

of the species came from the Haslar collection, its habitat being unknown.

Head,  $3\frac{3}{4}$  in length; depth,  $1\frac{3}{4}$ . D. circa, 88 (injured); A. 64 (62 to 66). Lat. l. about 80. Mouth very small, the maxillary  $3\frac{4}{5}$  in head. Interorbital space concave, rather broad, its width  $3\frac{1}{2}$  in head. Eyes large, the lower considerably before the upper; its diameter  $3\frac{1}{2}$  in head.

Lateral line with a short sharp curve anteriorly. Gill-rakers very small. Anterior rays of dorsal not elevated. Left pectoral not produced, little longer than right,  $1\frac{1}{4}$  in head.

Coloration highly variegated with different shades of gray, the pale blotches rounded, very irregular in size and position. No distinct black spots along the lateral line. A large whitish cloud between the eyes.

Blind side pale, scaled like the eyed side.

U. S. NATIONAL MUSEUM, *July 28, 1884.*

## A REVIEW OF THE AMERICAN SPECIES OF MARINE MUGILIDÆ.

By DAVID S. JORDAN and JOSEPH SWAIN.

In the present paper is given the synonymy of the species of *Mugilidæ* known to inhabit the salt and brackish waters of America, with analytical keys by which the species and genera may be distinguished. Five of the species of *Mugil* are also described in full.

The marine *Mugilidæ* of America fall naturally into three genera, which may be thus distinguished:

- a. Anal spines three; teeth ciliiform, flexible; stomach muscular, gizzard-like.
- b. Cleft of mouth chiefly anterior; lower jaw broad; cilia in one or few series.
  - MUGIL, 1.
  - bb. Cleft of mouth lateral; lower jaw narrow; cilia in very many series, pavement-like; upper lip very thick; no adipose eyelid; vertical fins scaly.
    - CHÆNOMUGIL, 2.
- aa. Anal spines two, the first soft ray simple, but distinctly articulate; teeth distinct, scarcely ciliiform; lips thin; no adipose eyelid; vertical fins, not scaly; stomach muscular, gizzard-like..... QUERIMANA, 3.

### Genus 1.—MUGIL.

**Mugil**, (Artedi, Genera, 32) Linnæus, Syst. Nat., ed. x, 1758, 316 (*cephalus*).

**Liza**, Jordan & Swain (subgenus nova) (*capito*).

The species of the genus seem to fall into two natural groups, the one having the eye largely covered by a transparent adipose eyelid, the other group having the eyelid obsolete. These groups should apparently rank as subgenera. The type of the genus *Mugil*, *M. cephalus*, as now understood, belongs to the first of these groups, which should retain the name *Mugil*. The other group may receive the name of *Liza*, a name almost universal among Spanish-speaking people for the different species of mullet. All the American species belong to the subgenus *Mugil*, the species of *Liza* being confined to the Old World. Of the latter group,

*Mugil capito* Cuvier (*œur* Forskål) may be taken as the type. Some of the species of *Liza* approach in dentition to *Chænomugil*, and it is possible that the two groups will be found to intergrade.

Besides the species mentioned below, a species with elongate pectorals, as yet undescribed, has been obtained by Prof. Charles H. Gilbert at Panama. Unfortunately all the known examples of this species have been destroyed by fire.

## ANALYSIS OF AMERICAN SPECIES OF MUGIL.\*

- a. Eye with a well-developed adipose membrane (subgenus MUGIL).
- b. Soft dorsal and anal fins almost naked; anal rays, iii, 8; sides with dark longitudinal stripes along the rows of scales; caudal deeply forked; size large.
- c. Scales about 33 in a longitudinal series; depth about  $4\frac{1}{2}$  in length to base of caudal; teeth very minute; distance from tip of pectoral to front of dorsal about two-sevenths the length of the pectoral; lips rather thin.....LIZA, 1.
- cc. Scales about 40 in a longitudinal series; depth about 4 in length to base of caudal; teeth close set, rather small; distance of tip of pectoral from front of dorsal about two-ninths length of pectoral.....CEPHALUS, 2.
- bb. Soft dorsal and anal fins scaly; sides without dark stripes along the rows of scales; caudal less deeply forked; size smaller.
- d. Anal rays, iii, 9; scales 35 to 45 in a longitudinal series.
- e. Scales 42 to 45 in a longitudinal series; teeth small, hair-like; lips rather thin.....INCILIS, 3.
- ee. Scales 35 to 38 in a longitudinal series.
- f. Pectoral nearly reaching origin of dorsal; the distance from tip of pectoral to front of dorsal about one-sixth the length of the pectoral; teeth rather wide set, very small, scarcely visible without a lens in the adult; larger in the young; scales 35 or 36 in a longitudinal series.....GAIMARDIANUS, 4.
- ff. Pectoral not nearly reaching origin of dorsal; the distance from tip of pectoral to front of dorsal being in the adult about one-sixth length of pectoral; teeth close set, rather small (but distinctly visible without a lens); scales 38 or 39 in a longitudinal series.....CUREMA, 5.
- dd. Anal rays, iii, 8; scales very large, about 33 in a longitudinal series; teeth wide set, larger than in any other species, about as long as the nostril; upper lip thick; pectoral not nearly reaching front of dorsal; size small.....BRASILIENSIS, 6.

1. *Mugil liza*. *Lebrancho*. *Liza*. *Queriman*.

*Mugil liza* CUVIER & VALENCIENNES, xi, 83, 1836 (Brazil, Porto Rico, Maracaibo, Surinam, Martinique); JENYNS, Zool. Beagle, Fishes, 1842, 80; Günther, iii, 423, 1861 (West Indies, British Guiana); GOODE, Bull. U. S. Nat. Mus., 5, 1876, 63 (Bermudas); STEINDACHNER, Fisch-Fauna Magdalenen-Stromes, 1878, 10 (Carthagena, Cannavieras, Victoria, Rio Janeiro, Rio Grande do sul, Maldonado, Montevideo, Puerto San Antonio, Patagonia).

*Mugil lebranchus* POEY, Memorias, ii, 1860, 260, tab. 18, fig. 3 (Cuba); POEY, Synopsis, 1868, 388; POEY, Enumeratio, 1875, 98.

\* *Mugil platanus* Günther, a species which we have not seen, is omitted in this analysis.

*Habitat.* Cuba to Patagonia.

Head, 4 in length ( $5\frac{1}{4}$  including caudal); depth,  $4\frac{4}{7}$  ( $5\frac{6}{7}$ ); D. IV-I, 8; A. III, 8. Scales, 12-35. Length, 18 inches.

Body elongate, its depth less than in any other American *Mugil*. Snout broad and bluntish, the upper profile almost straight and horizontal (in young examples the anterior profile is about equally oblique above and below). Interorbital space gently convex, its width 2 in head. Upper lip rather thin. Space at the chin between the mandibular bones oblongate, acutish posteriorly. Preorbital large, almost covering maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth very minute.

Scales large, those on top of head larger; about 21 large scales between origin of dorsal and tip of snout; soft dorsal and anal almost naked. Margin of soft dorsal very concave; the sixth ray shortest, 3 times in second and longest ray. Anal similar to soft dorsal, but slightly less concave. Caudal deeply forked.

Color dusky above, silvery below. A dusky streak along each row of scales, this streak not so wide as in *M. cephalus*. Scales on side and opercle with dark punctulations. Ventrals pale yellowish, the fins otherwise dusky.

This species is abundant in the markets of Havana, where it is usually known as *Lebrancho*. It has not yet been noticed in the waters of Florida, although probably occurring there.

It is readily distinguished from *Mugil cephalus* and other species with naked dorsal and anal by its large scales.

Its synonymy presents little difficulty. The Cuban form was separated by Poey under the name of *Mugil lebranchus* on account of slight discrepancies or errors in the description of Valenciennes. The species *lebranchus* has been regarded as doubtful by Poey. There seems, in fact, no reason of importance for thinking *liza* and *lebranchus* different.

**2. *Mugil cephalus*.** *Striped Mullet. Common Mullet. Céfalo. Cephalus. Antiquarum.*

MUGIL, Artedi, Genera, xxvi, 32, 1738. (Synonymy includes several species; description not diagnostic.)

*Mugil cephalus*, LINNÆUS, Syst. Nat., x, 1758, 316 (based on ARTEDI); CUV. & VAL., xi, 1836, 19 (Mediterranean); GÜNTHER, iii, 1861, 417 (River Niger); (and of European authors generally).

*Mugil albula*, LINNÆUS, Syst. Nat. xii, 520, 1766 (Charleston); GMELIN, Syst. Nat., 1788, 1398 (copied); CUV. & VAL., xi, 1836, 96 (New York); DE KAY, New York Fauna, Fishes, 1842, 146 (New York); GOODE, Proc. U. S. Nat. Mus., 1879, 116 (Saint John's River); GOODE & BEAN, *op. cit.*, 1879, 148 (West Florida); BEAN, *op. cit.*, 1880, 102 (Wood's Holl, Newport, Washington Market, North Carolina, Charleston); JORDAN & JOUY, *op. cit.*, 1881, 13 (San Diego, Santa Barbara, San Francisco); JORDAN & GILBERT, *op. cit.*, 1881, 143 (Monterey, southward); GOODE & BEAN, *op. cit.*, 1882, 239 (Gulf of Mexico); JORDAN & GILBERT, *op. cit.*, 1882, pp. 266, 379, 588 (Charleston, Galveston, Cape San Lucas, Panama); JORDAN & GILBERT, Bull. U. S. Nat. Mus., 1882, 106 (Mazatlan); JORDAN & GILBERT, Synopsis Fishes North America, 1883, 403 (Atlantic coast U. S.), (and of recent American writers generally).

- Mugil tang*, BLOCH, "Ichthyologia, taf. 395," about 1795 (Africa); BLOCH & SCHNEIDER, Systema Ichthyologia, 1801, 115 (copied).
- Mugil plumieri*, BLOCH "Ichthyologia, taf. 396" (St. Vincent: on a drawing by Plumier); CUV. & VAL., 1836, xi, 90 (Martinique, Brazil, New York); DE KAY, New York Fauna, 1842, 147 (New York); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1878, 381-382 (Beaufort Harbor).
- Sphyrna plumieri*, BLOCH & SCHNEIDER, Ichthyologia, 1801, 110, (copied).
- Mugil lineatus*, (MITCHILL), CUV. & VAL., xi, 96, 1836 (New York); DE KAY, New York Fauna, Fishes, 1842, 144 (New York); GÜNTHER, iii, 420, 1861; AYRES, Boston, Jour. Nat. Hist., v, 265, pl. 12 (Brookhaven).
- Mugil rammelsbergii*, TSCHUDI, Faun., Peruan., Ichthy., 1845, 20 (Peru); GÜNTHER, iii, 1861, 420 (Chili).
- Mugil liza*, GAY, "Hist. Chili, ii, 256, 1847, lam. 4b, fig. 2" (*not of Curier*).
- Mugil berlandieri*, GIRARD, U. S. Mexican Boundary Survey, 1859, 20, pl. 10, fig. 1 (St. Joseph's Island, Indianola, Brazos Santiago, Brazos and Galveston, Tex.).
- Mugil güntheri*, GILL, Proc. Acad. Nat. Sc. Phila., 1863, 169 (Western coast Central America; *not of Steindachner*).
- Mugil mexicanus*, STEINDACHNER, Ichthy. Beiträge, iii, 59, 1878 (Acapulco); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 18-1, 274 (Punta San Ygnacio, Mexico); JORDAN & GILBERT, Synopsis Fishes North America, 1883, 403 (Pacific coast of U. S., south of Point Concepcion).
- Mugil cephalotus*, LOCKINGTON, Amer. Nat., 1879, 305 (California); STEINDACHNER, Ichth. Beitr., x, 39, 1881; (identification of *Mugil mexicanus*; probably not *Mugil cephalotus* C. & V., which is a species of Southern Asia).

*Habitat*.—Coasts of Southern Europe and Northern Africa; Atlantic coast of America, from Cape Cod to Brazil; Pacific coast, from Monterey to Chili (not yet known from Cuba).

Head,  $4\frac{1}{6}$  ( $5\frac{1}{3}$ ); depth,  $3\frac{5}{8}$  (5); D. IV-I, 8; A. III, 8 (very rarely III, 7). Scales, 13-41. Length,  $10\frac{1}{2}$  inches.

Body rather robust, somewhat compressed; its depth moderate. Snout rather narrow and acutish, its upper profile little less oblique than lower. Interorbital space slightly convex,  $2\frac{2}{5}$  in head. Upper lip rather thin. Space at the chin between the mandibular bones oblongate, acutish posteriorly. Preorbital narrow, not nearly covering the maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth close-set, rather small, but evident. Scales rather small; about 23 large scales between origin of dorsal and tip of snout; scales on top of head slightly enlarged; soft dorsal and anal, with very few scales. Margin of soft dorsal concave, the seventh ray shortest,  $2\frac{1}{2}$  times in length of second or longest ray; anal similar to soft dorsal, but less concave. Pectoral reaching nearly to front of spinous dorsal. Caudal deeply forked.

Color dark bluish above; sides silvery, with conspicuous dark stripes along each row of scales; pale yellowish below. Ventrals yellowish, the other fins dusky.

This is the common mullet of our South Atlantic and Gulf coast, in which region it is one of the most abundant and important food-fishes. It is equally abundant along the coast of Southern California and

southward. In tropical America it seems to be less abundant, and in Cuba it has not yet been found. In the Mediterranean it is also an abundant food-fish, although probably less common than *Mugil œur (capito)*.

We have carefully compared specimens of this type from Venice (*Mugil cephalus*), from various points on the east coast of the United States (*Mugil albula*=*lineatus*), from California and Mexico (*Mugil mexicanus*), and from Chili (*Mugil rammelsbergi*). They agree fully in form, color, fin-rays, squamation, dentition, and we find ourselves entirely unable to point out any distinctive characters among them at all likely to be permanent. We therefore regard them as a single species. Varietal names could be given to specimens from these different localities by any one so disposed, but at present we know of no characters to mark such varieties.

As to the synonymy a few words may be necessary.

The name *cephalus* was based on a long description by Artedi of some mullet, the habitat not stated. This description contains nothing distinctive; but, on the whole, it seems to point to the present species, which was the *cephalus* of the Romans, and is still the *Céfalo* of the Italians. Valenciennes, however, thinks that Artedi's fish was probably the *Mugil œur (capito)*, because of this expression: "*oculi nulla cute communitecti*," "an expression which he would certainly not have employed if he had examined the eyes of a true *cephalus*."

But this seems to me not so sure. Even in the species with the adipose eyelid, the eye is not covered by the common skin of the head, the pupil being naked.

The *Mugil cephalus* of Cuv. & Val., and of all later writers is the present species.

The *Mugil albula*, which first appears in the twelfth edition of the *Systema Naturæ*, is based on a fish sent from Charleston, by Dr. Garden. This specimen has been examined by Messrs. Goode and Bean, and identified with the present species.

The names *plumieri* and *lineatus* undoubtedly belong to this species, as also that of *berlandieri*.

*Mugil rammelsbergi* is the representative of this form on the Pacific coast of South America. It is regarded as different by Günther and Steindachner, but our specimens show no tangible distinctive characters.

The description of *Mugil güntneri* does not fully agree with *M. cephalus*. The discrepancies are probably due to the small size or poor condition of the original type, which is now lost.

*Mugil mexicanus* does not appear to differ at all from the Atlantic form. The original type had seven soft rays in the anal, but the normal number in the California mullet is eight. Lockington and Steindachner have since identified this species with *Mugil cephalotus*, C. & V., from Southern Asia. There is nothing in the descriptions of the latter spe-

cies to forbid this identification, but we prefer not to unite *cephalotus* with *cephalus* until Asiatic specimens are compared. If they are really the same, *Mugil cephalus* is a cosmopolitan species, like *Elops saurus*, *Albula vulpes*, and other similar forms.

If the identification of *Mugil cephalus*, L. with this species be regarded as uncertain, the name *Mugil albula*, concerning which no doubt exists, should be used.

### 3. *Mugil platanus*.

*Mugil platanus*, GÜNTHER, Ann. Mag. Nat. Hist., July, 1880, 9. (Buenos Ayres.)

*Habitat*.—Coast of Buenos Ayres. This species, briefly described by Dr. Günther, is closely related to *Mugil cephalus*. The scales appear to be larger (lat. 1. 38), the head broader, the interorbital width being half the length of the head. The coloration is not described, so that we cannot say whether this is striped like *M. cephalus* and *M. liza* or not.

### 4. *Mugil incilis*. Trench Mullet.

*Mugil incilis*, HANCOCK, Lond. Quart. Journ. Sc., 1830, 127 (Guiana); GÜNTHER, Fishes Central America 1869, 443, (Dutch and British Guiana; Chagres River); STEINDACHNER, Fisch Fauna Magdalenen-Stromes, 1878, 10 (Rio Magdalena, San Domingo, Demerara, Maranhão, Pará, Cameta Porto de Moz, Bahia, San Matheos, Chiapam); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 624 (Panama); JORDAN & GILBERT, Bull. U. S. Fish Comm. 1882, 109 (Panama).

*Mugil güntneri*, STEINDACHNER, Notizen, i, 12, 1864 (British Guiana).

*Habitat*.—Antilles, northern coasts of South America, both coasts of Central America, ascending the streams.

This species appears to be abundant on both coasts of tropical America. We have, however, seen but a single specimen. This is in the museum of Yale College, having been obtained at Panama. It is very well distinguished from *Mugil curema* by the small size of the scales.

As already remarked by Steindachner, the long description by Hancock of his "Trench Mullet" (*Mugil incilis*)\* contains nothing distine-

\* The following is Dr. Hancock's original description: "In the Trench Mullet (*Mugil incilis*), as we may designate this species (being chiefly found in the trenches or ditches dug for draining the flat lands of the coast of Guiana), the scales are small; the anal fin has 12 rays; grows to 8 or 10 inches in length; is of a lighter color than the queriman, but otherwise differs very little from a young queriman of the same size; the structure of the stomach is also the same, being a sort of gizzard. Like the latter fish, it lives entirely by suction. It delights in water that is slightly brackish; and although it is often found on the coast, yet a sudden immersion in sea-water soon kills it. I once observed at Cape Batave (the property of Mr. Gilgens), on the west coast of Essequibo, great numbers of mullets swimming with their heads or snouts out of the water. On inquiry I found that the front dam had given way in the night from a high spring tide, and nearly filled the trenches with salt water. It appears extraordinary that this fish, although it constantly inhabits fresh-water trenches, is never found (not to my knowledge at least) in the natural pools or rivulets of fresh water; and I am not certain whether it is ever found in the proper salt water of the ocean, for the water of the coast is seldom very salt, &c. The only obvious

tive except that the anal rays are III, 9, and the scales are much smaller than in the "Queriman" (*Mugil liza*). These statements are equally true of *M. curema* and *M. gaimardianus*. As, however, Dr. Günther has received numerous specimens from British Guiana, he may have some good reason for retaining Hancock's name for this species, rather than to regard it as a synonym of *curema*.

The name of *güntheri*, given to this species by Steindachner, is preoccupied in this genus.

5. *Mugil gaimardianus*. Red-eye Mullet; *Liza Ojo de Perdiz*.

*Mugil gaimardianus*, DESMAREST, Dict. Class, 1831, tab. 109, (no description);  
POEY, Ann. Lyc. Nat. Hist., N. Y., 1875, 64, tab. 7., fig. 1-3 (Cuba);  
POEY, Enumeratio, 1875, 99.

*Habitat*.—Cuba, Florida Keys.

Head, 4 ( $5\frac{1}{4}$ ); depth,  $3\frac{3}{5}$  ( $4\frac{3}{4}$ ). D. IV, I, 8; A. III, 9. Scales 11-35 or 36. Length, 11 inches.

Body rather robust, moderately compressed. Snout rather narrow and pointed, upper profile almost as oblique as lower. Interorbital space convex,  $2\frac{1}{4}$  in head. Upper lip rather thick, about as in *M. curema*. Space at the chin between the mandibular bones, elliptical, aentish in front and behind, scarcely longer than snout. Preorbital rather narrow, covering about half of the maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth rather wide-set, very small, not visible without the aid of a lens. Scales in the adult rather large, evident in the young, about 20 in a line from origin of spinous dorsal to tip of snout; soft dorsal and anal, densely scaly. Soft dorsal concave on its margin; the seventh ray shortest,  $2\frac{1}{2}$  in second or longest ray. Anal similar to soft dorsal but more concave. Pectoral reaching very nearly to front of spinous dorsal. Caudal forked.

Color dusky above, with bluish reflections, silvery below, no dusky streaks along sides. Spinous and soft dorsal dusky, the latter finely

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distinction between the queriman and trench mullet appears to be in the anal fin and the scales on the back of the head, the anal fin in the queriman having only 11, while the trench mullet has constantly 12 rays. The scales on the back of the head of the former are marked with concentric circles, but the trench mullet shows no trace of this character; its scales are smaller and quite smooth; the head is not so angular, is less flattened, of a light color, and is more delicate in appearance, *i. e.*, taking a full-grown trench mullet and a queriman of the same size for comparison, the scales in the latter are stouter and much more developed. But in these respects you require to compare them together to observe the difference, and that with somewhat careful attention, being so near alike that many think them the same species, that the mullet is the young of the queriman. The lips are protractile in both. I observe very fine setæ in the lips in both species, but less crowded in the mullet than in the queriman. The body of the mullet is more soft and flexible than in the queriman, and its taste is also different, having a peculiar, delicate flavor, different from that of other fishes. It has a gall-bladder very small and oval; the queriman has a large, oblong, pointed gall-bladder. In both the liver is situated close to the anterior part of the stomach. The Guiana mullets have 24 dorsal vertebræ; that is, if we include the fan-shaped bone of the tail."

punctulate with brown, its anterior rays tipped with black. Caudal pale, broadly margined with black. Anal pale, its basal half appearing dusky from dark punctulations. Pectoral pale in front, rather dusky behind, where there is a dusky blotch at base.

The above description is taken from a specimen from Cuba. Numerous small specimens from Key West entirely agree with it, except that the teeth are larger, being distinctly visible in both jaws. The body is less compressed and the color lighter.

Little is known of the distribution of this species. It is recorded by Poey as rather rare at Havana. Several specimens were obtained there by Professor Jordan. The young are also common at Key West, where the species is known as Red-eye Mullet.

In Jordan's list of the fishes of Key West in the current volume of the Proceedings, U. S. Nat. Mus. this species was improperly omitted, the young specimens above referred to having been overlooked.

This species is not described by Desmarest and the name *gaimardianus* should date from its use by Poey.

**6. *Mugil curema*.** *White mullet; Blue-back mullet; Liza.*

*Albula bahamensis* (the Mullet), CATESBY, Nat. Hist. Carolina, 1738, taf. 6 (Bahamas).

*Mugil curema*, CUV. & VAL., xi, 1836, 87 (Brazil, Martinique, Cuba); ?GAY, "Hist. Chil., Zoöl., ii, 1847, 250."

*Mugil petrosus*, CUV. & VAL., vi, 1836, 89 (Brazil, Surinam, Gulf of Mexico, Cuba); DE KAY, New York Fauna, 1842, 146 (copied).

*Mugil braziliensis*, GÜNTHER, iii, 431, 1861 (Vera Cruz, San Domingo, Jamaica, St. Vincent, British Guiana, Surinam, Para); GÜNTHER, Fishes Central America, 1869, 443 (Belize, Chiapam, Panama); COPE, Trans. Amer. Philos. Soc., 1870, 481 (St. Croix, New Providence); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1878, 381 and 382 (Beaufort Harbor); STEINDACHNER, Fisch-Fauna Magdalenen-Strömes, 1878, 10; STEINDACHNER, Beiträge III, 1878, 60 (Rio Janeiro, Cannavieras, Campos, Mendez, Santa Cruz, Porto Alegre, Porto Seguro, Muriahe, Pernambuco, Ceará, Bahia, Rio Pará, Carthagena, St. Thomas, Panama, Acapulco, Magdalena Bay); GOODE, Proc. U. S. Nat. Mus., 1879, 116 (Saint John's River); GOODE & BEAN, *op. c.*, 1879 (West Florida); JORDAN, *op. c.*, 1880, 20 (East Florida); JORDAN & GILBERT, *op. c.*, 1881, pp. 232, 233, 274, 277 (Porto Escondido, Mex.; La Union, San Salvador; Guaymas; Mulege, Lower Cal.); GOODE & BEAN, *op. c.*, 1882, 239 (Gulf of Mexico); JORDAN & GILBERT, *op. c.*, 1882, pp. 238, 374, 379, 588, 624 (Cape San Lucas, Colima, Panama, Charleston); JORDAN & GILBERT, Bull. U. S. Nat. Mus., 1882, 106, 109, 112 (Mazatlan, Panama, Punta Arenas); JORDAN & GILBERT, Synopsis Fishes North America, 403, 1283 (Cape Cod to South America and Lower California); POEY, Ann. Lye. Nat. Hist. New York, 1875, xi, 61, tab. 7 (Cuba); POEY, Enumeratio, 1875, 99; JORDAN, Proc. U. S. Nat. Mus., 1884 (Key West). (Not of Agassiz & Spix.)

*Mugil lineatus*, STORER, Hist. Fishes Mass., 1867, 167, pl. 16, f. 4. (Not of Mitchell.)

*Habitat.*—Atlantic coast of America from Cape Cod to Brazil; Pacific coast of America from Magdalena Bay to Chili.



Head,  $4\frac{1}{3}$  ( $5\frac{1}{2}$ ); depth,  $3\frac{5}{8}$ . D. IV, I, 8; A. III, 9. Scales 12-38. Length,  $11\frac{1}{3}$  inches.

Body moderately elongate, its depth about equaling that of *M. cephalus*. Snout rather narrow and pointed, the upper profile not so oblique as lower. Interorbital space slightly convex,  $2\frac{4}{9}$  in head. Upper lip rather thick. Space at the chin between the mandibular bones oblanceolate, acutish posteriorly. Preorbital rather narrow, nearly covering the maxillary posteriorly. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth thick-set, rather small, but distinctly visible to the naked eye. Scales rather small, about 23 from origin of dorsal to tip of snout; soft dorsal and anal densely scaled. Soft dorsal slightly concave; the seventh and shortest ray  $2\frac{1}{3}$  in second or longest ray. Anal similar to soft dorsal. Pectoral falling short of spinous dorsal by a distance equal to one-third its length in adult, sometimes longer in young. Caudal forked. Color dark olive above, with some bluish reflections; silvery below. No dusky streaks along sides. A rather small dark blotch at base of pectoral. Spinous and soft dorsal and pectorals pale, with numerous small dark punctulations. Caudal pale, yellowish at base; margin of fin blackish. Anal and ventrals yellowish.

This species is very widely distributed in tropical America, being very abundant throughout that region, and equally so on both sides of the continent. We find no difference whatever between Atlantic and Pacific specimens.

This is the species called *Mugil brasiliensis* by all recent writers. It is, however, certainly not the original *Mugil brasiliensis* of Agassiz.

Dr. A. Spaugenberg, curator of the museum at Munich, in which institution the types of Agassiz and Spix are preserved, has kindly given us the following information concerning the types of *Mugil brasiliensis*. The following is a translation of a portion of Dr. Spaugenberg's letter:

"The badly preserved dried example (400 millimeters long) seems to me to be certainly the one figured by Spix, but on this one it is entirely impossible to count the number of anal rays, since the fin is dried down. The distance from the end of the pectoral to the beginning of the dorsal, after allowing for the broken tip of the pectoral, is a good third of the length of the pectoral. The number of scales in a longitudinal series is 32. Teeth, so far as visible, of moderate size. This original type thus best fits your species 1. (= *Mugil trichodon* Poey).

"Besides this dried example, which best fits the figure in the above named work (Agassiz and Spix), if it does not wholly agree with it, we have in a bottle of spirits two other specimens labelled *Mugil brasiliensis* Spix, which do not resemble the figure and the dried specimen, and, in fact, each of them is a distinct species, so that, under the same label, we have three distinct species.

"Of these the larger specimen shows the following peculiarities: Anal, III, 9. Scales of the lateral line, 35. Distance of the end of the pectoral

from the beginning of the dorsal, one-third the length of the pectoral (nearly 1.20: 3.70). Small teeth. This form agrees with your species 2 (*Mugil gaimardianus*), except in the distance of the pectoral from the dorsal.

"The small example, in its whole appearance quite unlike the preceding, shows: Anal, III, 9. Scales, 38 or 39. Distance of the end of the pectoral from the dorsal very slight (about one-twelfth of the length of the pectoral, nearly .03 to .34); teeth large, absolutely larger than in the preceding larger fish.

"This animal differs from your species 3 (*Mugil curema=brasiliensis* Auct.) again in the distance of the pectoral from the dorsal. To conclude: Only the dried example agrees exactly with your species 1 (*trichodon*), (except in the number of anal rays, which cannot be counted), and this example is certainly the one originally figured by Spix (I have also asked Professor Zittle to verify this), the discrepancies of the figure being the fault of the artist."

In any case, therefore, whatever the two smaller specimens collected by Spix and referred to *M. brasiliensis* by Agassiz, may prove to be, it is evident that the original type of *Mugil brasiliensis* does not belong to the species called by the latter name by Günther, Steindachner, and other recent writers. There can be little doubt, in fact, of its identity with *Mugil trichodon* Poey, for which reason we here retain for the latter species the name *Mugil brasiliensis*.

*Mugil curema* is doubtless the present species, as I am informed by Dr. Sauvage that the type preserved in the museum at Paris has 40 scales in a longitudinal series.

*Mugil petrosus* is to all appearance also the same species, some of the specimens (New York) being certainly the same.

*Mugil platanus*, Günther is identified by Steindachner with this species, the presence of but 8 soft rays in the anal fin being regarded as accidental. As, however, in *M. platanus*, the dorsal and anal fins are said to be naked, it is probably most nearly related to *M. cephalus*, of which it may be a variety.

#### 7. *Mugil brasiliensis*. Fan-tail mullet.

*Mugil brasiliensis*, AGASSIZ, SPIX, Pisc. Brasil., 1829, 234, tab. 72 (Brazil) (typical example; not the two smaller ones).

*Mugil trichodon*, POEY, Ann. Lyc. Nat. Hist. New York, 1875, xi, 66, tab. 8, f. 4-8 (Cuba); POEY, Enumeratio, 1875, 99; JORDAN, Proc. U. S. Nat. Mus., 1884 (Key West).

*Habitat*.—Cuba, Florida Keys, Brazil. Head,  $4\frac{1}{2}$  ( $5\frac{1}{4}$ ); depth,  $3\frac{2}{3}$  ( $4\frac{3}{8}$ ). D. IV, I, 8. A. III, 8; Scales, 11-33. Length, 11 inches.

Body rather robust, its depth somewhat greater than in *M. curema*. Snout rather narrow and pointed, the upper and lower profile about equally oblique. Interorbital space flattish or slightly convex,  $2\frac{1}{2}$  in head. Upper lip thick; thicker than in any other species here described. Space at the chin between the mandibular bones oblanco-

late, acutish posteriorly. Preorbital narrow, covering little of maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth wide-set; larger than in the other species; plainly visible in both jaws, and about as long as the nostril. Scales large, about 21 from origin of dorsal to tip of snout; soft dorsal and anal densely scaled. Soft dorsal concave; the seventh ray shortest,  $2\frac{3}{4}$  in second or longest ray; anal similar to soft dorsal. Pectoral not reaching nearly to front of spinous dorsal. Caudal broad, forked.

Color dusky olive above, with some bluish reflections; silvery below. No dusky streaks along the rows of scales. A dark blotch at base of pectoral. Dorsals and caudal pale, the former with very small dark punctulations. Caudal margined with blackish. Anal and ventrals yellowish. Pectorals pale, finely punctulate with brown.

This little mullet is very abundant at Key West, where it is known as fan-tail mullet. At Cuba it is reported as rare by Poey. It has not been noticed elsewhere. Numerous specimens, large and small, are in our collection, none of them quite a foot in length.

The reasons for adopting for this species the name of *brasiliensis* instead of that of *trichodon* are stated under *Mugil curema*.

Measurements.

Name of species .....	<i>Liza</i> .		<i>Cephalus</i> .		<i>Incilis</i> .	
	Havana.		Cedar Key.		Copied.	
Locality .....	Inches and 100ths.	100ths of length to base of caudal.	Inches and 100ths.	100ths of length.	Inches and 100ths.	100ths of length.
Extreme length.....	18.00	.....	10.55	.....	7.00	.....
Length to base of caudal.....	14.10	.....	8.60	.....	5.6	.....
Body:						
Greatest height.....		22		26		22
Greatest width.....		19		17		.....
Head:						
Greatest length.....		26		24		22
Greatest width.....		18		18		14
Width of interorbital area.....		13		10		9
Length of snout.....		5½		6		.....
Dorsal (spinous):						
Distance from snout.....		48		50		.....
From tip of pectoral to origin of dorsal.....		5		4		.....
Height at first spine.....		12		14		13
Height at first and longest ray of soft dorsal.....		12½		13		.....
Height at last ray.....		7		7		.....
Anal:						
Length of base.....		12		12		10
Height at first and longest ray.....		12½		15		.....
Height at last ray.....		7		7		.....
Caudal:						
Length of middle rays.....		14		14		.....
Length of upper lobe.....		30		25		25
Pectoral:						
Length.....		18		19		.....
Ventral:						
Length.....		15		15		16
Dorsal.....	IV, I, 8	.....	IV, I, 8	.....	IV, I, 8	.....
Anal.....	III, 8	.....	III, 8	.....	III, 9	.....
Number of scales in lateral line.....	35	.....	41	.....	43	.....
Number of scales in transverse row from spinous dorsal to ventrals.....	12	.....	13	.....	14	.....

## Measurements—Continued.

Name of species ..... Locality .....	<i>Gaimardianus</i> Havana.		<i>Curema</i> Key West.		<i>Brasiliensis</i> Key West.	
	Inches and 100ths.	100ths of length.	Inches and 100ths.	100ths of length.	Inches and 100ths.	100ths of length.
Extreme length .....	11. 00	.....	11. 30	.....	11. 00	.....
Length to base of caudal .....	8. 50	.....	9. 10	.....	8. 60	.....
Body:						
Greatest height .....		28		26		28
Greatest width .....		15		16		16
Head:						
Greatest length .....		26		23		24
Greatest width .....		17		15½		16½
Width of interorbital area .....		11½		9½		10
Length of snout .....		5		4		4½
Dorsal (spinous):						
Distance from snout .....		50		50		51
From tip of pectoral to origin of dorsal .....		3		6½		7
Height at first spine .....		14		13		15
Height at first and longest ray of soft dorsal .....		14		12		13
Height at last ray .....		7		6½		6½
Anal:						
Length of base .....		15		13½		12
Height at first and longest ray .....		15		12		13
Height at last ray .....		7		6		6½
Caudal:						
Length of middle rays .....		18		16		16
Length of upper lobe .....		31		29		29
Pectoral:						
Length .....		19		18		17
Ventral:						
Length .....		16		14		15
Dorsal .....	IV, I, 8	.....	IV, I, 8	.....	IV, I, 8	.....
Anal .....	III, 9	.....	III, 9	.....	III, 8	.....
Number of scales in lateral line .....	36	.....	38	.....	33	.....
Number of scales in transverse row from spinous dorsal to ventrals .....	11	.....	12	.....	11	.....

## Genus 2.—CHÆNOMUGIL.

*Chænomugil*, GILL, Proc. Ac. Nat. Sci., Phila., 1863, 169 (*proboscideus*).

But one species of this genus is known. This is allied to some species of the subgenus *Liza*, such as the European *Mugil chelo* and others with thickened lips and enlarged papillæ in more than one series. Unless, however, a more perfect gradation exists than is now known, it should be regarded as constituting a distinct genus, for which the hybrid name *Chænomugil* must be used.

8. *Chænomugil proboscideus*.

*Mugil proboscideus*, GÜNTHER, Cat. Fishes, iii, 459, 1861 (Island of "Cordova" [Cardon], West Coast Central America).

*Chænomugil (proboscideus)*, GILL, Proc. Ac. Nat. Sci., Phila., 1863, 169 (Generic diagnosis); JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, 106, 109 (Mazatlan, Panama).

*Habitat*.—Pacific coast of tropical America, Mazatlan, Cardon, Panama.

This small mullet reaches a length of four or five inches, and is not uncommon on the Pacific Coast of Mexico and Central America. I suppose the island of "Cordova," whence Dr. Günther obtained his typical

specimens, to be a slip of the pen for Cardon. If this is true, the species is not known from the Atlantic.

The numerous specimens collected by Professor Gilbert having been destroyed by fire, we are unable to add anything to Dr. Günther's account, which is sufficiently full and accurate.

Genus 3.—**QUERIMANA.**

**Querimana**, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 588 (*harengus*).

This genus includes little mullets, some of them of very small size, with distinct teeth in the jaws rather than cilia, and with but two spines in the anal fin. In this last regard they differ from the genus *Myxus*, Günther, which has three anal spines. The species, so far as known, are all American, and are very closely related. We refer *Mugil curvidens* provisionally to this genus, not having seen its type. It may, however, prove to belong to *Myxus*.

ANALYSIS OF SPECIES OF QUERIMANA.

- a. Teeth in lower jaw distinct ; anal rays II, 9 or II, 10.
- b. Teeth unusually strong, those in the lower jaw directed downwards and forwards, like those in the upper ..... CURVIDENS, 9.
- bb. Teeth feebler, rather ciliiform, the lower not curved downwards. CILIILABIS, 10.
- aa. Teeth in lower jaw obsolete ; species of very small size.
- c. Anal rays II, 9 or II, 10 ; lat., 1, 38 ..... HARENGUS, 11.
- cc. Anal rays II, 7 ; lat. I., 29 or 30 ..... GYRANS, 12.

**9. Querimana curvidens.**

*Mugil curvidens*, CUV. & VAL., xi, 1836, 149, pl. 313 (Ascension, Bahia).

*Myxus curvidens*, GÜNTHER, iii, 1861, 467 (copied).

*Habitat.*—Island of Ascension, Bahia.

Nothing is known of this species except what is contained in the original description.

**10. Querimana ciliilabis.**

*Mugil ciliilabis*, CUV. & VAL., xi, 1836, 151 (Callao).

*Myxus ciliilabis*, GÜNTHER, iii, 1861, 467 (copied) Steindachner.

*Querimana ciliilabis*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 283 (Callao).

*Habitat.*—Coast of Peru.

The original types of this species in the museum at Paris have been examined by Professor Jordan. The species is very close to *Q. harengus*, differing in the rather stronger dentition, stiffened cilia or teeth being present in both jaws, rather strongest in the upper. Head,  $3\frac{2}{5}$  in length ; depth,  $4\frac{1}{4}$  ; no adipose eyelid ; preorbital serrate ; anal spines, 2 ; first soft ray of anal simple, but evidently articulate.

11. *Querimana harengus*. *El Verde*.

*Myxus harengus*, GÜNTHER, iii, 467, 1861 (Pacific coast of Central America); JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, 106, 109 (Mazatlan, Panama); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 624. (Panama).  
*Querimana harengus*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 283. (Panama, Mazatlan; Zorritas, Peru).

*Habitat*.—Mazatlan, Panama, Peru.

This little fish is abundant both at Mazatlan and Panama. It is recognized by the fishermen as a distinct species, and at Mazatlan, from its clear green color. It is known as *El Verde*.

Dr. Günther's original types, like all the other specimens examined by us, have but two spines in the anal fin.

12. *Querimana gyraus*.

*Querimana harengus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 588, 618 (Charleston); (not *Myxus harengus*, GÜNTHER).  
*Querimana gyraus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1884 (Key West).

*Habitat*.—Charleston, Key West.

This curious little fish, the smallest of known mullets, is abundant about Key West, and a few specimens have been taken at Charleston. We venture the prediction that, in time, it will be found to be abundant throughout the West Indies. It may, however, be easily confounded with the young mullets, although its habits are altogether different from those of the latter.

*Nominal species arranged in chronological order with identifications.*

Nominal species.	Year.	Identification.
<i>Mugil cephalus</i> , Linnaeus.....	1758	<i>Mugil cephalus</i> .
<i>Mugil albula</i> , Linnaeus.....	1766	Do.
<i>Mugil tang</i> , Bloch.....	1795	Do.
<i>Mugil plumieri</i> , Bloch.....	1795	Do.
<i>Mugil brasiliensis</i> , Agassiz.....	1829	<i>Mugil brasiliensis</i> .
<i>Mugil tacilis</i> , Hancock.....	1830	(?) <i>Mugil tacilis</i> .
<i>Mugil liza</i> , Cuv. & Val.....	1836	<i>Mugil liza</i> .
<i>Mugil lineatus</i> , Mitchell.....	1836	<i>Mugil cephalus</i> .
<i>Mugil curema</i> , Cuv. & Val.....	1836	<i>Mugil curema</i> .
<i>Mugil petrosus</i> , Cuv. & Val.....	1836	Do.
<i>Mugil curvidens</i> , Cuv. & Val.....	1836	<i>Querimana</i> (?) <i>curvidens</i> .
<i>Mugil ciliatilis</i> , Cuv. & Val.....	1836	<i>Querimana ciliatilis</i> .
<i>Mugil rammelsbergi</i> , Tschudi.....	1845	<i>Mugil cephalus</i> .
<i>Mugil beaudieri</i> , Girard.....	1859	Do.
<i>Mugil lebranchus</i> , Poey.....	1860	<i>Mugil liza</i> .
<i>Myxus harengus</i> , Günther.....	1861	<i>Querimana harengus</i> .
<i>Mugil güntheri</i> , Gill.....	1861	<i>Mugil cephalus</i> .
<i>Chaenomugil proboscideus</i> , Gill.....	1863	<i>Chaenomugil proboscideus</i> .
<i>Mugil trichodon</i> , Poey.....	1875	<i>Mugil brasiliensis</i> .
<i>Mugil guibardianus</i> , Desmarest.....	1875	<i>Mugil guibardianus</i> .
<i>Mugil mexicanus</i> , Steindachner.....	1878	<i>Mugil cephalus</i> .
<i>Mugil cephalotus</i> , Lockington.....	1878	Do.
<i>Mugil platanus</i> , Günther.....	1880	<i>Mugil platanus</i> .
<i>Querimana gyraus</i> , Jordan & Gilbert.....	1882	<i>Querimana gyraus</i> .

## RECAPITULATION.

We here repeat the list of species recognized by us, with a brief statement of such doubts as may exist in regard to them. The distribution of each species is indicated by the letters U (south Atlantic coast of

United States), C (California), W (western Atlantic, West Indies, Brazil), E (Europe), A (Western Africa), B (southern coast of Brazil and southward), P (Pacific coast of Mexico and Central America), G (western coast of South America).

Genus 1.—MUGIL, (Artedi) Linnæus.

1. *Mugil liza*, Cuv. & Val. (W.).
2. *Mugil cephalus*, L. (E.) (*cephalus*), (A.) (*cephalus*), (U. W.) (*albula*), (C. P.) (*güntheri*=*mexicanus*), (G.) (*rammelsbergi*), (Asia?) (*cephalotus*). (Possibly divisible into geographical subspecies.)
3. *Mugil platanus*, Günther. (B.) (Species not sufficiently known.)
4. *Mugil incilis*, Hancock. (W. P.) (Identification of name *incilis* somewhat doubtful.)
5. *Mugil curema*, Cuv. & Val. (U. W. B. P. G.).
6. *Mugil gaimardianus*, (Desmarest) Poey (W. U.).
7. *Mugil brasiliensis*, Agassiz (W. U.).

Genus 2.—CHÆNOMUGIL, Gill.

8. *Chænomugil proboscideus*, Günther (P.).

Genus 3.—QUERIMANA, Jordan & Gilbert.

9. *Querimana?* *curvidens*, C. & V. (A. W.). (Species unknown to us; of uncertain genus.)
10. *Querimana ciliilabis*, C. & V. (G.).
11. *Querimana harengus*, Günther (P. G.). (Possibly young of *Q. ciliilabis?*)
12. *Querimana gyrans*, Jordan & Gilbert (U.).

**SYNOPSIS OF THE GENERA OF THE SUPERFAMILY TEUTHIDOIDEA  
(FAMILIES TEUTHIDIDÆ AND SIGANIDÆ).**

**By THEODORE GILL.**

Having recently had occasion to inquire into the relations and characteristics of the constituents, and into the applicability of the names employed for the genera of the family "Teuthyes" of Cuvier, I was obliged to dissent from the taxonomic views as well as nomenclature most in vogue, and have reached the conclusions embodied in the following synopsis. The changes of nomenclature have invariably been made in obedience to the rules of the British and American associations for the advancement of science. Those who are lawless, or follow rules only when they suit their purpose or convenience, will doubtless disapprove of the changes. The necessity for the changes has been appreciated by Messrs. Jordan, Meek, and Bean, and the first two had independently reached the same conclusion with reference to the *Teuthis hepatus*.