

No. 11.— *Review of the Engraulidae, with Descriptions of new and rare Species.*

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THIS paper includes an account of the known genera of Engraulidae (Anchovies), with descriptions of the species represented in the Museum of Comparative Zoölogy, seven of which are described as new to science.

All the descriptions are the work of the junior author. The generic sequence and adjustments are chiefly the work of the senior author.

The Engraulidae are closely related to the Clupeidae (herrings) from which they differ mainly in the form and structure of the mouth.

Body more or less elongate, compressed, covered with thin, cycloid scales; head scaleless, compressed; mouth very large, oblique, usually overlapped by the short, pig-like snout; gape very wide, the maxillary typically long and slender, nearly straight, formed of three pieces, extending backwards beyond the eye, sometimes far behind the head. Premaxillaries small, not protractile, firmly joined to the maxillaries; teeth slender, usually fine and even; teeth on vomer, palatines, pterygoids, and hyoids; small, in some genera interspersed with sharp canines. Eye large, well forward, covered by an imperforate adipose eyelid; preorbital narrow; opercle thin and membranaceous, set obliquely; gill-rakers slender, usually long, often numerous. Branchiostegals slender, numerous. Gill-membranes free from the isthmus, sometimes united across it. Pseudobranchiae present; no lateral line; belly rounded, compressed or serrated. Dorsal fin short, median; anal fin with few or many rays; no adipose fin. Caudal deeply forked, sometimes preceded by a short free spine, with the lower part joined to the anal.

Small, carnivorous fishes swarming along sandy shores in most warm seas, occasionally entering rivers. Some species are valued as food, and in northern Europe a common species is pickled or crushed into paste.

The sequence of genera offers some embarrassments. It appears from palaeontology as well as from comparative anatomy that the Engraulidae are derived as a group from the Clupeidae. The presence of ventral scutes, characteristic of the herrings, is a trait not likely to be twice evolved, and this feature is found in nearly all the species of the Indian region. Such forms as *Stolephorus* and *Scutengraulis* must be nearest the primitive stock. On the other hand, the species

of simplest structure are found in the genus of temperate regions, *Engraulis*, and in *Anchoviella* of tropical America. To this group one of the fossil anchovies (*Engraulites*) also belongs. These species stand as the opposite to the more herring-like forms which show rather definite relationships to *Ilisha* and *Medipellona*, the nearest allied genera among the Clupeidae. The traits of these American forms are apparently due to degeneration, not to primitive simplicity, and with this point of view we have arranged the sequence of genera. The genus of simplest structure, *Engraulis*, is the only one of cosmopolitan distribution, and the only one confined to temperate seas, being represented on the shores of Europe, California, Chile, Japan, and Australia, while none of its species occur in the tropics.

We may note that the *Coiliinae*, which we place first, finds its nearest allies in *Setipinna* and *Scutengraulis*, forms with the ventral region serrated, and the teeth even. But, as usual in grouping, a natural arrangement cannot be a linear one, and we begin with this specialized offshoot from the primitive stock.

The four fossil species do not yield a satisfactory record of the origin of the group. *Engraulites remifer*, and *Engraulis brevipinnis* of the Miocene seem not far from *Engraulis*. The Miocene species called *Engraulis longipinnis* is certainly close to *Scutengraulis* and is one of the *Stolephorinae*, a group which theoretically ought to be older than the *Engraulinae*. *Engraulis evolans* of the Eocene is probably not an anchovy. It looks more like a young flying-fish, with which group some writers have placed it.

#### GENERA OF ENGRAULIDAE.

- a. COILIINAE. Body greatly elongate; pectoral fin with 4 to 6 upper rays produced as slender filaments; caudal unequally forked, its lower part united to the many-rayed anal; gill-rakers 20 to 30.<sup>1</sup> (Asiatic genera).
  - x. Body very long, acute at base of caudal; anal rays 80 to 110. . . *Coilia*.
  - xx. Body shorter, rounded at base of caudal; anal rays 35 to 40.
    - Demicoilia*.
- aa. Body not greatly elongate, the anal fin free from the caudal which is strongly forked.
- b. STOLEPHORINAE. Ventral margin armed with bony scutes or serrae; body compressed; anal fin long, its insertion not far from that of dorsal; maxillary more or less broadened behind; alar scale (at base of caudal) often obsolete; gill-rakers 15 to 30. (Asiatic genera).

<sup>1</sup> Counted on lower limb of the first arch.

- c. Uppermost ray of pectoral produced in a long filament; mouth moderate; a small free spine before dorsal; the very long anal fin beginning before origin of dorsal; alar scale present; gill-rakers 18 to 21; vertebrae 46 to 56; anal rays 50 to 75.
  - d. Lower jaw projecting beyond upper.....*Stethochaetus*.
  - dd. Lower jaw included.....*Setipinna*.
- c. Uppermost ray of pectoral not produced.
  - e. Maxillary greatly prolonged, extending to base of pectoral or beyond; alar scale obsolete; vertebrae 41; gill-rakers 10 to 18; anal rays 35 to 40; a free dorsal spine.....*Thrissolles*.
  - ee. Maxillary of moderate length, not extending beyond gill-opening.
  - f. Insertion of anal before front of dorsal, the fin long, of 45 or 46 rays; no free spine before dorsal; canine teeth present; gill-rakers 9.....*Lycotrissa*.
  - ff. Insertion of anal behind front of dorsal.
    - g. Jaws with sharp canines; gill-rakers 14; vertebrae 48; dorsal preceded by a short, free spine; anal rays about 45; ventral scutes strong.....*Xenengraulis*.
    - gg. Jaws without canine teeth.
    - h. Dorsal preceded by a short, free spine.
      - i. Ventral scutes strong, developed from gill-opening to vent; vertebrae 45 to 48; anal rays about 40.  
*Scutengraulis*.
      - ii. Ventral margin with weak scutes, developed from ventrals to anal only, those almost hidden by the scales; scales firm; teeth even; no silvery lateral stripe; vertebrae 39 or 40; gill-rakers 23; anal rays 32.  
*Thrissina*.
    - hh. Dorsal fin not preceded by a free spine; ventral margin with 2 to 7 sharp scutes between pectorals and ventrals; teeth even; body translucent, usually with a silvery lateral stripe; vertebrae 39 to 43; gill-rakers 22 to 28; anal rays 15 to 37; origin of anal fin behind that of dorsal.....*Stolephorus*.
- bb. ENGRAULINAE. Ventral margin rounded or compressed; without scutes so far as known; no free dorsal spine; alar scale larger. (Genera chiefly American).
  - k. Origin of anal fin before that of dorsal.
    - l. Jaws with sharp canines, those of lower jaw largest; anal rays 25 to 46; vertebrae 42; gill-rakers 19 to 21.....*Lycengraulis*.
    - ll. Jaws without canines, the teeth all small and even, pectoral fin very long; vertebrae 45; gill-rakers 14, anal rays 32.....*Pterengraulis*.

- kk.* Origin of anal fin behind that of dorsal.
- m.* Gill-membranes nearly separate, not united across the isthmus.
- n.* Pectoral fin very long, reaching tip of the long ventrals; body slender. . . . . (Miocene).  
*Engraulites.*
- nn.* Pectoral fin short, not reaching base of ventrals.
- o.* Gill-rakers relatively few, 12 to 30 (49).
- p.* Vertebrae 46 to 47; skeleton fragile; flesh oily; body subcylindrical, little compressed, silvery, but without lateral stripe; gill-rakers 36 to 49.  
*Engraulis.*
- pp.* Vertebrae fewer than 46; skeleton firmer; body translucent, compressed, usually with a sharply-defined, silvery, lateral stripe as in *Stolephorus*.
- q.* Mouth large; maxillary straight, narrow, somewhat pointed behind.  
*Anchoviella.*
- qq.* Mouth small, herring-like, maxillary curved, rather broad, rounded behind. . . . . *Amplova.*
- oo.* Gill-rakers very many, 95 to 120; body much compressed; snout short; ventral margin sharp, but without scutes; anal fin moderate, of about 30 rays.  
*Anchovia.*
- mm.* Gill-membranes broadly united across isthmus (the membrane easily torn); gill-rakers numerous, 52 to 57; vertebrae 41; anal fin moderate, of 20 to 25 rays. . . *Cetengraulis.*

#### COILIA Gray.

Zool. misc., 1831, p. 9.

*Mystus* Lacépède, Hist. nat. poiss., 1803, 5, p. 466.

*Trichosoma* Swainson, Nat. hist., 1839, 2, p. 839.

*Chaetomus* McClelland, Calcutta journ. nat. hist., 1844, 4, p. 405.

*Leptonurus* Bleeker, Verh. Batav. genootsch., 1849, 21, p. 114.

*Osteoglossum* Basilewski, Nouv. mem. Soc. nat. Mosc., 1855, 10, p. 244.

TYPE.—*Colia hamiltoni* Gray.

This genus is divisible into two groups, the typical one with the

maxillary barely reaching the gill-opening, the other (*Chaetomus*) with the maxillary extending beyond root of pectorals.

### COILIA MYSTUS (Linné).

*Clupea mystus* Linné, Syst. nat., ed. 10, 1758, 1, p. 319.

*Mystus clupeioides* Lacépède, Hist. nat. poiss., 1803, 5, p. 467.

*Coilia clupeioides* Günther, Cat., 1868, 7, p. 404.

*Coilia nasus* Schlegel, Fauna Japonica. Pisces, 1846, [4], p. 243, pl. 100, fig. 4.

Günther, Cat., 1868, 7, p. 405.

Head 6.1; depth 6.1; dorsal I, 13; anal 80; ventral 7.<sup>1</sup> Six long pectoral filaments. Scales caducous, about 62 (pockets counted). Ventral profile of belly rather strongly curved, its margin sharp and armed with forty-four (17 + 27) sharp scutes. Eye 5.5 in head, being distinctly less than snout even in the young. Snout projecting, pointed, its length 3.7 in head. Mouth large, the maxillary extending to the middle of the axil of the pectoral, even in the young of 110 mm. Its length is distinctly more than head, being 5.7 in the standard length, it is broadened at the mandibular joint, but its posterior half is pointed and armed with strong teeth. The length of the mandible equals the head posterior of the middle of the eye. Teeth distinct in jaws, vomer, palatines, and pterygoids, those of the lower jaw quite small. Gill-membranes not broadly united. Gill-rakers twenty-four on the lower limb of the first arch, the longest equal to, or slightly more than eye. Opercle with a distinct oblique ridge extending back across its upper portion, anteriorly this unites with a second ridge which extends down and back. Length of opercle 3 in head, its width 1.7 in its length. Depth of V on cheeks 3.5 in head. Origin of the dorsal midway between the end of the snout and the 12th anal ray. Its base 1.8 in its longest ray, which is equal to the head posterior of the nostril. Origin of the ventrals distinctly anterior to origin of the dorsal, being a third nearer to origin of the pectoral than to origin of the anal. Length of ventral 2 in head. Origin of the pectoral is much nearer to ventrals than to eye, its length (not of filaments) almost equal to head, and its tip extending to tip of ventrals. Filaments extending to anterior third of anal, the longest 3 in the standard length. Origin of the anal posterior to the last dorsal ray by a distance which is equal to head behind the pupil. Caudal forming a tip, its upper lobe much the longest, its lower lobe united with anal.

Color silvery, without spots, back brownish, no silver lateral stripe.<sup>2</sup>

M. C. Z. 934. China: Hongkong. Augustine Heard. One specimen. Length 275 mm.

<sup>1</sup> These measurements are based on the standard length of the fish, which is the distance between tip of snout and end of last caudal vertebrae.

<sup>2</sup> Unless otherwise stated the colors are described from alcoholic specimens.

M. C. Z. 31,405. Mongolia: Port Arthur. Stanford University. Five specimens. Length 110-194 mm.

M. C. Z. 31,531. Japan: Tokio. Shigeo Tanaka. Four specimens. Common in southern Japan and China.

#### COILIA DUSSUMIERI Cuvier and Valenciennes.

Hist. nat. poiss., 1848, **21**, p. 81. Günther, Cat., 1868, **7**, p. 304. Day, Fishes of India, 1888, p. 631. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, **2**, p. 50. Bleeker, Atlas ichthy., 1872, **6**, p. 140.  
*Leptonurus chryso stigma* Bleeker, Verh. Batav. genootsch., 1849, **23**, p. 14.

Head 5.5; depth 5.2; dorsal I, 14; anal 107; ventral 7. Six long pectoral filaments. Body pointed. Scales caducous about 65-68 in lateral series (pockets counted). Profile of belly moderately curved, its margin sharp and armed with twelve (5 + 7) strong scutes. No scutes in front of pectorals. Eye equal to snout, 4.5 in head. Imperforated adipose eyelid present. Mouth large, the maxillary ending at gill-openings, its tip pointed, its length equal to head posterior of the nostrils, being 6.5 in the standard length. Mandible equal in length to the head posterior of the middle of the eye. Teeth in jaws, vomer, palatines, pterygoids, and hyoid. The teeth of jaws small but distinct. Gill-rakers twenty-two on the lower limb of the first arch, the longest 1.2 in eye, these are slim, pointed, and spinulose on the inner margin. V of cheeks 3 in head. Opercle with three to five indistinct grooves radiating back on its upper half. Length of opercle 3 in head, its width 1.5 in its length. It is largely covered by sub- and preopercular bones. Origin of the dorsal is midway between tip of the snout and a vertical line with the base of the 23rd anal ray. (Rays broken in specimens studied). Origin of the ventral is directly below the solitary spine in front of the dorsal, being midway between origin of the pectoral and the origin of the anal, its length 2.7 in head. Origin of the pectoral much nearer to ventrals than to eye, its longest ray (not the filament) equal to head posterior of the middle of eye, its tip not reaching the tip of the ventrals. The longest filament extends to anterior third of anal, its length being 3.2 in the standard length. Origin of the anal posterior of the last dorsal ray by a distance about equal to eye. Caudal ending in a tip, its upper lobe much the longer, the lower lobe united to anal by membrane.

Color silvery, below the median line there is a row of pearl-white round spots, nineteen on one side and twenty-one on the other, the number varying from seventeen to twenty-one in the same specimen. Below this row is the second row, irregular in shape. Eight to ten pearly spots on the sides of the belly, followed posteriorly by fifteen to nineteen golden yellow spots which extend to the caudal.

M. C. Z. 1,136. Straits Settlements: Singapore. C. L. Salmin. Four specimens.

M. C. Z. 17,975. Ceylon: Colombo. W. H. A. Putnam. Four specimens. Length 90-110 mm.

COILIA GRAYI Richardson.

Zoölogy voy. Sulphur. Ichthy., 1845, no. 10, p. 99, fig. 1, 2.

Head 6; depth 5.3; dorsal I, 13; anal 86; ventral 7. Seven long pectoral filaments. Scales 62, the grooves incomplete; there is a net-work of lines posteriorly. Ventral profile curved, its margin compressed and armed with forty (16+24) sharp scutes, seven of which are in front of pectorals. Eye equal to snout, its length 4.5 in head. Mouth large, the maxillary long, extending to below the axil of the pectoral, its length therefore much greater than head, being 4.7 in the standard length. Maxillary broadened at maxillary joint, the posterior portion being sharp pointed and armed with strong teeth. Mandible ending below the anterior margin of the opercle, its length equal to head posterior of the middle of eye. Teeth distinct in jaws, vomer, palatines, pterygoids, and hyoids, the largest ones being on the posterior portion of the maxillary. Gill-membranes not broadly united. Gill-rakers thirty on the lower limb of the first arch, the longest 1.5 in eye. These are flat, thin, and round pointed, spinulose on their inner side. Opercle with a short, oblique ridge, ending in a buried spine on the upper anterior portion. Length of opercle 3 in head, its width 1.9 in its length, its posterior margin slightly concave and with a broad membrane. Origin of the dorsal midway between the snout and a line with the base of the 18th anal ray, its longest ray much greater than the base of the fin, being equal to head behind nostrils. Origin of the ventrals but slightly anterior to origin of the dorsal being much nearer origin of the pectoral than to anal, its length equal to distance from tip of snout to posterior margin of eye. Origin of the pectoral much nearer to ventrals than to posterior margin of eye, its length (without the filaments) being equal to head posterior of the middle of the eye, its longest filament extending to anterior third of anal being 2.9 in the standard length. Origin of the anal posterior of the last dorsal ray by a distance of 2 in head. Anal united by membrane to caudal. Caudal pointed, but in reality it is forked with the upper lobe much the longer and the lower lobe which has been considered by many as a part of the anal with which it is joined.

Color silvery, grayish above. No silvery stripe. (M. C. Z. 23,281).

M. C. Z. 18,051. China. Two specimens.

M. C. Z. 18,053. China: Hongkong. W. H. A. Putnam. Four specimens. Length 170-250 mm.

M. C. Z. 23,281. China. J. D. Davis. Ten specimens. Length 185-245 mm.

M. C. Z. 31,532. ———. Jeffries Wyman Coll. One specimen.

## COILIA RENDAHLI, sp. nov.

Head 6.2; depth 6.5; dorsal I, 14; anal 92; ventral 7. Six long pectoral filaments. Scales caducous (75 pockets counted). Ventral profile moderately curved, its margin sharp and armed with fifty-two (17 + 35) strong scutes some of which are in front of pectoral. Eye equal to snout which is 4.1 in head. The snout is produced and sharp pointed. Imperforated adipose eyelid present. Mouth large, the maxillary ending at gill-openings, its length being equal to the head posterior of the nostrils or 7.1 in the standard length. The maxillary is somewhat broadened at mandibular joint, but the tip is pointed. Length of mandible equal to the head posterior of the middle of the eye. Teeth distinct in jaws, vomer, palatines, and pterygoids, those on the posterior portion of the maxillary being the largest. Gill-membranes not broadly united. Gill-rakers twenty-four on the lower limb of the first arch, the longest being 1.3 in eye, these are thin narrow, pointed, the inner margin spinulose. Opercle with some fine striae radiating back on its upper portion, also a short oblique ridge which terminates in a buried spine located on the upper anterior portion. Length of opercle 2.9 in head, its width 1.7 in its length. Depth of the V of the cheeks 2.7 in the head. Origin of the dorsal midway between tip of snout and a vertical line with the base of the 15th anal ray, its longest ray more than the base of the fin, being equal to head without the snout. Origin of the ventral but slightly anterior to the origin of the dorsal, being a third nearer to origin of the pectoral than to origin of anal, its length 2.1 in head. Origin of the pectoral distinctly nearer to ventrals than to eye, its length (without filaments) is equal to head posterior of nostrils, its tip falling short of the tip of ventrals. Filaments reaching posterior to origin of anal, the longest 3 in the standard length. Origin of the anal posterior of the last dorsal ray by a distance equal to head, anal connected to lower caudal ray by membrane. Caudal pointed, its upper lobe much the longer, the lower lobe united with anal. Length of caudal equal to head without snout.

Color silvery, without spots, somewhat brownish above. No silvery lateral stripe.

TYPE.—M. C. Z. 18,052. China: Shanghai. One specimen. Length 250 mm.

PARATYPES.—M. C. Z. 31,530. (Orig. 18,052). China: Shanghai. Five specimens. Length 127–150 mm.

This species, named for Hjalmar Rendahl, is near *Coilia brachygnathos* Kreyenberg and Pappenheim (1909), but that species has fifty-eight ventral serrae and 101 rays in the anal fin, thus approaching *Coilia ectenes* Jordan and Seale from Korea.



## DEMICOILIA Jordan and Seale.

Copeia, 1925, no. 141, p. 28.

Similar to *Coilia*, but with the posterior half of the body short and ending normally not far behind the dorsal, not prolonged and pointed as in *Coilia*. The depth at the base of the caudal is two to three in the depth at front of the dorsal. Anal relatively short, of thirty-five to forty rays, its posterior ray attached to the lower lobe of caudal. Pectoral filaments present. A short, free dorsal spine. Maxillary extending at least to joint of mandible. Snout pointed, projecting. Scales more or less caducous.

TYPE.—*Demicoilia quadragesimalis* Cuvier & Valenciennes.

The type has forty-two anal rays, hence the specific name. No pearly spots are mentioned.

## DEMICOILIA MARGARITIFERA, sp. nov.

Head 3.7; depth 3.3; dorsal I, 13; anal 35; ventral 7. Body elongate, though much shorter than in *Coilia*. Depth in front of caudal 2 in head. Six pectoral filaments. Scales caducous (about 35 pockets counted). Ventral profile moderately curved, the margin compressed and armed with thirteen (5 + 8) strong scutes. No scutes in front of pectoral. Eye 4.2 in head. Snout pointed, projecting, its length 5 in head. Mouth large, the maxillary extending posterior to mandible to, or almost to, the gill-openings, its length equal to head behind the nostrils, or four in standard length. It is broadened at the mandibular joint, from which point the upper margin curves abruptly down and extends back forming a sharp point. Mandible equal to the head posterior of the front margin of eye. Teeth small in jaws, palatines, pterygoids, and hyoids; there seems to be small, probably deciduous, teeth in the vomer. Gill-membranes not broadly united. Branchiostegals ten. Gill-rakers twenty-three on the lower limb of the first arch, the longest 1.1 in eye; these are thin and pointed, with their inner margin spinulose. V-formed area of cheeks distinct, its depth 3 in head. Opercle with four or five radiating grooves on upper half, the posterior margin slightly concave. Length of opercle 2.5 in head, its width 1.5 in its length. Origin of the dorsal midway between the tip of snout and base of caudal, its base 2.5 in the length of head. The rays broken in type. Origin of the ventral slightly anterior to dorsal being nearer to origin of the pectoral than to origin of the anal, its length 2.7 in head. Origin of the pectoral slightly nearer to ventrals than to eye, its tip extending beyond ventrals. Origin of the anal posterior to the last dorsal ray by a distance equal to eye. Caudal large, its length more than head; lower lobe attached to anal.

Color silvery, brownish on sides and back. Two rows of pearl colored spots

below the median line, extending from head to caudal, the upper row of eighteen to nineteen round spots, the lower row of sixteen to eighteen spots some of which may be golden yellow. On the sides of the belly below these two rows is a third irregular row of eight or nine spots; there are also four or five spots on thorax and four or five on the under jaw.

TYPE.—M. C. Z. 31,533 (Orig. 17,975). Ceylon: Colombo. W. H. A. Putnam. One specimen. Length 97 mm.

#### STETHOCHAETUS Gronow.

Catalogue of fishes, 1854, p. 174.

*Heterothrissa* Günther, Cat., 1868, 7, p. 401.

TYPE.—*Stethochaetus biguttatus* Gronow.

This genus is very close to *Setipinna*, differing mainly in the projecting lower jaw, which is longer than in any other of the *Engraulidae*. Anal fin many-rayed, inserted before front of dorsal.

East Indies.

#### STETHOCHAETUS BREVICEPS (Cantor).

*Engraulis breviceps* Cantor, Journ. Asiatic soc. Bengal, 1850, 18, p. 1288.

Günther, Cat., 1868, 7, p. 401. Day, Fishes of India, 1888, p. 628.

*Setipinna breviceps* Bleeker, Atlas ichthy., 1872, 6, p. 137. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, 2, p. 29.

*Engraulis pfeifferi* Bleeker, Nat. tijd. Neder-Ind., 1852, 3, p. 433.

*Colia pfeifferi* Sauvage, Bull. Soc. philom., 1882, ser. 7, 6, p. 175.

This species we have not seen.

#### STETHOCHAETUS BIGUTTATUS Gronow.

Catalogue of fishes, 1854, p. 174.

This species, said to have thirty-six anal and eleven dorsal rays, is not recognized by recent writers. The number thirty-six is no doubt a misprint, probably for sixty-three. The pectoral filament is said to be as long as the body; the lower jaw projects, and there are two dark blotches on the side. Except for this color-mark we would think the nominal species was based on *Stethochaetus breviceps*.

#### SETIPINNA Swainson.

Nat. hist., 1839, 2, p. 292.

*Telara* Günther, Cat., 1868, 7, p. 400.

TYPE.—*Clupea telara* Hamilton.

This genus is at once distinguished by the very long uppermost ray

of the pectoral and by the very long anal fin which begins in front of the middle of the dorsal, sometimes in advance of that fin; lower jaw included.

Vertebrae forty-five or forty-six. Body rather elongate, deep anteriorly, narrowed behind; scales caducous. Ventral margin sharp, armed throughout with strong scutes. Maxillary of moderate length, broadened behind, not reaching beyond gill-opening. Teeth small, even. A small free spine before dorsal; upper ray of pectoral reaching to tip of ventrals or beyond. Anal fin very long, of fifty to seventy-five rays, its origin just before or just behind front of dorsal. No silvery stripe.

East Indies.

#### SETIPINNA TELARA (Hamilton).

*Clupea phasa* Hamilton, Fishes Ganges, 1822, p. 240, 382.

*Clupea telara* Hamilton, Fishes Ganges, 1822, p. 241, 382, pl. 2, fig. 272.

*Setipinna megalura* Swainson, Nat. hist., 1839, 2, p. 292.

*Engraulis brevifilis* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 54.

Head 6.1; depth 3.8; dorsal I, 14; anal 77; ventral 7. Vertebrae fifty-six. Pectorals large, the upper ray filiform and extending to near middle of base of anal. Scales caducous, about 54 in a lateral series. The grooves on the anterior half of each scale incomplete; the entire posterior half of scale covered with a net-work of lines, there being about ten rows of "eyes" (the term applied by fishermen to each unit of a net). Ventral profile but little curved, except the lower portion of head and below pectorals. Ventral margin very sharp and armed with nineteen (13 + 6) strong scutes. Eye 5.5 in head. An adipose eyelid covering eye. Snout little projecting, equal to eye, the jaws are practically equal. Mouth large and placed at an angle of about seventy degrees. Maxillary ending slightly posterior to distal end of mandible, but falling short of the gill-openings, its length equal to head posterior of the nostrils, its tip obliquely truncate. Mandible ending below the anterior margin of the preopercle, its length equal to head posterior of the nostrils. Teeth small, but distinct on jaws, palatines, vomer, pterygoid, and hyoid. No canines. Gill-rakers twenty-one on the lower limb of the first arch; these are wide, flat, curved, and dull pointed, their inner margin spinulate, the longest scarcely equal to eye. Opercle with three or four rather distinct grooves on its lower half and some fine longitudinal lines on its upper half. A short distinct ridge, ending in a buried spine on the upper anterior portion. Length of opercle 1.5 in head, its depth 2.5 in its width. The V of cheeks distinct, its depth 1.9 in head. Origin of the dorsal much nearer tip of snout than to posterior end of anal, its longest ray more than the base of the fin, being equal to head. Origin of ventral anterior to dorsal, but much nearer to anal than to

origin of pectoral, its length 2.5 in head. Origin of the pectoral midway between ventral and middle of eye, its length (without upper ray) equal to dorsal, its tip extending to middle length of ventrals. Origin of anal is distinctly anterior to origin of the dorsal, its base 1.7 in standard length. Caudal forked (its rays broken in the specimen studied).

Color silvery, somewhat darker above; in some specimens the ventrals are black, in others there is but little color. Margin of caudal dark.

M. C. Z. 18,050. Burma: Rangoon. W. H. A. Putnam. Two specimens. Length 215, 240 mm.

India.

#### SETIPINNA TATY (Cuvier and Valenciennes).

*Engraulis taty* Cuvier & Valenciennes, Hist. nat. poiss., 1848, **21**, p. 60.

Cantor, Journ. Asiatic soc. Bengal, 1850, **18**, p. 1288. Günther, Cat., 1868, **7**, p. 400. Day, Fishes of India, 1888, p. 628.

*Setipinna taty* Bleeker, Atlas ichthy., 1872, **6**, p. 136. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, **2**, p. 30.

Head 5; depth 3.1; dorsal I, 14; anal 51; ventral 7. Vertebrae forty-six. The upper pectoral ray is filiform and extends about to middle of base of anal. Scales 48. The scales are peculiar in that the entire surface is covered with a fine net-work of lines. Such markings are usually confined to the posterior half or two thirds of the scale, in most species of this family. Ventral profile moderately curved, the margin sharp and armed with thirty-four (?23 + 10) scutes. Eye 4.1 in head, entirely covered with an adipose eyelid. Snout but slightly produced, its length 1.5 in the eye. Mouth large, the maxillary ending slightly posterior to end of mandible, its tip wide and obliquely truncate, its length equal to head posterior to anterior margin of the eye. Mandible ending below the lower anterior margin of the preopercle, its length slightly less than maxillary. Teeth small and distinct in jaws, palatines, pterygoids, vomer, and hyoid, no canines. Gill-rakers eighteen on the lower limb of the anterior arch, these flat, thin, the inside margin ratchet-like and spinulate, the longest equal to eye. Opercle with three or four light striae and one distinct groove on its lower half, a notch on the posterior border, a short buried spine on the upper anterior portion, and some light longitudinal lines on upper portion. Length of opercle 1.9 in head, its width 2.7 in its length. V of the cheeks distinct, its depth 2.2 in head. Origin of the dorsal midway between tip of snout and anterior end of caudal peduncle, its longest ray about twice the base, being equal to head posterior of the nostrils. Origin of ventrals anterior to dorsal being midway between origin of pectoral and ventrals, its length 2.5 in head. Origin of the pectoral midway between origin of ventral and middle of eye, its second ray about equal to longest dorsal ray, its tip extending to ventral.

Origin of anal is below the base of the 6th dorsal ray, its base 2.3 in its standard length. Caudal forked, its length more than head. No alar scales.

Color silvery, slightly darker above.

M. C. Z. 4,412. Siam. C. L. Salmin. Two specimens. Length 108, 118 mm.

M. C. Z. 24,863. Java. One specimen. Length 128 mm.

M. C. Z. 31,534 (Orig. 17,975). Ceylon: Colombo. W. H. A. Putnam. Nine specimens. Length 94-152 mm.

India.

### THRISOCLES Jordan and Evermann.

Genera of fishes, 1917, p. 98.

*Thrissa* Cuvier, Règne anim., 1817, 2, p. 176.

*Thryssa* Cuvier, Règne anim., ed. 2, 1829, 3, p. 38.

TYPE.—*Clupea setirostris* Broussonet.

This genus is distinguished from *Stolephorus* and related forms by the excessively long maxillary which extends beyond base of pectorals, in some species to base of anal. Vertebrae forty to forty-two. Body rather deep and compressed. The ventral margin armed with strong scutes from gill-opening to vent. Teeth small, even. Gill-rakers few, ten to eighteen; anal rays thirty-five to forty. Pectorals reaching ventrals. Origin of anal below last rays of dorsal; a free dorsal spine. No silvery lateral stripe.

East Indies.

### THRISOCLES SETIROSTRIS (Broussonet).

*Clupea setirostris* Broussonet, Ichthy., 1782, dec. 1.

*Engraulis setirostris* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 69.

Günther, Cat., 1868, 7, p. 379. Bleeker, Atlas ichthy., 1872, 6, p. 134.

Day, Fishes of India, 1888, p. 626. Günther, Fisch. Südsee, 1909, 8, p.

379. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, 2, p. 40.

*Stolephorus setirostris* Bleeker, Nat. tijd. dierk., 1865, 2, p. 291.

*Anchovia setirostris* Jordan & Richardson, Bull. U. S. bur. fish., 1908, p. 237.

*Thrissa macrognathus* Bleeker, Verh. Batav. genootsch., 1849, 22, p. 14.

This species we have not seen. A good account is given by Günther.

## THRISSOCLES DUSSUMIERI (Cuvier and Valenciennes).

*Engraulis dussumieri* Cuvier & Valenciennes, Hist. nat. poiss., 1848, **21**, p. 69. Bleeker, Verh. Batav. genootsch., 1852, **24**, p. 43. Kner, Novara exped. Fish., 1867, p. 333. Day, Fishes of India, 1888, p. 627. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, **2**, p. 41.

*Engraulis mystax* Günther, Cat., 1868, **7**, p. 397.

Head 4; depth 3.5; dorsal I, 14; anal 35; ventral 7. Vertebrae forty-one. Posterior two anal rays are somewhat thickened and united. Scales 40 caducous, almost as long as deep, the anterior half of each scale with five or six complete grooves, and three or four that are incomplete. Any or all of these may be more or less branched into a large rayed net-work. Ventral profile but little curved, its margin sharp and armed with twenty-three (16 + 7) distinct scutes. Eye 4 in head. Snout slightly projecting, its length 1.3 in eye. Mouth large, the maxillary extending to near the tip of ventrals, its length 2.5 in standard length. Mandibles ending below anterior border of preopercle, its length equal to head behind anterior margin of pupil. Teeth distinct, but small in jaws, vomer, palatines, pterygoid, and hyoid. No canines. Gill-rakers eighteen on the lower limb of the first arch, the longest scarcely equal to eye; these are flat, wide, and curved, the inner margin ratchet-like and spinulate. Opercle with a distinct groove near and parallel with its anterior margin, a hidden spur on upper anterior portion. V of cheek distinct, its depth 2.5 in head. Origin of the dorsal is nearer tip of snout than to end of caudal vertebra, its longest ray almost twice the length of the base of the fin, being greater than head behind eyes. Ventral anterior to dorsal, being nearer to origin of pectoral than to anal, its length 2.1 in head. Origin of pectoral nearer to ventral than to eye, its length equal to head behind eyes, its tip reaching to ventrals. Origin of anal under the last dorsal ray or very slightly posterior, its base 3 in the standard length. Caudal forked, much longer than head. No alar scales.

Color silvery, brownish above, no distinct markings.

M. C. Z. 17,972. Penang. W. H. A. Putnam. Four specimens. Length 110-125 mm.

M. C. Z. 17,973. Penang. W. H. A. Putnam. One specimen. Length 100 mm.

## LYCOTHRISSA Günther.

Cat., 1868, **7**, p. 399.

TYPE.—*Engraulis crocodilus* Bleeker.

This genus is separated from related genera by the posterior origin of the dorsal, which is behind the origin of the anal, and by the teeth of the lower jaw, which are large and canine-like.

The genus is characterized by Weber and Beaufort as follows (Fish. Ind. Austr. arch., 1913, 2, p. 31):—

Elongate, compressed, scales moderately thin, deciduous, with irregular curved, transverse lines. Abdominal scutes only between pectoral and anus. Snout prominent. Mouth oblique. Head small. Maxillary narrow, extending to mandibular joint, its supplemental bone only partially ossified. Origin of the dorsal behind the origin of the anal, which is very long. Upper pectoral rays not produced. Teeth small on vomer, palatines, and pterygoids, those in jaws caninoid, especially a few in the lower jaw.

We have seen no species of this East Indian genus.

#### LYCOTHRISSE CROCODILUS (Bleeker).

*Engraulis crocodilus* Bleeker, Nat. tijd. Neder-Ind., 1851, 1, p. 15. Günther, Cat., 1868, 7, p. 400.

*Lycothrissa crocodilus* Bleeker, Atlas ichthy., 1872, 6, p. 125. Weber & Beaufort, Fish. Ind. Austr. arch., 1913, 2, p. 31.

This species is well described by Günther.

#### XENENGRAULIS Jordan and Seale.

Copeia, 1925, no. 141, p. 29.

TYPE.—*Xenengraulis spinidens* Jordan & Seale.

This genus is near *Scutengraulis*, differing in the presence of canine teeth, as in *Lycothrissa* and *Lycengraulis*.

#### XENENGRAULIS SPINIDENS Jordan and Seale.

Copeia, 1925, no. 141, p. 29.

Head 5; depth 3.2; dorsal I, 13; anal 46; ventral 7. Vertebrae forty-eight. Scales about 42-12, caducous, the grooves incomplete with very little net-work of lines showing. Body compressed, deep, the ventral margin very sharp and armed with twenty-seven (16 + 11) strong, exposed scutes six or seven of which are in front of the pectorals; eye 4.6 in head. Snout deep, not projecting beyond the lower jaw, its length 1.4 in eye. Mouth large, the maxillary extending posterior to gill-openings, but falling a little short of the base of the pectorals, its length equal to head; it is swollen at the mandibular joint, but the tip is pointed. Mandible equal to head posterior of the middle of the eye. Teeth large, canine-like, not close set, there being only about fifteen on each side of the lower jaw. These are fully as large as the teeth in *Lycengraulis grossidens*. Teeth of the maxillary somewhat less than those of the mandible, but still quite large anteriorly, graduating to small teeth on the posterior end.

Small teeth in vomer, palatines, pterygoids. Gill-rakers fourteen on the lower limb of the first arch, the longest 1.2 in eye, they are thin, curved, rounded at the tip with the inner margin spinulose. Opercle smooth except a single groove near and parallel with its anterior margin and a small hidden spine on its upper anterior portion. There is a distinct notch in the lower posterior border. Length of opercle 1.9 in head, its width 2.1 in its length. V of cheeks distinct, its depth 2.6 in head. Origin of the dorsal midway between the end of caudal vertebra and the posterior margin of eye, its base 1.9 in its longest ray. Origin of ventral far anterior to dorsal, being much nearer to origin of the pectoral than to anal pore, its length greater than distance from tip of snout to posterior margin of the eye. Origin of the pectoral about midway between origin of ventrals and posterior margin of the eye, its length equal to head without snout, its tip reaching to middle of ventral. Origin of anal is below the last ray of dorsal, its base 2.8 in the standard length. Caudal forked, its length slightly more than head, its lower lobe the longest. Enlarged scales at base of caudal.

Color silvery, brownish above, no dark venules on scapular region.

TYPE.—M. C. Z. 4,413. Siam. Length 208 mm.

PARATYPES.—M. C. Z. 1,541 (Orig. 4,413). Siam. Two specimens. Length 191, 207 mm.

M. C. Z. 18,054. India: Calcutta. W. H. A. Putnam. One specimen. Length 185 mm.

M. C. Z. 31,543 (Orig. 17,967). Burma: Rangoon. William Theobald. Two specimens. Length 175, 190 mm.

#### SCUTENGRAULIS Jordan and Seale.

Copeia, 1925, no. 141, p. 30.

TYPE.—*Thrissa hamiltoni* Gray.

Ventral scutes strong and exposed from head to anal pore. A distinct free spine in front of dorsal. Vertebrae forty-five. Body thin, deep and compressed to the sharp ventral margin which is armed with strong exposed scutes from head to vent. Scales thin, more or less caducous. Maxillary ending between the mandibular joint and axil of pectoral, usually extending beyond gill-openings. Teeth small and even. Gill-rakers wide set, few, twelve to twenty-five. Origin of anal under or slightly behind the posterior portion of dorsal. Sides usually without silvery stripe. Anal fin long, of about forty rays.

#### SCUTENGRAULIS MYSTAX (Bloch and Schneider).

*Clupea mystax* Bloch & Schneider, Syst. ichthy., 1801, p. 426, tab. 83.

*Engraulis mystax* Bleeker, Atlas ichthy., 1872, 6, p. 132. Day, Fishes of India, 1888, p. 625.



*Thryssa porava* Bleeker (*nec* Hamilton), Verh. Batav. genootsch., 1849, **22**, p. 14.

*Trichosoma porava* Rutter, Proc. Acad. nat. sci. Phil., 1897, p. 65.

*Engraulis mystacoides* Bleeker, Verh. Batav. genootsch., 1852, **24**, p. 42.  
Günther, Cat., 1868, **7**, p. 396.

*Engraulis hamiltoni* Kner (*nec* Gray), Novara exped. Fish, 1867, p. 334.

Head 4.1; depth 3.5; dorsal I, 14; anal 39; ventral 7. Vertebrae forty-six. Scales 45-12, caducous. Body compressed, the ventral profile about evenly curved with the dorsal, the ventral margin sharp and armed with twenty-nine (18 + 11) sharp scutes which extend anterior to pectoral. Eye 3.7 in head, imperforated adipose eyelid present. Snout but little projecting, its length 1.2 in eye. Mouth large, the maxillary extending somewhat posterior of the gill-openings but falling short of the base of pectoral, its length equal to head posterior of the nostril. Mandible equal to head posterior of the anterior margin of the pupil. Teeth very small in jaws, vomer, palatines, and pterygoids. No canine-like teeth. Gill-membranes not broadly united. Gill-rakers twelve on the lower limb of the first arch; these are flat, curved, not very sharp pointed, and with the inner margin spinulose, the longest raker 1.5 in eye. Opercle is smooth except a single groove near and parallel with its anterior margin. Length of opercle 2.1 in head, its width 2.1 in its length, its posterior border slightly subconcave on its lower half. V of cheeks distinct, its depth 2.6 in head. Origin of dorsal is midway between the end of the caudal vertebra and the anterior margin of eye; the base of the dorsal is 1.8 in its longest ray. Ventral anterior to dorsal, being slightly nearer to origin of pectoral than to origin of anal, its length equal to distance from tip of snout to posterior margin of the pupil. Origin of pectoral slightly nearer the ventrals than to eye, its length equal to head posterior of the anterior margin of the pupil, its tip reaching ventrals. Origin of anal is under the last ray of dorsal, its base 2.9 in the standard length. Caudal forked, its length about equal to head. Alar scales present.

Color silvery, brownish above. No silvery lateral stripe. Dark punctulations on posterior portion of jaws, and tip of dorsal and caudal.

M. C. Z. 1,107. Java. C. L. Salmin. One specimen. Length 152 mm.

M. C. Z. 30,349. Penang. L. P. Ward. One specimen.

Externally this species most nearly resembles *S. malabaricus* (Cuvier and Valenciennes). The latter species, however, has twenty-five gill-rakers, fewer vertebrae (44), shorter maxillary, and the dorsal is located a little farther forward.

#### SCUTENGRAULIS HAMILTONI (Gray).

*Thryssa hamiltoni* Gray (*nec* *Engraulis hamiltoni* Gray), Illustr. Ind. zoöl., 1836, **2**, tab. 5, fig. 6.

- Engraulis hamiltoni* Günther, Cat., 1868, 7, p. 395. Day, Fishes of India, 1888, p. 625. Vinciguerra, Ann. Mus. civ. Genova, 1885, ser. 2, 2, p. 94.
- Stolephorus hamiltoni* Bleeker, Nat. tijd. dierk., 1863, 1, p. 261.
- Trichosoma hamiltoni* Rutter, Proc. Acad. nat. sci. Phil., 1897, p. 66.
- Anchovia hamiltoni* Jordan & Richardson, Bull. 27, U. S. bur. fish., 1908, p. 236.
- Engraulis grayi* Bleeker, Verh. Batav. genootsch., 1852, 24, p. 41. Kner, Novara exped. Fish., 1867, p. 333.
- Engraulis poorawah* Bleeker, Atlas ichthy., 1872, 6, p. 152.

Head 4.5; depth 3.2; dorsal I, 15; anal 40; ventrals 7. Vertebrae forty-five. Scales forty-five persistent, the grooves incomplete, a net-work of lines on the posterior portion of the scale. Body compressed, the ventral profile but little curved, the margin sharp and armed with twenty-seven (17 + 10) scutes, which are, however, not very prominent, being almost hidden by the scales; they extend anterior to pectorals. Eye 3.5 in head. Snout not projecting beyond tip of lower jaw; its length 1.2 in eye. Mouth large, the maxillary extending posterior to gill-openings, but falling short of the base of the pectorals, its length equal to head posterior of nostrils. Mandible equal to head posterior of the anterior margin of the pupil. Very small teeth in jaws, vomer, palatines, and pterygoids, those of jaws somewhat directed forward. No canine-like teeth. Gill-rakers twelve or thirteen on the lower limb of the first arch, the longest 1.5 in eye, these are thick, blunt, and spinulose on their inner side. Opercle smooth except a short buried spine on its upper anterior portion. Length of opercle 2.1 in head, its width 2.5 in its length, its lower anterior portion largely covered by the preopercle.

V of cheeks 1.7 in head. Origin of the dorsal midway between end of caudal vertebrae and the middle of eye; its base is contained 1.7 in its longest ray. Origin of ventrals anterior to dorsal, being midway between origin of the pectoral and the anal pore, its length equal to distance from tip of snout to middle of eye. Origin of the pectoral midway between the origin of the ventrals and the pupil, its length equal to head posterior of snout, its tip reaching ventrals. Origin of anal is under the last ray of dorsal, its base 3 in the standard length. Caudal forked, its length more than head, its lower lobe the longest.

Color silvery, brownish above; no silvery lateral stripe. Scapular region with dark venules. Under jaw powdered with dark dots.

M. C. Z. 17,969. India: Calcutta. W. H. A. Putnam. Two specimens. Length 187-191 mm.

M. C. A. 17,970. Penang. W. H. A. Putnam. One specimen. Length 170 mm.

M. C. Z. 31,535 (Orig. 17,972). Penang. W. H. A. Putnam. Eleven specimens. Length 135-140 mm.

M. C. Z. 31,537 (Orig. 17,972). Penang. W. H. A. Putnam. Ten specimens. Length 130-159 mm.

M. C. Z. 31,538 (Orig. 17,975). Ceylon: Colombo. W. H. A. Putnam. Three specimens. Length 105-140 mm.

China to east coast of India. Common.

#### SCUTENGRAULIS PURAVA (Hamilton).

*Clupea purava* Hamilton, Fishes Ganges, 1822, p. 138, 382.

*Engraulis purava* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 65.

Cantor, Journ. Asiatic soc. Bengal, 1850, 18, p. 1290. Günther, Cat., 1868, 7, p. 397. Bleeker, Atlas ichthy, 1872, 6, p. 135. Day, Fishes of India, 1888, p. 628.

Head 4.3; depth 3.7; dorsal I, 14; anal 40; ventral 7. Scale caducous, the scale-pits thirty-eight. Ventral profile moderately curved, the margin compressed and armed with twenty-six (17 + 9) sharp scutes. Eye 3.7 in head. Snout projecting, 1.7 in eye. Mouth large, the maxillary extending to below the lower axil of the pectoral, its tip sharp pointed; it is expanded above mandibular joint, its length distinctly more than head, mandible ending below anterior margin of preopercle, its length equal to head posterior of snout. Teeth distinct in jaws, vomer, palatines, pterygoid, and hyoids. No canines. Gill-rakers seventeen on the lower limb of the first arch. These are flat, strongly curved on their anterior third, the tip rounded, the inner margin spinulose, the longest raker 1.5 in eye. Opercle smooth except a groove near its anterior margin, and a short oblique ridge ending in a hidden spine on its upper anterior portion. Length of opercle 2 in head, its width 2.3 in its length. V of cheeks distinct; its depth 2.7 in head. Origin of dorsal midway between end of caudal vertebra and the nostril, its longest ray more than base of the fin, being about equal to head posterior of eye. Origin of ventrals anterior to dorsal, being nearer to origin of pectoral than to anal pore, their length equal to the distance from tip of snout to middle of eye. Origin of the pectoral is midway between origin of the ventrals and eye, its length about equal to postorbital portion of head, its tip reaching ventrals. Origin of the anal is under the posterior ray of dorsal, its base 3 in the standard length. Caudal forked, its length about equal to head.

Color silvery, brownish above; no distinct silvery lateral stripe. A dark venule on scapular region.

M. C. Z. 31,536 (Orig. 1,107). Java. C. L. Salmin. Two specimens. Length 104, 106 mm.

East Indian Seas.

#### SCUTENGRAULIS VALENCIENNESI (Bleeker).

*Stolephorus (Thryssa) valenciennesii* Bleeker, Nat. tidj. dierk., 1866, 3, p. 306.

Head 4; depth 3.2; dorsal I, 13; anal 41; ventral 7. Scales thirty-four; the grooves are chiefly incomplete, although usually two or three are complete.

The distal half of the scale is covered with a peculiar lace-like pattern. Ventral profile but little rounded, the margin sharp and armed with fifteen (7 + 8) distinct keeled scutes, each ending in a sharp spine. Eye about a third longer than snout, being 3.7 in head. Adipose eyelid well developed. Mouth large, the snout slightly projecting, the under jaw included. Maxillary extending slightly posterior to base of pectoral, its length distinctly greater than head, being 3.5 in the standard length; its distal end is pointed and but little curved, two supplemental bones present, fine teeth on its lower margin. Mandible ending under the middle of opercle, its length 1.2 in head, its greatest depth 3.5 in its length. Fine teeth in jaws, vomer, palatines, pterygoids, and tongue. Gill-rakers sixteen, the longest a fourth less than the eye. Posterior wall of the gill-chamber rounded, without soft dermal points. Opercle smooth, except a single ridge near its anterior border. Depth of opercle 2.1 in head, its width 2.7 in its length. Origin of the dorsal midway between tip of snout and base of caudal fin, its longest ray almost a half shorter than the base of the fin, being equal to distance from tip of the snout to the middle of the opercle. Origin of the ventral entirely in front of dorsal fin, being nearer to origin of the pectoral than to origin of the anal, its length equal to distance from tip of snout to posterior margin of the pupil. Origin of the pectoral midway between ventrals and the posterior margin of the eye, its length equal to distance from tip of snout to middle of opercle, its tip extending much beyond base of ventral. Base of anal long, 2.7 in the standard length. Caudal forked, about equal to length of head. No alar scales.

Color silvery, darker above with brownish shade.

Mus. Stanford Univ. 8,170. Sumatra. One specimen. Length 140 mm.

East Indies.

#### SCUTENGRAULIS MALABARICUS (Cuvier and Valenciennes).

*Engraulis malabaricus* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 63. Günther, Cat., 1868, 7, p. 395. Meyer, Ann. Soc. Esp. hist. nat., 1885, 14, p. 42. Day, Fishes of India, 1888, p. 625.

Head 4.5; depth 3.3; dorsal I, 14; anal 40; ventral 7. Vertebrae forty-five. Scales thirty-eight, persistent, the scale-grooves for the most part incomplete but overlapping, two or three grooves may be complete; the posterior third of the scale has ten or more closely-crowded, narrow lines, the four or five posterior lines forming a net-work on the apical margin. Ventral profile moderately rounded, the margin sharp and armed with twenty-four (15 + 9) sharp scutes. Imperforated adipose eyelid present. Snout short, slightly projecting, its length 1.7 in eye. Mouth large, maxillary ending below lower anterior margin of opercle, its tip slightly posterior to gill-openings, pointed but dilated at mandibular point, its length equal to head posterior of the

nostril. Mandible ending below lower anterior margin of the preopercle, its length equal to head posterior of the middle of eye. Teeth small, on jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-rakers twenty-five, the longest about equal to pupil; these are rather wide flat and inner margin with spinules. Opercle has indistinct striae radiating down and back, a very distinct double groove, parallel and near the anterior margin. Length of opercle 1.9 in head, its width 2.1 in its length, a shallow notch on its posterior border; V of cheeks distinct, its depth 3 in head (this is measured from eye to the inside of the apex of the angle). Origin of the dorsal midway between end of vertebra and the middle of eye, its longest ray almost twice the base of the fin, being about equal to head without the snout. Origin of the ventral anterior to dorsal, being nearer to origin of the pectoral than to the anal, its length equal to the distance from tip of snout to posterior margin of the pupil. Origin of pectoral midway between ventral and the middle of the eye, its length equal to the longest dorsal ray, its tip extending to ventrals. Origin of the anal is below the next to posterior dorsal ray, its base 3 in the standard length. Caudal forked, its length greater than head. No alar scales.

Color silvery, scapular region with black venules, tip of dorsal and caudal slightly dark. Pectorals with some dark dots.

M. C. Z. 4,290. India: Canara. Francis Day. One specimen. Length 168 mm.

#### SCUTENGRAULIS LONGIPINNIS (Heckel).

*Engraulis longipinnis* Heckel, Sitzber. Akad. wiss. Wien, 1853, **11**, p. 128.

To the neighborhood of *Scutengraulis* must belong *Engraulis longipinnis* Heckel from the Upper Miocene at Chiavenna. It is described as approaching *Engraulis malabaricus* Cuvier and Valenciennes. The depth of the body is greater than length of head, which is about 3 in length of body; the anal fin very long (hence the specific name) and equal to depth of body. Teeth fine, even. Type  $5\frac{1}{2}$  inches long. Nothing is said of the scutes or of the insertion of the dorsal, characters presumably as in *Scutengraulis malabaricus*. This is probably the oldest fossil anchovy known.

#### THRISSINA Jordan and Seale.

Copeia, 1925, no. 141, p. 30.

TYPE.—*Clupea boelama* Forskål.

Scutes small and almost hidden by the scales, and there are none in front of pectorals. Gill-rakers few.

Vertebrae thirty-nine or forty. Body only moderately compressed, not very deep. Ventral margin with scutes from pectoral to anal pore. These are of moderate size, but almost hidden by the ventral scales. Maxillary not extending posterior to root of mandible. Teeth small, even. Gill-rakers about twenty-three; anal rays thirty-two. A distinct, small, free spine in front of dorsal as in *Scutengraulis*. Origin of the anal posterior to last dorsal ray. Scales firm. No silvery stripe.

This Asiatic genus is between *Scutengraulis* and *Stolephorus*, distinguished from both by its limited ventral armature and from *Stolephorus* by the free dorsal spinule.

#### THRISSINA BOELAMA (Forskål).

*Clupea boelama* Forskål, *Descript. anim.*, 1775, p. 72. Bloch & Schneider, *Syst. ichthy.*, 1801, p. 429.

*Engraulis boelama* Cuvier & Valenciennes, *Hist. nat. poiss.*, 1848, **21**, p. 35. Günther, *Cat.*, 1868, **7**, p. 393. Klunzinger, *Verh. Zoöl. bot. ges. Wien*, 1871, **21**, p. 597. Günther, *Proc. Zool. soc. London*, 1871, p. 671. Bleeker, *Atlas ichthy.*, 1872, **6**, p. 130. Day, *Fishes of India*, 1888, p. 626. Günther, *Fisch. Südsee*, 1909, **8**, p. 379.

*Stolephorus encrasicholoïdes* Bleeker, *Nat. tijd. dierk.*, 1863, **1**, p. 236.

*Engraulis encrasicholoïdes* Kner, *Novara exped. Fish.*, 1867, p. 333. Günther, *Cat.*, 1868, **7**, p. 387. Bleeker, *Atlas ichthy.*, 1872, **6**, p. 130.

Head 3.8; depth 4.3; dorsal I, 16; anal 32; ventral 7. Vertebrae thirty-nine, forty. Scales forty persistent; the anterior half of the scale has five or six incomplete lines; there are nine or ten complete bent lines. The apical portion of scale has six to eight rows of net-work of lines. Ventral profile but slightly curved, the margin not very sharp. Scutes twenty-two, two being isolated in front of pectorals, eight between pectorals and ventrals, ten posterior to ventrals. The scutes are all more or less hidden by scales. Eye 4.7 in head; snout projecting, 1.3 in eye. Mouth large, the maxillary ending on a line with end of mandible, its tip expanded and oblique, its length equal to head posterior of the anterior margin of pupil. Mandible about equal to length of maxillary. Teeth small, present in jaws, vomer, palatines, pterygoid, and hyoid. No canines. Gill-rakers twenty-three on lower limb of first arch, the longest equal to eye; these are flat with inner margin spinulate. Opercle with a single groove. The opercle is peculiar in shape in that the lower half is of much less width than usual in this family, length of opercle 1.9 in head, its greatest width 2 in its length, the width of its lower half 4 in its length. V of cheek distinct, its depth 2.5 in head. Origin of dorsal midway between end of caudal vertebra and tip of snout, its longest ray equal to head posterior of eyes. Ventral anterior to dorsal, their origin much nearer to origin of pectoral than to anal, its length 2 in head. Origin of pectoral slightly nearer ventral than to eye, its

length equal to head behind eye, its tip scarcely reaching to ventrals. Origin of anal distinctly posterior to last dorsal ray, its base 4.4 in standard length; it is almost inclosed in a deep scaly sheet. Caudal about as long as head. Alar scales present.

Color silvery, no lateral stripe.

M. C. Z. 3,740. Red Sea. Three specimens. Length 104–120 mm.

M. C. Z. 6,132. Mauritius. Nicholas Pike. Six specimens. Length 93–110 mm.

M. C. Z. 17,971. Ceylon: Colombo. W. H. A. Putnam. Fifteen specimens. Length 100–145 mm. (Description from a specimen 145 mm. in length).

The species is abundant in the Red Sea and Indian Ocean, and is recorded from Guam.

#### STOLEPHORUS Lacépède.

Hist. nat. poiss., 1803, 5, p. 382.

TYPE.—*Stolephorus commersoni* Lacépède.

This genus is readily distinguished by the two to seven sharp-pointed, spine-like scutes between the pectoral and ventral; in other respects much like *Anchoviella*, the vertebrae fewer and the bones stronger than in *Engraulis*.

Vertebrae thirty-nine to forty-three. Body compressed but not deep, translucent. Ventral margin compressed, with two to seven scutes, ending in long, sharp spines. Scales thin, caducous. Maxillary not extending behind the gill-openings. Teeth small. Gill-rakers eighteen to twenty-eight. Origin of the anal below or behind the middle of dorsal. A silvery lateral stripe always present.

As now limited, the species are all tropical, and confined to the Indian region. The original description of Lacépède was based on *Stolephorus commersoni*, but a species of the genus *Spratelloides* of the *Dussumieriidae* was placed first in the genus, it being unknown to Lacépède and very loosely described by Houttuyn.

At one time the senior author was disposed to substitute the name *Stolephorus* for *Spratelloides*. The case for this change is not above cavil, and it seems best to follow current custom unless there is definite warrant for abandoning it. For this reason we regard *Stolephorus commersoni* as the type of *Stolephorus* rather than *Atherina japonica* Houttuyn, which is a *Spratelloides*.

No species of *Stolephorus* is known from American waters, and but two, *Stolephorus evermanni* Jordan and Seale and *S. insularum* Seale, from the South Seas (Samoa and Tahiti).

*STOLEPHORUS COMMERSONII* Lacépède.

Hist. nat. poiss., 1803, 5, p. 382. Bleeker, Atlas ichthy., 1872, 6, p. 128.

Weber & Beaufort, Fish. Ind. Austr. arch., 1913, 2, p. 45.

*Engraulis commersonianus* Günther, Cat., 1868, 7, p. 388. Day, Fishes of India, 1888, p. 629.

Head 4.2; depth 4.8; dorsal I, 15; anal 22; ventral 7. Vertebrae thirty-nine. Scales thirty-six, caducous, anteriorly the scale has three to five grooves from center to outer margin; the posterior two thirds of the scale is occupied by ten to fourteen graduated lines of net-work; the apical margin is crenulate. Ventral profile scarcely curved, the margin moderately compressed. Scutes absent except between pectorals and ventrals where there are six to eight scutes, each with a sharp spine. Eye 3.7 in head. Snout produced, 2 in eye. Mouth large, the maxillary ending exactly at gill-openings, its tip not very pointed; it is distinctly broadened above mandibular joint, and its length equal to head without snout. Mandible ending under anterior margin of preopercle, its length equal to head posterior of the middle of the eye. Teeth fine in jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-rakers twenty-three on the lower limb of the first arch, the longest 1.5 in eye. Opercle smooth, its length 1.7 in head, its width 2.3 in its length, its lower anterior portion ending in a stiff, flat spine. Origin of dorsal midway between end of caudal vertebra and posterior margin of eye, its longest ray scarcely equal to base of the fin, being equal to head posterior of the middle of the eye. Origin of the ventrals anterior to dorsal being nearer to origin of pectoral than to anal, its length 2.2 in head. Origin of pectoral midway between ventrals and middle of eye, its length equal to head posterior of pupil, its tip falling short of ventrals. Origin of the anal is below the 9th ray of dorsal, its base 5 in standard length. Caudal forked, its length equal to head. No alar scales.

Color hyaline, a silvery lateral stripe from head to caudal becoming wider posteriorly.

M. C. Z. 17,748. Straits Settlements: Singapore. W. H. A. Putnam. 197 specimens.

M. C. Z. 17,749. Straits Settlements: Singapore. W. H. A. Putnam. One specimen. Length 40 mm.

M. C. Z. 17,968. India: Calcutta. W. Theobald. One specimen.

M. C. Z. 30,345. Penang. L. P. Ward. Two specimens.

M. C. Z. 31,539 (Orig. 17,975). East Indies. W. H. A. Putnam. 184 specimens. Length 35-60 mm.

This species is common in the Indian region.



## STOLEPHORUS INDICUS (Van Hasselt).

- Engraulis indicus* van Hasselt, Algem. konst-en letterbok, 1823, p. 329.  
 Bleeker, Atlas ichthy., 1872, 6, p. 127. Day, Fishes of India, 1888, p. 629.  
 Günther, Fisch. Südsee, 1909, 8, p. 377.  
*Stolephorus indicus* Bleeker, Atlas ichthy., 1872, 6, p. 127. Weber & Beaufort,  
 Fish. Ind. Austr. arch., 1913, 2, p. 46.  
*Anchovia indica* Jordan & Herre, Proc. U. S. N. M., 1906, 31, p. 638.  
*Engraulis balinensis* Bleeker, Verh. Batav. genootsch., 1849, 22, p. 11.  
*Engraulis russelli* Bleeker, Verh. Batav. genootsch., 1852, 24, p. 38. Günther,  
 Cat., 1868, 7, p. 390.

Head 3.9; depth 5; dorsal 14; anal 21; ventral 7. Vertebrae forty-three. The recumbent spine in front of the dorsal obsolete or inconspicuous. Scales forty, caducous. Ventral profile but little curved, about equal to dorsal, the margin somewhat compressed, the scutes between pectoral and ventral only, these are three or four and armed with long sharp spine. Eye 3.4 in head. Snout projecting, 1.3 in eye. Mouth large, the maxillary not reaching to posterior end of mandible; in no case is it extended to a line with the lower anterior border of the opercle; its tip is obliquely truncate and broad; its length is equal to head posterior of the center of the eye. Mandible equal to maxillary. Teeth small in jaws, palatines, vomer, pterygoids, and hyoids; no canines. Gill-rakers twenty-two on the lower limb of the first arch, the longest 1.7 in eye. These are flat, thin, the inner margin spinulate. Opercle smooth, its lower anterior tip pointed, its length 2.4 in head, its width 2 in its length. V of cheeks distinct, its depth 3.2 in head. Origin of dorsal midway between end of vertebra and posterior margin of eye, its longest ray equal to the base of the fin, being equal to head posterior of eyes. Origin of the ventral anterior to dorsal, being midway between anal and the origin of the pectoral. Origin of pectoral midway between ventral and pupil of eye, its length slightly more than the head behind eyes, its tip falls slightly short of ventrals. Origin of anal is below the 13th dorsal ray; its base is 5.5 in the standard length. Caudal forked, its length about equal to head.

Color hyaline, with a narrow silvery lateral stripe from head to caudal, a dark area on top of head.

M. C. Z. 1,108. Java. C. L. Salmin. One specimen. Length 95 mm.

M. C. Z: 17,974. Straits Settlements: Singapore. W. H. A. Putnam. One specimen. Length 84 mm.

East Indies.

## STOLEPHORUS WAITEI, sp. nov.

Head 5; depth 6; dorsal 14; anal 19; ventral 7. Scales caducous, about forty in lateral series, the grooves complete and almost free of net-work of lines. Ventral profile scarcely curved, its margin compressed with five to

seven spines between pectorals and ventrals. Eye 3.5 in head. Snout short, pointed, projecting, its length 2 in eye. Mouth large, the maxillary ending at gill-openings, its tip pointed, its length equal to head posterior of the anterior margin of the eye. Mandible ending below anterior border of the preopercle, its length equal to head behind the middle of eye. Teeth distinct but small in jaws, vomer, palatines, pterygoids, and hyoid bones. Gill-rakers twenty-three on the lower limb of the first arch, the longest 2 in eye. Opercle smooth, its posterior margin rounded, its depth 2.3 in head, its width 2 in its length. V of cheeks distinct, its depth 3.1 in head. Origin of the dorsal midway between the end of the caudal vertebra and the nostril, its longest ray equal to base of the fin or a little longer. Origin of the ventral anterior to origin of dorsal being midway between anal and origin of the pectoral, its length equal to distance from tip of snout to the middle of the eye. Origin of the pectoral midway between origin of the ventrals and the anterior margin of the pupil, its length equal to head posterior of the middle of the eye, its tip falling short of the ventrals. Origin of the anal is below the 10th dorsal ray; its base is 6 in the standard length. Caudal forked, equal to length of head, its lower lobe the longest.

Color silvery, with a slight shade of light brown. A very distinctly outlined silvery lateral stripe from head to caudal, the width of which is contained 1.5 in eye.

M. C. Z. 18,254. Queensland. C. E. Beddome. Length 110 mm. North Australia.

This species is most nearly related to *S. indicus*, but has a longer maxillary, fewer anal rays and the origin of the dorsal farther forward. In *S. indicus* the maxillary reaches only to joint of mandible.

Named for Edgar R. Waite, the Australian ichthyologist.

#### STOLEPHORUS REX, sp. nov.

Head 4; depth 5.1; dorsal I 15; anal 20; ventral 7. Scales thirty-eight, caducous. Ventral profile about equal to dorsal, the margin moderately compressed. About five scutes with long, sharp spines between pectorals and ventrals as in *S. indicus*. Eye 4. Snout projecting, its length 1.1 in eye. Mouth large, the maxillary pointed and ending below the lower tip of the opercle, its point almost reaching gill-openings, the point above mandibular joint but slightly broadened, its length equal to head without snout. Mandible ending below anterior margin of the preopercle, its length equal to head posterior of the pupil. Teeth small in jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-rakers twenty-three on the lower limb of the first arch; these are flat, narrow, spinulose on inner margin, the longest 1.5 in eye. Opercle smooth, its length 2.1 in head, its width 2.2 in its length, its posterior border rounded, without notch, its lower portion ending in a stiff, broad point.

V of cheeks distinct, its depth 3.7 in head. Origin of the dorsal midway between end of vertebra and middle of eye, its longest ray less than the base of the fin, being equal to head posterior of eye. Ventrals anterior to dorsals, being slightly nearer to anal than to origin of pectoral, their length 2.3 in head. Origin of the pectorals midway between ventrals and anterior margin of the eye, its length equal to head posterior of eye. Origin of the anal is below the base of the 10th dorsal ray; its base is 5 into the standard length. Caudal forked, its length equal to head, alar scale present.

Color hyaline, a distinct narrow silvery lateral stripe, the least width of which is directly posterior of head. A dark brown spot on nuchal region, top of orbit and top of head dusky.

TYPE.—M. C. Z. 4,318. India: Canara. Francis Day. One specimen. Length 130 mm.

This species differs from *S. indicus* (*russelli* Bleeker) in the longer, pointed maxillary. In *indicus* the maxillary ends at the mandibular joint. According to Günther, who had Bleeker's type, it also has a few more gill-rakers, there being but twenty in *S. indicus*. It is distinguished from *S. commersonii* by its less depth, and different location of the fins.

#### STOLEPHORUS INSULARUM, sp. nov.

Head 4.3; depth 6.9; dorsal 15; anal 20; ventral 7. Vertebrae forty-two. Scales caducous, about forty in a lateral series (the pockets counted). Ventral profile but little curved, the margin moderately compressed, and armed with two sharp spines between the pectorals and ventrals. No scutes in front of pectorals or behind ventrals. Eye 3.5 in head. Snout projecting, pointed, its length 1.5 in eye. Maxillary not extending posterior to mandible, its tip truncate, its length equal to head posterior of the anterior margin of the pupil. Mandible ending at the anterior margin of the preopercle, its length equal to maxillary. Teeth distinct in jaws, vomer, palatines, and pterygoids. Gill-membranes not broadly united. Gill-rakers twenty-eight on the lower limb of the first arch, the longest 2 in eye. These are thin, pointed, and with the inner margin spinulose. Opercle smooth, its posterior margin somewhat rounded, its length 2.5 in head, its width 2 in its length. V of cheeks short, its depth 3.7 in head. Origin of dorsal midway between end of caudal vertebra and the middle of eye, its longest ray equal to the base of the fin. Origin of the ventrals distinctly anterior to dorsal being midway between the origin of the pectoral and the base of the 4th anal ray, its longest ray equal to the distance from tip of snout to middle of pupil. Origin of the pectoral is midway between the origin of the ventrals and the anterior margin of orbit, its longest ray equal to the head posterior of the middle of the eye, its tip falling far short of the ventrals. Origin of the anal is below the 11th dorsal ray; its base is 6 in the standard length. Caudal forked, its length about equal to head.

Color light brown, with a narrow but distinct silvery lateral stripe from head to caudal, its width about equal to pupil.

TYPE.—M. C. Z. 17,936. Tahiti. Andrew Garrett. Length 85 mm.

PARATYPES.—M. C. Z. 31,540 (Orig. 17,936). Tahiti. Andrew Garrett. Two specimens. Length 75, 92 mm.

This species is well separated from the Samoan *Stolephorus evermanni* by its much shorter anal fin.

#### STOLEPHORUS EXTENSUS, sp. nov.

Head 4.7; depth 6.2; dorsal 16; anal 20; ventral 7. Vertebrae forty-three. Scale about forty, caducous. Body elongate, cylindrical, its ventral profile but little compressed, two spinules between pectorals and ventrals. Eye 3.4 in head. Snout pointed, projecting, its length 1.2 in eye. Mouth large, the maxillary ending at the mandibular joint, its tip rounded, its length equal to head posterior of the eye. Mandible ending below the anterior margin of the preopercle, its length equal to maxillary. Teeth small, but distinct in jaws, vomer, palatines, and pterygoid. No canines. Gill-membranes not broadly united. Gill-rakers twenty-seven, the longest 1.3 in eye; these are slim, flat, and pointed, their inner margin spinulose. Opercle smooth, its lower anterior portion ending in a wide, flat point or spine. Length of opercle 2.4 in head, its width 2 in its length. V of cheeks small, its depth 3.2 in head. Origin of the dorsal midway between end of caudal vertebra and the middle of eye, its length about equal to the base of the fin. Origin of the ventral anterior to dorsal being midway between origin of anal and origin of pectoral, its length 2.5 in head. Origin of the pectoral midway between ventrals and the nostril, its length equal to head posterior of eye, its tip reaching only about half the distance to ventrals. Origin of the anal below the 10th ray of dorsal, its base 6.1 in the standard length. Caudal forked, its length about equal to head.

Color light brown, a narrow silvery lateral stripe from head to caudal, its margins not very well outlined. It is narrow anteriorly; behind it broadens to the width of the pupil.

TYPE.—M. C. Z. 6,133. Mauritius. Nicholas Pike. One specimen.

PARATYPES.—M. C. Z. 31,542. Mauritius. Nicholas Pike. Three specimens.

This species must be near *S. heterolobus* Rüppell. It has a very close relationship to *S. insularum*, but has a much shorter head and longer body, also the origin of the ventrals is a little more anterior. From *S. indicus* it differs in the increased number of gill-rakers.

## LYCENGRAULIS Günther.

Cat. 1868, 7, p. 399.

TYPE.—*Engraulis grossidens* Agassiz.

This genus has the origin of the anal behind origin of the dorsal; the ventral margin is without scutes, and there is no distinct spine in front of dorsal. Some of the teeth enlarged, canine-like, as in *Lycotrichisa* and *Xenengraulis*.

Vertebrae forty-two to forty-five. Body deep and compressed. Scales thin, rather firm, caducous. Ventral margin of body compressed, but without scutes. Maxillary falling short of gill-openings. Teeth unequal in size, some being caninoid. Gill-rakers twelve to twenty-four. No separate exposed spine in front of dorsal. Origin of anal below posterior third of dorsal. Pectoral usually reaching ventrals. Silvery stripe wide and diffuse.

Three species are known, two from the Brazilian fauna and one *Lycengraulis poeyi* (Kner and Steindachner) from Panama.

## LYCENGRAULIS GROSSIDENS (Agassiz).

*Engraulis grossidens* Agassiz, Pisc. Bras., 1829, p. 50. Günther, Cat., 1868, 7, p. 399.

*Engraulis janeiro* Spix, Pisc. Bras., 1829, t. 24, fig. 1.

*Engraulis dentex* Cuvier & Valenciennes, Hist. nat. poissons., 1848, 21, p. 28.

Head 4.5; depth 4.1; dorsal 15; anal 26; ventral 7. Vertebrae forty-two. Scales forty-two, on the anterior half of each scale the grooves are incomplete and oblique; on the distal half there are about five more or less complete grooves, the net-work form almost absent. Ventral profile very little curved, the margin moderately sharp, but without scutes. Eye a third more than snout, which is 4.7 in head. Snout pointed, projecting, a notch in the upper jaw. Mouth large, maxillary ending below middle of preopercle, being slightly posterior to end of mandible. Length of maxillary is equal to head posterior of the anterior margin of the pupil. Mandible equal to head posterior to middle of eye. The lower border of the maxillary is armed with curved canine teeth; the side of the mandible has about thirty large canine teeth; there are also numerous small teeth in front of the jaws and on vomer, palatines, and pterygoids. Branchiostegals numerous, the gill-membranes not broadly united. Gill-rakers eighteen or nineteen on the lower limb of the anterior arch; these are short, flat, their inner margin toothed, the longest equal to pupil. Opercle smooth, its length 2.3 in head, its width 2.1 in its length. Origin of the dorsal midway between end of the caudal vertebra and the posterior margin of the eye, its longest ray scarcely equal to base of the fin, being equal to head posterior of eye. Origin of ventral anterior to dorsal, being midway between origin

of pectoral and anal, its length equal to the distance from tip of the snout to the posterior margin of the pupil. Origin of pectoral midway between origin of ventral and the middle of eye, its length equal to head posterior of the middle of eye. Origin of the anal is under the 9th dorsal ray, its base 3.7 in the standard length. Caudal forked, distinctly longer than head. Alar scales present.

Color hyaline, a wide, silvery lateral band, not always distinct, usually so in young specimens.

M. C. Z. 970. Brazil: Rio de Janeiro. C. F. Hartt. Two specimens. Length 168, 180 mm. (Gill-rakers 21).

M. C. Z. 4,688. Brazil: Para. Nathaniel Thayer Expedition. Seven specimens.

M. C. Z. 17,943. Uruguay River. Jeffries Wyman Coll. Two specimens.

M. C. Z. 17,977. Uruguay: Montevideo. Hassler Expedition. One specimen.

M. C. Z. 17,978. Uruguay: Montevideo. Hassler Expedition. One specimen.

M. C. Z. 17,979. Uruguay: Montevideo. Hassler Expedition. One specimen.

M. C. Z. 17,980. Uruguay: Montevideo. Hassler Expedition. One specimen.

M. C. Z. 18,003. Brazil: Rio de Janeiro. Nathaniel Thayer Expedition. Ten specimens. Length 157-190 mm. (Vertebrae 43. Gill-rakers 19).

M. C. Z. 18,005. Brazil: Bahia. Louis Agassiz. Three specimens. Length 74-136 mm.

M. C. Z. 18,016. Brazil: Cachoeira. Nathaniel Thayer Expedition. Four specimens. Length, 225 mm.

M. C. Z. 18,017. Brazil: Rio Puty. Nathaniel Thayer Expedition. Three specimens. Length 235-285 mm. (Gill-rakers 12 on lower limb of the first arch; they are short, flat, and wide. Origin of dorsal midway between end of caudal vertebra and median anterior margin of opercle).

M. C. Z. 18,019. Brazil: Rio Alegre. Hartt and Copeland. One specimen.

M. C. Z. 18,021. Brazil: Rio Doce. Hartt and Copeland. One specimen. Length, 132 mm.

M. C. Z. 18,034. Brazil: Rio Grande do Sul. Capt. Harrington. Two specimens. Length 207, 210 mm. (Gill-rakers 24).

M. C. Z. 18,047. Brazil: Rio Grande do Sul. Dom Pedro. One specimen.

M. C. Z. 18,089. Brazil: Rosario. Two specimens. Length 175, 195 mm. (Gill-rakers 20, the longest 1.1 in pupil).

M. C. Z. 31,544 (Orig. 18,017). Brazil: Santos. Nathaniel Thayer Expedition. Three specimens. Length 185–225 mm.

M. C. Z. 31,560 (Orig. 18,044). Brazil: Para. Nathaniel Thayer Expedition. Three specimens. Length 135–160 mm.

Coast of Brazil; common.

#### LYCENGRAULIS BATESII (Günther).

*Engraulis batesii* Günther, Cat., 1868, 7, p. 399.

Head 4.3; depth 5; dorsal 16; anal 26; ventral 7. Vertebrae forty-five. Scales forty, caducous. Ventral profile but little curved, the margin compressed but not particularly sharp. No scutes. Eye 5 in head; imperforated adipose eyelid present. Snout projecting, pointed, its length 1.3 in eye. Mouth large, the maxillary extending to posterior end of mandible, its length equal to head posterior of middle of eye. Mandible ending below anterior margin of the preopercle, its length equal to head posterior of the pupil. Teeth in jaws, vomer, palatines, pterygoids, and hyoid, those on the mandible are large, canine-like, about twenty-four on each side; the longest of these is 3 in pupil; the teeth on the lower margin of the maxillary are strong and curved. Gill-rakers twenty-one on the lower limb of the first arch (in specimens of 285 mm.), fifteen in young; these are short, flat, rounded at tip and spinulate on their inner margin, the longest 1.7 in pupil. Opercle smooth, its length 2.2 in head, its width 2.1 in its length. Origin of dorsal midway between end of caudal vertebra and upper anterior margin of preopercle, its longest ray more than the base of the fin. Origin of the ventral anterior to dorsal and distinctly nearer to origin of dorsal than to anal pore, its length equal to distance from tip of the snout to the anterior margin of the eye. Origin of the anal below the base of the 11th dorsal ray, its base 4.5 in the standard length, being equal to head posterior of the nostrils. Caudal forked, its length greater than head, its lower lobe the longest.

Color in life silvery, brownish above, the silvery lateral stripe broad and not well defined, a dark spot on lower lobe of caudal.

M. C. Z. 17,941. Brazil: Rio Grande. One specimen. Length 105 mm. (Dorsal 15. Anal 25. Gill-rakers 23).

M. C. Z. 18,006. Brazil: Teffe. Louis Agassiz Coll. Four specimens. Length 180–185 mm.

M. C. Z. 18,015. Brazil: Jutahy. Nathaniel Thayer Expedition. Two specimens. Length 165, 180 mm. (Depth 5.2. Gill-rakers 15).

M. C. Z. 18,620. Brazil: Rio Doce. Hartt and Copeland. One specimen. Length 285 mm.

Coast of Brazil.

## PTERENGRAULIS Günther.

Cat., 1868, 7, p. 398.

TYPE.—*Clupea atherinoides* Linné.

This genus may be at once distinguished from the fact that the origin of the anal fin is anterior to that of the dorsal and the teeth in the jaws are small.

Vertebrae forty-five. Body compressed, rather deep. Scales thin, but firm. Ventral margin compressed, but without scutes. Maxillary not extending posterior to the mandible. Teeth small. Gill-rakers about fourteen. Origin of anal anterior to origin of dorsal, its rays thirty-two. A broad, diffuse, silvery lateral stripe.

## PTERENGRAULIS ATHERINOIDES (Linné).

*Clupea atherinoides* Linné, Syst. nat., ed. 12, 1766, 1, p. 523.

*Engraulis atherinoides* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 31.

Head 4.2; depth 3.7; dorsal 14; anal 32; ventral 7. Vertebrae forty-five. Scales forty-two, the anterior grooves on the scales incomplete, the ten or more grooves on the posterior half are crowded upon each other and are almost completely lacking the ordinary net-like arrangement of lines. The scales persistent. Ventral profile but little curved, the margin sharp, but without scutes. Eye a half more than the projecting snout, being 5 in head. Mouth large, the maxillary ending on a line with the end of the mandible, which is below the anterior margin of the preopercle, its length equal to head posterior of pupil. The mandible is about equal to maxillary in length. Teeth distinct, in several rows in jaws, vomer, palatines, and pterygoids. Gill-membranes not broadly united. Gill-rakers fourteen; these are short, flat, and toothed on the inside, the longest a third more than pupil. Opercle smooth, its length 2.1 in head, its width 2.1 in its length. The region at the upper posterior portion of the head somewhat concave. Origin of the dorsal midway between end of caudal vertebra and the posterior margin of the opercle, its longest ray more than the base of the fin, but less than head posterior of the eyes. Ventral small, far anterior to dorsal, being midway between origin of the pectoral and the origin of the dorsal, its length equal to the distance from tip of the snout to posterior margin of the eye. Pectorals very large, their length equal to head posterior of nostrils, their origin midway between ventral and eye. Origin of the anal slightly anterior on a line with the origin of the dorsal, its base 3.3 in the standard length. Caudal forked, equal to length of head.

Color hyaline, a very wide, silvery lateral band anteriorly not well defined, becoming narrowed to the width of the eye under dorsal fin.

M. C. Z. 991. Brazil: Para. C. F. Hartt. Two specimens. Length 125, 140 mm. (Gill-rakers 14).



M. C. Z. 4,687. Brazil: Para. Louis Agassiz Collection. Five specimens. Length 150–227 mm.

M. C. Z. 18,007. Brazil: Cameta. Nathaniel Thayer Expedition.

M. C. Z. 18,008. Brazil: Arary. Louis Agassiz Collection. One specimen. Length 215 mm.

M. C. Z. 18,009. Brazil: Gurupa. Nathaniel Thayer Expedition. One specimen. Length 156 mm.

M. C. Z. 31,545. Brazil. Stanford University. One specimen.

#### ENGRAULITES Jordan and Gilbert.

Stanford univ. publ. Biol. sci., 1925, 4, p. 12.

TYPE.—*Engraulites remifer* Jordan & Gilbert.

This extinct anchovy is near *Engraulis*, differing in the very long, slender-rayed ribbon-like pectoral which reaches nearly to the tip of the long ventral. It is from a Miocene deposit of diatoms, at Lompoc, Santa Barbara County, California.

#### ENGRAULITES REMIFER Jordan and Gilbert.

Stanford univ. publ. Biol. sci., 1925, 4, p. 12, pl. 3b.

The type of this species (Stanford University Coll. 651) is the anterior half of a small anchovy one and one half inches long, the entire length in life not far from three inches.

Head crushed, but showing the very oblique opercle and the short lower jaw peculiar to anchovies. Depth about equal to length of head, the body rather slender, as in the living *Engraulis mordax* of the California coast. Vertebrae and interspinals slender, the vertebrae not counted. Dorsal inserted about over eighth vertebra; its rays rather high, not numerous; ventrals rather long, inserted under its middle. Anal short, well behind dorsal, a few slender rays only preserved. Pectoral narrow, very long, its length about  $1\frac{1}{2}$  times depth of body; its rays slender and close set, its tip reaching well beyond base of ventrals, about to middle of length of that fin. Faint traces of rather small scales along back.

#### ENGRAULIS Cuvier.

Règne anim., 1817, p. 98.

*Encrasicolus* (Commerson) Lacépède, Hist. poiss., 1803, 5, p. 455. Fleming, Brit. anim., 1828, p. 122.

TYPE.—*Clupea encrasicolus* Linné.

The species of this familiar genus are known by the subcylindrical

form, the absence of a silvery lateral stripe, the absence of canines, of ventral scutes, of prolonged fins, and more positively by the feeble skeleton, the rather dark, oily flesh, and by the relatively large number of vertebrae (46 or 47) and of gill-rakers (36 to 49), the number of vertebrae increased, as is usual in fishes of cooler waters. Maxillary not reaching gill-opening, anal fin short, inserted behind front of dorsal. The alar scales, at base of caudal, are always large.

The known species of this genus are closely related, and all inhabit temperate regions. It is the only group not having its center in the tropics, and the only one of which the distribution is world-wide. Of the species *E. encrasicolus* abounds in Europe, *E. mordax* in California, *E. ringens* in Chile, *E. japonicus* in Japan, and *E. antipodium* in southern Australia and New Zealand.

#### ENGRAULIS ENCRASICOLUS (Linné).

*Clupea encrasicolus* Linné, Syst. nat., ed. 10, 1758, 1, p. 318.

*Engraulis encrasicolus* Cuvier, Règne anim., 1817, 2, p. 175.

Head 4.6 in length to base of caudal; depth 6; dorsal rays 13; anal 19; ventral 7. Vertebrae forty-seven. Scales about forty-two, very deciduous, the grooves incomplete, parallel on the anterior portion of scale. Body cigar-shaped, the ventral profile but little curved, the margin rounded. No ventral scutes. Eye a third longer than the snout, being 3.3 in head. Mouth large, the snout conical, projecting. Maxillary ending at mandibular joint, its anterior end under nostril, its length 1.5 in head, its distal end rounded, its outline almost straight, its lower margin denticulate, its width one half of pupil. Mandible ending below the preopercle, its length 1.4 in the head, its greatest depth 4.7 in its length. Fine teeth in jaws, tongue, vomer, and palatines. Gill-rakers thirty-six on the lower limb of the first arch, the longest less than eye. Posterior wall of gill-chamber rounded. Opercle with two wide shallow hollows. The cheek, measured obliquely, greater than eye. Origin of the dorsal midway between tip of the snout and the end of the caudal vertebra, its longest ray about equal to the base of the fin, being equal to the distance from tip of the snout to the posterior margin of the postorbital. Origin of the ventrals in front of dorsal, being midway the origin of the pectorals and the anal pore; its length is equal to the distance from the top of the snout to the posterior margin of the pupil. Origin of the anal posterior to dorsal. Origin of the pectoral midway between the origin of the ventrals and the anterior margin of the pupil. Caudal forked, its length less than head. Alar scales present.

Color silvery, darker above.

M. C. Z. 3,876. Italy: Messina. Ernst Haeckel. One specimen.  
 M. C. Z. 17,947. Europe. Ernst Haeckel. Three specimens.  
 Length 102–123 mm.

M. C. Z. 18,025. Italy: Venice. Theodore Lyman. Two specimens. Length 102, 112 mm.

M. C. Z. 18,039. Austria. Two specimens. Length 102, 125 mm.

M. C. Z. 24,407. Italy: Venice. D. S. Jordan. One specimen.

M. C. Z. 31,394 (Orig. 20,603). Italy: Naples. E. C. Starks. Five specimens. Length 130–137 mm.

M. C. Z. 31,546 (Orig. 18,054). France: Nice. Theodore Lyman. One specimen.

This well-known species is common on all sandy shores throughout Europe.

#### ENGRAULIS MORDAX Girard.

Proc. Acad. nat. sci. Phil., 1854, p. 138.

*Engraulis nanus* Girard, Rept. Pacific R. R. surv., 1858, 10, p. 335.

Head 3.4; depth 5.3; dorsal 14; anal 23; ventral 7. Vertebrae forty-six. Scales forty, persistent, 4–6 almost parallel grooves from center to anterior margin, 3–5 incomplete grooves on the sides, the posterior half of the scale with 6–8 more or less complete grooves, a few net-like meshes on the margin of the scale. Ventral profile scarcely curved, the body cigar-shaped. No scutes, the margin scarcely compressed. Eye 4.5 in head. Snout projecting, pointed, its length 1.4 in eye. Mouth large, the maxillary ending below the middle of the lower margin of the opercle, its tip extending slightly beyond the end of the mandible, but not to gill-opening, its length equal to head posterior of pupil, its tip pointed. Mandible ending below anterior margin of the preopercle, its length equal to head posterior of the iris. Teeth small, but distinct in jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-membranes not broadly united. Gill-rakers forty-three on the lower limb of the first arch, the longest equal to distance from tip of snout to middle of pupil; an inner gill-membrane with branches extending up into it as in *Cetengraulis*. The gill-rakers are slim and pointed. Opercles and cheek covered with a fine net-work of venules, otherwise opercle smooth, its outline strongly curved, its length 2 in head, its width 2.5 in its length. V of cheek prominent, its depth 2.2 in head. Origin of the dorsal midway between the end of the caudal vertebra and posterior margin of the pupil, its longest ray equal to the base of the fin. Origin of ventral slightly anterior to dorsal, being midway between origin of pectoral and base of the fifth anal ray, its length equal to distance from tip of snout to posterior margin of pupil. Origin of pectoral midway between ventral and posterior margin of eye. Origin of anal under posterior ray of dorsal, its base 5.5 in standard length, being equal to head posterior of eye.

Caudal forked, the lower lobe the longest, being equal to head posterior of middle of eye. Alar scales large.

Color silvery, bluish above. No distinct lateral stripe.

M. C. Z. 17,994. Cal.: San Francisco. Seventy-two specimens. Length 85-124 mm.

M. C. Z. 17,995. Cal.: San Francisco. Thirty-three specimens. Length 65-102 mm.

M. C. Z. 17,997. Cal.: San Francisco. Twenty-four specimens. Length 82-150 mm.

M. C. Z. 17,998. Cal.: San Francisco. Two specimens. Length 92, 100 mm.

M. C. Z. 17,999. California. Seven specimens. Length 72-82 mm.

M. C. Z. 18,000. Cal.: San Francisco. T. G. Cary. One specimen. Length 135 mm.

M. C. Z. 18,023. Cal.: San Francisco. Alexander Agassiz. One specimen. Length 100 mm.

M. C. Z. 18,028. Cal.: San Francisco. One specimen. Length 110 mm.

M. C. Z. 18,023. California. T. G. Cary. Seven specimens. Length 135-140 mm.

M. C. Z. 18,033. Cal.: San Francisco. T. G. Cary. One specimen. Length 117 mm.

M. C. Z. 18,048. Cal.: San Francisco. Franz Steindachner. Five specimens. Length 130-154 mm.

M. C. Z. 18,122. Cal.: San Francisco. Fifty-three specimens. Length 90-145 mm.

M. C. Z. 18,129. Cal.: San Francisco. Two specimens. Length 82, 85 mm.

This species is extremely abundant along the coast of California, especially northward, often taken in great numbers in fine-meshed nets. Here described from M. C. Z. 18,048.

#### ENGRAULIS RINGENS Jenyns.

Voyage Beagle. Fish., 1842, pt. 4, p. 136.

*Engraulis pulchellus* Girard, Proc. Acad. nat. sci. Phil., 1854, p. 138.

Head 3.3; depth 4.1; dorsal 16; anal 21; ventral 7. Vertebrae forty-six. Scales forty, persistent, the grooves incomplete; there is scarcely a trace of the usual net-work of lines on apical portion of scale. Ventral profile moderately curved and slightly compressed. No scutes. Eye 4.1 in head. Snout projecting, its length 1.7 in eye. Mouth large, the maxillary not extending

posterior to mandible, its length equal to head posterior of eye. Mandible ending below anterior margin of preopercle, its length equal to head posterior of orbit. Teeth small, but distinct on jaws, vomer, palatines, pterygoid, and hyoid. No canines. Gill-rakers forty-nine on the lower limb of the anterior arch, the longest equal to distance from tip of snout to pupil, a low membrane on inside of gill-rakers. Opercle smooth, its length 1.8 in head, its width 2.5 in its length. V of cheeks distinct, its depth 3 in head. Origin of dorsal midway between end of caudal vertebra and the posterior margin of pupil, its longest ray more than the base of the fin. Origin of ventrals anterior to dorsal, its origin nearer to anal than to origin of pectoral, its length equal to distance from tip of snout to posterior margin of the eye. Origin of the pectoral midway between ventral and eye, its length a third less than head posterior of eye, its tip not reaching ventrals. Origin of the anal distinctly posterior to the last dorsal ray, being usually at least half the length of the eye posterior of the dorsal. Its base is 6.5 in the standard length, being less than the length of the head, posterior of the eye. Caudal forked, its length equal to head posterior of the anterior margin of pupil. Alar scales large.

Color silvery, brownish above, the line between the colors distinctly drawn. No lateral stripe.

M. C. Z. 17,982. Peru: Callao. Hassler Expedition. Three specimens. Length 104-140 mm.

M. C. Z. 17,984. Peru: Callao. Hassler Expedition. Twenty specimens. Length 100-145 mm.

M. C. Z. 30,797. Panama. Albatross Collection. Five specimens.

This species is certainly distinct from *E. mordax*. In comparing specimens of the same length of the two species we find the following differences: — *E. ringens* is a shorter, deeper fish with an increased number of gill-rakers (49 as compared to 43 in *E. mordax*); the origin of the anal is always under the last dorsal ray in *E. ringens*; it is always posterior to dorsal in *E. mordax*; in *E. mordax* the maxillary extends posterior to mandible, while in *E. ringens* it ends before end of mandible; and in *E. mordax* the anal base is 5.5 in standard length, in *E. ringens* it is 6.5.

#### ENGRAULIS JAPONICUS Schlegel.

Fauna Japonica. Pisces, 1846, [4], p. 239, pl. 108, fig. 3.

Head 4; depth 6; dorsal 15; anal 19; ventral 7. Vertebrae forty-six. Scales about forty, caducous (the pits counted). Body cylindrical, the ventral profile almost straight, little compressed, no scutes. Eye 3.7 in head. Snout projecting, pointed, its length 1.2 in eye. Mouth large, the maxillary ending at mandibular joint, its length equal to head posterior of the pupil, its tip

rounded. Mandible ending below anterior margin of the preopercle, its length equal to head posterior of the anterior margin of the pupil. Teeth small, but distinct, in jaws, vomer, palatines, and pterygoids. Gill-rakers thirty-eight on the lower limb of the first arch, the longest 1.4 in eye, these are curved, thin and pointed, the inner margin spinulose. Opercle with shallow venules and pits, its length 2.3 in head, its width 2.3 in its length, its upper posterior margin curved, its lower posterior margin slightly concave. V of cheeks distinct, its depth 3.1 in head. Origin of the dorsal midway between the end of the caudal vertebra and the nostril, its base 1.2 in its length. Origin of ventrals anterior to dorsal, being midway between the origin of the dorsal and the anal pore, its length 2.3 in head, being equal to distance from the tip of the snout to the posterior margin of the eye. Origin of the pectoral is midway between the origin of the ventrals and the anterior margin of the pupil, its length slightly less than head posterior of the eyes, its tip falling far short of the ventrals. Origin of the anal posterior of the last dorsal ray by a distance equal to the eye, its base 7 in the standard length. Caudal forked, its length about equal to head without the snout, its lower lobe the longest. Alar scales very large.

Color yellowish below, bluish on back. No silvery lateral stripe.

M. C. Z. 31,409 (Orig. 362, 366, 367, 377, 386). Japan: Tokio. Shigeo Tanaka. Five specimens. Length 135-144 mm.

Generally common on the coasts of Japan, from Saghalin to Nagasaki.

#### ENGRAULIS ANTIPODUM Günther.

*Engraulis encrasicolus antipodum* Günther, Cat., 1868, 7, p. 386.

*Engraulis antarcticus* Castelnau, Proc. Zool. soc. Victoria, 1872, p. 186.

Head 4; depth 5.1; dorsal 15; anal 17; ventral 7. Vertebrae forty-six. No elongate rays or appendages. Scales caducous. Ventral profile but little curved, the body being cigar-shaped. Scutes not visible in badly damaged specimens. Eye 3.3 in head. Snout projecting, pointed, its length 1.5 in eye. Mouth large, the maxillary ending at joint of mandible, its tip truncate. Teeth very minute, and easily overlooked, in jaws, vomer, palatines, and pterygoids. Opercle smooth, its length 2.5 in head. Gill-membranes not broadly attached to isthmus. Gill-rakers forty on the lower limb of the first arch, the longest almost equal to eye. Origin of the dorsal midway between end of caudal vertebra and the nostril. Origin of the anal posterior to the last dorsal ray.

Color silvery, bluish above, no distinct lateral stripe.

M. C. Z. 18,036. Australia: Victoria. Two specimens. Length 103, 122 mm.

This species, closely resembling the others of the genus, is common on the shores of temperate Australia and New Zealand.

## ENGRAULIS BREVIPINNIS Heckel.

Sitzber. Akad. wiss. Wien, 1853, **11**, p. 120.

This species from the Upper Miocene at Chiavon (Chiavenna) is very briefly described as much more slender than *Engraulis longipinnis*, and with the anal fin very much shorter, its base scarcely one third of depth of body, which is equal to the length of the head.

There is nothing in this description to separate the species from *Engraulis*.

## ENGRAULIS EVOLANS (Blainville).

*Clupea evolans* Blainville, Nouv. dict. hist. nat., 1818, p. 344.

*Exocoetus evolans* Volta (nec Linné), Ittiolit. Veronese, 1796, p. 102, pl. 24.

*Engraulis evolans* Agassiz, Neues jahrb., 1835, p. 306. Poiss. foss., 1844, **5**, pt. 2, p. 321, pl. 37; fig. 1, 2.

This species, as figured by Agassiz, is slender, the depth about equal to length of head which is long and pointed,  $3\frac{1}{2}$  to 4 times in body. Pectoral with ten rays, the median longest, slender and stiff, not branched, wide set, as long as head, apparently inserted high, with strong basal bones; ventrals median, similar, as long as head, the rays about eight; anal long and low, even, its base about equal to head, its rays about fifteen; dorsal represented by bases of several broken rays, the first behind front of anal, the dorsal and anal fins apparently equal in life; caudal well forked, the lobes strong, the lower a little the stronger, as long as head. Eye large; teeth small, even, no trace of ventral scutes. Mouth not clearly defined, the mandible shorter than the pointed snout; maxillary not reaching gill-opening, lower jaws pointed, sharp at tip with divergent branches below. Vertebrae stronger than in the Anchovies, forty in number.

This species, from the Upper Eocene at Monte Bolca, the earliest in time assigned to this group, may possibly be an anchovy, as supposed by Agassiz, but the probabilities seem against it. The long pectoral is composed of wide-set and rather strong rays; it is inserted rather high, and its basal bones are relatively strong; the dorsal is inserted farther back than in any anchovy, and apparently matches the long anal. The structure of the mouth is not clearly shown in the type, although possibly not unlike that of an anchovy. In fact, it seems more like a very young flying-fish than any other form. Its strong pectorals and ventrals, the backward insertion of the dorsal and the

strong lower lobe of the caudal all point in that direction, and some flying-fishes (Fodiator) have a pointed head.

There is no warrant for placing the species in Exocoetoides (Cheirothricidae) as suggested by Kramberger. In that genus the caudal fin is rounded, while in this species it is deeply forked. The species seems nearest the modern genus Exonautes, flying-fishes with the dorsal and anal equal and opposite.

#### ANCHOVIELLA Fowler.

Proc. Acad. nat. sci. Phil., 1911, p. 211.

*Menidia* Browne (*nec* Bonaparte), Hist. Jamaica, 1789, p. 441.

TYPE.—*Engraulis per fasciatus* Poey.

This genus is close to *Engraulis*, differing in the firmer, translucent substance of the body. The flesh is less oily, the skeleton more solid. Technically it differs in fewer vertebrae, fewer gill-rakers, both characters connected with its tropical habit. The body is more compressed, and the sides are usually marked with a broad silvery band as in *Stolephorus*. As in *Engraulis* the anal rays are sixteen to thirty-seven; gill-rakers fifteen to forty-three; vertebrae forty to forty-two. There are no ventral scutes, a character which distinguishes it fully from the East Indian genus *Stolephorus*. Usually there are no alar scales.

The characters of the genus are apparently not primitive but rather to be regarded as traits of degeneration, the origin of the group being from forms probably now extinct, but connecting it with *Stolephorus*.

The genus may need further subdivision as some species (*spinifera*, *mundicola*, *panamensis*, *compressa*, *eigenmannia*) have the anal fin very long, twenty-nine to thirty-seven rays, some as *rastralis* have gill-rakers in increased number.

The species are very numerous, being found on all sandy shores of tropical America. In this paper we describe only those represented in the M. C. Z.

#### ANCHOVIELLA PERFASCIATA (Poey).

*Engraulis per fasciatus* Poey, Memorias, 1860, 2, p. 313.

*Stolephorus per fasciatus* Jordan & Evermann, Bull. 47, U. S. N. M., 1896, 1, p. 441.

Head 3.7; depth 6; dorsal 16; anal 17; ventral 7. Vertebrae forty-three. Scales caducous, about forty in a lateral series, the grooves (radii) incomplete, and not forming a net-work of lines on the apical portion of scale. The ventral



profile but little curved or compressed, approaching *Engrauris* in form. No scutes. Snout projecting, pointed, its length 1.6 in head. Mouth large, the maxillary ending at the mandibular joint, not extending posterior of mandible, its posterior end obtusely rounded, its length equal to head posterior of the middle of eye. Mandible ending below the anterior margin of the preopercle, its length equal to the maxillary. Teeth small, present in jaws, vomer, palatines, and pterygoids. Gill-rakers twenty-six on the lower limb of the first arch, the longest 1.3 in eye. These are rather slim, pointed, with their inner margin spinulose. Opercle smooth, its length 2.6 in head, its width 2 in its length. The V of cheeks distinct, its depth 3.2 in head. Origin of the dorsal midway between the end of the caudal vertebra and the middle of eye, its longest ray slightly more than the base of the fin, being equal to head behind the eyes. Origin of the ventrals anterior to the dorsal, being nearer to origin of the pectoral than to anal, its length equal to eye. Origin of the pectoral midway between origin of the ventrals and the anterior margin of the eye, its tip falling short of the ventrals. Origin of the anal slightly posterior of the last dorsal ray. The length of its base is 7 in the standard length. Alar scales prominent. Caudal forked, its length less than head.

Color dull yellowish brown, with a very bright and distinctly outlined silvery lateral stripe from head to caudal. The width of the center of this stripe is 1.5 in eye, while the anterior and posterior portions are 1.1 in the same organ. There is a dark margin to the upper portion of the stripe, and a dark blotch on the top of the head, and on the upper base of the caudal.

TYPE.—M. C. Z. 17,965 (Orig. 153). Cuba. Poey Coll. One specimen. Length 100 mm.

M. C. Z. 17,966 (Orig. 31). Cuba. Poey Coll. Two specimens. Length 87, 90 mm.

M. C. Z. 31,549 (Orig. 17,955). Cuba. Poey Coll. Nine specimens.

Florida Keys to Cuba. Common but less abundant than *Anchoviella epsetus*.

#### ANCHOVIELLA EXIGUA (Jordan and Gilbert).

*Stolephorus exiguus* Jordan & Gilbert, Proc. U. S. N. M., 1882, 4, p. 342.

Head 4; depth 5.5; dorsal 15; anal 21; ventral 7. Vertebrae forty-four. No elongate rays or appendages. Scales thirty-nine, caducous, ventral profile about equal to dorsal, its ventral margin moderately compressed but without scutes. Eye 3.4 in head, unperforated adipose eyelid present. Snout projecting, pointed, its length 1.2 in eye. The nostrils with slight rims. Mouth large, the maxillary extending to gill-openings; it is expended above mandibular joint but the tip is sharp pointed. Mandible ending below the anterior margin of the preopercle, its length equal to the head anterior of the middle of

eye. Teeth small, but distinct in jaws, vomer, palatines, and pterygoids. Gill-membranes not broadly joined. Gill-rakers thirty on the lower limb of the first arch, the longest 1.2 in eye. Opercle smooth except for a low rounded ridge in the center, the major portion of its posterior margin is straight, its length 2.3 in head, its width 1.7 in its length. V of cheeks distinct, its depth 3.2 in head. Origin of dorsal midway between end of caudal vertebra and posterior margin of eye, its longest ray equal to the base of the fin. Origin of the ventrals anterior to dorsal, being midway between origin of pectoral and origin of anal, its length equal to the distance from tip of snout to posterior margin of pupil. Origin of the pectoral midway between origin of ventrals and the middle of eye, its length equal to head posterior of the pupil. Origin of the anal is below the 10th ray of dorsal, its base 4.7 in standard length. Caudal forked, its length equal to head without snout.

Color light brown. An indistinct silver lateral stripe, the edges of which are moderately well outlined, it is narrow anteriorly but posteriorly is equal to the width of the eye.

COTYPES.—M. C. Z. 31,393 (Orig. 115). Mex.: Mazatlan. Stanford University. Four specimens. Length 75–82 mm.

A small and slender species. Rare on the west coast of Mexico.

#### ANCHOVELLA EPSETUS (Bonnaterre).

*Esox epsetus* Bonnaterre, Ichthy., 1788, p. 175.

*Atherina brownii* Gmelin, Syst. nat., 1789, 1, p. 1397.

*Stolephorus brownii* Jordan & Evermann, Bull. 47, U. S. N. M., 1896, 1, p. 443.

Head  $3\frac{3}{4}$ ; depth  $4\frac{3}{4}$ ; eye  $3\frac{1}{2}$ . D. 15; A. 20; scales 40. Body rather elongate, compressed, not elevated; belly compressed, serrulate. Head rather short, the snout five in head, projecting much beyond the tip of the lower jaw. Teeth pretty strong; maxillary extending beyond base of mandible, but not quite reaching to the edge of the gill-opening. Eye large, cheeks triangular, scarcely larger than eye. Gill-rakers long,  $\frac{2}{3}$  diameter of eye, about twenty in number. Anal with a sheath of scales; dorsal inserted nearer caudal than snout. Length four to six inches.

Olivaceous, translucent, sides silvery; the silvery lateral band about as wide as the eye, very distinct.

M. C. Z. 4,691. Brazil: Rio de Janeiro. Louis Agassiz. Fourteen specimens.

M. C. Z. 17,938. N. J.: Somers Point. William Stimpson. Eight specimens.

M. C. Z. 17,942. Uruguay River. Jeffries Wyman. One specimen.

- M. C. Z. 17,944. Fla.: Tortugas. J. E. Mills. One specimen.  
 M. C. Z. 17,946. Florida. Eight specimens.  
 M. C. Z. 17,948. Fla.: Captiva Key. G. Würdeman. One specimen.  
 M. C. Z. 17,950. Florida. Theodore Lyman. Fifteen specimens.  
 M. C. Z. 17,952. Cuba. Poey Coll. Two specimens.  
 M. C. Z. 17,954. Cuba. Poey Coll. Nine specimens.  
 M. C. Z. 17,959. Cuba. Poey Coll. Fourteen specimens.  
 M. C. Z. 17,963. Cuba. Poey Coll. One specimen.  
 M. C. Z. 18,002. Brazil: Rio de Janeiro. Louis Agassiz. One specimen.  
 M. C. Z. 18,013. Brazil: Sambaia. D. Bourget. Twenty specimens.  
 M. C. Z. 18,027. S. C.: Charleston. J. E. Holbrook. Five specimens.  
 M. C. Z. 18,035. Fla.: Key West. L. F. de Pourtalès. Sixty-eight specimens.  
 M. C. Z. 18,038. N. Y.: Fisher's Island. J. H. Blake. Twenty-three specimens.  
 M. C. Z. 31,398 (Orig. 4,844). Jamaica. Stanford University. Seven specimens.  
 M. C. Z. 31,489. Cuba. Greenwood. One specimen.  
 M. C. Z. 31,550. —————. Three specimens.  
 M. C. Z. 31,551 (Orig. 17,976). Uruguay: Montevideo. One specimen.  
 Cape Cod to Uruguay. The commonest and best known species of tropical America.

ANCHOVIELLA ISCHANA (Jordan and Gilbert).

*Stolephorus ischanus* Jordan & Gilbert (*nec* Gilbert & Starks), Proc. U. S. N. M., 1882, 4, p. 340.  
*Anchovia starksi* Gilbert & Pierson, Fishes of Panama, 1904, p. 42.

Head 3.7; depth 5.1; dorsal 13; anal 16; ventral 7. Scales caducous about forty in lateral series. Dorsal and ventral outlines almost equal, the ventral margin moderately sharp. No scutes. Eye 4 in head, imperforated eyelid present. Snout pointed, projecting its length 1.2 in eye. Mouth large, the maxillary extending posterior to mandible, but ending a little short of the gill-openings, its length equal to the head posterior of the middle of the pupil, its tip sharp pointed. Mandible ending below anterior margin of the preopercle, its length equal to maxillary. Teeth small, but distinct in jaws, vomer, palatines, and pterygoids. No canines. Gill-membranes not broadly united. Gill-rakers eighteen on the lower limb of the first arch, the longest 1.5 in eye;

these are slim and flat with the inner margin spinulose. Opercle smooth, its length 2.5 in head, its width 1.5 in its length. V of cheeks distinct, its length 2.7 in head. Origin of the dorsal midway between end of caudal vertebra and the anterior margin of eye, its longest ray about equal to the base of the fin. Origin of the ventrals anterior to dorsal, being midway between origin of the pectoral and anal, its length 2.7 in head. Pectoral midway between ventrals and middle of pupil. Origin of anal below the last ray of dorsal, its base 6 in standard length. Caudal forked, its length less than head. Alar scales present.

Color hyaline, a silvery lateral stripe, narrow from head to caudal, its width at center slightly less than eye; the width is less directly behind head and in front of the caudal.

M. C. Z. 23,286. Panama. Alexander Agassiz. Eight specimens.

M. C. Z. 27,876 (Orig. 46,692). Mex.: Magdalena Bay. U. S. N. M. One specimen. Length 75 mm.

M. C. Z. 29,437. Mex.: Acapulco, U. S. B. F. Nine specimens. Length 45-50 mm.

Magdalena Bay to Panama, replacing as geminate species, *Anchoviella epsctus* which it much resembles. Quite as close is *Anchoviella arenicola* from Panama, a more slender species.

#### ANCHOVIELLA DELICATISSIMA (Girard).

*Engraulis delicatissimus* Girard, Proc. Acad. nat. sci. Phil., 1854, p. 154.

Dorsal 13; head 4.4; depth 5.4; anal 23; ventral 7. Vertebrae forty-five. Scales forty, caducous, the grooves incomplete, and the net-work of lines apparently absent. Ventral profile scarcely curved, the margin but moderately compressed, with no scutes. Eye 3 in head. Snout projecting, its length 1.4 in head. Mouth large, the maxillary extending posterior to the end of the mandible, but falling short of the gill-openings, its tip being on a line with the middle of the opercle. It is expanded at the mandibular joint, but the tip is pointed. It is equal in length to head without the snout. Mandible ending on a line with the anterior margin of the preopercle, its length slightly less than maxillary. Teeth very small, in jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-membranes not broadly united, gill-rakers thirty-three, the longest 1.3 in eye; these are thin, curved, pointed, their inner margin spinulose. Opercle smooth, its length 2.2 in head, its width 2 in its length. The V of cheeks not very marked, its depth 4 in head. Origin of the dorsal midway between end of the caudal vertebra and the posterior margin of eye, its longest ray equal to the base of the fin, being equal to head behind eyes. Origin of the ventrals anterior to dorsal, being distinctly nearer to origin of the pectoral than to anal, its length equal to distance from tip of snout to posterior

portion of the pupil. Origin of the pectoral midway between origin of the ventrals and the anterior margin of the eye, its length equal to the distance from tip of the snout to opercle, its tip falling far short of the ventrals. Origin of the anal under the 10th ray of the dorsal, its base 4 in the standard length. Caudal forked, its length about equal to head. Alar scales present.

Color hyaline, with a distinct silver lateral stripe, rather narrow anteriorly, broadening to the width of the pupil posteriorly. Top of head dark, some dark dots on the dorsal surface, especially on the upper base of the caudal.

M. C. Z. 17,992. Cal.: San Diego. Hassler Expedition. Ten specimens.

M. C. Z. 17,993. Cal.: San Diego. Hassler Expedition. Seven specimens.

M. C. Z. 17,996. Cal.: "San Francisco"? Eleven specimens. Length 63-68 mm.

M. C. Z. 27,396. Cal.: San Diego. C. H. Eigenmann. Three specimens. Length 60-63 mm.

M. C. Z. 31,401 (Orig. 6,845). Cal.: San Diego. Stanford University. Three specimens. Length 66-74 mm.

M. C. Z. 31,544 (Orig. 17,989). Cal.: San Diego. Hassler Expedition. Thirty-seven specimens. Length 65-73 mm. (Gill rakers 30).

M. C. Z. 31,555 (Orig. 17,990). Cal.: San Diego. Nine specimens.

Common from San Diego Bay southward along the coast of lower California. Not noticed north of Santa Barbara.

#### ANCHOVIELLA CUBANA (Poey).

*Engraulis cubanus* Poey, Synopsis, 1865, p. 420.

*Stolephorus cubanus* Jordan & Evermann, Bull. 47, U. S. N. M., 1896, 1, p. 445.

Head 4.2; depth 5.7; dorsal 16; anal 21; ventral 7. Vertebrae forty-three. Scales about forty, caducous, the grooves incomplete, the net-work of radii absent in the few scales we have seen. Ventral profile but little curved, being about equal to the dorsal. Ventral margin but little compressed. No scutes. Eye 3.1 in head. Snout pointed, projecting, its length 1.2 in snout. Mouth large, the maxillary extending posterior to mandible, reaching to opercle. Its tip is pointed and its greatest width at mandibular joint, its length is equal to head behind the anterior margin of the pupil. Teeth small, in jaws, vomer, palatines, and pterygoids, no canines. Gill-rakers thirty-four on the lower limb of the first arch, the longest slightly less than eye, these are rather wide, flat, and pointed, the inner margin spinulose. Opercle smooth, its length 2.1 in head, its width 2 in its length, its lower anterior margin not ending in a sharp spine. The V of the cheeks distinct, its depth 3.5 in head. Origin of the dorsal

midway between the end of the caudal vertebra and the posterior margin of eye, its longest ray but little more than base of the fin, being equal to head posterior of the middle of the eye. Origin of the ventral anterior to dorsal, being nearer to origin of the pectoral than to the origin of the ventral. Its length equal to distance from tip of snout to pupil. Origin of pectoral midway between ventrals and the anterior margin of eye, its length equal to head posterior of the eye, its tip not reaching ventrals. Origin of the anal under the 10th ray of dorsal, its base 5 in the standard length. Caudal forked, its length probably about equal to head, the rays broken in type. Alar scales prominent.

Color yellowish light brown, a silvery lateral stripe, about equal to width of eye, extending from head to caudal; this is of less width anteriorly.

COTYPES.—M. C. Z. 17,958. Cuba. Poey Coll. Four specimens. Length 60–63 mm.

M. C. Z. 31,547 (Orig. 17,959). Cuba. Poey Coll. Nine specimens. Length 60–65 mm.

This species resembles *A. epsetus* somewhat, but has an increased number of gill-rakers, and less distinct lateral stripe. It is rather common along the shores of Cuba and Porto Rico.

#### ANCHOVIELLA LUCIDA (Jordan and Gilbert).

*Stolephorus lucidus* Jordan & Gilbert, Proc. U. S. N. M., 1882, 4, p. 341.

Head 3.9; depth 3.4; dorsal 13; anal 29; ventral 7. Vertebrae forty-one. Scales thirty-six, caducous. Ventral profile moderately curved, the margin sharp, but without scutes. Eye 3.5 in head. Snout 1.7 in eye; it is projecting and pointed. Mouth large, the maxillary extending slightly posterior to mandible, but falling short of the gill-openings, its tip sharp pointed. Mandible ending below the anterior margin of the preopercle, its length equal to head posterior of the middle of the eye. Teeth small, but distinct in jaws, vomer, palatines, and pterygoids. No canines. Gill-rakers nineteen on the lower limb of the first arch, the longest 2 in eye, these are thin, flat and not very sharp, their inner margin spinulose. Opercle smooth except for a low rounded ridge in its center, its posterior border convex, its length 2.2 in head, its width 1.7 in its length. V of cheeks distinct, its depth 3.3 in head. Origin of the dorsal midway between the end of the caudal vertebra and the middle of eye, its longest ray more than the base of the fin, being equal to head behind the eyes. Origin of the ventrals anterior to the dorsal, being midway between the origin of the pectoral and origin of the anal, its length equal to the distance from tip of the snout to the posterior margin of the pupil. Origin of the pectoral midway between ventral and eye, its length equal to the head posterior of the middle of the pupil, its tip reaching ventrals. Origin of the anal under the last dorsal ray, its base 3.5 in the standard length. Caudal forked, its length about equal to head.

Color light brown, a rather indistinct silvery lateral stripe, narrow with diffuse margins, it expands on the base of caudal, dark spot on top of head, and two rows of black dots on the dorsal region. Tip of caudal dusky in some specimens.

M. C. Z. 31,403 (Orig. 32). Mex.: Mazatlan. Stanford University. Two specimens. Length 75, 82 mm.

West coast of Mexico.

#### ANCHOVIELLA PERUANA (Steindachner).

*Engraulis peruanus* Steindachner, Sitzber. Akad. wiss. Wien, 1880, 80, p. 173.

Head 3.5; depth 4; dorsal 16; anal 27; ventral 7. Vertebrae forty-one. Scales about thirty-six, anterior half of scale with 5-8 longitudinal lines from center, and five incomplete lines, which are almost at right angles to these, the posterior half of scale with 2-4 curved lines scarcely any net-work of lines. Ventral profile almost straight, its margin compressed but without scutes. Eye 4.3 in head. Snout projecting, prominent, pointed, with a distinct notch on its under side, its length about equal to eye. Mouth large, the maxillary ending below the lower median portion of preopercle, its tip scarcely posterior to end of mandible, its length equal to head posterior of the middle of eye, mandible ending below the anterior half of the preopercle, its anterior tip under anterior margin of eye, its length equal, head posterior of the pupil. Teeth small, but perfectly distinct in jaws, vomer, palatines, pterygoids, and hyoids. No canines. Gill-rakers twenty-six on the lower limb of the first arch, the longest equal to snout, a very narrow membrane inside of the gill-rakers. Opercle smooth, curved, its length 2 in head, its width 2.5 in its length. Origin of dorsal midway between end of caudal vertebra and the posterior margin of eye, its longest ray greater than the base of the fin, but slightly less than head posterior of the eye. Origin of the ventrals anterior to dorsal, being much nearer to origin of pectoral than to anal pore, its length equal to distance from tip of snout to posterior margin of eye. Origin of pectoral distinctly nearer ventrals than to eye, its length equal to longest dorsal ray. Origin of the anal under the 10th dorsal ray, its base 4.5 in the standard length, being equal to head posterior of the anterior margin of pupil. Caudal forked, its lower lobe the longest, being equal to head. No alar scale.

Color silvery, brownish above, a wide indistinct silvery lateral stripe, more distinct in young.

M. C. Z. 17,983. Peru: Callao. Hassler Expedition. Seventeen specimens. Length 100-140 mm.

Coast of Peru.

## ANCHOVIELLA ASTILBE (Jordan and Rutter).

*Engraulis astilbe* Jordan & Rutter, Proc. Acad. nat. sci. Phil., 1897, p. 95.

Head 4; depth 5.8; dorsal 15; anal 20; ventral 7. Vertebrae forty-four. Scales about forty, caducous (the pockets counted). Body cylindrical, the ventral margin slightly compressed and without scutes. Eye 3.5 in head, imperforated adipose eyelid present. Snout projecting, pointed, its length 1.2 in eye. Mouth large, the maxillary extending to gill-openings, its tip sharp pointed. Mandible ending below anterior margin of preopercle, its length equal to head posterior of the middle of eye. Teeth very small, but present in jaws, vomer, palatines, pterygoid. No canines. Gill-rakers thirty on the lower limb of the first arch, the longest 1.3 in eye. Opercle smooth, its length 2 in head, its width 1.8 in its length, its posterior margin rounded. V-shaped figure of cheeks distinct, its depth 3 in head. Origin of the dorsal midway between the end of the caudal vertebra and the posterior margin of eye, its longest ray equal to the base of the fin. Ventrals anterior to dorsal, being slightly nearer to origin of pectorals than to anal. Origin of the pectorals midway between the ventrals and the middle of eye, its length equal to head posterior of the eye, its tip falling far short of ventrals. Origin of the anal is below the 9th dorsal ray, its base is 5 in the standard length. Caudal forked, its length about equal to head. Alar scales present.

Color hyaline, an indistinct light silvery stripe from head to caudal, the margins of which are not distinctly marked, its width less than eye.

COTYPES.—M. C. Z. 31,392. Jamaica. J. S. Roberts. Stanford University. Nine specimens. Length 49–70 mm.  
Jamaica.

## ANCHOVIELLA ARGYROPHANUS (Cuvier and Valenciennes).

*Engraulis argyrophanus* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 49.

*Stolephorus eurystole* Swain & Meek, Proc. Acad. nat. sci. Phil., 1884, p. 34.

Head 3.9; depth 5.7; dorsal 14; anal 18; ventral 7. Vertebrae forty-four. Body cylindrical, the belly scarcely compressed, no scutes. Scales caducous, about forty pockets. Eye 4.7; snout projecting, pointed, its length almost equal to eye. Mouth large, the maxillary ending at mandibular joint, its tip truncated. Teeth distinct in jaws, vomer, palatines, and pterygoid. Gill-rakers thirty, as long as snout. Opercle smooth except a small knob on upper anterior portion. Length of opercle 2.2 in head, its width 2.5 in its length, its posterior margin rounded. V-shaped area of cheeks distinct, its depth 3 in head. Origin of dorsal nearer tip of snout than to the end of the caudal vertebra. The origin of the ventral is but slightly anterior to origin of the



dorsal. The origin of the anal is posterior of the last dorsal ray by a distance equal to eye, its base is 6.8 in the standard length.

Color brown, with a distinct, sharply-outlined silver stripe from head to caudal, its greatest width in the center where it is equal to eye.

M. C. Z. 27,592. Mass.: Provincetown. J. H. Blake. One specimen. Length 94 mm.

This rare species drifts northward in the Gulf Stream, to Cape Cod. The type of *Engraulis argyrophanus* examined by Dr. Jordan in Paris is regarded by him as identical with *Stolephorus eurystole* from Cape Cod. The smaller number of vertebrae and of gill-rakers as well as its tropical habit would seem to range this species and others with *Anchoviella* rather than with *Engraulis*.

#### ANCHOVIELLA PURPUREA (Fowler).

*Engraulis purpurea* Fowler, Proc. Acad. nat. sci. Phil., 1900, p. 497.

Head 3.7; depth 7; dorsal 14; anal 16; ventral 7. Vertebrae forty-four. The last anal ray is distinctly longer than those immediately preceding it. Scales caducous, forty-two in lateral series (pockets counted). Body cylindrical, the ventral margin but little compressed and without scutes. Eye 3.7 in head. Snout projecting, pointed, its length 1.2 in eye. Mouth large, the maxillary not extending posterior to mandible, its length equal to head posterior of the middle of eye. Mandible ending below the anterior margin of the preopercle, its length slightly more than maxillary. Teeth small, but distinct in jaws, vomer, palatines, and pterygoids. No canines. Gill-membranes not broadly joined. Gill-rakers twenty-eight on the lower limb of the first arch, the longest 1-5 in eye. Opercle smooth, its posterior border rounded, its length 1.7 in head, its width 1.8 in its length. V of cheeks distinct, its depth 3 in head. Origin of the dorsal midway between the end of the caudal vertebra and the anterior margin of eye, its longest ray slightly more than the base of the fin. Ventrals but little anterior to dorsal, being distinctly nearer to anal than to origin of pectoral, its length equal to the distance from tip of snout to middle of the eye. Origin of the pectoral midway between the ventrals and the eye, its length equal to the head posterior of eye, its tip falling far short of the ventrals. Origin of the anal distinctly posterior to the last dorsal ray, its length 6.7 in the standard length. Caudal forked, its length less than head. Alar scale present.

Color brownish, a distinct silver lateral stripe from head to caudal, the edges of which are well defined, its width less than eye, it is of slightly less width anteriorly and posteriorly.

M. C. Z. 17,935. Oahu: Honolulu. Andrew Garrett. Six specimens. Length 40-65 mm.

M. C. Z. 28,951. Oahu: Honolulu. U. S. B. F. Six specimens. Length 42-66 mm.

M. C. Z. 31,391 (Orig., 7,650). Oahu: Honolulu. Jordan Collection. Nine specimens. Length 45-60 mm.

This species is very abundant on sandy shores of Oahu and is largely used as bait. It seems to be a true *Anchoviella*, as is also *Anchovia apiensis* Jordan and Seale from Samoa. *Anchovia erermanni* Jordan and Seale, from Samoa, belongs to *Stolephorus* as here defined.

#### ANCHOVIELLA CHOEROSTOMA (Goode).

*Engraulis choerostomus* Goode, Amer. Journ. Sci., 1874, ser. 3, 8, p. 125.

Head 3.2; depth 5.7; dorsal 13; anal 23; ventral 7. Scales about thirty-eight, caducous. Ventral profile scarcely curved, its margin moderately compressed. No scutes. Eye 4 in head, snout long, projecting, pointed, its length equal to eye. Mouth large, the maxillary extending posterior of the end of mandible, but falling slightly short of the gill-openings, its length equal to head posterior of the anterior margin of eye, its tip pointed. Length of mandible slightly less than that of maxillary. Teeth small in jaws, vomer, palatines, pterygoids, and hyoids. Gill-rakers twenty-four on the lower limb of the first arch, the longest slightly more than eye. Opercle smooth except a low rounded ridge in the center. The upper posterior margin is slightly concave, thus forming a slight point on the extreme posterior margin. Length of opercle 2.3 in head, its width 2.7 in its length. V of cheeks large, its depth 2.5 in head. Origin of the dorsal midway between the end of the caudal vertebra and the middle of eye, its longest ray distinctly greater than the base of the fin. Origin of the ventral anterior to dorsal being slightly nearer to anal than to origin of the pectoral, its length equal to the distance from the tip of snout to posterior margin of the pupil. Origin of the pectoral midway between origin of the ventrals and the posterior margin of the eye, its length equal to head posterior of the eye, its tip falling short of the ventrals. Origin of the anal is below the last ray of dorsal, its base is 4.7 in the standard length. Caudal forked, its length less than head.

Color light brown, with a distinct silver lateral stripe which is about equal to width of eye, some dark dots on its upper margin.

M. C. Z. 18,024. ————. Alexander Agassiz. One specimen.

M. C. Z. 23,296. Panama: East Coast. Watson. Three specimens.

M. C. Z. 28,848. Porto Rico: Fajardo. U. S. B. F. Four specimens. Length 38-44 mm.

Bermudas and southward. Common in Hamilton Harbor, Bermuda.

## ANCHOVIELLA MITCHILLI (Cuvier and Valenciennes).

*Engraulis mitchilli* Cuvier & Valenciennes, Hist. nat. poiss., 1848, **21**, p. 50.

*Engraulis louisiana* Le Sueur. Cuvier & Valenciennes, Hist. nat. poiss., 1848, **21**, p. 51.

*Engraulis duodecim* Cope, Trans. Amer. philos. soc., 1866, **13**, p. 405.

Head 4; depth 4.1; dorsal 13; anal 27; ventral 7. Vertebrae forty-one. Scales caducous, thirty-eight in a lateral series (the pockets counted). Body rather short and compressed. The ventral profile moderately curved, its margin sharp but without scutes. Eye 3.2 in head. Snout produced, pointed, its length 2 in eye. Mouth large, the maxillary extending posterior to mandible, but falling a slight distance short of gill-openings, its tip sharp pointed. Mandible ending below the anterior margin of the preopercle, its length less than the maxillary. Teeth distinct in jaws, vomer, palatines, and pterygoids. No canines. Gill-rakers twenty-four, the longest 1.5 in eye. Opercle with a single low ridge in its center, its posterior border concave, a small point thus formed at its lower posterior border. Length of opercle 1.6 in head, its width 2.7 in its length. V of cheeks distinct, its depth 3.2 in head. Origin of the dorsal midway between end of caudal peduncle and the upper anterior margin of the opercle, its longest ray about equal to the base of the fin. Origin of the ventrals anterior to dorsal, being midway between the origin of the pectoral and origin of the anal, its length equal to the distance from tip of snout to middle of the eye. Origin of the pectoral midway between origin of ventrals and middle of eye, its length equal to the head posterior of the middle of eye, its tip scarcely reaching ventrals. Origin of anal is below the 6th ray of dorsal, its base is 3.7 in the standard length. Caudal forked, its length much greater than head.

Color light yellowish brown, a more or less distinct lateral stripe from head to caudal, its margins indistinct, its width less than eye.

M. C. Z. 17,939. N. J.: Somers Point. William Stimpson. Five specimens. Length 28-55 mm.

M. C. Z. 17,940. N. J.: Somers Point. William Stimpson. Four specimens.

M. C. Z. 17,949. Florida. J. E. Holbrook. Three specimens. Length 49-54 mm.

M. C. Z. 17,956. Cuba. Poey Coll. Three specimens. Length 55-70 mm.

M. C. Z. 18,004. Brazil. Louis Agassiz. Sixty-four specimens. Length 48-68 mm.

M. C. Z. 18,012. Brazil: Pernambuco. Nathaniel Thayer Expedition. Eight specimens.

M. C. Z. 18,026. S. C.: Charleston. Louis Agassiz. One specimen.

M. C. Z. 31,399 (Orig. 21,382). Louisiana. D. S. Jordan. Four specimens. Length 67-80 mm.

M. C. Z. 31,548. Va.: Ft. Monroe. Mrs. C. N. Willard. One specimen.

M. C. Z. 31,552 (Orig. 17,938). N. J.: Somers Point. William Stimpson. Three specimens.

M. C. Z. 31,553. ————. Twenty-two specimens.

Ranges from the West Indian region, northward to Cape Cod, entering sandy streams in abundance.

#### ANCHOVIELLA JANUARIA (Steindachner).

*Engraulis januarius* Steindachner, Sitzber. Akad. wiss. Wien, 1880, **80**, p. 178.

Head 4.1; depth 4.5; dorsal 17; anal 20; ventral 7. Vertebrae forty. Scales about thirty-eight, persistent, the grooves complete in the center of the scale, with three or four short lines anteriorly and two or three rows of net-work of lines posteriorly. Posterior margin of scales crenulate. Body rather deep, the margin compressed, but without scutes. Eye 3.3 in head. Snout projecting, pointed, its length 1.7 in head. Mouth large, the maxillary not extending posterior to end of mandible, the tip not very sharp, its length equal to head posterior of the anterior margin of the eye. Mandible scarcely less than maxillary. Very small teeth in jaws, vomer, palatines, and pterygoids. Gill-membranes not broadly united, gill-rakers twenty-three, the longest scarcely equal to pupil. Opercle smooth, its posterior margin slightly concave, forming a slight point at its lower border, as in *A. mitchilli*. Length of opercle 2.2 in head, its width 1.5 in its length. Origin of dorsal midway between the end of the caudal vertebra and the posterior margin of the eye. Origin of the ventrals distinctly anterior to dorsal. Origin of the pectoral is midway between the origin of the ventrals and the middle of eye, its tip falling far short of ventrals. Origin of the anal is below the 8th dorsal ray. Caudal forked, its length about equal to head.

Color light brownish, a distinctly outlined silver stripe from head to caudal, this graduating in width from the head, where it is about as wide as the pupil to the base of the caudal, where it is half as wide as the eye, it then spreads over the base of the caudal.

M. C. Z. 4,692. Brazil: Rio de Janeiro. Two specimens. Length 47-55 mm.

M. C. Z. 31,400 (Orig. 22,089). Brazil. Stanford University. Seven specimens.

Coast of Brazil.

## ANCHOVIELLA CURTA (Jordan and Gilbert).

*Stolephorus curtus* Jordan & Gilbert, Proc. U. S. N. M., 1882, 4, p. 343.

Head 4; depth 5; dorsal 14; anal 23; ventral 7. Vertebrae forty-one. Scale thirty-six, caducous (the pockets counted). Ventral profile but slightly curved, its margin compressed, but without scutes. Eye 3.1 in head. Snout projecting, pointed, its length 1.5 in eye. Mouth large, the maxillary extending slightly posterior to mandible, but falling short of the gill-openings, its length equal to head behind the posterior margin of the pupil, its tip rather sharp pointed. Mandible ending below anterior margin of the preopercle, its length slightly less than the maxillary. Teeth small, but present in jaws, vomer, palatines, and pterygoids. No canines. Gill-rakers twenty-five on the lower limb of the first arch, the longest 1.5 in eye. Opercle smooth except a single low ridge in the center, the posterior margin concave, forming a point where it meets the subopercle. Length of opercle 2.4 in head, its width 2 in its length. V of cheeks distinct, its depth 3.7 in head. Origin of the dorsal midway between end of caudal vertebra and the posterior margin of the pupil, its longest ray equal to the base of the fin. Origin of the ventral anterior to dorsal, being slightly nearer to origin of the pectorals than to origin of anal. Origin of the pectoral midway between origin of ventral and anterior margin of the eye, its length more than head posterior of eye, its tip falling a little short of ventrals. Origin of the anal is below the 8th dorsal ray, its base 4 in the standard length. Caudal forked, its length equal to head.

Color yellowish brown. A silvery lateral stripe about the width of eye, from head to caudal, but usually more distinct posteriorly, this stripe diffused and almost obsolete in some specimens.

COTYPES.—M. C. Z. 31,402 (Orig. 2,694). Mex.: Mazatlan. C. H. Gilbert. Twenty-one specimens. Lengths 40–53 mm.

This species is locally abundant about Mazatlan, in the muddy estuary.

## ANCHOVIELLA COMPRESSA (Girard).

*Engraulis compressus* Girard, Rept. Pacific R. R. surv., 1858, 10, p. 336.

Head 4; depth 3.9; dorsal 13; anal 30; ventral 7. Vertebrae forty. Scales caducous, thirty-six in a lateral series. The grooves on the anterior half of the scale incomplete and more or less radiating, the grooves on the posterior portion of the scale with ten grooves complete or nearly so, the net-work form confined to about three rows at the tip. Ventral profile but little curved, the margin rather dull and without scutes. Snout short, little projecting, its length 2 in eye. The eye is 3.3 in head. Mouth large, the maxillary ending below the anterior lower border of the preopercle, its tip on a line with the end of the mandible, its length equal to head posterior of the middle of the pupil.

Mandible 1.5 in head, its anterior tip below nostril. Distinct teeth but no canines in jaws, palatines, pterygoids, and vomer. Gill-membranes not broadly connected. Gill-rakers twenty-three on the lower limb of the first arch, the longest 1.7 in eye. These are flat and the inner margin spinulate. Opercle smooth, its length 2.3 in head, its width 1.7 in its length. Origin of the dorsal midway between end of caudal vertebra and posterior margin of eye, its longest ray distinctly more than the base of the fin, being equal to head posterior to middle of eye. Origin of the ventral anterior to dorsal, being midway between origin of pectoral and base of the third anal ray. Origin of pectoral midway between base of ventral and posterior margin of pupil, its length equal to head posterior of the anterior margin of eye, its tip extending to ventrals. Origin of the anal under the fifth ray of dorsal, its base equal to distance from origin of dorsal to opercle. Caudal forked, the lower lobe the longest, its length more than head.

Color hyaline, a distinct silvery lateral stripe, equal to length of eye or more anteriorly.

M. C. Z. 17,986. Cal.: San Diego. Hassler Expedition. Twenty specimens.

M. C. Z. 17,987. Cal.: San Diego. Hassler Expedition. Twenty-three specimens.

M. C. Z. 17,988. Cal.: San Diego. Hassler Expedition. Thirteen specimens.

M. C. Z. 17,989. Cal.: San Diego. Hassler Expedition. Twenty-one specimens.

M. C. Z. 17,990. Cal.: San Diego. Hassler Expedition. Eight specimens.

M. C. Z. 17,991. Cal.: San Diego. Hassler Expedition. One specimen.

M. C. Z. 24,298. Cal. Alexander Agassiz. One specimen. Length 112 mm.

M. C. Z. 31,404. Mexico. Stanford University. Three specimens.

California, from Point Concepcion to Magdalena Bay. Common. A rather large fish, notable for its unusual number of anal rays.

#### ANCHOVIELLA MUNDEOLA (Gilbert and Pierson).

*Stolephorus mundeolus* Gilbert & Pierson, Bull. 47, U. S. N. M., 1898, 3, p. 2812.

Head 4; depth 3.8; dorsal 13; anal 35; ventral 7. Scales thirty-six. The grooves on the distal end of the scale are complete but with a distinct notch in the center, the anterior half of the scale has some horizontal grooves and three

or four incomplete grooves. The scales are persistent. Ventral profile but little curved and moderately sharp on its edge but without scutes. Eye one half greater than the snout, its length 3.6 in head. Mouth large, with a conical projecting snout above it. The anterior tip of the under jaw is under nostril. Maxillary reaching to the anterior third of opercle, its length 1.3 in the head, its tip obliquely pointed, its outline almost straight, its lower border with fine teeth. Mandible ending below the anterior border of the opercle, its length 1.4 in the head, its greatest depth 5 in its length. Fine teeth in jaws, vomer, palatines, and hyoid. Gill-rakers twenty-two on the lower limb of the first arch, the longest slightly more than one half of eye. Posterior half of the gill-chamber rounded. Opercle smooth. Origin of the dorsal is midway between the end of the caudal vertebra and the posterior margin of the eye, the longest ray much greater than the base of the fin, being equal to the distance from tip of the snout to opercle. Origin of the ventral anterior to dorsal, being midway between the origin of the pectoral and the anal pore, its length equal to the distance from tip of the snout to the posterior margin of the eye. Origin of the anal under the sixth dorsal ray. Origin of the pectoral midway between the origin of the ventrals and the posterior margin of the pupil, its length equal to the head without the snout. Caudal forked, its length greater than head. No alar scales.

Color silvery.

This species is abundant about Panama; it may prove inseparable from *Anchoviella panamensis*, both species having the anal fin unusually long.

#### ANCHOVIELLA SPINIFERA (Cuvier and Valenciennes).

*Engraulis spinifer* Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 39.

Head 4; depth 4.2; dorsal 16; anal 37; ventral 7. Vertebrae forty-three. Scales forty-one, caducous, the scale-grooves on the anterior half of the scale incomplete, on the distal portion they form seven to nine rows of net-work or eyes. Ventral profile moderately curved, the margin not very sharp. No scutes. Snout projecting, pointed, its length 1.3 in eye. The eye is 5 in head. Mouth large, the maxillary extending slightly beyond the distal end of the mandible, its length equal to head posterior of the anterior margin of eye. Mandible ending below the lower anterior margin of preopercle, its length 1.2 in head, its anterior end under nostril. Distinct teeth in jaws, palatines, vomer, and pterygoids. Gill-membrane not broadly united. Gill-rakers fifteen on the lower limb of the first arch, these are short, flat, the longest about equal to eye. Subopercle with a short triangular projection extending posterior to opercle, hence *spinifer*. Length of opercle 1.7 in head, its width 3.1 in its length. Triangle of cheeks prominent. Origin of dorsal midway between tip of snout and the anterior margin of the caudal peduncle, its longest ray distinctly more than the base of the fin. Origin of ventral anterior to dorsal,

midway between origin of pectoral and anal. Origin of pectoral midway between origin of ventral and eye, its length slightly more than head posterior of the eye. Origin of the anal is below the 8th dorsal ray, its base equal to distance from origin of the dorsal to the upper anterior margin of the preopercle. Caudal forks, its lower lobe the longest, about equal to head.

Color silvery, brownish above. The silver lateral band wide and poorly defined anteriorly, but becoming narrowed to width of one scale posteriorly where it is well defined. Tip of dorsal and margin of caudal dark.

M. C. Z. 31,558 (Orig. 17,982). Panama. One specimen. Length 170 mm.

M. C. Z. 31,559 (Orig. 18,016). Brazil: Cachoeira. Nathaniel Thayer Expedition. Fourteen specimens. Length 80-185 mm.

West Indies and Brazil, also taken at Panama. A strongly-marked species notable for its long anal fin.

This species, with *Anchoviella panamensis*, *Anchoviella mundeola*, and others with many-rayed anal are quite different from the type of *Anchoviella*, but we fail to find any sharp line of demarcation.

#### AMPLOVA Jordan and Seale.

Copeia, 1925, no. 141, p. 31.

A name used at Nice for the common European Anchovy; evidently derived from the same root, Gr. *Anchovia*.

TYPE.—*Amplova balboae* Seale.

This genus is close to *Anchoviella*, differing in the form of the mouth, which approaches that of *Clupea*, the maxillary being short, rounded behind, its width about equal to that of pupil. Anal rays twenty-seven; gill-rakers twenty to twenty-five.

Three species, from Brazil and Panama.

#### AMPLOVA JAMESI, sp. nov.

Head 4; depth 6; dorsal 12; anal 22; ventral 7. Scale caducous, about thirty-eight in lateral series. The scale with three to four grooves from center to anterior margin and a complete groove through the center, also four complete grooves on the posterior half but no net-work of lines. Ventral profile about equal to dorsal, body moderately compressed, the ventral margin sharp but without scutes. Head short and rounded, the snout not projecting, the jaws being almost equal, the deep rounded snout is above the tip of the lower jaw. Eye 3.2 in head. Snout 1.7 in eye. Mouth small, the maxillary being shaped much as in *Clupea*, its width being almost equal to the pupil, its tip



distinctly anterior to mandibular joint, being but little posterior to hind margin of eye, its length 2 in head, its posterior margin rounded. Mandible inserted under the posterior margin of the preopercle, its length less than head posterior of eye. Teeth small, in jaws, vomer, palatines, and pterygoids. No canines. Gill-membranes not broadly united. Gill-rakers twenty on the lower limb of the first arch, the longest 2 in eye. They are slim, narrow, and pointed, spinulose on their inner margin. Opercle smooth, its length 2.3 in head, its width almost equal to its length, its greatest width being on its lower half. Posterior margin concave. The subopercle is quadrangular in shape and forms the most posterior portion of the head, at the point where it joins the opercle. V of cheeks not evident. Origin of the dorsal midway between the caudal vertebra and the middle of the opercle, its longest ray almost twice the base of the fin, being equal to head behind the anterior margin of eye. Ventral anterior to dorsal, being midway between the origin of the pectoral and origin of anal, its length 2 in head. Origin of pectoral midway between ventrals and the anterior margin of eye, its length equal to dorsal, its tip reaching to ventrals. Origin of the anal is below the fifth dorsal ray, its base 4.2 in the standard length. Caudal forked, its length about equal to head.

Color light brownish, a rather indistinct silvery lateral stripe from head to caudal, its margin rather diffuse, its width less than eye.

TYPE.—M. C. Z. 18,014. Brazil: Jutahy River. William James. One specimen.

M. C. Z. 17,783. Brazil: Lago Alexo. S. V. R. Thayer. One specimen.

M. C. Z. 17,784. Brazil: Lago Alexo. S. V. R. Thayer. One specimen.

#### AMPLOVA BALBOAE, nom. nov.

*Anchovia brevirostra* Meek & Hildebrand, Fishes of Panama, 1923, p. 198.

This species lately described from Balboa in the Canal Zone is the original type of *Amplova*, having the same small herring-like mouth. It is, however, much deeper in body than *Amplova jamesi*, the depth  $3\frac{1}{2}$  to 4; the anal rays twenty-three to twenty-seven; the gill-rakers twenty-five to thirty. The snout is very short, scarcely longer than pupil, and the maxillary does not reach posterior edge of eye. The caudal is edged with black.

*Engraulis brevirostris* Günther from Cachoeira, Bahia, Brazil, seems to belong to this same genus, being near *Amplova jamesi*. The name of the present species must therefore be changed.

## ANCHOVIA Jordan and Evermann.

Bull. 47, U. S. N. M., 1896, 1, p. 449.

TYPE.—*Engraulis macrolepidota* Kner & Steindachner.

This genus is distinguished by the numerous, close set gill-rakers, there being ninety-five to one hundred and twenty on the lower limb of the first arch. The body is very deep and compressed, not translucent. Vertebrae forty to forty-two. No ventral scutes. Scales firm. Maxillary not extending posterior to the gill-openings. Origin of anal below anterior third of dorsal. Teeth fine, even. Tip of pectorals reaching to beyond base of ventrals. Silvery stripe, if present, broad and diffuse.

Several species in tropical America, among the largest of anchovies, deep-bodied and with very many long gill-rakers.

## ANCHOVIA CLUPEOIDES (Swainson).

*Engraulis clupeioides* Swainson, Nat. hist., 1839, 2, p. 388.

*Engraulis productus* Poey, Repertorio, 1866, 1, p. 380.

*Stolephorus surinamensis* Bleeker, Nat. tijd. dierk., 1866, 3, p. 178.

Head 3.6; depth 3.6; dorsal 15; anal 30; ventral 7. Vertebrae forty. Scales forty, the grooves incomplete, the radii forming a net-work pattern of lines, two or three rows deep on the apical portion of scale. Ventral profile moderately curved, the margin somewhat compressed but not sharp. No scutes. Eye 4.5 in head. Snout pointed, projecting, its length half that of eye. Maxillary extending slightly posterior to mandible, but falling short of gill-openings, its length equal to head posterior of the eye, its anterior tip below the nostril. Small but perfectly formed teeth on vomer, palatines, and jaws, those on the edge of the maxillary very fine. Gill-rakers one hundred and two on the lower limb of the first arch, the longest equal to the distance from tip of snout to middle of eye, these are slim, pointed, and spinulose on their inner margin. Opercle smooth, its length 1.8 in head, its width 3 in its length. Subopercle with a projecting point, which, however, is much less distinct than in *Anchoviella spinifera*. Origin of the dorsal is midway between end of caudal vertebra and middle of eye. Origin of the ventral anterior to dorsal, being nearer to origin of the pectoral than to the anal, its length equal to the distance from the tip of snout to posterior margin of the eye. Origin of the pectoral midway between anal pore and the middle of the eye, its length equal to head posterior of the eye. Origin of the anal is under the 7th dorsal ray, the length of its base is 3.1 in the standard length. Caudal forked, its length equal to head.

Color silvery. No silvery lateral stripe on the type.

M. C. Z. 17,951. Cuba. Poey Coll. Two specimens. Length 160, 165 mm.

M. C. Z. 17,961. Cuba. Poey Coll. Two specimens. Length 160, 175 mm. COTYPES of *A. producta* (Poey).

M. C. Z. 17,964. Cuba. Poey Coll. One specimen. Length 160 mm.

M. C. Z. 18,010. Brazil: Pernambuco. Hart and Copeland. Three specimens.

M. C. Z. 28,822. Porto Rico: Palo Seco. Coll. Fish Hawk. One specimen. Length 133 mm.

M. C. Z. 31,556 (Orig. 22095). Brazil. Stanford University. Two specimens.

Abundant from Cuba to Brazil.

Largest of the Anchovies, reaching the length of a foot.

#### ANCHOVIA NATTERERI (Steindachner).

*Engraulis nattereri* Steindachner, Sitzber. Akad. wiss. Wien, 1880, **80**, p. 174.

Head 3.5; depth 3.3; dorsal 15; anal 33; ventral 7. Vertebrae forty-two. Scales forty, caducous, the grooves incomplete anteriorly, a net-work of lines on the posterior portion. Body deep and compressed, the ventral profile moderately curved, the margin compressed, but without scutes. Eye 4 in head. Snout pointed, projecting, its length 2 in eye. Mouth large, the maxillary ending at the mandibular joint and not extending posterior of the mandible, its length equal to head posterior of the pupil, its tip obliquely truncate. Mandible ending below the anterior margin of the preopercle, its length equal to the maxillary. Teeth apparently absent; a lens, however, reveals their presence in the jaws, vomer, palatines, pterygoids, and hyoids. Gill-rakers ninety-eight on the lower limb of the first arch, the longest equal to eye, these are slim, pointed, with their inner margin spinulose. No broad membrane on their inner margin. Opercle 1.8 in head, its width 3.5 in its length. Its surface smooth except a low rounded ridge in the center. Suboperculum with a point extending back (as in *Anchoviella spinifera* and *Anchovia clupeioides*). V of the cheeks distinct, its depth 2.5 in head. Origin of the dorsal midway between the end of the vertebra and posterior margin of the pupil, its longest ray slightly more than the base of the fin, but distinctly less than the head posterior of the eyes. Origin of the ventral posterior to dorsal, being nearer to origin of the pectoral than to anal, its length more than eye, broken in type. Origin of the pectoral midway between origin of the anal and the tip of snout, being much nearer to ventral than to eye, its length less than head posterior of the eyes, its tip reaching to ventrals. Origin of the anal is

below the 4-7 dorsal ray, its base 3.2 in the standard length. Caudal forked, its length less than head.

Color silvery, slightly darker above, no silvery lateral stripe.

M. C. Z. 18,044. Brazil: Pará. Nathaniel Thayer Expedition. Five specimens. Length 95-135 mm.

This species resembles *A. clupeoides* more nearly than it does Steindachner's description of *A. nattereri*. There is very little, if any, difference between the two.

### CETENGRAULIS Günther.

Cat., 1868, 7, p. 383.

TYPE.—*Engraulis edentulus* Cuvier.

This genus differs from all other members of the family in having the gill-membranes broadly united over the isthmus. These membranes are thin and readily torn, a fact which has caused confusion among the nominal species. Vertebrae forty-one. Body elongate, compressed, rather deep. No armed scutes on ventral margin. Maxillary short, not extending beyond base of mandible. Teeth very minute. Gill-rakers fine, numerous, fifty to fifty-seven, with a broad membrane lining their inner surface. Origin of anal under posterior third of dorsal, its rays twenty-three to twenty-six. No silvery lateral stripe.

The two known species are from tropical America.

### CETENGRAULIS EDENTULUS (Cuvier).

*Engraulis edentulus* Cuvier, Règne anim., ed. 2, 1829, 3, p. 323.

*Cetengraulis edentulus* Günther, Cat., 1868, p. 383. Cuvier & Valenciennes, Hist. nat. poiss., 1848, 21, p. 51. Meek & Hildebrand, Fishes of Panama, 1923, p. 214.

*Engraulis brevis* Poey, Repertorio, 1866, 1, p. 379.

*Stolephorus garmani* Evermann & Marsh, Rept. U. S. fish. for 1899, 1900, p. 352. Separate: Washington, 1900, p. 89.

*Stolephorus gilberti* Evermann & Marsh, Rept. U. S. fish. for 1899, 1900, p. 352. Separate: Washington, 1900, p. 90.

Head 3.3; depth 3; dorsal 15; anal 23 to 25; ventral 7. Vertebrae forty-one. Last ray of the anal and also of the dorsal is slightly longer than the middle rays. Each ventral is almost concealed beneath a large scale. Dorsal and anal with very deep scaly sheaths. Scales thirty-nine, not caducous, the grooves incomplete forming numerous angles on the anterior half of the scale and about eight rows of graduated net-work on the posterior half. Ventral

profile not strongly curved, the margin rather dull, without scutes. Snout projecting, pointed, its length 1.7 in eye. The eye is 4.5 in head. Mouth large, the maxillary falling a trifle short of the end of the mandible, its length equal to head posterior of the eye. Mandible 1.7 in head, its posterior margin on a line with preopercle. Fine teeth in the jaw and vomer, palatines, and pterygoids. Gill-membranes broadly united across the isthmus, unless torn apart. Gill-rakers fifty-two on the lower limb of the anterior arch. The rakers are long, slim, the longest equal to the distance from tip of snout to hind margin of pupil. There is a deep gill-membrane on the inside of each gill-arch. Each gill-raker is strongly bent or rather branched, one branch forming the true raker and the other a false raker buried in membrane just inside of the true raker, being more or less V-shaped in section. Opercle smooth, its length 1.7 in head, its width 2.1 in its length, its lower margin strongly oblique. Origin of the dorsal midway between the end of the caudal vertebra and the posterior margin of eye, its longest ray scarcely equal to the base of the fin, being less than head posterior of eyes. Origin of the ventral anterior to dorsal, being midway between pectoral and anal bases, its length equal to the distance from tip of the snout to posterior margin of the pupil. Origin of the pectoral midway between ventrals and the posterior margin of the eye, its length less than head posterior of the eye; a third of the fin is covered with scales. Origin of the anal is under the 12th dorsal ray, its base equal to head posterior to the middle of eye. Caudal forked, length less than head. Alar scales present.

Color yellowish bronze, no trace of silver lateral stripe.

M. C. Z. 4,694. Brazil: Rio de Janeiro. Nathaniel Thayer Expedition. Twenty-four specimens. Length 115-165 mm.

M. C. Z. 17,957. Cuba: Poey Coll. Two specimens. Length 150, 155 mm.

M. C. Z. 17,960. Cuba. Poey coll. One specimen. Length 140 mm.

M. C. Z. 17,962. Cuba. Poey Coll. One specimen. Length 130 mm.

M. C. Z. 18,058. Brazil: Sambaia. Nathaniel Thayer Expedition. Two specimens.

M. C. Z. 18,059. Brazil: Cachoeira. Nathaniel Thayer Expedition. One specimen. Length 130 mm.

M. C. Z. 24,296. Cuba. Poey Coll. One specimen. Length 128 mm. (TYPE of *Engraulis brevis* Poey. Head 3.1; depth 3.1; maxillary equal to postorbital part of head; gill-rakers 57).

M. C. Z. 31,451. Brazil: Rio de Janeiro. One specimen.

M. C. Z. 31,557 (Orig. 17,951a). Cuba. Poey Coll. Two specimens. Length 150, 155 mm.

Atlantic coasts of tropical America.

According to Meek and Hildebrand who have examined the types of both, *Stolephorus garmani* and *Stolephorus gilberti* are both identical with *Cetengraulis edentulus*, the weak membrane of the branchiostegal having in both cases been torn.

#### CETENGRAULIS MYSTICETUS (Günther).

*Engraulis mysticetus* Günther, Proc. Zool. soc. London, 1866, p. 604.

*Cetengraulis mysticetus* Günther, Cat. 1868, 7, p. 383.

*Stolephorus opercularis* Jordan & Gilbert, Proc. U. S. N. M., 1882, 4, p. 275.

Head 2.5; depth 3.2; dorsal 15; anal 23; ventral 7. Vertebrae eighty-one. The last anal and last dorsal a trifle longer than the middle rays of these fins. Scales forty-one; the grooves incomplete, the posterior half of the scale with about eight rows of net-work which are graduated. Ventral profile moderately rounded, more rounded than dorsal, its margin compressed but not sharp. No scutes. Snout projecting, pointed, its length 1.5 in eye. The eye is 5.1 in head. Mouth large, the maxillary 1.7 in head, its posterior end not quite reaching distal end of the mandible, its length being less than head posterior of eye. Mandible 1.7 in head, its anterior tip under the nostril, its posterior end under the lower anterior border of the preopercle. Some very small teeth present in jaws, palatines, and hyoid. Gill-membranes broadly united, gill-rakers fifty-seven on the lower limb of the first arch. These are long, slim, with a broad membrane on the inner side (as described for *Cetengraulis edentulus*). Longest gill-raker equal to the distance from tip of snout to posterior margin of pupil. Opercle smooth, its length 2 in head, its width 2 in its length. Origin of the dorsal midway between end of the caudal vertebra and anterior margin of the preopercle, its longest ray equal to the base of the fin. Origin of ventral but little anterior to dorsal, its length equal to distance from tip of snout to posterior margin of the pupil. Origin of the pectoral much nearer the ventrals than to eye, its length distinctly less than the postorbital portion of head. Origin of the anal under the 12th ray of dorsal, its base less than the postorbital portion of head. Caudal forked equal to postorbital of head. Alar scales distinct.

Color silvery, darker above, no silvery lateral stripe on our specimens, tip of caudal a little dark.

M. C. Z. 18,055. Panama. Hassler Expedition. Three specimens. Length 137–150 mm. (These specimens differ from *C. edentulus* chiefly in the longer and more pointed head).

M. C. Z. 18,056. ————. Hassler Expedition. Eight specimens. Length 140–155 mm.

Pacific Coast of tropical America.

*Cetengraulis engymer* Gilbert and Pierson from Panama is said to

have the gill-membranes narrower, the gill-rakers thirty, the anal rays twenty to twenty-three. Meek and Hildebrand regard this species as identical with *C. mysticetus*, but the gill-rakers are much fewer in number. *Stolephorus opercularis* they consider the same, the branchiostegal membrane in the type being evidently torn.

#### MEDIPELLONA, gen. nov.

TYPE.—*Pellona bleekariana* Poey.

This genus, based on a very rare Cuban species, shows some traits intermediate between *Ilisha* of the Clupeidae, and the Engraulidae. There are teeth on vomer as well as on palatines and pterygoids and some of them canines. Maxillary firmly joined to premaxillary; lower jaw projecting; snout broad, deeply notched; ventral fin very small; origin of dorsal behind front of anal. Vertebrae forty-three; anal fin long, of forty-three rays. Gill-rakers few.

#### MEDIPELLONA BLEEKERIANA (Poey).

*Pellona bleekariana* Poey, Repertorio, 1867, 2, p. 242.

*Ilisha bleekariana* Jordan & Evermann, Bull. 47, U. S. N. M., 1896, 1, p. 436.

Body elongate, compressed, not deep, the ventral profile but little curved, its margin sharp and armed with distinct scutes from head to anal pore. Vertebrae forty-three. Scales caducous. Maxillary prolonged, wide, its width equal to two thirds of eye, its length 1.2 in head, tapering to a sharp point posterior of the mandible. Mandible short, deep, shaped as in Clupea, its greatest depth being on its anterior third and about 2 in its length. Teeth distinct in jaws, vomer, palatines, and pterygoids, those of the maxillary, strong canines, intermixed with numerous small teeth. Two to four canines in the front of each jaw; maxillary firmly united to premaxillary; two supplemental bones present. Gill-membranes not broadly united over isthmus. Gill-rakers about fifteen on lower limb of first arch. Origin of dorsal behind origin of anal. Ventrals very small, less than eye, and located midway between end of vertebrae and postorbital, its base 2.5 in standard length. Opercle smooth except a short ridge ending in a buried spine on upper anterior portion. Caudal forked. Depth  $5\frac{2}{3}$  with caudal. D. 15; A. 43; Scutes twenty-five (Poey).

Poey's types of *Pellona bleekariana* from which the above account is taken exhibits relationship to both *Ilisha* (*Pellona*) and the engraulids. The presence of distinct teeth on the vomer and the maxillary firmly joined to the premaxillary separates it at once from *Ilisha*. Its short

deep under jaw and wide maxillary, projecting under jaw, and the broad, thin, short snout with its deep notch is not at all like the engraulids. The arrangement of the fins, however, and the teeth, also the presence of the silvery lateral stripe indicates a close relationship to that group, and the junior author believes that *Medipellona* is as closely related to the Engraulidae as to *Ilisha* in which genus it has been placed by Jordan and Evermann. In the judgement of the senior author, its relationships are on the whole nearer *Ilisha*, a matter worthy of investigation as perhaps indicating the point of union of Clupeidae and Engraulidae.

MEDIPELLONA CARIBBEA (Meek and Hildebrand).

*Ilisha caribaea* Meek & Hildebrand, Fishes of Panama, 1923, p. 191, fig. 1.

Besides *Medipellona bleckeriana*, a second species not very different has been lately described from Panama. It has the head  $4\frac{2}{3}$  in length, the depth  $5\frac{1}{2}$ . Anal rays thirty-seven or thirty-eight. Gill-rakers sixteen. Ventrals shorter than eye. Dorsal beginning slightly behind front of anal.