; teeth small (not disappearing with age as has been stated); scales firm, rather adherent; vertebrae 41 to 43; origin of anal somewhere under anterior two-thirds of base of dorsal.

An increase in the number of gill rakers with age and growth already has been noted for some of the Clupeidae, as in the shad, *Alosa sapidissima* and

the alewives, *Pomololus aestivalis* and *P. pseudoharengus* (see Hildebrand & Schroeder, 1928, 82 to 93). Among the American anchovies a somewhat similar increase among the species that early in life already have a comparatively large number of gill rakers seems to take place.

KEY TO THE SPECIES

- a. Origin of anal under or posterior to vertical from middle of base of dorsal; cheek very long, exceeding length of snout and eye, except in very young; ventral fin inserted much nearer vertical from origin of dorsal than base of pectoral.
- b. Postorbital part of head rather long, 4.3 to 5.0 in length; eye small, 4.0 to 4.6 in head; snout short, 9.0 to 10.5 in head; maximum length attained about 190 mm.
- c. Body deep, depth 2.6 to 2.9 in length in specimens 175 to 185 mm. long; gill rakers very numerous, 95 to 100 + 120 to 135 in large specimens. fewer in young; pectoral generally reaching base of ventral, 5.2 to 6.0 in length; origin of anal under middle of base of dorsal. *macrolepidota*, p. 21
- cc. Body more elongate, depth 3.2 in length in specimens 185 mm. long; gill rakers less numerous, 80 to 83 + 97 or 98 in large specimens; pectoral shorter, failing to reach base of ventral approximately by diameter of eye, 6.5 to 7.0 in length; origin of anal distinctly posterior to middle of base of dorsal. *magdalenae* n. sp., p. 23
- bb. Postorbital part of head shorter, 5.2 to 6.2 in length; eye larger, 3.6 to 4.1 in head; snout longer, 6.8 to 8.0 in head; body not especially deep, depth 3.25 to 4.5 in length; origin of anal under middle of dorsal, with 27 to 31 rays; sides with a distinct silvery band; maximum length attained about 110 mm.
rastralis, p. 25
- aa. Origin of anal well in advance of middle of base of dorsal, the fin with 31 to 34 rays; cheek moderately short, not exceeding length of snout and eye; ventral fin inserted about equidistant from base of pectoral and vertical from origin of dorsal; body fairly slender, depth 3.3 to 3.7 in length; postorbital part of head moderately short, 5.4 to 6.4 in length; maximum length attained about 200 mm. *clupeoides*, p. 27

TABLE 3.—FREQUENCY DISTRIBUTION OF ANAL RAYS IN *Anchovia*

Species	Number of anal rays									
	27	28	29	30	31	32	33	34	35	
<i>macrolepidota</i>	1	2	3	4	4	4	1			
<i>magdalenae</i> . . . . .	.	.	1	.	.	1	.	.	.
<i>rastralis</i>	2	6	12	15	8	.	.	.	.
<i>clupeoides</i> . . . . .	.	.	.	1	6	9	11	7	1

***Anchovia macrolepidota* (Kner & Steindachner) (Fig. 6)**

Engraulis macrolepidotus Kner & Steindachner, 1865, 21, Pl. III, fig. 2, Rio Bayano, Panama.

Anchovia macrolepidota Jordan & Evermann, 1896, 449; Gilbert & Starks, 1904, 47; Meek and Hildebrand, 1923, 210.*

Head 2.9 to 3.25; depth 2.6 to 4.0; D. 14 or 15; A. 27 to 33; P. 14 or 15; scales partly lost, about 40 to 43; vertebrae 41 or 42 (3 specimens dissected).

Body deep, strongly compressed, the depth rather variable, increasing proportionately with age; chest and abdomen scarcely carinate; head short; snout very short, scarcely half as long as eye, projecting fully two-thirds its length beyond tip of mandible, 9.0 to 10.5 in head; eye 4.0 to 4.6; maxillary

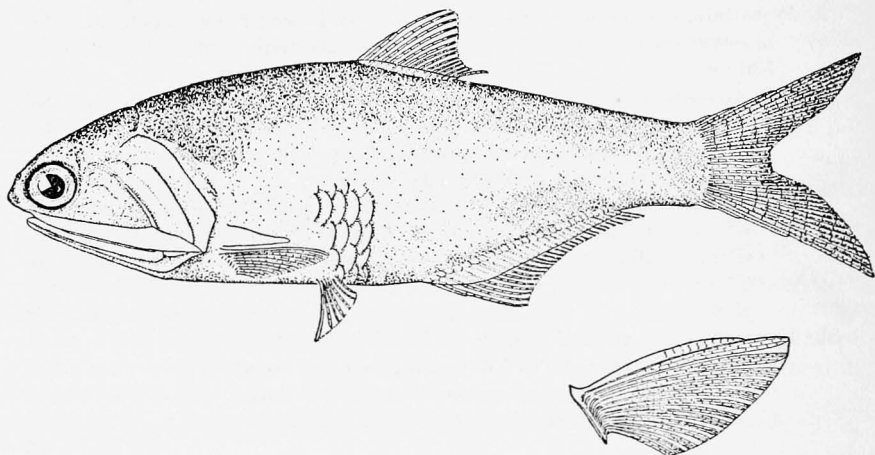


Fig. 6.—*Anchovia macrolepidota*. From a specimen 185 mm. long, Panama City (U. S. N. M., No. 79590). Insert, pectoral fin enlarged. (Drawing by Mrs. Alice C. Mullen.)

long and pointed, variable in length, sometimes reaching nearly or quite to margin of opercle, 1.2 to 1.35 in head; cheek long, somewhat longer than snout and eye, its posterior angle acute, about 40° ; postorbital part of head long in proportion to the rest of the head, 4.3 to 5.0 in length; mandible 4.5 to 4.9; gill rakers very fine, close-set, difficult to enumerate (though generally the roots may be rather accurately counted), those at angle somewhat longer than eye, increasing in number with age, 58 to $100 + 68$ to 135 ($58 + 68$ in a specimen 55 mm. long, $95 + 138$ in one 185 mm. long) on first arch; dorsal fin rather small, with concave margin, the longest rays failing to reach tip of last one if deflexed, its origin somewhat nearer base of caudal than tip of snout; caudal deeply forked, both lobes acute, the

* Fowler (1939, 2) described a specimen under this name from Guayaquil, Ecuador. However, according to the small number of gill rakers given, namely, $75 + 100$, for a 160-mm. specimen, it would seem to belong elsewhere, possibly to *E. magdalenae*, herein described as a new species.

lower one slightly longer than the upper; anal fin long, its origin under middle of base of dorsal, about equidistant from joint of mandible and base of caudal, its base generally equal to length of head, 3.1 to 3.5 in length; ventral rather small, reaching fully half way to origin of anal, inserted equidistant from base of pectoral and origin of anal or a little nearer the latter; pectoral much longer, reaching nearly or quite to base of ventral and occasionally beyond this point, 1.7 to 2.0 in head, 5.2 to 6.0 in length; axillary scale of pectoral very broad at base, rather abruptly pointed, about half as long as the longest rays of fin, 2.9 to 3.3 in head.

Color bluish green above, shading into silvery somewhat above middle of side; no indication of a silvery lateral band, except in the smallest specimen (55 mm. long) at hand; fins unmarked except for dark posterior margin of caudal.

Twenty-one specimens, 55 to 187 mm. long, are available for study. The proportions and enumerations given in the description are based on all of these fish, unless otherwise stated. The depth, though variable, evidently increases with age, being contained 2.6 to 2.9 in specimens 175 to 185 mm. long, whereas it is contained 3.3 to 3.5 in specimens around 100 mm. in length, and 4.0 times in a specimen 55 mm. long. The gill rakers become more numerous with age, as the number on the first arch in specimens 175 to 185 mm. long ranges from 95 to 100 + 120 to 135, in fish 97 to 120 mm. in length from 75 to 88 + 96 to 106, and 58 + 68 in one 55 mm. long.

This species is rather close to *A. rastralis*, from which it differs principally in the deeper body, longer head, larger eye, shorter snout, and rather prominently in the greater development of the opercular bones, making the post-orbital part of the head notably longer. This species, also, appears to reach a much larger size.

Range.—Gulf of California (Guaymas, Mexico) to Ecuador (Guayaquil). Once erroneously recorded from the Atlantic coast of Panama (Fowler, 1917, 130).

***Anchovia magdalenae* n. sp. (Fig. 7)**

Head 3.3, 3.4; depth 3.2, 3.2; D. 15, 15; A. 29, 32; P. 14, 14; scales partly lost, about 43, 48; vertebrae in type 43.

Body moderately elongate, compressed, its greatest thickness less than depth of caudal peduncle; chest and abdomen scarcely carinate; head moderately short; snout very short, scarcely half as long as eye, projecting about two-thirds its length beyond tip of mandible, 9.0, 10.5 in head; eye 4.3, 4.3; maxillary reaching a little beyond joint of mandible, but not to preopercular margin, rather abruptly pointed, 1.3, 1.3 in head; cheek long and narrow, exceeding length of snout and eye, its posterior angle about 40°; opercle long, its upperposterior margin oblique, ending in membranous point just above

base of pectoral; postorbital part of head, 4.9, 4.9 in length; mandible 5.0, 5.1; gill rakers very slender, close-set, about as long as eye, 83 + 98, 80 + 97 on first arch; scales deeper than long with crenulate margins, small scales on caudal fin, and a broad sheath at base of dorsal and anal, covering nearly the entire anal fin; dorsal fin moderately small, with concave margin, the last ray considerably produced, extending well beyond the tips of the other rays, origin of fin rather nearer anterior margin of eye than base of caudal; caudal damaged, apparently moderately deeply forked, exact shape undeterminable; anal rather long and low, origin distinctly behind middle

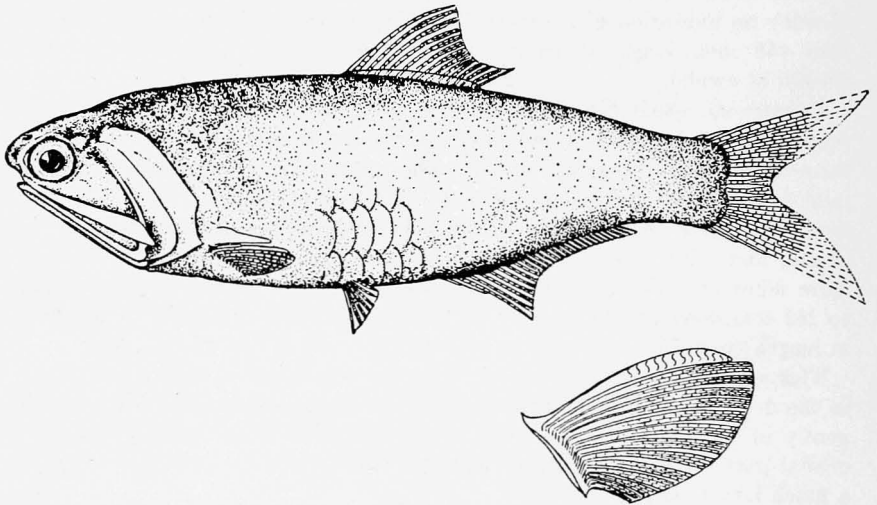


Fig. 7.—*Anchovia magdalenae* n. sp. From the type, 148 mm. long, Magdalena Bay, Lower Cal. (U. S. N. M., No. 119791). Insert, pectoral fin enlarged. (Drawing by Mrs. Alice C. Mullen.)

of base of dorsal and scarcely nearer base of pectoral than base of caudal, its base a little shorter than head, 3.6, 3.8 in length; ventral small, failing to reach half way to origin of anal, inserted only a little nearer origin of anal than base of pectoral; pectoral short, failing to reach base of ventral by diameter of eye, 2.0, 1.9 in head, 7.0, 6.5 in length; axillary scale of pectoral rather broad at base, distally pointed, about two-thirds as long as fin, 3.2, 3.5 in head.

Color of old preserved specimens brownish above; sides of head, and lower three-fourths of body silvery.

The two specimens on which this species is based differ from *A. macrolepidota* in the smaller number of gill rakers. The body also seems to be rather more elongate, the pectoral and ventral fins are proportionately

shorter than in any of the 17 specimens of *A. macrolepidota* at hand, and the origin of the anal is farther back under the base of the dorsal.

Range.—Known from two specimens from Magdalena Bay, Lower California. The specimen selected as type (U. S. N. M., No. 119791) has a length to base of caudal fin of 146 mm., and a total length of about 185 mm., and the paratype 148 mm. to base of caudal and total length of about 188 mm. (caudal damaged in both specimens). The proportions and enumerations given first in the description pertain to the type.

Anchovia rastralis (Gilbert & Pierson) (Fig. 8)

Stolephorus rastralis Gilbert & Pierson, in Jordan & Evermann, 1898, 2811, Panama Bay.

Anchovia rastralis Gilbert & Starks, 1904, 42, Pl. VIII, fig. 14; Meek & Hildebrand, 1923, 209.

Stolephorus branchiomelas Eigenmann, 1917, 682, Mouth of Rio Dagua, Colombia; and 1922, 179, Pl. 28, fig. 1.

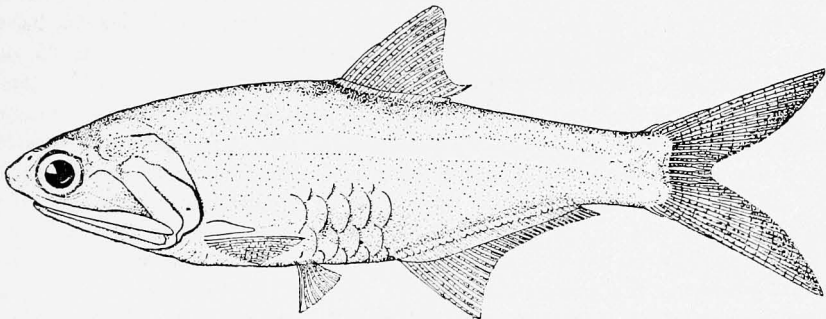


Fig. 8.—*Anchovia rastralis*. From a specimen 90 mm. long, Miraflores Locks, C. Z. (Drawing by Mrs. Alice C. Mullen.)

Head 3.2 to 3.5; depth 3.25 to 4.5; D. 14 to 16; A. 27 to 31; P. 12 to 14; scales about 40 to 45; vertebrae 41 or 42 (6 specimens dissected).

Body strongly compressed; ventral outline more strongly convex than the dorsal; depth increasing with age and growth, about 4.5 in length at 50 mm., 3.25 at 105 mm.; head moderately short; snout about half as long as eye, projecting about two-thirds its length beyond tip of mandible, 6.8 to 8.0 in head; eye 3.6 to 4.1; maxillary moderately long, rather gently pointed, reaching well beyond joint of mandible, but not to margin of opercle, 1.2 to 1.4 in head; cheek quite long and narrow, exceeding length of eye and snout in adults, its posterior angle about 35°; postorbital part of head only moderately long, 5.2 to 6.2 in length; mandible 4.5 to 5.25; gill rakers nearly as long as eye, very close-set, difficult to enumerate, increasing in num-

ber with age, about 28 + 48 on first arch in specimens 35 mm. long, about 45 + 68 in specimens 55 mm. long, and about 75 + 100 in 100-mm. specimens; dorsal fin with concave margin, the longest rays generally failing to reach tip of posterior one if deflexed, its origin usually equidistant from tip of snout and base of caudal, though occasionally equidistant from anterior margin of eye and base of caudal; anal fin moderately long, its origin about under middle of base of dorsal, its base generally as long as head, 3.3 to 3.8 in length; ventral rather small, reaching about half way to origin of anal, inserted nearly equidistant from base of pectoral and origin of anal; pectoral much larger, usually reaching base of ventral 1.6 to 1.9 in head, 5.6 to 6.5 in length; axillary scale of pectoral generally slightly exceeding half the length of longest rays of the fin, 3.4 to 3.8 in head.

Color olivaceous above, lower half or so of head and sides silvery; silvery lateral band (dark in formalin specimens) somewhat wider than pupil, remaining distinct in specimens 110 mm. long; median line of back with a dark streak; tips of caudal lobes dusky.

Numerous specimens from the Pacific Coast of Colombia and Panama, and from Triunfo, El Salvador, ranging from 35 to 110 mm. in length, have been examined. The proportions and enumerations are based on 25 or more specimens, including 2 paratypes, and 2 paratypes of *S. branchiomelas*.

This species is close to *A. clupeioides*, from which it differs in several minor details. Comparing specimens of about equal size, such as are available from the opposite coasts of Panama, ranging in length from 90 to 110 mm., *A. rastralis* seems to be a little deeper, as in 14 specimens measured the depth is contained in the length 3.25 to 3.6 times, whereas in 59 specimens of *A. clupeioides* the depth is contained 3.7 to 4.0 times in the length. In the same specimens the postorbital part of the head is contained 5.2 to 6.2 times in the length in *rastralis*, and 4.3 to 5.0 in *clupeioides*. The anal rays are fewer in *rastralis*, as in 43 specimens the distribution is 2 with 27 rays, 6 with 28, 12 with 29, 15 with 30, and 8 with 31 rays. In 31 specimens of *clupeioides* the distribution is 1 with 30 rays, 6 with 31, 9 with 32, 11 with 33, 7 with 34, and 1 with 35 rays. Therefore, overlapping occurs only at 30 and 31 in the specimens examined (see table 3). The anal base also is a little shorter in *rastralis*, with little overlapping, and the origin apparently always is under the middle of the base of dorsal, instead of in advance of that point as in *clupeioides*. The dorsal fin has a slightly higher average number of rays in *rastralis*, as in 28 specimens 4 have 14 rays, 19 have 15 and 5 have 16 rays, whereas in 29 specimens of *clupeioides* 2 have 13 rays, 14 have 14 and 12 have 15 rays. This fin usually is slightly more anteriorly inserted in *rastralis* as it generally is about equidistant from tip of snout and base of caudal. Although the distal free part of the maxillary usually is more gently pointed and rather longer than in *clupeioides*, there is so much

variation that this character has little diagnostic value. According to specimens in hand, *A. clupeioides* reaches a much larger size.

Range.—Known from the Pacific coasts of Colombia, Panama, and El Salvador.

***Anchovia clupeioides* (Swainson) (Fig. 9)**

Engraulis clupeioides Swainson, 1839, 388, Pernambuco, Brazil.

Engraulis productus Poey, 1866, 380, Cuba.

Engraulis surinamensis Steindachner (not of Bleeker), 1879, 55, Bahia, Brazil. (Steindachner has stated that the maxillary is pointed, that the anal has 30 rays, and that its origin is anterior to middle of base of dorsal. In all these respects the description of *surinamensis* by Steindachner agrees with *clupeioides*, as here understood, and is in disagreement with the original description of *surinamensis*, which states that the maxillary is truncate, that the anal has 26 or 27 rays, and that its origin is under the posterior rays of the dorsal.)

Anchovia macrolepidota Fowler (not of Kner & Steindachner), 1917, 130.

(I have examined two specimens from Colon, Panama, identified as *macrolepidota* by Fowler, and find them to be large *clupeioides*.)

Anchovia producta Hildebrand & Meek, 1923, 210.

Anchovia clupeioides Jordan & Seale, 1926, 412.

Anchovia nattereri Jordan & Seale, 1926, 413. (The specimens upon which this record is based, which I have examined, are not in good condition, and quite certainly are not *nattereri* of Steindachner, but more probably *clupeioides* of Swainson.)

Head 3.2 to 3.6; depth 3.2 to 4.0 (about 4.5 in specimens 50 mm. long); D. 13 to 15; A. 31 to 34 (occasionally 30 or 35); P. 13 or 14; scales about 39 to 43; vertebrae 42 or 43 (6 specimens dissected).

Body quite strongly compressed, its ventral outline more strongly convex than the dorsal, depth increasing with age; head moderately short, its depth at joint of mandible equal to its length without snout in large examples; snout notably shorter than eye, projecting about half its length beyond tip of mandible, 6.0 to 8.0 in head; eye 3.5 to 4.5; maxillary reaching to or a little beyond joint of mandible, rather abruptly pointed, 1.3 to 1.5 in head; teeth in jaws and on roof of mouth minute; cheek moderately long, equal to snout and eye in large specimens, proportionately shorter in small ones, its posterior angle about 40°; postorbital part of head rather long, 5.4 to 6.5 in length; mandible 5.0 to 5.9; gill rakers fully as long as eye in large specimens, shorter in small ones, increasing in number with age, about 35 + 40 in specimens 50 mm. long, about 75 + 110 in specimens 130 mm. in length, on first arch; dorsal fin with slightly concave margin, the longest rays often reaching beyond the tip of the posterior one if deflexed, almost entirely enclosed in a scaly sheath, its origin about equidistant

from anterior margin to middle of eye and base of caudal; anal fin long, with a scaly sheath extending nearly to its margin, its origin about under beginning of second third of base of dorsal, its base a little longer than head, 3.0 to 3.3 in length; ventral small, reaching only about half way to anal, inserted about equidistant from base of pectoral and origin of anal; pectoral large reaching to or beyond base of ventral in small specimens, not quite to ventral in large ones, 1.7 to 1.9 in head, 5.8 to 6.5 in length; axillary scale of pectoral short and broad, about half as long as pectoral, 3.0 to 3.9 in head.

Color of preserved specimens pale; sides of head and lower three-fourths of body silvery; a narrow silvery lateral band present in young, becoming diffuse in specimens about 100 mm. long, disappearing completely with age.

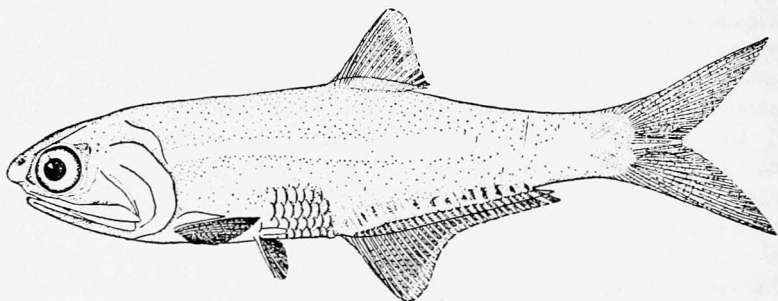


Fig. 9.—*Anchovia clupeioides*. From a specimen 60 mm. long, Gulf of Venezuela. (Drawing by Miss Louella E. Cable.)

Back with a dark streak (missing in some specimens, probably having faded).

Many specimens from Puerto Rico, Jamaica, Cuba, Atlantic coast of Panama, Venezuela and Brazil, ranging in length from 50 to 205 mm., have been examined. The proportions and enumerations used are based on 29 or more specimens.

This species resembles *Cetengraulis edentulus* in general appearance. The gill membranes are almost entirely free from each other, however; the postorbital part of the head is shorter; the lower jaw projects farther forward; the maxillary is longer and more pointed; and the anal fin is longer, with its origin farther forward in relation to the base of the dorsal. Its nearest relative is *A. rastralis* of the Pacific coast, from which it differs in the slightly longer anal, which also is inserted a little farther forward with respect to the base of the dorsal; the origin of the dorsal is scarcely as far forward; and the body is somewhat more slender, a difference evident only if specimens of equal size are compared. Usually the maxillary is a little shorter and tapers more abruptly. All these differences are average ones, as shown in the account of *A. rastralis*. *A. clupeioides* seems to reach a

larger size, a length of 300 mm. having been reported. I know of no specimens of *A. australis* exceeding 110 mm.

Range.—West Indies, and Panama to Brazil, to or beyond Recife. A specimen about 115 mm. long (caudal damaged), standard length 98 mm. (C. A. S., No. 9398), from Lake Rogogagua, Bolivia, in the upper part of the Amazon Basin, also seems to belong here.

Genus ANCHOA Jordan & Evermann

Anchoa Jordan & Evermann, 1927, 501 (type *Engraulis compressus* Girard).

Body usually quite elongate, moderately to strongly compressed, maxillary long, reaching to or more usually beyond joint of lower jaw, frequently nearly or quite to margin of opercle, always more or less pointed; gill rakers not very numerous, seldom more than 30 on lower limb of first arch, not increasing in number with the age and the growth of the fish; vertebrae about 38 to 44, rarely 45 or 46; origin of anal usually somewhere under the base of the dorsal, occasionally behind it; ventral generally inserted well in advance of dorsal, but always nearer dorsal than base of pectoral.

The complete original generic description reads as follows: "Distinguished from *Anchoviella* by a much greater number of gill rakers, there being 35 to 50, while in *Anchoviella* there are only 25 to 40; anal rays 30 or more; body deeper. These characters indicate a transition toward *Anchovia*." The characters offered are scarcely distinctive. The number of gill rakers stated is not understood. If only those on the lower limb of the first arch were considered the range given is much too high. If the total number was meant it is rather too low. The number of anal rays given is correct for the type selected, but most of the species included in the genus as herein redefined have fewer than 30 anal rays. Neither do many of the species have as deep a body as the type.

The genus, as here understood, differs from *Anchoviella* principally in having a longer maxillary, which is more or less sharply pointed distally, not rounded nor square. From *Anchovia* it differs chiefly in having fewer gill rakers, the number not increasing with age and growth of the fish. From *Engraulis* it differs in having a more compressed body, and usually in possessing fewer vertebrae.

Some of the species enter brackish to virtually fresh water, but none is known to run far up stream.

KEY TO THE SPECIES

- A. Anal fin long, usually with 30 to 40 rays (sometimes only 29 in *compressa* and *munduoloides*), its base 2.6 to 3.3 in length (4.0 in *duodecim*); dorsal fin high anteriorly, the longest rays reaching beyond tip of last ray if deflexed.
- B. Origin of anal under or in advance of middle of base of dorsal.

- C. Origin of dorsal at least an eye's diameter nearer tip of snout than base of caudal; anal very long, with 35 to 40 rays, its origin about under middle of base of dorsal; eye very small, 4.2 to 5.0 in head. *spinifer*, p. 38
- CC. Origin of dorsal nearer base of caudal than tip of snout; anal usually shorter, with 29 to 35 rays (occasionally 36 or 37 in *panamensis*); eye larger, 3.0 to 3.8 in head.
- D. Sides with a broad silvery band, often nearly as wide as eye, becoming diffuse ventrally in large specimens; maxillary bluntly pointed, extending to or only slightly beyond joint of mandible.
- E. Gill rakers 19 to 22 + 24 to 27. *compressa*, p. 39
- EE. Gill rakers 16 to 18 + 19 to 22. *schultzi*, n. sp., p. 41
- DD. Sides with a narrow silvery band, about width of pupil (sometimes missing in specimens preserved in formalin); maxillary more sharply pointed, longer, reaching far beyond joint of mandible, usually nearly to margin of opercle.
- F. Origin of anal usually under origin of dorsal; pectoral long, extending well beyond base of ventral; cheek rather broad, about as long as eye and half the snout. *panamensis*, p. 42
- FF. Origin of anal well behind origin of dorsal; pectoral shorter, not extending beyond base of ventral; cheek longer, narrower, usually as long as eye and snout. *mundeoloides*, p. 45
- BB. Origin of anal well behind entire base of dorsal; origin of dorsal nearly an eye's diameter nearer tip of snout than base of caudal; gill rakers 14 or 15 + 20. *duodecim*, p. 46
- AA. Anal fin shorter, with 17 to 30 rays, its base 3.4 to 7.0 in length (3.0 to 3.4 in *trinitatis*).
- G. Gill rakers few, usually 9 to 14 + 12 to 18 (occasionally 15 on upper limb in *cayorum*, and sometimes 19 and rarely 20 on lower limb in *pectoralis*).
- H. Gill rakers very few, 9 or 10 + 12 to 14; teeth in jaws slightly enlarged.
- I. Anal long, with 27 to 30 rays, its base 3.25 to 3.5 in length, its origin usually under base of fourth or fifth ray of dorsal; vertebrae 42 or 43
eigenmannia, p. 47
- II. Anal shorter, with 24 to 26 rays, its base 3.9 to 4.25 in length, its origin under or slightly in advance of middle of base of dorsal; vertebrae 44
schofieldi, p. 49
- HH. Gill rakers somewhat more numerous, 12 to 15 + 15 to 20; teeth in jaws minute.
- J. Pectoral with 12 or 13 rays; axillary scale of pectoral reaching opposite about midlength of fin, 3.0 to 3.5 in head; origin of anal notably anterior to middle of base of dorsal. *cayorum*, p. 50
- JJ. Pectoral with 15 to 17 rays; axillary scale of pectoral longer, reaching well beyond midlength of fin, 2.5 in head; origin of anal under middle of base of dorsal. *pectoralis*, n. sp., p. 52
- GG. Gill rakers more numerous, usually 14 to 25 + 18 to 33 (rarely 13 on upper limb in *lamprotaenia*, and sometimes 16 or 17 on lower limb in *lamprotaenia*, *arenicola* and *ischana*).
- K. Uppermost ray of pectoral not greatly produced, not filamentous (rarely

with a slight filament in *lamprotaenia*); origin of dorsal usually nearer base of caudal than tip of snout (very rarely nearly equidistant).

- L. Anal usually with 17 to 23 rays (rarely 24 or 25 in *parva*, *januaria* and *helleri*; sometimes 24 or 25, and rarely 26 in *lamprotaenia*).
- M. Gill rakers on lower limb usually 16 to 22 (rarely 23 in *hepsetus hepsetus*, and sometimes 25 and rarely 26 in *lyolepis*), upper limb with 13 to 21, usually 14 to 20.
- N. Origin of anal under or rarely in advance of middle of base of dorsal, often somewhat behind middle; cheek short and broad, usually not much longer than eye.
- O. Body slender, depth 5.0 to 5.75 in length; maxillary short, extending only to joint of mandible; not sharply pointed, 1.3 to 1.5 in head.
- P. Anal with 25 rays, its origin far in advance of middle of base of dorsal; postorbital part of head short, 8.1 in length
chamensis, n. sp., p. 54
- PP. Anal with 18 to 22 rays, its origin usually slightly posterior to middle of base of dorsal; postorbital part of head longer, 6.3 to 6.9 in length; vertebrae 44 or 45
ginsburgi, n. sp., p. 55
- OO. Body deeper, its depth in adults about 4.5 to 5.0 in length; maxillary much longer, extending far beyond joint of mandible, nearly or quite to margin of opercle, usually sharply pointed, 1.15 to 1.3 in head, vertebrae 40 to 44. *hepsetus*
- Q. Pectoral of moderate length, often failing to reach base of ventral by diameter of eye; silvery lateral band usually three fourths width of eye. *hepsetus hepsetus*, p. 57
- QQ. Pectoral generally longer and more falcate, frequently extending nearly or quite to base of ventral; silvery lateral band usually narrower, sometimes scarcely wider than pupil
hepsetus colonensis, n. subsp., p. 60
- NN. Origin of anal far behind middle of base of dorsal, somewhere under its posterior third, and rarely behind base of dorsal; cheek usually longer, and narrower, generally notably longer than eye.
- R. Anal rather long, usually with 20 to 25 rays, its base 4.25 to 5.0 (sometimes 5.3 in *lyolepis*) in length; dorsal fin moderately high anteriorly, the longest rays generally extending to or beyond tip of last ray if deflexed; vertebrae 39 to 43.
- S. Body moderately deep, depth 4.3 to 5.0 in length in adults; head moderately deep, its depth at joint of mandible exceeding postorbital length; snout always notably shorter than eye.
- T. Dorsal with 13 to 15 rays; origin of anal well in advance of base of last ray of dorsal; axillary scale of pectoral short and broad, generally extending scarcely beyond midlength of fin, 3.0 to 3.6 in head; silvery lateral band scarcely as wide as eye. *lamprotaenia*, n. sp., p. 62

- TT. Dorsal with 16 rays; origin of anal about under last ray of dorsal; axillary scale of pectoral long and narrow, extending opposite distal fourth of fin, 2.7 to 2.9 in head; silvery lateral band wider than eye. *helleri*, p. 64
- SS. Body quite elongate, depth 5.0 to 6.0 in length; head long and low, its depth at joint of mandible about equal to its post-orbital length; snout scarcely shorter than eye; origin of anal under or slightly behind base of last ray of dorsal; silvery lateral band fully as wide as eye. *lyolepis*, p. 65
- RR. Anal shorter, with 17 to 20 rays, its base 5.1 to 7.0 in length; dorsal lower anteriorly, the longest rays failing to extend to tip of last ray if deflexed; vertebrae 44 to 46; axillary scale of pectoral nearly as long as fin.
- U. Body moderately slender, its depth 5.25 to 6.25 in length; eye small, 3.6 to 6.25 in head; cheek as long as eye and three-fourths snout; silvery lateral band about as wide as eye; length attained about 80 mm. *isohana*, p. 67
- UU. Body more slender, its depth 5.5 to 7.0 in length; eye larger, 3.5 to 4.2 in head; cheek shorter, about as long as eye and one-third snout; silvery lateral band narrower, about three-fourths width of eye; length attained about 125 mm.
arenicola, p. 68
- MM. Gill rakers generally more numerous, 22 to 33 on lower limb, and 17 to 23 on upper limb (unknown in *cultrata*).
- V. Origin of anal generally under posterior third of base of dorsal, occasionally entirely behind base of dorsal; pectoral long, generally failing to reach base of ventral by a distance not exceeding diameter of pupil (not checked in *cultrata*).
- W. Origin of anal posterior to base of dorsal; snout very long, extending beyond tip of mandible a distance nearly equal to diameter of eye; maxillary long, pointed, extending nearly to margin of opercle; body rather deep, its depth 4.17 in length
cultrata, p. 70
- WW. Origin of anal somewhere under posterior third or so of base of dorsal; snout shorter, extending only about half an eye's diameter beyond tip of mandible, its length 4.7 to 6.5 in head.
- X. Cheek long and narrow, as long as eye and fully three-fourths snout, with acute posterior angle of about 30°; axillary scale of pectoral scarcely more than half length of fin, 3.0 to 4.0 in head; anal with 22 to 24 rays; pectoral with 12 to 14 rays. *choerostoma*, p. 71
- XX. Cheek short and broad, scarcely longer than eye, its posterior angle broader, about 45° to 55°; axillary scale of pectoral long, about three-fourths length of fin, 1.9 to 2.7 in head; anal usually with 18 to 22 rays.
- Y. Maxillary long, sharply pointed, its upper free margin nearly straight, extending nearly to margin of opercle, 1.25 to 1.35 in head; origin of dorsal usually scarcely nearer

- base of caudal than tip of snout; anal with 20 to 23 rays; pectoral usually with 15 or 16 rays; gill rakers usually 21 to 23 + 25 to 27..... *starksi*, p. 72
- YY. Maxillary shorter, not sharply pointed, its upper free margin rounded, extending to or slightly beyond joint of mandible, 1.3 to 1.4 in head; origin of dorsal about equidistant from base of caudal and middle of eye; anal with 18 to 22 rays; pectoral with 13 to 15 rays; gill rakers 18 to 22 + 24 to 28
tricolor, p. 74
- VV. Origin of anal about under middle of dorsal (sometimes behind middle in *januaria*); pectoral shorter, often failing to reach base of ventral by a distance nearly or quite equal to diameter of eye.
- Z. Body very slender, its depth 5.3 to 6.7 in length; base of anal rather short, 4.5 to 5.7 in length; vertebrae 42 to 45; head rather long and low, its depth at joint of mandible shorter than its length without snout.
- a. Gill rakers numerous, very fine, close-set, usually 25 to 30 (sometimes as few as 23 and as many as 33) on lower limb; anal with 20 to 24 rays; silvery lateral band only about as wide as pupil..... *cubana*, p. 76
- aa. Gill rakers usually fewer, coarser, not especially close-set, 23 to 25 (rarely 26) on lower limb; anal with 19 to 22 rays; silvery lateral band wider than pupil.
- b. Gill rakers 19 to 22 + 22 to 26, most frequently 20 or 21 + 24, total number 42 to 47, most frequently 45; pectoral with 13 to 15, usually 14 rays..... *exigua*, p. 78
- bb. Gill rakers 17 to 20 + 22 to 25, most frequently 17 to 19 + 23 or 24, total number 40 to 45, most frequently 40 or 42; pectoral with 12 to 14, usually 13 rays. *tropica*, n. sp., p. 80
- ZZ. Body notably deeper, its depth in adults about 4.5 to 5.0 in length; base of anal longer, 3.8 to 4.8 in length; vertebrae 38 to 42; head deeper, its depth at joint of mandible equal to its length without snout.
- c. Maxillary short, bluntly pointed, extending to or only slightly beyond joint of mandible, 1.3 to 1.5 in head; gill rakers 21 to 23 + 23 to 26..... *januaria*, p. 81
- cc. Maxillary long, sharply pointed, extending nearly to margin of opercle, 1.2 to 1.35 in head; gill rakers 18 to 20 + 23 to 27
parva, p. 83
- LL. Anal longer, with 23 to 30 (sometimes 22 in *curta*, *marinii* and *naso*) rays.
- d. Head rather short, usually 3.8 to 4.5 (occasionally only 3.6 in *lucida*) in length; eye large, 2.9 to 4.1 in head; postorbital part of head short, 7.5 to 10 in length; cheek short and broad, usually scarcely longer than eye (about as long as eye and half snout in *trinitatis*).
- e. Gill rakers 15 to 20 + 18 to 26, usually 16 to 19 + 19 to 25.
- f. Anal base not especially long, 3.4 to 4.7 in length; axillary scale of pectoral rather long and slender, extending beyond midlength

- of fin, 2.0 to 3.0 in head; cheek short and broad, equal to or scarcely longer than eye.
- g. Head short and deep, its depth at mandible usually equal to its length without snout; maxillary long and pointed, usually extending nearly to margin of opercle; origin of anal in advance of middle of base of dorsal (sometimes under middle in *curta*).
- h. Anal rather short, its base 4.0 to 4.7 in length, usually with 22 to 25 (rarely 21 or 26) rays; pectoral with 12 or 13 rays; origin of anal under or slightly in advance of middle of base of dorsal; dorsal rather high, the longest rays extending to or a little beyond tip of last one if deflexed
curta, p. 85
- hh. Anal longer, its base usually 3.3 to 3.8 in length, generally with 25 to 29 (occasionally with 24 or 30) rays; pectoral with 11 or 12 rays; origin of anal under anterior third of dorsal; dorsal low, its longest rays failing to reach tip of last one if deflexed.
mitchilli
- i. Body rather elongate, not very strongly compressed, its greatest thickness usually exceeding depth of caudal peduncle, depth 4.0 to 6.3 in length; pectoral rather short, often failing to reach base of ventral by diameter of eye, 5.5 to 8.3 in length; vertebrae 39 to 44, most frequently 42. *mitchilli mitchilli*, p. 87
- ii. Body usually deeper and more strongly compressed, its greatest thickness often less than depth of caudal peduncle, depth 3.75 to 5.5 in length; pectoral usually longer, often extending nearly or quite to base of ventral, 5.0 to 7.7 in length; vertebrae 38 to 42, most frequently 40. *mitchilli diaphana* subsp. n., p. 91
- gg. Head longer and lower, its depth at joint of mandible shorter than its length without snout; origin of anal usually behind middle of dorsal; maxillary short, extending only slightly beyond joint of mandible; gill rakers 16 to 20 + 18 to 23
lucida, p. 95
- ff. Anal longer, its base 3.0 to 3.4 in length, with 26 to 30 rays; axillary scale of pectoral short and broad, scarcely extending opposite midlength of fin, 3.0 to 3.6 in head; cheek rather longer and narrower, as long as eye and half snout; body deep, strongly compressed, depth in adults about 4.0 in length
trinitatis, p. 96
- ee. Gill rakers more numerous, 18 to 21 + 26 to 32; body rather elongate, depth 4.8 to 5.3 in length; dorsal moderately high anteriorly, the longest rays extending nearly to tip of last ray if deflexed; anal with 23 to 26 rays. *delicatissima*, p. 98
- dd. Head longer, 3.1 to 3.8 in length; eye smaller, 3.7 to 4.8 in head; postorbital part of head longer, 5.5 to 6.8 in length; cheek longer and narrower, generally nearly or quite as long as snout and eye.

TABLE 4.—Cont'd

Species	Number of anal rays																							
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
<i>lyolepis</i>			2	7	11	5	1																	
<i>ischana</i>	5	7	9	2																				
<i>arenicola</i>	1	11	16	9																				
<i>choerostoma</i>					5	14	16	9	3															
<i>starksi</i>				7	21	17	1																	
<i>tricolor</i>	2	9	30	17	6																			
<i>cubana</i>				9	13	7	9	4	1															
<i>exigua</i>		5	9	6	6																			
<i>tropica</i>	1	7	9	14	5																			
<i>januaria</i>				1	3	12	4																	
<i>parva</i>		1	8	18	18	3	2																	
<i>curta</i>			1	6	9	13	4	1																
<i>mitchilli mitchilli</i>						1	8	22	63	74	51	30	11	1										
<i>mitchilli diaphana</i>						2	11	55	83	62	44	14	5											
<i>lucida</i>						1	5	3	13	18	7	4												
<i>trinitatis</i>									2	4	7	5	2											
<i>delicatissima</i>						2	7	4	3															
<i>marinii</i>					1	2	4																	
<i>naso</i>					5	5	12	5	2	2	1													
<i>nasus</i>				1	1	2	4	3	4	1														
<i>filifera</i>	1	3	3	5	2																			
<i>howelli</i>								1	1															

TABLE 5.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN ANCHOA*

Species	Number of gill rakers on upper limb of first arch																
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
<i>spinifer</i>				1	2	11	14	3									
<i>compressa</i>											4	35	28	7			
<i>schultzi</i>								5	3	2							
<i>panamensis</i>						3	15	17	29	17	5	4					
<i>mundeolooides</i>							4	6	5								
<i>duodecim</i>						1	1										
<i>eigenmannia</i>	9	9															
<i>schofieldi</i>	1	6															
<i>cayorum</i>			1	12	24	3											
<i>pectoralis</i>			1	12	2												
<i>chamensis</i>								2									
<i>ginsburgi</i>								1	2	1							
<i>hepsetus hepsetus</i>							1	19	52	47	23	9					
<i>hepsetus colonensis</i>							3	9	24	12	1						
<i>lamprotaenia</i>				7	56	47	13	6	4								
<i>helleri</i>								1	2	2							
<i>lyolepis</i>							1	5	8	23	12	6	1				
<i>ischana</i>					2	6	9	7	1								
<i>arenicola</i>							4	18	17	1							
<i>choerostoma</i>										1	9	9	4				
<i>starksi</i>												7	13	9	13		1
<i>tricolor</i>											1	7	19	8	1		
<i>cubana</i>										2	3	9	12	5	8	5	
<i>exigua</i>												4	11	12	3		
<i>tropica</i>										10	14	9	1				
<i>januaria</i>													2	1	2	2	
<i>parva</i>												3	25	10			

* If the enumerations given in the table exceed the number of specimens listed in the text the gill rakers in some of the specimens were counted on both anterior arches.

TABLE 5.—Cont'd

Species	Number of gill rakers on upper limb of first arch																
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
<i>curta</i>								5	21	19	13	3					
<i>mitchilli mitchilli</i> ..							8	38	63	56	5						
<i>mitchilli diaphana</i> ..							9	95	118	44	8						
<i>lucida</i>								6	10	7	7	4					
<i>trinitatis</i>							1	1	7	9	1						
<i>delicatissima</i>										1	2	8	7				
<i>marinii</i>											3	5	3				
<i>naso</i>										4	24	16	6	3	2	2	
<i>nasus</i>													1	5	5	4	3
<i>filifera</i>									5	4	4						
<i>howelli</i>													4				

TABLE 5.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN ANCHOA*—Cont'd

Species	Number of gill rakers on lower limb of first arch																								
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33			
<i>spinifer</i>			4	11	24	4																			
<i>compressa</i>													24	33	9	2									
<i>schultzi</i>							3	3	3	1															
<i>panamensis</i>					4	9	11	14	11	27	10	3	2												
<i>mundeoloides</i>					1	4	8	2																	
<i>duodecim</i>									2																
<i>eigenmannia</i>	7	16	1																						
<i>schofieldi</i>	4	2	1																						
<i>cayorum</i>				18	40	22	1																		
<i>pectoralis</i>					3	13	4	2																	
<i>chamensis</i>										1	1														
<i>ginsburgi</i>									2	3	8														
<i>hepsetus hepsetus</i> ..							9	27	97	93	47	2	1												
<i>hepsetus colonensis</i> .								4	15	25	4														
<i>lamprotaenia</i>					2	26	94	82	31	8	5														
<i>helleri</i>								2	1	2															
<i>lyolepis</i>								4	11	14	11	7	5	5	4										
<i>ischana</i>					4	2	10	7	2																
<i>arenicola</i>					1	4	12	17	4																
<i>choerostoma</i>												10	12	9	6										
<i>starksi</i>														2	7	22	9	4							
<i>tricolor</i>														11	20	25	8	2							
<i>cubana</i>														3	2	11	6	8	18	8	7	2	2		
<i>exigua</i>														1	4	16	5	3							
<i>tropica</i>														5	14	12	4								
<i>januaria</i>															2	4	4	5							
<i>parva</i>															7	10	14	13	1						
<i>curta</i>														6	26	21	9	4							
<i>mitchilli mitchilli</i> ..										4	21	45	70	54	21	6									
<i>mitchilli diaphana</i> ..										12	64	125	92	46	10	3									
<i>lucida</i>							1	9	16	13	6	2													
<i>trinitatis</i>							1	1	3	7	8														
<i>delicatissima</i>																	3	5	6	4	3	2			
<i>marinii</i>										4	3	7	3	1											
<i>naso</i>										1	2	9	17	14	5	3	4	2							
<i>nasus</i>													1	3	8	5	1								
<i>filifera</i>										3	3	12	1												
<i>howelli</i>																2	1	1							

* If the enumerations given in the table exceed the number of specimens listed in the text the gill rakers in some of the specimens were counted on both anterior arches.

Anchoa spinifer (Cuvier & Valenciennes) (Fig. 10)

Engraulis spinifer Cuvier & Valenciennes, 1848, 39, Cayenne, French Guiana; Günther, 1868, 394.

Stolephorus spinifer Jordan & Evermann, 1896, 448.

Anchovia spinifera Gilbert & Starks, 1904, 46, Pl. 8, fig. 15.

Anchoviella spinifera Jordan & Seale, 1926, 409.

Head 3.6 to 4.0; depth 4.0 to 5.2; D. 14 to 16; A. 35 to 40; P. 12 to 14; scales mostly lost, about 45; vertebrae 43 to 45 (15 specimens dissected).

Body rather elongate, its depth variable among individuals, increasing somewhat with age, rather strongly compressed; head quite short, its depth at joint of mandible scarcely exceeding its postorbital length; snout pointed, shorter than eye, projecting nearly its full length beyond tip of mandible,

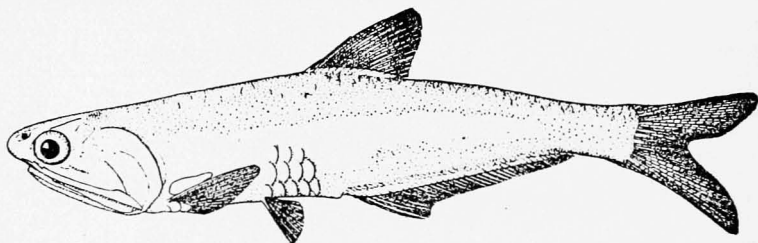


Fig. 10.—*Anchoa spinifer*. From a specimen 90 mm. long, Gatun Locks, C. Z. (Drawing by Miss Louella E. Cable.)

6.6 to 7.5 in head; eye small, 4.2 to 5.0; maxillary long and pointed, reaching nearly or quite to margin of opercle, 1.1 to 1.25 in head; opercle short, scarcely covering gills; cheek in young as long as snout and eye, very much longer in adults, its posterior angle acute, about 30°; postorbital part of head rather long, 6.0 to 6.7 in length; mandible 4.9 to 5.7; gill rakers about two-thirds length of eye, 12 to 16 + 15 to 18 on first arch; dorsal fin high anteriorly, its longest rays reaching far beyond tip of last ray if deflexed, its origin generally rather more than an eye's diameter nearer tip of snout than base of caudal; anal fin very long, its origin usually somewhat in advance of middle of base of dorsal, its base 2.8 to 3.0 in length; ventral fins inserted about equidistant from base of pectoral and origin of anal; pectoral large reaching to or sometimes considerably beyond base of ventral, 1.3 to 1.5 in head, 5.0 to 5.7 in length; axillary scale of pectoral very broad, reaching somewhat beyond midlength of the fin, 2.4 to 2.9 in head.

Color of preserved specimens pale or slightly yellowish above; back with dusky punctulations; lower half of sides of head and body silvery; young sometimes with an ill defined silvery lateral band, missing in adults; margins,

or at least the tips, of dorsal and caudal black. The larger specimens taken in Pedro Miguel and Miraflores Locks, Canal Zone, were bright orange when fresh, the orange contrasting conspicuously with the black margin of the caudal fin.

Many specimens, ranging in length from about 30 to 195 mm., from the Pacific coast of Panama, from the Atlantic coast of Panama, and from Brazil have been examined. The proportions and enumerations are based on 26 or more specimens. This anchovy was exceedingly numerous in the brackish and fresh water of the Pedro Miguel and Moraflores Locks, Canal Zone, when dewatered in 1937. Though individuals are variable, particularly in depth and length of pectoral fins, it cannot be determined from the specimens at hand that the fish from the opposite coasts differs constantly in any one character. Nearly all the specimens from the Atlantic have been preserved a long time, all have faded, and most of them are not in good condition, making the comparison rather unsatisfactory. In general, the Atlantic fish seem to have a rather deeper body, but the measurements are unsatisfactory for reasons stated.

Range.—Both coasts of Panama, southward on the Atlantic as far as Santos, Brazil, and on the Pacific to Guayaquil, Ecuador. Jordan and Seale (*loc. cit.*) included the West Indies in the range. I have seen no specimens from there and have found no other record.

Anchoa compressa (Girard) (Fig. 11)

Engraulis compressus Girard, 1858, 336, San Diego, Cal.

Stolephorus compressus Eigenmann, 1893, 140, Pl. 10, figs. 1-5; Jordan and Evermann, 1896, 447.

Anchoiella compressa Jordan & Seale, 1926, 407; Walford, 1931, 49, fig. 27; Barnhart, 1936, 16, fig. 51.

Head 3.8 to 4.25; depth 3.7 to 4.9; D. 13 or 14; A. 29 to 33; P. 13 or 14; scales about 45; vertebrae 40 or 41 (5 specimens examined).

Body deep, strongly compressed, its greatest thickness notably less than depth of caudal peduncle, the depth increasing with age (about 4.9 in length at 50 mm., about 3.8 at 140 mm.); ventral outline more strongly convex than the dorsal; head short, its depth at joint of mandible about equal to its length without snout; snout generally only about half length of eye, extending about two-thirds its length beyond tip of mandible, 6.25 to 7.0 in head; eye 3.0 to 3.5; maxillary rather bluntly pointed, reaching to or slightly beyond joint of mandible, 1.3 to 1.4 in head; cheek rather short and broad, scarcely as long as eye and half the snout, its posterior angle rather broad, about 45°; postorbital part of head moderately short, 7.3 to 8.0 in length; mandible 5.3 to 6.1; gill rakers slender, scarcely as long as eye, 19 to 22 + 24 to 27 (counted in 73 specimens) on first arch, not in-

creasing in number with age; dorsal fin high anteriorly, the rays decreasing in length following the first divided one, the last one not longer than the preceding ones, longest rays reaching far beyond its tip if deflexed, its origin equidistant from base of caudal and anterior margin to middle of eye; anal very long, its origin generally under base of about the third or fourth ray of dorsal, and notably nearer base of pectoral than base of caudal, its base longer than head, 3.0 to 3.3 in length; ventral reaching considerably more than half way to origin of anal, inserted somewhat nearer base of pectoral than origin of anal; pectoral long, reaching to and often beyond base of ventral, 1.2 to 1.4 in head, 5.0 to 5.3 in length; axillary scale of pectoral moderately broad at base, reaching about opposite midlength of fin, 2.25 to 3.0 in head.

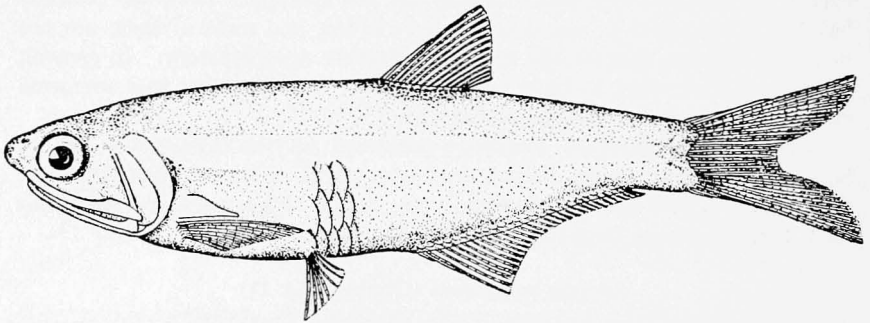


Fig. 11.—*Anchoa compressa*. From a specimen 110 mm. long, San Diego, Cal. (U. S. N. M., No. 125579). (Drawing by Mrs. Alice C. Mullen.)

Color in alcohol brownish above, lower parts and sides of head silvery; a bright silvery lateral band, often nearly as wide as eye, becoming somewhat diffuse ventrally on anterior part of body, but not disappearing with age; median line of back with dusky punctulations; base of anal with dusky markings.

Many specimens, 52 to 140 mm. long, from the vicinity of San Diego, and San Pedro, Cal., have been examined. The proportions and enumerations given in the description, unless otherwise stated, are based on 15 specimens, 50 to 140 mm. long. This species has been described as having "numerous gill rakers," which probably is an error. Jordan & Evermann (1927, 501) in describing *Anchoa* said, presumably referring to the number on the lower limb of the first arch only, ". . . a much greater number of gill rakers, there being 35 to 50," and chose this species as type, which has at the most only 27.

A. compressa attains a length of about 150 mm., and is used extensively as bait, especially in the tuna fishery.

Range.—Point Conception, Cal., to Lower California (Walford, 1931, 49).

TABLE 6.—FREQUENCY DISTRIBUTION OF THE TOTAL NUMBER OF GILL RAKERS ON THE FIRST ARCH IN *Anchoa compressa* AND *A. schultzi*

Species	Number of gill rakers on first arch													
	35	36	37	38	39	40	41	42	43	44	45	46	47	48
<i>A. compressa</i>									3	16	22	23	6	3
* <i>A. schultzi</i>	3	2	1	2	2									

* The enumerations shown exceed the number of specimens on hand because the gill rakers in some of the specimens were counted on both anterior arches.

***Anchoa schultzi* n. sp. (Fig. 12)**

Head 3.5 to 4.0; depth 3.8 to 4.4; D. 13 or 14; A. 31 to 34; P. 13 to 15; scales lost, about 43; vertebrae 40 (2 specimens dissected).

Body very deep, strongly compressed, its greatest thickness less than depth of caudal peduncle; ventral outline much more strongly convex than

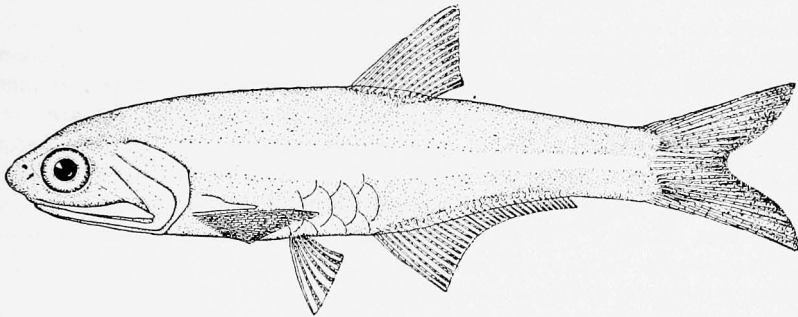


Fig. 12.—*Anchoa schultzi*. From the type, 58 mm. long, Gulf of California, near mouth of Colorado River. (U. S. N. M., No. 119799). (Drawn by Mrs. Alice C. Mullen.)

the dorsal; head short, its depth at joint of mandible about equal to its postorbital length and half eye; snout very short, rather pointed, extending at least two-thirds its length beyond tip of mandible, 6.6 to 8.0 in head; eye 3.5 to 3.8; maxillary bluntly pointed, reaching scarcely beyond joint of mandible, 1.3 to 1.45 in head; cheek short and broad, about as long as eye and half the snout, its posterior angle approximately 45°; postorbital part of head rather short, 7.2 to 7.6 in length; mandible 5.0 to 6.0; gill rakers slender, only a little shorter than eye, 16 to 18 + 19 to 21 on first arch; dorsal fin high anteriorly, the rays following the first divided one decreasing in length rather strongly, the last ray not extending beyond the tip of the preceding one, the longest rays extending far beyond the tip of the last one if deflexed, origin of fin about equidistant from base of caudal and middle of eye; anal very long, its origin only slightly behind that of dorsal, much nearer base of pectoral than base of caudal, its base 2.8 to 3.0 in length; ventral reaching about two-thirds the distance to origin of anal, inserted

rather nearer base of pectoral than origin of anal; pectoral long, pointed, the longest rays reaching well beyond base of ventral, 1.3 to 1.5 in head, 5.0 to 5.5 in length; axillary scale of pectoral rather broad at base, scarcely extending beyond midlength of the longest rays of the fin, 2.3 to 3.0 in head.

Color of old preserved specimens rather dark; sides of head silvery; a prominent silvery lateral band present, only a little narrower than eye anteriorly, gradually diminishing in width posteriorly, scarcely wider than pupil over middle of anal; distal margin of caudal dusky.

Five specimens of this species, ranging in length from 44 to 48 mm., standard length 35 to 55 mm., are included in a lot in the National Museum, (No. 15102) labeled "opposite the mouth of the Colorado River," therefore, from the extreme upper tip of the Gulf of California, and 3 specimens with broken caudal fins, respectively 53, 78 and 83 mm. in standard length, in the Museum of Comparative Zoology (No. 31404) labeled "Mexico" (very probably from San Juan Lagoon), are of this species. These specimens are rather close to *A. compressa* from which they differ principally in having fewer gill rakers, and apparently in being rather deeper. The last mentioned difference is apparent only if specimens of about equal size are compared, because *A. compressa*, at least, grows deeper with age. Comparing the 8 specimens of this species, which range from 35 to 83 mm. in standard length, with 8 specimens of nearly equal length of *A. compressa*, the range of depth in standard length of the former is 3.8 to 4.4, the average being 4.13, whereas the range in the latter is 4.1 to 4.9, and the average 4.46. The difference in depth, therefore, is only an average one. However, the gill rakers in this new species are distinctly fewer, as shown in the descriptions, and in table 6 in which the total number of gill rakers on the first arch of each species is given.

This species is named for Dr. Leonard P. Schultz, Curator of Fishes in the National Museum. A specimen 58 mm. long, with standard length of 45 mm. (U. S. N. M., No. 119799) has been selected as type. The following proportions and enumerations are based on the type: Head in length 3.75; depth 4.1; postorbital part of head 7.5; base of anal 2.8; and pectoral 5.0. Eye in head 3.75; snout 7.0; maxillary 1.4; postorbital part of head 2.0; pectoral 1.32; and axillary scale of pectoral 3.0. D. 14; A. 31; P. 13; and gill rakers 16 + 19.

Range.—Known from the extreme northern end of the Gulf of California, near the mouth of the Colorado River; and from "Mexico," probably from San Juan Lagoon, on the Gulf of California.

Anchoa panamensis (Steindachner) (Fig. 13)

Engraulis panamensis Steindachner, 1875, 39, Panama Bay.

Stolephorus mundeola Gilbert & Pierson, in Jordan and Evermann, 1898, 2812, Panama Bay.

Anchovia panamensis Gilbert & Starks, 1904, 44; Meek & Hildebrand, 1923, 207, Pl. XV, fig. 1.

Anchovia mundeola Gilbert & Starks, 1904, 44; Meek & Hildebrand, 1923, 208, Pl. XV, fig. 2.

Head 3.7 to 4.7; depth 3.7 to 5.0; D. 12 to 14; A. 30 to 37, usually 32 to 36; P. 12 to 14, usually 13; scales mostly lost, about 38 to 41; vertebrae 41 to 43 (8 specimens dissected).

Body rather deep, especially in adults, variable, strongly compressed, its greatest thickness notably less than depth of caudal peduncle; ventral outline more strongly convex than the dorsal; chest and abdomen, and sometimes the back from nape to dorsal fin trenchant; head quite short, its depth at joint of mandible a little less than postorbital part of head and

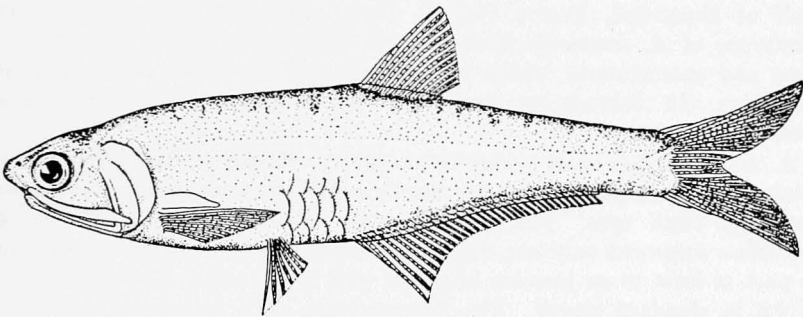


Fig. 13. *Anchoa panamensis*. From a specimen 80 mm. long, Balboa, C. Z. (U. S. N. M., No. 79561). (Drawing by Mrs. Alice C. Mullen.)

eye; snout moderately short, projecting about two-thirds its length beyond tip of mandible, 6.0 to 7.5 in head; eye 3.2 to 3.7; maxillary rather variable in shape and length, usually rather bluntly pointed, and not quite extending to margin of opercle, 1.2 to 1.4 in head; cheek about as long as eye and half the snout, its posterior angle rather broad, about 50° ; postorbital part of head, moderately long, 7.4 to 8.6 in length; mandible 5.0 to 6.8; gill rakers only a little more than half the length of eye, 14 to 20 + 17 to 25 on first arch, apparently not increasing in number with age; dorsal fin rather high anteriorly, the last ray not longer than the immediately preceding one, the longest rays reaching far beyond its tip when deflexed, origin of fin generally about equidistant from base of caudal and middle of eye; anal fin long, its origin often under origin of dorsal, sometimes slightly in advance of or slightly behind this point, and at least an eye's diameter nearer joint of mandible than base of caudal, its base 2.6 to 3.1 in length; ventral reaching a little more than half way to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral long, reaching well beyond base of

ventral, at least in adults, 1.15 to 1.25 in head, 4.8 to 6.1 in length; axillary scale of pectoral rather variable in shape and length, usually quite broad, bluntly pointed, and about half as long as the longest pectoral rays, 2.5 to 3.2 in head.

Color in preservative brownish to straw; sides of head bright silvery; a rather narrow silvery lateral band, generally nowhere much broader than pupil, present (often apparently faded in specimens preserved in formalin); back with dusky punctulations, usually forming a streak at least behind dorsal fin; base of anal with dusky spots; a dark median line on ventral surface of caudal peduncle.

Many specimens, 45 to 145 mm. long, collected in the mouth of the Rio Dagua, Colombia; at several places on the coast of Panama; at Triunfo, El Salvador; and at Mazatlan, Mexico; and one specimen, 98 mm. long, from Gulf of Guayaquil, Puerto Pizarro, Peru, have been examined. Twelve paratypes of *A. mundeola* from Panama City are included. The proportions and enumerations, unless otherwise stated, are based on 44 or more specimens. In Panama, at least, this species enters brackish or almost fresh water.

A. mundeola has been placed in synonymy, though it perhaps might be retained as a subspecific name for the especially deep specimens, with rather unusually small eyes. The intergradation, however, is complete. In 44 specimens measured only one mode in depth (though the range is wide, due in part at least to an increase in depth with age) occurs, which falls at 4.4 to 4.5 in standard length. The intergradation with respect to the eye is similarly complete, the mode falling at 3.4 to 3.5 in 44 specimens if the diameter of the eye is divided in the length of the head, or at 14 to 16 if divided in the standard length. A wide divergence in the number of gill rakers also exists. Again, no break of any significance occurs in 91 enumerations made, as shown by accompanying tables. It so happens, however, that the smallest specimens have the smallest number of gill rakers and the largest ones the greatest number. The possibility that a slight increase in number of gill rakers may take place with age and growth exists, but it cannot be proven from the specimens at hand. Gilbert and Starks (*loc. cit.*) concluded in their final work on the fishes of Panama Bay that *mundeola* was scarcely tenable. This conclusion is now amply confirmed.

The nearest relatives of this species are *A. lucida* and *A. mundeoloides*. From the former it differs in the longer anal fin, with more numerous rays, with its origin farther forward. From that species it differs also in the rather shorter head, proportionately smaller eye, longer cheek, longer pectoral fins, and rather notably in the more strongly compressed body. From *A. mundeoloides* it differs in the more anterior position of the anal fin, the longer pectoral fins, the shorter and broader axillary scale of the pectoral,

the notably shorter and broader cheek, and in the more compressed body.
Range.—Mazatlan, Mexico, to the Gulf of Guayaquil, Puerto Pizarro, Peru.

***Anchoa mundeoloides* (Breder) (Fig. 14)**

Anchoa mundeoloides Breder, 1928, 9, fig. 5, San Filipe Bay, Gulf of California (type B. O. C., No. 1168).

Head 4.1 to 4.5; depth 3.9 to 4.1; D. 13 or 14; A. 29 to 34, usually 31 to 34; P. 13 to 15; scales lost, about 37 to 41; vertebrae 41 (1 specimen dissected).

Body moderately deep, rather strongly compressed, its greatest thickness not quite equal to depth of caudal peduncle; chest and abdomen scarcely trenchant; head rather short, its depth at joint of mandible scarcely as long

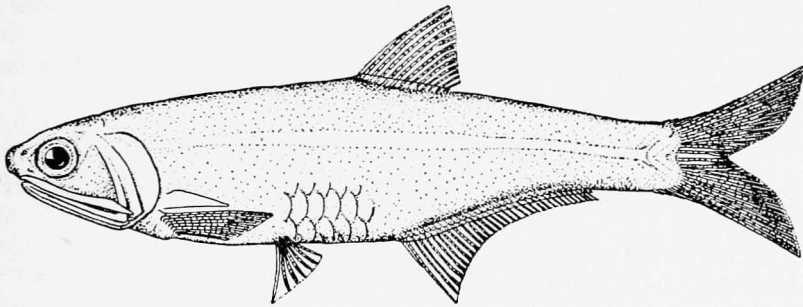


Fig. 14.—*Anchoa mundeoloides*. From a paratype, 146 mm. long, Filipe Bay, Lower Cal. (B. O. C., No. 1169). (Drawing by Mrs. Alice C. Mullen.)

as head without snout; snout moderately short, projecting about two-thirds its length beyond tip of mandible, 6.5 to 7.0 in head; eye 3.2 to 3.8; maxillary distally rather pointed, extending beyond joint of mandible, but not to margin of opercle, 1.25 to 1.35 in head; cheek quite long, usually equal to length of eye and snout, its posterior angle rather acute, about 30°; post-orbital part of head rather long, 7.1 to 8.2 in length; mandible 5.75 to 6.5; gill rakers about two-thirds length of eye, 15 to 17 + 17 to 20 on first arch; dorsal fin quite high anteriorly, the last ray not longer than the immediately preceding one, the longest rays reaching far beyond its tip if deflexed, origin of fin usually about equidistant from base of caudal and middle of eye; anal long, its origin well behind that of dorsal, usually under about the fourth or fifth ray of dorsal, and about equidistant from base of caudal and joint of mandible, its base 3.0 to 3.2 in length; ventral reaching a little more than half way to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral moderately long, reaching nearly or quite to base of ventral and sometimes slightly beyond that point, 1.2 to 1.3 in head, 5.1 to 5.5 in

length; axillary scale of pectoral long and narrow, sharply pointed, reaching well beyond midlength of the longest rays of fin, 2.1 to 2.6 in head.

Color of preserved specimens (in formalin) very pale; sides of head silvery; a narrow dark lateral band (no doubt silvery in life) present, apparently nowhere wider than pupil; back with dusky points forming a rather definite streak behind dorsal fin.

The foregoing description is based on 18 paratypes (B. O. C., No. 1169), 115 to 150 mm. long from San Filipe Bay, Gulf of California, the only specimens seen by me. This species is rather closely related to *A. panamensis* and *A. lucida*. Its relationship with the first named species is discussed in the account of that species. From *A. lucida* it differs in the somewhat longer anal fin, with more numerous rays, and with its origin rather farther forward (intermediate of *lucida* and *panamensis*), in the longer head, and in the notably longer and narrower cheek. *A. mundeoloides* apparently reaches a much larger size than *A. lucida*.

Range.—Known only from the type material from San Filipe Bay and San Francisco Bay, Gulf of California, and Bahia Hunda, Panama.

***Anchoa duodecim* (Cope)**

Engraulis duodecim Cope, 1869, 405, Beesley's Point, N. J. (type, A. N. S. P., No. 1363).

Anchoa duodecim Fowler, 1906, 111; and 1911, 219.

Head 3.7; depth 4.0; D. 14; A. 30; P. 12; scales about 38.

Body rather short, deep, well compressed; dorsal profile more strongly convex than the ventral; head short, deep, its depth at joint of mandible equal to its postorbital length and half the eye; snout rather short, projecting a little less than a third its length beyond tip of mandible, 5.8 in head; eye small, 4.7; maxillary fairly short, reaching joint of lower jaw, broad and abruptly pointed posteriorly, 1.25 in head; cheek as long as snout and eye, its posterior angle about 35°; postorbital part of head rather long, 6.1 in length; mandible 4.8; gill rakers at angle nearly as long as eye, 15 + 20 on first arch of left side; 14 + 20 on right side; dorsal fin high anteriorly, longest rays reaching far beyond tip of last one if deflexed, its origin nearly an eye's diameter nearer tip of snout than base of caudal; anal rather long and low, its origin half an eye's diameter posterior to end of base of dorsal, about equidistant from base of caudal and base of pectoral, its base 4.0 in length; ventral fin large, shorter than pectoral only by diameter of pupil, extending about two-thirds the distance to origin of anal, inserted a little nearer joint of lower jaw than origin of anal; pectoral extending to base of ventral, 1.5 in head, 5.5 in length; axillary scale of pectoral a little more than half the length of fin, 2.7 in head.

Color of old preserved specimen grayish brown above, lower two-thirds

of side silvery; no lateral band, and no dark punctulations now present. "Iridescent silvery, dorsal region pale brownish (in spirits)." (Cope, original description.)

The foregoing description is based on the type having a length of 97 mm. (77 mm. to base of caudal), the only specimen known, taken at Beesley's Point, N. J. I have examined this fish, which is in fairly good condition, critically. It differs strikingly from the other local forms, in its deep body, high dorsal fin, in the position of the dorsal and anal fins, as well as in several other respects. It is very interesting that this species has never reappeared in collections, though it is understood that a special search has been made for it in the type locality. It should be easily recognized if taken.

Range.—Known only from Beesley's Point, N. J.

Anchoa eigenmannia (Meek & Hildebrand) (Fig. 15)

Anchoa eigenmannia Meek & Hildebrand, 1923, 205, Pl. XIV, fig. 2, Taboga Island, Panama (type U. S. N. M., No. 79589).

Head 3.7 to 4.1; depth 4.5 to 5.2; D. 13 to 15, usually 14; A. 27 to 30; P. 13 or 14; scales lost, about 40 to 43; vertebrae 42 or 43 (3 specimens dissected).

Body strongly compressed, its greatest thickness not quite equal to depth of caudal peduncle, moderately deep; ventral outline rather more strongly rounded than the dorsal; head moderately short, its depth at joint of mandible equal to postorbital part of head and half the eye; snout about two-thirds as long as eye, projecting a little more than half its length beyond tip of mandible, 6.3 to 7.3 in head; eye 4.0 to 4.5; maxillary rather long, reaching beyond joint of mandible, but not to margin of opercle, 1.25 to 1.35 in head; teeth rather prominent; cheek moderately long, only a little shorter than eye and snout, its posterior angle rather acute, about 40°; postorbital part of head fairly long, 6.8 to 7.3 in length; mandible 5.1 to 6.0; gill rakers at angle about as long as snout, 9 or 10 + 12 to 14 on first arch; dorsal fin high anteriorly, its margin slightly concave, the longest rays reaching well past tip of last ray if deflexed, its origin about equidistant from base of caudal and middle of eye; anal fin rather long, its origin distinctly in advance of middle of base of dorsal, usually under base of fourth or fifth ray, its origin generally about equidistant from base of caudal and joint of mandible, its base longer than head, 3.25 to 3.5 in length; ventral reaching a little more than half way to anal, inserted about equidistant from base of pectoral and origin of anal; pectoral rather long, generally reaching base of ventral, 1.4 to 1.5 in head, 5.4 to 6.0 in length; axillary scale of pectoral long and pointed, about three-fourths as long as the fin, 2.25 to 2.5 in head.

Color of specimens preserved in formalin pale; sides of head bright silvery; a faint silvery lateral band, notably less than half as wide as eye,

evident in some specimens, sides more usually simply with a narrow dusky streak; back with numerous dusky points; a rather definite dark streak behind dorsal fin; base of anal with numerous dusky points; ventral surface of caudal peduncle with a sharp median dark line.

The description is based on the type and 6 paratypes, from Taboga Island, Panama, and many specimens from the Pearl Islands, Panama, 35 to 80 mm. long. The young, as usual among anchovies, are quite slender, but after a length of about 55 to 60 mm. is attained the depth in proportion to the length seems to be fairly constant.

This species and *A. schofieldi* agree in the small number of gill rakers, and in general are so closely related that when more specimens become available for study the two probably will show intergradation. According to the material now available *A. eigenmannia* has a longer anal fin, with 27 rays

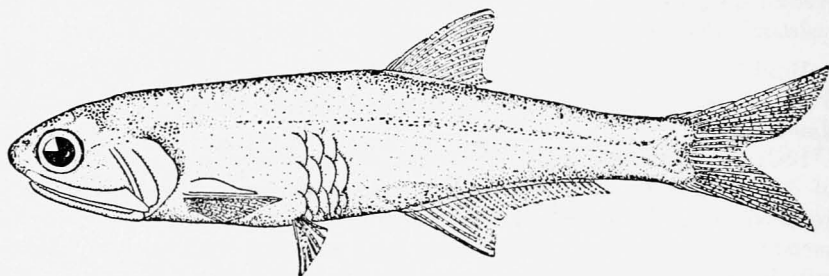


Fig. 15.—*Anchoa eigenmannia*. From a paratype, 65 mm. long, Taboga Island, Panama (U. S. N. M., No. 81752). (Drawing by Mrs. Alice C. Mullen.)

once, 28 nine times, 29 fifteen times and 30 three times. In 7 specimens of *A. schofieldi* the range is 24 to 26, with 24 rays in one, 25 in three, and 26 in the other three. The base of this fin in *A. eigenmannia* is correspondingly longer, and its origin is farther forward as shown in the descriptions and figures. The pectoral fins also seem to be a little longer in *A. eigenmannia*, and although the teeth in both species are longer than in most other species of the genus, they appear to be stronger in *A. schofieldi* than in *A. eigenmannia*. According to a limited number of enumerations *A. schofieldi* has slightly more numerous vertebrae. The apparent difference in color is somewhat uncertain because of the supposedly different methods of preservation, the specimens of *A. schofieldi* presumably having been preserved in alcohol, whereas those of *A. eigenmannia* were preserved originally in formalin though later transferred to alcohol. The latter have a dark stripe along the side, which is near the upper border of the silvery lateral band in those specimens in which the silver has not been entirely obliterated. No dark

pigment can be seen within the silvery lateral band in specimens of *A. schofieldi*.

Range.—Known only from some islands in Panama Bay.

Anchoa schofieldi (Jordan & Culver) (Fig. 16)

Stolephorus schofieldi Jordan & Culver, in Jordan, 1895, 410, Mazatlan, Mex.; and in Jordan & Evermann, 1898, 2814.

Head, 3.7 to 4.1; depth, 4.5 to 4.7; D. 14; A. 24 to 26; P. 13 or 14; scales mostly lost, about 38 to 42; vertebrae 44 (1 specimen dissected).

Body strongly compressed, its greatest thickness less than depth of caudal peduncle, moderately deep; ventral outline rather more strongly convex than the dorsal; depth apparently not increasing with age, head moderately short, its depth at joint of mandible equal to postorbital part of head and

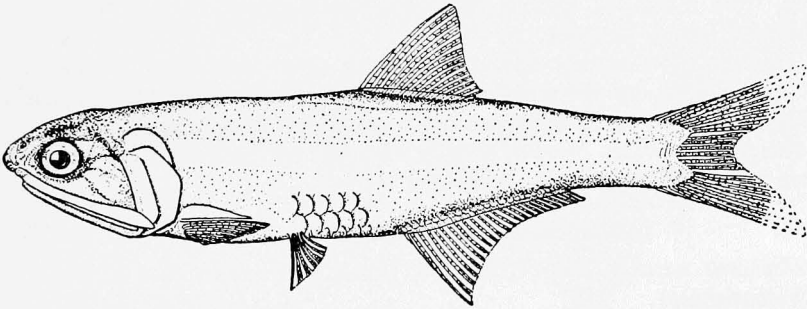


Fig. 16.—*Anchoa schofieldi*. From a specimen 75 mm. long, Mazatlan, Mex. (U. S. N. M., No. 47495). (Drawing by Mrs. Alice C. Mullen.)

half to three-fourths of eye; snout about three-fourths length of eye, projecting a little more than half its length beyond tip of mandible, 7.0 to 7.5 in head; eye 3.7 to 4.2; maxillary moderately pointed, reaching somewhat beyond joint of mandible, 1.25 to 1.3 in head; teeth in jaws, as well as on roof of mouth quite large (larger than in related species of similar size); cheek moderately long, about as long as snout and eye, its posterior angle moderately acute, about 40°; postorbital part of head fairly long, 6.5 to 7.1 in length; mandible 5.0 to 5.4; gill rakers at angle about as long as snout, 9 or 10 + 12 to 14 on first arch; dorsal fin high anteriorly, its margin only slightly concave, the longest rays reaching well beyond tip of last one if deflexed, its origin usually about equidistant from base of caudal and middle of eye; anal fin moderately long, its origin under or a little in advance of middle of base of dorsal, and about equidistant from base of caudal and joint of lower jaw, its base equal to length of head, 3.9 to 4.25 in length; ventral reaching approximately half way to origin of anal, inserted about equidistant from

base of pectoral and origin of anal; pectoral moderately short, generally failing to reach base of ventral by rather more than half diameter of eye, 1.6 to 1.9 in head (1.3 in an exceptionally large specimen), 6.3 to 7.1 in length; axillary scale of pectoral moderately short, about three-fourths as long as longest pectoral rays, 2.2 to 2.7 in head.

Color of preserved specimens, more or less straw color; with a silvery lateral band about as broad as eye; middle of back with dusky punctulations, most concentrated posterior to dorsal fin, curved downward and extending somewhat on base of upper rays of caudal; base of anal generally with a few dusky points, extending on median ventral line of caudal peduncle, not forming a continuous dark line.

The foregoing description is based on 5 syntypes from the Stanford University collection (No. 2941), 68 to 80 mm. long, and another specimen in the U. S. National Museum (No. 47495), probably also a syntype, 75 mm. long, from Mazatlan, Mexico, and one large specimen 136 mm. long, from La Plata Island, Ecuador.

This species is readily distinguished from other local forms, exclusive of *A. eigenmannia*, by the small number of gill rakers. Its close relationship with *A. eigenmannia* is discussed in the account of that species.

Range.—Mazatlan, Mexico, and La Plata Island, Ecuador. No specimens from intermediate localities have been seen.

***Anchoa cayorum* (Fowler) (Fig. 17)**

Stolephorus mitchilli Bean, 1890, 206, Cozumel, Yucatan (not of Cuvier & Valenciennes).

Anchovia choerostoma cayorum Fowler, 1906, 85, fig. 4, Hailer's Rock, Florida Keys (type A. N. S. P., No. 30613).

Head 3.5 to 4.0; depth 4.75 to 5.5; D. 13 to 15; A. 26 to 28 (rarely 25 or 29); P. 12 or 13; scales lost, about 39 to 42; vertebrae 43 (3 specimens examined).

Body elongate, compressed; head quite long, its length exceeding its depth at joint of mandible by more than an eye's diameter; snout moderately long and pointed, projecting beyond the mandible a distance equal to about two-thirds diameter of eye, its length 5.0 to 6.0 in head; eye 3.5 to 4.25; maxillary long and pointed in large specimens, its upper margin distally straight, reaching nearly or quite to margin of opercle, 1.1 to 1.35 in head; cheek fully as long as eye and three-fourths the snout, its posterior angle quite acute, about 40°; opercular margin at and below beginning of silvery lateral band straight, rounded elsewhere; postorbital part of head moderately long, 6.5 to 7.5 in length; mandible 5.0 to 5.4; gill rakers about three-fourths the length of eye, 13 to 15 + 15 to 17 (rarely 18) on first arch; dorsal fin with concave margin, the longest rays reaching well past

the tips of the last one if deflexed, its origin generally about equidistant from anterior margin of eye and base of caudal; anal fin long, its origin about under beginning of second fourth of base of dorsal, a little nearer joint of lower jaw than base of caudal, its base generally a little longer than head, 3.4 to 4.0 in length; ventral rather small, inserted somewhat nearer base of pectoral than origin of anal; pectoral long, falcate, sometimes failing to reach base of ventral by half diameter of eye, occasionally nearly to ventral, the first (or uppermost) ray generally reaching tip of second one and about twice as long as last ray, 1.5 to 1.9 in head, 6.0 to 7.2 in length; axillary scale of pectoral rather short, scarcely reaching past midlength of fin, 3.0 to 3.5 in head.

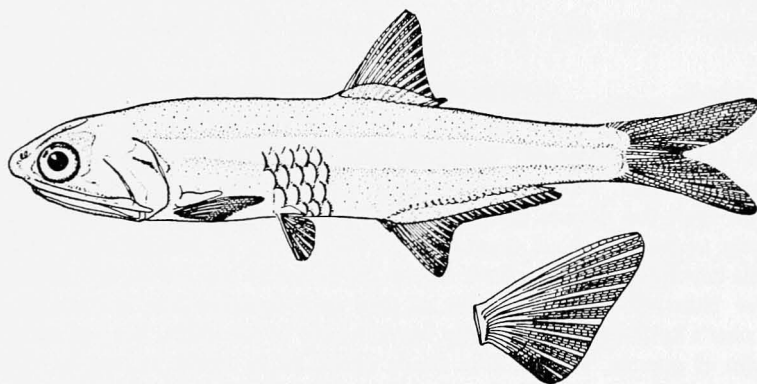


Fig. 17.—*Anchoa cayorum*. From a specimen 85 mm. long, Cabañas Bay, Cuba (U. S. N. M., No. 82341). Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

Color of preserved specimens pale; sides of head silvery; middle of side with a bright silvery band, about as wide as eye above base of anal.

Several dozen specimens, ranging in length from about 50 to 95 mm., have been examined. The collections are from Tortugas, Fla.; Cabañas Bay, Cuba; Cozumel Island, off Yucatan; Beliez, British Honduras; and the type material from Hailer's Rock, Florida Keys. This species is related to *A. lamprotaenia* from which it differs in the narrower and more sharply pointed maxillary (see figs. 17 and 23); in the longer anal fin, with its origin farther forward; and in the fewer gill rakers, as shown in the descriptions and table 5. The proportions and enumerations used are based on 28, and the enumerations of gill rakers, and the anal and pectoral rays on many more, specimens.

Specimens of this species in museum collections, presumably because of the long anal fin, usually have been identified with *A. mitchilli*. They differ from that species, however, in the generally larger size, the notably fewer

gill rakers, and in the much broader and more prominent lateral band. It is interesting that only one specimen of this species was found among several collections and numerous specimens of anchovies from Tortugas, and Key West, Fla., where the species apparently is scarce.

The type (A. N. S. P., No. 30613) 68 mm. long (55 mm. to the base of caudal), and 10 paratypes, 50 to 60 mm. long, collected at Hailer's Rock, Florida Keys, were carefully examined. The following proportions and enumerations are based on the type: Head in length, 3.8; depth 5.3; anal base 3.5; pectoral 6.1; postorbital part of head 6.9. Eye in head 4.2; snout 6.0; maxillary 1.2; pectoral 1.6; axillary scale of pectoral 3.0. D. 13; A. 28; P. 12; scales lost, about 39; gill rakers 14 + 15 on left arch, 13 + 15 on right arch.

Range.—Florida Keys to Honduras, and the West Indies.

Anchoa pectoralis n. sp. (Fig. 18)

Head 3.8 to 4.2; depth 4.5 to 5.1; D. 14 to 16; A. 25 to 28; P. 15 to 17; scales lost about 35 to 40; vertebrae 42 (2 specimens dissected).

Body elongate, strongly compressed; the ventral outline more strongly curved than the dorsal; head short, its depth at joint of mandible scarcely as long as head without snout; snout very short, projecting about half its length beyond mandible, about 6.0 to 7.0 in head; eye 3.2 to 3.7; maxillary rather blunt, the upper margin of free part rounded like the sharp edge of a chef's knife, reaching slightly beyond joint of mandible, but not nearly to margin of opercle, 1.2 to 1.4 in head; cheek short, about as long as eye, its posterior angle moderately broad, about 50°, 2.8 to 3.4 in head (measured from eye to posterior tip); postorbital part of head moderately short, 7.25 to 7.75 in length; mandible 5.7 to 6.3; gill rakers (at angle) about three-fourths length of eye, 12 to 14 + 17 to 20 on first arch; dorsal fin with slightly concave margin, the longest rays reaching nearly to and occasionally beyond tip of last ray if deflexed, origin of fin generally a little nearer base of caudal than middle of eye; anal fin long, and low, its origin generally under middle of base of dorsal, its base about as long as head, 3.9 to 4.25 in length; ventral small, reaching only about half way to origin of anal, inserted equidistant from base of pectoral and origin of anal, or slightly nearer the latter; pectoral rather broad, and falcate, the upper 2 rays of about equal length, reaching nearly to base of ventral, the rays decreasing rather rapidly in length, the lowermost ray rather less than half the length of the uppermost one, the longest one 1.3 to 1.4 in head, 5.3 to 5.6 in length; axillary scale of pectoral rather long, pointed, about two-thirds length of fin, 2.5 in head.

Color of old preserved specimens, brownish silvery, with a distinct silvery lateral band, about two-thirds width of eye above base of anal, becoming

narrower and less distinct anteriorly. Back with dark dots, forming a more or less distinct line; base of anal with black dots; dark dots extending on outer rays of caudal; margin of the middle rays dusky; no distinct V at base of upper rays of caudal, and no dark bar at base of the middle rays.

This species is one of the *mitchilli*, *parva* and *januaria* group, differing prominently, however, in the more slender, closer set, and more numerous pectoral rays. It also differs in the smaller number of gill rakers, wherein it overlaps slightly with *mitchilli diaphana* (see table 5). It has a greater number of anal rays than *parva* and *januaria*, and agrees in this respect with *mitchilli mitchilli* and *mitchilli diaphana*. The origin of the fin, in relation to the dorsal, is farther back than in those subspecies, and about as in *januaria*.

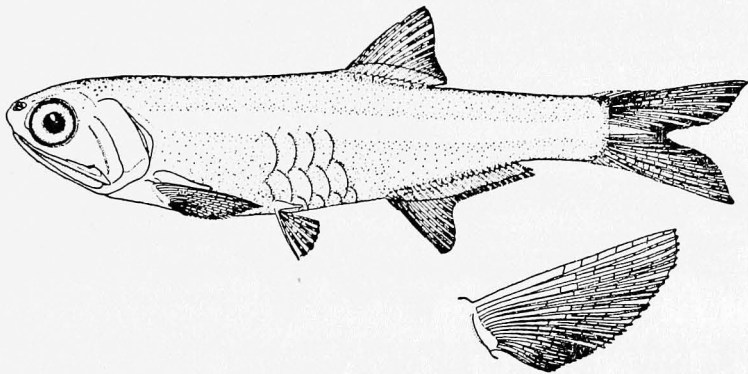


Fig. 18.—*Anchoa pectoralis* n. sp. From the type, 61 mm. long, Vigia, Brazil (M. C. Z., No. 35276). Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

The maxillary agrees essentially in length and shape with *januaria*. The specimens are extremely strongly compressed, which may be due in part, however, to shrinkage, as the indications are that the fish once may have been nearly or quite dry. The proportions used are based on 7 specimens, and the enumerations on 17 specimens.

The following proportions and enumerations are based on the type, which is 60 mm. long, 48 mm. to base of caudal (M. C. Z., No. 35,276): Head in length 4.0; depth 4.6; postorbital part of head 7.6; mandible 5.6; base of anal 4.0; pectoral 5.6. Eye in head 3.25; snout 6.0; maxillary 1.33; post-orbital part of head 1.9; mandible 1.4; pectoral 1.4; axillary scale of pectoral 2.5. D. 15; A. 26; P. 17; scales about 35; gill rakers 13 + 17.

The species is named *pectoralis* in allusion to the many rayed pectoral fin.

Range.—Only the type material, consisting of 64 specimens, 43 to 65 mm. long, is known. This is the lot listed as *A. mitchilli* from "Brazil" by Jordan and Seale (1926, 405). A definite place of collection, namely, Vigia, how-

ever, appears on the label with the specimens. The fish were collected by the Thayer Expedition.

Anchoa chamensis n. sp. (Fig. 19)

Head 4.1; depth 5.0; D. 15; A. 25; P. 16; scales 38.

Body elongate, strongly compressed, its greatest thickness rather less than depth of caudal peduncle; ventral outline slightly more convex than the dorsal; head short, its depth at joint of mandible equal to its postorbital length and half the eye; snout very short, projecting a little less than half its length beyond tip of mandible, 8.0 in head; eye small, 3.7; maxillary reaching joint of mandible, abruptly pointed, 1.5 in head; cheek short and broad, as long as eye and about half the snout, its posterior angle about 55°; postorbital part of head short, 8.1 in length; mandible 6.1; gill rakers about two-thirds length of eye, 16 + 21 or 22 on first arch; dorsal fin rather

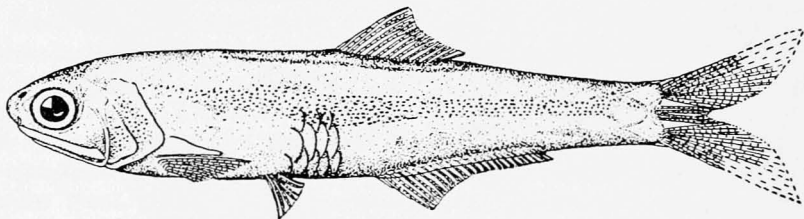


Fig. 19.—*Anchoa chamensis*. From the type, 72 mm. long, Chame Point, Panama (U. S. N. M., No. 119787). (Drawing by Mrs. Alice C. Mullen.)

high anteriorly, the last ray not longer than the immediately preceding ones, the longest rays reaching tip of last one if deflexed, the origin equidistant from base of caudal and anterior margin of eye; anal fin moderately long, its origin under beginning of second third of dorsal, a little nearer base of caudal than joint of mandible, its base 4.1 in length; ventral reaching slightly more than half way to origin of anal, inserted a little nearer base of pectoral than origin of anal; pectoral nearly reaching base of ventral, 1.4 in head, 5.8 in length; axillary scale of pectoral moderately broad at base, pointed distally, reaching opposite beginning of distal third of pectoral, 2.3 in head.

Color pale, side with a dark band in specimen preserved in formalin (no doubt silvery in life), about two-thirds width of eye above base of anal; back with definite dark dots; these also prominent on opercle; no definite dark spots on base of anal.

This species, as far as may be determined from a single specimen, is most nearly related to *A. lucida* from which it differs in the more elongate body, a difference most evident if specimens of equal size are compared (the depth in 8 specimens of *A. lucida*, 65 to 80 mm. long, being contained in the

length 4.25 to 4.5 times); the snout is shorter and does not project as far beyond the mandible; the eye is smaller; the maxillary is shorter; the anal fin is slightly shorter and rather more anteriorly inserted with respect to the base of dorsal; the pectoral fin appears to have more rays; and it has very definite dark dots on the opercle, which have not been noticed in any related species.

Range.—Known only from the type (U. S. N. M., No. 119787), 72 mm. long (58 mm. to base of caudal), from Chame Point, Panama.

***Anchoa ginsburgi* n. sp. (Fig. 20)**

Head 3.5 to 4.0; depth 5.3 to 5.75; D. 14 or 15; A. 18 to 20; P. 13 to 15; scales lost, about 42 to 45; vertebrae 44 or 45 (2 specimens dissected).

Body quite elongate, moderately compressed; head compressed, rather

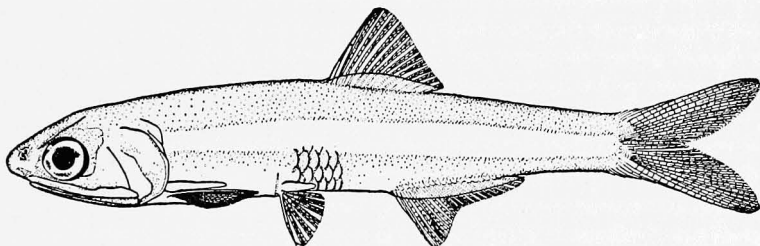


Fig. 20.—*Anchoa ginsburgi* n. sp. From a paratype, 60 mm. long, Gulf of Venezuela. (Drawing by Miss Louella E. Cable.)

long and low, its depth at joint of mandible equal to its postorbital length and about half the eye; snout rather short, always less than eye, projecting beyond mandible a little more than half its own length, 4.5 to 5.25 in head; eye 3.25 to 4.0; maxillary rather short, reaching joint of mandible, scarcely pointed, the upper margin shaped like the sharp edge of a rather bluntly rounded chef's knife, its length 1.4 to 1.5 in head; cheek a little longer than eye, with rather broad posterior angle, about 45°; postorbital part of head moderately long, 6.3 to 6.9 in length; mandible 5.6 to 6.4; gill rakers about three-fourths length of eye, 16 to 18 + 20 to 22 on first arch; dorsal fin with slightly concave margin, the anterior rays failing to reach tip of posterior ones if deflexed, its origin usually rather nearer base of caudal than anterior margin of eye; anal fin rather short, its origin commonly slightly posterior to middle of base of dorsal, its base somewhat shorter than head, 4.5 to 5.2 in length; ventral small, inserted equidistant or a little nearer to base of pectoral than origin of anal; pectoral not strongly falcate, the upper ray apparently always shorter than the next one, the shortest ray about half the length of the longest one, failing to reach base of ventral by about half

diameter of eye, 1.7 to 2.0 in head, 6.5 to 7.25 in length; axillary scale of pectoral moderately long, pointed, failing to reach tip of longest rays by a distance equal to about three-fourths diameter of eye, 2.8 to 3.1 in head.

Color of preserved specimens pale; sides of head silvery; body with a bright silvery lateral band, about three-fourths the width of eye above base of anal.

The collections studied contain 16 specimens, ranging in length from 28 to 60 mm., all from the Gulf of Venezuela. The proportions and enumerations given are based on 14 of these specimens.

This species is rather close to *hepsetus hepsetus*, with which it agrees in the number of gill rakers and fin rays, and also fairly well in the shape and position of the fins. Comparing specimens of equal size (55 to 70 mm. long) of *hepsetus hepsetus* from Beaufort, N. C., with the specimens from Venezuela it is evident that the latter are more slender, the depth being contained 5.3 to 5.75 in length, whereas in the specimens from Beaufort it is contained 4.9 to 5.3; the head is shorter, 3.7 to 3.8, and 3.3 to 3.4 in Beaufort fish; the eye is smaller, 3.4 to 3.8 in head, and 13.7 to 14.0 in length, and 3.25 to 3.5 in head and 10.9 to 11.7 in length in the North Carolina specimens; and the axillary scale of pectoral is shorter, failing to reach the tip of the fin by a distance equal to about three-fourths the diameter of eye, whereas in Beaufort specimens it generally fails to reach the tip of the fin by a distance scarcely equal to the pupil. The most pronounced difference is in the length and shape of the maxillary. In *ginsburgi* it is distally slightly rounded, not sharply pointed and it reaches only to the joint of mandible. In *hepsetus hepsetus* (except in very young) the maxillary is much more pointed, and it reaches well past the joint of the mandible, nearly or quite to the margin of opercle. The number of vertebrae in *ginsburgi* is greater than in southern specimens of *hepsetus hepsetus* (though scarcely greater than in northern ones), it being 44, whereas 41 to 43 are present in specimens of *hepsetus hepsetus* from the Gulf coast of the United States, West Indies, and Panama.

As no perfect specimen is included in the collection it becomes necessary to choose an imperfect one as type, which has the maxillary on one side and some of the fins somewhat damaged. It is about 55 mm. long (caudal imperfect), 45 mm. to base of caudal, and is deposited in the U. S. National Museum (No. 119788). The following proportions and enumerations are based on the type: Head in length 3.75; depth 5.6; distance from snout to dorsal 1.8; anal base 5.0; postorbital part of head 5.6. Eye in head 4.0; snout 5.2; maxillary 1.5; pectoral 1.8; axillary scale of pectoral 3.1. D. 14; A. 19; P. 13; scales lost, about 44 pockets; gill rakers 17 + 22.

This species is named for my colleague, Isaac Ginsburg, who furnished much material from the Gulf coast of the United States for these studies.

Range.—Known only from the Gulf of Venezuela.

Anchoa hepsetus hepsetus (Linnaeus) (Fig. 21)

Piquitinga Maregrave, 1648, 159, Brazil.

Menidia Browne, 1756, 441, Jamaica.

Esox hepsetus Linnaeus, 1758, 314, "America." (This author gave the references cited above. Fowler (1936, 183) seems to have been the first among recent writers to cite *Esox hepsetus* Linnaeus.)

Esox epsetus Bonnaterre, 1788, 175, American seas. (This author apparently followed Linnaeus (*loc. cit.*), having dropped the h from the specific name. He, indeed, gave a reference to Linnaeus, though apparently not to the Tenth Edition.)

Atherina brownii Gmelin, 1788, 1397, Jamaica. (After Browne; *loc. cit.*)

Engraulis vittatus Mitchill, 1815, 456, New York.

Engraulis hiculus Goode & Bean, 1880, 343, Clear Water Harbor, Fla. (I have examined the type, U. S. N. M., No. 23632, which is in poor condition. It is about 57 mm. long, and not 47 mm. as stated in the original description.)

Stolephorus perthecatus Goode & Bean, 1883, 434, Pensacola, Fla. (According to the original description the anal fin has 16 rays. However, I have examined the type, U. S. N. M., No. 30483, and have counted 21 (19 divided) anal rays, bringing the number well within the range of *hepsetus*.)

Anchoviella epsetus Jordan & Seale, 1926, 396 (in part); Hildebrand & Cable, 1930, 388-394. (The last paper cited is principally on the development of the eggs and young.)

Head 3.3 to 4.0; depth 4.5 to 5.4; D. 13 to 16; A. 18 to 23; P. 13 to 15; scales mostly lost, about 37 to 43; vertebrae 40 to 44 (377 specimens dissected), decreasing in number in southern specimens (see table 7).

Body elongate, moderately compressed, its greatest thickness somewhat exceeding depth of caudal peduncle; head rather long, its depth at joint of mandible equal to postorbital part of head and about one-fourth of eye; snout moderately long, projecting beyond the mandible a distance equal to two-thirds its length, 4.5 to 6.0 in head; eye moderately large, 3.25 to 4.0; maxillary long and pointed in adults, blunter in young, reaching nearly or quite to margin of opercle, 1.2 to 1.3 in head; cheek a little longer than eye, its posterior angle rather broad, about 45°; opercular margin more or less rounded, nowhere concave; postorbital part of head rather long, 6.5 to 7.7 in length; mandible 4.7 to 6.1; gill rakers at angle about three-fourths length of eye, 15 to 20 + 18 to 24 (usually 16 to 19 + 19 to 22) on first arch; dorsal fin with nearly straight margin, the anterior rays reaching past the tips of some of the succeeding ones but not to tip of the posterior one if deflexed, the origin of fin usually about equidistant from middle of eye and base of caudal; anal fin rather short, its origin under middle to posterior fourth of base of dorsal, its base always shorter than head, 4.4 to 5.2 in

length; ventral small, not pointed, the longest rays exceeding the shortest by half the diameter of pupil, generally inserted equidistant from base of pectoral and origin of anal; pectoral rather short, though variable, not strongly falcate, the upper 4 rays usually of about equal length, the uppermost or first one sometimes shorter than the second one, the last or shortest ray usually reaching well past midlength of the first one, the fin generally failing to reach base of ventral by diameter of eye, though sometimes only by diameter of pupil, length of fin 1.7 to 2.0 in head, 5.6 to 7.0 in length; axillary scale of pectoral long and narrow, generally failing to reach tips of longest rays by rather less than diameter of pupil, 2.0 to 2.5 in head.

Color of preserved specimens pale above; sides of head silvery; lower parts of body with silvery sheen; sides with a bright silvery band, variable in

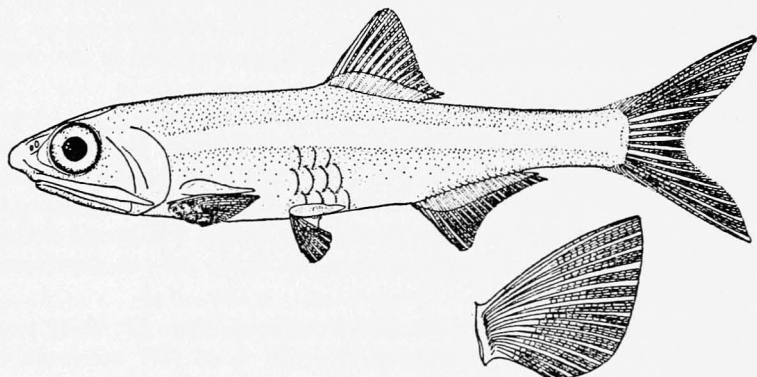


Fig. 21.—*Anchoa hepsetus hepsetus*. From a specimen 114 mm. long, Atlantic City, N. J. Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

width, usually about three-fourths width of eye above base of anal; base of upper rays of caudal with a V-shaped dark marking.

Many specimens, ranging from juveniles to adults, from Massachusetts, New York, New Jersey, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Mississippi, Texas, Louisiana, Yucatan, Panama (Atlantic), Brazil, Uruguay, Cuba, Puerto Rico, Jamaica, New Grenada and Curacao, were examined. The proportions and enumerations used are based on not fewer than 83 specimens, 55 to 140 mm. long, and some of them on many more. Table 7 seems to indicate that different sections of the coast probably have their own populations.

Range.—Massachusetts, rarely to Nova Scotia, through the West Indies, and southward at least as far as Montevideo. It is interesting that only one specimen of this anchovy is included in the 12 collections at hand from Key West and Tortugas, Fla., made at different times and by several collectors.

This species was recorded from Cape Verde, Africa, but that record needs verification. It is common to numerous from the middle Atlantic states southward, where it is preyed upon extensively by predatory fish and water birds. It is also used commercially to a limited extent.

TABLE 7.—FREQUENCY DISTRIBUTION OF THE TOTAL NUMBER OF VERTEBRAE IN 373 SPECIMENS OF *Anchoa hepsetus hepsetus* BY STATES*

States or localities	Total number of vertebrae				
	40	41	42	43	44
<i>New York</i>	2	9
<i>New Jersey</i>	2	21	15
<i>Maryland</i>	8	1
<i>Virginia</i>	3	19	2
<i>North Carolina</i>	5	35	15
<i>Georgia</i>	1	1	17	5
<i>Florida (east coast)</i>	1	7	1
<i>Florida (west coast)</i>	17	26	1
<i>Mississippi</i>	3	3	.
<i>Louisiana</i>	3	24	29	.
<i>Texas</i>	1	3	1	.
<i>Yucatan</i>	1	20	41	.	.
<i>Panama (Atlantic)</i>	1	4	2	.	.
<i>West Indies</i>	7	15	1	.

* One specimen from each of the following states or places was examined: Massachusetts; South Carolina; Bahia, Brazil; and Montevideo, Uruguay, which in the order named had 44, 43, 42 and 43 vertebrae.

TABLE 8.—FREQUENCY DISTRIBUTION OF LENGTH OF PECTORAL EXPRESSED IN PERCENT OF STANDARD LENGTH IN *Anchoa hepsetus hepsetus*, *A. hepsetus colonensis*, AND *A. lamprotaenia*

Species and subspecies	Length of pectoral in percent of standard length						
	13	14	15	16	17	18	19
<i>Anchoa hepsetus hepsetus</i>	6	29	47	27	6	.	.
<i>Anchoa hepsetus colonensis</i>.....	.	4	20	17	2	.	.
<i>Anchoa lamprotaenia</i>.....	.	6	13	56	38	17	2

TABLE 9.—FREQUENCY DISTRIBUTION OF LENGTH OF AXILLARY SCALE OF PECTORAL EXPRESSED IN PERCENT OF STANDARD LENGTH IN *Anchoa hepsetus hepsetus*, *A. hepsetus colonensis*, AND *A. lamprotaenia*

Species and subspecies	Length of axillary scale of pectoral in percent of standard length								
	7	8	9	10	11	12	13	14	15
<i>Anchoa hepsetus hepsetus</i>.....	.	.	1	6	28	49	31	9	2
<i>Anchoa hepsetus colonensis</i>.....	.	.	.	1	3	7	3	1	.
<i>Anchoa lamprotaenia</i>	5	30	35	36	6	1	.	.	.

TABLE 10.—FREQUENCY DISTRIBUTION OF PECTORAL RAYS IN *Anchoa hepsetus hepsetus*, *A. hepsetus colonensis*, AND *A. lamprotaenia*

Species and subspecies	Total number of pectoral rays						
	11	12	13	14	15	16	17
<i>Anchoa hepsetus hepsetus</i>.....	.	.	7	46	63	20	2
<i>Anchoa hepsetus colonensis</i>.....	.	.	3	11	9	.	.
<i>Anchoa lamprotaenia</i>	1	44	62	10	3	.	.

TABLE 11.—FREQUENCY DISTRIBUTION OF TOTAL NUMBER OF GILL RAKERS ON FIRST ARCH IN *Anchoa hepsetus hepsetus*, *A. hepsetus colonensis*, AND *A. lamprotaenia*

Species and subspecies	Total number of gill rakers on first arch														
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
<i>Anchoa hepsetus hepsetus</i>.....	.	.	.	.	.	8	13	23	49	35	21	21	6	.	1
<i>Anchoa hepsetus colonensis</i>.....	.	.	.	.	.	4	5	11	6	2	.	.	.	.	.
<i>Anchoa lamprotaenia</i>	1	12	34	36	36	7	3	.	.	.	.	.	.	.	.

TABLE 12.—FREQUENCY DISTRIBUTION OF THE TOTAL NUMBER OF VERTEBRAE IN *Anchoa hepsetus hepsetus*, *A. hepsetus colonensis*, AND *A. lamprotaenia*

Species and subspecies	Total number of vertebrae					
	39	40	41	42	43	44
<i>Anchoa hepsetus hepsetus</i>....	.	2	32	94	145	46
<i>Anchoa hepsetus colonensis</i>...	.	2	13	12	9	.
<i>Anchoa lamprotaenia</i>	7	29	44	18	.	.

***Anchoa hepsetus colonensis* n. subsp. (Fig. 22)**

Anchoa brownii Meek & Hildebrand, 1923, 204, Colon and Porto Bello, Panama (in part *A. hepsetus colonensis*).

Head 3.5 to 3.75; depth 4.6 to 5.3; D. 13 to 15; A. 19 to 23; P. 13 to 15; scales about 38 to 42; vertebrae 42 or 43 (3 specimens dissected).

Body rather more strongly compressed than in *A. hepsetus hepsetus*, its greatest thickness scarcely exceeding depth of caudal peduncle; head moderately long, its depth at joint of mandible equal to postorbital part of head and a fourth of eye; snout moderately long, projecting about two-thirds its length beyond tip of mandible, 5.2 to 5.7 in head; eye 3.3 to 3.8; maxillary long, moderately pointed, its upper free edge straight to slightly curved, not quite reaching margin of opercle, 1.15 to 1.3 in head; cheek rather short and broad, exceeding length of eye by about fourth of snout, its posterior angle about 45°; postorbital part of head slightly longer than snout and eye, 6.5 to 7.5 in length; mandible 4.7 to 5.6; gill rakers scarcely longer than pupil, 15 to 18 + 19 to 21 on first arch; dorsal moderately low, with slightly concave margin, the longest rays failing to reach tip of last one if

deflexed, origin of fin equidistant from base of caudal and some point over anterior half of eye; anal rather short, its origin about under middle of base of dorsal, its base 4.3 to 4.9 in length; ventral reaching about half way to origin of anal, inserted about equidistant from origin of anal and base of pectoral; pectoral quite long, often reaching nearly or quite to base of ventral, 1.7 to 2.0 in head, 6.3 to 7.0 in length; axillary scale of pectoral long and slender, reaching opposite beginning of distal fourth of fin, 2.2 to 2.4 in head.

Color as in *A. hepsetus hepsetus*, except that the silvery lateral band is narrower, being scarcely wider than pupil.

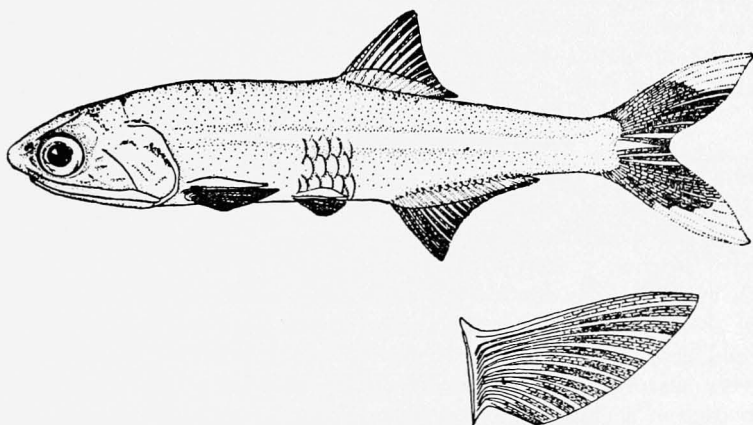


Fig. 22.—*Anchoa hepsetus colonensis* n. subsp. From the type, 70 mm. long, Colon, Panama (U. S. N. M., No. 117664). Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

The description is based on 13 specimens, 50 to 70 mm. long, from the vicinity of Colon, Panama, including the type, which is 70 mm. long, 56 mm. to base of caudal (U. S. N. M., No. 117664). These specimens are the extremes of this subspecies. Other specimens, more or less definitely assigned to it, are from Porto Bello, Panama; Jamaica; St. Thomas; St. Vincent Pass, Fla.; Grand Isle, La.; and Mustang Island, Texas.

This subspecies differs from the typical form principally in having longer and more falcate pectoral fins (see inserts of figs. 21 and 22) which extend nearly or quite to the base of the ventrals (though their proportional length, as in the head and in the length, do not seem to differ), and in the notably narrower silvery band. The dorsal fin also is higher anteriorly and has a more deeply concave margin. The body seems to be more strongly compressed, as well as slightly deeper than in specimens of about the same size

of *hepsetus hepsetus*. For example, in 8 specimens, 50 to 70 mm. long, from Colon, the depth is contained in the length 4.6 to 5.1 times, whereas in 9 specimens, 45 to 65 mm. long, from Beaufort, N. C.,* the depth is contained 5.1 to 5.4 times in the length, and the greatest thickness of the body is scarcely equal to the depth of the caudal peduncle, whereas in the typical form it exceeds the depth of the peduncle. Furthermore, a smaller size seems to be attained, as no specimen exceeding a length of 70 mm. was seen.

This subspecies, if that be the proper designation, is not a geographical variant, as specimens of the typical form also were taken on the Atlantic coast of Panama. There is no intergradation between the two in the Panama material, and so far as those specimens are concerned the two might stand as distinct species. Northward, especially on the Gulf coast of the United States, intergradation takes place.

Range.—Gulf coast of the United States to Panama, and the West Indies.

***Anchoa lamprotaenia* n. sp. (Fig. 23)**

Head 3.3 to 4.0; depth 4.3 to 5.25; D. 13 to 15; A. 19 to 26 (usually 21 to 24); P. 11 to 15 (usually 12 to 14); scales lost, about 38 to 41; vertebrae 39 to 42 (98 specimens dissected).

Body elongate, rather strongly compressed; head moderately long, its length exceeding the depth by a little more than diameter of eye; snout rather short, pointed, projecting about two-thirds its own length, beyond tip of mandible, 4.5 to 5.75 in head; eye 3.5 to 4.0; maxillary moderately long, not very sharply pointed, generally distally rounded above, shaped like the sharp edge of a chef's knife, reaching to joint of mandible or more usually beyond this point but not to margin of opercle, 1.2 to 1.4 in head; cheek as long as eye and fully half the snout, its posterior angle acute, about 35°; opercular margin straight at and somewhat below beginning of silvery lateral band, rounded elsewhere; postorbital part of head rather long, 6.25 to 7.0 in length; mandible 4.5 to 5.4; gill rakers three-fourths the length of eye, 13 to 18 + 16 to 22 (most frequently 14 or 15 + 18 or 19) on first arch; dorsal with margin slightly concave, the anterior rays usually reaching beyond the tips of the posterior ones if deflexed, its origin generally nearer base of caudal than tip of snout, frequently equidistant from middle of eye and base of caudal; anal fin, moderately long, its origin about under beginning of the posterior third of base of dorsal, its base a little shorter than head, 4.25 to 4.9 in length; ventral pointed, usually inserted slightly nearer origin of anal than base of pectoral; pectoral long, pointed, falcate, usually failing

* Comparison of specimens from North Carolina is necessary, as no specimens of equal size of *hepsetus hepsetus* from Panama are at hand. A comparison of the depth of specimens of unequal size is not practicable in these fish as the proportionate depth of the body tends to increase with age and growth.

to reach base of ventral by half diameter of eye, the first (upper) ray generally longest, in a few specimens with a slight filament, the rays decreasing rapidly in length beginning with the third one, the last or shortest ray scarcely reaching past midlength of the first one, length of fin 1.5 to 1.9 in head, 5.5 to 6.5 in length; axillary scale of pectoral short, broad at base, often reaching only a little past midlength of pectoral, about 3.0 to 3.6 in head.

Color of preserved specimens pale; side of head silvery; middle of side with a bright silvery band, not quite as wide as eye above anal fin.

Many specimens, varying from 30 to 92 mm. in length, have been examined, which were collected at Palm Beach, Miami, Key West and Tortugas, Fla.; Progreso, Yucatan; Cuba, Puerto Rico, British Honduras; and on the Atlantic Coast of Panama. This species is common at Key West, and

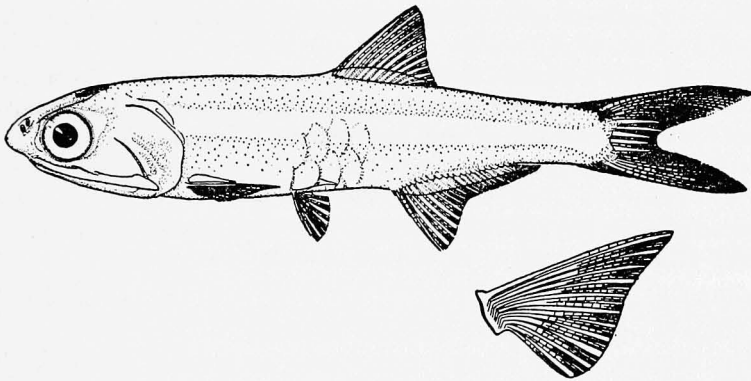


Fig. 23.—*Anchoa lamprotaenia* n. sp. From a paratype, 60 mm. long, Key West, Fla. (U. S. N. M., No. 35000). Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

Tortugas, Fla., in Cuba, Puerto Rico, and Panama. It apparently attains a smaller size than *hepsetus hepsetus*, which some specimens approach rather closely, and with which specimens in museum collections have been consistently identified. It generally is readily distinguished, however, by the longer and more falcate pectoral and dorsal fins (see table 8, and figures 21 and 23) the longest rays of the dorsal usually reaching beyond the tip of the posterior ray if deflexed; the shorter and broader axillary scale of the pectoral (see table 9); and the broader and more bluntly pointed maxillary, with its upper free margin rounded like the sharp edge of a chef's knife (there being variation, however, in these respects in both species). The anal fin is rather longer, has a higher average number of rays, and usually is placed farther back under the dorsal; the average number of pectoral rays is fewer; and the gill rakers and vertebrae are somewhat fewer. The

distribution of the anal and pectoral rays, the gill rakers, and vertebrae, in a large series, is shown in tables 4, 5, 10, 11 and 12. The proportions and enumerations given are based on at least 80 specimens, and some of them on many more. Although it may not always be feasible to separate this species from *hepsetus hepsetus* and *hepsetus colonensis* by any one character it can be separated by a combination of characters. The different modes in the enumerations and proportions shown in the tables presented are striking.

The specimen selected as type is 80 mm. long (65 mm. to base of caudal). It is from Key West, Fla., and bears U. S. National Museum catalogue number 117661.

The following proportions and enumerations are based on the type: Head in length 3.5; depth 4.3; distance from snout to dorsal 1.8; anal base 4.5; pectoral 6.5; postorbital part of head 6.8. Eye in head 3.7; snout 5.6; maxillary 1.7; pectoral 1.8; axillary scale of pectoral 3.7. D. 14; A. 24; P. 13; scales lost, about 40; gill rakers 15 + 19.

Range.—Southern Florida to Panama and the West Indies. An imperfect specimen from Bahia, Brazil, also seems to be of this species. Very numerous in the Florida Keys where it virtually replaces *A. hepsetus*.

***Anchoa helleri* (Hubbs) (Fig. 24)**

Anchoiella helleri Hubbs, 1921, 47, San Filipe Bay, Gulf of California (type F. M. N. H., No. 3332).

Head 3.5 to 3.7; depth 4.6 to 5.0; D. 16; A. 20 to 24; P. 14; scales mostly lost, about 38; vertebrae 41 (1 specimen dissected).

Body elongate, rather strongly compressed, its greatest thickness about equal to depth of caudal peduncle; ventral outline rather more strongly convex than the dorsal; head quite long, its depth at joint of mandible a little greater than its postorbital length; snout long, pointed, only a little shorter than eye, extending nearly its full length beyond tip of mandible, 5.5 to 6.4 in head; eye 3.8 to 4.6; maxillary reaching beyond joint of mandible

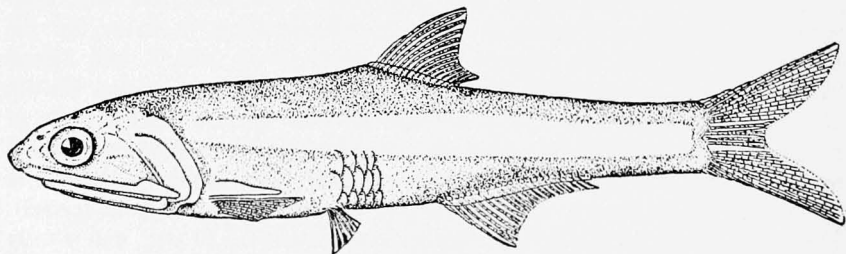


Fig. 24.—*Anchoa helleri*. From a specimen 90 mm. long, Cape San Lucas, Lower Cal. (U. S. N. M., No. 2526). (Drawing by Mrs. Alice C. Mullen.)

but not to margin of opercle, its upper free margin distally rounded somewhat like the sharp edge of a chef's knife, 1.2 to 1.3 in head; cheek long and narrow, only a little shorter than snout and eye, its posterior angle very sharp, about 30°; postorbital part of head long, 6.8 to 7.0 in length; mandible 5.0 to 5.3; gill rakers moderately stocky, a little shorter than snout, 16 to 18 + 19 to 21 on first arch; dorsal fin moderately high, with concave margin, the longest rays reaching beyond tip of last one if deflexed, its origin nearly equidistant from base of caudal and anterior margin of eye; anal rather small, its origin under or somewhat in advance of last ray of dorsal, about equidistant from base of caudal and base of pectoral, its base 4.6 to 5.0 in length; ventral reaching about half way to anal, inserted nearly equidistant from origin of anal and base of pectoral; pectoral moderately long, not quite reaching base of ventral, 1.6 in head, 6.2 in length; axillary scale of pectoral long, reaching opposite distal fourth of fin, 2.7 to 2.9 in head.

Color of preserved specimens brownish; sides of head bright silvery; a broad silvery lateral band present, wider than eye; upper surface of head and back with dusky punctulations, not forming a definite streak.

The description is based on 4 specimens, 90 to 100 mm. long, not in very good condition. One specimen from Cape San Lucas, Lower California, was stored in a bottle with several *Engraulis mordax*, which this species in general appearance resembles. The other three are from St. Georges Island, Gulf of California. I have found nothing inconsistent in these specimens with the description of *A. helleri*, the type of which I have not seen.

Range.—Lower California, from San Filipe Bay and St. Georges Island to Cape San Lucas.

Anchoa lyolepis (Evermann & Marsh) (Fig. 25)

Stolephorus lyolepis Evermann & Marsh, 1902, 89, fig. 13, Culebra, Puerto Rico (type U. S. N. M., No. 49528).

Stolephorus choerostoma Evermann & Marsh, 1902, 88 (not of Goode).

? *Engraulis (Stolephorus) argentivittatus* Regan, 1904, 255, "Pas Peñas," Jalisco, Mex.

Anchoviella platyargyrea Fowler, 1911, 216, fig. 4, St. Martins, West Indies.

Anchoviella choerostoma Jordan & Seale, 1926, 404 (in part not of Goode, as specimens listed from Puerto Rico are *A. lyolepis*); Beebe & Tee-Van, 1928, 47, with fig. (not of Goode).

Head 3.1 to 3.7; depth 5.0 to 6.0; D. 12 to 15; A. 19 to 23, most frequently 20 to 21; P. 12 to 14; scales mostly lost, about 40 to 44; vertebrae 41 to 43 (9 specimens dissected).

Body very elongate, rather strongly compressed; head long and low, its depth at joint of mandible about equal to its postorbital length; snout long and pointed, extending beyond mandible a distance only a little less than its

length, 4.3 to 5.5 in head; eye small, scarcely longer than snout in adults, 4.25 to 5.0; maxillary rather bluntly pointed, its upper margin round like the sharp edge of a chef's knife, generally reaching past joint of mandible but not quite to margin of opercle, 1.15 to 1.3 in head; cheek long and narrow, about as long as snout and eye, its posterior angle very acute, only about 25° ; opercular margin nearly straight at shoulder, scarcely covering gills at this point; postorbital part of head long, slightly exceeding eye and snout, 6.0 to 6.5 in length; mandible 4.5 to 5.0; gill rakers nearly as long as eye, 15 to 21 + 19 to 26 on first arch; dorsal fin rather deeply concave, elevated anteriorly, the longest rays reaching nearly to tip of last one if deflexed, the origin usually somewhat nearer base of caudal than tip of snout; anal fin moderately short, its origin under or slightly behind base of last ray of dorsal, its base somewhat shorter than head, 4.4 to 5.3 in length; ventral small,

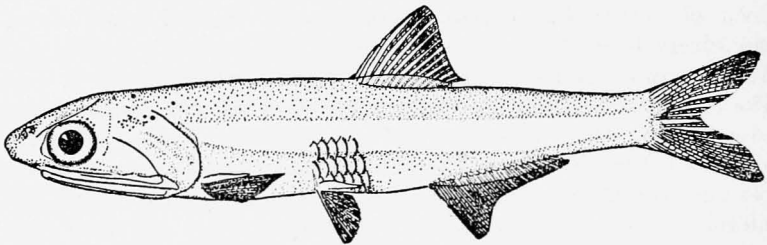


Fig. 25.—*Anchoa lyolepis*. From a specimen 63 mm. long, Hucares, Puerto Rico (U. S. N. M., No. 125580). (Drawing by Miss Louella E. Cable.)

pointed, inserted equidistant from base of pectoral and origin of anal or rather nearer the former, generally failing to reach origin of anal by more than an eye's diameter; pectoral rather pointed, falcate, failing to reach ventral by half to two-thirds diameter of eye, the last ray only about half as long as the first (upper) one, 1.75 to 2.1 in head, 6.5 to 7.2 in length; axillary scale of pectoral broad at base, half to two-thirds as long as pectoral, 2.9 to 3.5 in head.

Color of preserved specimens pale; sides of head silvery; body with a broad, bright silvery lateral band, fully as wide as eye, often dusky in specimens preserved in formalin. Back, dorsal and caudal fins with dusky punctulations, frequently present at base of anal also.

Numerous specimens, including the type material of *Stolephorus lyolepis* Evermann & Marsh, and 8 paratypes of *Anchoviella platyargyrea* Fowler, have been studied. The proportions and enumerations given in the description, unless otherwise stated, are based on 22 or more specimens, 45 to 70 mm. long. The specimens studied are in the National Museum, the Museum of Comparative Zoology, and the Academy of Natural Sciences of Philadelphia.

They were collected in Puerto Rico (where this species apparently is common), Cuba, St. Martins, off St. Vincents Island, Fla., in Mobile Bay, in Mississippi Sound, off Grand Isle, La., and off Galveston and off Aransas Pass, Texas, and in the Gulf of Venezuela. This species is represented from United States waters by six small lots, all taken with trawls some distance off shore in the Gulf of Mexico. The specimens from the Gulf of Mexico have a greater average number of gill rakers, but seem to agree in other respects.

It is evident from a comparison of the type and paratypes of *Stolephorus lyolepis* Evermann & Marsh, consisting of juveniles 30 to 37 mm. long, with adults identified as *S. choerostoma* by the same investigators, that they are all one species. The small specimens, *lyolepis*, already have the characteristic long low head, long pointed snout, and the knifeblade shaped maxillary of the adults. The position of the fins, together with the number of rays, also agree. Although Fowler apparently was the first to recognize that the adults differed from *A. choerostoma* Goode, and proposed the name *platyargyrea*, his name becomes a synonym, as *lyolepis* has priority.

Range.—West Indies, Gulf of Mexico, and Gulf of Venezuela; also Jalisco, Mexico, if *Engraulis argentivittatus* Regan is a synonym, which is not at all certain.

Anchoa ischana (Jordan & Gilbert) (Fig. 26)

Stolephorus ischana Jordan & Gilbert, 1882, 340, Mazatlan, Mex. (type U. S. N. M., No. 29246).

Anchoviella ischana Jordan & Seale, 1926, 397 (in part *A. starksi*).

Anchovia ischana Breder, 1928, 8, Gulf of California.

Head 3.6 to 4.0; depth 5.25 to 6.25; D. 14 or 15; A. 17 to 20 (usually 18 or 19); P. 14 to 16; scales lost, about 40 to 44; vertebrae 44 to 46 (6 specimens dissected).

Body moderately deep, compressed, its greatest thickness usually exceeding depth of caudal peduncle by diameter of pupil; dorsal and ventral outlines about equally convex; chest and abdomen scarcely trenchant; head moderately short, its depth at joint of mandible scarcely equal to its postorbital length; snout moderately short, projecting a little more than half its length beyond tip of mandible, 5.4 to 6.4 in head; eye 3.6 to 4.5; maxillary rather long, reaching well beyond joint of lower jaw, but not to margin of opercle, rather bluntly pointed, 1.25 to 1.4 in head; cheek moderately long, equal to length of eye and about three-fourths of snout, its posterior angle approximately 40°; postorbital part of head rather short, 7.0 to 7.75 in length; mandible 5.25 to 5.8; gill rakers scarcely shorter than snout, 14 to 18 + 17 to 21 on first arch; dorsal fin with moderately concave margin, the longest rays failing to reach tip of last one if deflexed, its origin generally equidistant from base of caudal and some point over snout; anal small, its

origin somewhere under posterior third of base of dorsal or slightly behind it, a little nearer base of caudal than base of pectorals, its base 5.5 to 6.2 in length; ventral frequently reaching scarcely half way to origin of anal in adults, inserted about equidistant from origin of anal and base of pectoral; pectoral short, often failing to reach base of ventral in adults by a distance exceeding diameter of eye, 1.9 to 2.2 in head, 6.8 to 8.0 in length; axillary scale of pectoral rather long, slender, but not reaching tips of longest rays of fin, 2.2 to 2.9 in head.

Color in alcohol pale; sides of head silvery, a broad, sharply defined silvery lateral band present, as wide as eye above base of anal; back with dusky punctulations, these sometimes arranged in a double series posterior to base of dorsal; base of anal with dusky dots, sometimes continued in a single median series posterior to base of anal.

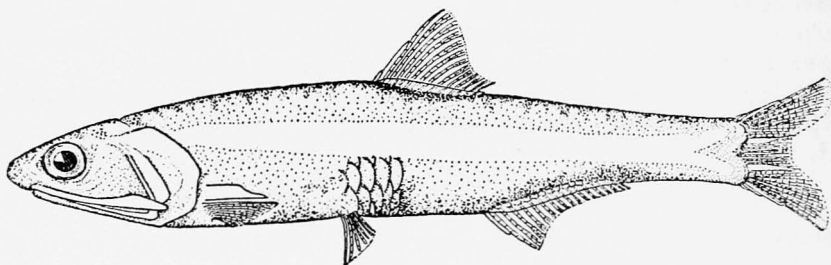


Fig. 26.—*Anchoa ischana*. From a specimen 75 mm. long, Magdalena Bay, Lower Cal. (U. S. N. M., No. 46692). (Drawing by Mrs. Alice C. Mullen.)

Rather numerous specimens, including the "types" (U. S. N. M., No. 29246), ranging in length from 45 to 80 mm., have been examined. The proportions and enumerations, unless otherwise stated, are based on 36 specimens. This species is close to *A. arenicola*, as stated in the account of that species. It is related also to *A. starksi*, with which it has been confused, but from which it is readily distinguishable.

Range.—According to the material at hand this species ranges from Lower California to Acapulco, Mexico. Specimens examined are from Magdalena Bay, Mazatlan, and Acapulco, Mexico. Material previously recorded as this species from Panama apparently is referable to *A. starksi* and *A. arenicola*.

***Anchoa arenicola* (Meek & Hildebrand) (Fig. 27)**

Anchoa ischana Gilbert & Starks, 1904, 42, Panama Bay (not of Jordan & Gilbert).

Anchoa arenicola Meek & Hildebrand, 1923, 201, Pl. XIII, fig. 1, Panama Bay (type U. S. N. M., No. 81744); Breder, 1928, 8, Bahia Hunda, and Pearl Islands, Panama.

Head 3.6 to 4.0; depth 5.5 to 6.4; D. 14 or 15, occasionally 16; A. 17 to 20; P. 14 to 16; scales about 38 to 41; vertebrae 44 to 46 (14 specimens dissected).

Body very slender, moderately compressed, its greatest thickness generally exceeding depth of caudal peduncle by half diameter of pupil; dorsal outline rather more convex than the ventral; chest and usually the abdomen somewhat trenchant; head moderately long and low, its depth at joint of mandible equal to or slightly exceeding its postorbital length; snout moderately long, projecting about two-thirds its length beyond tip of mandible, 5.25 to 6.1 in head; eye 3.5 to 4.2; maxillary only moderately long, reaching somewhat beyond joint of lower jaw, rather bluntly pointed, its upper margin shaped more or less like the sharp edge of a chef's knife, 1.25 to 1.4 in head; cheek moderately short and broad, its length exceeding diameter

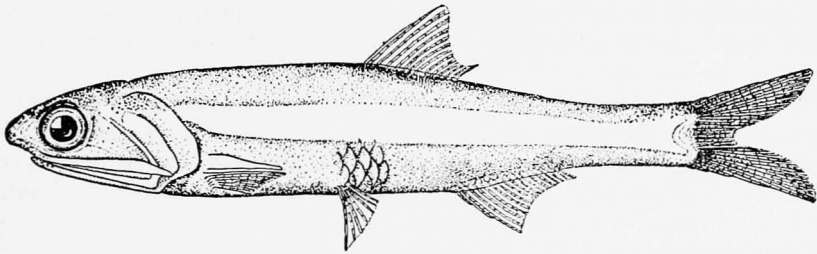


Fig. 27.—*Anchoa arenicola*. From a specimen 105 mm. long, Chame Point, Panama (U. S. N. M., No. 82050). (Drawing by Mrs. Alice C. Mullen.)

of eye by about one-third length of snout, its posterior angle approximately 35° ; postorbital part of head moderately long, 6.75 to 8.2 in length; mandible 5.3 to 5.8; gill rakers a little shorter than snout, 15 to 18 + 17 to 21 (usually 15 to 17 + 18 to 20) on first arch; dorsal fin with rather deeply concave margin, the longest rays not nearly reaching tip of last one if deflexed, its origin generally equidistant from base of caudal and some point over anterior half of eye; anal moderately small, its origin under posterior third of base of dorsal, generally equidistant from base of caudal and base of pectoral, its base 5.1 to 7.0 in length; ventral reaching only half way to origin of anal in adults, proportionally longer in young, inserted rather nearer origin of anal than base of pectoral; pectoral short, failing to reach base of ventral by a distance often exceeding diameter of eye in adults, proportionally longer in young, 1.9 to 2.25 in head, 6.5 to 6.9 in length; axillary scale of pectoral very long and slender, often nearly or quite as long as fin, 1.8 to 2.4 in head.

Color in alcohol pale; sides with a sharply defined silvery band, generally three-fourths vertical diameter of eye above base of anal; back with scat-

tered dusky punctulations, more prominent in young than in adults, sometimes more or less definitely in two rows behind dorsal fin; base of anal with dusky dots, generally continued as a single median series posterior to the fin.

Many specimens, ranging from 40 to 125 mm. in length, have been examined. The proportions and enumerations given in the description, unless otherwise stated, are based on 47 specimens, including several paratypes. The development of adipose tissue of the eye is variable, as in one lot of specimens of the same size some specimens have it much more profusely developed than others.

This species is close to *A. ischana* from which it eventually, if specimens from localities intermediate of Mexico and Panama become available, may prove to be only subspecifically distinct. In addition to the narrower silvery lateral band, and the apparently much larger size attained by *A. arenicola*, it is more slender, has a larger eye, apparently a somewhat lower and longer head, a narrower and shorter cheek, and a longer axillary scale of the pectoral.

In specimens of various sizes of both species all the proportions given in the description intergrade, though if fish of equal size are compared it is seen that the Panama and Colombia ones, *A. arenicola*, are more slender, and have a larger eye. In 16 specimens of *A. arenicola*, varying in length to base of caudal from 51 to 72 mm., the depth is contained in the length 5.8 to 6.4 times, mode 6.0; eye in head 3.5 to 3.9, mode 3.7; eye in post-orbital part of head 1.7 to 2.0, mode 1.8; postorbital in length 7.6 to 8.1, mode 7.8. In a series of 16 specimens of *A. ischana*, varying in length to base of caudal from 52 to 69 mm., the same proportions are as follows: Depth in length 5.3 to 6.0, mode 5.6; eye in head 3.9 to 4.5, mode 4.2; eye in postorbital part of head 1.9 to 2.4, mode 2.2; postorbital in length 7.1 to 7.7, mode 7.4.

Range.—Pacific coast of Panama and Colombia, Ecuador and the Galapagos Islands. Specimens at hand are from La Venta, Chame Point, Taboga Island, Pearl Islands and Balboa, Panama; Tumaco, Colombia; and La Plata Island and Galapagos Islands, Ecuador. Some small, poorly preserved specimens from Corinto, Nicaragua, probably also are of this species. Apparently not entering brackish or fresh water.

Anchoa cultrata (Gilbert)

Stolephorus cultratus Gilbert, 1892, 544, Santa Margarita Island, off Lower Cal.; Jordan & Evermann, 1896, 443.

Head 3.66; depth 4.17; D. 12; A. 20; scales 40.

Body compressed, of medium depth; chest and abdomen trenchant; head slender, sharp; snout long, compressed, extending beyond tip of mandible

a distance nearly equal to diameter of orbit; maxillary rather sharply pointed, extending beyond joint of mandible and nearly to gill opening; origin of dorsal about equidistant from base of caudal and anterior margin of pupil; origin of anal behind last ray of dorsal; ventral inserted equidistant from origin of anal and joint of mandible.

Color olivaceous; sides with silvery band, narrow anteriorly, becoming wider posteriorly, as wide as eye above anal; dorsal region with black speckling; snout and margin of lobes of caudal dusky. (Condensed and rearranged, after Gilbert).

This species is known to me only from the original description based on a specimen about 83 mm. long, which cannot now be found. It apparently is rather close to *A. ischana* from which it seems to differ in the very long snout, the more posterior origin of the anal fin, and apparently in the deeper body. In the long snout it seems to resemble *A. naso*, from which it differs, however, according to the description in the more posterior origin of the anal, and in the deeper body. Furthermore, *A. naso* has more than 20 anal rays, if undivided rays are included.

Range.—Known only from Santa Margarita Island, off Lower California.

Anchoa choerostoma (Goode) (Fig. 28)

Engraulis choerostoma Goode, 1874, 125, Bermuda.

Stolephorus choerostoma Jordan & Evermann, 1896, 444.

Anchoviella choerostoma Jordan & Seale, 1926, 404 (specimens listed from Puerto Rico and Panama are not of this species).

Head 3.3 to 3.6; depth 4.8 to 5.5; D. 13 to 15; A. 22 to 24 (rarely 21 or 25); P. 12 to 14; scales lost, about 38 to 40; vertebrae 41 or 42 (2 specimens dissected).

Body rather strongly compressed, with a moderately sharp edge on chest and abdomen; head rather short and deep, its depth at joint of mandible equal to postorbital portion and about half eye; snout short, 4.7 to 5.6

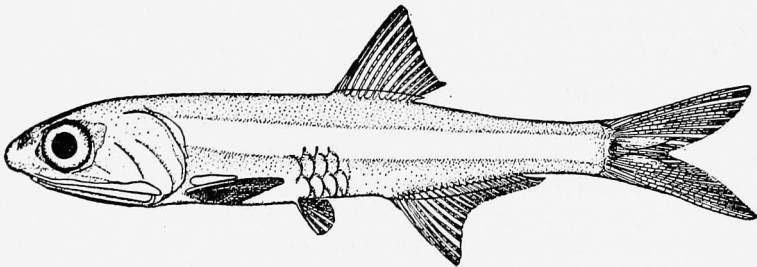


FIG. 28.—*Anchoa choerostoma*. From a specimen 68 mm. long, Bermuda (U. S. N. M., No. 21976). (Drawing by Miss Louella E. Cable.)

in head; eye large, 3.5 to 4.2; maxillary reaching beyond articulation of mandible, but not to margin of opercle, not sharply pointed, its upper free margin rounded somewhat like the sharp edge of a chef's knife, 1.2 to 1.3 in head; cheek long, equal to eye and fully three-fourths snout, with acute posterior angle of about 30°; postorbital part of head moderately long, 6.3 to 7.5 in length; mandible 4.4 to 5.2; gill rakers at angle scarcely as long as eye, 17 to 20 + 23 to 26 on first arch; dorsal fin with concave margin, the longest rays reaching to or beyond tip of last one if deflexed, its origin usually about equidistant from anterior margin of eye and base of caudal; anal fin, moderately short, its origin somewhere under posterior half of base of dorsal, its base somewhat shorter than head, 4.4 to 5.0 in length; ventral inserted a little nearer origin of anal than base of pectoral, failing to reach anal by nearly an eye's diameter; pectoral moderately long, the outer ray scarcely longer than the second one, failing to reach ventral by about diameter of pupil, 1.5 to 1.9 in head, 5.4 to 6.4 in length; axillary scale of pectoral little more than half the length of outer ray of pectoral, 3.0 to 4.0 in head.

Color of preserved specimens pale, with a silvery lateral band (often dusky in specimens preserved in formalin), generally about three-fourths width of eye. Upper surface of head and back with numerous dusky dots, generally in two longitudinal series posterior to base of dorsal.

This apparently common species of Bermuda differs from *lyolepis* of the West Indies, with which it has often been considered identical, in the proportionately much shorter and deeper head; shorter snout; larger eye; more numerous gill rakers; longer anal with origin farther forward; and notably narrower silvery lateral band. These differences are indicated in the descriptions and in part in the drawings herewith.

One hundred or more specimens, ranging in length from 32 to 80 mm., are included in the collections of the National Museum, the Museum of Comparative Zoology, and the Bingham Oceanographic Laboratory. The proportions and enumerations used are based on at least 22 specimens, ranging in length from 55 to 75 mm.

Range.—Bermuda only. West Indian and Panama (Atlantic) records are referable to other species.

Anchoa starksi (Gilbert & Pierson) (Fig. 29)

Stolephorus starksi Gilbert & Pierson, in Jordan & Evermann, 1898, 2813, Panama Bay. (The indications are that the original description was based in part on *A. arenicola*. However, no specimens of that species occur among 25 type specimens (S. U. N. H. M., No. 5814).)

Anchovia starksi Gilbert and Starks, 1904, 43.

Anchovia ischana Meek & Hildebrand, 1923, 203, Pl. XIII, fig. 2, Panama Bay; Hildebrand, 1939, 36 (not of Jordan & Gilbert).

Head 3.5 to 4.0; depth 4.4 to 5.5; D. 14 to 16; A. 20 to 23 (most frequently 21 or 22); P. 15 or 16 (rarely 14 or 17); scales mostly lost, about 40 to 44; vertebrae 41 to 43 (15 specimens dissected).

Body moderately deep, compressed, its greatest thickness about equal to depth of caudal peduncle; dorsal and ventral outlines about equally convex; chest and abdomen scarcely trenchant; head moderately short, its depth at joint of mandible about equal to postorbital part of head and half of eye; snout rather short, extending fully three-fourths its length beyond tip of mandible, 5.5 to 6.5 in head; eye 3.3 to 3.9; maxillary narrow, pointed, reaching well beyond joint of mandible, sometimes nearly to margin of opercle, 1.25 to 1.35 in head; cheek quite short and broad, scarcely longer than eye, its posterior angle about 45° ; postorbital part of head moderately long, 7.2 to 7.8 in length; mandible 5.5 to 6.2; gill rakers slender, about as

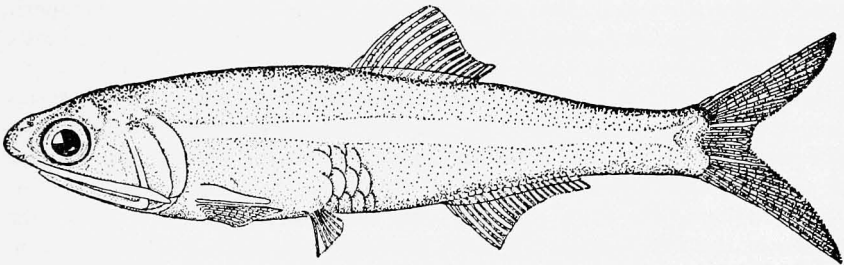


Fig. 29.—*Anchoa starksii*. From a specimen 65 mm. long, Miraflores Locks, C. Z. (Drawing by Mrs. Alice C. Mullen.)

long as snout, 20 to 23 + 24 to 28 (most frequently 21 to 23 + 25 to 27) on first arch; dorsal fin moderately low, with concave margin, the longest rays failing to reach tip of last one if deflexed, its origin generally only a little nearer base of caudal than tip of snout; anal moderately long, its origin about under the beginning of the posterior third of base of dorsal, nearly equidistant from base of caudal and base of pectoral, its base 4.5 to 5.5 (usually 4.75 to 5.0) in length; ventral reaching somewhat more than half way to origin of anal, usually inserted about equidistant from origin of anal and base of pectoral; pectoral moderately long, generally failing to reach base of ventral by a distance equal to rather less than diameter of pupil, proportionately longer in young than in adult, 1.6 to 1.9 in head, 6.1 to 7.2 in length; axillary scale of pectoral long and pointed, reaching beginning of distal fourth of fin 1.9 to 2.5 in head.

Color of preserved specimens pale; sides with a distinct silvery stripe, often dark in specimens preserved in formalin, about as wide as eye in the larger specimens, rather narrower in young, becoming indistinct and shading

into the silvery color of the belly ventrally in specimens upward of about 70 mm. in length; median line of back densely punctulate, forming a rather definite dark stripe; caudal with dusky dots, the lobes distally quite dark; base of anal with few or no dark dots, generally not continued behind fin on caudal peduncle.

Numerous specimens, ranging in length from 30 to 95 mm., have been examined. The proportions and enumerations given in the description are based on 43 specimens, unless otherwise stated, including several type specimens (S. U. N. H. M., No. 5814). The differences between this species and *A. arenicola* and *A. ischana* have not been well understood. It differs from each in several characters, some of which intergrade. The body generally is deeper, even than in *A. ischana*, the range of the depth in length in 36 specimens being 4.4 to 5.5, whereas the range in 36 specimens of *A. ischana* is 5.25 to 6.25. Similarly, the snout is shorter, and the anal, ventral and pectoral fins are longer, but in one or more of these characters some specimens intergrade to a limited extent. For example, among 43 specimens of *starksi* 7 have 20 rays and all the rest have more. Whereas in 36 specimens of *ischana* 5 have 20 rays and all the rest have fewer. In 35 specimens of *arenicola* 10 have 20 rays and the rest have fewer. In the size of the jaw teeth (which are decidedly smaller in *starksi*) and in the number of gill rakers and vertebrae, a clear distinction, however, seems to exist, the gill rakers being more numerous and the vertebrae fewer in *starksi*, as shown in the descriptions. In most preserved specimens a dark stripe on the back also differentiates *starksi* from *ischana* and *arenicola*.

Range.—El Salvador to Colombia. Specimens examined are from Triunfo, El Salvador; from various localities on the Pacific coast of Panama; and one small specimen from the Rio Dagua, Colombia. This species is more numerous in Panama than its local relative, *A. arenicola*, and contrary to that species it enters brackish water freely. It was exceedingly numerous in the Miraflores Locks, Canal Zone, when dewatered in 1937.

Anchoa tricolor (Agassiz) (Fig. 30)

Engraulis tricolor Agassiz and Spix, 1829, 51, tab. 23, fig. 1, Bahia, Brazil.

Anchovia brownii Starks, 1913, 10, Natal, Brazil. (An examination of the specimens shows that they are not *brownii* of Gmelin, but *tricolor* of Agassiz.)

Anchoviella salvatoris Fowler & Bean, 1923, 6, Rio de Janeiro, Brazil. (The type, U. S. N. M., No. 83165, is in bad condition, but apparently may be identified with *tricolor*.)

Anchoviella epsetus Jordan & Seale, 1926, 396. (Specimens listed from Brazil and Uruguay are not *epsetus*, but *tricolor*.)

Anchoviella bonariensis Marini, 1935, 446, Mar del Plata, Argentina. (*Nomen nudum*. I have seen the type and a paratype, which are *tricolor*.)

Head 3.75 to 4.2; depth 4.75 to 5.5; D. 14 to 16; A. 18 to 22; P. 13 to 15; scales mostly lost, about 42 to 45; vertebrae 40 to 43 (8 specimens dissected).

Body quite elongate, moderately compressed; head compressed, rather long and low, its depth at joint of mandible equal to postorbital part of head and fully half the eye; snout rather short, always notably shorter than eye, 4.75 to 5.8 in head; eye 3.25 to 3.75; maxillary rather short, reaching to or little past joint of mandible, not sharply pointed distally, upper margin rounded, more or less like the sharp edge of a chef's knife, 1.3 to 1.4 in head; cheek rather broad, scarcely longer than eye, its posterior angle moderately broad, about 55°; postorbital part of head rather long, 7.4 to 8.0 in length; mandible 5.3 to 6.4; gill rakers at angle about three-fourths diameter of

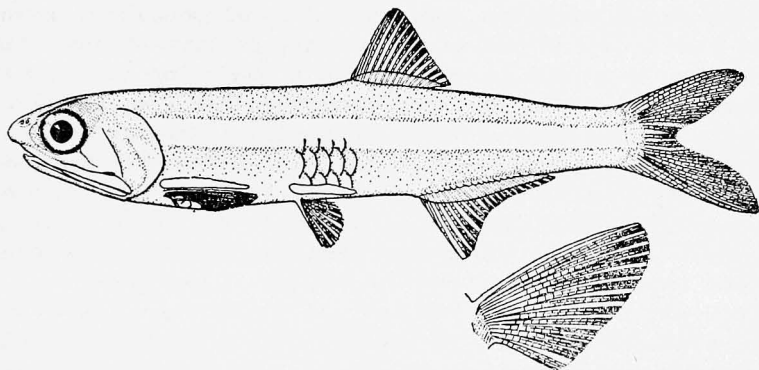


Fig. 30.—*Anchoa tricolor*. From a specimen 110 mm. long, Rio de Janeiro, Brazil (U. S. N. M., No. 87721). Insert, pectoral fin enlarged. (Drawing by Miss Louella E. Cable.)

eye, 18 to 22 + 24 to 28 on first arch; dorsal fin with slightly concave margin, the longest rays not reaching the tip of the last one if deflexed, its origin about equidistant from middle of eye and base of caudal; anal fin rather short, its origin under beginning of last fourth or almost at end of base of dorsal, its base notably shorter than head, 5.0 to 5.8 in length; ventral small, inserted about equidistant from base of pectoral and origin of anal; pectoral not very strongly pointed, the upper ray somewhat shorter than the next one, the shortest ray reaching somewhat past midlength of the longest ones, tip of fin failing to reach ventral by a distance varying from diameter of pupil to three-fourths the eye, 1.75 to 2.0 in head, 6.75 to 7.1 in length; axillary scale of pectoral very large, often failing by less than diameter of pupil to reach tip of fin, 1.9 to 2.75 in head.

Color of preserved specimens pale; sides of head silvery; sides of body with a bright silvery band, about three-fourths the width of eye above base

of anal, not becoming noticeably narrower anteriorly as in many other anchovies; a dark V at base of upper rays of caudal.

The specimens herein identified as *tricolor* agree well with Agassiz's description and figure. This species is rather near *hepsetus hepsetus* from which it differs principally in the shorter and differently shaped maxillary, and in the more numerous gill rakers. In this species the maxillary as stated in the description reaches to or only slightly beyond the articulation of the mandible, and its upper margin distally is rounded like the sharp edge of a chef's knife. In *hepsetus hepsetus*, on the other hand, it reaches nearly or quite to the margin of the opercle, and the upper margin of its free portion usually is straight. The differences in the length and shape of the maxillaries are shown in figures 21 and 30. The distribution of the anal rays and the gill rakers in a rather large series of specimens is shown in tables 4 and 5. The proportions and enumerations, unless otherwise stated, are based on 41 or more specimens, ranging in length from 63 to 118 mm.

Museum specimens of this species generally have been identified as *brownii* or *epsetus*, which as herein understood are synonyms of *hepsetus hepsetus*. Specimens from Rio de Janeiro (M. C. Z., Nos. 4691 and 18002), and Samboia, Brazil (M. C. Z., No. 18013), and a specimen from Montevideo (M. C. Z., No. 31551), identified as *Anchoviella epsetus* by Jordan and Seale (1926, 396), are of this species. Specimens from Natal, identified as *Anchovia brownii* by Starks (1913, 10), are also of this species.

Range.—Brazil to northern Argentina, and probably northward to Venezuela. I have studied 8 specimens from Natal, 52 from Rio de Janeiro, 5 from São Francisco, and 20 from Samboia, Brazil; 1 from Montevideo, Uruguay; and 2 from Punto de (or Rio) Quequen, Mar del Plata, Argentina, ranging in length from 90 to 118 mm. I also have one damaged specimen, 63 mm. long, from the Gulf of Venezuela, which apparently belongs to this species. The specimens are in the National Museum, the Museum of Comparative Zoology, the Field Museum of Natural History, the University of Michigan, Stanford University, and the Museo de Historia Natural de Buenos Aires.

Anchoa cubana (Poey) (Fig. 31)

Engraulis cubanus Poey, 1868, 420, Cuba.

Stolephorus astilbe Jordan & Rutter, 1897, 95, Kingston, Jamaica.

Anchoviella cubana Jordan & Seale, 1926, 399.

Anchoviella astilbe Jordan & Seale, 1926, 402.

Head 3.6 to 4.3; depth 5.5 to 6.7; D. 14 to 16; A. 20 to 24; P. 13 or 14; scales lost, about 40 to 43; vertebrae 42 or 43 (14 specimens dissected).

Body elongate, compressed, with a moderately sharp edge on chest and abdomen; head small, its depth at joint of mandible equal to its postorbital length and about third of eye; snout short, pointed, extending about two-

thirds its length beyond tip of mandible, 4.8 to 6.5 in head; eye small, 3.5 to 4.0; maxillary long, its upper free margin nearly straight, bluntly pointed, usually not quite reaching margin of opercle, 1.1 to 1.25 in head; cheek somewhat longer than eye, its posterior angle moderately broad, about 45°; postorbital part of head short, 8.0 to 9.5 in length; mandible 5.3 to 6.4; gill rakers slender, close-set, with moderately prominent spinules on inner margin, those at angle fully three-fourths diameter of eye, often difficult to enumerate, about 17 to 23 + 23 to 33 on first arch; dorsal fin low, the longest rays usually not reaching beyond tips of the succeeding ones and not to tip of last ray if deflexed, scarcely as long as base of fin, its outer margin generally nearly straight, the origin of fin about equidistant from base of caudal and middle to posterior margin of eye; anal fin low, its origin usually under middle of base of dorsal, sometimes slightly in advance

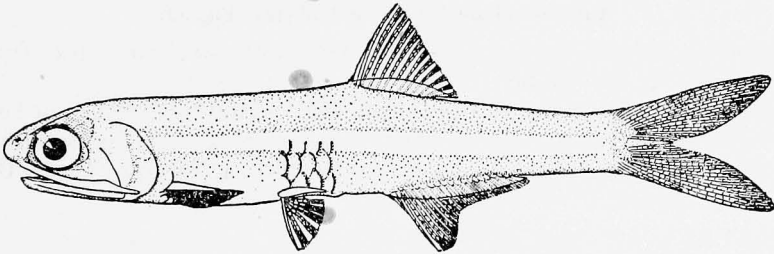


Fig. 31.—*Anchoa cubana*. From a specimen 63 mm. long, St. Thomas, W. I. (U. S. N. M., No. 83802). (Drawing by Miss Louella E. Cable.)

of this point, its base shorter than head, 4.5 to 5.4 in length; ventral small, inserted a little nearer origin of anal than base of pectoral, reaching somewhat less than half the distance to origin of anal; pectoral not falcate, two uppermost rays of about equal length, failing to reach the base of ventral by a distance somewhat shorter than diameter of eye, 1.75 to 1.9 in head, 7.2 to 8.0 in length; axillary scale of pectoral long, pointed, about three-fourths as long as upper rays of fin, 2.4 to 3.0 in head.

Sides with a bright silvery band about as wide as pupil, often missing in specimens preserved in formalin. Dusky punctulations on back few or wanting, not arranged in definite longitudinal rows.

Through the kindness of William C. Schroeder, I have been able to study two specimens of Poey's type material of *A. cubana* (M. C. Z., No. 17958), eight other specimens of *A. cubana* from Poey's collection, and two paratypes of *A. astilbe* (M. C. Z., No. 31392); all in the collection of the Museum of Comparative Zoology. I have also had specimens from St. Thomas, Jamaica and Cuba, and from off Melbourne Beach and Marco, Fla., from south of Mobile, Ala., from several off shore stations in the vicinity of Grand

Isle, La., from Puerto Barrios, Guatemala, and from Yucatan. The study of the specimens listed has enabled me to conclude that *astilbe* is a synonym of *cubana*. The rather wide range in the number of gill rakers, shown in the description and in table 5, undoubtedly results from the difficulty of making accurate enumerations. The enumerations and proportions given are based on at least 42 specimens, unless otherwise stated.

A. cubana differs from *A. hepsetus*, and nearly all other local and related species, in the numerous slender close-set gill rakers, and slender body.

Range.—Cuba, Jamaica, St. Thomas, both coasts of Florida to Louisiana, Yucatan and Puerto Barrios, Guatemala: Recorded from Puerto Rico by Poey in Gundlach (1881, 344), and from Grenada by Fowler (1930, 269) from specimens not seen by me. Previously recorded only from Cuba, Jamaica, and Puerto Rico.

***Anchoa exigua* (Jordan & Gilbert) (Fig. 32)**

Stolephorus exiguus Jordan & Gilbert, 1882, 342, Mazatlan, Mex. (type, U. S. N. M., No. 28120).

Anchoviella exigua Jordan & Seale, 1926, 395. (Thirty gill rakers on lower limb of first arch are given, which seems to be a mistake; description based on paratypes from Mazatlan); Seale, 1940, 4, Tangola-Tangola Bay, Oaxaca, Mexico.

Head 3.8 to 4.2; depth 5.3 to 6.2; D. 13 to 15, most frequently 14; A. 19 to 22; P. 13 to 15, usually 14; scales lost, about 38 to 40; vertebrae 43 to 45 (4 specimens dissected).

Body quite slender, moderately compressed; chest and abdomen scarcely trenchant; head moderately low and long, its depth at joint of mandible equal to or a little shorter than postorbital part of head and half eye; snout about two-thirds length of eye, projecting a little more than half its length beyond tip of mandible, 5.6 to 6.6 in head; eye 3.5 to 3.75; maxillary long, pointed, reaching nearly or quite to margin of opercle, 1.2 to 1.3 in head; cheek moderately short, equal to or a little longer than eye, its posterior angle fairly broad, about 50°; postorbital part of head moderately short, 8.0 to 8.7 in length; mandible 5.5 to 6.3; gill rakers about two-thirds length of eye, 19 to 22 + 22 to 26, usually 20 or 21 + 24 or 25, on first arch; dorsal fin not much elevated anteriorly, the last ray somewhat produced, extending beyond tips of longest rays if deflexed, its origin usually about equidistant from middle of eye and base of caudal; anal fin rather short, its origin somewhat in advance of middle of base of dorsal, and generally about equidistant from base of pectoral and base of caudal, its base always shorter than head, 4.75 to 5.5 in length; ventral small, reaching scarcely more than half way to origin of anal, generally inserted slightly nearer origin of anal than base of pectoral; pectoral moderately short, failing to reach base of

ventral by a distance nearly or quite equal to diameter of eye, 1.7 to 2.0 in head, 6.8 to 7.6 in length; axillary scale of pectoral quite long and pointed, fully three-fourths as long as the fin, 2.5 to 3.0 in head.

Color of preserved specimens pale, bluish to silvery where scales remain; sides of head bright silvery; a silvery lateral band, nowhere as wide as eye; back with few dusky points, not forming a definite streak; base of anal with dusky points, extending as an almost continuous dark median line behind the fin to base of caudal; caudal fin with dusky points.

Five "type" specimens, about 35 to 55 mm. long (caudal fins damaged) from Mazatlan, which are soft and unsatisfactory for study, and many specimens from San Josef Island, Lower California, ranging in length from 55 to 70 mm., have been examined. They do not differ greatly from specimens from Panama and Colombia, *A. tropica*, and may prove to be only

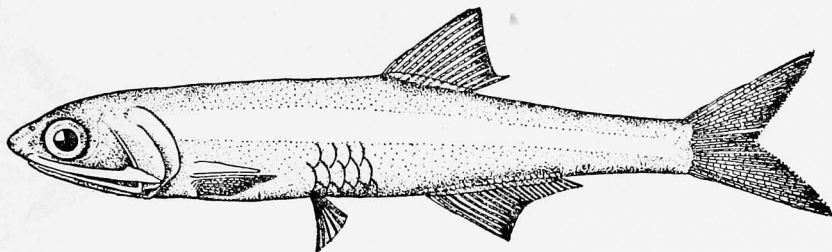


Fig. 32.—*Anchoa exigua*. From a specimen 65 mm. long, San Josef Island, Lower Cal. (U. S. N. M., No. 125581). (Drawing by Mrs. Alice C. Mullen.)

subspecifically distinct when material from intermediate localities becomes available for study.

These species are most readily recognized by the slender body, moderately short head, rather short anal, with its origin somewhat anterior to middle of base of dorsal, short pectorals, numerous vertebrae, the narrow silvery lateral band, and small size. The differential characters of *A. exigua* and *A. tropica* are shown chiefly in tables 13 and 14.

Range.—Known from the mouth of the Gulf of California. Four specimens recorded from Tangola-Tangola Bay, Oaxaca, Mexico, by Seale (*loc. cit.*) may belong to this species.

TABLE 13.—FREQUENCY DISTRIBUTION OF PECTORAL RAYS IN *Anchoa exigua* AND *A. tropica*

Species	Total number of pectoral rays			
	12	13	14	15
<i>Anchoa exigua</i>.....	.	4	26	8
<i>Anchoa tropica</i>	7	35	3	.

TABLE 14.—FREQUENCY DISTRIBUTION OF GILL RAKERS ON THE FIRST ARCH IN *Anchoa exigua* AND *A. tropica*

Species	Gill rakers on upper limb					Gill rakers on lower limb					Total number of gill rakers									
	17	18	19	20	21	22	22	23	24	25	26	40	41	42	43	44	45	46	47	48
<i>Anchoa exigua</i>	1	5	12	16	6		1	5	19	11	3		1	1	5	10	11	7	4	1
<i>Anchoa tropica</i>	15	18	11	1			4	19	16	7		10	15	14	7		1			

***Anchoa tropica* n. sp. (Fig. 33)**

Anchoa exigua Meek & Hildebrand, 1923, 200, Panama Bay (not of Jordan & Gilbert).

Head 4.0 to 4.25; depth 5.3 to 6.0; D. 13 to 15 (usually 14); A. 18 to 22; P. 12 to 14, usually 13; scales mostly lost, about 38 to 42; vertebrae 44 or 45 (6 paratypes dissected).

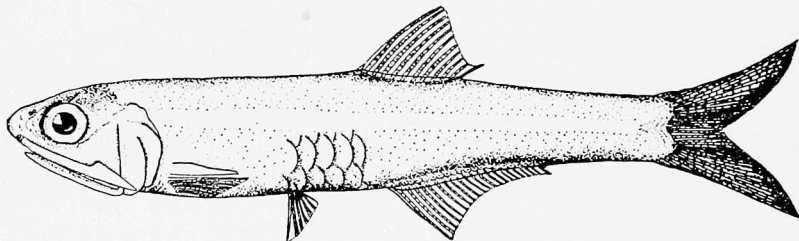


Fig. 33.—*Anchoa tropica* n. sp. From the type, 60 mm. long, Cupica Island, Colombia (U. S. N. M., No. 101630). (Drawing by Mrs. Alice C. Mullen.)

Body quite slender, moderately compressed; chest and abdomen scarcely trenchant; head moderately low and long, its depth at joint of mandible equal to postorbital and fully half the eye; snout about three-fourths length of eye, projecting about half its length beyond mandible, 5.3 to 6.0 in head; eye 3.25 to 3.75; maxillary long, pointed, not quite reaching margin of opercle, 1.25 to 1.35 in head; cheek moderately short and broad, equal to or a little longer than eye, its posterior angle about 50°; postorbital part of head rather short, 7.9 to 9.4 in length; mandible 5.25 to 6.5; gill rakers about three-fourths length of eye, 17 to 20 + 22 to 25, most frequently 17 to 19 + 23 or 24, on first arch; dorsal fin rather low anteriorly, the longest rays failing to reach tip of last ray if deflexed, its origin about equidistant from base of caudal and middle of eye; anal fin rather small, origin somewhat in advance of middle of base of dorsal, its base 5.2 to 5.7 in length; ventral small failing to reach quite half way to origin of anal, inserted about equidistant from origin of anal and base of pectoral; pectoral moderately long, failing to reach base of ventral by about half diameter of eye, 1.7 to 1.9 in head, 6.8 to 8.0 in length; axillary scale of pectoral

quite long, narrow, fully three-fourths length of the fin, 2.2 to 2.7 in head.

Color of preserved specimens pale; with a silvery lateral band notably narrower than eye; back usually with dusky points; base of anal with dark dots, continued behind anal in a median series; caudal with many dusky points.

The following proportions and enumerations are based on the type, a specimen 60 mm. long (48 mm. to base of caudal) from Cupica Island, Colombia (U. S. N. M., No. 119013): Head 4.1; depth 5.6; postorbital part of head 9.4; mandible 6.0; anal base 5.3; pectoral 7.0. Snout in head 5.8; eye 3.3; maxillary 1.25; pectoral 1.7; axillary scale of pectoral 2.3. D. 14; A. 22; P. 13; scales about 38; gill rakers 17 + 24.

The differences between *A. exigua* and *A. tropica* are chiefly meristic, and therefore are most readily set forth in tables. Although there is intergradation, the modes in at least two groups of enumerations are different, and for the present at least, the two may be regarded as specifically distinct.

Range.—LaVenta, Chame Point, and Balbo, Panama; and Cupica Island, Colombia. Common in the vicinity of Balboa, where it was found numerous in the drydock in 1937.

Anchoa januaria (Steindachner) (Fig. 34)

Engraulis januarius Steindachner, 1879, 58, Harbor of Rio de Janeiro, Brazil.

Anchoa januaria Starks, 1913, 9, Natal, Brazil.

Anchoviella januaria Jordan & Seale, 1926, 406.

Head 3.8 to 4.5; depth 4.5 to 5.5 (4.5 to 5.0 in adults); D. 14 or 15; A. 21 to 24; P. 12 or 13; scales about 36 to 40; vertebrae 41 or 42 (3 specimens dissected).

Body strongly compressed, moderately deep, the ventral outline a little more strongly curved than the dorsal; head short, deep, its depth at joint of mandible about equal to its length without snout; snout short, rather blunt, projecting fully half its length beyond mandible, much shorter than eye, 5.0 to 6.0 in head; eye 2.9 to 3.6; maxillary rather blunt, especially in the smaller specimens, reaching to or only slightly beyond joint of mandible, and not nearly to margin of opercle, upper margin of free portion somewhat rounded like the sharp edge of a chef's knife, its length 1.3 to 1.5 in head; cheek short, about as long as eye, its posterior angle broad, about 50°; 3.4 to 3.9 in head (measured from eye to posterior tip); postorbital part of head short, 7.1 to 9.5 in length; mandible 5.8 to 6.5; gill rakers at angle about three-fourths diameter of eye, 21 to 23 + 23 to 26 on first arch; dorsal not high anteriorly, the longest rays not reaching tip of last ones if deflexed; its origin about equidistant from base of caudal and middle of eye; anal fin low, its origin under or slightly posterior to middle of base of dorsal and generally a little nearer base of caudal than

base of pectoral, its base scarcely shorter than head, 3.8 to 4.5 in length; ventral very small, reaching notably less than half the distance to origin of anal in largest specimens, proportionately longer in smaller ones, inserted about equidistant from base of pectoral and origin of anal; pectoral small, failing to reach ventral by rather more than half the diameter of eye, 1.4 to 2.0 in head, 5.7 to 6.4 in length; axillary scale of pectoral about three-fourths length of fin, 2.4 in head.

Color of preserved specimens pale silvery; with a rather distinct silvery lateral band, one-half to three-fourths width of eye above base of anal, narrower anteriorly. Small specimens with two dark lines on back, these missing in larger specimens; a dark V at base of upper rays of caudal generally distinct; and a short narrow dark bar (vertical to more or less oblique) usually present at base of middle rays of caudal.

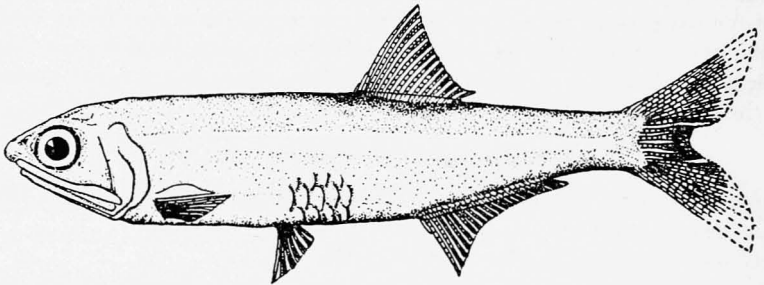


Fig. 34.—*Anchoa januaria*. From a specimen 75 mm. long, Pernambuco, Brazil (M. C. Z., 18012). (Drawing by Mrs Alice C. Mullen.)

In preparing the foregoing description 28 specimens, ranging in length from 30 to 75 mm., were before me. The proportions and enumerations used are based on 15 or more specimens. These fish are from the Gulf of Venezuela; Pernambuco, Natal, and Rio de Janeiro, Brazil. The specimens from Natal (M. C. Z., No. 22089) apparently are part of a lot collected by the Stanford University expedition to Brazil in 1911. Starks (*loc. cit.*) remarked, "Specimens that answer very well to the description of this species (*januaria*), which has hitherto been known only from the harbor of Rio Janeiro, were taken in abundance in the harbor at Natal." The specimens from Pernambuco, here listed as *januarius* (M. C. Z., No. 18012), were recorded as *mitchilli* by Jordan and Seale (1926, 405).

This species is related to *mitchilli*, *parva* and *pectoralis*. In depth and number of vertebrae it agrees with northern specimens of *mitchilli*. In the number of gill rakers on the lower limb of the first arch it is within the range of *mitchilli* and in agreement with *parva*, but the number on the upper limb apparently is a little greater. It has a more strongly projecting

snout than *mitchilli*, but is about in agreement with *parva* in this character. The origin of the anal fin generally is posterior to the vertical from middle of base of dorsal, which is farther back than in *mitchilli*, and usually also slightly farther back than in *parva*. The number of rays in the anal fin agrees with *parva*, but is smaller than in *mitchilli*. *Januaria* differs from *mitchilli* and *parva* in having a shorter and blunter maxillary, wherein it agrees with *pectoralis*. It differs from *pectoralis* in the fewer pectoral rays.

Range.—This species, as now understood, ranges from the Gulf of Venezuela to Rio de Janeiro.

Anchoa parva (Meek & Hildebrand) (Fig. 35)

Anchovia parva Meek & Hildebrand, 1923, 202, Porto Bello, Panama; Hildebrand (in part), 1939, 25.

? *Anchoviella parva* Fowler, 1931, 392. (Reported from Trinidad from a 98-mm. specimen, which is much larger than any seen by me. Anal rays are given as 29, which is a higher count than any obtained from specimens at hand.)

Head 3.6 to 4.3; depth 4.5 to 5.0; D. 13 to 16; A. 21 to 23, rarely as many as 25; P. 12 or 13; scales mostly lost, about 38 to 42; vertebrae 38 to 40, rarely 41 (61 specimens dissected).

Body rather strongly compressed, moderately deep, chest and abdomen to ventrals bluntly trenchant; head short and deep, its length exceeding its depth at joint of mandible only by length of snout; snout very short, extending about half its length beyond tip of mandible, 4.5 to 6.0 in head; eye 3.0 to 3.5; maxillary long and pointed in the larger specimens, reaching nearly to margin of opercle, 1.2 to 1.35 in head; cheek short and broad, scarcely longer than eye, its posterior angle about 60°; postorbital part of head short, 7.0 to 9.0 in length; mandible 5.3 to 6.7; gill rakers scarcely shorter than eye at angle, 18 to 20 + 23 to 27 on first arch; dorsal fin with only slightly concave margin, the longest rays failing to reach tip of last ray if deflexed, its origin generally about equidistant from middle of eye and base of caudal; anal fin moderately long, its origin under or more usually slightly anterior to middle of base of dorsal, and somewhat nearer base of pectoral than base of caudal, its base usually slightly shorter than head, 4.0 to 4.8 in length; ventral small, reaching scarcely half way to origin of anal, inserted about equidistant from base of pectoral and origin of anal; pectoral rather variable in length, failing to reach base of ventral by a distance equal to or greater than diameter of pupil, 1.5 to 1.7 in head, 5.75 to 7.0 in length; axillary scale of pectoral usually about two-thirds as long as longest rays, 2.3 to 3.0 in head.

Color of specimens in alcohol (originally preserved in formalin) pale; side with a narrow silvery band (often missing), scarcely as wide as pupil

above base of anal, becoming very narrow anteriorly; back with black punctulations, at least posterior to dorsal fin, extending on base of upper rays of caudal; a short indefinite oblique dark bar at base of caudal; dark dots usually present at base of anal, extending on median line of peduncle to base of caudal.

This species is rather close to *A. mitchilli*, from which it differs in the shorter anal fin, which has fewer rays (though there is slight overlapping) and a shorter base, and it is placed a little farther back under base of dorsal. In depth of body *parva* agrees more nearly with *mitchilli mitchilli* than with *mitchilli diaphana*, though it is equally as strongly compressed as the latter. In the number of gill rakers it again agrees more nearly with *mitchilli mitchilli* than with *mitchilli diaphana*, but in number of vertebrae it agrees with the last mentioned subspecies. *A. parva* has a longer snout

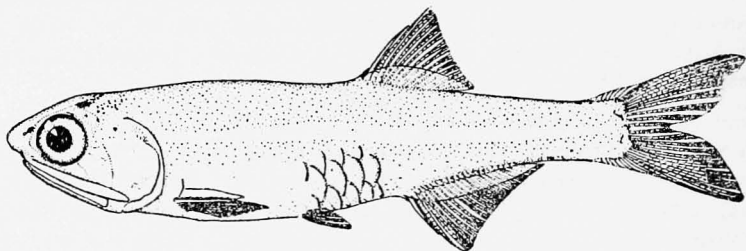


Fig. 35.—*Anchoa parva*. From a paratype 60 mm. long, Colon, Panama (U. S. N. M., No. 79554). (Drawing by Miss Louella E. Cable.)

than either subspecies of *mitchilli*, and it projects more strongly beyond the mandible. These differences are easily seen if specimens of equal size are compared, but are difficult to show by measurements. *A. parva* apparently is a smaller fish than either subspecies of *mitchilli* as no specimen exceeding a length of 60 mm. has been seen.

A. parva is extremely closely related to *januarius*, from which it seems to differ in the smaller number of vertebrae, the longer and more sharply pointed maxillary (in adults), in the rather more anteriorly placed anal fin, and apparently in the fewer gill rakers on the upper limb of the first arch. Its exceedingly close relationship with *curta* from the Pacific is discussed in the account of the last mentioned species.

The proportions and enumerations given in the description, unless otherwise stated, are based on at least 30 specimens 30 to 60 mm. long. Many specimens from Porto Bello and Colon, Panama, and from Gatun Locks, Canal Zone; 1 from Trinidad (U. S. N. M., No. 83801); many from Jamaica, 2 from Cuba (part of M. C. Z., No. 17956) and 1 from Venezuela were identified as this species. The specimens from Cuba, including a third one,

were recorded as *mitchilli* by Jordan and Seale (1926, 405). However, the third specimen is not of this species, and quite certainly is *mitchilli*. I have seen no (other) specimens of that species from the West Indies, and have found no evidence that it occurs there. This third specimen is firmer and darker in color than the other two in the lot, indicating that it probably was preserved by a different method and not with the others. Furthermore, the bottle contains a note saying, "Specimen sent to Poey by Gill for comparison." In all likelihood the specimen of *mitchilli* is the one sent by Gill, and it probably is from the Atlantic Coast of the United States. There is also a specimen in the University of Michigan from Laguna de Tacarigua, Venezuela, which seems to belong here.

Range.—West Indies, and the Atlantic coast of Panama to Venezuela.

TABLE 15.—FREQUENCY DISTRIBUTION OF TOTAL NUMBER OF GILL RAKERS ON FIRST ARCH IN *Anchoa curta* AND *A. parva*

Species	Total number of gill rakers on first arch								
	39	40	41	42	43	44	45	46	47
<i>Anchoa curta</i>	5	13	13	10	9	5	1	.	.
<i>Anchoa parva</i> . . . . .	.	.	.	5	9	9	6	4	1

TABLE 16.—FREQUENCY DISTRIBUTION OF TOTAL NUMBER OF VERTEBRAE IN *Anchoa curta* AND *A. parva*

Species	Total number of vertebrae				
	38	39	40	41	42
<i>Anchoa curta</i> . . . . .	.	1	14	35	6
<i>Anchoa parva</i>	5	30	25	1	.

TABLE 17.—FREQUENCY DISTRIBUTION OF LENGTH OF HEAD EXPRESSED IN PERCENT OF STANDARD LENGTH IN *Anchoa curta*, AND *A. parva*

Species	Length of head in percent of standard length						
	22	23	24	25	26	27	28
<i>Anchoa curta</i>	2	14	21	16	5	.	.
<i>Anchoa parva</i> . . . . .	.	1	5	14	27	9	1

Anchoa curta (Jordan & Gilbert) (Fig. 36)

Stolephorus curtis Jordan & Gilbert, 1882, 343, Mazatlan, Mex. (type, U. S. N. M., No. 29242).

Anchoa curta Meek & Hildebrand, 1923, 206.

Anchoviella curta Jordan & Seale, 1926, 407.

Anchoa parva Hildebrand, 1939, 35, Miraflores Locks, C. Z. (not of Meek & Hildebrand).

Head 3.8 to 4.4; depth 4.4 to 5.4; D. 14 to 16 (rarely 13); A. 22 to 25, (rarely 21 or 26); P. 12 or 13; scales mostly lost, about 40; vertebrae 40 to 42 (rarely 39) (62 specimens dissected).

Body quite strongly compressed, with chest and abdomen trenchant nearly to ventrals; head very short, its length exceeding its depth at joint of mandible only by length of snout; snout scarcely two-thirds length of eye, projecting a little more than half its length beyond mandible, 5.3 to 6.5 in head; eye 3.0 to 3.4; maxillary quite long and pointed, reaching nearly to margin of opercle, 1.2 to 1.4 in head; cheek very short and broad, only about as long as eye, its posterior angle about 60° ; postorbital part of head very short, 8.3 to 9.6 in length; mandible 5.2 to 6.9; gill rakers about two-thirds length of eye, 16 to 20 + 22 to 26 (usually 17 to 19 + 23 or 24) on first arch; dorsal fin rather high anteriorly, the longest rays often reaching beyond tip of last ray if deflexed, though sometimes shorter (rather variable), its margin more or less concave, the origin equidistant from middle to posterior margin of eye and base of caudal; anal fin moderately

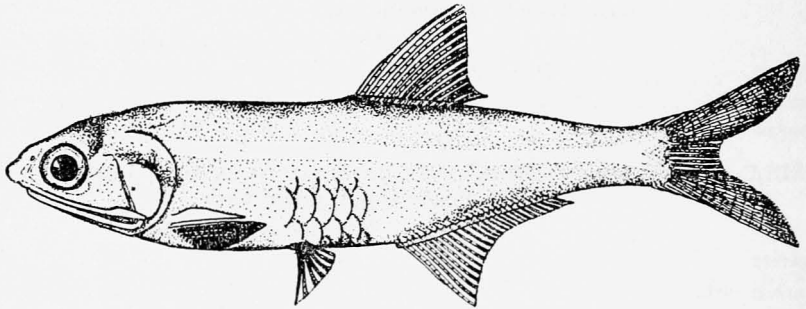


Fig. 36.—*Anchoa curta*. From a specimen 55 mm. long, Miraflores Locks, C. Z. (Drawing by Mrs. Alice C. Mullen.)

long, its origin under or more usually a little in advance of middle of base of dorsal, and nearer base of pectoral than base of caudal by diameter of pupil, its base generally equal to length of head, 4.0 to 4.7 in length; ventral small, reaching about half way to origin of anal, inserted equidistant from base of pectoral and origin of anal; pectoral scarcely falcate, failing to reach base of ventral by diameter of pupil, 1.5 to 1.8 in head, 6.25 to 7.6 in length; axillary scale of pectoral long, slender, reaching about the beginning of distal fifth of pectoral, 2.0 to 2.7 in head.

Color of preserved specimens pale; sides of head bright silvery; indistinct silvery lateral band present, scarcely wider than pupil, missing in specimens preserved in formalin; upper surface of head and back with dusky punctulations, these usually in two series posterior to dorsal fin; a row of dark dots along base of anal, forming a single median series behind anal; caudal with dusky markings, the margin usually quite dusky.

Numerous specimens, 25 to 78 mm. long, were examined. Besides the

many specimens from brackish or nearly fresh water from the Rio Culebra, a tributary of the Rio Bayano, Panama, and the Miraflores Locks, Canal Zone, others from strictly salt water from Venado Beach, and Chame Point, Panama, are at hand. Still others from Triunfo, El Salvador; Mazatlan (type material), and from San Juan Lagoon, Mexico; and from the Gulf of Guayaquil, Puerto Pizarro, Peru, were examined. Unless otherwise stated the proportions and enumerations given in the description are based on 27 or more specimens.

This species is extremely close to *A. parva* of the Atlantic coast of Panama and elsewhere. The differences discovered are ones appearing only as averages in some of the enumerations, proportions, and probably in shape and size. The head in *curta* is somewhat shorter than in *parva*, the gill rakers are rather fewer, and the vertebrae are slightly more numerous. The differences are evident from tables 15, 16 and 17. Usually the dorsal fin is higher anteriorly in *curta*, the longest rays extending to or beyond the tip of the last ray if deflexed, whereas in *parva* the longest rays fail to reach the tip of the last one. However, there is sufficient variation in the shape of this fin that some specimens cannot be definitely identified by this character. Finally, *curta* seems to grow somewhat larger, as several specimens in the collection exceed 60 mm. (the length of the largest *parva* seen), the largest having a length of 78 mm. The two apparently, originated from a common stock and have not been separated long enough (after the closing of the last passageway for marine fishes across the Isthmus of Panama) for diversification to have proceeded far enough to eliminate intergradation. Perhaps the two should be considered only sub-specifically distinct.

Range.—Mouth of Rio Yaqui, Mexico, to Gulf of Guayaquil, Puerto Pizarro, Peru. Recorded from LaPlata Island, Ecuador, by Seale (1940, 4), but without data, except that the specimen was 110 mm. long, which is much larger than any of the numerous specimens examined by me. The identification is regarded as probably incorrect.

Anchoa mitchilli mitchilli (Cuvier & Valenciennes) (Fig. 37)

Engraulis mitchilli Cuvier & Valenciennes, 1848, 50, New York.

Stolephorus mitchilli Jordan & Evermann, 1896, 446.

Anchoa mitchilli Kuntz, 1914, 13-19. (On the development of the eggs and larvae.)

Anchoviella mitchilli Jordan & Seale, 1926, 405.

Head 4.2 to 4.5; depth 4.8 to 6.3; D. 15 or 16; A. 24 to 28; P. 11 or 12; scales mostly lost, about 38 to 44; vertebrae 43 or 44 (4 specimens dissected).

Body rather slender, moderately compressed, its greatest thickness notably exceeding depth of caudal peduncle; head short, its depth at joint of mandible equal to its length without snout and fourth of eye; snout very

short, projecting not more than a fourth of its length beyond tip of mandible, 6.0 to 7.0 in head; eye rather small, 3.5 to 3.9; maxillary long, pointed, extending nearly to margin of opercle, 1.2 to 1.3 in head; cheek short and broad, about as long as eye, its posterior angle about 60° ; postorbital part of head short, 7.9 to 9.0 in length; mandible 5.3 to 6.6; gill rakers somewhat shorter than eye, 16 to 18 + 24 or 25 on first arch; dorsal rather low, margin nearly straight, the last ray scarcely longer than the preceding one, the longest rays failing to reach its tip if deflexed, origin of fin only a little nearer base of caudal than upper anterior angle of gill opening; anal quite long, its origin somewhat posterior to origin of dorsal, its base

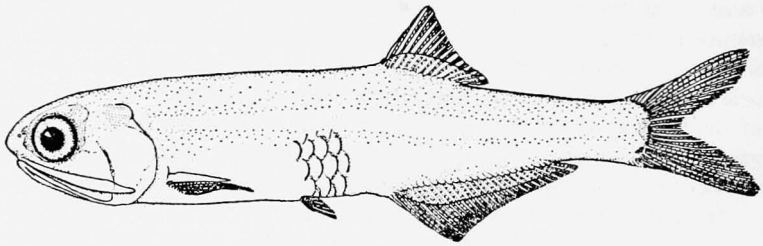


Fig. 37.—*Anchoa mitchilli mitchilli*. From a specimen 85 mm. long, Woods Hole, Mass. (U. S. N. M., No. 125582). (Drawing by Miss Louella E. Cable.)

TABLE 18.—FREQUENCY DISTRIBUTION OF THE TOTAL NUMBER OF VERTEBRAE IN 1247 SPECIMENS OF *Anchoa mitchilli* (BOTH SUBSPECIES) BY STATES

States	Total number of vertebrae						
	38	39	40	41	42	43	44
Massachusetts.....				12	53	20	1
Rhode Island.....				1	7	4	
Connecticut.....				7	17	5	
New York.....				13	41	15	2
New Jersey.....			2	23	41	14	1
Delaware.....			2	18	50	6	
Maryland.....			5	17	44	9	
Virginia.....	1	2	37	43	17		
North Carolina.....	3	8	26	58	10		
South Carolina.....	2	26	58	3			
Georgia.....		3	10	6	1		
Florida (east coast).....	1	10	7	1			
Florida (west coast).....	34	68	18	1			
Mississippi.....		8	21	4			
Louisiana.....	1	21	72	14			
Texas.....	6	30	56	4			
Yucatan.....		52	72	2			

3.3 to 4.0 in length; ventral very small, not quite extending half way to anal, inserted nearer origin of anal than base of pectoral by diameter of pupil; pectoral rather short, failing to reach base of ventral by a distance equal to or even greater than diameter of eye, 1.65 to 1.85 in head, 6.6 to 7.8 in length; axillary scale of pectoral long, rather narrow, 2.3 to 2.7 in head.

Color of preserved specimens pale; side of head silvery; side of body with a silvery band nearly as wide as eye; back with dusky punctulations, arranged in two more or less definite series posterior to dorsal; base of anal with dark dots, continued on median ventral line of caudal peduncle as an almost unbroken dark line; caudal with many dark points.

The description is based on 8 specimens, ranging in length from 62 to 85 mm., all from Woods Hole, Mass., which are the most divergent representatives available of *mitchilli mitchilli*, just as those from Grand Isle, La., are the most extreme of *mitchilli diaphana*.

TABLE 19.—FREQUENCY DISTRIBUTION OF DEPTH OF BODY EXPRESSED IN PERCENT OF STANDARD LENGTH IN 1672 SPECIMENS OF *Anchoa mitchilli* (BOTH SUBSPECIES) BY STATES*

States	Depth of body in percent of standard length											Average standard length of specimens measured, in mm.
	17	18	19	20	21	22	23	24	25	26	27	
Massachusetts.....	7	16	22	12	7	6	1	.	.	.	.	52.5
Rhode Island.....	.	2	2	4	1	1	.	.	.	.	.	52.5
Connecticut.....	8	25	15	2	2	1	.	.	.	.	.	44.3
New York.....	.	4	9	22	19	17	10	3	1	.	.	57.3
New Jersey.....	.	1	4	20	36	35	17	10	3	1	.	57.2
Delaware.....	.	1	4	15	37	35	21	4	.	.	.	55.7
Maryland.....	.	2	11	36	32	9	5	.	.	.	.	52.9
Virginia.....	.	2	19	34	41	23	8	5	1	.	.	54.3
North Carolina.....	.	1	14	32	40	18	7	2	.	.	.	51.6
South Carolina.....	.	1	3	5	7	12	22	20	13	5	.	50.6
Georgia.....	1	1	.	5	9	3	1	55.0
Florida (east coast)...	.	1	3	4	10	6	1	2	2	1	.	50.7
Florida (west coast)...	.	1	3	12	18	43	55	26	12	4	.	53.4
Mississippi.....	.	.	2	8	7	5	4	1	.	.	.	48.5
Louisiana.....	.	.	.	1	7	18	25	50	55	24	3	50.0
Texas.....	.	.	.	1	11	19	39	48	34	20	8	46.6
Yucatan.....	.	1	5	10	33	47	42	21	6	.	.	48.4

* Specimens 40 mm. and above in standard length only are included for the reason stated in the text.

The following proportions and enumerations are based on at least 42 specimens (and some of them on many more), ranging in length from 52 to 102 mm., included in collections made from Massachusetts to North Carolina: Head in length 3.75 to 4.5; depth 4.0 to 6.3; postorbital part of head 7.9 to 9.0; anal base 3.3 to 4.0; pectoral 5.5 to 8.3. Snout in head 5.0 to 7.0; eye 2.9 to 3.9; maxillary 1.15 to 1.3; mandible 1.3 to 1.5; post-orbital part of head 1.8 to 2.1; pectoral 1.5 to 1.85; axillary scale of pectoral 2.3 to 3.0. D. 14 to 16; A. 24 to 30; P. 11 or 12; scales about 38 to 44; vertebrae 39 to 44 (689 specimens dissected); gill rakers 15 to 19 + 20 to 26.

This subspecies is generally more slender than *diaphana*, and also less strongly compressed. The average number of gill rakers on the lower limb of the first arch is a little greater, the vertebrae are rather more numerous, the dorsal fin is placed farther back, and the pectorals are shorter. Much intergradation takes place between the two subspecies, as is evident from the descriptions and from tables 18, 19 and 20.

Range.—Massachusetts to North Carolina. The southern limit of the range of course is indefinite. The majority of specimens seen from North Carolina and northward, however, may be more or less definitely classed as *mitchilli mitchilli*.

TABLE 20.—FREQUENCY DISTRIBUTION OF LENGTH OF PECTORAL EXPRESSED IN PERCENT OF STANDARD LENGTH IN 1249 SPECIMENS OF *Anchoa mitchilli* (BOTH SUBSPECIES) BY STATES

States	Length of pectoral in percent of standard length									
	12	13	14	15	16	17	18	19	20	
Massachusetts.....	6	26	20	4	2	.	.	.	.
Rhode Island.....	.	.	5	4	1	.	.	.	.
Connecticut.....	4	17	18	8	2	.	.	.	.
New York.....	3	12	26	24	6	.	.	.	.
New Jersey.....	1	7	21	50	27	9	1	.	.	
Delaware.....	1	2	14	35	36	16	3	.	.	
Maryland.....	1	7	30	30	11	1	.	.	.	
Virginia.....	.	5	18	21	10	2	.	.	.	
North Carolina.....	.	5	18	22	9	2	.	.	.	
South Carolina.....	.	1	3	9	9	10	5	1	.	
Georgia.....	.	.	.	5	7	5	1	.	.	
Florida (east coast).....	.	.	2	2	4	6	4	1	.	
Florida (west coast).....	.	3	11	38	53	20	4	.	.	
Mississippi.....	.	1	1	2	6	6	2	1	.	
Louisiana.....	.	.	1	8	28	49	27	6	.	
Texas.....	.	.	.	9	38	60	38	17	4	
Yucatan.....	.	.	4	20	51	44	8	1	.	

Anchoa mitchilli diaphana n. subsp. (Fig. 38)

Engraulis louisiana Cuvier & Valenciennes, 1848, 51. (This name is given under *E. mitchilli* with the following notation: "M. Lesueur a eu aussi cette spèce qu'il a décrite et figurée sous le nom d'*Engraulis Louisiana*, d'après des individus qu'il avait observés dans la lac Ponchartrain, a la Nouvelle-Orleans." As no place of publication of the description and figure has been found it is assumed that *E. louisiana* is a manuscript *nomen nudum*, and as such it has no nomenclatorial standing.)

Stolephorus mitchilli Jordan & Gilbert, 1883, 248.

Head 3.8 to 4.3; depth 3.75 to 4.3; D. 14 or 15; A. 26 to 30; P. 11 or 12; scales mostly lost, about 40; vertebrae 39 to 41 (9 specimens dissected).

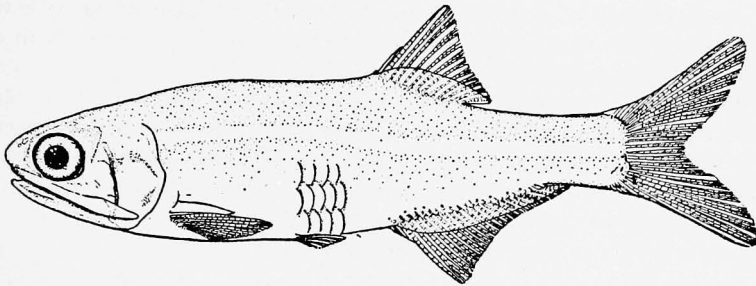


Fig. 38.—*Anchoa mitchilli diaphana* n. subsp. From the type, 72 mm. long, Grand Isle, La. (U. S. N. M., No. 119790). (Drawing by Miss Louella E. Cable.)

Body rather deep, strongly compressed, its greatest thickness not quite equal to depth of caudal peduncle; head short, its depth at joint of mandible nearly as great as length of head without snout; snout short, projecting only about a third of its length beyond tip of mandible, 5.6 to 6.5 in head; eye 3.1 to 3.3; maxillary long and pointed, extending nearly to margin of opercle, 1.1 to 1.2 in head; cheek short and broad, scarcely longer than eye, its posterior angle about 60°; postorbital part of head short, 7.5 to 7.8 in length; mandible 5.3 to 6.1; gill rakers scarcely as long as eye, 16 to 18 + 21 to 23 on first arch; dorsal with nearly straight margin, its last ray a little longer than immediately preceding one, the longest rays scarcely reaching tip of last one if deflexed, origin of fin usually nearer base of caudal than eye, occasionally about equidistant from posterior margin of eye and base of caudal; anal long, its origin somewhere under anterior third of base of dorsal, sometimes scarcely posterior to origin of dorsal, its base 3.4 to 3.6 in length; ventral small, reaching scarcely more than half way to origin of anal, inserted about equidistant from base of pectoral and origin of anal; pectoral rather long, reaching nearly or quite to base of ventral, 1.4 to 1.55 in head, 5.7 to 6.0 in length; axillary scale of pectoral 2.3 to 2.6 in head.

Color of preserved specimens pale; side of head silvery; a more or less distinct silvery lateral band present, scarcely wider than pupil; back with dusky punctulations, these sometimes arranged in two more or less definite rows posterior to dorsal fin; base of anal with dark dots, extending from anal to caudal in a single more or less broken median line; caudal fin with dusky markings along the rays.

The foregoing description is based on 16 specimens from Grand Isle, La., ranging in length from 48 to 76 mm., which includes the type (U. S. N. M., No. 119790), a specimen 72 mm. long (57 to base of caudal). Specimens from Grand Isle were described chiefly because they are the most divergent representatives available of this subspecies.

The following proportions and enumerations are based on at least 110 specimens, ranging in length from 45 to 76 mm., all included in collections taken from South Carolina to Yucatan, Mexico: Head in length 3.8 to 4.3; depth 3.75 to 5.5; postorbital part of head 7.5 to 9.0; anal base 3.3 to 3.8; pectoral 5.0 to 7.7. Snout in head 5.0 to 6.5; eye 2.9 to 3.5; maxillary 1.1 to 1.3; mandible 1.25 to 1.5; postorbital part of head 1.9 to 2.2; pectoral 1.4 to 1.6; axillary scale of pectoral 2.3 to 3.0. D. 14 or 15, occasionally 16; A. 23 to 30; P. 11 or 12; scales about 38 to 41; vertebrae 38 to 42 (544 specimens dissected); gill rakers 15 to 19 + 20 to 26.

This subspecies is distinguished from the typical subspecies by the generally deeper and more strongly compressed body, by the slightly fewer gill rakers on the lower limb of the first arch, fewer vertebrae, longer pectoral fin, and narrower silvery lateral band. That there is complete intergradation is evident from the descriptions and from tables 4, 5, 18, 19 and 20.

The depth of the body in *A. mitchilli* (both subspecies) increases proportionately with growth. The increase is especially pronounced in the young, continuing to some extent as long as the fish grow. Although no measurements of specimens less than 40 mm. in standard length are included in table 19, the results are somewhat influenced by the size of the specimens. For example, the average depth in percent of the standard length in specimens measured from New York, New Jersey and Delaware is greater than in the ones from Maryland, Virginia and North Carolina, apparently in part because the fish measured from the first group of states named were larger, as shown by the last column of the table. However, the depth in specimens from Louisiana and Texas, for example, though smaller, is still greater. It is evident from table 19 that the general trend is toward a proportionate increase in depth in the body of specimens from the northern part of the range southward. It is believed, and in part shown by measurements, that this increase would be more regular than indicated in the table, if specimens of equal size had been available from all the states from Massachusetts to Texas. That it would be entirely regular, however seems doubtful, as shown subsequently.

Dr. Alfred Perlmutter (whose manuscript was made available to me through the kindness of Dr. Carl L. Hubbs), also measured a large number of specimens, none of which I have measured, except possibly a few from Yucatan. He, too, found that specimens from New York and New Jersey (he had none from Delaware and Maryland) had a rather greater average depth than specimens from Virginia, which was true even of comparatively small fish of 40 to 59 mm. in length. Furthermore, Dr. Perlmutter's measurements, based on fishes of the west coast of Florida, closely parallel mine, and show that the specimens from that coast are rather more slender than those from the south Atlantic and other Gulf coast states. It is of interest, also, that specimens from Yucatan are more slender than those from Louisiana and Texas, and according to my measurements are scarcely deeper than those from the west coast of Florida. A map shows at a glance that Yucatan is much nearer southern Florida than the other Gulf states named, which possibly accounts for the close relationship.

The measurements then indicate, although there is some irregularity, that in general the depth of the body of this anchovy increases in proportion to its standard length from the northern extreme of its range southward. Measurements made by Dr. Perlmutter, as already stated, closely parallel mine for the most part, though made independently and based on almost wholly different collections. The data accumulated strongly suggest that such sections of the coast as the New England States, south of Cape Cod; New York, New Jersey, and Delaware; Maryland, Virginia, and North Carolina; South Carolina, Georgia, and probably the east coast of Florida;* the west coast of Florida; Mississippi, Louisiana and Texas; and Yucatan, have distinct populations. That such distinct populations exist is supported by measurements of the pectoral fin, and by the enumeration of vertebrae (see tables 18 and 20).

A more or less regular increase in the proportionate length of the pectoral fin in southern specimens (apparently unaffected by age and size except perhaps in very young) similar in general to the increase in the depth of the body, is indicated in table 20. A slightly longer pectoral is shown in specimens from New Jersey and Delaware than in specimens from adjacent states to the north and south. Specimens from New York, though nearly as deep as those from New Jersey and Delaware, are intermediate in the length of the pectoral of those from the states just named and the ones from the New England states. The specimens measured from the west coast of

* Too few specimens have been available for measuring from the east coast of Florida to show whether the population of *A. mitchilli* should be grouped with that of South Carolina and Georgia, or with that of the West coast of Florida; in the length of the pectoral fin, as shown subsequently, they agree with the adjacent states to the north.

Florida, which also were more slender, had slightly shorter pectoral fins than those from adjacent states. In this character, as in the depth of the body, specimens from Yucatan agree fairly closely with those from the west coast of Florida.

That the vertebrae become fewer in southern specimens is clearly shown in table 18. The decrease, however, is only slight in specimens examined from Massachusetts to North Carolina. A rather sharp decline is indicated in the table for specimens from South Carolina, and another one in specimens from Florida. The number of vertebrae in specimens examined from Florida to Yucatan is rather constant, even though differences in the proportionate depth of the body and length of pectoral existed in these specimens, as already explained. Dr. Perlmutter's (MS.) many enumerations of vertebrae, based on specimens from Massachusetts, New York, New Jersey, Virginia, South Carolina, Georgia, Florida, Texas, Vera Cruz and Yucatan, as in the measurements already discussed, closely parallel mine, though based on different specimens, except the ones from Yucatan, which in part were examined by both of us.

The data presented in tables 18, 19 and 20, then seem to show rather convincingly that different sections of the coast, from Massachusetts to Yucatan, have more or less distinctive populations of this anchovy. Surely if migrations of some extent did take place, the rather gradual increase in the proportionate depth of the body and the length of the pectoral, and the gradual decrease in the number of vertebrae in specimens from the northern part of the range southward would not have been indicated in the data presented. It seems logical, therefore, to conclude that *A. mitchilli* is rather sedentary, and that individuals probably do not stray far away from the place of their birth.

Range.—South Carolina to Yucatan, Mexico but not in the West Indies, and no specimens are included in the collections at hand from the Florida Keys. The northern limits of the range has been set arbitrarily, as some fairly deep specimens (*diaphana*) occur as far north as Delaware Bay, or even Long Island, whereas slender ones (*mitchilli*) occur as far south as Tampa Bay, Fla. However, the majority of the specimens examined from South Carolina southward were deep, whereas most of those north of that state were rather slender. Tables 18, 19 and 20 show, in addition to a moderately sharp increase in depth in specimens from South Carolina, a notable increase in the length of the pectoral, and a decrease in the number of vertebrae in the specimens from that state.

* Some of these data were published recently in a paper entitled, "Biometric comparison of several samples, with particular reference to racial investigations," by Carl L. Hubbs and Alfred Perlmutter. Amer. Nat., 76, no. 767, 1942, pp. 582-92.

Anchoa lucida (Jordan & Gilbert) (Fig. 39)

Stolephorus lucida Jordan & Gilbert, 1882, 341, Mazatlan, Mex.

Anchovia lucida Meek & Hildebrand, 1923, 205.

Anchoviella lucida Jordan & Seale, 1926, 400.

Anchovia curta Hildebrand (not of Jordan & Gilbert) 1939, 36.

Head 3.6 to 4.0; depth 3.7 to 4.8; D. 13 or 14, occasionally 15; A. 25 to 29, rarely only 24 and occasionally 30; P. 12 to 14; scales large, about 35 to 38; vertebrae 39 or 40 (9 specimens dissected).

Body moderately elongate, rather strongly compressed, growing deeper with age, its greatest thickness about equal to depth of caudal peduncle; ventral profile more convex than the dorsal; head moderately short, its

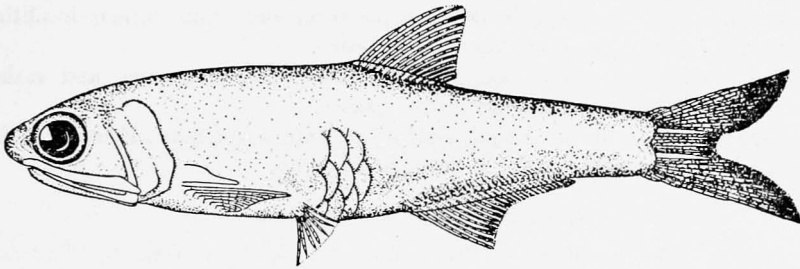


Fig. 39.—*Anchoa lucida*. From a specimen 90 mm. long, Pedro Miguel Locks, C. Z. (Drawing by Mrs. Alice C. Mullen.)

depth at joint of mandible about equal to postorbital part of head and three-fourths eye; snout moderately short, projecting about two-thirds its length beyond tip of mandible, 5.5 to 6.8 in head; eye 3.0 to 3.4; maxillary generally reaching only slightly beyond joint of mandible, its upper free margin somewhat rounded distally, ending in a rather blunt point, 1.25 to 1.35 in head; cheek moderately short and broad, equal to eye in young, only a little larger than eye in adult, its posterior angle rather broad, about 37° ; postorbital part of head moderately short, 7.5 to 8.4 in length; mandible 4.9 to 6.2; gill rakers only a little more than half the length of eye, 16 to 20 + 18 to 23 on first arch, not increasing in number with age; dorsal fin high anteriorly, the last ray not longer than those immediately preceding it, longest rays extending far beyond tip of last one if deflexed, outer margin very slightly concave, its origin about equidistant from base of caudal and anterior margin of eye; anal fin moderately long, its origin under or more usually slightly behind middle of base of caudal and joint of mandible or slightly nearer the latter, its base about as long as head, 3.4 to 3.9 in length; ventral reaching a little more than half way to origin of anal, inserted

about equidistant from origin of anal and base of pectoral; pectoral moderately long, reaching about to base of ventral, 1.3 to 1.5 in head, 5.0 to 6.3 in length; axillary scale of pectoral scarcely reaching past middle of pectoral, 2.5 to 3.0 in head.

Color in preservative, brownish to straw; sides of head bright silvery; a somewhat indistinct silvery lateral band, about half the width of eye, present (usually missing in specimens preserved in formalin); snout and back with dusky punctulation, largest on median line, forming a dusky streak behind dorsal fin, base of anal usually with dusky spots.

Many specimens, ranging from 40 to 105 mm. in length, taken at Chone, Ecuador; mouth of Rio Dagua, Colombia; several places in Panama; Tirunfo, El Salvador; Mazatlan, Mexico; and San Juan Lagoon and mouth of Rio Yaqui, Gulf of California, have been examined. The proportions and enumerations show the range in 36 or more specimens from various localities, including 7 paratypes from Mazatlan, Mexico.

The moderately robust body, rather short anal, large eye, and rather numerous gill rakers characterize this species.

Range.—Mouth of Rio Yaqui, Gulf of California to Chone, Ecuador. Entering brackish water freely, at least in Panama.

Anchoa trinitatis (Fowler) (Fig. 40)

Anchoa trinitatis Fowler, 1915, 527, fig. 3, Port-of-Spain, Trinidad. (Type A. N. S. P., No. 45083.)

Head 3.7 to 4.1; depth 3.9 to 4.5; D. 13 or 14; A. 26 to 30; P. 13 or 14; scales about 38 to 42; vertebrae 41 (1 specimen dissected).

Body rather strongly compressed, its greatest thickness about equal to depth of caudal peduncle, its ventral outline slightly more strongly convex than the dorsal; head short, its depth at joint of mandible about equal to its postorbital length and two-thirds of eye; snout rather short, blunt, protruding about two-thirds its length beyond tip of mandible, 5.7 to 6.6 in head; eye 3.4 to 3.7; maxillary rather pointed, reaching nearly to margin of opercle, 1.2 to 1.4 in head; cheek rather short and broad, scarcely as long as eye and half the snout in the type, rather longer in other specimens, its posterior angle about 40°; postorbital part of head short, 7.5 to 8.6 in length; mandible 5.25 to 6.0; gill rakers slender, about three-fourths length of eye, 15 to 19 + 19 to 22 on first arch; dorsal fin moderately high anteriorly, its longest rays extending beyond tip of last one if deflexed, its origin equidistant from base of caudal and some point over posterior half of eye; anal rather long and low, its origin in advance of middle of base of dorsal (about under beginning of second third of dorsal in the type), its base 3.0 to 3.4 in length; ventral reaching fully half way to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral often

not quite reaching base of ventral, 1.35 to 1.52 in head, 5.25 to 6.0 in length; axillary scale of pectoral rather broad at base, reaching scarcely opposite midlength of fin, 2.8 to 3.6 in head.

Color in alcohol pale; back and upper surface of head with dusky punctulations, often forming two almost continuous lines posterior to dorsal fin; lower part of side and head silvery; a faint silvery lateral band present, nowhere as wide as pupil in the type, often missing in specimens preserved in formalin.

The foregoing description is based on the type (A. N. S. P., No. 45083), 95 mm. long (76 mm. to base of caudal), according to my measurements, from Port-of-Spain, Trinidad, a specimen (A. N. S. P., No. 53365) 110 mm. long (92 mm. to base of caudal), from Vessigny, Trinidad, and 17 specimens, 55 to 65 mm. long, from Laguna de Tacarigua, Venezuela. The specimen

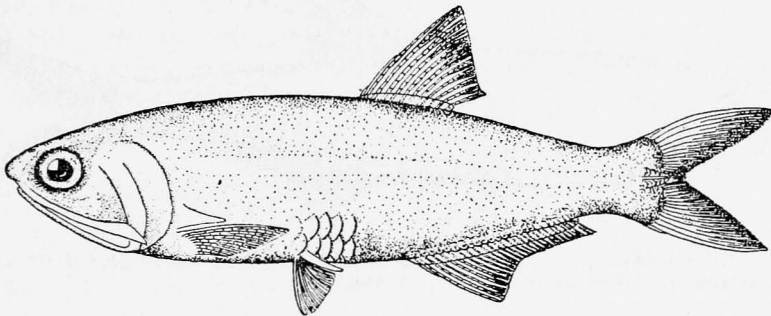


Fig. 40.—*Anchoa trinitatis*. Modified after Fowler. (Modified drawing by Mrs. Alice C. Mullen.)

from Vessigny differs somewhat from the type in being plumper, having a shorter and blunter snout, and the origin of its anal is not quite as far forward under the base of the dorsal. The first two differences may be due, at least largely, to better preservation and to the larger size of this specimen. None of the differences mentioned seem to be great enough to be inconsistent with variations that often occur within a species. The specimens from Venezuela agree more nearly with the type.

This species clearly belongs to the *mitschilli*, *parva*, *curta*, *januaria*, and *pectoralis* group. It evidently reaches a larger size than its near relatives, its body is deeper, except sometimes in *mitschilli diaphana*, the dorsal fin is rather higher anteriorly and differently shaped, and the axillary scale of the pectoral is shorter and broader.

Range.—Known from Island of Trinidad, and from Laguna de Tacarigua, on the coast of Venezuela.

Anchoa delicatissima (Girard) (Fig. 41)

Engraulis delicatissimus Girard, 1856, 154, San Diego, Cal.; and 1858, 335.
Stolephorus delicatissimus Eigenmann, 1893, 138, Pl. 12; Jordan & Evermann, 1896, 444.

Anchoviella delicatissima Jordan & Seale, 1924, 398; Barnhart, 1936, 16, fig. 49; Seale, 1940, 4, Corinto, Nicaragua.

Head 4.0 to 4.5; depth 4.8 to 5.3; D. 14 or 15; A. 23 to 26; P. 12 or 13; scales about 43; vertebrae 40 or 41 (3 specimens dissected).

Body quite elongate, moderately compressed; chest and abdomen scarcely trenchant; ventral outline somewhat more convex than the dorsal; head short, its depth at joint of mandible about equal to its length without snout; snout extending little more than half its length beyond tip of mandible,

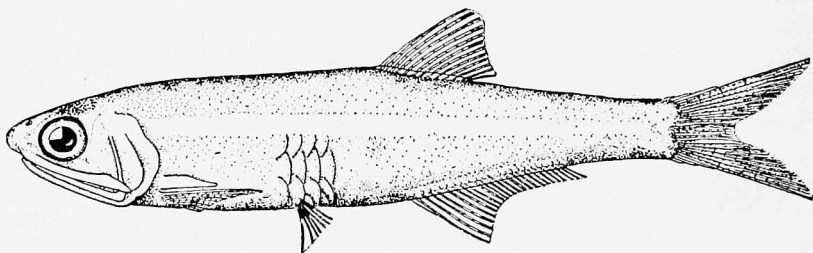


Fig. 41.—*Anchoa delicatissima*. From a specimen 85 mm. long, San Diego, Cal. (U. S. N. M., No. 49568). (Drawing by Mrs Alice C. Mullen.)

5.5 to 6.5 in head; eye 3.0 to 3.8; maxillary rather pointed, reaching beyond joint of mandible, but not quite to margin of opercle, 1.2 to 1.3 in head; cheek short and very broad, about as long as eye, its posterior angle wide, about 50°; postorbital part of head short, about 8 to 10 in length; mandible 5.8 to 6.7; gill rakers slender, those at angle about two-thirds length of eye, 18 to 21 + 26 to 32 on first arch, not increasing in number with age; dorsal fin only moderately elevated anteriorly, the longest rays if deflected scarcely reaching tip of last one, origin of fin about equidistant from base of caudal and anterior half of eye; anal moderately long, its origin generally well in advance of middle of base of dorsal, and equidistant from base of pectoral and base of caudal, its base scarcely longer than head, 3.75 to 4.4 in length; ventral short, reaching little more than half way to origin of anal, generally inserted a little nearer origin of anal than base of pectoral; pectoral short, failing to reach ventral at least by diameter of pupil, 1.4 to 1.5 in head, 5.8 to 7.3 in length; axillary scale of pectoral moderately slender, reaching well beyond midlength of fin, 2.3 to 2.7 in head.

Color in alcohol brownish; sides of head silvery; side with bright silvery

band, about three-fourths width of eye; back with dusky punctulations, more or less in two rows posterior to dorsal fin.

Specimens from San Diego, Calif., only have been available for study. The proportions and enumerations given in the description, unless otherwise stated, are based on 19 specimens 45 to 83 mm. long. It is easily distinguished from *A. compressa*, with which it sometimes has been confused in museum collections, by the notably more elongate body, especially in adults; the shorter anal, with fewer rays, and its more posterior origin; shorter pectoral; lower and differently shaped dorsal; shorter and broader cheek; and by the rather more numerous gill rakers on the lower limb of the first arch. This species fails to grow as large as *A. compressa*, reaching only 75 mm. according to Barnhart (*loc. cit.*). That length is somewhat exceeded, however, by a few specimens at hand.

Range.—According to Barnhart (*loc. cit.*) the range extends from "Los Angeles County and southward." According to Jordan, Evermann and Clark (1930, 48) the range extends from "San Diego Bay and southward on coast to Lower California." However, recently Seale recorded a specimen (not seen by me) from Corinto, Nicaragua.

***Anchoa marinii* n. sp. (Fig. 42)**

Anchoa platana Marina, 1935, 446. Argentina. (*Nomen nudum*).

Head 3.3 to 3.8; depth 4.2 to 4.6; D. 13 to 15; A. 22 to 24; P. 13 or 14; scales partly lost, about 40 to 43; vertebrae 42 (1 specimen dissected).

Body moderately deep, compressed, chest and abdomen slightly carinate; ventral outline much more strongly curved than the dorsal; head compressed, its depth at joint of mandible about equal to head without snout; snout rather pointed, projecting about three-fourths its length beyond mandible, shorter than the small eye, 5.3 to 6.0 in head; eye 4.0 to 4.3; maxillary moderately pointed distally, reaching beyond joint of mandible, but not to margin of opercle, upper margin of free portion nearly straight,

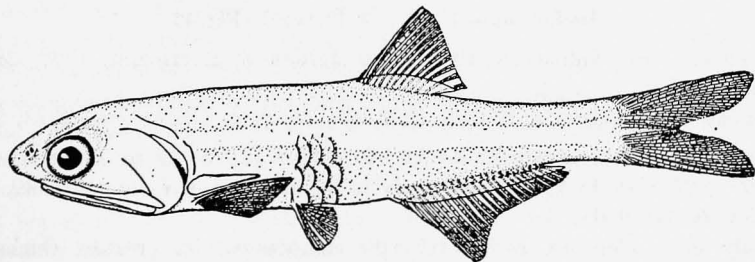


Fig. 42.—*Anchoa marinii* n. sp. From the type, 75 mm. long, Isla Flores, Uruguay (U. S. N. M., No. 87786). (Drawing by Miss Louella E. Cable.)

1.25 to 1.4 in head; cheek as long as eye and about two-thirds snout, with acute posterior angle of about 35° ; postorbital part of head long, 6.4 to 6.8 in length; mandible 5.1 to 5.6; gill rakers about three-fourths diameter of eye, 19 to 21 + 21 to 25 on first arch; dorsal fin with slightly concave margin, the longest rays failing to reach tip of last ray if deflexed, its origin equidistant from base of caudal and anterior half of eye; anal fin low, its origin about under middle of base of dorsal, its base equal to or a little shorter than head, 3.8 to 4.2 in length; ventral reaching only about half the distance to origin of anal, inserted about equidistant from base of pectoral and origin of anal; pectoral not strongly falcate, nearly reaching ventral in specimen 75 mm. long, shorter in larger ones, failing to reach ventral by one-half to the full length of pupil in specimens upward of 100 mm. in length, 1.5 to 1.7 in head, 5.25 to 6.0 in length; axillary scale of pectoral moderately long and slender, about three-fourths length of fin, 2.5 to 3.0 in head.

Color of old preserved specimens, pale to brownish above, more or less silvery below, with a bright silvery lateral band, nearly as broad as eye over base of anal. Fins without definite markings, though the margin of caudal is somewhat dusky, no black V at base of upper rays of caudal.

This species is known to me from the 6 paratypes in the University of Michigan, ranging in length from 92 to 115 mm., from Mar del Plata or Puerto de Quequen, Argentina, and the holotype and a paratype, respectively, 75 and 100 mm. long (U. S. N. M., Nos. 87786 and 7) from off Isla Flores, Montevideo, Uruguay. Its closest relative is *A. januaria*, from which it apparently differs in having a somewhat longer head, longer cheek with a more acute angle posteriorly, probably a smaller eye, longer snout, longer pectoral, and in the absence of an indefinite dark bar at base of caudal. These species agree in the number of dorsal and anal rays, and in the number of gill rakers on the lower limb of the first arch. The species is named for Dr. Tomas L. Marini, the Argentine ichthyologist.

Range.—Montevideo, Uruguay to Mar del Plata, Argentina.

Anchoa naso (Gilbert & Pierson) (Fig. 43)

Stolephorus naso Gilbert & Pierson, in Jordan & Evermann, 1898, 2813, Panama Bay.

Anchovia naso Gilbert & Starks, 1904, 43; Meek & Hildebrand, 1923, 201.

Head 3.1 to 3.4; depth 4.2 to 5.4; D. 14 or 15; A. 22 to 25 (rarely as many as 27); P. 13 to 15; scales about 38 to 42; vertebrae 40 or 42 (13 specimens dissected).

Body quite elongate, rather strongly compressed, its greatest thickness about equal to depth of caudal peduncle; dorsal outline scarcely more convex than the ventral; chest and abdomen slightly trenchant; head rather

long and low, its depth at joint of mandible generally equal to postorbital and a fourth the eye; snout exceptionally long, projecting nearly its full length beyond tip of mandible, 4.9 to 6.0 in head; eye small 4.0 to 4.8; maxillary moderately long, reaching beyond joint of mandible but not to margin of opercle, rather bluntly pointed, its upper free margin gently rounded, 1.25 to 1.4 in head; cheek long and narrow, equal to or longer than eye and snout in large examples, its posterior angle sharp, about 25° ; post-orbital part of head rather long, 5.7 to 6.4 in length; mandible 4.6 to 5.2; gill rakers a little shorter than snout, 18 to 23 + 20 to 27 on first arch; dorsal fin with concave margin, the longest rays failing to reach tip of last one if deflexed, its origin equidistant from base of caudal and some point over anterior half of eye; anal moderately long and low, its origin usually slightly posterior to middle of base of dorsal, equidistant from base of caudal

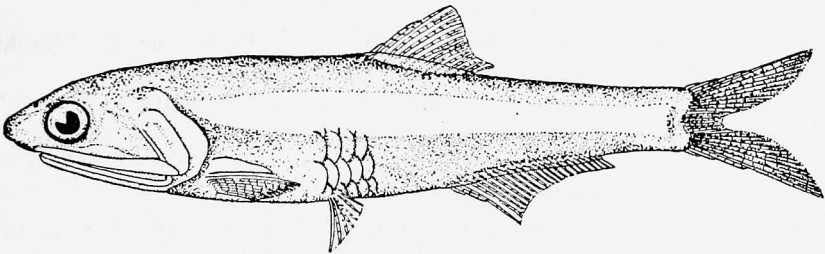


Fig. 43.—*Anchoa naso*. From a specimen 70 mm. long, Taboga Island, Panama (U. S. N. M., No. 79570). (Drawing by Mrs. Alice C. Mullen.)

and base of pectoral or a little nearer the latter, its base 3.8 to 4.8 in length; ventral reaching somewhat more than half way to origin of anal, generally inserted rather nearer base of pectoral than origin of anal; pectoral moderately long, sometimes failing to reach base of ventral by nearly diameter of pupil, occasionally nearly reaching ventral, 1.7 to 2.1 in head, 5.7 to 7.4 in length; axillary scale of pectoral short, rather broad, reaching somewhat past midlength of fin, 3.0 to 3.7 in head.

Color of preserved specimens pale; side of head silvery; body with silvery lateral band, about as wide as eye above base of anal, this band often missing or dark in specimens preserved in formalin; back with dusky points, not dense enough to form a dark streak, sometimes arranged in two more or less definite rows posterior to dorsal fin; base of anal with dark dots, continued in a single series posterior to the fin; caudal and usually the dorsal with dusky points; other fins pale. Color, as observed among schools of swimming fish, pinkish.

Numerous specimens, ranging in length from 32 to 135 mm., have been examined. The proportions and enumerations used, unless otherwise stated,

are based on 32 specimens. The number of anal rays and gill rakers runs a little higher in Peruvian specimens than in Panama material.

This anchovy is characterized chiefly by the elongate body, long snout, long narrow cheek, and the moderately few anal rays and few gill rakers.

Range.—Known from the Pacific coast of Panama, where it enters brackish water to a limited extent. A few specimens were taken in the lower chambers of Miraflores Locks when dewatered in 1937. It was the predominating species of anchovy in the Balboa dry dock when visited several times in 1937, and it came freely to an electric light lowered from an oil dock at Balboa. It was seined also at La Venta, Chame Point, and Taboga Island. A pelican shot while feeding at the Pearl Islands was gorged with this anchovy. It is now recorded for the first time from the Gulf of Guayaquil at Puerto Pizarro, Santa Island, and Cabo Blanco, Peru.

Anchoa nasus (Kner & Steindachner) (Fig. 44)

Engraulis nasus Kner & Steindachner, 1866, 388, Pl. II, fig. 17, Chincha Island, Peru.

Engraulis tapirulus Cope, 1877, 45, Pacasmayo Bay (?), Peru.

Engraulis peruanus Steindachner, 1879, 60, Callao, Peru.

Stolephorus tapirulus Abbott, 1899, 355.

Anchoviella peruana Jordan & Seale, 1926, 401.

Head 3.3 to 3.9; depth 3.9 to 4.6; D. 15 or 16; A. 21 to 27; P. 13 to 15; scales about 36 to 40; vertebrae 41 (2 specimens dissected).

Body fairly elongate, somewhat variable in depth; ventral and dorsal outlines about equally convex; chest and abdomen somewhat compressed, scarcely trenchant; head moderately long, its depth at joint of mandible nearly equal to its postorbital length and half of eye; snout long and conical, extending nearly or quite its full length beyond tip of mandible, 5.0 to 5.7 in head; eye 3.7 to 4.6; maxillary moderately pointed, reaching somewhat beyond joint of mandible, but not to margin of opercle, 1.2 to 1.3 in head; cheek rather long and narrow, nearly as long as snout and eye in large examples, notably shorter in young, its posterior angle about 40°; postorbital part of head moderately long, 5.5 to 7.5 in length; mandible 4.7 to 5.6; gill rakers fairly slender, about two-thirds length of eye, 21 to 25 + 24 to 28 on first arch; dorsal fin rather high anteriorly, its margin concave, the longest rays generally not quite reaching tip of last one if deflexed, origin of fin usually slightly nearer posterior margin of eye than base of caudal; anal moderately small, its origin sometimes just behind base of last ray of dorsal, but more usually under or somewhat in advance of it, its base 4.2 to 4.6 in length; ventral reaching fully half way to origin of anal, inserted about equidistant from base of pectoral and origin of anal; pectoral rather variable in length, sometimes reaching base of ventral, but

more usually falling short of this point, occasionally by a distance as great as diameter of pupil, 1.6 to 1.9 in head, 5.3 to 6.3 in length; axillary scale of pectoral broad at base, generally reaching opposite beginning of distal third of longest rays, 2.5 to 3.4 in head.

Color of old preserved specimens brownish above; sides of head and lower two-thirds of body silvery. Small specimens, 48 to 70 mm. long with a bright silvery lateral band. Top of head and back with dark punctulations, sometimes forming a dark band.

Twenty-six specimens, 48 to 140 mm. long, are at hand, and form the basis for the description. Nine of these (M. C. Z., No. 17983), from Callao, Peru, according to the label with them, are from Steindachner's collection, and were identified as *peruanus*. These are the specimens described by Jordan and Seale (*loc. cit.*). Three other specimens (S. U. N. H. M., No.

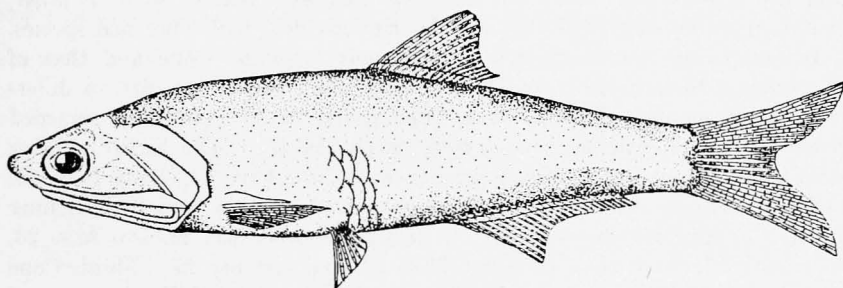


Fig. 44.—*Anchoa nasus*. From a specimen 105 mm. long, "Peru" (M. C. Z., No. 17983). (Drawing by Mrs. Alice C. Mullen.)

6227), also from Callao, apparently are the ones described as *Stolephorus tapirulus* by Abbott (*loc. cit.*). The two lots undoubtedly represent only one species. The moderately wide variation in the number of anal rays, together with some variability in the place of origin with respect to the dorsal, and the variation in the length of the pectoral fins seem to have been the principal reasons for believing that two species were represented. Fourteen small specimens from the Gulf of Guayaquil, taken near Puerto Pizarro, Peru, and one from Sechura Bay, Peru, are also at hand.

It is not evident from Steindachner's work that he knew of *Engraulis tapirulus* Cope, when he described *E. peruanus*, and he evidently did not consider his *peruanus* closely related to *E. nasus* Kner and Steindachner, to which he made no reference.

The original descriptions set forth only two differences that require comment. First, the profiles, as described, seem to differ rather strongly. However, anchovies are soft fish and the shape is profoundly affected by the position in which the fish are hardened. Specimens with differently curved

profiles, in fact, occur in a single collection. Knerr and Steindachner presumably had only one specimen of *E. nasus*, and considered the strongly curved dorsal and nearly straight ventral profile a natural condition, which would require more specimens to prove. The second difference is in the number of anal rays, the number given for *E. nasus* being 22, and for *E. peruanus* 26 or 27. It is shown in the description above that as few as 21 and as many as 27 anal rays were found in the specimens studied. Some investigators have counted only divided rays, whereas the enumerations in the description above include the two anterior undivided ones. Therefore, the second difference evidently also is insignificant. On the other hand, the two descriptions agree with each other (and with the specimens at hand) in so many apparently essential characters, such as the length of head, depth of body, unusually long snout, shape and length of maxillary, and the positions of the dorsal and anal fins with respect to each other, that it must be concluded that the descriptions deal with only one species.

In comparing the description of *Engraulis tapirulus* Cope and that of *E. peruanus* Steindachner, the chief discrepancies noticed are, first, a difference in the number of dorsal rays, Cope giving "I, 11" (which is regarded herein as error), whereas Steindachner gave "16-17." The higher number does not occur in the specimens examined, as two have 14, seven have 15, and five have 16 rays. Second, Cope gave anal rays 25, and Steindachner 26 or 27. In specimens at hand one has 21, another has 22, two have 23, four have 24, three have 25, three have 26, and one has 27. Third, Cope stated that the origin of the anal was under the base of the last ray of the dorsal, whereas Steindachner said it lay behind the base of dorsal. Sufficient variation exists among the specimens at hand to show that this difference is of no specific value. The specimen labeled "*Engraulis tapirulus* Cope, type" in the Academy of Natural Sciences of Philadelphia apparently is *Lycengraulis poeyi* (see p. 146), and not the specimen described by Cope.

Abbott (*loc. cit.*) believed that *Engraulis tapirulus* differed from *E. peruanus* "in the smaller number of dorsal and anal fin rays, origin of anal, length of pectoral, position of lateral stripe, and depth of head at occiput." Although Abbott counted only 14 rays in the dorsal, I am able to count 15 in his specimens, bringing the range within the range of Steindachner's material. He counted 23 and 24 anal rays, which agree with my enumerations, and which come within the range of Steindachner's specimens. The position of the anal, and the length of the pectoral fins, are variable and are of no specific value, as already shown. Finally, I find no difference in the position of the lateral band, nor in the depth of the head, beyond a slight variability, in the three lots of specimens studied. It has been concluded, therefore that *peruanus* and *tapirulus* are identical, and as already shown, both apparently are synonyms of *nasus*.

Jordan and Seale (*loc. cit.*) stated that no axillary scale of pectoral is present. However, that is an error, as in the lot of nine specimens, which those authors studied, five have it present on both sides, in two it is lost on one side, and in two others both scales are lost. The absence of this scale in any American species of the family, at least, would be unusual.

Range.—Gulf of Guayaquil, Puerto Pizarro; Sechura Bay, Callao and Chincha Islands, Peru.

Anchoa filifera (Fowler) (Fig. 45)

Anchoa filifera Fowler, 1915, 524, fig. 2. Port-of-Spain, Trinidad (type N. A. S. P., No. 45080).

Anchoviella longipinna Beebe & Tee-Van, 1928, 48, with fig., Bizoton, Haiti (type D. T. R. N. Y. Z. S., No. 7460).

Head 3.4 to 3.6; depth 5.0 to 5.6; D. 13 to 15; A. 19 to 23; P. 13 or 14; scales lost, about 36; vertebrae 39 or 40 (3 specimens dissected).

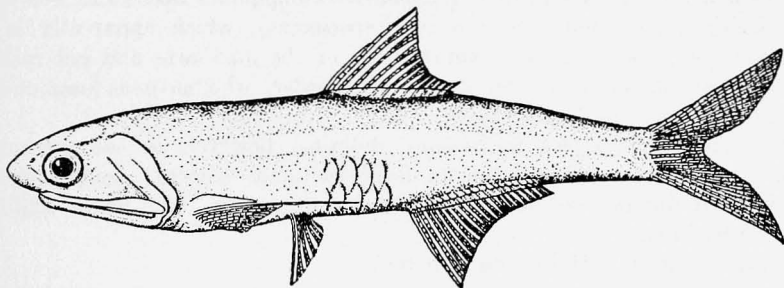


Fig. 45.—*Anchoa filifera*. From a specimen 70 mm. long, Kingston, Jamaica. (Drawing by Mrs. Alice C. Mullen.)

Body rather strongly compressed; head moderately long and low, its depth at joint of mandible slightly exceeding its postorbital length; snout rather long, pointed, projecting nearly its full length beyond mandible, only a little shorter than eye, 5.0 to 5.5 in head; eye very small, 4.2 to 4.8; maxillary long, not quite reaching margin of opercle, not sharply pointed, its upper margin distally rounded like the sharp edge of a chef's knife, 1.25 to 1.3 in head; cheek long and narrow, equal to eye and snout, its posterior angle sharp, about 30°; postorbital part of head long, 6.2 to 6.8 in length; mandible 4.75 to 5.5; gill rakers about three-fourths length of eye at angle, 17 to 19 + 20 to 23 on first arch; dorsal fin rather high anteriorly, with concave margin, the longest rays reaching nearly to tip of last ray if depressed, origin of fin usually slightly nearer tip of snout than base of caudal; anal fin low, its origin about under beginning of posterior third of base of dorsal, its base 4.8 to 5.4 in length; ventral inserted a little

nearer base of pectoral than origin of anal, reaching notably more than half way to origin of anal; pectoral with upper ray produced, its filament (frequently broken) extending to tips of ventrals or possibly beyond in perfect specimens, the second ray reaching base of ventrals, the fin (without filament) 1.6 to 1.8 in head, 6.0 to 6.4 in length; axillary scale of pectoral broad at base, about two-thirds length of fin, 2.8 to 3.5 in head.

Color of preserved specimens pale above, with numerous dusky punctulations on head and back, not arranged in longitudinal series; side of head, and lower parts of body silvery; middle of side with a silvery lateral band (often dusky in specimens preserved in formalin), as wide as eye above base of anal.

The foregoing description is based on the type material (type and two paratypes), which I have studied, from Port-of-Spain, Trinidad, 72 to 75 mm. long, one, 74 mm. long, from Puerto Rico, and on 15 specimens from Kingston, Jamaica, ranging in length from 55 to 70 mm. This material agrees well with the description of *Anchoviella longipinna* Beebe and Tee-Van (of which I have not seen the type specimens), which apparently is a synonym of *A. filifera*. My enumerations of the anal rays and gill rakers of the type material do not agree with Fowler, who gave a total of 25 anal rays, and 25 + 22 gill rakers.

This species resembles *A. lyolepis*, differing, however, in the produced upper ray of the pectoral, the fin itself (without filament) being longer; in the more anterior position of the dorsal and anal fins; and in the slightly fewer vertebrae.

Range.—Jamaica, Haiti, and Trinidad.

***Anchoa howelli* n. sp. (Fig. 46)**

Head 4.0, 3.8; depth 5.2, 5.1; D. 14, 13; A. 25, 24; P. 14, 13; scales lost, about 40, 44; vertebrae 41 (in paratype).

Body quite elongate, rather strongly compressed; head long and low, its depth at joint of mandible exceeding postorbital length by one-fourth diameter of eye; snout moderately long, extending nearly its full length beyond tip of mandible, 5.0, 5.5 in head; eye fairly large, 4.0, 4.0; maxillary extending somewhat beyond joint of mandible, distally rather broad, not sharply pointed, its upper free margin slightly rounded, 1.3, 1.3 in head; cheek moderately long and narrow, equal to eye and a little more than half the snout, its posterior angle about 35°; postorbital part of head moderately long, 8.0, 7.0 in length; mandible 5.7, 5.4; gill rakers at angle about three-fourths length of eye, 21 + 26, 21 + 25 on first arch, left side, and 21 + 27, 21 + 25 on right side; dorsal fin with slightly concave margin, the longest rays not nearly reaching tip of last one if deflexed, origin of fin about equidistant from tip of snout and base of caudal; anal moderately

low and long, its origin under posterior one or two rays of dorsal, its base 4.5, 4.75 in length; ventral reaching a little less than half way to origin of anal, inserted much nearer base of pectoral than origin of anal; pectoral with a long filament on upper ray, reaching somewhat beyond base of ventral on the single fin in the type on which it remains (evidently incomplete); pectoral fin exclusive of filament rather short, the second ray failing to reach base of ventral by diameter of eye, 2.25 in head, 8.0 in length (fins broken in paratype); axillary scales of pectoral lost or imperfect, broad at base, probably not more than two-thirds length of fin, exclusive of filament.

Color of old preserved specimens pale; sides of head and lower parts of body silvery; side with a bright silvery band, fully as wide as eye above base of anal; caudal fin with a dark margin.

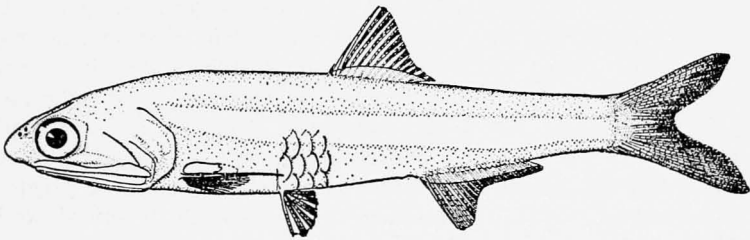


Fig. 46.—*Anchoa howelli* n. sp. From a paratype, 95 mm. long, Rio de Janeiro, Brazil (U. S. N. M., No. 76328). (Drawing by Miss Louella E. Cable.)

The foregoing description is based on the type, a specimen 100 mm. long (80 mm. to base of caudal), from the market at Santos, Brazil (U. S. N. M., No. 100888), and another specimen not in very good condition, about 95 mm. long (76 mm. to base of caudal) from Rio de Janeiro, Brazil (U. S. N. M., No. 76328). The proportions and enumerations based on the type are given first in the description. These specimens are close to *A. filifera* from which they may prove to be only subspecifically distinct when more material becomes available for study. The specimens now at hand differ in several minor respects, as follows: The anal has a few more rays; the vertebrae and gill rakers apparently are slightly more numerous; the head is proportionately a little shorter; the snout and cheek are rather notably shorter; the eye is larger; the ventral and pectoral (without its filament) are shorter; and the origin of the anal is farther back with respect to the dorsal.

This species is named for Dr. Luis Howell Rivero, the Cuban ichthyologist, who sent extensive collections of anchovies, which have been very useful in these studies.

Range.—Santos and Rio de Janeiro, Brazil.

Genus ANCHOVIELLA Fowler

Anchoviella Fowler. 1911, 211 (type *Engraulis perfasciata* Poey).

Anchoviella, as recognized herein, differs chiefly from *Anchoa* in having a shorter maxillary, which is round to more or less square distally, and it may or may not extend to the joint of the mandible, but not beyond it. Considerable variation in the size of the mouth, and a consequent variation in the length of the maxillary exists among the species. There is variation also in the width of this member. The extremes of shortness and of width occur in *Anchovia brevirostris* Meek and Hildebrand, renamed *Amplova balboae* by Jordan and Seale because they regarded *brevirostris* preoccupied by *Engraulis brevirostris* Günther. *Amplova jamesi* Jordan and Seale, also has an extremely short maxillary, which in each of the two species named scarcely extends beyond the posterior rim of the orbit. Jordan and Seale took notice of this character and based upon it their genus *Amplova*. However, it is evident from the descriptions that follow that various degrees of length occur among the species, making a definite generic separation impossible. Nevertheless, *Amplova* may be regarded as a subgenus to which at least *balboae*, *jamesi* and *brasiliensis* should be assigned, but not *Engraulis brevirostris* as Jordan and Seale supposed, as according to specimens examined that species has a rather long maxillary similar to *perfasciata*, the type of *Anchoviella*. The maxillary is insufficiently described, at least in *nattereri* and *vallanti* (of which I have seen no specimens) to place them as to subgenus.

The body is elongate and compressed; the teeth are all small; the gill rakers on the lower limb of the first arch generally are fewer than 35, except in *pallida* which may have as many as 45, not known to increase in number with age; the anal fin is rather short, seldom having as many as 29 rays; and the ventral fin usually is much nearer vertical from origin of dorsal than base of pectoral. A small size is attained. The largest specimens of any species seen were of *eurystole* of which only one somewhat exceeded a length of 125 mm.

When Fowler proposed the "subgenus," *Anchoviella*, he intended it to include all the species of the large genus *Anchovia*, as previously understood, that had a small number of gill rakers, and attained a small size. Such a division seems impracticable now because of the known variation in the number of gill rakers, as well as in size attained. Therefore, I propose to restrict *Anchoviella* to the species that have a comparatively short and posteriorly rounded (never pointed) maxillary, together with other characters already described.

Most of the species enter fresh water. Several South American ones are known only from lakes and streams, a few of the species having been taken a great distance from the sea.

KEY TO THE SUBGENERA AND SPECIES

- a. Maxillary moderately long, extending beyond posterior rim of orbit a distance equal to or greater than diameter of pupil, sometimes equal to or greater than diameter of eye (character undescribed in *nattereri* and *vallianti*)
 subgenus *Anchoviella*, p. 112
- b. Origin of anal under or behind posterior half of base of dorsal, fin short, with 15 to 20 rays (except *vallianti* which has 22 to 25 rays).
- c. Origin of anal entirely behind base of dorsal, generally under or behind deflexed tip of last ray of dorsal; gill rakers 24 to 28 + 27 to 33.
- d. Eye moderately small, 3.75 to 4.5 in head, 2.1 to 2.5 in postorbital part of head; gill rakers about three-fourths length of eye, not very broad nor close-set, with moderate serrations on inner edges; anterior rays of dorsal rather low, failing to reach tip of last one if deflexed.
eurystole, p. 112
- dd. Eye very small, 4.4 to 4.8 in head, 2.5 to 2.75 in postorbital part of head; gill rakers nearly as long as eye, rather broad and close-set, with minute serrations on inner edge; anterior rays of dorsal high, the longest reaching beyond tip of last one if deflexed. *estauquae* n. sp., p. 115
- cc. Origin of anal somewhere under posterior half of base of dorsal, or sometimes slightly behind the base; fewer than 24 gill rakers on upper, and fewer than 29 on lower limb of first arch.
- e. Anal fin short, with 15 to 20 rays; origin of dorsal about equidistant from base of caudal and tip of snout (equidistant from base of caudal and middle of eye in *scitula*).
- f. Mouth large; maxillary about 1.4 to 1.6 in head; pectoral fin short, failing to reach base of ventral by space equal to or greater than diameter of eye, about 1.7 to 2.5 in head, 7.0 to 8.2 in length.
- g. Gill rakers rather numerous, 18 to 23 + 23 to 28; pectoral with 14 to 16 rays.
- h. Origin of anal under or slightly behind base of last ray of dorsal; gill rakers fairly numerous, 19 to 23 + 24 to 28; axillary scale of pectoral long and narrow, not much shorter than the fin, 1.9 to 2.3 in head. *perfasciata*, p. 116
- hh. Origin of anal slightly posterior to middle of base of dorsal; gill rakers rather fewer, 18 + 23; axillary scale of pectoral very small, only about half as long as fin, 3.2 in head. . . *scitula*, p. 118
- gg. Gill rakers less numerous, 12 to 14 + 18 to 20.
- i. Body moderately slender, depth 5.33 to 6.3 in length; eye large, 3.0 to 3.5 in head; pectoral with 11 or 12 rays. *brevirostris*, p. 119
- ii. Body very slender, depth 7.0 to 8.0 in length; eye small, 4.6 to 5.5 in head; pectoral with 13 or 14 rays. *miarcha*, p. 121
- ff. Mouth smaller; maxillary 1.6 to 1.9 in head; pectoral longer, failing to reach ventral by diameter of pupil, 1.4 to 1.6 in head, 5.9 to 6.4 in length; gill rakers 16 to 18 + 23 to 26; pectoral with 12 or 13 rays.
- j. Maxillary moderately long, extending three-fourths diameter of eye beyond orbit; cheek moderately broad, fully as long as eye, with a

- definite posterior angle of about 60°; eye large, 3.2 to 3.5 in head; axillary scale of pectoral rather short, reaching to or somewhat beyond midlength of fin, 2.4 to 2.9 in head; a median dark stripe posterior to anal fin. *guianensis*, p. 122
- jj. Maxillary shorter, extending diameter of pupil beyond orbit; cheek very broad, scarcely as long as eye, without definite posterior angle; eye smaller, 3.75 to 4.2 in head; axillary scale of pectoral long, about three-fourths length of fin, 2.0 to 2.2 in head; no dark median line posterior to anal fin. *alleni*, p. 124
- ee. Anal fin longer, with 22 to 25 rays; origin of dorsal nearer tip of snout than base of caudal; 18 or 19 gill rakers on lower limb of first arch; pectoral reaching nearly or quite to base of ventral. . . *vaillanti*, p. 125
- bb. Origin of anal under or in advance of middle of base of dorsal (sometimes slightly behind middle of base in *elongata*), the fin longer, with 22 to 29 rays.
- k. Gill rakers not especially numerous, 21 or fewer on upper limb, and 30 or fewer on lower limb of first arch; body not very deep, the depth usually 4.0 or more in the length.
- l. Anal moderately short, with 22 to 27 rays; pectoral short, failing to reach base of ventral.
- m. Gill rakers fairly numerous, 17 to 21 + 19 to 25; eye very large, 3.0 to 3.7 in head.
- n. Body extremely elongate, the depth 5.0 to 5.7 in length; head long, 3.6 to 3.9; postorbital length 7.5 to 8.2; gill rakers 17 or 18 + 22 to 24; anal with 22 to 24 rays. *elongata*, p. 126
- nn. Body deeper, the depth 4.0 to 5.1 in length; head shorter, 4.2 to 4.7; postorbital length 8.3 to 9.6.
- o. Gill rakers 17 or 18 + 19 or 20; silvery lateral band very prominent, notably wider than eye. *lepidentostole*, p. 127
- oo. Gill rakers 18 to 21 + 22 to 25; silvery lateral band as wide as eye
hubbsi, n. sp., p. 128
- p. Gill rakers very few, 10 to 12 + 15 to 17; head short and deep, 4.0 to 4.6 in length; eye moderately large, 3.5 to 4.5 in head; dorsal with 13 to 15 rays. *blackburni*, n. sp., p. 129
- pp. Gill rakers more numerous, 13 to 15 + 18 to 21; head longer, 3.6 to 3.9 in length; eye very small, 4.8 to 5.2 in head; dorsal with 15 or 16 rays. *parri*, n. sp., p. 131
- ll. Anal longer, with 28 or 29 rays; pectoral extending to middle of ventral; depth 4.0 in length. *nattereri*, p. 133
- kk. Gill rakers very numerous, 28 to 34 + 36 to 45; body deep, quite strongly compressed, its depth 3.5 to 3.9 in length; anal with 24 to 26 rays; pectoral long, reaching beyond base of ventral. *pallida*, p. 134
- aa. Maxillary very short and rather broad, extending only slightly (less than diameter of pupil) beyond posterior rim of orbit subgenus *Amplova*, p. 112
- q. Anal fin with 23 to 27 rays; gill rakers 19 to 21 + 29 to 35; depth 3.5 to 4.1 in length. *balboae*, p. 135
- qq. Anal fin with 19 to 22 rays; gill rakers 12 to 17 + 20 to 25; depth 4.5 to 6.1 in length.

- r. Gill rakers 12 or 13 + 20 or 21; maxillary extending scarcely beyond eye, 1.9 to 2.0 in head; pectoral not quite reaching ventral, 5.4 to 6.5 in length, with 11 rays. *jamesi*, p. 137
- rr. Gill rakers 17 + 24 or 25; maxillary slightly longer, extending half diameter of pupil beyond eye, 1.65 to 1.7 in head; pectoral shorter, failing to reach ventral by half diameter of eye, with 14 or 15 rays. *brasiliensis*, n. sp., p. 138

TABLE 21.—FREQUENCY DISTRIBUTION OF ANAL RAYS IN *Anchoviella*

Species	Number of anal rays												
	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>eurystole</i>	6	8	17	7	1								
<i>estauquae</i>	1	1	2										
<i>perfasciata</i>	6	9	22	9	2								
<i>scitula</i>				1									
<i>brevirostra</i>		2	1	1	1								
<i>miarcha</i>			1	5	2	1							
<i>guyanensis</i>				1	1								
<i>alleni</i>				4	4								
<i>elongata</i>								4	5	5			
<i>lepidentostole</i>									1		1		
<i>hubbsi</i>									8	9	1	2	
<i>blackburni</i>											2	2	3
<i>parri</i>				3	11	4	2						
<i>pallida</i>										1	1	1	
<i>balboae</i>									1	6	2	2	1
<i>jamesi</i>					1		1						
<i>brasiliensis</i>					2								

TABLE 22.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN *Anchoviella**

Species	Number of gill rakers on upper limb of first arch																								
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
<i>eurystole</i>															4	11	12	7	4						
<i>estauquae</i>																	1	1							
<i>perfasciata</i>								1	12	20	16	5	3												
<i>scitula</i>								1																	
<i>brevirostra</i>		4	2																						
<i>miarcha</i>		1	4	1																					
<i>guyanensis</i>						1	1																		
<i>alleni</i>						1	7	2																	
<i>elongata</i>							7	8																	
<i>lepidentostole</i>							3	1																	
<i>hubbsi</i>									3	10	6	2													
<i>blackburni</i>	1	1	1																						
<i>parri</i>			2	1	5																				
<i>pallida</i>																		1				1	2	1	
<i>balboae</i>										5	6	3													
<i>jamesi</i>		1	1																						
<i>brasiliensis</i>								3																	

* If the enumerations exceed the number of specimens listed in the text, the gill rakers on both anterior arches in at least some of the specimens were counted.

TABLE 22.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN *Anchoviella**—Cont'd

Species	Number of gill rakers on lower limb of first arch																															
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
<i>eurystole</i> ...																2	10	13	10	3	5	2										
<i>estauquae</i> ...																		2	1	1												
<i>perfasciata</i> ...											4	6	19	17	9																	
<i>scitula</i> ...										1																						
<i>brevirostra</i> ...			2	4																												
<i>miarcha</i> ...			4	1	1																											
<i>guianensis</i> ...										1	1																					
<i>alleni</i> ...										1	5	3	1																			
<i>elongata</i> ...										2	10	3																				
<i>lepidentostole</i> ...						3	1																									
<i>hubbsi</i> ...										7	8	5	1																			
<i>blackburni</i> ...	1	4	2																													
<i>parr</i> ...						2	1	2	3																							
<i>pallida</i> ...																																
<i>balboae</i> ...																									2			1		1		1
<i>jamesi</i> ...										1	1																					
<i>brasiliensis</i> ...												1	2																			

* If the number of enumerations exceeds the number of specimens listed in the text the gill rakers have been counted on both anterior arches in at least some of the fish.

Subgenus *Anchoviella* Fowler

Anchoviella Fowler, 1911, 211 (type *Engraulis perfasciatus* Poey).

Subgenus *Amplova* Jordan and Seale

Amplova Jordan & Seale, 1925, 31 (type *Anchovia brevirostris* Meek & Hildebrand = *Amplova balboae* Jordan & Seale).

The characters of the subgenera are shown in the generic account and in the preceding key.

Anchoviella eurystole (Swain & Meek) (Fig. 47)

Stolephorus eurystole Swain & Meek, 1885, 34. Woods Hole, Mass. (In using this name I am not unmindful of the fact that Jordan and Seale (1926, 403) stated Jordan had examined the type of *Engraulis argyrophanus* and regarded it as identical with *Stolephorus eurystole*. However, Jordan and Seale did not show the essential differences between the northern and southern forms. It is quite certain, therefore, that they did not recognize them. Consequently, the examination of the type did not settle the question.)

Stolephorus argyrophanus Jordan & Evermann, 1896, 444; Kuntz & Radcliffe, 1917, 116.

Head 3.5 to 4.0; depth 5.25 to 6.5; D. 13 to 16; A. 15 to 18 (rarely 19); P. 15 or 16; scales mostly lost, about 40 to 45; vertebrae 43 to 45 (9 specimens dissected).

Body quite slender, not strongly compressed; ventral profile more strongly convex than the dorsal; head low, rather long, its depth at joint of mandible almost exactly equal to postorbital length; snout only a little shorter than the small eye (in large examples), 4.75 to 6.5 in head; eye 3.75 to 4.5 in head, 2.1 to 2.5 in postorbital length of head; maxillary scarcely expanded, rounded posteriorly, reaching beyond orbit a distance equal to about 1.3 diameter of eye, failing to reach the joint of mandible by about half diameter of pupil, 1.5 to 1.7 in head; cheek only a little shorter than snout and eye, its posterior angle rather narrow, about 45° ; postorbital part of head long, 6.5 to 7.25 in length; mandible 5.4 to 6.7; gill rakers about three-fourths length of eye, 24 to 28 + 27 to 33 on first arch, not broad nor very close-set, with moderate serrations on inner edge; dorsal fin with slightly concave margin, low anteriorly, the longest rays failing to reach tip of posterior ray if deflexed, its origin usually rather nearer tip of snout than base of caudal; anal short, its origin rather variable, most frequently

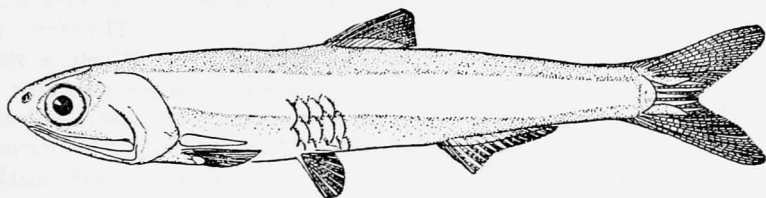


Fig. 47.—*Anchoviella eurystole*. From a specimen 75 mm. long, Woods Hole, Mass. (U. S. N. M., No. 77778). (Drawing by Miss Louella E. Cable.)

under tips of longest dorsal rays if deflexed, sometimes somewhat in advance of and occasionally a little behind this point, its base 6.25 to 8.0 in length; ventral small, inserted about an eye's diameter in advance of dorsal, and usually somewhat nearer base of pectoral than origin of anal, reaching nearly or quite to vertical from middle of base of dorsal; pectoral short, failing to reach base of ventral by a distance fully equal to eye and half the snout, 1.8 to 2.2 in head, 7.3 to 8.0 in length; axillary scale of pectoral long and narrow, failing to reach tip of fin by scarcely half the diameter of pupil, 2.25 to 3.0 in head.

Color of preserved specimens pale; sides of head silvery; a very broad silvery lateral band, about as wide as eye in small specimens, becoming wider and less distinctly outlined with age, about equal to eye and half the snout in very large specimens (130 mm.).

Many specimens, ranging in length from 55 to 130 mm., mostly from Woods Hole, Mass., and a few from Naomi, Conn., Long Island, N. Y., Brigantine Bay, N. J., and Beaufort, N. C., have been examined. The proportions and enumerations given are based on 41 or more specimens.

This northern form generally has been classed more or less indifferently as *argyrophana* and *perfasciata*. Just wherein these two nominal species were supposed to differ is not very clear from the literature. The Florida Keys and the West Indian specimens, too, have been classed either as *argyrophana* or *perfasciata*. Nevertheless, there are rather well marked differences between the northern form, herein called *eurystole*, and the southern form, *perfasciata*.

Swain and Meek (*loc. cit.*) believed the specimens from Woods Hole, Mass., to be different from those from Key West, Fla., and Cuba, and proposed the name *eurystole* for the northern fish. These writers stated that the northern form had a longer anal fin (20 rays, according to a published account, whereas the southern form had only 14 to 16 rays). They also thought that the northern form reached a larger size. Among specimens from northern localities examined, not one has as many as 20 anal rays, only 2 have 19, and the usual number is 16 to 18. In specimens from the Florida Keys and the West Indies, the highest number of anal rays is 18, found in 5 specimens, the usual number being 16 or 17. Therefore, the supposed difference in the number of anal rays, at most, is only a small average difference (see table 21). It seems probable from the specimens examined that the northern form does reach a somewhat larger size. Although the differences mentioned by Swain and Meek do not separate the northern and southern forms very well, nevertheless there are rather well marked differences, as shown by the descriptions and the key. As *argyrophana* does not seem to be definitely available, as pointed out under *perfasciata*, *eurystole* apparently should be recognized.

Range.—Woods Hole, Mass., at least to Beaufort, N. C. As no specimens of *Anchoviella* from the coast between Beaufort, N. C., and Melbourne Beach, Fla., are at hand, the southern range remains undetermined. This species is reported as common to abundant at times at Woods Hole, Mass., and vicinity. At Beaufort, N. C., it is very rare, for it was taken only once during many years of intensive collecting. It appears to be rare in New York and in New Jersey, and it was not found in Chesapeake Bay during several years of rather persistent collecting. It has long been supposed that the home of this anchovy was the Gulf Stream. This supposition apparently arose from the belief that *Engraulis argyrophanus* Cuvier & Valenciennes, from somewhere in the Atlantic, was the same species as that found on the coast of New England, and that it drifted northward in the Gulf Stream. Thus, we read in some current works concerning the general distribution, "Gulf stream; occasionally northward to Cape Cod." No evidence in support of the supposition was gained from the present study.

***Anchoviella estauquae* n. sp. (Fig. 48)**

Head 3.6 to 3.7; depth 5.2 to 6.5; D. 13 to 15; A. 15 to 17; P. 15 or 16; scales about 44 to 46; vertebrae 45 (1 specimen dissected).

Body slender; dorsal and ventral profiles equally convex; head rather long, low, its depth at joint of mandible scarcely equal to postorbital length of head; snout moderately long, a little shorter than the small eye, its length 5.0 to 5.3 in head; eye 4.4 to 4.8 in head, 2.5 to 2.75 in postorbital length of head; maxillary rounded posteriorly, not especially broadened, reaching beyond orbit a distance equal to 1.3 diameter of eye, not quite to joint of mandible, 1.5 to 1.6 in head; cheek nearly as long as snout and eye, its posterior angle quite sharp, about 40°; postorbital part of head long, 6.3 to 6.45 in length; mandible 5.4 to 5.7; gill rakers scarcely as long as eye, 26 to 28 + 30 to 32 on first arch, broad and close-set, with minute serrations

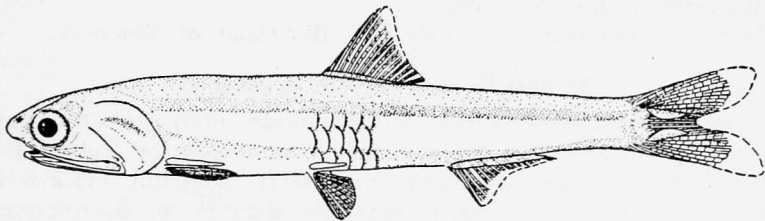


Fig. 48.—*Anchoviella estauquae* n. sp. From the type, 82 mm. long, Estauques Bay, Gulf of Venezuela (U. S. N. M., No. 119795). (Drawing by Miss Louella E. Cable.)

on inner edge; dorsal fin rather high anteriorly, with a slightly concave margin, the longest ray reaching beyond tip of posterior ray if deflexed, its origin about equidistant from tip of snout and base of caudal; anal short, its origin well behind tips of longest dorsal rays, its base 6.5 to 7.5 in length; ventral moderately small, inserted about half diameter of eye in advance of origin of dorsal and nearly equidistant from base of pectoral and origin of anal, reaching fully to vertical from middle of base of dorsal; pectoral rather short, failing to reach base of ventral by about an eye's diameter, 1.9 to 2.5 in head, 7.0 to 7.8 in length; axillary scale of pectoral long, failing to reach tip of pectoral by diameter of pupil or less, 2.3 to 2.7 in head.

Color of preserved specimens pale; sides of head bright silvery; a broad silvery lateral band, fully as broad as eye above base of anal.

Four specimens, about 77 to 92 mm. long (caudal fins damaged), 65 to 77 mm. to base of the caudal, collected along a sandy beach in Estauques Bay, Gulf of Venezuela, are at hand. A specimen about 82 mm. long, 72 mm. to the base of caudal (U. S. N. M., No. 119795), is designated as type.

The following proportions and enumerations pertain to this specimen: Head in length 3.6; depth 5.9; postorbital 6.4; mandible 5.4; anal base 7.4; pectoral 7.7. Snout in head 5.3; eye 4.8, or 2.75 in postorbital part of head; maxillary 1.6; pectoral 2.5; axillary scale of pectoral 2.7. D. 13; A. 17; P. 17; scales about 46; gill rakers 32 on lower limb of first arch.

This species is very close to *eurystole* from which it can scarcely be separated with the meager material at hand. In the number of gill rakers (see table 22) it is near the upper limits of that species, but the rakers seem to be a little longer, certainly broader, and apparently closer together, with perhaps slightly smaller serrations on their inner margins. It has a higher and somewhat differently shaped dorsal fin than *eurystole*, the fin being more nearly as in *perfasciata*. The eye is notably smaller than in *perfasciata*, and apparently a little smaller than in *eurystole*, and the postorbital part of the head is definitely longer than in *perfasciata* and perhaps a little longer than in *eurystole*.

Range.—Known only from Estauques Bay, Gulf of Venezuela.

***Anchoviella perfasciata* (Poey) (Fig. 49)**

? *Engraulis argyrophanus* Cuvier & Valenciennes, 1848, 49. (The authors state that the type was caught in the Atlantic Ocean by Kuhl and Van Hasselt on a voyage from Europe to Batavia. This fish, which is very inadequately described, therefore, may not belong to the American fauna, though it has been so considered by various authors. Because of the uncertainty of the type locality and the very inadequate description, I have queried the identity of *argyrophana* and *perfasciata*.)

Engraulis perfasciatus Poey, 1860, 312. Cuba.

Stolephorus miarchus Jordan, 1885, 106 (not of Jordan & Gilbert; probably the young of *A. perfasciata*).

Anchoviella perfasciata Jordan & Seale, 1926, 394.

Head 3.9 to 4.3; depth 5.5 to 6.5; D. 12 to 15; A. 15 to 18; P. 14 to 16; scales mostly lost, about 40 to 44; vertebrae 42 to 44 (9 specimens dissected).

Body moderately slender, not especially strongly compressed; dorsal profile scarcely as strongly convex as the ventral; head rather low, not very long, its depth at joint of mandible slightly exceeding its postorbital length; snout notably shorter than eye, extending about half its length beyond tip of lower jaw, 4.2 to 5.75 in head; eye 3.25 to 4.0 in head, 1.6 to 2.0 in postorbital length of head; maxillary slightly expanded and rounded posteriorly, reaching an eye's diameter beyond posterior margin of orbit, falling short of joint of mandible by nearly the diameter of pupil, 1.4 to 1.55 in head; cheek only slightly longer than eye, its posterior angle rather broad, about 60°; postorbital part of head rather short, 7.5 to 8.5 in length; mandible 5.8 to 6.6; gill rakers somewhat shorter than eye, 19 to 23 + 24 to 28 on

first arch; dorsal fin with concave margin, rather high anteriorly, the longest rays reaching to or more usually past the tip of the last ray if deflexed, its origin rather variable, most frequently about equidistant from tip of snout and base of caudal, sometimes anterior and again posterior to this point; anal short, its origin generally under and sometimes slightly behind base of last ray of dorsal, its base 6.5 to 7.25 in length; ventral small, inserted about an eye's diameter in advance of dorsal, and about equidistant from base of pectoral and origin of anal, reaching to or slightly beyond vertical from origin of dorsal; pectoral short, failing to reach base of ventral by nearly an eye's diameter, 1.7 to 2.0 in head, 7.0 to 8.2 in length; axillary scale of pectoral very long and narrow, failing to reach tip of pectoral by less than diameter of pupil, 1.9 to 2.3 in head.

Color of preserved specimens pale; sides of head bright silvery; a broad silvery lateral band, generally nearly as broad as eye above base of anal.

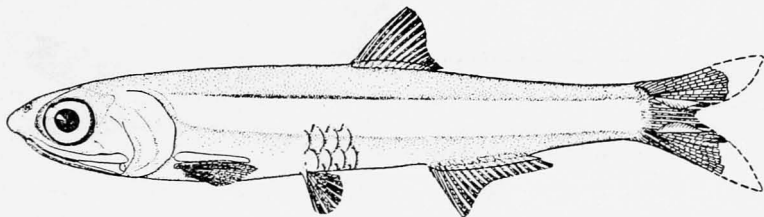


Fig. 49.—*Anchoviella perfasciata*. From a specimen 100 mm. long, Cuba (U. S. N. M., No. 37472). (Drawing by Miss Louella E. Cable.)

The description is based on specimens from Jamaica, Puerto Rico, Cuba and St. Lucia. The proportions and enumerations given in the description are founded on at least 41 specimens, ranging in length from 60 to 105 mm. Several poorly preserved specimens from off Melbourne Beach, Key West and Tortugas, Fla., and a few from Mississippi Sound, seem to be more or less intermediate of this species and *A. eurystole*, but closer to the West Indian form than the northern one. The gill rakers seem to be rather more numerous than in the West Indian specimens. However, the enumerations are uncertain, because of the poor condition of the specimens. The shape of the dorsal, the length of the pectoral, and the size of the eye correspond rather closely with the southern form, but the position of the anal fin is intermediate. More and better material is needed to determine the exact relationship.

This species differs from *eurystole* chiefly in having a larger eye (a difference clearly evident in specimens of equal size); a higher dorsal, with the longest rays reaching to or beyond the tip of the last ray if deflexed; the more anteriorly placed anal, which has its origin under or

only slightly behind the base of the last ray of dorsal; in the longer pectoral; and in having fewer gill rakers (see table 22).

Range.—The West Indies, and northward to southern Florida and Mississippi. This species apparently is not as abundant as many other anchovies.

Anchoviella scitula (Fowler) (Fig. 50)

Anchovia scitula Fowler, 1911, 211, fig. 2, San Diego, Cal. (type, A. N. S. P., No. 1576).

Head 4.4; depth about 6.9; D. 14; A. 18; P. 14; scales all lost, about 38.

Body very elongate, slender (depth not exactly determinable because of the softness of the specimen); head very short, its depth at joint of mandible equal to its postorbital length and half the eye; snout short, only

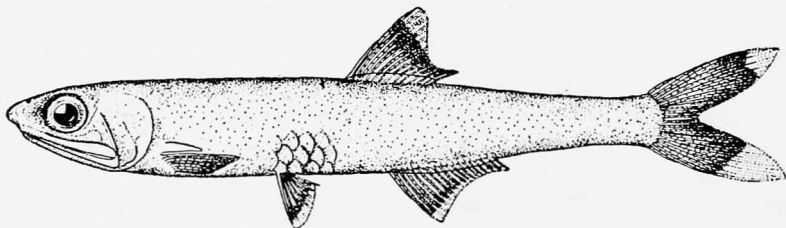


Fig. 50.—*Anchoviella scitula*. Modified, after Fowler. San Diego, Cal. (Modified drawing by Mrs. Alice C. Mullen.)

a little longer than half diameter of eye, projecting only about a third its length beyond tip of lower jaw, 5.4 in head; eye large, 3.4; maxillary short, not quite reaching joint of mandible, extending beyond orbit a distance equal to about two-thirds diameter of eye, distally rounded (neither pointed nor square), its upper margin being more convex than the lower one, 1.4 in head; cheek short and broad, scarcely longer than eye, its posterior angle about 45°; postorbital part of head rather short, 9.3 in length; mandible 6.5 in length; gill rakers scarcely as long as pupil, 18 + 23 on first arch left side, 15 + 23 right side (possibly partly missing on upper limb of right side); dorsal damaged, apparently low anteriorly, its origin equidistant from base of caudal and middle of eye; anal low, its origin a little posterior to middle of base of dorsal, and equidistant from base of caudal and base of pectoral, its base 6.5 in length; ventral very small, extending scarcely half the distance from its base to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral damaged, evidently short, probably falling short of reaching base of ventral at least by diameter of eye, about 2.1 in head; axillary scale of pectoral very small, 3.2 in head.

Color of this old, very poorly preserved specimen is now quite dark, without distinctive markings. When Fowler described it in 1911, he was able to discern a narrow pale (silvery) lateral band.

The foregoing description is based on the type, a specimen about 97 mm. long (caudal fin damaged), 84 mm. to base of caudal, from San Diego, Cal., which was examined by me. This fish is fairly accurately illustrated by Fowler (*loc. cit.*), except that the maxillary is definitely more rounded and scarcely as long as indicated.

This species is characterized by the very slender body, large eye, the short anal, and the rather long, and only moderately rounded maxillary. In the last mentioned character it approaches some of the species herein assigned to the genus *Anchoa* rather closely. In fact, its nearest relative seems to be *A. exigua*, from which it differs principally in the rounded and notably shorter maxillary. The specimen on which this species is based seems to be as unique to the fauna of the Pacific coast of the United States as *Anchoa duodecum* is to the Atlantic.

Range.—Known only from San Diego, Cal.

***Anchoviella brevirostris* (Günther)**

Engraulis brevirostris Günther, 1868, 392. Rio Piauhy, tributary of Rio Paranaíba, Caxoeira, Brazil; Jordan and Seale, 1926, 411.

Amplova brevirostris Myers, 1940, 440.

? *Anchoviella carrikeri* Fowler, 1941, 73, fig. 28. Mouth of Rio Chapare, Boca Chapare, Cochabama, Bolivia.

Head 4.5; depth 5.33; D. 14; A. 18; scales 41. Snout much shorter than eye, projecting only slightly beyond the lower jaw; eye 3.5 in head; maxillary dilated and rounded behind, not extending to joint of mandible; origin of the dorsal equidistant from tip of snout and base of caudal; origin of anal below the posterior rays of dorsal; pectorals terminating a great distance from the ventrals. Sides with a well defined silvery band, nowhere wider than eye.

One specimen 87 mm. long. (Condensed, after Günther.)

The collection of the Museum of Comparative Zoology contains 2 specimens, 24 and 26 mm. to the base of the caudal, from Lago Maximo, far up the Amazon Basin, and 6 specimens (that have been more or less dry), 17 to 22 mm. to the base of the caudal, from Teffe, also far up the Amazon Basin, which may be of this species. The small size (juveniles) and the bad condition of the specimens do not permit definite determination. However, nothing seems to exclude them from *brevirostris*. The snout is not exceptionally short for an anchovy, projecting about half its length beyond tip of mandible; the maxillary is rather straight, round posteriorly, and although it reaches about an eye's diameter beyond the orbit it does not extend to

the joint of the mandible; and the mouth is not herring-like as in *Anchoviella* (*Amplova*) *balboae*, for example. The origin of the dorsal is about equidistant from base of caudal and tip of snout; the origin of the anal is under the last two or three rays of the dorsal; the pectoral fails to reach the base of ventral by diameter of eye; the ventral fails to reach origin of anal by the same distance; and the gill rakers are rather fewer than in related species (not given in the original description).

The following proportions are based on two of the better specimens from Lago Maximo, and the enumerations on 4 specimens: Head in length 4.1, 4.9; depth 6.2, 6.5; mandible 6.5, 7.25, base of anal 5.2, 5.7, pectoral 8.6, imperfect in second specimen. Snout in head 5.5, 6.3; eye 3.0, 3.2; maxillary 1.5, 1.75; postorbital part of head 1.75, 1.9; pectoral 2.0, imperfect in second specimen. D. 12 or 13; A. 16 to 19; P. 11 or 12; gill rakers 13 or 14 + 19.

Still another small specimen, 40 mm. long, taken in Lake Rogagua, Bolivia (being part of C. A. S. No. 9398), seems to be of this species. The following proportions and enumerations pertain to this specimen: Head in length 4.25; depth 6.2; mandible 7.4; base of anal 6.2; pectoral 7.2. Snout in head 6.6; eye 3.65; maxillary 1.8; postorbital part of head 2.2; pectoral 1.65; axillary scale 3.6. D. 12; A. 19; P. 12; gill rakers 13 + 18.

Anchoviella carrikeri, according to the description and figure offered by Fowler (I have not seen the specimens) somewhat doubtfully belongs here, as the gill rakers apparently are rather too few on the lower limb of the first arch in comparison with specimens at hand tentatively identified as *A. brevirostris*, and the pectoral fin, according to the figure, extends nearer to the base of the ventral (very probably variable with age), though its length in the head seems to come within the range of the specimens at hand. Fowler gave the following proportions and enumerations based on the type and paratypes, 26 to 65 mm. long: Head $3\frac{3}{4}$ to 4; depth $4\frac{4}{7}$ to 5. Snout $4\frac{1}{2}$ to $5\frac{2}{5}$ in head; eye $2\frac{2}{3}$ to 4; maxillary $1\frac{2}{5}$ to $1\frac{3}{7}$; pectoral $1\frac{2}{5}$ to $1\frac{3}{5}$. D. 12 to 14; A. 17 to 18; P. 12; gill rakers 13 + 14 or 15.

The principal difficulty in classifying specimens with *A. brevirostris* is the inadequacy of the original description, and the lack of specimens from the type locality. It is regarded as rather doubtful that this species is as widely distributed as indicated by the records herein given.

Range.—"Caxoeira, Province of Bahia, Brazil," type locality, on the Rio Piauhy, tributary of the Rio Paranaíba. Probably also from the Rio Capare, and Lake Rogagua, Bolivia; and Lago Maximus and Teffe, Brazil. Known only from fresh water.

Anchoviella miarcha (Jordan & Gilbert) (Fig. 51)

Stolephorus miarchus Jordan & Gilbert, 1882, 344, Mazatlan, Mex.; and 1883, 622, Pearl Islands, Panama Bay.

Anchovia miarcha Meek & Hildebrand, 1923, 199, Panama Bay.

Anchoviella miarchus Seale, 1940, 4.

Head 3.8 to 4.1; depth 7.0 to 8.0; D. 14 or 15; A. 17 to 20; P. 13 or 14; scales apparently largely undeveloped in the juvenile specimens at hand; vertebrae 43 or 44 (2 specimens dissected).

Body very elongate, moderately compressed, its greatest thickness a little greater than depth of caudal peduncle; dorsal outline rather more convex than the ventral; chest and abdomen rounded; head moderately low and short, its depth at joint of mandible scarcely equal to postorbital part of head; snout moderately short, projecting about two-thirds its length beyond tip of lower jaw, less in the smaller specimens, 5.9 to 7.0 in head; eye 4.6

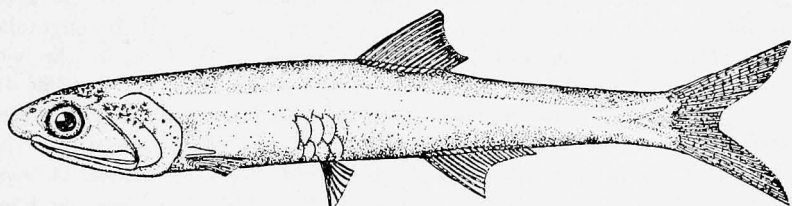


Fig. 51.—*Anchoviella miarcha*. From a specimen 45 mm. long, Chame Point, Panama (U. S. N. M., No. 82032). (Drawing by Mrs. Alice C. Mullen.)

to 5.5; maxillary short, rounded posteriorly, not quite reaching joint of lower jaw, 1.5 to 1.7 in head; cheek moderately short and broad, as long as eye and about half the snout, its posterior angle about 40°; postorbital part of head rather long, 6.8 to 7.8 in length; mandible 5.8 to 6.8; gill rakers scarcely as long as snout, 12 to 14 + 18 to 20 on first arch; dorsal fin with slightly concave margin, the longest rays failing to reach tip of last one if deflexed, its origin a little nearer base of caudal than tip of snout; anal fin rather small, its origin under the base of the last 2 or 3 rays of the dorsal, about equidistant from base of caudal and base of pectoral; ventral small, failing to reach half way to origin of anal, inserted about equidistant from origin of anal and base of pectoral; pectoral very short, failing to reach half way to base of ventral, 2.8 to 3.0 in head, 10.5 to 12.0 in length; axillary scale of pectoral very short, probably not fully developed.

Color of preserved specimens pale, with only a trace of a silvery lateral band. Top of head and upper part of opercle with dark dots; these usually also present on posterior rim of gill opening; a row of dark spots or a

dark line on the isthmus; base of anal with dark dots, continued as a single median line posterior to this fin.

About 36 specimens, probably all juveniles, 28 to 45 mm. in length are at hand. The proportions and enumerations given, unless otherwise stated, are based on 8 specimens.

Although this species has been reported from four different localities, the adults remain unknown. There appears to be no other species of anchovy known from the Pacific coast of the Americas that has a similar combination of a small number of both anal rays and gill rakers. On the Atlantic *Anchoviella brevirostris* seems to parallel it in this respect. However, in that species the body at the same length as some of the specimens of *A. miarcha* at hand is very much deeper; the pectoral and ventral fins are longer; the dorsal fin seems to be higher anteriorly, the longest rays reaching beyond the tip of the last one if deflexed; and scales are developed, as shown by definite pockets.

It is not even certain that this species should be placed in the genus *Anchoviella* as herein understood, because the maxillary in all the engraulids so far studied is short and rounded in juveniles. In fact, in the very young the mouth and maxillaries are very herring-like. In some of the species the maxillary later becomes elongated and pointed whereas in others it always remains rather short and rounded. It can only be stated here that the maxillary in several other species, such as *A. curta*, *A. starksi*, *A. naso*, and *A. arenicola* of the same size as the largest one of *A. miarcha* at hand, the maxillary already is longer and decidedly more pointed. However, it is evident also that the maxillary in the larger specimens of *A. miarcha* is rather longer and less bluntly rounded than in the smaller ones. Therefore, this species is placed in *Anchoviella* only tentatively.

Range.—Mazatlan, Mexico, to Panama Bay, and probably to the Galapagos Islands. Specimens, all juveniles, have been reported from Mazatlan, Mexico, Corinto, Nicaragua (these not seen by me), and from Chame Point and Pearl Islands, Panama. Two specimens, 29 and 30 mm. long, from Albemarle Island, in the collection of the California Academy of Sciences, apparently are also of this species. This species has been recorded erroneously from the Atlantic.

***Anchoviella guianensis* (Eigenmann) (Fig. 52)**

Stolephorus guianensis Eigenmann, 1912, 447, Pl. LXII, fig. 5, Bartica Rocks, British Guiana (type C. M., No. 2448a).

Anchovia brevirostris Pearson (not of Günther), 1924, 50.

Amplova guianensis Myers, 1940, 440.

Head 4.2, 4.1; depth 5.0, 5.6; D. 13, 14; A. 18, 19; P. 12, 12; scales all lost, about 38 to 40 pockets.

Body quite elongate, compressed; chest and abdomen compressed, but scarcely trenchant; head rather short, its depth at joint of mandible about equal to postorbital part of head and half the eye; snout rather short, projecting nearly half its length beyond mandible, 5.2, 4.9 in head; eye small, 3.2, 3.5; mouth slightly oblique; maxillary not reaching joint of mandible by about half the pupil, extending beyond orbit a distance equal to three-fourths diameter of eye, slightly expanded and rounded posteriorly, 1.9, 1.8 in head; cheek broad, fully as long as eye, its postorbital angle about 60° ; postorbital part of head rather short, 9.0, 7.2 in length; mandible 7.1 to 7.2; gill rakers scarcely as long as eye, more or less broken in one specimen at hand, about $16 + 23$, $17 + 24$ on first arch; dorsal fin with slightly concave margin, the longest rays reaching a little past the tip of the posterior one if deflexed, its origin equidistant from tip of snout and base of caudal; anal

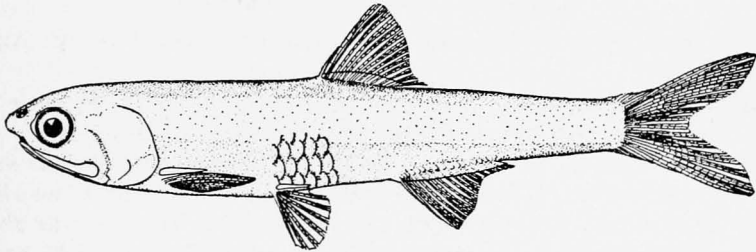


Fig. 52.—*Anchoviella guianensis*. From a specimen 62 mm. long, Amazonas, Brazil (F. M., N. H. No. 15480). (Drawing by Miss Louella E. Cable.)

rather short, its origin at or a little in advance of the end of the dorsal base, its base 6.7, 6.5 in length; ventral fins inserted equidistant from base of pectoral and origin of anal, and well in advance of the dorsal; pectoral quite long, failing to reach base of ventral by diameter of pupil, 1.5, 1.45 in head, 6.5, 5.9 in length; axillary scale of pectoral rather narrow, reaching well past midlength of pectoral, 2.4 to 2.5 in head.

Color of preserved specimens pale, without silver, except on sides of head; a pale streak along sides, probably silvery in life; back with dark punctulations, forming two more or less definite lines posterior to dorsal fin; dusky punctulations along base of anal, and a median dark stripe posterior to anal; middle of side in paratype with dusky points; these also present on dorsal, caudal, anal, and upper rays of pectoral.

A paratype, 50 mm. long, (C. M., No. 2449) from mudflats, Demerara River, British Guiana, and a rather poorly preserved specimen, 62 mm. long (F. M. N. H., No. 15480) from Itacoatiara, Amazonas, Brazil, form the basis for the foregoing description. The Brazilian specimen agrees rather well

with the paratype, except that the body is more slender. The proportions and enumerations given first in each instance pertain to the paratype.

This species apparently is close to *Engraulis brevirostris* Günther, from which it seems to differ in having longer pectoral fins, in the rather more strongly projecting snout, and in the more numerous gill rakers. The material at hand is insufficient to determine the true relationship.

Range.—Trinidad, and Venezuela to northern Brazil, and Bolivia. The species seems to ascend fresh-water streams. Myers (*loc. cit.*) examined specimens from Lagoa Grande, on the lower Amazon, and others from Lake Rogoagua, Bolivia, in the upper Amazon drainage, identified as *A. brevirostris* by Pearson (*loc. cit.*), which apparently also belong here. Recorded also from the Island of Trinidad and from Venezuela by Fowler (1931, 392 and 406) without comment.

***Anchoviella alleni* (Myers) (Fig. 53)**

Amplova alleni Myers, 1940, 441, Lake Cashiboya, Peru (type C. A. S., No. 6421).

Head 4.0 to 4.4; depth 5.0 to 5.3; D. 14 or 15; A. 18 or 19; P. 12 or 13; scales mostly lost, about 44; vertebrae 42 (1 specimen dissected).

Body quite elongate, moderately robust; dorsal and ventral outlines more or less equally convex; head moderately short, its depth at joint of mandible nearly equal to its postorbital length and eye; snout short, projecting about half its length beyond tip of mandible, 5.5 to 6.0 in head; eye 3.75 to 4.1 in head, 1.9 to 2.1 in postorbital length of head; mouth slightly oblique; maxillary failing to reach joint of mandible by about half the pupil, extending beyond posterior rim of orbit a distance equal to diameter of pupil, slightly expanded and round posteriorly, 1.7 to 2.0 in head; cheek very short and broad, scarcely as long as eye, posteriorly rounded, scarcely forming an angle; postorbital part of head short, 8.4 to 8.7 in length; mandible 7.0 to 7.8;

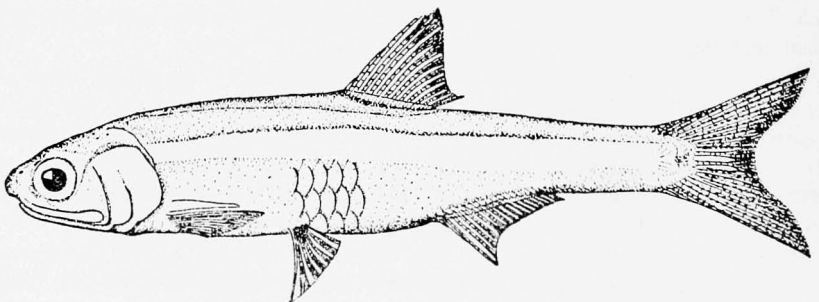


Fig. 53.—*Anchoviella alleni*. From a paratype 80 mm. long, Lake Cashiboya, Peru (C. A. S., No. 6421). (Drawing by Mrs. Alice C. Mullen.)

gill rakers scarcely two-thirds length of eye, 16 to 18 + 23 to 26 on first arch; dorsal fin with slightly concave margin, the longest rays reaching to or slightly beyond tip of last ray if deflexed, its origin generally a little nearer base of caudal than tip of snout; anal short, its origin generally immediately behind vertical from base of last ray of dorsal, its base 6.7 to 7.4 in length; ventral reaching a little more than half way to origin of anal, inserted nearer base of pectoral than origin of anal by diameter of pupil; pectoral moderately pointed, failing to reach ventral by diameter of pupil, 1.4 to 1.6 in head; 6.0 to 6.8 in length; axillary scale of pectoral long and slender, reaching opposite beginning of distal third of fin, 2.0 to 2.2 in head.

Color pale; silvery lateral band bright, nearly or quite as wide as eye, bounded above by a dark line; sides of head bright silvery; tip of snout and back with dusky punctulations, sometimes forming two more or less definite rows posterior to dorsal fin; caudal with dusky markings, and generally with a broad dusky margin.

This species, here described from the holotype and 6 paratypes, 80 to 84 mm. long, is closely related to *A. guianensis* from which it differs only in several minor details, as shown in the key to the species. The specimens were made available to me through the kindness of the late H. Walton Clark of the California Academy of Sciences.

Range.—Known only from the Peruvian Amazon country. The type material examined by me is from Lago Cashiboya and from the Rio Morona at Gosulimacocha. Recently Eigenmann and Allen (1942, 333) recorded the species from additional specimens from the places named, and also from Contamana on the Rio Ucayali. The type and several paratypes are deposited in the Museum of the California Academy of Sciences, and two paratypes are in the U. S. National Museum.

***Anchoviella vaillanti* (Steindachner)**

Engraulis vaillanti Steindachner, 1908, 193, Joazeiro and Barra on Rio São Francisco, Rio Grande do Norte, and Rio Preta, Brazil.

Stolephorus vaillanti Eigenmann, 1910, 451, name only.

Anchovia vaillanti Starks, 1913, 10, name only.

Amplova vaillanti Myers, 1940, 439.

Head 3.6 to about 4; depth 4.35 to 4.8; D. 12 or 13; A. 22 to 25; scales 35 to 38; eye 3.65 to 4.4 in head; snout 4.65 to 5.5; maxillary nearly to articulation of mandible, bluntly rounded; gill rakers shorter than eye, 18 or 19 on lower limb of first arch; origin of dorsal always in advance of middle of body without caudal; origin of anal under base of last ray of dorsal; pectoral reaching nearly or quite to base of ventral. A silvery gray, well defined lateral band; a dusky bar or spot on base of caudal. (Condensed, after Steindachner.)

This species was not seen by me. Myers (*loc. cit.*) said, "I have examined a single specimen in the Indiana University (now in the California Academy of Sciences), collected by J. D. Haseman at Barra, Rio São Francisco, whence came Steindachner's types. It agrees well with the above account; dorsal 12; anal 20."

Range.—Known only from the type localities, Joazeiro and Barra on Rio São Francisco, Rio Grande do Norte, and Rio Preta, Brazil, presumably all in fresh water.

Anchoviella elongata (Meek & Hildebrand) (Fig. 54)

Anchovia elongata Meek & Hildebrand, 1923, 198, Pl. XII, fig. 2, Mindi (near Gatun), Canal Zone (type, U. S. N. M., No. 81768); Breder, 1925, 141.

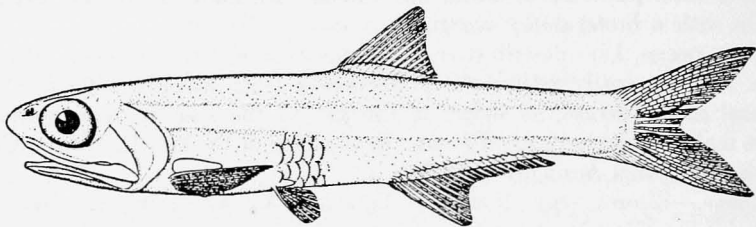


Fig. 54.—*Anchoviella elongata*. From a specimen 100 mm. long, Porto Bello, Panama (U. S. N. M., No. 82093). (Drawing by Miss Louella E. Cable.)

Head 3.6 to 3.9; depth 5.0 to 5.7; D. 13 or 14; A. 22 to 24; P. 12 or 13; scales about 36 to 40; vertebrae 39 (2 specimens dissected).

Body rather slender, moderately compressed; head low, its depth at joint of mandible about equal to postorbital part of head and half the eye; snout short, pointed, 5.3 to 5.8 in head; eye very large, 3.0 to 3.3 in head; maxillary short, moderately blunt, reaching beyond orbit a distance scarcely equal to diameter of eye, nearly or quite to joint of mandible, 1.3 to 1.4 in head; cheek rather short and broad, about equal to length of eye, its posterior angle about 60°; postorbital part of head moderately long, 7.5 to 8.2 in length; mandible 5.3 to 5.6; gill rakers only a little more than half the length of eye, 17 or 18 + 22 to 24 on first arch; dorsal fin with slightly concave margin, the anterior rays reaching beyond the tip of the posterior one if deflexed, its origin nearly equidistant from anterior margin of eye and base of caudal; anal fin rather short, its origin under or slightly behind middle of base of dorsal, its base shorter than head, 4.2 to 4.5 in length; ventral moderately long, reaching more than half way to origin of anal, usually inserted a little nearer base of pectoral than origin of anal; pectoral moderate, scarcely to base of ventral, 1.6 to 1.75 in head, 6.1 to 6.5 in

length; axillary scale of pectoral moderately long and pointed, about half as long as longest ray of pectoral, 2.8 to 3.75 in head.

Color pale; sides with an ill-defined silvery band, narrower than eye; top of head and back with numerous dusky punctulations; dark spots at base of anal, and a narrow black line from anal to lower rays of caudal.

In the preparation of the foregoing description the type material from Mindi (near Gatun), Canal Zone, a specimen from Porto Bello, and a lot of 22 specimens from Puerto Pilon, Panama, ranging in length from 70 to 100 mm., have been at hand. The proportions and enumerations are based on at least 14 specimens.

This species is characterized by the rather slender body, very large eye, and the moderately few gill rakers (see table 22). In the length and shape of the maxillary it approaches the genus *Anchoa* rather closely.

Range.—Atlantic coast of Panama where it apparently is not rare; entering brackish water.

***Anchoviella lepidentostole* (Fowler) (Fig. 55)**

Anchoviella lepidentostole Fowler, 1911, 214, fig. 3, Surinam (type, A. N. S. P., No. 1346).

Amplova lepidentostole Myers, 1940, 439.

Head 4.4, 4.2; depth 4.0, 4.5; D. 14, 15; A. 25, 23; P. 12 (?), 14; scales mostly lost, about 38.

Body rather deep and robust, its greatest thickness slightly exceeding depth of caudal peduncle; dorsal and ventral outlines about evenly curved; head very short, its depth at joint of mandible nearly equal to length of head, without snout; snout short, blunt, extending half its length beyond tip of mandible, 7.0, 5.5 in head; eye 3.3, 3.3; maxillary short, not quite square, scarcely reaching joint of lower jaw, extending fully length of eye beyond orbit, 1.4, 1.6 in head; cheek short and very broad, as long as eye,

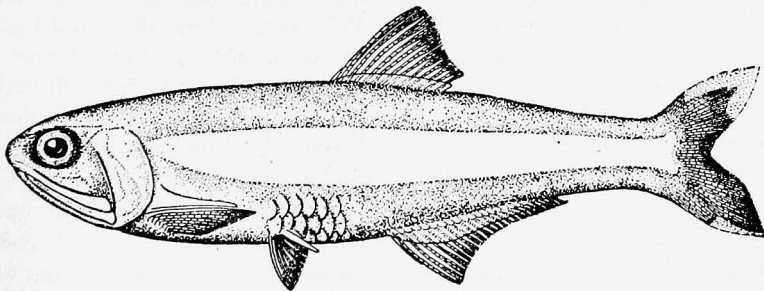


Fig. 55.—*Anchoviella lepidentostole*. Modified, after Fowler. (Modified drawing by Mrs. Alice C. Mullen.)

its posterior angle about 50° ; postorbital part of head moderately short, 9.3, 9.0 in length; mandible 6.1, 6.3; gill rakers not much longer than pupil, 17 + 19 on first arch of right side, 18 + 20 on left side, and 17 + 19 on each side; dorsal fin rather low, the longest rays not reaching tip of last one if deflexed, origin of fin a little nearer base of caudal than tip of snout; anal low, its origin under middle of dorsal, equidistant from base of caudal and joint of lower jaw, its base 4.2, 4.2 in length; ventral very small, extending scarcely half way to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral short, failing to reach ventral by diameter of pupil, 1.45, 1.5 in head, 6.1, 6.3 in length; axillary scale of pectoral long, slender, failing by half diameter of pupil to reach tip of fin, 2.0, 2.15 in head.

Color in alcohol grayish brown; lower parts silvery; side with a broad, strikingly prominent silvery band, notably broader than eye.

The foregoing description is based on the type, 96 mm. long (84 mm. to base of caudal), and a paratype, 76 mm. long (63 mm. to base of caudal) from "Surinam" (A. N. S. P., Nos. 1346 and 1347), which were before me when the account was prepared. The proportions and enumerations based on the type are given first in each instance.

Range.—Known only from the type material from "Surinam."

***Anchoviella hubbsi* n. sp. (Fig. 56)**

Head 4.3 to 4.7; depth 4.2 to 5.1; D. 14 to 16; A. 23 to 26; P. 13 or 14; scales about 40 or 41; vertebrae 40 (6 specimens dissected).

Body moderately elongate and compressed, its greatest thickness exceeding depth of caudal peduncle; head short, its depth at joint of mandible slightly exceeding length of postorbital part of head and half the eye; snout short, projecting about half its length beyond tip of mandible, 4.8 to 5.7 in head; eye large, 3.1 to 3.7; maxillary rather long, projecting scarcely an eye's diameter beyond orbit, not quite to joint of mandible, notably expanded distally, very broadly rounded, 1.4 to 1.55 in head; cheek short and broad, about as long as eye, its posterior angle about 65° ; postorbital part of head moderately short, 8.3 to 9.6 in length; mandible 6.2 to 6.8; gill rakers about three-fourths length of eye, 18 to 21 + 22 to 25 on first arch; dorsal fin with slightly concave margin, the longest rays failing to reach tip of the last ray if deflexed, origin of fin usually about equidistant from base of caudal and tip of snout; anal fin rather short, its origin about under middle of base of dorsal, its base 4.0 to 4.7 in length; ventral small, reaching less than half way to origin of anal, inserted about equidistant from base of pectoral and origin of anal; pectoral moderately short, failing to reach base of ventral by about diameter of pupil, 1.4 to 1.7 in head, 6.5 to 7.5 in

length; axillary scale of pectoral very long, failing to reach tip of fin by about half diameter of pupil, 1.6 to 2.0 in head.

Color of preserved specimens yellowish gray above, pale silvery below; sides with silvery band, as wide as eye, bordered above by a dark streak; back with dusky punctulations, but without a dark streak; no dark spots along base of anal; caudal with many dusky points, the margin dark, a rather prominent black area on peduncle at base of its upper lobe.

This species is represented by 37 specimens, 105 to 130 mm. long, in the University of Michigan collection (in part transmitted to the U. S. National Museum). Its nearest relative seems to be *A. elongata*, from which it differs in having a shorter head, rather deeper body, smaller eye, shorter maxillary and mandible, shorter ventral and pectoral fins, a differently shaped dorsal fin, notably longer axillary scale of pectoral, apparently 2 or 3

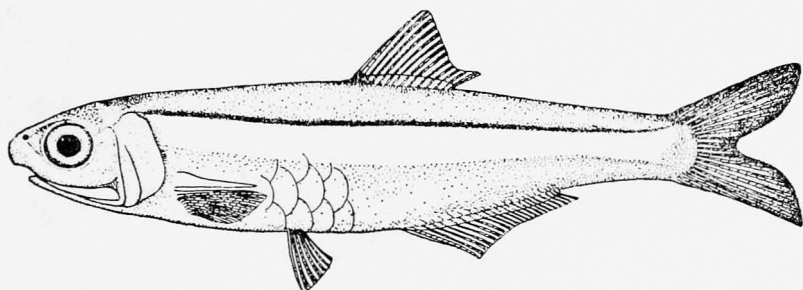


Fig. 56.—*Anchoviella hubbsi*. From a paratype, 117 mm. long, Rio Ribeira de Iguapé, São Paulo, Brazil (U. S. N. M., No. 119806). (Drawn by Mrs. Alice C. Mullen.)

more gill rakers on upper limb of first arch, and in color, as well as in several other minor respects.

The following proportions and enumerations are based on the type, which is 123 mm. long, 99 mm. to the base of the caudal (U. M., No. 133664). Head 4.3; depth 4.9; maxillary 6.6; mandible 6.6; postorbital part of head 8.6; base of anal 4.4; pectoral 6.7. Eye in head 3.3; snout 5.4; maxillary 1.53; mandible 1.53; postorbital part of head 2.0; pectoral 1.55; axillary scale of pectoral 1.75. D. 15; A. 23; P. 14; gill rakers 20 + 25; scales about 41.

The species is named for Dr. Carl L. Hubbs who has kindly placed the University of Michigan collection of Engraulidae in my hands for study.

Range.—Known only from the type material from Rio Ribeira de Iguapé, São Paulo, Brazil.

***Anchoviella blackburni* n. sp. (Fig. 57)**

Head 4.0 to 4.6; depth 4.8 to 5.5; D. 13 to 15; A. 25 to 27; P. 13 or 14; scales mostly lost, about 38 to 41; vertebrae 43 (1 specimen dissected).

Body quite strongly compressed; dorsal and ventral profiles about evenly convex; head short, its depth at joint of mandible equal to or a little shorter than postorbital part of head and half the eye; snout very short and blunt, projecting little beyond mandible, about 5.0 to 7.0 in head; eye 3.5 to 4.5; maxillary rounded and somewhat broadened posteriorly, extending beyond orbit a distance scarcely equal to half diameter of eye, not quite to joint of mandible, 1.6 to 2.0 in head; cheek short, equal to snout and about half the eye, its posterior angle rather broad, about 60°; postorbital part of head rather short, 7.0 to 9.0 in length; mandible 6.7 to 8.1; gill rakers about two-thirds length of eye, 10 to 12 + 15 to 17 on first arch; dorsal fin not especially elevated anteriorly, the margin slightly concave, the longest rays failing to reach the tip of the posterior ray if deflexed, its origin about equidistant from base of caudal and middle of eye; anal rather long, its

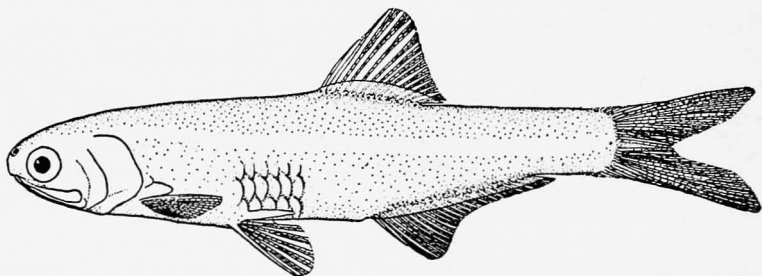


Fig. 57.—*Anchoviella blackburni* n. sp. From the type, 35 mm. long, Gulf of Venezuela (U. S. N. M., No. 119793). (Drawing by Miss Louella E. Cable.)

origin well in advance of middle of base of dorsal, or about under beginning of second third of dorsal, its base 3.75 to 4.25 in length; ventral moderately large, inserted its full length in advance of origin of dorsal; pectoral moderate, failing to reach ventral by nearly an eye's diameter, 1.25 to 1.6 in head, 6.0 to 7.2 in length; axillary scale of pectoral broad, only a little more than half as long as the fin, about 4.0 in head.

Color of preserved specimens pale, with only a slight suggestion of a narrow silvery lateral band. A row of dark spots along base of anal, extending along median ventral line of peduncle and on lower lobe of caudal; a similar row along base of dorsal to upper lobe of caudal.

This species is described from 11 specimens ranging in length from about 33 to 38 mm. (caudal fins injured), all from the Gulf of Venezuela, the largest one from Estauques Bay and the others from Jacque Point. A specimen about 35 mm. long (caudal slightly injured) is designated as type, and is deposited in the U. S. National Museum (No. 119793).

The specimens probably are not full grown. It is expected that larger

specimens would be proportionately somewhat deeper. The maxillary, which is shorter and often blunter in very young anchovies than in the adults, probably has acquired its adult shape. At least, it is shorter and much more rounded in the fish here described than in specimens of equal size of *Anchoa parva*, a species that the present one superficially resembles. In some species of anchovies, namely, those with numerous gill rakers, the number of rakers increases with age as stated elsewhere. It has not been noticed, however, that an increase takes place with age in the species possessing a small number of gill rakers. Therefore, the number given for the present species probably will hold for larger specimens too. The long anal fin and the small number of gill rakers (see tables 21 and 22), together with the short head and very short snout which projects only slightly beyond the mandible, separate this species from *lepidentostole* and other related forms.

This fish is named for the collector, P. P. Blackburn, one time commanding officer of the U.S.S. Niagara, who made an extensive collection of fishes in the Gulf of Venezuela.

Range.—Known only from the Gulf of Venezuela.

***Anchoviella parri* n. sp. (Fig. 58)**

Head 3.6 to 3.9; depth 4.7 to 5.3; D. 15 or 16; A. 23 to 26; P. 12 or 13; scales lost, about 37 to 39; vertebrae 39 or 40 (3 specimens dissected).

Body moderately deep, rather strongly compressed, its greatest thickness about equal to depth of caudal peduncle; head short, moderately deep, its depth at joint of mandible equal to its postorbital length and about half the eye; snout moderately short, projecting about half its length beyond tip of mandible, 6.2 to 6.9 in head; eye very small, 4.8 to 5.2 in head; maxillary short, blunt, its upper free margin broadly rounded, not quite reaching joint of mandible, 1.5 to 1.6 in head; cheek moderately short and broad, equal to length of eye and fully half the snout, its posterior angle about 40°; postorbital part of head moderately long, 6.6 to 7.2 in length; mandible 5.1 to 5.5; gill rakers about three-fourths length of eye, 13 to 15 + 18 to 21 on first arch; dorsal fin rather high anteriorly, the longest rays generally reaching nearly to tip of last one if deflexed, its origin equidistant from base of caudal and some point over anterior half of eye; anal fin rather long, its origin slightly in advance of middle of base of dorsal, and about equidistant from base of caudal and joint of mandible, its base 3.4 to 4.0 in length; ventral very small, extending fully half way to origin of anal, inserted about equidistant from origin of anal and base of pectoral; pectoral reaching only about half way to ventral, about 2.4 in head, and about 9.3 in length.

Color of specimens preserved in formalin pale, with at most only a

faint suggestion of a silvery band (now represented by a stripe rather paler than rest of side); base of anal with dark dots, continued on median ventral line of caudal peduncle; dark dots also present on caudal fin. The dark dots are most prominent in the smallest specimens which have them also on the side of the abdomen.

This species is represented by a lot of over 100 specimens, ranging from 15 to 33 mm. in length, probably all young, taken by the "Pawnee" in a trawl hauled at 3 fathoms, in San Filipe Bay, Gulf of California. The proportions are based on 6 of the largest and most mature specimens, and the enumerations of the dorsal and anal rays on 20, and the gill raker counts on 8 specimens. The enumerations of the dorsal and anal rays, the vertebrae and the gill rakers are accurate, but the other enumerations, owing to the small size and undeveloped condition of the specimens, are only ap-

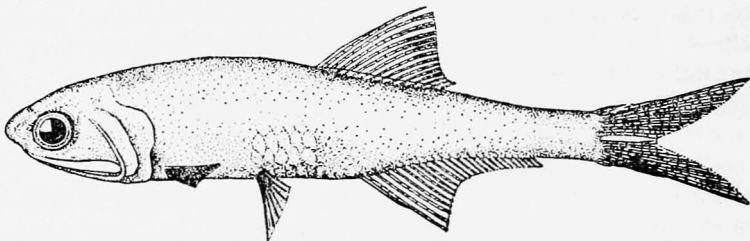


Fig. 58.—*Anchoviella parri* n. sp. From the type, 33 mm. long, San Filipe Bay, Lower Cal. (B. O. C., No. 3852). (Drawing by Mrs. Alice C. Mullen.)

proximately correct. The pectoral fin, for example, is not fully developed, except possibly in a few of the largest specimens.

This species differs from *A. blackburni* and other related forms in the number of fin rays and gill rakers (see tables 21 and 22). The nearest approach to a similar number of fin rays and gill rakers is in *Anchoa lucida*, but that species has fewer dorsal rays and apparently a greater average number of anal rays. That species also has a notably larger eye, and the adults have a much longer and more pointed maxillary. Young of that species under 40 mm. long, unfortunately, are not available for comparison. As all immature anchovies, as far as known, have short blunt maxillaries, it is difficult to place this species as to genus. However, the young of several species of *Anchoa* have been compared, and were found to have longer and rather more pointed maxillaries at the same size. Therefore, this species, at least tentatively, may be placed in *Anchoviella*.

The following proportions and enumerations are based on the type, which is 33 mm. long, 26 mm. to the base of caudal (B. O. C., No. 3852): Head 3.9; depth 5.3; postorbital part of head 7.1; mandible 5.4; base of anal 3.8. Eye

in head 5.2; snout 6.2; maxillary 1.6; postorbital part of head 1.8; mandible 1.4. D. 16; A. 24; gill rakers 15 + 19.

The species is named for Prof. A. E. Parr, who kindly lent the specimens upon which the species is based, and many others, for study.

Range.—Only the type material from San Filepe Bay, Gulf of California, is known.

***Anchoviella nattereri* (Steindachner)**

Engraulis nattereri Steindachner, 1879, 56, Pará, Brazil.

Head 3.33; depth 4.0; D. 12; A. 28 or 29; scales about 40.

Dorsal profile less convex anterior to dorsal than ventral profile; snout fairly long, reaching well beyond lower jaw, 4.0 in head; eye 3.6; maxillary nearly square posteriorly, not quite reaching joint of mandible; longest gill rakers about as long as eye; origin of dorsal slightly nearer base of caudal than tip of snout; origin of anal about under middle of base of dorsal; pectoral slightly longer than the postorbital part of head, reaching middle of ventral.

The silvery lateral band is indefinitely marked. (Condensed, after Steindachner.)

No specimens of this species were seen. It is known to me only from the original account.* The description by Jordan and Seale (1926, 413) seems to be based on a different species. It is unfortunate that the number of gill rakers is not given in the original description. In general, *nattereri* seems to be related to *blackburni* and *lepidentostole*, differing from both in having somewhat more numerous anal rays, and in having the beginning of this fin under the middle of the dorsal, instead of at the beginning of the second third of the base of dorsal. It differs, also, in the longer pectoral which reaches to the middle of the ventral, whereas in the other two species this fin falls notably short of reaching base of ventral.

Range.—As here understood this species is known only from the type, a specimen 50 mm. long, from Pará, Brazil.

* A description and figure of an anchovy from Iquitos, Peru (upper Amazon basin), designated *Engraulis equitensis* by Shoji Nakashima (1941, 6) is before me. The author's description and figure do not agree in several respects. The maxillary is not described and its shape is not definitely shown in the figure. Furthermore, the number of gill rakers is not stated. Therefore, it is impossible to place the fish with any degree of certainty in any genus, and it is, of course, impossible to determine if the species is a valid one. In general it does seem to possess some of the characters of *A. nattereri*. At least, the general shape of the body, the depth, the number of anal rays, and the long pectoral which overlaps the ventral seem to agree. Recently Eigenmann and Allen (1942, 332) placed this name in the synonymy of *Lycengraulis batesii* Günther. Except for this mention no reference to *Engraulis equitensis* is made in this work. As the author designated no type, and made no comparison with any known species, the name probably is without standing.

Anchoviella pallida (Starks) (Fig. 59)

Anchovia pallida Starks, 1913, 9, Pl. I, Pará, Brazil (type, S. U. N. H. M., No. 22216).

Anchoviella venezuelae Fowler, 1931, 406, fig. 6, Caño Guanoco, Venezuela (type A. N. S. P., No. 53322).

Head 3.5; depth 3.5; D. 14; A. 24; P. 13; scales about 38.

Body moderately deep, rather strongly compressed; ventral outline more strongly convex than the dorsal; chest and abdomen slightly trenchant; head moderately long, its depth at joint of mandible about equal to its postorbital length and half the eye; snout moderately long, projecting about two-thirds its length beyond tip of lower jaw, 6.4 in head; eye 4.5; maxillary failing to reach joint of mandible, extending beyond orbit a distance equal to 1.5 diameter of eye, somewhat expanded and rounded distally, 1.4 in

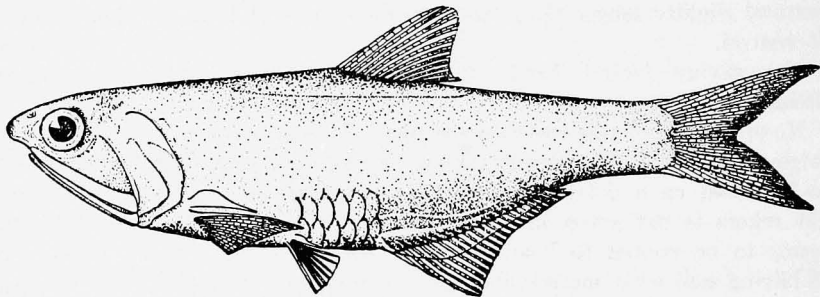


Fig. 59.—*Anchoviella pallida*. From the type, 102 mm. long, Pará, Brazil (S. U. N. H. M., No. 22216). (Drawing by Mrs. Alice C. Mullen.)

head; cheek quite long and narrow, as long as snout and eye, its posterior angle about 35° ; postorbital part of head moderately long, 5.9 in length; mandible 5.0; gill rakers slender, close-set, about as long as eye, $34 + 45$ on first arch; dorsal fin high anteriorly, the longest rays reaching far beyond tip of last one if deflexed, origin of fin about equidistant from tip of snout and base of caudal; anal fin rather low, its origin about under middle of base of dorsal, its base 3.5 in length; ventral rather long, reaching about two-thirds distance to origin of anal, inserted a little nearer origin of anal than base of pectoral; pectoral large, reaching beyond base of ventral a distance nearly equal to diameter of pupil, 1.4 in head, 5.0 in length; axillary scale of pectoral broad at base, scarcely half as long as fin, 3.3 in head.

Color of preserved specimen plain; side of head more or less silvery; back with dusky punctulations; margin of caudal fin blackish.

The description is based on the type, 102 mm. long (80 mm. to base of

caudal). In general it resembles *Cetengraulis edentulus* greatly, from which it differs, however, in the absence of a membrane across the isthmus; shorter head, especially the postorbital part; narrower cheek; notably higher dorsal fin; longer anal base, beginning farther forward; and notably longer pectorals. These differences are all evident from the descriptions.

Anchoviella venezuelae Fowler apparently is a synonym of *A. pallida*. That nominal species was described from two specimens, the type (A. N. S. P., No. 53322), 72 mm. long, and the paratype (A. N. S. P., No. 53323), 80 mm. long (respectively 58 to 63 mm. to base of caudal), according to my measurements, both from Caño Guanoco, Venezuela. The slight disagreement in some of the characters of these specimens and the type of *pallida* probably are chiefly due to age and size. The cheek apparently is a little shorter, being not quite equal to snout and eye, a character known to vary with age; the pectoral appears to be a little shorter, not extending quite as far beyond the base of ventral as in the type of *pallida*; and the margin of the caudal fin is not black. The slight differences in some of the proportions and enumerations will become evident from a comparison of the following proportions and enumerations (in which those of the type of *A. venezuelae* are given first) with those given in the foregoing description. Head in length 3.4, 3.5; depth 3.8, 3.9; anal base 3.6, 3.5; mandible 5.3, 5.2; postorbital part of head 6.3, 6.1; pectoral 5.3, 5.1. Eye in head 4.25, 4.2; snout 6.0, 6.0; maxillary 1.5, 1.55; mandible 1.5, 1.55; postorbital part of head 1.8; 1.75; pectoral 1.8, 1.5; axillary scale of pectoral 3.4, 3.6 D. 14, 12; A. 25, 26; P. 13, 12; gill rakers on first arch 34 + 42, 28 + 38, on right arch, 33 + 40 on left arch; scales 34, 36.

Range.—Caño Guanoco, Venezuela, to Pará, Brazil.

***Anchoviella balboae* (Jordan & Seale) (Fig. 60)**

Anchovia brevirostra Meek & Hildebrand, 1923, 198, Pl. XII, fig. 1, Balboa, Canal Zone (type, U. S. N. M., No. 79578).

Stolephorus brevirostris Hildebrand, 1925, 284.

Amplova balboae Jordan & Seale, 1926, 411 (*Anchovia brevirostra* was regarded as preoccupied by *Engraulis brevirostris* Günther); Myers, 1940, 439.

Head 4.1 to 4.6; depth 3.5 to 4.1; D. 13 to 15; A. 23 to 27; P. 13 or 14; scales 35 to 40; vertebrae 41 or 42 (2 specimens dissected).

Body quite deep; head very short, its greatest depth about equal to its length without snout; snout very short and blunt for an anchovy, scarcely longer than pupil, extending not more than one-fourth its length beyond tip of lower jaw; 6.4 to 8.0 in head; eye 2.5 to 2.9 in head, 1.1 to 1.3 in postorbital length of head; maxillary short, reaching scarcely half diameter of pupil beyond eye, and scarcely opposite the joint of mandible, slightly

curved, expanded and rounded posteriorly, about as wide as pupil, 1.55 to 1.65 in head; cheek short and broad, scarcely longer than pupil; post-orbital part of head short, 8.7 to 10.9 in length; mandible 6.9 to 7.5; gill rakers rather close-set, about three-fourths length of eye at angle, 19 to 21 + 29 to 35 on first arch; dorsal fin with concave margin, the anterior rays nearly or quite to tip of last ray if deflexed, its origin generally equidistant from middle of eye and base of caudal; anal moderately long, its origin generally about under middle of dorsal, its base 3.6 to 4.2 in length; ventral moderately short, reaching a little more than half way to origin of anal, and scarcely opposite origin of dorsal, inserted about equidistant from base of pectoral and origin of anal; pectoral long, usually reaching base of ventral, 1.05 to 1.15 in head, 4.8 to 5.4 in length; axillary scale of

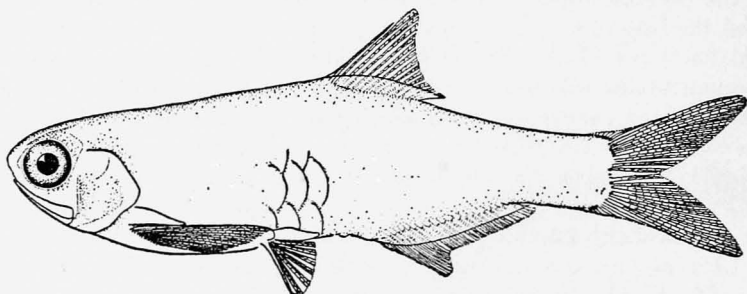


Fig. 60.—*Anchoviella balboae*. From a specimen 80 mm. long, Chame Point, Panama (U. S. N. M., No. 82053). (Drawing by Miss Louella E. Cable.)

pectoral rather narrow, pointed, somewhat more than half the length of the longest rays of the fin, 1.9 to 2.3 in head.

Color pale silvery; no lateral band evident in specimens at hand; back with dusky punctulations, most numerous posterior to dorsal fin, sometimes more or less distinctly in 2 rows; margins of caudal dusky.

This species and *jamesi* are of the extreme *Amplova* type, that is, the head is short, snout very short, and the maxillaries are shorter than in any other species studied. Jordan and Seale were in error, however, when they said of *balboae*, “. . . maxillary does not reach posterior edge of eye,” as it reaches well beyond the eye, though not quite to the joint of the mandible. This anchovy differs from *jamesi* prominently in the more numerous gill rakers and anal rays. The proportions and enumerations are based on 12 or more specimens, including the type, ranging in length from 75 to 90 mm.

Range.—Panama Bay to El Salvador. Specimens examined are from Balboa, Miraflores Locks, and Chame Point, Panama; and Cituro, El Salvador.

Anchoviella jamesi (Jordan and Seale) (Fig. 61)

Amplova jamesi Jordan & Seale, 1926, 410, Jutahy River, and Lago Alexo, Brazil (type, M. C. Z., No. 18014); Myers, 1940, 441.

Head 4.5 (4.0)*; depth 4.5 to 5.3 (6.0); D. 12 or 13 (12); A. 19 to 21 (22); P. 11; scales mostly lost, about 40 (38); vertebrae 40 (one specimen dissected).

Body elongate, compressed; head short, its depth at joint of mandible equal to its postorbital length and about half the eye; snout very short, only about half as long as eye, projecting only about a third its length beyond the lower jaw, 7.2 in head; eye 3.5 to 3.8 (3.2); maxillary short, rounded distally, reaching scarcely beyond posterior margin of eye, and not to articulation of mandible, its lower margin somewhat curved, 1.9 to 2.0 (2.0) in head; cheek short, not forming a triangle, its lower posterior

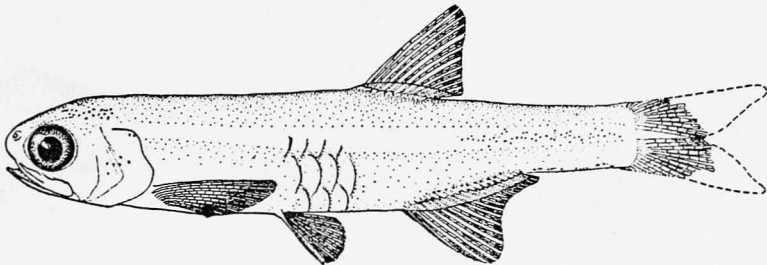


Fig. 61.—*Anchoviella jamesi*. From a paratype 37 mm. long, Lago Alexo, Brazil (M. C. Z., No. 17783). (Drawing by Miss Louella E. Cable.)

margin being rounded; gill rakers slender, those at angle about half as long as eye, 12 or 13 + 20 or 21 (20) on first arch; dorsal fin rather high anteriorly, the longest rays reaching far beyond the tip of the last ray if deflexed, its origin about equidistant from base of caudal and middle of postorbital part of head; anal fin rather prominently elevated anteriorly, its origin somewhat in advance of vertical from middle of base of dorsal, the base 4.8 to 5.3 (4.2) in length; ventral moderately long, but failing to reach vent, inserted about equidistant from base of pectoral and origin of anal; pectoral long, not quite reaching ventral, 1.2 to 1.25 in head, 5.4 to 6.5 in length.

Color of old preserved specimens pale, with a narrow diffuse silvery lateral band.

The description is based on 2 small specimens (M. C. Z., Nos. 17783 and

* The figures in parenthesis were copied from the original description, based on the type, which I have not seen.

17784) from Lago Alexo, Brazil, 32 and 36 mm. long to the base of caudal, a part of the type material. The species is of the extreme *Amplova* type, the maxillary being very short for an anchovy, and the mouth small, almost exactly as in *Anchoviella* (*Amplova*) *balboae*. The anal fin is somewhat shorter, however, the gill rakers are less numerous, and the dorsal fin is situated more posteriorly than in that species.

Range.—Known from fresh water from the Rio Jutahy and Rio Ucayali, both upper tributaries of the Amazon; and from Lago Alexo, Brazil.

***Anchoviella brasiliensis* n. sp. (Fig. 62)**

Head 4.4, 4.6; depth 5.7, 6.1; D. 13, 12; A. 19, 19; P. 15, 14; scales mostly lost, about 44; vertebrae 41 (1 specimen dissected).

Body quite elongate, rather strongly compressed, its greatest thickness equal to depth of the slender caudal peduncle; head very short, its depth

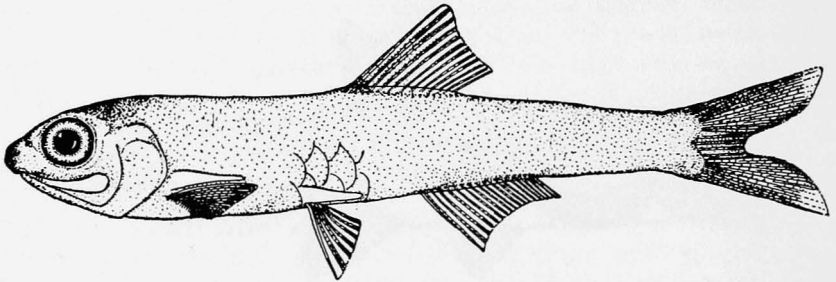


Fig. 62.—*Anchoviella brasiliensis*. From the type, 82 mm. long, Rio Ribeira de Iguapé, São Paulo, Brazil (U. M., No. 133633). (Drawing by Mrs. Alice C. Mullen.)

at joint of mandible equal to postorbital part of head and about two-thirds eye; snout very short, projecting very little beyond tip of mandible, 5.7, 5.4 in head; eye large, 3.2, 3.0; maxillary very short, projecting rather less than half diameter of pupil beyond orbit, and not nearly to joint of mandible, notably expanded posteriorly, broadly rounded, 1.7, 1.65 in head; cheek broader than long, notably shorter than eye, without a definite posterior angle; postorbital part of head short, 9.4, 9.7 in length; mandible 6.7, 6.7; gill rakers not much shorter than eye, 17 + 24, 17 + 25 on first arch; dorsal fin only moderately high anteriorly, the longest rays failing to reach tip of last one if deflexed, its origin about equidistant from base of caudal and tip of snout; origin of anal somewhat posterior to middle of base of dorsal, its base 5.9, 5.75 in length; ventral rather long reaching fully half way to origin of anal, inserted rather nearer origin of anal than base of pectoral; pectoral failing to reach ventral by nearly half diameter of eye, 1.65, 1.6 in head, 7.4, 7.4 in length; axillary scale of pectoral about three-fourths length of fin, 2.8, 2.2 in head.

Color of preserved specimens pale; no silvery lateral band evident; back with dusky punctulations, arranged in two rather definite rows behind dorsal fin; base of anal with dusky spots, continued in a single median row behind the fin; base of caudal with a dusky bar curved forward; outer rays of caudal dusky.

The description is based on two specimens, the only ones known, 82 and 77 mm. long (66 and 61 mm. to base of caudal), collected in the Rio Ribeira de Iguapé, São Paulo, Brazil, by Dr. Paulo Sawaya, who sent them to the University of Michigan. The larger one has been selected as type (U. M., No. 133663), and the paratype has been deposited in the National Museum. This species is of the extreme *Amplova* type, the mouth being small and somewhat herring-like. It is related to *A. jamesi*, from which it differs principally in having more numerous gill rakers, a larger eye, a lower and differently shaped dorsal fin, which also is more anteriorly placed, and in the shorter pectoral with more numerous rays. The proportions and enumerations placed first in the description apply to the type.

Range.—Known only from the type and paratype from Rio Ribeira de Iguapé, São Paulo, Brazil.

Genus **PTERENGRAULIS** Günther

Pterengraulis Günther, 1868, 398 (type *Clupea atherinoides* Linnaeus).

Body rather deep, strongly compressed; teeth all small; maxillary rounded posteriorly, reaching nearly or quite to joint of mandible; gill rakers few, about 14 on lower limb of first arch, short and broad in adults; anal fin long, with about 30 to 33 rays, its origin under or more usually a little in advance of origin of dorsal; ventral fin about midway between base of pectoral and vertical from origin of dorsal. Distinguished from other genera of the family by the following combination of characters: Anterior origin of the anal fin, small teeth of uniform size, and the short posteriorly rounded maxillary.

Pterengraulis atherinoides (Linnaeus) (Fig. 63)

Clupea atherinoides Linnaeus, 1766, 523, Surinam.

Engraulis atherinoides Günther, 1868, 398.

Pterengraulis atherinoides Jordan & Evermann, 1896, 450; Starks, 1913, 10; Jordan & Seale, 1926, 386.

Clupea pilchardus de Magalhaes, 1931, 194, fig. 104 (not of Linnaeus).

Head 3.8 to 4.5; depth 3.5 to 4.4; D. 12 to 14; A. 27 to 35 (usually 31 to 32); P. 13 to 15; scales 42 to 47; vertebrae 43 to 45 (2 specimens dissected).

Body rather deep, strongly compressed; dorsal profile anteriorly less strongly rounded than the ventral; head rather small, its depth at joint of mandible about equal to its length behind middle of eye; snout short, rather

obtuse, much shorter than the small eye, 8.0 to 10.0 in head; eye 4.0 to 6.0; maxillary rather short, rounded posteriorly, often failing to reach joint of mandible, 1.3 to 1.5 in head; cheek long, more than twice diameter of eye in adults, proportionately shorter in young, its posterior angle about 40° ; postorbital part of head long, 6.0 to 7.0 in length; mandible 5.5 to 6.0; gill rakers short, broad, becoming shorter and broader with age, rudimentary on anterior part of both limbs, scarcely exceeding length of pupil at angle in adults, 10 to 12 + 12 to 15 on first arch; dorsal fin with nearly straight outer margin, the longest rays reaching beyond tip of last ray if deflexed, its origin about equidistant from base of caudal and margin of opercle; anal fin very long, its origin under or more usually a little in advance of dorsal, base 2.9 to 3.3 in length; ventral small, reaching somewhat more than one-third the distance to anal, usually inserted a little nearer base of pectoral

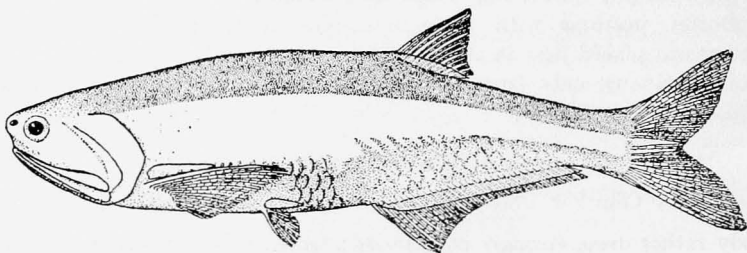


Fig. 63.—*Pterengraulis atherinoides*. From a specimen 245 mm. long, "Amazon River" (U. S. N. M., No. 72551). (Drawing by Miss Louella E. Cable.)

than origin of anal; pectoral large, reaching to or beyond middle of ventral, 1.0 to 1.3 in head, 4.2 to 4.8 in length; axillary scale of pectoral broad at base, about two-thirds length of the fin, 1.8 to 2.1 in head.

Color of specimens in alcohol, pale brownish above; side of head and lower part of body silvery; side with a broad silvery band, decreasing in width posteriorly, diffused with the silvery of the lower part of side anteriorly in large specimens, apparently persisting posteriorly.

The proportions and enumerations given in the description, unless otherwise stated, are based on 20 specimens, 66 to 250 mm. long. According to Starks (*loc. cit.*) this fish is very common in the market at Para, Brazil. Examples 300 mm. long have been reported.

An otherwise normal specimen, 190 mm. long from Para (M. C. Z., No. 4687), is entirely without ventral fins. As there is no indication of injury it seems probable that it never possessed these fins.

Range.—Venezuela to northern Brazil, ascending fresh water streams. Specimens examined from Caño Guanoco, and Río Apuré, San Fernando de Apuré, Venezuela; and "Amazon River," Para, and Fortaleza, Brazil.

Genus **LYCENGRAULIS** Günther

Lycengraulis Günther, 1868, 385 and 399 (type *Engraulis grossidens* Cuvier).

Body elongate, compressed; ventral margin of body compressed, without scutes; mouth very large; maxillary extending far beyond eye, generally to or beyond joint of mandible; jaws with enlarged teeth, those of lower jaw especially enlarged, and usually unequal in size; gill rakers about 12 to 25 on lower limb of first arch, not increasing in number with age; origin of dorsal in advance of origin of anal; ventral fin inserted about midway between base of pectoral and vertical from origin of dorsal. Young with silvery lateral band, disappearing with age.

The species of this genus reach a comparatively large size, specimens of upward of 250 mm. in length being known.

KEY TO THE SPECIES

- a. Gill rakers rather slender, about as long as pupil.
- b. Gill rakers numerous, 13 to 20 + 18 to 25 on first arch; cheek rather short and broad, scarcely longer than snout and eye, 2.4 to 2.9 in head (measured from eye to posterior acute angle); origin of dorsal usually about equidistant from base of caudal and posterior margin of eye.
- c. Pectoral with 14 or 15 rays; snout moderately short, projecting scarcely half its length beyond mandible; teeth in lower jaw notably enlarged.
- d. Body deep, strongly compressed, the depth 3.85 to 4.4 (in adults) in length; maxillary long and rather sharply pointed posteriorly, reaching well beyond joint of mandible, and sometimes nearly to margin of opercle, generally 4.8 to 5.3 in length; vertebrae 43 or 44.
 - grossidens*, p. 143
 - dd. Body generally more slender and less strongly compressed, the depth 4.3 to 5.0 (usually 4.4 to 4.8) in length; maxillary rather shorter and blunter, reaching to or only a little beyond joint of mandible, generally 5.4 to 5.8 in length; vertebrae 46 to 48. *olidus*, p. 144
- cc. Pectoral with 16 or 17 rays; snout very short and blunt, projecting notably less than half its length beyond mandible; teeth in lower jaw smaller than in related species; depth 4.2 to 4.8 in length; maxillary reaching somewhat beyond joint of mandible, 5.3 to 5.8 in length; median line of back with a dark stripe. *poeyi*, p. 146
- bb. Gill rakers few, 9 to 13 + 12 to 15 on first arch; cheek long and narrow, notably longer than snout and eye, 2.0 to 2.25 in head; body quite slender, the depth 5.25 to 6.0 in length; maxillary reaching nearly or quite to joint of mandible, 5.5 to 5.8 in length; origin of dorsal notably nearer base of caudal than eye. *batesii*, p. 148
- aa. Gill rakers very short and broad, partly rudimentary, the longest ones scarcely exceeding half the length of pupil, very spiny; cheek long and narrow, notably longer than eye and snout.
- e. Maxillary long, rather sharply pointed distally, extending well beyond joint of mandible, nearly to margin of opercle; origin of dorsal well forward,

- equidistant from base of caudal and middle of eye; gill rakers on first arch 11 or 12 + 16 or 17..... *abbottii*, p. 150
- ee. Maxillary short, more or less rounded distally, not extending beyond joint of mandible; origin of dorsal farther back, about equidistant from base of caudal and upper anterior angle of gill opening.
- f. Gill rakers few, 9 to 11 + 12 to 14 on first arch; eye small, 5.5 to 5.8 in head; origin of anal about under middle of base of caudal. . . *barbouri* n. sp., p. 151
- ff. Gill rakers more numerous, 17 or 18 + 21 or 22 on first arch; eye larger, 4.9 in head; origin of anal under posterior third of base of dorsal
schroederi, n. sp., p. 153

TABLE 23.—FREQUENCY DISTRIBUTION OF ANAL RAYS IN *Lycengraulis*

Species	Number of anal rays						
	23	24	25	26	27	28	29
<i>grossidens</i>	1	1	4	4	3	5	.
<i>olidus</i>	2	5	15	4	1	1
<i>poeyi</i>	2	1	3	.	2	1
<i>batesii</i>	6	3	1	.
<i>abbotti</i>	1	.	.	.	.
<i>barbouri</i>	1	2	1	.
<i>schroederi</i>	1	.	.	.

TABLE 24.—FREQUENCY DISTRIBUTION OF GILL RAKERS IN *Lycengraulis**

Species	Number of gill rakers on upper limb of first arch											
	9	10	11	12	13	14	15	16	17	18	19	20
<i>grossidens</i>.....	.	.	.	.	4	15	6	7	1	.	.	.
<i>olidus</i>.....	.	.	.	.	.	.	3	15	8	4	1	3
<i>poeyi</i>.....	.	.	.	.	.	.	.	5	7	1	.	.
<i>batesii</i>	3	2	4	5	2	.	.	.	.	.	.	.
<i>abbotti</i>.....	.	.	1	1	.	.	.	.	.	.	.	.
<i>barbouri</i>	1	3	4	.	.	.	.	.	.	.	.	.
<i>schroederi</i>.....	.	.	.	.	.	.	.	.	1	1	.	.

Species	Number of gill rakers on lower limb of first arch														
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
<i>grossidens</i>.....	.	.	.	.	.	1	9	13	15	8	.	.	.	.
<i>olidus</i>.....	.	.	.	.	.	.	2	5	6	20	7	5	2	1
<i>poeyi</i>.....	.	.	.	.	.	.	.	1	2	8	2	1	.	.
<i>batesii</i>	2	5	7	2	.	.	.	.	.	.	.	.	.	.
<i>abbotti</i>.....	.	.	.	.	1	1	.	.	.	.	.	.	.	.
<i>barbouri</i>	1	6	1	.	.	.	.	.	.	.	.	.	.	.
<i>schroederi</i>.....	.	.	.	.	.	.	.	.	.	1	1	.	.	.

* If the enumerations exceed the number of specimens reported in the text, the gill rakers were counted on both anterior arches of at least some of the fish.

Lycengraulis grossidens (Cuvier) (Fig. 64)

Engraulis grossidens Cuvier, in Spix & Agassiz, 1829, 50. Rio de Janeiro.

Engraulis janeiro Spix & Agassiz, 1829, Pl. 24, fig. 1. Rio de Janeiro.

Engraulis dentex Cuvier & Valenciennes, 1848, 28. Rio de Janeiro.

Lycengraulis grossidens Jordan & Seale, 1926, 383.

Head 4.1 to 4.7; depth 3.85 to 4.4 (more slender in young under 100 mm. in length); D. 14 or 15; A. 24 to 28; P. 14 or 15; scales mostly lost, about 40 to 44; vertebrae 43 or 44 (4 specimens dissected).

Body strongly compressed, quite deep; head moderately deep, its depth at joint of mandible nearly equal to its length without snout; snout short and blunt, projecting rather less than half its length beyond tip of mandible, 5.6 to 6.9 in head; eye 4.2 to 4.9; adipose eyelid very strongly developed in large specimens; maxillary very long and slender, rather pointed,

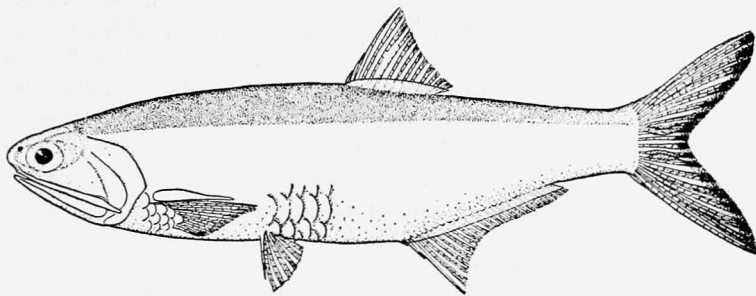


Fig. 64.—*Lycengraulis grossidens*. From a specimen 214 mm. long, Porto Inháuma, Brazil (U. S. N. M., No. 100835). (Drawing by Miss Louella E. Cable.)

reaching beyond joint of mandible, often nearly to margin of opercle, 1.15 to 1.25 in head; mandible pointed, curved upward slightly at tip, reaching forward to or slightly past anterior nostril; teeth in lower jaw rather large, unequal in size and variable in number, about 18 to 25 enlarged; those of upper jaw smaller and much more numerous, very variable, 45 to 65 more or less enlarged; cheek rather short, somewhat longer than eye and snout in large specimens, about equal to depth of head at middle of eye, not nearly reaching tip of maxillary, proportionately much shorter in young, about equal to snout and eye in specimens 100 mm. or so in length, its length (measured from eye to the posterior acute angle) 2.4 to 2.7 in head, its posterior angle about 40°; postorbital part of head moderately long, 6.65 to 7.4 in length; gill rakers rather slender, flattened, the ones at angle fully as long as pupil, 13 to 17 + 17 to 21 on first arch, most frequently 14 to 16 + 18 to 21 (evidently no increase in number with age); dorsal fin moderately low, its outer margin concave, the longest rays reaching nearly to

tip of last ray if deflexed, the origin rather variable, generally nearer base of caudal than posterior margin of eye, though sometimes considerably farther forward; anal fin long and low, its origin usually about under middle of base of dorsal, its base generally a little longer than head, 3.9 to 4.2 in length; ventral small, reaching notably less than half the distance to origin of anal in adults, usually inserted a little nearer origin of anal than base of pectoral; pectoral large, often reaching nearly to base of ventral, 1.25 to 1.35 in head, 5.0 to 6.0 in length; axillary scale of pectoral about three-fourths the length of fin, 1.5 to 1.9 in head.

Color of preserved specimens grayish above; side of head and lower two-thirds of body uniform silvery in adults; young with a distinct silvery lateral band, narrower than eye in specimens under about 90 mm., notably broader than eye and less distinctly outlined below in specimens about 120 mm. long; posterior margin of caudal blackish in adults.

Forty specimens, ranging in length from 40 to 220 mm. were examined. These specimens are from the Gulf of Venezuela; Pará, Vigia, Cachoeria, Recife, Bahia, Rio Doce, Rio Ribeira de Iguapé, São Paulo, Rio de Janeiro, Porto Inháuma, and Santos, Brazil, and are in the collections of the National Museum, University of Michigan, and the Museum of Comparative Zoology. Many of the specimens at hand were purchased by collectors in markets, indicating that the species is of some direct commercial value. This species, like the others of the genus, seems to enter fresh water freely. Its close relationship with *olidus* is shown in the key to the species, and is discussed in the account of that species.

Range.—Venezuela southward, about to Rio de Janeiro, Brazil. The more southern locality records of this species in the literature, generally without descriptions or comments, such as Evermann and Kendall (1906, 76), Devincenzi (1924, 189), and Berg (1895, 21), probably are all referable to *olidus*. Certainly, Thompson's record (1916, 403) is referable to that species, as an examination of most of the specimens upon which it was based has shown.

***Lycengraulis oloidus* (Günther) (Fig. 65)**

Engraulis oloidus Günther, 1874, 455, Paraná River, Brazil.

Lycengraulis grossidens Berg (not of Cuvier) 1895, 21; Evermann & Kendall (not of Cuvier), 1906, 76; Thompson (not of Cuvier), 1916, 403; Devincenzi (not of Cuvier), 1924, 189.

? *Stolephorus poeyi* Lahille (not of Kner & Steindachner), 1895, 274. (Reported without comment from Rio de la Plata, where the species does not occur.)

Stolephorus oloidus Eigenmann, 1907, 453; Devincenzi, 1924, 189.

Lycengraulis polymera Marini, 1935, 446, Rio de la Plata, *nomen nudum*.

(The type specimens were examined and found to be *L. oloidus*.)

Head 4.0 to 4.5; depth 4.3 to 5.0 (usually 4.4 to 4.8); eye 4.1 to 4.9 in head; snout 6.5 to 8.0; maxillary 1.2 to 1.35 in head, 5.2 to 5.9 (usually 5.4 to 5.8) in length; cheek 2.4 to 2.6 in head; postorbital part of head 1.55 to 1.75 in head; 6.5 to 7.5 in length; pectoral 1.25 to 1.35 in head, 5.6 to 6.3 in length. D. 14 or 15; A. 24 to 28; P. 14 or 15; scales lost, about 40 to 45; gill rakers 15 to 20 + 18 to 25 (most frequently 15 to 17 + 20 to 22); enlarged teeth in lower jaw about 23 to 30; in upper jaw about 45 to 60; vertebrae 46 to 48 (4 specimens dissected).

This species apparently intergrades northward with *grossidens*, and probably should stand as a subspecies of that form. Several differences are evident, however, if for example individuals from Venezuela and from Uruguay are compared. The southern specimens (*olidus*) are more slender, less strongly compressed, with a shorter and less strongly pointed maxillary, and rather smaller and less prominent teeth in the upper jaw. These

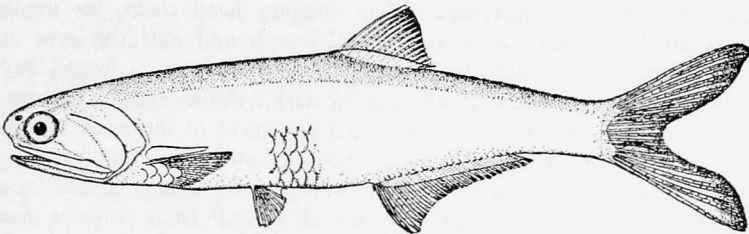


Fig. 65.—*Lycengraulis olidus*. From a specimen 215 mm. long, Buenos Aires, Argentina (U. S. N. M., No. 77313). (Drawing by Miss Louella E. Cable.)

differences intergrade more or less, as already indicated, in specimens from intermediate localities.

The southern specimens (*olidus*) also have a larger number of vertebrae according to enumerations made of eight specimens. Three from Montevideo have, respectively, 46, 47 and 48 vertebrae and one from Buenos Aires has 47, whereas two specimens (*grossidens*) from Rio de Janeiro each have 43, and one from the Gulf of Venezuela has 43 and another has 44. It seems possible that the number of vertebrae might prove to overlap if enough specimens from intermediate localities were examined. The average number of gill rakers also is higher in *olidus*.

The type and only specimen, 10 inches long, upon which Günther based the original description, was from the Paraná River. All the characters mentioned in the description, which is rather adequate, are in agreement with the southern slender specimens herein discussed.

The 56 specimens, 90 to 240 mm. long, at hand, and more or less definitely identified as *olidus* are from Porto Alegre, and Rio Grande de Sul, Brazil;

from "Paraguay"; Montevideo, Uruguay; "Uruguay River"; "Rosario, South America"; "Rio de la Plata," and Buenos Aires, Argentina. These specimens are included in the collections of the National Museum, the Museum of Comparative Zoology, the University of Michigan, Stanford University, and the Museo Nacional de Historia Natural de Buenos Aires. The several records of *L. grossidens* based on specimens from Argentina, Uruguay, and southern Brazil probably are all referable to this species.

***Lycengraulis poeyi* (Kner & Steindachner) (Fig. 66)**

Engraulis poeyi Kner & Steindachner, 1865, 23, Pl. III, fig. 3, Rio Bayano, Panama.

Lycengraulis poeyi Meek & Hildebrand, 1923, 211.

Head 4.25 to 4.4; depth 4.2 to 4.8; D. 14 to 16; A. 24 to 29; P. 16 or 17; scales 40 to 43; vertebrae 42 or 43 (2 specimens dissected).

Body moderately compressed, rather slender; head short, its depth at joint of mandible equal to its postorbital length and half the eye; snout very short and blunt, projecting notably less than half its length beyond mandible, 7.4 to 8.4 in head; eye 3.5 to 4.5; adipose eyelid strongly developed in adults, extending over the snout and most of the head; maxillary moderately pointed, reaching beyond joint of lower jaw, but not to gill opening, 1.2 to 1.35 in head; mandible moderately pointed, curved upward slightly at tip, reaching forward well beyond vertical from anterior nostril; teeth in the lower jaw rather smaller than in the other species of the genus, about 25, those of the upper jaw quite small and much more numerous; cheek short, somewhat longer than snout and eye in large examples, proportionately shorter in young, 2.6 to 2.9 in head, posterior angle about 45°; postorbital part of head moderately long, 6.8 to 7.5 in length; gill rakers rather slender, fully as long as pupil, 16 to 18 + 19 to 23 on first arch; dorsal fin rather small, its outer margin slightly concave, the longest rays not quite reaching tip of last one if deflexed, the origin equidistant from some point over eye and base of caudal; anal fin long and low, its origin under or slightly in advance of middle of base of dorsal, its base a little longer than head, 3.75 to 4.25 in length; ventral very small, reaching only a little more than a third the distance to origin of anal, inserted about half an eye's diameter nearer base of pectoral than origin of anal; pectoral rather long, reaching to or a little past base of ventral, 1.25 to 1.4 in head; axillary scale of pectoral about three-fourths length of fin, 1.7 to 1.8 in head.

Color of preserved specimens grayish above; side of head and lower two-thirds of body uniform silvery in large specimens; the smallest specimen (135 mm. long) with a very broad, diffuse silvery lateral band. Middle of back with a blackish stripe, more than half the width of eye in adults,

notably narrower in young (this stripe not present in specimens of related species at hand). Posterior margin of caudal blackish.

The foregoing description is based on 13 specimens, varying in length from 135 to 230 mm., from Panama (Pacific). This species is close to *L. olidus*, with which it agrees in the shape and length of the maxillary, and the relative position of the dorsal and anal, as well as in depth. It differs from *olidus* and *grossidens* in the very short blunt snout, which projects little beyond the mandible; in the smaller and more uniform size of the teeth in the lower jaw; the rather longer pectoral fins, which apparently have 1 or 2 more rays, and reach to or a little beyond base of ventrals; and apparently in the presence of a dark stripe or band on the back. The species sometimes is seen in the Panama City market.

A specimen in the Academy of Natural Sciences of Philadelphia, labeled, "*Engraulis tapirulus* Cope, type," seems to belong here. This specimen

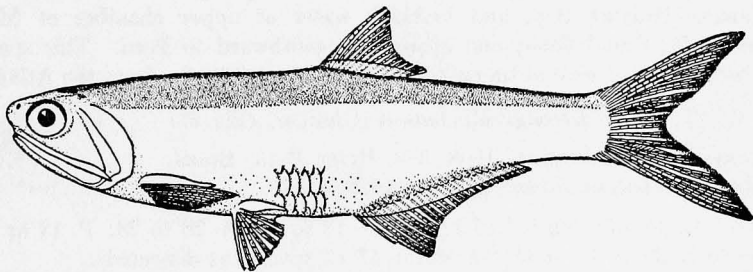


Fig. 66.—*Lycengraulis poeyi*. From a specimen 133 mm. long, Balboa, C. Z. (U. S. N. M., No. 79557). (Drawing by Miss Louella E. Cable.)

is from Peru, and somewhat doubtfully from Pecosmayo Bay. It has a total length of 207 mm. (170 mm. to the base of caudal). It certainly is a *Lycengraulis*, as it has the characteristically enlarged jaw teeth of that genus, there being about 30 large ones on the lower jaw, and about 55 on the upper jaw that are somewhat enlarged. In a few of the proportions and enumerations listed below, this specimen is slightly outside the range of specimens from Panama Bay, but apparently to no significant extent. Head in length 4.3; depth 4.4; anal base 4.0; mandible 6.1; postorbital part of head 7.1. Eye in head 4.9; snout 7.4; maxillary 1.3; mandible 1.4; axillary scale of pectoral 2.0. D. 16; A. 26; P. 15; gill rakers 17 + 23; scales 43. In addition to a slight divergence in a few of these proportions and enumerations the cheek apparently is rather longer, exceeding the length of the snout and eye by diameter of pupil; the pectoral fins, though somewhat damaged, seem to be shorter, apparently failing to reach the ventral by nearly an eye's diameter; and there is no dark stripe on the back, which

of course may have been present, but faded away during the many years the specimen has been in preservative.

When Cope (1877, 45) described *Engraulis tapirulus* he had two specimens, for he stated, "The two specimens probably came from Pacasmayo Bay." The length of only one is given in the original description, which was 120 mm. (100 mm. to base of caudal) long. The specimen now labeled as type apparently cannot be that specimen. Furthermore, the description states that, "There are minute teeth in both the jaws." The origin of the anal is said to be under the last ray of the dorsal. Both characters disagree with the specimen labeled "type," which as already stated has enlarged teeth in the jaws, and the anal begins under the middle of the base of the dorsal. It seems rather certain, therefore, that the description was based on a specimen smaller than this "type," which presumably no longer is extant. It is highly probable that the specimen Cope did describe belongs to the species herein designated as *Anchoa nasus* (see p. 102).

Range.—Panama Bay, and brackish water of upper chamber of Miraflores Locks, Canal Zone; and apparently southward to Peru. This species has been reported several times, quite certainly mistakenly, from the Atlantic.

***Lycengraulis batesii* (Günther) (Fig. 67)**

Engraulis batesii Günther, 1868, 399, River Pará, Brazil.

Lycengraulis batesii Jordan & Seale, 1926, 385.

Head 4.3 to 4.7; depth 5.25 to 6.0; D. 13 to 15; A. 26 to 28; P. 13 or 14; scales lost, about 41 to 45; vertebrae 47 (2 specimens dissected).

Body compressed, slender; head moderately long, its depth at joint of mandible about equal to its postorbital length; snout short, moderately pointed, 7.0 to 8.0 in head; eye 4.5 to 5.4; maxillary slightly expanded, scarcely pointed, reaching nearly or quite to joint of mandible, 1.2 to 1.3 in head, 5.5 to 6.0 in length; lower jaw rather pointed, curved upward anteriorly, reaching about to vertical from anterior nostril, 5.5 to 6.2 in length; teeth in lower jaw enlarged, unequal in size, about 20 on each side; teeth in the upper jaw smaller and much more numerous, about 50 on each side; cheeks moderately long, much longer than snout and eye in adults, shorter in young, 2.0 to 2.5 in head (measured from eye to acute posterior angle), its posterior angle about 35°; postorbital part of head rather long, 6.4 to 7.0 in length; gill rakers moderately long, those at angle fully half the length of eye, 9 to 13 + 12 to 15 on first arch; dorsal fin rather low, with only moderately concave margin, the longest rays nearly or quite reaching tip of last one if deflexed, its origin generally fully half an eye's diameter nearer upper anterior angle of opercle than base of caudal; anal fin low, its base usually about an eye's diameter longer than head, 3.8 to 4.0 in length, the origin a little in advance of middle of base of dorsal some-

what nearer base of pectoral than base of caudal; ventral fin small, failing to reach half the distance to origin of anal in adults, longer in young, inserted nearer base of pectoral than origin of anal; pectoral scarcely reaching ventral in adults, longer in young, about 1.25 to 1.5 in head, 5.3 to 6.5 in length; axillary scale of pectoral about two-thirds length of fin, 2.3 to 2.7 in head.

Color of old preserved specimens grayish above, lower two-thirds of side, ventral surface and side of head bright silvery. Although the original description stated, "an oblong blackish patch on the lower half of the end of the tail," no blackish patch is now evident on any of the specimens at hand. The smaller specimens have a very broad silvery lateral band, which does not fully shade into the silvery color of the lower part of sides as in the larger ones; a dark vertebral band also present.

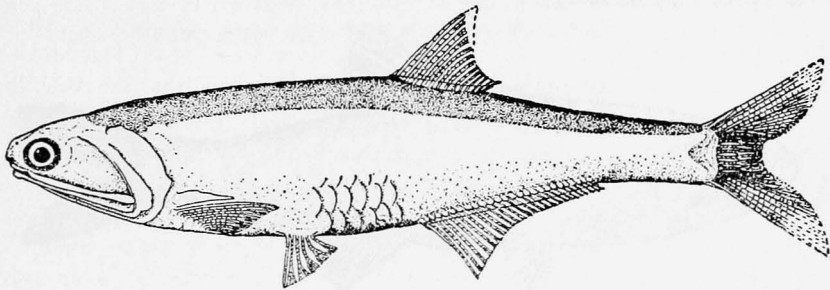


Fig. 67.—*Lycengraulis batesii*. From a specimen 155 mm. long, Teffe, Brazil (M. C. Z., No. 18006). (Drawing by Mrs. Alice C. Mullen.)

Six specimens, ranging in length from 160 to 185 mm., in the Museum of Comparative Zoology collection, and 6, ranging from 45 to 87 mm. in length, in the University of Michigan, form the basis for the foregoing description. These specimens resemble *olidus*, but are at once distinguishable by the much small number of gill rakers, and the longer cheek.

Mr. J. R. Norman kindly reexamined the types (3 specimens, respectively 125, 135 and 195 mm. long to base of caudal) in the British Museum, and has sent a gill arch for examination. This gill arch, and some data not in the original description, have been of much help in placing the specimens in this species with some assurance. The chief difficulty, in making the identification from the description only was the omission therefrom of a description of the cheek and the statement, "Gill rakers very short, like tubercles." Inasmuch as the specimens, herein referred to *L. barbouri*, have about an equal number of gill rakers, though much shorter, identification became puzzling. Mr. Norman has verified the proportionate depth

of the body, which is correctly stated in the original description, and his description of the cheek shows that structure to agree with the specimens before me. It is evident from the gill arch sent that the gill rakers are identical in shape and number (12 + 1 rudiment on lower limb of first arch) and they are quite as long as in the specimens at hand.

Range.—Rio Apuré (an upper tributary of the Orinoco) at San Fernando de Apuré, Venezuela; Pará River (types); also Teffe (M. C. Z., No. 18006); and Rio Jutahy (M. C. Z., No. 18015), Brazil, the last two localities being far up the Amazon Basin. Recently Eigenmann and Allen (1942, 332) recorded this species from Rio Paranapura, Yurimaguas and Rio Morona, Gosulimacocha, in the upper Amazon Basin.

***Lycengraulis abbotti* (Fowler) (Fig. 68)**

Anchovia abbotti Fowler, 1915, 522, fig. 1, Port-of-Spain, Trinidad (type, A. N. S. P., No. 45079).

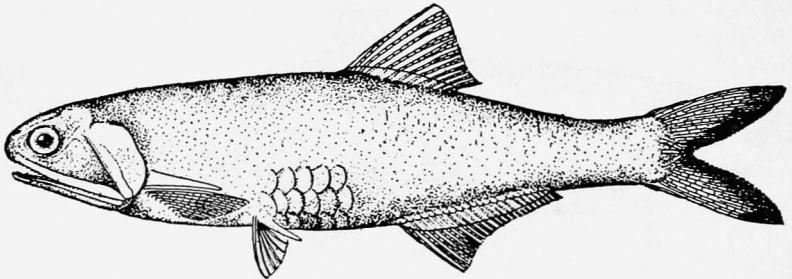


Fig. 68.—*Lycengraulis abbotti*. Modified after Fowler. Modified drawing by Mrs. Alice C. Mullen.)

Head 4.25; depth 3.7; D. 13; A. 25; P. 16; scales mostly lost, about 37.

Body moderately elongate, fairly robust, its greatest thickness exceeding depth of caudal peduncle by fully diameter of pupil; head fairly short and deep, its depth at joint of mandible scarcely less than its length without snout; snout fairly short, blunt, reaching rather less than half its length beyond tip of mandible, 7.0 in head; eye 4.8; maxillary long, pointed, extending nearly to margin of opercle, 1.13 in head; mandible curved upward at tip, 5.5 in length; teeth in jaws partly enlarged, the lower jaw with 16 more or less enlarged, upper jaw with about 40 enlarged ones, though smaller than in lower jaw; cheek large, exceeding in length the snout and eye by diameter of pupil, with acute posterior angle of about 30°; post-orbital part of head moderately long, 6.75 in length; gill rakers short, broad, and very spinose, partly rudimentary, the longest scarcely more than half the pupil, 11 + 17 and 12 + 16 (including rudiments) on the first arch of each side; dorsal with concave margin, the longest rays not quite reaching

tip of last ray if deflexed, origin of fin equidistant from base of caudal and middle of eye; anal long, quite low, its origin slightly in advance of middle of base of dorsal, and equidistant from base of caudal and base of pectoral, its base 3.9 in length; pectoral not quite extending to base of ventral, 1.3 in head; 5.5 in length; axillary scale of pectoral fully three-fourths length of fin, 1.8 in head.

Color grayish above, sides and belly silvery; caudal with a narrow dark margin.

This species is here described from the type, the only specimen known, 180 mm. (148 mm. to the base of caudal) long, which was examined by me. It obviously belongs to *Lycengraulis*, as shown by its enlarged jaw teeth. It is related to *barbouri* and *schroederi*, both herein described as new, having similarly short (partly rudimentary) and very spiny gill rakers, differing from both, however, in the number of gill rakers, in the longer and more pointed maxillary, and in the more anterior position of the dorsal fin.

Range.—Known only from Port-of-Spain, Trinidad.

***Lycengraulis barbouri* n. sp. (Fig. 69)**

Lycengraulis batesii Starks, 1913, 11 (not of Günther).

Lycengraulis grossidens Jordan & Seale, 1926, 384 (in part not of Günther).

Head 3.9 to 4.5; depth 4.3 to 4.7; D. 14 or 15; A. 26 to 28; P. 14 or 15; scales lost, about 40 to 45.

Body rather strongly compressed, moderately deep; head rather large, its depth at joint of mandible about equal to its postorbital length; snout very short, blunt, projecting much less than half its length beyond mandible, 7.8 to 9.2 in head; eye with well developed adipose eyelid, 5.0 to 5.8; maxillary rather short, scarcely reaching joint of mandible, rounded distally, 1.2 in head; mandible curved upward at tip, reaching forward somewhat beyond anterior nostril, 4.8 to 5.7 in length; teeth in lower jaw moderately enlarged, unequal in size, about 25 more or less enlarged; those in upper jaw smaller and much more numerous, about 65 more or less enlarged; cheek very long and narrow, nearly twice as long as eye and snout, 1.8 to 1.9 in head, its posterior angle sharp, about 30°; postorbital part of head long, 5.6 to 6.9 in length; gill rakers mostly very short, mere flattish points, those at angle slightly produced, though not more than half length of pupil, 9 to 11 + 12 to 14 on first arch; dorsal fin anteriorly somewhat elevated, its margin deeply concave, the longest rays reaching to or slightly past tip of last one if deflexed, the origin about equidistant from base of caudal and upper anterior angle of gill opening; anal long, elevated anteriorly, its origin under or somewhat in advance of middle of base of dorsal, its base equal to length of head, 3.8 to 4.1 in length; ventral small, reaching about half way to vent; pectoral moderate, reaching to or a little beyond base

of ventral, 1.3 to 1.4 in head, 5.5 to 5.9 in length; axillary scale of pectoral about three-fourths length of fin, 2.0 to 2.1 in head.

Color of old preserved specimens, grayish above, lower parts of body and side of head silvery; fins unmarked except for an indication of a black margin on the caudal.

This species was represented in the collections of the Museum of Comparative Zoology (No. 18017) by three specimens, respectively 237, 230 and 205 mm. long to the base of caudal, from the Rio Poty, Brazil, collected about 1865 by the Nathaniel Thayer expedition. The largest one (No. 35277) is designated as type, and upon it the following proportions and enumerations are based: head 3.9; depth 4.3; snout in head 9.2; eye 5.7; maxillary 1.2; post-orbital part of head 1.3; mandible 1.2; pectoral 1.4; axillary scale of pectoral 2.0; anal base in length 4.0. D. 13; A. 27; P. 14; scales lost, about 43; gill

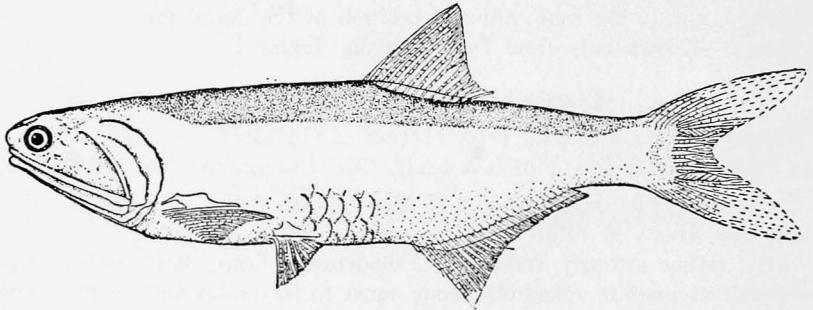


Fig. 69.—*Lycengraulis barboursi* n. sp. From the type, 290 mm. long, Rio Poty, Brazil (M. C. Z., No. 35277). (Drawing by Mrs. Alice C. Mullen.)

rakers 11 + 13. One of the paratypes has been transferred to the U. S. National Museum (No. 118997). These specimens were listed as *L. grossidens* by Jordan and Seale (*loc. cit.*), though mention was made of the shorter and fewer gill rakers, as well as of the more posterior position of the dorsal. However, nothing was said of the shorter maxillary, the smaller eye, and the very much longer and narrower cheek. A specimen in the Stanford University collection (No. 22086), from Pará, Brazil, identified as *L. batesii* by Starks (*loc. cit.*), though it differs slightly from the others in the rather more forward position of the anal fin, seems to belong here.

L. barboursi is related to *L. batesii* from which it differs in having a deeper body, a more posteriorly placed anal fin, and in the much shorter gill rakers, which however are equal in number in the two species.

This species is named for Dr. Thomas Barbour, through whose generosity it has been possible to study the fine collection of South American Engraulidae in the collection of the Museum of Comparative Zoology.

Range.—Rio Poty, tributary of Rio Paranyba, Brazil (type locality), and Pará, Brazil.

***Lycengraulis schroederi* n. sp. (Fig. 70)**

Lycengraulis batesii Jordan & Seale, 1926, 385 (in part not of Günther).

Head 4.0; depth 4.9; D. 16; A. 26; P. 13; scales lost, about 50.

Body rather strongly compressed, slender; head low and long, its greatest depth about equal to its postorbital length and half the eye; snout short, rather blunt, 8.0 in head; eye moderately large, 4.9; maxillary rather short, not expanded, somewhat rounded distally, reaching joint of mandible, 1.3 in head; lower jaw quite pointed, bent upward at tip, reaching forward somewhat beyond nostrils, 5.5 in length; about 23 teeth in lower jaw moderately enlarged; those of the upper jaw smaller and much more numerous, about 86 somewhat enlarged; cheek long and moderately pointed, about

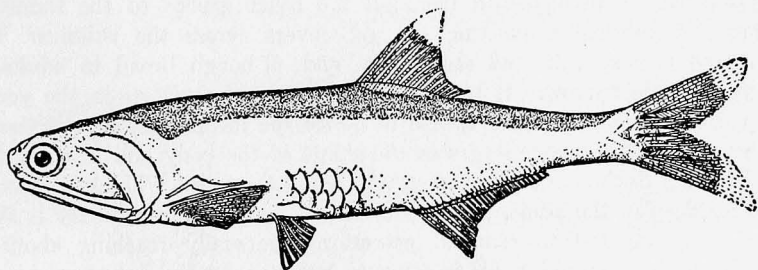


Fig. 70.—*Lycengraulis schroederi* n. sp. From the type, 280 mm. long, Rio Doce, Brazil (M. C. Z., No. 35275). (Drawing by Mrs. Alice C. Mullen.)

1.5 times as long as snout and eye, 2.0 in head, its posterior angle about 35° ; postorbital part of head long, 6.1 in length; gill rakers very short and flat, anterior ones rudimentary, those at angle a little longer, though scarcely half the length of pupil, 17 or 18 + 20 or 21 on first arch; dorsal fin somewhat elevated anteriorly, its origin about equidistant from base of caudal and upper anterior angle of gill opening; anal fin rather strongly elevated anteriorly, its base scarcely equal to length of head, 4.3 in length, the origin under posterior third of dorsal, about an eye's diameter nearer base of caudal than base of pectoral; ventral small, reaching only about one-third the distance to origin of anal; pectoral moderate, about reaching base of ventral, 1.5 in head, 6.1 in length; axillary scale of pectoral damaged, about two-thirds as long as the fin.

Color of old preserved specimen plain grayish above, lower two-thirds of sides, ventral surface, and sides of head bright silvery; fins unmarked, except for indications of dusky blotches on basal half of caudal.

This species is described from the holotype, a specimen 225 mm. long to

the base of the caudal, total length about 280 mm. (caudal fin broken), (M. C. Z., No. 35275) from Rio Doce, Brazil. This specimen was listed as *L. batesii* by Jordan and Seale (*loc. cit.*), from which it differs principally in the shorter and more numerous gill rakers (see table 24), and in the more posteriorly placed anal fin. From *L. barbouri* this species differs in the much more numerous gill rakers, though equally short, the larger eye, and in the more posterior position of the anal fin.

This species is named for William C. Schroeder, a former co-worker of the writer, who has been very helpful in these studies.

Range.—Known only from the Rio Doce, a small coastal stream, having its mouth at Regencia, Brazil.

Genus **CETENGRAULIS** Günther

Cetengraulis Günther, 1868, 383 (type *Engraulis edentulus* Cuvier).

This genus is distinguished from all the other genera of the family in having a membrane connecting the gill covers across the isthmus. This membrane is very thin and easily torn and, although broad in adults, in the young it is narrow. If torn, and when very narrow, as in the young, it is easily overlooked. The failure to notice the membrane, combined with the comparatively great changes in the shape of the body and in color with age, have led to the description of several nominal species. The body usually is rather deep in the adult, but slender in the young; the maxillary is short and bluntly pointed to rounded posteriorly, generally reaching about to articulation of mandible; teeth minute, but apparently not disappearing entirely with age as has been stated. The gill rakers are long, close-set, numerous (about 25 to 60 on lower limb of first arch), increasing in number with age, and the ventral fin is inserted under or only a little in advance of origin of dorsal. A silvery lateral band is present only in small specimens.

KEY TO THE SPECIES

- a. Head moderately large, 3.0 to 3.4 in length; postorbital part of head moderately long, 4.6 to 5.3; body deep, greatest depth 2.9 to 3.4; eye large, 3.7 to 4.6 in head (all measurements based on fish 100 mm. and more in length); cheek equal to or shorter than snout and eye; anal with 23 to 26 rays, most frequently 24 or 25; pectoral short, failing to reach base of ventral.
 - edentulus*, p. 155
- aa. Head notably larger, 2.5 to 2.9 in length; postorbital part of head very long, 3.75 to 4.0; body more slender 3.5 to 3.8; eye smaller, 5.25 to 6.5 in head (all measurements based on specimens 100 mm. and more in length); cheek notably longer than snout and eye; anal with 21 to 23 rays; pectoral short, failing to reach base of ventral.....*mysticetus*, p. 157
- aaa. Head moderately short for a *Cetengraulis*, 3.5 in length; body very slender, 5.0; eye moderately small, 5.5 in head; anal with 23 rays; pectoral reaching beyond base of ventral.....*juruenis*, p. 158

Cetengraulis edentulus (Cuvier) (Fig. 71)

Engraulis edentulus Cuvier, 1829, 323, Jamaica; Cuvier & Valenciennes, 1848, 51.

Cetengraulis edentulus Günther, 1868, 383; Meek & Hildebrand, 1923, 214; Jordan & Seale, 1926, 414.

Stolephorus surinamensis Bleeker, 1866, 178, Surinam. (The original description states that the maxillary is truncate, the origin of the anal is under the posterior rays of the dorsal, and has 26 or 27 rays. The small specimen (96 mm.) described had small teeth and a silvery lateral band, which are characteristic of the young. The connection of the gill covers across the isthmus is not mentioned. It may have been broken or overlooked. I find nothing in the description that separates *surinamensis* from young *edentulus*.)

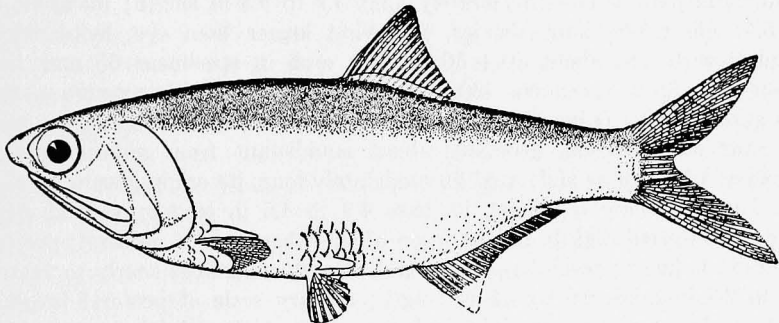


Fig. 71.—*Cetengraulis edentulus*. From a specimen 120 mm. long, Havana, Cuba (U. S. N. M., No. 35159). (Drawing by Miss Louella E. Cable.)

Engraulis brevis Poey, 1866, 379, Cuba. (I follow Jordan and Seale (*loc. cit.*), who examined "cotypes," in placing this name here.)

Stolephorus robertsi Jordan & Rutter, 1897, 95, Jamaica. (The type was not seen by me. The original description contains nothing separating the small specimen (50 mm.) from *C. edentulus*. The slender body (depth 4 in length), and the silvery lateral band are characteristic of small examples of *edentulus*. The membrane across the isthmus is not mentioned. As it is narrow in the young it may have been overlooked.)

Stolephorus garmani Evermann & Marsh, 1900, 352; and 1902, 89, fig. 14, Puerto Real, Puerto Rico. (The type, U. S. N. M., No. 49360, has the membrane connecting the gill covers, but is broken.)

Stolephorus gilberti Evermann & Marsh, 1900, 352; 1902, 90, fig. 15, Palo Seco, Puerto Rico. (The type, U. S. N. M., No. 49359, has the characteristic membrane across the isthmus present, but broken.)

? *Stolephorus manjuba* Miranda-Ribeiro, 1908 (no pagination), Rio de Janeiro, Brazil. (Nothing is said about a membrane connecting the gill covers across the isthmus, nor about the number of gill rakers present. Nothing in the inadequate description is in disagreement with young *C. edentulus*.)

Head 3.0 to 3.5; depth 2.9 to 3.3; D. 14 to 16; A. 23 to 26; P. 14 or 15; scales 40 to 43; vertebrae 42 (3 specimens dissected).

Body strongly compressed, ventral outline much more strongly convex than the dorsal, the depth increasing with age; head rather long; snout pointed, notably shorter than eye, projecting nearly its full length beyond tip of mandible, 5.5 to 8.0 in head; eye 3.7 to 4.8; maxillary short, bluntly pointed, failing to reach joint of mandible, 1.72 to 1.8 in head; cheek long, nearly or quite equal to snout and eye, its posterior angle narrow, about 35°; postorbital part of head moderately long, 4.7 to 5.5 in length; mandible 5.2 to 5.5; gill rakers long, slender, somewhat longer than eye, increasing in number with age, about 30 + 36 on first arch in specimens 65 mm. long, about 52 + 55 in specimens 130 mm. long; dorsal fin with concave margin, the anterior rays failing to reach tip of posterior ray if deflexed, its origin more or less variable, generally about equidistant from anterior margin of eye and base of caudal; anal fin moderately long, its origin generally under last fourth of base of dorsal, its base 4.3 to 4.6 in length; ventral small, generally inserted slightly nearer origin of anal than base of pectoral; pectoral generally failing to reach base of ventral, though sometimes nearly to ventral, 1.9 to 2.3 in head, 6.0 to 7.5 in length; axillary scale of pectoral broad at base, its lower margin straight and somewhat thickened, about two-thirds to three-fourths as long as the fin, 3.25 to 3.7 in head.

Sides silvery, the back bluish gray. Small specimens with a silvery lateral band, becoming indistinct and generally disappearing in fish about 80 to 100 mm. long.

About 72 specimens, ranging in length from 35 to 160 mm., from Puerto Rico, Cuba, Jamaica, Atlantic coast of Panama, Venezuela and Brazil have been examined and form the basis for the foregoing account.

The specimen from Brazil described by Günther (1868, 393) as *Engraulis surinamensis* probably is *edentulus*. At least, there is nothing in the description that is in disagreement. It seems highly probable that the small specimens (27 and 37 mm.) from British Guiana, identified as *surinamensis* by Eigenmann (1912, 448) also are *edentulus*. The number of fin rays, the relative positions of the dorsal and anal, the short maxillary and the number of gill rakers (35 on lower limb of first arch) all agree with small specimens of *edentulus* as here understood. Eigenmann stated that the specimens had no lateral band. This may be due to extreme youth. There are specimens

under 50 mm. in length at hand in which the silvery band is quite indistinct, whereas, those having a length of about 60 to 90 mm. generally have a very distinct band. In larger ones it becomes broad and the lower margin fades into the silvery color of the abdomen.

Range.—West Indies to Brazil.

TABLE 25.—FREQUENCY DISTRIBUTION OF ANAL RAYS IN *Cetengraulis edentulus* AND *C. mysticetus*

Species	Total number of anal rays					
	21	22	23	24	25	26
<i>Cetengraulis edentulus</i>.....	.	.	6	19	20	6
<i>Cetengraulis mysticetus</i>	17	22	20	3	.	.

***Cetengraulis mysticetus* (Günther) (Fig. 72)**

Engraulis mysticetus Günther, 1866, 604, Panama.

Cetengraulis mysticetus Günther, 1868, 383; Meek & Hildebrand, 1923, 212; Jordan & Seale, 1926, 416; Seale, 1940, 4.

Stolephorus opercularis Jordan & Gilbert, 1882, 275, Punta San Felipe, Gulf of Cal. (The type, which is in rather poor condition, U. S. N. M., No. 29366, was reexamined. It quite certainly is identical with specimens from Panama Bay.)

Cetengraulis engyмен Gilbert & Pierson, in Jordan & Evermann, 1898, 2815, Panama Bay. (Syntypes of this nominal species are now at hand. The specimens, which are only 37 to 62 mm. long, are the young of *mysticetus*.)

Anchovia opercularis Gilbert & Starks, 1904, 42; Kendall & Radcliffe, 1912, 81.

Head 2.5 to 3.1; depth 3.3 to 4.3; D. 14 to 16; A. 21 to 24; P. 15; scales 42 to 45; vertebrae 41 or 42 (3 specimens dissected). Eye 5.0 to 6.0 in head; snout 7.5 to 10.0; maxillary 1.75 to 1.85; pectoral 2.15 to 2.6; post-orbital part of head 3.7 to 4.7 (proportionately much longer in large fish than in small ones) in length; gill rakers increasing in number with age, about 25 on lower limb of first arch in specimens 50 mm. long, about 60 in specimens 140 mm. long.

A silvery lateral band present in the young, generally disappearing when a length of about 90 to 100 mm. is attained.

It may be assumed that this species and *edentulus* originated from the same stock. They have become well differentiated, however, since the last passageway across the Isthmus of Panama was closed to marine fishes. Several distinctions are apparent. Because of the comparatively great variation with age some of the proportional differences are not very evident in measurements based on specimens of a wide range in size, such as are supplied at the head of this account.

Comparing specimens of 100 mm. and more in length, of the two species from the opposite coasts of Panama, it is evident at once that the head is longer in *mysticetus* (2.5 to 2.9 in length, 3.0 to 3.4 in *edentulus*), the postorbital part of the head especially being longer (3.75 to 4.0 in length, and 4.75 to 5.3 in *edentulus*). The eye is notably smaller in *mysticetus* (5.25 to 6.5 in head, and 3.7 to 4.6 in *edentulus*, and the cheek is much longer, always being longer than the snout and eye, whereas in *edentulus* it is equal to or more usually slightly shorter than snout and eye. The body is more slender in *mysticetus* (3.5 to 3.8 in length, and 2.9 to 3.4 in *edentulus*).

The differences mentioned are evident at any age if specimens of equal size are compared. The proportions pertaining to the head are especially pronounced in large specimens, as *mysticetus* acquires an excessively large head with age.

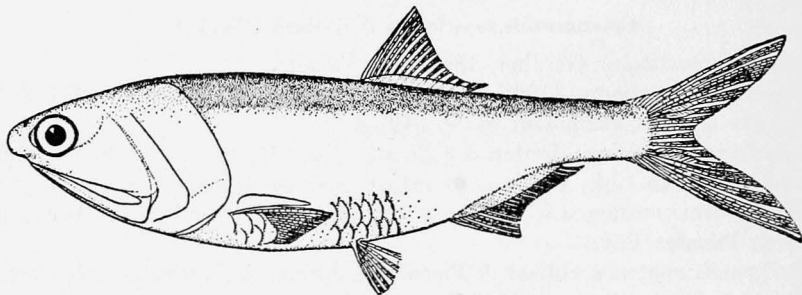


Fig. 72.—*Cetengraulis mysticetus*. From a specimen 144 mm. long, Panama Bay (U. S. N. M., No. 79609). (Drawing by Miss Louella E. Cable.)

Although the number of anal rays overlaps, there is a pronounced difference in the mode as well as in the average, as shown in table 25.

Numerous specimens, 40 to 160 mm. long, collected at Panama City, Balboa, Naos Island, Taboga Island, Chame Island, Chame Point, Pearl Islands, and the Miraflores Locks were examined; also 3 specimens from Sechura Bay, off the mouth of the Rio Piura, Peru, and 1 specimen from Guaymas, Mexico. The type of *Stolephorus opercularis* from the Gulf of California, the syntypes of *Cetengraulis engymer* from Panama City, and one specimen from Guayaquil, Ecuador, too were examined. This species is common in Panama Bay, often appearing in large schools. It was seen from time to time in the Panama City market.

Range.—Gulf of California to Sechura Bay, Peru.

***Cetengraulis juruensis* Boulenger**

Cetengraulis juruensis Boulenger, 1898, 427, Pl. XLI, fig. 3, Rio Jurua, Brazil.

Head 3.5; depth 5.0; D. 13; A. 23; scales 38. Snout strongly projecting, a little shorter than eye; eye 5.5 in head; maxillary reaching articulation of

mandible; gill rakers long, about 40 on lower limb of first arch; dorsal originating equidistant from tip of snout and base of caudal; anal originating below posterior rays of dorsal; pectoral a little more than one-half head, reaching a little beyond base of ventral. Sides silvery; snout blackish above; caudal rays blackish at tips. (Condensed, after Boulenger.)

This species is known to me only from the description and figure of the type, a specimen 140 mm. long. It seems to differ from *edentulus* in the more slender body (depth in specimens of *edentulus* about 140 mm. long 2.9 to 3.2), and in the longer pectorals, which reach beyond the base of the ventrals, whereas they fail to reach the base of the ventrals in *edentulus*.

Range.—Known only from fresh water of the Rio Jurua, Brazil.

BIBLIOGRAPHY

ANONYMOUS:

1941. B. C. fisheries value advanced four million dollars. *Commercial Fishermen's Weekly*, 7 (32): 375-376.

ABBOTT, J. F.:

1899. The marine fishes of Peru. *Proc. Ac. Nat. Sci. Phila.* (1900): 324-364.

BARNHART, P. S.:

1936. Marine fishes of southern California. *Univ. Cal. Press*: 1-209, 290 figs.

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 Comm.*, (1888), 8: 193-206, 2 pls.

BEEBE, W. AND TEE-VAN, J.:

1928. The fishes of Port-Au-Prince Bay, Haiti. *Zoologica*, 10 (1): 1-279, many figs.

1933. Nomenclatural notes on the shore fishes of Bermuda. *Zoologica*, 13 (7): 133-158, 1 fig.

BERG, C.:

1895. Enumeracion sistematica y sinonimica de los peces de las costas Argentina y Uruguay. *Buenos Aires*. 4 (1): 1-165.

BLEEKER, P.:

1866. Description d'une espèce inédite de *Stolephorus* de Suriname. *Neder. Tijdschr. Dierk.* (1865), 3: 178-180.

BONNATERRE (L'ABBÉ), J. P.:

1788. *Tableau encyclopédique et méthodique des trois règnes de la nature etc., Ichthyologie.* Paris: 1-215, 100 pls.

BORODIN, N. A.:

1928. Scientific results of the Yacht "Ara" expedition during the years 1926 to 1928, while in command of William K. Vanderbilt. *Fishes. Bull. Vanderbilt Oceanog. Mus.*, 1 (1): 1-37, 5 pls.

1934. Scientific results of the Yacht "Alva" Mediterranean cruise, 1933, in command of William K. Vanderbilt. *Fishes. Bull. Vanderbilt Marine Museum*, 1 (4): 103-124.

- BOULENGER, G. A.:
 1898. On a collection of fishes from the Rio Jurua, Brazil. *Trans. Zool. Soc. London*, **14** (7): 421-428, pls. 39-42.
- BREDER, C. M., JR.:
 1925. Notes on fishes from three Panama localities, Gatun Spillway, Rio Tapia and Caledonia Bay. *Zoologica*, **4** (4): 137-158, figs. 33-38.
 1928. Scientific results of the second oceanographic expedition of the "Pawnee" 1926: Nematognathi, Apodes, Isospondyli, Synentognathi, and Thoracostraci from Panama to Lower California. *Bull. Bingham Oceanographic Coll.*, **2** (2): 1-25, 10 figs.
- BROWNE, P.:
 1756. The civil and natural history of Jamaica. London: 1-503, 48 pls.
- COPE, E. D.:
 1869. Supplementary synopsis of the Esoces of Middle North America. *Trans. Amer. Phil. Soc.*, **13** (2): 407-410.
 1877. Synopsis of the cold blooded vertebrata procured by Prof. James Orton during his exploration of Peru in 1876-77. *Proc. Amer. Phil. Soc.*, **17**: 33-49.
- CUVIER, G. L. C. F. D.:
 1817. Le règne animal distribué d'après son organisation etc. *Fishes*, Paris. Ed. 1, **2**, and Ed. 2 (1829), **2**: 1-532.
- CUVIER, G. AND VALENCIENNES, M. A.:
 1848. Histoire naturelle des poissons. Paris. **21**: 1-536, pls. 607-633.
- DE MAGALHAES, A. C.:
 1931. Monographia Brasileira de peixes fluviaes. São Paulo: 1-260, 120 figs.
- DEVINCENZI, G. J.:
 1924. Peces del Uruguay. *Anal. Mus. Nac. Montevideo*, Ser. 2, (5): 139-193, pls. 14-24.
- EIGENMANN, C. H.:
 1893. The fishes of San Diego, California. *Proc. U. S. Nat. Mus.*, (1892), **15**: 123-178, pls. 10-18.
 1907. On a collection of fishes from Buenos Aires. *Proc. Wash. Acad. Sci.*, (1906), **8**: 449-458, pls. 21-23.
 1910. Catalogue and bibliography of the fresh water fishes of the Americas south of the Tropic of Cancer. *Rept. Princeton Univ. Exp. 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. *Memoir. Carnegie Mus.*, **5**: 1-578, 103 pls.
 1917. Eighteen new species of fishes from northwestern South America. *Proc. Amer. Phil. Soc.*, **54**: 673-689.
 1922. The fishes of western South America. *Memoir. Carnegie Mus.*, **9** (1): 1-350, 38 pls.
- EIGENMANN, C. H. AND ALLEN, W. R.:
 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*. *Univ. Ky.*: 1-494, 48 figs., 22 pls.

EVERMANN, B. W. AND KENDALL, W. C.:

1906. Notes on a collection of fishes from Argentina, South America, with descriptions of three new species. *Proc. U. S. Nat. Mus.*, **31**: 67-108, 4 figs.

EVERMANN, B. W. AND MARSH, M. C.:

1900. Descriptions of new genera and species of fishes from Puerto Rico. *Rept. U. S. Comm. Fish. for 1899*: 351-362, pl. 17.
1902. The fishes of Porto Rico. *Bull. U. S. Fish Comm.*, (1900), **20** (1): 49-350, 112 figs., 49 pls.

EVERMANN, B. W. AND RADCLIFFE, L.:

1917. The fishes of the west coast of Peru and the Titicaca Basin. *Bull. U. S. Nat. Mus.*, No. 95: 1-166, 14 pls.

FOWLER, H. W.:

1906. The fishes of New Jersey. *Annual Rept. N. J. State Mus.*, (1905): 35-477, text figs. and 103 pls.
1906. Some cold-blooded vertebrates of the Florida Keys. *Fishes. Proc. Ac. Nat. Sci. Phila.*, **58**: 77-109, 14 figs.
1911. Notes on Clupeoid fishes. *Proc. Ac. Nat. Sci. Phila.*, **63**: 204-221, 4 figs.
1915. The fishes of Trinidad, Grenada, and St. Lucia, British West Indies. *Proc. Ac. Nat. Sci. Phila.*, **67**: 520-546, 4 figs.
1917. A second collection of fishes from the Panama Canal Zone. *Proc. Ac. Nat. Sci. Phila.*, **69**: 127-136, 2 figs.
1930. The fishes obtained by Mr. James Bond at Grenada, British West Indies, in 1929. *Proc. Ac. Nat. Sci. Phila.*, **82**: 269-277, 2 figs.
1931. Fishes obtained by the Barber Asphalt Company in Trinidad and Venezuela, in 1930. *Proc. Ac. Nat. Sci. Phila.*, **83**: 391-410, 6 figs.
1936. The marine fishes of west Africa. *Bull. Amer. Mus. Nat. Hist.*, No. 70 (1): 1-605, figs. 1-275; (2): 607-1493, figs. 276-567.
1939. Fishes from the Pacific slope of Colombia, Ecuador and Peru. *Notulae Naturae, Ac. Nat. Sci. Phila.*, No. 33: 1-7.
1941. Zoological results of the second Bolivian expedition for the Academy of Natural Sciences of Philadelphia, 1936-37. I. Fishes. *Proc. Ac. Nat. Sci. Phila.*, (1940), **92**: 43-103, 52 figs.

FOWLER, H. W. AND BEAN, B. A.:

1923. Descriptions of eighteen new species of fishes from the Wilkes Exploring Expedition, preserved in the United States National Museum. *Proc. U. S. Nat. Mus.*, (1924), **63**, Art. 19: 1-27.

GILBERT, C. H.

1892. Scientific results of exploration of the U. S. Fish Commission Steamer *Albatross*. No. 22. 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. Nat. Mus.*, (1891), **14**: 539-566.

GILBERT, C. H. AND STARKS, E. C.:

1904. The fishes of Panama Bay. *Memoir. Cal. Ac. Sci.*, **4**: 1-304, 33 pls.

GILL, T.:

1874. Arrangement of the families of fishes or classes Pisces, Marsipobranchii and Leptocardii. *Smithson. Misc. Coll.* (1872), **11**, (247): I-XLVI, 1-49.

GIRARD, C. F.:

1856. Abstract of a report to Lieut. Jas. M. Gilliss, U. S. N., upon the fishes collected during the U. S. N. astronomical expedition to Chile. Proc. Ac. Nat. Sci. Phila., (1854), **7**: 197-199.
1856. Descriptions of new fishes, collected by Dr. A. L. Heermann, naturalist, attached to the survey of the Pacific Railroad Route, under Lieut. R. S. Williamson, U. S. A. Proc. Ac. Nat. Sci. Phila., (1854), **7**: 129-156.
1858. Pacific railroad routes, 1857. Fishes. U. S. Senate Misc. Doc. No. 78, (4): 1-400, 27 pls.

GMELIN, J. F.:

1788. Systema naturae etc. of Linnaeus, enlarged. Leipsig. **1**: fishes on pp. 1126-1516.

GOODE, G. B.:

1874. Descriptions of two new species of fishes from the Bermuda Islands. Amer. Journ. Sci., **8**: 123-125.

GOODE, G. B. AND BEAN, T. H.:

1880. Catalogue of a collection of fishes obtained in the Gulf of Mexico by Dr. J. W. Velie with descriptions of seven new species. Proc. U. S. Nat. Mus., (1879), **2**: 333-345.
1883. Descriptions of twenty-five new species of fish from the southern United States, and three new genera, *Letharcus*, *Ioglossus*, and *Chriodorus*. Proc. U. S. Nat. Mus., (1882), **5**: 412-437.

GUNDLACH, J.

1881. Apuntes para la fauna Puerto-Riqueña. Anal. Soc. Esp. Hist. Nat. **10** (4). Fishes by Poey: 317-350, pl. 6.

GÜNTHER, A.:

1866. On the fishes of the states of Central America, founded upon specimens collected in the fresh and marine waters by Messrs. Salvin, Godman and Capt. J. M. Dow. Proc. Zool. Soc. London: 600-604, 25 pls.
1868. Catalogue of the fishes of the British Museum. London. **7**: 1-512.
1874. Descriptions of new species of fishes in the British Museum. Ann. and Mag. Nat. Hist., ser. 4, **14**: 453-455.

HILDEBRAND, S. F.:

1925. Fishes of the Republic of El Salvador, Central America. Bull. U. S. Bur. Fish., (1926), **41**: 237-287, 20 figs.
1939. The Panama Canal as a passageway for fishes, with lists and remarks on the fishes and invertebrates observed. Zoologica, **24**, (1): 15-45, pls. 1-2.

HILDEBRAND, S. F. AND CABLE, L. E.:

1930. Development and life history of fourteen teleostean fishes at Beaufort, N. C. Bull. U. S. Bur. Fish., **46**: 383-488, 101 figs.

HILDEBRAND, S. F. AND SCHROEDER, W. C.:

1928. Fishes of Chesapeake Bay. Bull. U. S. Bur. Fish., (1927), **43**, (1): 1-388, 211 figs.

HUBBS, C. L.:

1921. Notes on three clupeoid fishes collected by Edmund Heller in San Felipe Bay, Gulf of California. Proc. Biol. Soc. Wash., **34**: 47-48.
1925. Racial and seasonal variation in Pacific herring, California sardine and

California anchovy. Cal. Fish and Game Comm., Fish. Bull. No. 8: 1-23, 4 pls.

JENYNS, L.:

1842. Voyage of the H.M.S. "Beagle" during the years 1832-1836. Fish, (4): 1-172, 29 pls.

JORDAN, D. S.:

1885. List of fishes collected at Key West, Florida, with notes and descriptions. Proc. U. S. Nat. Mus. (1884), 7: 103-112.
1895. The fishes of Sinaloa. Proc. Cal. Ac. Sci., ser. 2, 5: 377-514, pls. 27-55.

JORDAN, D. S. AND EVERMANN, B. W.:

- 1896-1900. The fishes of North and Middle America. Bull. U. S. Nat. Mus., No. 47, 1896, (1): 1-1240; 1898, (2): 1241-2183; 1898, (3): 2183a-3136; 1900, (4): 3137-3313, 392 pls., with 958 figs.
1927. New Genera and species of North American fishes. Proc. Cal. Ac. Sci., 4 ser., 16, (15): 501-507.

JORDAN, D. S., EVERMANN, B. W., AND CLARK, H. W.:

1930. Check list of the fishes and fish-like vertebrates of North and Middle America, north of the northern boundary of Venezuela and Colombia. Appendix to Rept. U. S. Comm. Fisheries, (1928) (2): 1-670.

JORDAN, D. S. AND GILBERT, C. H.:

1882. List of fishes collected by Lieut. Henry E. Nichols, U. S. N., in the Gulf of California and on the west coast of Lower California with descriptions of four new species. Proc. U. S. Nat. Mus., (1881), 4: 273-279.
1882. Descriptions of thirty-three new species of fishes from Mazatlan, Mexico. Proc. U. S. Nat. Mus., (1881), 4: 338-365.
1883. Notes on fishes observed about Pensacola, Florida, and Galveston, Texas, with descriptions of new species. Proc. U. S. Nat. Mus., (1882), 5: 241-307.
1883. List of fishes now in the museum of Yale College, collected by Prof. Frank H. Bradley at Panama, with descriptions of three new species. Proc. U. S. Nat. Mus. (1882), 5: 620-632.

JORDAN, D. S. AND RUTTER, C.:

1897. A collection of fishes made by Joseph Seed Roberts in Kingston, Jamaica. Proc. Ac. Nat. Sci. Phila.: 91-133.

JORDAN, D. S. AND SEALE, A.:

1925. Analysis of the genera of anchovies or Engraulidae. Copeia, (141): 31.
1926. Review of the Engraulidae, with descriptions of new and rare species. Bull. Mus. Comp. Zool. 67, (11): 355-418.

KENDALL, W. C. AND RADCLIFFE, L.:

1912. Report on the scientific results of the expedition of the eastern tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross" from October, 1904, to March, 1905, Lieut. Commander L. M. Garrett, U. S. N., commanding. The shore fishes, 25. Memoir. Mus. Comp. Zool., 35 (3): 77-171, 8 pls.

KNER, R. AND STEINDACHNER, F.:

1865. Neue Gattungen und Arten von Fischen aus Central-America. Abh. k. Bayer. Ak. Wiss., 10 (1864): 1-61.

1866. Neue Fische aus dem Museum Herren Joh. C. Godeffroy & Sohn in Hamburg. Sitz. k. Akad. Wiss. Wien. **54**: 356-395, 5 pls.
- KUNTZ, A.:
1914. The embryology and larval development of *Bairdiella chrysura* and *Anchovia mitchilli*. Bull. U. S. Bur. Fish., (1913), **33**: 1-20, 46 figs.
- KUNTZ, A. AND RADCLIFFE, L.:
1917. Notes on the embryology and larval development of twelve teleostean fishes. Bull. U. S. Bur. Fish., (1915-16), **35**: 87-134, 126 figs.
- LAHILLE, F.:
1895. Liste de los pecados recogidos en los Alrededores de la Plata. Rev. Mus. la Plata, **4** (1): 265-276.
- LINNAEUS, C.:
1758. Systema naturae, etc., Holmiae Ed. 10, **1**: 1-824; and 1766, Ed. 12, **1**.
- MARCGRAVE, G.:
1648. Historiae naturalium Brasiliae: Fishes and crustaceans, book 4. Amstelodomi.
- MARINI, T. L.:
1935. La anchoita Argentina. Physis, Rev. Soc. Argentina Ciencias Nat., **11**: 445-458, 8 figs.
- MEEK, S. E. AND HILDEBRAND, S. F.:
1923. The marine fishes of Panama. Field Mus. Nat. Hist. Zool. Ser., **15**, (1): 1-330, pls. 1-24.
- MIRANDI-RIBEIRO, A.
1908. Peixes da Ribeira, resultados de excursão do Sr. Ricardo Krone, membro correspondente do Museu Nacional do Rio de Janeiro. Kosmos, Rio de Janeiro. **5** (no pagination).
- MITCHILL, S. L.:
1815. The fishes of New York, described and arranged. Trans. Lit. and Phil. Soc. N. Y., **1**: 355-492, 6 pls.
- MYERS, G. S.:
1940. The neotropical anchovies of the genus *Amplova*. Proc. Cal. Ac. Sci., ser. 4, **23**: 437-442.
- NAKASHIMA, SHOJI:
1941. Algunas peces del Orienta Peruano. Bol. Mus. Hist. Nat. "Javier Prado," **5** (16): 61-78.
- PEARSON, N. E.:
1924. 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. Studies, (1924), **11** (64): 1-82, 12 pls.
- POEY, F.:
1858-61. Memorias sobre la historia natural de la Isla de Cuba. Havana. **2**: 1-428, 19 pls.
1865-68. Repertorio fisico-natural de la Isla de Cuba. Havana. 1865-1866, **1**: 1-420; 1866-68, **2**: 1-484 (Synopsis piscium Cubensium: 279-484).
- REGAN, C. T.:
1904. Descriptions of new or little-known fishes from Mexico and British Honduras. Ann. Mag. Nat. Hist., ser. 7, **13**: 255-259.

SEALE, A.:

1940. Report on fishes from Allan Hancock Expeditions in the California Academy of Sciences. Allan Hancock Pacific Exp., **9**, (1): 1-46, 5 pls.

SPIX, J. B. VON AND AGASSIZ, L.:

1829. Selecta genera et species piscium quos in itinere per Brasiliam annis 1817-20 etc., Monachii. 1829-1831: 1-138; atlas, 101 pls.

STARKS, E. C.:

1913. The fishes of the Stanford expedition to Brazil. Stanford Univ. Pub., Univ. ser.: 1-77, 14 pls.

STEINDACHNER, F.:

1875. Ichthyologische Beiträge, 4 (Sitzb. k. Ak. Wiss. Wien, **72**): 1-65, 13 pls.
1879. Ichthyologische Beiträge, 8 (Sitzb. k. Ak. Wiss. Wien, **80**): 1-73, 3 pls.
1898. Die Fische der Sammlung Plate. Fauna Chilenensis. Zool. Jahrb., **4**: 281-337, pls. 15-21.
1908. Über zwei neue Fischarten aus dem Stromgebiete des Rio San Francisco. Anz. Akad. Wiss. Wien., **45**: 191-194.

SWAIN, J. AND MEEK, S. E.:

1885. Notes on a collection of anchovies from Havana and Key West, with an account of a new species (*Stolephorus eurystole*) from Woods Holl, Mass. Proc. Ac. Nat. Sci. Phila., (1884), **36**: 34-36.

SWAINSON, W.:

1839. The natural history and classification of fishes, amphibians and reptiles, or monocardian animals. London, (1838-1839), **1**: 1-368, 100 figs.; **2**: 1-452, 134 figs.

THOMPSON, W. F.:

1916. Fishes collected by the United States Bureau of Fisheries Steamer "Albatross" during 1888, between Montevideo, Uruguay, and Tome, Chile, on the voyage through the Straits of Magellan. Proc. U. S. Nat. Mus., **50**: 401-476, pls. 2-6.

WALFORD, L. A.:

1931. Handbook of common commercial and game fishes of California. Cal. Div. Fish and Game, Fish Bull. No. 28: 1-183, 137 figs.