















DIVISION OF FISHERIES

Carded

CONTRIBUTIONS TO BIOLOGY  
FROM  
THE HOPKINS SEASIDE LABORATORY  
OF THE  
LELAND STANFORD JR. UNIVERSITY

**XXXII**

THE FISHES OF PANAMA BAY

BY CHARLES H. GILBERT AND EDWIN C. STARKS

[ Reprinted from the Memoirs of the California Academy of Sciences  
Vol. IV ]

STANFORD UNIVERSITY, CALIFORNIA

1904

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NOTICE

AFTER CAREFUL EXAMINATION OF THE  
INNER MARGIN AND TYPE OF MATERIAL  
WE HAVE SEWN THIS VOLUME BY HAND  
SO IT CAN BE MORE EASILY OPENED  
AND READ.



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Fishes

*Fred. Gill*

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PREFATORY NOTE.

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This memoir is the thirty-second of a series designed to illustrate investigations and explorations connected with the Hopkins Seaside Laboratory, an adjunct of the biological laboratories of the Leland Stanford Junior University. These investigations have been carried on by means of the assistance given by Timothy Hopkins, Esq., of Menlo Park, California. This memoir appears in the publications of the California Academy of Sciences, the present edition being a reprint.

OLIVER P. JENKINS,

CHARLES H. GILBERT,

*Directors Hopkins Laboratory.*

Date of publication, February 6th, 1904.



# THE FISHES OF PANAMA BAY.

BY

CHARLES H. GILBERT AND EDWIN C. STARKS.

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## INTRODUCTION.

THE ichthyologic history of Panama Bay falls naturally into three periods. The first, beginning with 1860, depended upon the activity of Captain John M. Dow, whose collections, forwarded to the Smithsonian Institution and to the British Museum, were reported upon by Dr. Theodore Gill and Dr. Albert Günther. This early work culminated in 1869 through the publication of Günther's "Fishes of Central America," which contains an admirable summary of the state of our knowledge at that date, with valuable discussions of the faunal relations of both marine and fresh-water forms.

The second period was characterized by the work of Dr. Franz Steindachner, based in part upon his own collections, in part upon material obtained through various correspondents. No general summary was given by him, but the diagnoses of new species, which appeared in his series of "Notizen" and "Beiträge" (See Bibliography), form a model of accurate and detailed work of that description.

The third period has resulted from investigations undertaken either directly or with the assistance of the United States Fish Commission and the Smithsonian Institution. Under their auspices Dr. Gilbert made in 1881 large collections of the fishes of Panama, which served as the basis for numerous papers by Jordan and Gilbert. A second and much larger collection, made by him in 1883, was unfortunately destroyed by fire, together with all field-notes and the manuscript report then ready for the printer. The only record of this material is embodied in a list published by Jordan (1885). The new species indicated in that list remained, for the most part, still undescribed and unrepresented in any museum at a period ten years later!

The deeper waters off the Panama Bay, out as far as the Galapagos Islands, were thoroughly explored by the United States Fish Commission steamer Albatross in 1888 and 1891. Reports upon the fishes thus obtained have been given by Jordan and Bollman (1889), by Gilbert (1890 *b*), and recently in most admirable and complete form by Garman (1899).

The following account of the fishes of Panama Bay is based primarily upon material obtained in 1896 by an expedition from the Leland Stanford Junior University, generously equipped and sent out by Mr. Timothy Hopkins of Menlo Park, California. The party consisted of Dr. C. H. Gilbert and Messrs. E. C. Starks, C. J. Pierson and R. C. McGregor. During the six weeks (January 10th to February 24th) spent in residence at Panama, an almost hourly inspection of the excellent fish-market was maintained; the tide-pools of the reef were explored, and the rocks and islands near the city were investigated by the aid of dynamite. The effectiveness of the party became so reduced by illness during the last weeks of their stay, that they were unable to carry out that part of their plans which contemplated the exploration of the Pearl Islands on the one hand and the rivers of the Isthmus on the other. These localities offer still a rich field for investigation. Of the two hundred and eighty-three marine species obtained, forty-three were new, and included among them all but four (*Tylosurus* sp., *Cynoscion* sp., *Scarus* sp., and *Githarichthys* sp.) of the still undescribed forms of the list of 1885. Descriptions of many of the new species have already appeared in the different volumes of Jordan and Evermann's "Fishes of North and Middle America," and full accounts of all appear in the present paper.

We have admitted to our list all previous records of fishes from Panama Bay, unless good reason exists for doubting their validity. Several general references to "Panama," in Jordan and Evermann's work above cited, seem not to be based upon special records, and are rejected by us, even where there is a general probability of their occurrence at Panama in view of the known range of the species. Of the fishes obtained by the Albatross, we have included such only as were dredged within the fifty-fathom line. Even when thus restricted, the assemblage is found to contain many forms which are rarely or never taken along shore, and seem to constitute a sublittoral fauna of characteristic shallow-water species. The genera *Prionotus*, *Symphurus* and *Diplectrum* offer numerous examples of such species.

## LIST OF NEW SPECIES.

Types of all new species are deposited in the Ichthyological Collections of the Leland Stanford Junior University, and bear the numbers indicated in the following list:—

Carcharias velox.....	11893	Lutianus jordani.....	11988
Carcharias cerdale.....	11884	Rhegma thaumasium.....	5978
Carcharias azureus.....	11890	Sagenichthys mordax.....	6809
Myliobatis asperrimus.....	11895	Larimus effulgens.....	5520
Galeichthys xenauchen.....	5821	Odontoscion xanthops.....	5519
Galeichthys eigenmanni.....	6986	Stellifer illecebrosus.....	5515
Tachysurus emmelane.....	5818	Stellifer zestocarus.....	5518
Tachysurus evermanni.....	6706	Ophioscion simulus.....	5516
Tachysurus steindachneri.....	7026	Polyclemus goodei.....	5517
Pisoodonophis daspilotus.....	5820	Eques viola.....	5521
Muraena clepsydra.....	6807	Pomacentrus gilli.....	6803
Anchovia rastralis.....	5812	Halichæres macgregori.....	6804
Anchovia mundeola.....	5817	Xesurus hopkinsi.....	12671
Anchovia naso.....	5816	Balistes verres.....	6805
Anchovia starksi.....	5814	Prionotus ruscarius.....	6488
Cetengraulis engymen.....	5815	Microgobius miraflorensis.....	6511
Hemiramphus saltator.....	6806	Evermannia panamensis.....	6509
Fistularia corneta.....	6808	Batrachoides boulengeri.....	6487
Oligoplites refulgens.....	6799	Porichthys greenei.....	6485
Hemicaranx zelotes.....	5819	Hypsoblennius piersoni.....	6522
Peprilus snyderi.....	6800	Homesthes caulopus.....	5623
Lobotes pacificus.....	5883		

## Family GINGLYMOSTOMIDÆ.

1. *Ginglymostoma cirratum* (*Gmelin*).

A single specimen taken, 27 cm. long. The body and fins are light brownish, marked with small black spots about as large as pupil, those in front of dorsal arranged rather uniformly in cross-series. Snout unspotted. Lower side of head whitish, unspotted.

## Family GALEIDÆ.

2. *Mustelus lunulatus* (*Jordan & Gilbert*).

## PLATE I, FIG. 1.

Five specimens were secured seeming to agree in all respects with an individual collected by Dr. Jordan from the type locality, Mazatlan. In a young male 53 cm. long the claspers do not project beyond the edge of the ventral fin; in another 64 cm. long they are fully developed, protruding beyond edge of ventral for about 4 cm. A male from Mazatlan (68 cm. long) has the claspers undeveloped, not reaching beyond margin of ventrals. This seems to indicate considerable irregularity in the sexual development of the species. The young of *M. lunulatus* are as yet unknown.



The Panama specimens agree well with the original description of the species, except in the following respects:—

(a) Distance from insertion of first dorsal to anterior root of pectoral  $\frac{2}{5}$  (not “about  $\frac{1}{3}$ ”) its distance from tip of snout. This discrepancy is due, however, to an error in the original description. Mr. Barton A. Bean has kindly re-examined the type, and states that the first distance is contained about  $2\frac{2}{3}$  times in the second.

(b) Distance between dorsals  $2\frac{1}{3}$  to  $2\frac{1}{2}$  times (not “ $2\frac{2}{3}$  times”) base of first, and  $2\frac{2}{3}$  to  $3\frac{1}{3}$  times (“a little more than 3 times”) base of second. Mr. Bean gives base of first dorsal  $2\frac{2}{3}$  and base of second dorsal  $3\frac{1}{2}$ , in the interspace between dorsals. This interval is therefore longer in the type than in any of the Panama specimens. The latter agree, however, with the Mazatlan specimens above mentioned.

A specimen of *M. lunulatus* in the United States National Museum (No. 46838), taken by the “Albatross” at the mouth of the Mulegé River, Gulf of California, has the proportions of the type. The base of the first dorsal, excluding the fleshy hump which precedes the rays, is contained  $2\frac{2}{3}$  times in the interval between dorsals, the base of the second dorsal  $3\frac{1}{2}$  times in this interval. It is evident, therefore, that the size and relative positions of the dorsal fins must be used with caution for specific distinction.

(c) Middle of dorsal base usually midway between axil of pectorals and anterior insertion of ventrals, sometimes very slightly nearer pectorals. In none of the Panama specimens is it nearer the base of the pectorals by a distance equaling the diameter of the eye, as given in the description of the type (slightly less than this in the type according to Mr. Bean).

Following are dimensions of a Panama specimen:—

	mm.
Total length.....	53 <sup>0</sup>
Length of head.....	95
Length of snout .....	43
Diameter of orbit .....	17
Length of spiracle.....	3.5
Length of middle gill-slit.....	14
Distance from tip of snout to front of mouth .....	34.5
Distance from tip of snout to inner angle of nostrils.....	27
Distance between nostrils.....	14
Distance between angles of mouth.....	28
Distance from tip of mandible to line joining posterior angles of lips.....	21
Extreme length of upper lip .....	5.5
Extreme length of lower lip.....	8
Distance from tip of snout to base of pectorals.....	113
Greatest width of pectoral base.....	23
Outer pectoral margin .....	71
Inner pectoral margin .....	40
Distal pectoral margin .....	57
Axil of pectoral to base of ventrals.. .....	107
Snout to base of ventrals.....	230
Outer edge of ventrals .....	40



	mm.
Base of ventrals.....	27
Snout to base of dorsal fin proper, not including fleshy ridge .....	167
Base of first dorsal .....	51
Height of anterior margin of first dorsal (not including fleshy hump at base).....	65
Height of posterior margin .....	29
Distance between dorsals .....	125
Base of second dorsal.....	39
Distance from second dorsal to base of upper caudal lobe.....	52
Length of upper caudal lobe.....	110
Distance from tip of caudal to base of notch.....	41
Distance from base of notch to origin of lower lobe.....	75
Distance from origin of lower caudal lobe to base of anal.....	39
Base of anal.....	26

A specimen of *Galeus californicus* from Magdalena Bay, Lower California (No. 1404 L. S. J. U.) compared with *M. lunulatus* has the fins less incised and with rounded angles, the snout broader and less pointed, the lips longer, about equaling width of nostril, and the dorsal more backward in position, its base contained three and one-fourth in its distance from snout. The angle of the mouth is also much greater.

*G. californicus* ranges to the southward along the entire coast of Lower California and throughout the Gulf of California, where it is found associated with *M. lunulatus*. It occurs doubtless at Mazatlan, although it has not yet been recorded from that point. It was obtained by the "Albatross" in 1889 at San Quentin and Magdalena bays on the outer coast of Lower California, and in Concepcion Bay, San Luis Gonzales Bay, and at Station 3026 in the Gulf of California. The fetuses reported from Guaymas by Evermann and Jenkins (1891, p. 129), under the name of *Galeus dorsalis*, belonged to *G. californicus*, as is sufficiently evident from their measurements.

### 3. *Galeus dorsalis* Gill.

PLATE I, FIG. 2.

Previous diagnoses have called attention to the low, comparatively little-incised fins, and the short caudal. More conspicuous differences are found in the small size of the eye, the large spiracle, and the large nostrils. The diameter of the eye is contained  $2\frac{3}{8}$  to 3 times in the distance from tip of snout to front of upper jaw. In *M. lunulatus* of the same size, it is contained twice in this distance. The width of the internasal septum is less than the distance from inner angle of nostrils to margin of snout, while greater than this distance in *M. lunulatus*. The spiracle is a long slit,  $\frac{2}{3}$  or more than  $\frac{2}{3}$  diameter of eye. The nasal valve is smaller than in related species, produced mesially into a narrow flap, the width of which does not exceed  $\frac{1}{3}$  width of nostril. The inner folds are also much simpler and smaller, and fail to conceal the olfactory membrane. The snout is narrower and sharper, with the outlines less curved; it is also thinner, so as to appear whitish-translucent. The pores on snout are much more conspicuous than in related species, and contribute to give it a spongy texture; they are numerous on top and sides of snout as well as below, and are clustered to form a conspicuous patch below front of eye. The shagreen is much coarser than in *M. lunulatus*.

Both pectorals and ventrals have broad, rounded outer angles, and have the posterior margins straight or nearly straight when the fin is spread. The pectoral contrasts strongly with that of *M. lunulatus*, where the outer angle is prolonged, giving the fin a falcate shape. The tip of the pectoral reaches to or slightly beyond the vertical from the middle of the dorsal base. The first dorsal is low, with rounded anterior angle and gently concave margin, the anterior angle failing to reach the tip of the posterior angle when the fin is declined. Both dorsals are longer in proportion than they are in *M. lunulatus*, and the caudal peduncle as well as the caudal fin shorter. The base of the second dorsal equals in length the back of caudal peduncle; the base of the anal equals in length the lower side of the caudal peduncle. The bases of second dorsal and anal are much shorter than caudal peduncle in *M. lunulatus*. The angle of the lower caudal lobe is rounded or slightly angulated, never acute, the outline very gently concave next the angle. The margin of the posterior lobe is broad, evenly truncate when spread.

Following are measurements of a specimen from Panama:—

	mm.
Total length.....	468
Length of head (to first gill-slit).....	84
Length of head (to last gill-slit).....	107
Length of snout.....	41
Diameter of orbit.....	10.5
Length of spiracle.....	4
Tip of snout to front of mouth.....	31
Tip of snout to inner angle of nostrils.....	27
Distance between nostrils.....	11
Distance between angles of mouth.....	25
Distance from tip of mandible to line joining posterior angles of lips.....	18
Extreme length of upper lip.....	7
Extreme length of lower lip.....	6
Tip of snout to base of pectoral.....	107
Width of pectoral base.....	24
Outer pectoral margin.....	68
Inner pectoral margin.....	39
Distal pectoral margin.....	47
Axil of pectorals to base of ventrals.....	105
Snout to base of ventrals.....	233
Outer edge of ventrals.....	36
Base of ventrals.....	27
Snout to base of first dorsal.....	152
Base of first dorsal.....	52
Height of anterior margin of first dorsal.....	53
Height of posterior margin of first dorsal.....	17
Distance between dorsals.....	100
Base of second dorsal.....	41
Back of caudal peduncle.....	41
Length of upper caudal lobe.....	85
Tip of caudal to base of notch.....	30
Base of notch to origin of lower lobe.....	62
Origin of lower lobe to base of anal.....	29
Base of anal.....	28

This species is known as yet only from the Bay of Panama. Like *G. californicus*, from which it differs widely in other respects, it has the young attached to the oviduct by a placenta. The three specimens obtained by this expedition are all females; one of them contains well developed young.

#### 4. *Galeocerdo tigrinus* Müller & Henle.

Recorded from Panama by Jordan and Bollman (1889, p. 179), their specimen having been collected by the "Albatross." The species was not seen by the authors.

#### 5. *Carcharias æthalarus* Jordan & Gilbert.

Abundant at Panama, where it is used as food though not highly prized. Small specimens only were seen. In a male about 90 cm. long, the elaspers are very small, not reaching margin of ventrals. The teeth of both jaws are distinctly serrate in these young examples, the serræ growing coarser towards base, equally present on the two margins. The interspace between dorsals is 5 to 6 times base of second dorsal (excluding the fleshy ridge before fin), and the base of anal considerably less than ( $1\frac{2}{5}$  in) its distance from caudal. In other respects the Panama specimens answer well the original description.

#### 6. *Carcharias velox* (Gilbert).

PLATE I, FIG. 3.

*Carcharinus velox*, GILBERT, JORDAN & EVERMANN, 1898, p. 2747.

Distinguishable from other known sharks of the Pacific coast of America by the excessively long, slender, acute snout, the slender body, and the very long caudal fin.

Preoral portion of snout slightly more than  $1\frac{2}{3}$  times width of mouth, 5 times distance between nostrils,  $1\frac{2}{3}$  times width of snout opposite outer angles of nostrils,  $1\frac{1}{4}$  times interorbital width,  $2\frac{4}{5}$  times distance from chin to line joining angles of mouth. Nostrils transverse in position, the inner angle nearer mouth than tip of snout by a distance slightly less than length of nostril. Front of eye equidistant from nostril and front of mouth, the middle of eye nearer angle of mouth than nostril; diameter of eye less than nostril, slightly more than half longest gill-slit. Snout very porous. Folds at angle of mouth slightly longer than usual. Gill-slits rather wide, the middle slit  $1\frac{3}{4}$  times diameter of orbit.

Teeth of lower jaw very narrow, erect, very minutely serrulate, appearing entire except with the lens. The species thus represents a transition between *Carcharias* and the alleged genus *Hypoprion*. Teeth in upper jaw very oblique, wide at base, with a deep notch on outer margin, the terminal cusp rather narrowly triangular.

Pectoral broadly falcate, the anterior margin convex, the distal edge concave, both angles rounded. Tip of pectoral reaching a short distance beyond base of first dorsal. Anterior margin of pectoral  $2\frac{2}{5}$  times the posterior (inner) margin, about  $1\frac{1}{8}$  times the distal edge. First dorsal inserted about the diameter of orbit behind a vertical from axil of pectoral; nearer pectoral, therefore, than ventral. The anterior margin is concave basally, convex on distal half, the anterior angle rounded. The free margin is concave, largely owing to the much produced acute posterior lobe. The vertical height exceeds the length of the base; the anterior lobe very high, extending beyond tip of posterior when the fin is declined, equaling  $\frac{3}{5}$  length of anterior margin of pectoral. Posterior margin of first dorsal  $3\frac{1}{4}$  in the anterior margin. Base of first dorsal contained  $2\frac{1}{2}$  times in interspace



between dorsals; base of second dorsal  $6\frac{2}{7}$  times. Margin of second dorsal gently concave. Front margin low, the angle broadly rounded, barely reaching posterior end of base when fin is declined. The posterior lobe is much produced and acute, slightly longer than base of fin, the latter  $1\frac{5}{7}$  in the distance from its base to front of caudal pit. Upper lobe of caudal  $3\frac{2}{3}$  in total length; the lower lobe  $2\frac{1}{2}$  in the upper. Terminal lobe of caudal  $3\frac{2}{3}$  in the upper lobe. Anal larger than second dorsal, higher, with deeply incurved margin, its base a little longer, its origin slightly in advance of that of second dorsal; the posterior insertions of the two fins nearly opposite. Length of anal base  $1\frac{2}{3}$  in its distance from anterior edge of caudal pit.

Color bluish above, whitish or grayish below. Free margin of pectorals narrowly white, the anterior edge narrowly bordered with black, which is most evident when seen from the outer surface, the inner surface being dusky. The first dorsal is unmarked, the second dorsal has the anterior lobe dusky. Upper edge of caudal black, the lower margin faintly dusky. Fins otherwise unmarked.

A single specimen, a female, 120 cm. long, was procured in the Panama market. As preserved, it is partially skinned. The following measurements were taken when the specimen was intact, before preservation. Where not exactly agreeing with dimensions given above, the latter will be found more reliable.

	mm.
Tip of snout to insertion of dorsal.....	413
Base of first dorsal.....	111
Distance between dorsals.....	280
Base of second dorsal.....	45
From second dorsal to front of caudal pit.....	73
Front of caudal pit to tip of caudal.....	350
Tip of snout to axil of pectorals.....	380
Axil of pectorals to front of base of ventrals.....	283
Front of ventrals to front of anal.....	165
Front of anal to front of caudal pit.....	116
Girth at front of first dorsal.....	451

## 7. *Carcharias cerdale* (Gilbert.)

PLATE II, FIG. 4.

*Carcharinus cerdale* GILBERT, JORDAN & EVERMANN, 1898, p. 2746.

Body moderately compressed, not elevated, the depth at front of dorsal not more than one-fourth greater than the oblique anterior margin of the dorsal fin, less than the distance from the nostril to the first gill-slit. Head depressed, the snout flattened, long and narrow, acute. Length of snout beyond mouth  $\frac{1}{5}$  to  $\frac{1}{10}$  greater than distance between angles of mouth in all but one (the largest) specimen, where it is slightly less than width of mouth;  $\frac{2}{3}$  to  $\frac{1}{2}$  greater than distance from tip of lower jaw to a line connecting angles of mouth;  $\frac{1}{4}$  to  $\frac{1}{2}$  greater than width of snout opposite outer angle of nostrils. Interorbital width equaling distance from tip of snout to front of eye in the young, to middle or posterior border of eye in older specimens; less than half distance to first gill-opening. Middle of eye nearer nostril than angle of mouth by  $\frac{1}{2}$  to  $\frac{2}{3}$  its diameter. Distance from eye to nostril  $\frac{1}{2}$  or slightly more than  $\frac{1}{2}$  distance from nostril to tip of snout. Middle of nostrils much nearer front of mouth than tip of snout. Nasal flap with a very narrow, short, acute lobe, placed at end of inner third of flap. Outer angle of nostrils nearly at margin of snout, the inner angles separated by a distance equaling or slightly exceeding that between inner angle of nostril and back of eye. Lips very little developed, the lower entirely concealed in closed mouth, the upper visible as a very short fold.

Teeth in lower jaw narrow, erect, serrulate on both margins, more coarsely so toward base. The serration is more conspicuous in the smallest specimens (45 cm.), and is obsolescent on some of

the teeth in adults. Teeth in upper jaw broadly triangular, in front of jaw narrower and erect, those in sides of jaw growing at once broader and more oblique. The lateral teeth have a strong notch on the outer side. Both margins are strongly serrate, the serrations increasing toward base, one or more of those below notch sometimes enlarged and cusp-like in adults. Teeth about  $\frac{2.8}{3}$ .

Conspicuous areas of large and of small pores on under side of head. Gill-openings of moderate width, the longest equaling distance between eye and nostril, the fifth much shortened, about  $\frac{3}{4}$  length of first. Eye small, equaling length of nasal opening,  $1\frac{3}{4}$  to 2 in middle gill-slit.

Pectoral short and broad, the posterior margin not strongly incurved. Tip of fin extending to a vertical intersecting dorsal base at origin of its posterior third or fourth. Anterior margin of pectoral 3 times length of inner or posterior margin, the latter less than width of base. First dorsal beginning behind a vertical from axil of pectorals a distance about equaling that which separates eye from nostril. Free margin of fin gently concave, the anterior angle extending to a point midway between base and tip of posterior lobe, when the fin is depressed. Base of first dorsal  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in interspace between dorsals. Base of second dorsal 7 in interspace between dorsals,  $2\frac{1}{2}$  in its distance from anterior margin of pit. The origin of second dorsal falls over or behind middle of anal base. The fin is but slightly concave, with rounded anterior angle; its posterior angle much produced; the posterior margin exceeding base of fin, which about equals length of anterior margin. Anal inserted more anteriorly than second dorsal, its base longer, its margin much more deeply concave, the length of base contained about  $1\frac{1}{2}$  times in its distance from lower caudal lobe. Lower caudal pit in advance of the upper. The caudal is broad throughout, the lower lobe not falcate, slightly less ( $\frac{1}{10}$  to  $\frac{1}{4}$ ) than half length of upper lobe, which is about  $4\frac{1}{4}$  in total length. Shagreen coarse.

Color varying from light to dark gray above, the belly and lower part of sides whitish. Fins all dusky or grayish, the caudal often with a blackish border. Pectorals with or without a black tip, the latter when present not as conspicuous as in *C. aethalorus*, usually not extended onto inner face of fin. A specimen 73 cm. long has the claspers undeveloped, extending slightly beyond margin of ventrals. Another specimen, 85 cm. long, has the claspers fully developed, extending beyond the margin of the ventrals for a distance of 5 cm.

Abundant at Panama, where numerous specimens were secured.

*C. cerdale* strongly resembles *C. aethalorus*, with which it is associated in the Bay of Panama. It is distinguishable at sight by the narrower gill-slits, broader and less falcate fins, and by the much less conspicuous black tips to the pectorals. The dentition is very dissimilar in the two, and makes it necessary to arrange them in different parts of the genus, *C. cerdale* belonging to the subgenus *Platypodon*.

## 8. *Carcharias azureus* sp. nov.

CAZON AZUL.

PLATE II, FIG. 5.

Snout very short and bluntly rounded, its outline nearly parallel with cleft of mouth, the length of its preoral portion  $1\frac{2}{3}$  to  $1\frac{1}{2}$  in distance between angles of mouth, constantly greater than distance from chin to line joining angles of mouth, and very slightly ( $\frac{1}{4}$  to  $\frac{1}{10}$ ) less than distance between inner angles of nostrils. Width of snout opposite nostrils equals distance from angle of mouth to first gill-slit. Eye nearer mouth than nostril, nearer nostril than angle of mouth. Outer angle of nostril midway between tip of snout and middle of eye. Eye small, its horizontal diameter  $\frac{3}{4}$  nostril opening. Nostrils converging along lines which meet a short distance behind symphysis. The anterior margin is produced into a short, triangular flap. Width of mouth equaling half length of head in front of gill-slits. Gill-slits wide, equaling or slightly exceeding the distance from eye to nostril, about equaling length of branchial area. Two very short diverging furrows visible at angle of mouth, one representing as usual the obsolescent upper lip.

Teeth in upper jaw broadly triangular, oblique, the anterior edge gently convex, the inner gently concave and often with a slight notch dividing the margin into equal parts. Teeth in lower jaw erect, narrowly lanceolate from a broad base. All the teeth are strongly serrate on both margins.

Pectorals long and wide, concave posteriorly, hence appearing falcate, their tips extending slightly beyond base of first dorsal. Both angles are broadly rounded. Upper margin of pectorals  $3\frac{1}{3}$  to  $3\frac{1}{2}$  times lower margin, and  $1\frac{1}{3}$  to  $1\frac{1}{4}$  times the posterior margin; its length equals that of head in advance of first gill-slit. A line joining axil of pectorals passes in front of origin of first dorsal a distance equaling diameter of orbit. Base of first dorsal contained  $1\frac{2}{7}$  to  $1\frac{1}{5}$  times in anterior margin of fin, and  $1\frac{3}{4}$  or  $1\frac{1}{2}$  times in the interspace between dorsals. Upper margin concave, the posterior but little produced, contained  $3\frac{2}{3}$  to  $3\frac{5}{8}$  times in anterior margin. Second dorsal inserted well in advance of anal, the length of its base contained  $2\frac{1}{2}$  to  $2\frac{2}{3}$  times in base of first dorsal,  $4\frac{1}{2}$  to  $4\frac{3}{4}$  times in the interspace,  $1\frac{2}{5}$  to  $1\frac{1}{2}$  times in its distance from front of caudal pit. Posterior lobe of second dorsal extends nearly half-way to origin of upper caudal lobe. Front of anal under end of first third of dorsal base, the two fins nearly equal in length, the anal perhaps slightly the longer. Margin of anal much more deeply concave. Distance from anal to origin of lower caudal lobe contained  $1\frac{1}{3}$  times in distance from second dorsal to origin of upper caudal lobe. Caudal slightly exceeding  $\frac{1}{4}$  the total length; the lower lobe with rounded angle appearing bluntly falcate, contained  $2\frac{1}{4}$  times in upper lobe.

Color uniform light blue or bluish gray above, white below. Caudal and second dorsal black margined; the lower caudal lobe and distal half of pectoral largely blackish.

This species is well known though not abundant at Panama, and is more highly prized as food than other sharks. It appeared in the market on two occasions during the stay of the expedition, and three specimens were preserved, measuring from 92 to 95 cm. Two of these are males with the claspers quite undeveloped, not nearly reaching margin of ventrals. The species is said to reach a large size.

*C. azureus* is extremely near *C. nicaraguensis*, from Lake Nicaragua and its outlet, the San Juan River. Dr. Jordan has kindly compared the above description with a specimen of *C. nicaraguensis* (No. 39913) in the United States National Museum. The latter has a longer and wider snout, the length of which is contained  $1\frac{1}{2}$  in its preoral portion, its width opposite the nostrils equaling the distance from the angle of the mouth to the third gill-slit. The base of the first dorsal is  $\frac{1}{2}$  the interspace between dorsals, and the base of the second dorsal is contained  $2\frac{1}{3}$  times in the first. The lower caudal lobe is contained  $2\frac{2}{5}$  in the upper lobe. The pectoral is but faintly dusky. These differences are not great, but there has been no opportunity to make a direct comparison. In view of the exceptional distribution of *C. nicaraguensis*, known only from fresh waters, which belong to the Atlantic slope, it has not been thought wise to make the identification.

#### 9. *Scoliodon longurio* Jordan & Gilbert.

Abundant at Panama, where six specimens were obtained. The length of the base of the first dorsal is contained  $2\frac{3}{4}$  to nearly 3 times in the interspace between dorsals, not  $2\frac{1}{4}$  times, as stated by Jordan & Evermann (1896, p. 42). The teeth are not at all serrate in the Panama specimens; the thin margin is sometimes gently sinuate, but never toothed.



## Family SPHYRNIDÆ.

10. *Sphyrna tiburo* (Linnaeus).

Reported for the first time from the Pacific Coast of America by the Hopkins Mazatlan Expedition (Jordan, 1895 *b*, p. 383), which secured a single specimen. Although overlooked by previous observers, the species seems to be not rare at Panama.

Three specimens were preserved, each about 50 cm. long. A number of larger specimens were seen, from one of which were obtained a number of fully developed embryos. These measure about 20 cm. in length, and exhibit perfectly the reniform shape of the head characteristic of this species. The groove forward from the nostrils is better developed in the embryos than in older individuals, being considerably more prominent even than in specimens of *S. tudes*, 60 cm. long. In examples of *S. tiburo*, 60 cm. long, the prenasal groove is but little less distinct than in *S. tudes* of the same size. In the Panama specimens of *S. tiburo* there is a more decided fold at the angle of the mouth. In *S. tiburo* the head is both longer antero-posteriorly and wider than in *S. tudes*, the greater length being in large part due to the greater convexity in the curve of the anterior profile. Thus in *S. tiburo* a line joining inner angle of nostrils cuts off the anterior  $\frac{2}{3}$  of the snout; in *S. tudes*, the anterior  $\frac{2}{5}$  only. The angle between anterior and lateral margins of head is more obtuse in *S. tiburo*, owing to this increased convexity of the anterior profile. The angle is as distinct, however, as in *S. tudes*, and the current statement concerning *S. tiburo*, "anterior and lateral margins of head confluent into a semi-circle," is by no means justified.

11. *Sphyrna tudes* (Cuvier).

In common with other species of "Hammer-heads," *S. tudes* is frequently brought into the Panama market. It is undoubtedly abundant along the entire Pacific coast of Mexico and Central America. Several specimens were secured.

12. *Sphyrna zygaena* (Linnaeus).

Still more abundant than the preceding species, appearing in the market almost daily. Several specimens were obtained.

## Family SQUALIDÆ.

13. *Squalus sucklii* (Girard).

Jordan and Evermann (1896, p. 54) suggest that a single species of *Squalus* may be found to extend from the coast of California (*S. sucklii*) to Chile ("*S. fernandinus*"). In that case, it would be to this species we should assign the Panama record given by Günther (1868, p. 396).



## Family PRISTIDÆ.

14. *Pristis zephyreus* (Jordan & Starks).

A saw, 80 cm. long, was procured fresh in the market. A young specimen entire, 90 cm. in total length, was taken in fresh or slightly brackish water in a tributary of the Rio Grande at Miraflores. The smaller specimen agrees well with the type of the species.

Some statements in the original description which might lead to confusion are explained or corrected below.

The teeth are all deeply grooved behind, the groove with sharply trenchant edges. In both of the Panama specimens the teeth are in 22 pairs. The interspaces between the hind teeth are 4 times the base of teeth in the young,  $2\frac{1}{2}$  times in the adult. The length of the front teeth is slightly more than  $\frac{1}{2}$  the breadth of the saw between them in young,  $2\frac{2}{3}$  in this width in adults. Distance between first and second tooth  $2\frac{1}{4}$  times base of first in young, twice base of first in adult. Width of mouth slightly less than distance between tips of hinder teeth. The "slant height of pectoral" of the original description includes the anterior margin of the whole pectoral mass, from its angle forward to a point just behind eye. The "lower lobe" of caudal is the distance from anterior insertion of lobe to tip of fin. The saw in the type is 28 cm. long from base to tip, 31 cm. from tip of saw to front of nostril.

## Family RHINOBATIDÆ.

15. *Rhinobatus leucorhynchus* (Günther).

Seen on two occasions only.

The relationship is extremely close between this species and *R. glaucostigma*, which is abundant at Mazatlan. *R. leucorhynchus* has no slate-colored spots on the back, and no black blotch on the under side of the snout. The rostral ridges are much narrower, and the rostral cartilage tapers more anteriorly. The snout is broadly triangular, with almost perfectly straight sides, which are slightly concave near tip, making the latter narrow and sharp. In *R. glaucostigma*, the rostral outline is slightly concave from its base to near the tip, where it becomes convex, thus making the terminal portion of the snout broader and more bluntly rounded. The posterior gill-slit is narrower, contained  $1\frac{2}{3}$  times in the fourth slit. In other details of structure, the two forms agree very closely, the proportions of disk and fins, the size of eyes, nostrils, and mouth, and the character of nasal flaps being wholly similar.

*R. glaucostigma* has been considered the northern representative of *R. leucorhynchus*, but is now recorded from the Bay of Santa Helena, near Guayaquil (Boulenger, 1898-9, Vol. XIII, p. 1). Its discovery at Panama is therefore to be expected.

16. *Zapteryx xyster* (Jordan & Evermann).

Known only from the type specimens, collected by Prof. F. H. Bradley at Panama, in 1866.

## Family RAJIDÆ.

17. *Raja equatorialis* (Jordan & Bollman).

Known only from the type, which was dredged by the "Albatross" in 1888, at Station 2797, in the Bay of Panama, at a depth of thirty-three fathoms.

## Family NARCOBATIDÆ.

18. *Narcine entemedor* (Jordan & Starks).

Not rare at Panama; five specimens seen in the market. Obtained also by Dr. Gilbert at Panama, in 1883.

The interorbital width is less than given in the original description. The least width of frontal cartilage between the eyes is contained three times in the preocular portion of snout; the distance between the eyes  $1\frac{3}{4}$ . The longitudinal diameter of the eyeballs, which somewhat protrude, equals or slightly exceeds the diameter of the spiracle. The spiracle is horseshoe-shaped, the eye entering its anterior border; everywhere except in front it is surrounded by a raised border which bears a single series of small tubercles. Series of pores are conspicuous on upper surface of snout, each pore often surrounded by a dark ring; a pair of much larger pores near middle line behind spiracles.

A deep fold of integument surrounds the lower jaw posteriorly, growing very low as it surrounds angle of mouth, and passing anteriorly to join the base of the frenum of the nasal valve. Laterally it is concealed by a still deeper fold, which overlaps it postero-laterally and is continuous anteriorly with the inferior nasal valve.

19. *Discofyge ommata* (Jordan & Gilbert).

Not seen by the expedition. First taken by Dr. Gilbert at Panama, in 1882. The type is from "Albatross" Station 2795, in the Bay of Panama, at a depth of thirty-three fathoms.

## Family DASYATIDÆ.

20. *Urolophus halleri* (Cooper).

Not seen in 1896, but reported on previous occasions. *U. umbrifer* Jordan and Starks is one of the many color forms of this species. *U. nebulosus* has been ascribed to Panama (Jordan & Evermann, 1896, p. 81), but no authentic record of its occurrence can be found.

21. *Urolophus mundus* (Gill).

*Urolophus asterias* JORDAN & GILBERT, 1882 *m*, p. 579.

The types of *U. asterias*, obtained by Gilbert at Mazatlan and Panama in 1881, were originally identified as *U. mundus*, but were afterwards distinguished because of disagreement with the description of *U. mundus*, the types of the latter being lost. The discrepancies do not now seem very important, however, and it seems safe to identify *U. mundus* with the present species, which is abundant from Panama to the Gulf of California.

*U. mundus* was thought to be distinguished from other species, including *U. asterias*, by the short caudal spine, posteriorly inserted. If, however, the original description refers to the *posterior* point of insertion of the caudal spine, it agrees with *U. asterias*. Measured in that way, the insertion of the spine is usually behind the middle of the tail (measured from anus), and the length of the spine equals distance between snout and nostrils. *U. mundus* is said to have the skin "beset with numerous small stelliform tubercles, larger on the dorsal region," but no mention is made of the row of large spinous tubercles on median line of back and tail, characteristic of *U. asterias*. In *U. mundus* the distance of snout from hinder margin of pectorals is said to equal the width of the disk, while in *U. asterias* the disk is constantly somewhat wider ( $\frac{1}{10}$  to  $\frac{1}{15}$ ). If another species be discovered at Panama, with disk as wide as long, with stelliform prickles but with no median series of spines, the case will have to be reconsidered.

Five specimens were obtained by the expedition at Panama; three of them are males. The females are 42 and 31 cm. long, and contain embryos about two-thirds grown. The coloration in all the specimens is uniform dark brownish on upper side of disk, without the faint dusky spots found in a Mazatlan example. The fringe on velum is much less conspicuous in the Panama material. None of the specimens approach the closely related *U. rogersi* Jordan and Starks, which is undoubtedly distinct.

22. *Urolophus goodei* (Jordan & Bollman).

Not obtained by the expedition. The types were dredged by the "Albatross" at Station 2795, in Panama Bay, at a depth of thirty-three fathoms. Jordan and Evermann (1896, p. 81) state that this species was taken in Magdalena Bay, Lower California, but the present writers are unacquainted with the record. Boulenger (1898-9, Vol. XIII, p. 3) lists it from the Bay of Santa Helena, near Guayaquil.

23. *Urolophus aspidurus* (Jordan & Gilbert).

Abundant at Panama, where numerous specimens were secured, all but one of which are females. One contains embryos full grown.

The following corrections and additions may be made to current descriptions: The disk, taken to posterior margin of pectorals, is constantly a little broader than long; its length being less than that of tail measured from posterior insertion

of ventrals. The amount of exsertion of the snout is very variable, the protruding portion being sometimes short and broad, sometimes long and narrow. The distance from eye to tip of snout is  $3\frac{1}{2}$  or  $3\frac{2}{5}$  in disk, measured as above. The posterior insertion of caudal spine is very slightly in advance of middle of tail (measured from anus). The bucklers on tail vary in the present specimens from one to seven (eight in one of the types); they have not appeared at birth, and are still undeveloped in a young specimen 15 em. long. It will probably be found that there is always a regular series of seven or eight of these when they first appear, a variable number of them falling off later. In the adults, those remaining are usually unequally spaced, the interspaces often showing the scars of the lost bucklers. Minute asperities seem to be constantly present (at least in females), and are most numerous in a strip extending along the median line of disk. The teeth are much as in *U. mundus*, but are much more deeply grooved.

In females the teeth are flat without cusp, each tooth with a deep transverse groove, the hinder margin of which is elevated to form a ridge crossing the tooth transversely behind its middle. In the male, each tooth has a long acute median cusp; those in the upper jaw deeply grooved from base to tip along their anterior face, those in lower jaw transversely convex. In *U. mundus* the cusps of upper teeth in the males are provided with shallow grooves on basal portions only, and the transverse grooves on the flat teeth of the females are shallow, and followed by a lower transverse ridge. In embryos of *U. aspidurus*, the inner margin of spiracular rim is much elevated and produced anteriorly into a long slender coiled lobe, posteriorly into a much shorter projection. All trace of this raised rim disappears in the adult.

#### 24. *Dasyatis longa* (Garman).

Not rare. One female specimen preserved.

Anterior margins of pectorals gently concave along the middle, becoming convex toward tip of snout, the latter abruptly projecting. The cutaneous fold on lower side of tail is low, not over 3 mm. in height; it begins opposite the anterior insertion of caudal spine, and is evident on about half the length of the tail. An extremely low ridge on back of tail behind caudal spine. The tail is very rough behind the caudal spine. A series of 34 coarse, spinous tubercles on median line of back, the three largest at intersection of median line with shoulder-girdle. Opposite this point are two short series of much smaller tubercles converging slightly backward. In addition to these, the interorbital region and the median area of back contain numerous stellate prickles, but few of which are behind the shoulder-girdle.

Length of disk.....	355
Width of disk .....	420
Tail (from anal slit) evidently broken.....	790
Tip of snout to middle of nasal flap.....	80
Outer edge of ventrals .....	60
Anterior margin of pectorals.....	260
Longitudinal diameter of eyeball .....	20
Length of spiracle.....	25
Width of cartilage between eyes.....	38



Material is not at hand to decide the relation between *D. longa* and *D. dipterura*. The specimen listed by Jordan (1895 *b*, p. 389) from Mazatlan may be the latter, if the two species are distinct. In one of the Mazatlan specimens, with the disk 32 cm. long, the upper surface is naked, except three small spines on middle line near shoulder-girdle. The tail is also naked, and possesses, in addition to the very high cutaneous fold below, a free upper fin-fold half the height of the lower. It is probable that the two species are distinct.

#### 25. *Pteroplatea crebripunctata* (Peters).

Three specimens seen at Panama.

The proportions of disk are not essentially different in *P. crebripunctata*, *P. rava*, and *P. maclura*. In all, the distance from tip of snout to front of anal slit equals half the width of the disk (or a little less than half in *P. rava*); and the extreme length of disk, from tip of snout to hinder margin of pectorals, is contained  $1\frac{2}{3}$  to  $1\frac{3}{4}$  times in the width. A line joining angles of disk intersects very slightly in advance of its middle a line from tip of snout to tip of tail.

*P. crebripunctata* and *P. maclura* are extremely close, differing principally in color, the marblings and spots being finer in *P. maclura*, and the lighter markings brighter in color, more sharply contrasting with the rest. *P. rava* has a sharper snout than the others, the rostral angle being, however, in excess of a right angle (110 degrees). The type of *P. rava* is a male specimen, 29 cm. long, with well developed elaspers and no trace of caudal spine.

#### Family MYLIOBATIDÆ.

#### 26. *Aetobatus narinari* (Euphrasen).

Frequently seen; three specimens preserved, one of which has measurements as given below.

Rostro-frontal fontanel narrowing anteriorly to opposite the hinder margin of eyes, then abruptly expanding; its greatest width anteriorly, 21 mm.; least width at the constriction, 13 mm.; greatest width posteriorly, opposite middle of spiracles, 18 mm.

Tip of snout to front of anus.....	mm. 323
Tip of snout to posterior margin of pectorals.....	365
Width of disk .....	615
Length of tail (broken).....	1200
Greatest breadth of head (at anterior origin of pectorals) .....	106
Width at eyes (including the latter).....	87
Width of cranium opposite middle of eyes.....	53
Width of snout opposite front of eyes.....	56
Length of spiracle.....	31
Tip of snout to middle of nasal flap.....	61
Width of mouth .....	44
Diameter of iris .....	11

The Panama specimens agree entirely with those described by Jordan (1895 *b*, p. 391). The comparative measurements given in the paper cited are often

erroneous, as will appear by comparing them with the above. The size of the spots is somewhat variable, and the length of the tail is unreliable, the latter being usually more or less shortened by injury.

### 27. *Myliobatis asperrimus* (Gilbert).

PLATE III, FIG. 6.

*Myliobatis asperrimus* GILBERT, (JORDAN & EVERMANN, 1898, p. 2754).

Upper surface of head and body, excepting the snout, an area on outer side of spiracle, the pectoral margin and its posterior angle, and the ventral fins, thickly covered with minute usually stellate prickles of uniform size, most numerous on median portions of head and back; those on basal half or two-thirds of pectorals are least crowded, and are arranged in definite longitudinal series, corresponding with the muscle bands. The tail is very rough throughout, being covered with similar stellate prickles. It is also crossed by numerous narrow grooves, or indented lines, mostly convex forwards, somewhat irregular in position and direction, and not corresponding on the two sides. In the type they follow at an average interval of about 10 mm. Lower side of disk mostly smooth, with some prickles on the basal part of pectorals anteriorly, arranged in lengthwise series, and other patches on lower side of head, belly and base of ventrals.

Rostro-frontal fontanel scarcely constricted anteriorly, the bounding ridges diverging abruptly at their anterior ends. Nasal flap with a shallow median notch, covering the mouth except the median portion of lower dental plate, its posterior margin coarsely fringed. Teeth in each jaw in one broad, median row, and three lateral rows; those of median row about five times as broad as long antero-posteriorly.

The color is dusky-brown above, the anterior portion of pectorals with eight or ten narrow, transverse bars of bluish-white, most of which break up into series of spots towards outer margin of disk, the posterior ones also breaking up towards middle line. The bars and spots are fainter anteriorly, becoming whiter and more intense posteriorly. Towards outer angles of disk the bars are sometimes separated by intermediate series of light round spots. The bars usually fail to meet across the back. The posterior portion of disk, including base of tail and upper surface of ventrals, is covered with round white spots not much larger than pupil; some of those immediately succeeding the bars show a transverse serial arrangement. The top of head shows one or more pairs of indistinct light spots. Margin of snout and of pectorals blackish. Spiracular border black. Dorsal with a black blotch posteriorly. Under side of head and disk bright white. Proximal portion of tail blackish above, lighter below, the entire tail becoming black posteriorly.

	mm.
Length of disk to front of anus.....	272
Length of disk to posterior edge of pectorals.....	338
Width of disk.....	345
Length of tail (not perfect).....	1215
Greatest width of head, at origin of pectorals.....	79
Width of cranium, between orbits.....	45
Width of snout, opposite front of eye.....	55
Tip of snout to middle of nasal flap.....	60
Length of nasal flap.....	26
Greatest width of nasal flap.....	35
Diameter of iris.....	10½
Width of mouth.....	33
Distance between anterior gill-openings.....	75
Distance between posterior gill-openings.....	45
Distance from anterior to posterior gill-openings.....	45
Length of spiracle.....	26
Length of fontanel.....	60
Greatest width (at anterior end).....	23

One specimen taken, a male, with undeveloped claspers which do not nearly reach the edge of ventrals.

Family SILURIDÆ.

28. *Felichthys panamensis* (Gill).

Abundant. Of the six specimens preserved, three are males and three females, all being of nearly equal size. The specimens do not differ according to sex in the shape of the dorsal buckler as extensively as is indicated in Steindachner's figures (1876 *b*, Plate II). Furthermore, such difference as exists is in the opposite direction to that observed by him, as the buckler is larger and proportionally somewhat wider in the females than in the males. More obvious sexual differences are found in the length of the ventral fins and in the shape of the anal. In females, the ventrals are long, constantly extending beyond the front of the anal. In males, they fail to reach the front of the anal fin. In females, the anterior portion of the anal fin is produced, forming a projecting lobe, thus giving a strongly concave arch to the posterior half of the margin of the fin. In males, there is no lobe, and the margin of the fin is nearly or wholly straight. This difference in the shape of the anal was noticed by Steindachner (1876 *b*, p. 15), but was supposed by him to be due to age and not to sex. Another sexual difference seems to exist in the size of the head, which in the present specimens is less in the case of the females,  $3\frac{2}{7}$  to  $3\frac{1}{2}$  ( $3\frac{3}{5}$  in males). The specimens taken range from 325 to 360 mm. in length.

29. *Felichthys pinnimaculatus* (Steindachner).

NEGRO ENCUERO.

One of the most abundant food-fishes of the Panama market. Sexual peculiarities seem much less strongly marked than in *F. panamensis*.

30. *Galeichthys lentiginosus* (Eigenmann & Eigenmann).

Frequently seen; nine specimens preserved.

The species is at once recognized by the very long narrow occipital process, by the depressed head, which is wide posteriorly and tapers rapidly forward to the narrow pointed snout, by the very convex mouth, and the usually smooth head. In the latter respect, however, there is much variation. The granulations may be confined to the occipital process and the posterior part of occiput, and be faintly visible where present, or they may entirely cover the crown forward to the interorbital space. In the latter case, the pattern of sculpture is exactly similar to that figured for *Netuma planiceps* (Steindachner, 1876 *b*, Plate IV), except that the granulations are less definitely in series, and that an evident groove extends backward from fontanel to near base of occipital process. The difference in roughness of the head is dependent neither on age nor sex. The specimen with best marked granulations is a female.



The narrow pointed snout, and large convexly curved mouth combine to give the latter a considerable lateral cleft, when seen from the side. The length of the head is very constant,  $3\frac{3}{4}$  to  $3\frac{9}{10}$  in length, when measured to margin of opercular membrane. Eye 3 to  $3\frac{1}{2}$  in its distance from tip of snout. The upper jaw protrudes beyond the lower for about three-fourths the width of the thick upper lip. The maxillary barbels extend beyond base of pectoral spine, but not beyond its basal third. Pectoral pore variable, usually minute and detected with difficulty, occasionally an obvious slit.

The anal fin is very long, with perfectly straight margin, the rays declining regularly from the longest to the last. Five specimens have respectively 23, 24, 24, 24 and 25 anal rays, including rudiments. The anus is anteriorly placed, its distance from base of ventrals equaling half its distance from front of anal fin. All but one of the specimens are females, and have the inner edge of the ventrals and the upper side of the inner rays covered by a thickened fold of skin.

Light brownish in life, with blue and green reflections; the lower portion of the sides coarsely punctate with brown. The fins are all dusky toward tips, the basal portions dull orange yellow. Maxillary barbels blackish, the others white. The specimens answer well to the description of the types.

It is evident that the relative smoothness of the head cannot serve to distinguish the nominal genera *Galeichthys* and *Hexanematichthys*. The character is dependent partly on variation in the granulation of the bones, partly on the amount of thickening of the integument. Many species from different sections of the group show similar individual variations, according to which they might be placed in one or the other genus. The American species with villiform teeth and comparatively narrow crescentic palatine patches will be ranged under the oldest name, *Galeichthys*.

### 31. *Galeichthys peruvianus* (Lütken).

This rare species was not seen. Described originally from Callao, it has been recorded from Panama by Steindachner and by Gilbert, and from Altata, Mexico, by Steindachner. It has not been procured by any of the numerous investigators in northern Mexico.

### 32. *Galeichthys eigenmanni*, sp. nov.

PLATE IV, FIG. 7.

This species, found in abundance at Panama, and identified with *G. seemanni* by Eigenmann and others, seems to be an undescribed species. *G. seemanni* is from some unknown locality in Central America, not improbably from the Atlantic side. It is described (Günther, 1864 *a*, p. 147) as having the top of the head *finely* granular; the occipital process with a *prominent* ridge; vomerine patches of teeth *widely* separated; and particularly as having the *fontanel reaching to the base of the occipital process*. Dr. Jordan (1883, p. 282) has re-examined the type in the British Museum for this last character, and has found it as described. In all these respects the Panama specimens differ strongly, as shown below.

Head broad and flat,  $3\frac{2}{5}$  to  $3\frac{3}{4}$  in length; its depth at base of occipital process  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in its length. The dorsal profile from dorsal spine to tip of snout nearly (appearing perfectly) straight. Snout wide and depressed, sharply wedge-shaped as viewed from the side; its length to a point on the median line of head between anterior margin of eyes  $3\frac{3}{4}$  to 4 in head. The prefrontal does not form a protuberance in front of eye as in *G. jordani* and related species, the contour of snout rising uniformly to the edge of the dermal margin of eye. The interorbital area is flattened and wide; its width between dermal supraorbital margins 2 to  $2\frac{1}{6}$  in head. The top of head is coarsely granular, the granulated area extending forward usually to above middle of orbit in two diverging areas, separated by a triangular continuation backward of the naked or smooth area of the snout. The length of the fontanel is variable in the present specimens, but in none of them does it reach the occipital process.<sup>1</sup> In two specimens evidently abnormal, the groove is very short, extending only to the apex of the triangular smooth area, which extends backward from interorbital space. Usually, however, the groove narrows backward uniformly, though sometimes constricted where it enters the granular area of the head, and extends to within  $\frac{2}{3}$  diameter of eye of the occipital process. The occipital process is usually broader than long; in extreme cases it is broader than long by nearly the length of the basal plate of the dorsal spine; from this it varies to only as broad as long. The basal plate of the dorsal spine is twice, or a little more than twice, as broad as long. The median keel is lower than in *G. planiceps* or *G. jordani*; in some specimens it is scarcely evident at the termination of the fontanel, but grows stronger on the occipital process.

The maxillary barbel usually reaches base of pectoral spine; in one specimen to axillary pore, in several about to middle of opercle. The outer mental barbels often reach but  $\frac{2}{3}$  distance to gill-openings, but sometimes extend beyond the latter. The vomerine patches of teeth usually meet on median line, or are separated by a narrow groove only. In but one specimen (an adult male) are they widely separated (as figured by Günther and Eigenmann). The eye is contained  $6\frac{1}{2}$  to 7 times in the head, measured in a straight line from median tip of snout obliquely above eye to gill-opening.

As in other related species, the head is longer and the ventrals shorter in the male, the ventrals overlapping front of anal in females and provided with a very large fold of the integument. In the females the black of the ventrals passes gradually into the lighter margin. In males the transition between the two areas is abrupt. In five specimens examined, the gill-rakers are 5+10, 5+10, 6+10, 5+11, and 5+12. The pectoral pore is a long slit. The base of adipose fin is twice or nearly twice diameter of eye. The dorsal has 7 soft rays, and the anal 17 or 18. The length of the pectoral is very variable; measuring from base of spine to tip of soft rays, it is contained from  $1\frac{1}{5}$  to  $1\frac{1}{2}$  in head.

From *G. jordani* and other related species, *G. eigenmanni* can be at once recognized by the wider, flatter head, especially the more depressed snout, the smaller eye, the rougher head, and the less evident carina on the occipital process.

Three males and nine females were preserved.

It is not clear what species from Santa Helena Bay is referred to by Boulenger (1898-99, Vol. XIII, p. 5) under the name *Arius seemanni*. From his statement "Le *Galeichthys gilberti* Jord., n'en est pas séparable," we are disposed to believe that he had before him specimens of *G. jordani* rather than *G. eigenmanni*.

### 33. *Galeichthys jordani* (Eigenmann & Eigenmann).

Two specimens were obtained 250 and 345 mm. long. The larger individual is a female, with elongate ventrals overlapping the front of the anal fin, and provided

<sup>1</sup> From a drawing kindly communicated by Professor Garman, it is learned that Eigenmann's material in the Museum of Comparative Zoology agrees with the present specimens in the length of the fontanel groove.

on the upper surface of the inner rays with a much thickened fold of the integument, as in *G. platypogon* and *G. eigenmanni*.

The specimens taken agree well with Eigenmann's description of the types, except in the size of the palatine patch of teeth, which is in adults about as large as in *G. eigenmanni*, and many times the size of the small vomerine patch. It is probably true of this species, as of *G. gilberti* from Mazatlan (Jordan and Gilbert, 1882 *b*, p. 47, under *Arius assimilis*), that the palatine bands vary "considerably in size and somewhat in form, the width ranging from  $\frac{1}{3}$  diameter of eye to  $\frac{2}{3}$ , being generally larger in adults." Eigenmann's type of *G. jordani* was an immature specimen. In the smaller of our specimens the palatine patch is much less developed than in the adult, though somewhat larger and more ovate than in Eigenmann's figure.

In both of the specimens taken the fontanel groove terminates a very short distance in advance of the base of the occipital process, not reaching the base of process as described by Eigenmann.

The gill-rakers number 5+11 and 5+12, the most anterior being very minute. If the one at the branchial angle be reckoned with the vertical series instead of the horizontal, as above, one of the specimens will have the formula 6+10, as compared with Eigenmann's type 6+9.

Comparing the Panama material with the co-types of *G. gilberti* from Mazatlan, it is impossible to detect any appreciable differences, unless possibly in the color, which is lighter in the Mazatlan specimens. *G. gilberti* is said to lack the pectoral pore, but in reality possesses a minute round pore, as is evident in the co-types examined. The adult *G. jordani* from Panama has the pore likewise minute, while the younger example has a considerably larger, slightly elongate opening. The width of the mouth is the same in the Mazatlan and Panama specimens; measured externally, at the posterior labial angle, it equals the distance from the tip of the snout to the hinder margin of the pupil, and is contained  $2\frac{1}{4}$  to  $2\frac{1}{3}$  times in the length of the head.

The two would be united without question, were it not that the co-types of *G. gilberti* (three in number) agree perfectly among themselves and differ from the Panama specimens of *G. jordani* in having the occipital plate much wider, more evenly rounded in transverse section, and with a much lower keel. The occipital plate is, in each of these specimens, wider than long by half the width of the basal plate of the dorsal spine. In *G. jordani* the width of the occipital plate is  $\frac{4}{5}$  or  $\frac{5}{6}$  its length. This plate is also much more sharply keeled and more densely granular. On the basis of these differences the two species are held provisionally distinct.

In both species the upper lobe of the caudal is longer and more falcate than in related species, reaching far beyond the lower lobe, and contained  $3\frac{1}{4}$  to  $3\frac{3}{4}$  in the length. The head is finely and often sparsely granular, the granular area not continued forward in any of the Panama specimens as far as a line joining posterior margins of orbits. The fontanel groove widens anteriorly, is rather deep, with sharply defined margins, and terminates abruptly, not "merging into the broad, flat, smooth, interorbital area" as is described in the type of *G. gilberti*.



34. *Galeichthys xenauchen* (Gilbert).

PLATE IV, Fig. 8.

*Hexanematichthys xenauchen* GILBERT (JORDAN & EVERMANN 1898, p. 2777).

In appearance, *G. xenauchen* is most closely allied to species of *Netuma*, having the low depressed head, with the lateral outlines converging forwards to the narrow pointed snout, and a long largely adherent adipose dorsal. The palatine patches are, however, narrow, and without backwardly projecting lobes. The species is distinguished from all those known from the Pacific Coast of America by the long and extraordinarily narrow occipital process.

Type, a female 38 cm. long.

Head  $3\frac{3}{8}$  in length; depth at front of dorsal  $5\frac{1}{2}$ ; anal with 23 rays. Width of head at opercle  $1\frac{1}{7}$  in its length; width at front of eyes 2 in head. Width of mouth at inner angles  $2\frac{2}{3}$  in head. Interorbital width  $2\frac{1}{10}$ . Eye very small, 9 in head,  $3\frac{1}{2}$  in its distance from tip to snout,  $4\frac{5}{8}$  in postocular part of head,  $4\frac{1}{3}$  in interorbital width.

Teeth all villiform. Mandibular bands well separated on middle line, very broad mesially, rapidly tapering to a point laterally, the band produced beyond angle of mouth, its greatest width contained  $2\frac{1}{2}$  times in its length. Premaxillary band very convexly curved, following the outline of the snout, its width  $5\frac{2}{3}$  in its length. Vomerine patches roundish, separated by an evident medial groove, marked off from the palatine patches by a narrower groove and a constriction. The palatine patches are equal in width to the vomerine patches, and less than twice as long. They are of nearly equal width throughout.

Maxillary barbels very slender, reaching slightly beyond the base of the pectoral spine. The mental barbels do not reach edge of gill-membrane, the outer pair equaling length of snout and half of eye. Nostrils very large, the anterior broadly oval, with widely reflexed rim, the posterior widely elliptical, not concealed by the valve. Distance from anterior nostril to tip of snout equaling that from posterior nostril to front of eye.

Fontanel wide, with nearly parallel edges on frontal region, abruptly narrowing at front of occiput, where it is continuous with a narrow and shallow groove. The latter fails to reach base of occipital process by a distance equaling half diameter of eye. The raised margins of the fontanel are continuous with a pair of sharp ridges bounding the groove, these accompanied by a pair of lower ridges on their outer sides and parallel with them. Posteriorly, these ridges are roughened with granules, and merge into the granulated area on posterior part of occiput. Occipital process granulated, the granules arranged in more or less definite lines radiating backwards and downwards on each side from median point of base. Lateral portions of occiput with an area of radiating striæ, separated from the central ridges by a smooth groove-like depression. A narrow granulated area extends forward on each side of fontanel to above back of orbits. The occipital process is very long and narrow, its width opposite its middle being but  $\frac{2}{3}$  of its length. Near base it abruptly expands, the basal width being half its length plus that of dorsal plate on median line. Opercles and humeral plate weakly striate. Gill-membranes with a wide free fold posteriorly. Gill-rakers weak and short, 1+4 movable ones. No evident axial pore.

Dorsal spine slender, with a series of sharp granulations on anterior edge; minutely roughened, not serrate behind. It is broken in the type, but its length was about  $\frac{2}{3}$  that of head. Pectoral spines rather slender, rough granular on outer margins, with short fine serræ within. Both are mutilated in the type, but their length was about equal to that of dorsal spine. The pectorals extend nearly  $\frac{2}{3}$  distance to ventrals, the ventrals nearly to origin of anal. Distance from anus to

base of ventrals  $\frac{2}{3}$  its distance from front of anal. Anal fin very long, its base  $1\frac{3}{4}$  in head, its longest ray  $\frac{1}{3}$  head. Distance between dorsals  $3\frac{1}{2}$  in length. Adipose fin long, highest about opposite the middle, with a short almost vertical free posterior margin. Its vertical height is  $3\frac{2}{5}$  in its length, which is more than twice the distance from adipose fin to rudimentary caudal rays, greater than the base of the first dorsal, and equal to half the length of the head. Caudal fin with broad lobes, the lower rounded; the upper mutilated in the type, but evidently acute and longer than the lower.

Color purplish above, more bluish anteriorly; the lower parts silvery, coarsely punctate with brown. Fins all blackish, except the lower surface of the paired fins.

### 35. *Galeichthys guatemalensis* (Günther).

This species was not seen by the authors. Recorded by Günther (1868, p. 393) from Panama; by Boulenger (1899, p. 2) from Rio Lara, Darien.

### 36. *Galeichthys dasycephalus* (Günther).

This species was occasionally seen; eleven specimens were preserved, all of which are females.

It answers well the description of Günther (1864 *a*, p. 157), and of Jordan and Gilbert<sup>1</sup> (1882 *b*, page 51), except that the head is constantly longer, 4 to  $4\frac{1}{8}$  in length, and the dorsal spine is contained  $1\frac{1}{2}$  instead of  $1\frac{1}{4}$  times in head. The anal contains 21 rays, including the rudiments. The top of the head is constantly much rougher than in *G. longicephalus*, although exhibiting much variation in this respect. The fontanel groove reaches base of occipital process in all of the specimens taken.

### 37. *Galeichthys longicephalus* (Eigenmann & Eigenmann).

Taken occasionally; eight specimens were preserved, all of which are males.

There is little variation in the sculpturing of the head, which is either entirely smooth, invested with thick skin, or minutely roughened by a few scattered points. None of our specimens have the plates roughly granulated, as in *G. dasycephalus*.

The head is very constant in length,  $3\frac{2}{5}$ ,  $3\frac{3}{5}$ ,  $3\frac{4}{5}$ ,  $3\frac{1}{2}$ ,  $3\frac{1}{2}$ ,  $3\frac{2}{3}$ ,  $3\frac{2}{3}$  and  $3\frac{4}{5}$  times respectively in distance from tip of snout to base of caudal. The maxillary barbel reaches to base of pectoral spine, or to the end of its basal fourth. The outer mental barbels are variable, sometimes not reaching gill-opening, more often slightly beyond it. The eyes vary in length, and equal their distance from hinder end or middle of posterior nostril, and about half their distance from tip of snout. The width of mouth about equals the length of snout,  $2\frac{5}{6}$  to  $3\frac{1}{4}$  in head. In the description of the type, the width of mouth should doubtless stand  $3\frac{1}{5}$ , not  $2\frac{1}{5}$ , in head. The distance from the tip of snout to front of dorsal is contained  $2\frac{2}{3}$  to  $2\frac{3}{4}$  in the length; the interspace between dorsals  $3\frac{2}{5}$  to 4.

The color of the upper part is brown, sometimes continued down over the

<sup>1</sup> Dr. Jordan has kindly re-examined the specimens here referred to, collected by Gilbert at Panama on a previous expedition, and states that the head measures  $4\frac{1}{5}$  (not  $4\frac{1}{2}$ ) in length to base of caudal.



sides and belly, almost entirely masking the silvery of those parts. In other specimens, the sides and belly are bright silvery without brown tinge. The fins are all dusky, in some specimens much darker than in others; the ventrals sometimes narrowly edged with bright white.

We have been tempted to consider this species the male of *G. dasycephalus*, as our numerous specimens seem to be all males, while our specimens of *G. dasycephalus*, as well as all those of which we have record, seem to be females. The structural differences are so much greater in amount than are known to be sexual with any other species, that we hold the two forms distinct. In addition to the striking difference in the length and sculpturing of the head, *G. longicephalus* has shorter barbels, coarser gill-rakers, shorter pectoral spines, a wider fontanel, and a wider snout and mouth.

### 38. *Sciadeichthys troscheli* (Gill).

Abundant along the entire coast of Mexico and Central America. At Panama it occurred daily in the markets, but seldom in large numbers. The collection contains five specimens from Panama, one from Champerico.

The species varies in certain respects more than has been represented. The dorsal buckler varies much in width, and even in general shape; one specimen at hand has it triangular, tapering nearly uniformly from the base forward to the long acute apex, two-fifths of its length on the median line being contained within the notch of the occipital process. In one individual, the granulations are very sparse, and largely obscured by the thickened integument.

The maxillary barbels are blackish, with a conspicuous white inferior margin. They vary much in length, often failing to reach opercular opening, sometimes overlapping base of pectoral spine. The vomerine patch of teeth is sometimes long (transversely) and narrow, thus separating widely the palatine bands (as figured by Eigenmann and Eigenmann, 1890, p. 56); sometimes much shorter and wider. The head seems very constant in length,  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in total length (without caudal).

### 39. *Selenaspis dowi* (Gill).

Large specimens are frequently brought into the Panama market, but seldom more than two or three at a time. The young are rarely seen. In one of the specimens at hand, a curious variation is observable in the shape of the dorsal shield, which has its anterior margin medially produced and wedge-shaped, fitting into an emargination in the occipital process, much as in *Sciadeichthys troscheli*.

### 40. *Netuma kessleri* (Steindachner).

One of the most abundant species of catfishes at Panama. It varies in color from light brown to nearly black on the upper parts, and may be pure white below or variously marked with brown. The fins vary in a similar manner, the caudal, anal, and inner surfaces of pectorals and ventrals being black in the darkest specimens,

merely dusky in others. The vomerine patches vary somewhat in size and shape. A very narrow groove may be detected, separating them in all of the specimens, and they do not seem to be wholly confluent with the palatine patches even in adults. The pterygoid bands may be wholly absent, or represented by a linear group of small patches, or fully developed as an elliptical patch of large size.

Nine specimens were preserved.

#### 41. *Netuma insculpta* (Jordan & Gilbert).

Hitherto known only from the type (an adult male) and two young co-types, all from Panama. To these, the present collection has added an adult female, 27 cm. long.

The species is very close to *N. planiceps*, but differs in its wider head, more numerous and coarser granulations, wider occipital process, longer barbels, and shorter higher adipose fin. The occipital process is less sharply keeled, and the palatine teeth are in larger patches. In our specimen, the vomerine patches are large, the apposed magrins rounded, meeting in the middle but not confluent; evident furrows mark them off from the palatine patches. The latter are very large, with straight parallel inner edges, as in *N. plutyogon*.

In the following measurements the specimen varies somewhat from the type description:

Head  $3\frac{3}{4}$  in length. Interocular width  $2\frac{1}{6}$  in head; snout  $2\frac{3}{5}$ ; width of mouth (external measurement) 2; maxillary barbel reaching to end of second fifth of the length of the pectoral spine; outer mental barbel to little past gill-opening. Occipital process a little wider at base than its length on the median line. Length of predorsal plate on the median line one-third the length of one of its sides. The base of the adipose fin is contained  $2\frac{3}{4}$  times in the head, its height  $1\frac{3}{4}$  in its length. The ventrals overlap the rudimentary anal rays. The anal has 14 developed rays, 3 rudiments. The posterior face of the pectorals is black, the other fins dusky. The maxillary barbel is silvery white, with a black upper margin.

#### 42. *Netuma planiceps* (Steindachner).

Of frequent occurrence. This proves to be an extremely variable species, the variations not being dependent on age or sex, and not correlated. The occipital process may be very much narrower than figured by Steindachner (1876 *b*, Pl. IV), more tapering posteriorly; or it may be broader than there represented and more expanded at the base, so that the lateral margins are more concave and the greatest width and length of the plate are about equal. There is usually a wide shallow groove extending backward from the fontanel to within about a pupil's diameter of the occipital process. This is often obscured posteriorly by granules or granulated ridges, and may even be obliterated by the latter, as shown in the figure already cited. The carina on the occipital process is usually sharp, rarely

rounded posteriorly. In the former case it is not infrequently continued backward onto the dorsal plate. The granulations are always very fine; they are sometimes arranged in series, and are always rather distant and inconspicuous.

The teeth on the palate are especially variable. The vomerine patches are usually small, and may be either confluent with each other and with the palatine patches, or may be separated from both by a groove. This variation seems to be not determined by age. The palatine patches are sometimes ovate, small, with very indistinct backward processes; sometimes fully twice as large, produced backward, with their inner margins nearly straight and diverging.

The snout is usually broadly rounded or subtruncate, seen from above. In some cases, however, it is sharply convex, the mouth then with more lateral cleft, and often with swollen lips. In all the specimens, the premaxillary band of teeth is long, its width being contained not less than four times in the length. The barbels are always short, the maxillary barbel seldom reaching the gill-opening. In adults, the appearance is often peculiarly modified by the great enlargement of the upper portion of the cheek muscles, making the top of the head transversely concave.

The long adipose fin is highest near its middle, where the vertical height is about one-third the length. The fin is not wholly adnate, there being a short, free posterior border. It is constantly a little longer than the base of the first dorsal.

#### 43. *Netuma platypogon* (Günther).

Abundant in the Panama market. Of the ten specimens preserved, six are females, with elongate ventrals, which overlap the front of the anal. Unlike *G. eigenmanni*, the vent is constant in position, not more anteriorly placed in females. As in *G. eigenmanni* and *G. jordani*, the inner ventral ray is somewhat broadened in females, and gives attachment to a dermal thickening, less marked, however, in this species.

In one male specimen taken at some date between January 10 and February 24, the mouth contained eggs, and was obviously functioning as a brood-cavity. The strong arch to the buccal roof was evident. It is clear that the breeding season is not confined to June and July, as given by Steindachner (1876 *b*, p. 17).

*N. platypogon* has the basal portion of the paired fins jet black on their upper surfaces, in both males and females. The anal is blackish in its anterior two-thirds, with a wide white margin. The fontanel groove is everywhere sharply defined. It is widest a little in front of the middle of its length, tapering slowly backward to the base of the occipital plate, the base of which is always reached. Anteriorly, it narrows more rapidly, terminating in an acute point which is opposite or in advance of the middle of the eyes.

The dorsal spine is very narrowly compressed, its anterior margin sharp, strongly serrate.

#### 44. *Netuma oscula* (Jordan & Gilbert).

Two specimens are distinguishable from *N. planiceps* only by the smaller mouth and the shorter band of premaxillary teeth. The width of the latter (antero-



posteriorly) is contained but three times in its length. One specimen is a young male, the other an adult female with very narrow convexly curved snout, and small convex mouth with thick lips. The adult agrees exactly with adults of *N. planiceps*, except in the characters mentioned. *N. oscula* may represent an extreme variation in that most variable species, but the two forms are retained until intermediate specimens are obtained.

It is doubtful whether the specimen described by Eigenmann and Eigenmann (1890, p. 74) as *Tachysurus osculus* is properly referred to this species, as the mouth is wider (two in head), and the intermaxillary band is wider antero-posteriorly, its width one-fourth its length. The vomerine patches seem also much more widely separated than in *N. oscula* or *N. planiceps*. In our adult female the head is contained  $3\frac{2}{5}$  times in total length (without caudal).

#### 45. *Netuma elattura* (Jordan & Gilbert).

Known from the type specimen obtained by Dr. Gilbert at Panama in 1881; and from another obtained at Albatross Station 2800, Bay of Panama, at a depth of seven fathoms (Jordan and Bollman, 1889, p. 179).

#### 46. *Tachysurus steindachneri* sp. nov.

PLATE V, FIG. 9.

*Arius melanopus* STEINDACHNER, 1876 *b*, p. 29 (Panama); not *Arius melanopus* GÜNTHER (Rio Motagua, Atlantic slope of Guatemala).

It has been pointed out by Dr. Steindachner, in the article above cited, that Panama specimens of *Tachysurus*, allied to *T. melanopus*, differ not a little from Günther's description of that species. Two specimens in the present collection, 21 (♂) and 26 (♀) cm. long, agree with those examined by Steindachner. They differ from *melanopus* in the shorter head ( $4\frac{1}{3}$  in *melanopus*), the character of the longitudinal groove on top of head ("indistinct, narrow, linear behind, scarcely extending to the base of the occipital process" in *melanopus*), the shorter maxillary barbels (not quite extending to the middle of the pectoral fin, in *melanopus*), and in the small size of the axillary pore ("nearly as wide as a nasal opening" in *melanopus*). The description of *melanopus* is so lacking in detail that other differences may well exist. When to these considerations is added the fact that *melanopus* belongs to the Atlantic fauna, while no species of marine catfish is as yet known to be common to the two oceans, it seems advisable to recognize the Pacific form as distinct.

Of the Pacific species, *T. steindachneri* is most nearly allied to *T. liropus*, but the latter has the inner faces of the paired fins light or slightly dusky, instead of black on basal half; the spines are longer and more slender, the snout longer and more rounded at its extremity, the anterior divergent extensions of the granulated

area on top of head are much wider, and the nature of the lengthwise groove is widely different.

Type, ♂, 21 cm. long.

Head  $3\frac{3}{8}$  in length to base of caudal; depth 5. Greatest width of head  $\frac{3}{4}$  its length; interocular width  $2\frac{1}{5}$ ; snout 3; width of mouth (at outer angles)  $2\frac{1}{3}$ ; eye  $5\frac{1}{2}$ ; pectoral spine  $1\frac{3}{8}$ . Anal with 22 rays, including anterior rudiments.

Head narrow, the occiput slightly depressed opposite the upper angle of the opercle. Snout narrow, depressed, subtruncate anteriorly. Top of head with a very few minute granules, most numerous on the occipital plate, where they are more or less confluent to form wavy irregular lines. The occipital plate is wider than long by the diameter of the pupil; its posterior half is narrow, the lateral margins being strongly concave; the median ridge is very low, disappearing behind. The median line of the head is occupied by a sharply defined deep groove, which is continuous from a point opposite the posterior nostrils to a point distant from the base of the occipital plate by the diameter of the pupil. This cutaneous groove is much narrower than the fontanel depression which it traverses, and widens or narrows independently of the latter. Its widest points are at the anterior end of the groove and at the anterior end of its posterior third. There are no strongly marked striae parallel with the posterior portion of the groove. In no other species of *Tachysurus* known to us is there a continuous groove occupying the fontanel depression. In *T. furthii* the groove may be continued for a short distance in front of the sculptured area, and is then interrupted in the interorbital region, to reappear anteriorly as a short narrow linear depression. *T. emmclane* has also a short detached anterior portion; and this is even shorter, almost round, in *T. liropus*. In the type of *T. steindachneri*, the granulated area on top of head does not send forward diverging processes, the line connecting the middle of the orbits being equidistant from the front of the granulated area and the posterior nostrils. In the co-type, some granulations accompany very narrow diverging ridges, which reach the middle of the interorbital space.

The teeth are similar to those in other species of the genus. The palatine patches are large, well separated, of very coarse granular teeth. The maxillary and mandibular bands are wide, of villiform teeth except for those forming a backwardly projecting lobe near mandibular symphysis; these being coarsely granular.

Eye large,  $2\frac{2}{5}$  in interorbital width. The maxillary barbel extends beyond pectoral pore to end of basal sixth of the spine. The outer mental barbels reach to opposite base of pectoral spines, the inner barbels being half their length. The pectoral pore is a narrow slit scarcely half the length of nostril. The branchiostegal membrane has mesially a very narrow, free fold (not to be made out in the co-type). Gill-rakers slender, 5+12, the longest half the diameter of the orbit.

The pectoral spines are short and heavy, their width at base  $\frac{1}{10}$  their length, which is half the distance from margin of branchiostegal membrane to insertion of ventrals. The outer edge of the spine is weakly serrate near tip, minutely tuberculate elsewhere; the inner margin is provided with rather small, closely appressed teeth. The dorsal spine is broken in the type,  $\frac{2}{3}$  the length of the head in the co-type, the dorsal rays projecting well beyond it. The base of the adipose dorsal equals  $\frac{1}{4}$  the length of the head. The sexual orifice is very slightly nearer base of inner ventral rays than front of anal. In the (male) type, the ventrals fail to reach front of anal by  $\frac{1}{3}$  their length; in the female specimen they slightly overlap it.

Light grayish brown above, with greenish and bluish reflections; silvery below. Inner faces of paired fins uniformly black in type (male), the basal half only blackish in the female. Anterior half of ventrals dusky.



47. *Tachysurus emmelane* Gilbert.

PLATE VI, FIGS. 11 and 11a.

*Tachysurus emmelane* GILBERT, JORDAN & EVERMANN, 1898, p. 2785.

Head  $3\frac{2}{5}$  in length ( $4\frac{1}{10}$  in total); depth 5 (6 in total). A. 27 (3+24). Eye 7 in head,  $2\frac{1}{2}$  in its distance from tip of snout, 4 in postorbital part of head,  $3\frac{2}{3}$  in interorbital width,  $2\frac{1}{5}$  in frontal width opposite middle of eyes. Mouth of moderate width, gently convex, the distance between its angles (measured internally)  $2\frac{4}{5}$  in head.

Teeth in premaxillary and front of mandible finely villiform; posterior mandibular teeth stronger than those in front, bluntly conic, not, however, coarsely granular, as are the posterior mandibular teeth in *T. furthii*, *T. melanopus*, and *T. liropus*. Mandibular bands with a wide interspace mesially, each widest near symphysis, rapidly tapering laterally, and extending beyond angle of mouth. The width of the bands is less than in related species,  $\frac{1}{4}$  eye at their widest point. The length of one of the mandibular bands is slightly greater ( $1\frac{1}{10}$ ) than length of eye. Premaxillary band very short, its length but  $\frac{1}{6}$  greater than that of one of the mandibular bands, extending on each side less than  $\frac{1}{2}$  distance from median line to angle of mouth; width of band  $\frac{1}{5}$  its length. Palatine teeth granular, in small oblong patches, which taper to a point laterally, and are widely separated on median line, the patches agreeing in size and shape with those in *T. liropus*.

Head depressed, tapering, and at the same time narrowing anteriorly, as in other species of *Tachysurus*; profile rising in a uniform, gently convex curve to occiput, where it becomes concave, owing to the more rapidly ascending outline of the occipital process. Eye low, but little above angle of mouth, the interorbital space decidedly convex. Barbels slender, the maxillary barbels reaching edge of gill-membrane in front of pectoral spine, the outer mental barbels extending beyond gill-membrane,  $1\frac{2}{3}$  in head; the inner not to edge of membrane. Gill-membrane widely attached to isthmus, without free edge.

Occipital region with very fine granulations, those on middle of occiput forming parallel series along the fontanel groove, those on median portion of occipital process in series which diverge backward from the median line. The sculptured area extends forward to a vertical which traverses the cheek at a distance of its own diameter behind the eye; anterior edge of granulated area equidistant between the tip of snout and front of predorsal plate. Fontanel produced backward as a deep, narrow groove, which fails to reach base of occipital process by a distance equaling half the length of the process on the median line. The groove widens but little anteriorly; an area behind and on each side of the groove with parallel series of granulations, and marked off from the rest of the head by a shallow trench. Base of occipital process similarly indicated by a transverse indented line; occipital process not keeled, very wide at base, becoming abruptly very narrow behind, its posterior third having parallel margins and being as wide as long, the lateral margins therefore deeply concave; width of process at base equaling its length on median line plus that of predorsal plate, its hinder edge deeply incised to receive the anterior rounded wedge-shaped process of the predorsal plate. The latter is finely granulated anteriorly, the lateral wings concealed under the smooth skin. A narrow groove as long as eye occupies the anterior end of the fontanel. Opercle without radiating ridges. A short, slit-like axillary pore present. Humeral process short, the exposed portion not broadly triangular, the surface smooth, or indistinctly rough. Gill-rakers 6+13, of moderate length and thickness, the longest below the angle,  $\frac{2}{3}$  diameter of eye.

Dorsal spine with a series of obtuse granulations in front and very weak retrorse serræ behind, its length to tip of calcified portion  $1\frac{2}{3}$  in head; longest soft ray  $1\frac{2}{3}$  in head. Adipose dorsal not adnate, its anterior insertion about over middle of anal; base of adipose dorsal much greater than its height, less than base of first dorsal; distance between dorsals equal to length of head. Pectoral spine strong, ridged and granulated in front, the hinder edge with very strong serræ; length of

spine  $1\frac{2}{3}$  in head, the fin projecting beyond tip of spine and reaching  $\frac{2}{3}$  distance from axil to base of ventrals. Ventrals reaching to or nearly to origin of anal. Vent midway between base of ventrals and front of anal. Base of anal equaling length of pectoral spine, its margin gently concave, the longest ray  $2\frac{2}{3}$  in head. Caudal with pointed lobes, the lower longest in the type,  $1\frac{2}{3}$  in head.

Color dark steel blue or brownish above, becoming bright silvery below; posterior  $\frac{2}{3}$  of anal white, the anterior portion black with a narrow white edge; pectorals and ventrals with anterior (outer) face white or slightly dusky; pectorals with inner face of upper rays black; a black blotch covers all of inner face of ventrals except terminal half of inner rays; barbels blackish.

Closely related to *T. melanopus* and *T. multiradiatus*, differing from the former in the longer anal fin, from the latter in the black markings on lower fins.

The description of the type of *T. multiradiatus* (*Bagrus? arioides*) Kner & Steindachner (1864, p. 47), indicates a species with much rougher sculpturing of the head, a longer fontanel groove, narrower occipital process, and more anteriorly inserted adipose dorsal.

The type is a single specimen, 280 mm. long, from Panama.

#### 48. *Tachysurus furthii* (Steindachner).

Abundant, eighteen specimens preserved. Our specimens exhibit some variation in the size of the granulations on top of head, also in the extent of the granulated area, which sometimes extends as far forward on the ridges as the posterior border of the eye. The groove extending backwards from fontanel is variously developed. An occasional specimen shows no trace of the groove; others have it developed for half the distance to the occipital process; in most cases it nearly reaches the base of the latter. In the interorbital region, the fontanel depression contains no definite groove, but at the anterior end of the depression, a short oval detached portion of such groove is always present.

The interspace between dorsals is found to be  $3\frac{1}{2}$  to 4 in the length, not "3 to  $3\frac{1}{3}$ " as given by Eigenmann. The species stands alone in the delicate, easily ruptured skin, and the very light blue color of its upper parts.

#### 49. *Tachysurus evermanni* sp. nov.

PLATE V, FIG. 10.

*Type*, 252 mm.; Panama Bay; C. H. Gilbert and party, collectors; No. 6706, Ichthyological Collections, L. S. Jr. U.

Very close to *T. furthii*, from which it differs in the subequal jaws (the upper much protruding in *furthii*), the thick, gently rounded snout (thin and subtruncate in *furthii*), the shorter barbels, the coarser granulations on head, the absence of a depressed linear pit at anterior end of fontanel depression (this always present in *furthii*, representing a detached anterior portion of a fontanel groove), and the much wider union of gill-membranes with the isthmus.

Head  $3\frac{3}{8}$  in the length; depth  $4\frac{4}{5}$ ; tip of snout to front of dorsal  $2\frac{1}{2}$ ; distance between dorsals  $3\frac{2}{3}$ ; distance from base of inner ventral ray to front of anal  $6\frac{2}{7}$ . Eye 4 in interocular, 8 in head; greatest width of head  $1\frac{2}{5}$  in its length; length of snout  $2\frac{9}{10}$ ; width of mouth  $2\frac{3}{8}$ ; distance between anterior nostrils  $6\frac{2}{3}$  ( $5\frac{2}{3}$  in *furthii*); pectoral spine equaling length of head behind front of pupil; dorsal spine equaling length of head behind posterior margin of pupil; base of adipose fin equaling base of dorsal behind the spine.

The snout is convexly rounded anteriorly, less depressed than in *furthii*. The maxillary barbel barely reaches gill-opening, when laid horizontally backward; the outer mental barbels reach margin of gill-membrane on under side of head.

The palatine patches of teeth are narrowly elliptical, their length  $1\frac{1}{6}$  times the diameter of the orbit; they are narrowly separated in front, the interspace  $\frac{3}{4}$  diameter of pupil; the inner mandibular teeth next the symphysis are coarsely granular, like the palatine teeth.

Gill-membranes broadly united to the isthmus, without free fold, the width of the complete union with the isthmus more than twice the diameter of the eye (much narrower, less than diameter of eye in *furthii*). Gill-rakers rather strong, 5+9, the longest  $\frac{2}{3}$  the diameter of the eye.

Top of head much more coarsely granulated than in *furthii*; the groove is confined to the granulated area, terminating at a point  $\frac{2}{3}$  diameter of pupil in front of the base of the occipital process. Anteriorly, the fontanel depression is evident, but contains no definite groove at any point. The occipital process is very broad, wider at base than long, much shorter than in *furthii*, the median portion not elevated as in the latter; a raised line representing an obsolescent keel is present on the median line of the anterior two-thirds. The predorsal plate is narrow, sculptured like the occiput on its anterior transverse portion only.

The dorsal and pectoral spines are slender, rugose anteriorly, but without teeth except near the tips; the teeth on the posterior margin of the dorsal spine are scarcely visible, being smaller than in *furthii*; the inner pectoral teeth are stronger and less numerous than in *furthii*. The type is a male, with the ventral fins failing to reach the front of the anal by half their length. The vent is midway between ventrals and front of anal. The pectoral pore is small, slit-like.

The skin is thicker and less delicate than in *furthii*, and the color is darker, the upper parts dark brownish, with obscure bluish reflections. Barbels all more or less dusky.

#### 50. *Tachysurus multiradiatus* (Günther).

Not seen by us. The type specimen was recorded by Kner & Steindachner, 1864, p. 227, as *Bagrus ? arioides*, from the Rio Bayano near Panama. A second specimen has now been listed by Boulenger, 1891, p. 2, from Rio Cianati, Darien.

#### 51. *Cathorops hypophthalmus* (Steindachner).

Known only from the types, and from two specimens secured by Gilbert in 1881; all from Panama.

#### 52. *Cathorops gulosus* (Eigenmann & Eigenmann).

Two specimens were secured, 230 and 245 mm. long. None others are known save the types, from Panama, which are in the Museum of Comparative Zoology.

Our specimens agree for the most part with Eigenmann's description. The following details may be placed on record:

Head  $3\frac{3}{4}$  or  $3\frac{1}{2}$  in length; distance from tip of snout to origin of dorsal,  $2\frac{1}{2}$ ; distance between dorsals  $3\frac{2}{3}$  or  $3\frac{3}{5}$ . Interocular space 2 in head; width of mouth, measured at outer angle of lips,  $2\frac{1}{3}$  or  $2\frac{2}{3}$ ; length of dorsal spine  $1\frac{1}{4}$  to  $1\frac{1}{6}$  in head; upper caudal lobe  $1\frac{1}{3}$ ; longest anal ray  $2\frac{1}{4}$ ; ventrals 2 or  $2\frac{1}{2}$ . The retrorse teeth on inner border of dorsal and pectoral spines are minute, irregular, crowded. The maxillary barbels extend to distal fourth of pectoral spine; outer mental barbels to its middle, inner mental barbels to its base. The fontanel groove fails to reach the base of the occipital process by  $\frac{3}{4}$  the diameter of the eye. The palatine patches of granular teeth are wider than figured by Eigenmann, the two separated by a distance equal to or slightly in excess of the diameter of the eye. The patches vary in size and shape in the two specimens, and on opposite sides of the same individual. In one specimen are two detached teeth laterally on the head of the vomer, on one side only; none in the other specimen.

In addition to the other characters already noted, *Cathorops* differs from *Tachysurus* in the absence of the patch of coarsely granular teeth along the inner border of the symphysial portion of the mandibular band.

#### Family SYMBRANCHIDÆ.

##### 53. *Symbranchus marmoratus* Bloch.

Abundant in a fresh-water pond at Miraflores, where it is trapped for food. As none could be taken with the seine, it seems probable that the species burrows in the mud. The few specimens secured were all brownish, variously marbled with yellowish.

#### Family LEPTOCEPHALIDÆ.

##### 54. *Congrellus gilberti* Douglass-Ogilby.

*Congrellus gilberti* DOUGLASS-OGILBY, 1898, p. 288.

*Ophisoma* (?) *balearicum* GILBERT, 1891 a, p. 349.

Dredged by the "Albatross," Station 2797, Panama Bay, 33 fathoms; recorded by Gilbert as *Ophisoma* (?) *balearicum*. The species is based exclusively on Gilbert's description above cited. The type specimens are deposited in the United States National Museum.

##### 55. *Congrellus nitens* (Jordan & Bollman).

One specimen dredged by the "Albatross" in Panama Bay, Station 2799, 29 $\frac{1}{2}$  fathoms (Gilbert, 1890 b, p. 450).

##### 56. *Congrellus proriger* (Gilbert).

A co-type of this species was dredged by the "Albatross" in Panama Bay, Station 2799, 29 $\frac{1}{2}$  fathoms (Gilbert, 1891 a, p. 35).



## Family MURÆNESOCIDÆ.

57. *Murænesox coniceps* Jordan & Gilbert.

SAFIRO.

The most abundant eel at Panama, where it appears in the market nearly every day. The relations of the species to its Atlantic representative *M. savanna* are much in need of elucidation.

58. *Neoconger vermiformis* Gilbert.

"Albatross," Station 2799, Panama Bay, 29½ fathoms (Gilbert, 1890 *b*, p. 450).

## Family MYRIDÆ.

59. *Myrophis vafer* Jordan & Gilbert.

Numerous in rock-pools, from which several specimens were obtained, larger than any before recorded. The teeth are in a moderate band in upper jaw, narrowing backward, and widening rapidly in front, where it becomes confluent with the patch at anterior end of vomerine series. Behind this, the vomerine teeth are in a single series, which is continued backward to behind angle of mouth. Mandibular teeth in a single series laterally, widening into a band at symphysis. In *M. punctatus* all the bands of teeth are wider, and those of vomer and mandible are in more than one series.

Table of Measurements in Millimeters.

Total length.	Head and trunk.	Tail.	Head.	Length of snout.	Width of snout.	Gape.	Eye.	Length of pectoral	Width of pectoral base.	Length before dorsal.
280	108	172	31	5	4	8½	2	5	2½	65
215*	98	117*	28½	4½	3¼	8	2	4½	2	59
210	81	129	23	3½	3	6	2	3½	1½	49

## Family OPHICHTHYIDÆ.

60. *Myrichthys tigrinus* Girard.

*Ophisurus xysturus* JORDAN & GILBERT, 1881 *c*, p. 346.

Numerous specimens were obtained from tide-pools on the reef. They answer Girard's description of the type, and also the type description of *O. xysturus*. The number of rows of teeth on sides of mandible varies from two to four, younger speci-

\* Tail in this specimen evidently injured, though surrounded by the fin.



mens having frequently the lower number. The head varies in length, being contained  $3\frac{1}{3}$  to  $4\frac{1}{4}$  times in the trunk. There are but two conspicuous series of roundish spots on either side of the back, a third series of much smaller spots being only occasionally present along base of anal fin. The spots on head vary greatly in size, number and position. No arrangement can be assigned to these as normal for the species.

### 61. *Pisoodonophis daspilotus* Gilbert.

PLATE VII, FIG. 12.

*Pisoodonophis daspilotus* GILBERT (JORDAN & EVERMANN, 1898, p. 2803).

Brownish above, gray below, the head and body usually thickly covered with black spots smaller than the eye; these are smaller and more numerous on the head, fewer and fainter on the lighter inferior surface, and become indistinct or entirely disappear on the terminal portion of tail. In one specimen the head and trunk are spotted and the entire tail unicolor. In another no spots are present, the upper parts being a uniform dark brown, the under parts lighter brown, a few dark freckles only being present on sides of head. In all specimens the snout and lower jaw are blackish.

The anus is near the middle of the total length, sometimes nearer the tip of snout, sometimes nearer tip of tail. The cheeks are not greatly swollen. The gape extends behind the eye, its length, measured from tip of lower jaw to angle of mouth, being contained  $4\frac{3}{8}$  to  $4\frac{3}{4}$  in head. The snout projects beyond the lower jaw for a distance about equaling diameter of orbit. Eye 2 to  $2\frac{1}{3}$  in snout,  $1\frac{2}{3}$  to  $2\frac{1}{7}$  in interorbital width. Tubes of anterior nostrils about  $\frac{1}{2}$  diameter of eye, directed downward near tip of snout. Posterior nostrils under front of eye, concealed in the upper lip as usual.

Teeth all bluntly conic, in rather wide bands on jaws and vomer; they are usually not disposed in regular series within the bands, but each band has about the width of four series, and these are sometimes distinguishable. The mandibular teeth become larger on approaching the symphysis, those at point of mandible and those on head of vomer being much the largest teeth present. The patch on shaft of vomer tapers backward to a point considerably behind angle of mouth.

Origin of dorsal entirely behind tip of pectorals, its distance from snout  $\frac{1}{3}$  to  $\frac{1}{8}$  greater than length of the head. The tip of the tail is compressed, acute, horny, used for defense. Pectoral very short, from a wide base which slightly exceeds length of gill-slit. The fin rapidly narrows downward, the longest portion contained 12 to 14 times in length of head. The width of gill-slit is about  $\frac{1}{3}$  head.

Table of Measurements in Millimeters.

Total length.	Head and trunk.	Tail.	Head.	Gape.	Eye.	Interorbital width.	Width at cheeks.	Length of snout.	Projection of snout beyond mandible.	Length of pectoral.	Basal width of pectoral.	Distance from snout to dorsal.	Vertical height of dorsal.	Depth of body.
362	177	185	38	8	3	5	$9\frac{1}{2}$	$6\frac{1}{4}$	$2\frac{3}{4}$	$3\frac{1}{2}$	5	48	3	12
401	203	198	48	$10\frac{1}{2}$	$3\frac{1}{2}$	7	11	$7\frac{1}{2}$	$3\frac{1}{2}$	4	6	53	4	$14\frac{1}{2}$
492	248	244	52	11	$3\frac{1}{2}$	$7\frac{1}{2}$	$16\frac{1}{2}$	$8\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$6\frac{1}{4}$	68	$5\frac{1}{2}$	18
494	255	239	56	12	$4\frac{1}{4}$	7	16	$8\frac{1}{2}$	$4\frac{1}{2}$	4	6	$68\frac{1}{2}$	$5\frac{1}{2}$	16

Four specimens were secured, three obtained in brackish water at the mouth of a small stream which empties into Panama Bay, the fourth in a fresh-water pond at Miraflores. There is some reason to suppose that they burrow in the mud.

62. *Ophichthus triserialis* (Kaup).

No Panama record is known to the writers. The species is abundant on the Mexican coast, and has been recorded from the Galapagos Islands (GILBERT, 1890*b*, p. 450).

63. *Ophichthus zophochir* Jordan & Gilbert.

This species has been heretofore known only from the Mexican coast (Guaymas, Mazatlan, Acapulco). A single specimen was taken in a rock-pool at Panama. As in the type, the teeth are acute, biserial on all the bones. The color is as described, except that the dorsal is not definitely black-edged. The anal is conspicuously edged with black, the pectoral largely blackish. Pores on head black-edged.

Table of Measurements in Millimeters.

Total length.	Head and trunk.	Tail.	Head.	Snout.	Eye.	Gape.	Projection of snout.	Pectoral.	Distance from snout to origin of dorsal.
329	114 $\frac{1}{8}$	214 $\frac{1}{8}$	37	6 $\frac{1}{4}$	4	12 $\frac{1}{8}$	2	19	49

Family MURÆNIDÆ.

64. *Rabula panamensis* (Steindachner).

Recorded from Panama by Steindachner, and by Boulenger (1899, p. 2), as *Muræna panamensis*; not seen by the writers.

65. *Lycodontis verrilli* (Jordan & Gilbert).

Only the type specimen known; collected by Prof. F. H. Bradley at Panama in 1866; now in the museum of Comparative Zoology.

66. *Lycodontis dovii* (Günther).

A single specimen 753 mm. long was taken in a tide-pool on the reef at Panama.

The color is dark chestnut-brown, uniform on head, body and fins, except that the belly and under side of head are lighter. The spots are numerous, round, varying in size, but all of them small, the largest smaller than pupil; they were all very light yellow in life, and are not definitely ocellated, the ground-color being slightly darker around them. The larger spots are on the dorsal portions, with occa-

sional finer ones intermingled; those on ventral surface minute. Fins colored like the body, the spots of the same size and character. On the head the spots become less numerous, the anterior third of its length plain.

Teeth everywhere in single series, the lateral teeth small, those anteriorly in both maxillary and mandible much enlarged. Shaft of vomer with a very inconspicuous series of teeth, beginning opposite middle of eye, preceded after an interval by three very large depressible canines, the largest teeth present. A series of five black-edged pores along each half of upper and lower jaw, the two largest on upper jaw between front of eye and anterior nostril tube.

*Table of Measurements in Millimeters.*

Total length.	Head and trunk.	Tail.	Head.	Gape.	Snout.	Eye.	Depth at anus.	Distance from origin of dorsal to snout.
753	336	417	103	44	19	7	50	78

### 67. *Muraena clepsydra* Gilbert.

PLATE VII, FIG. 13.

*Muraena clepsydra* GILBERT (JORDAN & EVERMANN, 1898, p. 2805).

*Muraena melanotis* GÜNTHER, Cat. Fish., Vol. VIII, p. 98 (in part); here belong all other records of *M. melanotis* from the Pacific.

Closely related to *M. insularum* and *M. argus*, from the tropical Pacific, but differing from both in color.

Nostrils tubular, of almost equal length. Mouth closing completely, the teeth entirely concealed by the lips. Gape straight, horizontal, extending to well behind the eyes,  $2\frac{1}{3}$  to  $2\frac{3}{4}$  in head.

Teeth in jaws large, compressed and wide at base, tapering uniformly to an acute point, directed backward, close set, everywhere uniserial; those in sides of mandible noticeably smaller than those of upper jaw, the teeth in both jaws increasing in size anteriorly. As many as 18 or 20 teeth may be present in the half of either jaw, but many of them are usually wanting, leaving gaps in the series. A single row of small teeth on shaft of vomer, beginning opposite front of eye. Head of vomer with two long canines, larger than any of the other teeth, one or both of these usually wanting in larger specimens, having apparently fallen out.

Head 2 ( $1\frac{1}{2}$  to  $2\frac{1}{2}$ ) in trunk; head and trunk  $1\frac{1}{3}$  to  $1\frac{1}{4}$  in tail; depth at anus approximately half length of head. Eye small, its diameter contained 12 to 16 times in head; snout 5 to  $5\frac{1}{2}$ . Dorsal beginning on the head, its distance from snout  $1\frac{1}{3}$  to  $1\frac{1}{2}$  in head.

Color dark brown, lighter on belly, dull whitish on under side of head. Head, body and fins closely covered with white spots, those on posterior parts larger, with some smaller ones intermingled, the larger spots with a more or less evident central constriction which makes them hourglass-shaped. Toward the head, the spots become very small and crowded, not more than half as large as pupil. Fins indistinctly light margined. A large elliptical jet-black blotch surrounds the gill slit, distinctly margined by a series of confluent white spots. The longitudinal diameter of the blotch is contained 5 to  $5\frac{1}{2}$  times in the length of the head. Angle of mouth with a small black blotch, often obscure, preceded by a pale spot on mandible. The throat is marked with a number of parallel lengthwise folds, the bottom of each fold with a dark line.

Table of Measurements in Millimeters of Five Specimens:

Total length.	Head and trunk.	Tail.	Head.	Gape.	Snout.	Eye.	Depth at anus.	Distance from snout to origin of dorsal.
675	311	364	106	45	20½	7	59	72
630	289	341	96	38	18½	6¼	52½	70
612	287	325	98	39	19	6¼	47	64
473	203	270	66	28	13	5¾	40	50
397	177	220	58	21	11	4½	27	39

This species is abundant at Panama, where it is frequently brought to market. About 25 specimens were seen during the visit of the expedition, all essentially alike in coloration. The type is 397 mm. long (see table of measurements), and has the spots on body less numerous than in larger specimens.

68. *Muræna lentiginosa* *Jenyns*.

Originally described from the Galapagos Islands, this species seems much more abundant in Mexico, toward the northern limits of its range. No specimens were seen by the authors, the single Panama record being by Rowell (JORDAN & GILBERT, 1882 *l*, p. 381).

Family ELOPIDÆ.

69. *Elops saurus* *Linnaeus*.

This species was occasionally seen, but was not abundant.

Family ALBULIDÆ.

70. *Albula vulpes* (*Linnaeus*).

Not abundant. A few specimens only were seen in the market.

Family CLUPEIDÆ.

71. *Sardinella stolifera* (*Jordan & Gilbert*).

The species is apparently not abundant at Panama, as but two or three small specimens were seen. It is now known to extend as far south as Guayaquil (BOULENGER, 1898-9, Vol. XIV, p. 1).



72. *Opisthonema libertate* (Günther).

Abundant; several specimens preserved averaging about 25 cm. long. Young specimens were also seen at Acapulco.

This species differs from *O. oglinum* in coloration, in the shorter dorsal and anal fins (the latter containing 20 or 21 rays), and in the more numerous gill-rakers. The alleged differences in length of head are not reliable, both species varying greatly in this respect and no average difference being evident.

Six specimens of *O. libertate* give the following measurements:—

Head in length.	Depth in length.
$3\frac{2}{3}$	$2\frac{1}{5}$
$3\frac{2}{3}$	$2\frac{7}{8}$
4	$3\frac{2}{7}$
$4\frac{1}{10}$	3
$4\frac{1}{6}$	$3\frac{1}{10}$
$4\frac{2}{7}$	$2\frac{9}{10}$

In addition to the details of coloration already reported there is frequently present a series of small, round, evenly-spaced dark spots, behind the humeral spot, along the line separating the blue of the back from the silvery of the sides. Scutes 18+14 or 15.

73. *Ilisha furthi* (Steindachner).

*Pellona furthi* STEINDACHNER, 1875a, p. 14.

*Pellona panamensis* STEINDACHNER, l. c. p. 14.

A very abundant food-fish at Panama, but of inferior quality. The species is extremely variable in shape, but the deepest forms with strongly arched ventral outline (*I. furthi*) grade imperceptibly into the more slender forms with weak ventral curvature (*I. panamensis*). No other characters are correlated with this difference in ventral curvature, and it appears certain that but a single species is represented. The deeper specimens are constantly the smaller ones, so far as indicated by the material at hand. The eye is therefore proportionately larger, and the snout (measured into the eye) apparently shorter than in the larger, slenderer individuals. In none of the specimens do the first five to seven anal rays originate under the dorsal fin, as described in *I. furthi*. In both deep and slender forms the first anal ray is approximately under the last of the dorsal. The front of the dorsal is constantly nearer the tip of snout than the base of the caudal, the difference varying from  $\frac{2}{3}$  to  $\frac{3}{4}$  diameter of orbit.

The following table of measurements exhibits the variation in depth of body, and in size of eye and snout. The length into which the depth of body is measured, is taken from the tip of snout to base of caudal, excluding the projecting tip of lower jaw. Steindachner has apparently included the latter in his measurements.



Total length in millimeters.	Depth into the length.	Orbit into head.	Snout into orbit.
255	$2\frac{3}{5}$	$2\frac{3}{5}$	$1\frac{1}{3}$
280	$2\frac{6}{7}$	$2\frac{5}{8}$	$1\frac{1}{3}$
295	$2\frac{4}{5}$	$2\frac{9}{10}$	$1\frac{2}{3}$
295	$2\frac{10}{11}$	3	$1\frac{1}{3}$
305	3	3 (+)	$1\frac{1}{3}$
310	$2\frac{7}{8}$	3	$1\frac{2}{7}$
320	$3\frac{1}{5}$	$3\frac{1}{6}$	$1\frac{1}{4}$
330	$3\frac{1}{8}$	$3\frac{1}{4}$	$1\frac{1}{8}$
390	3 (+)	$3\frac{1}{2}$	1

74. *Opisthopterus dovii* (Günther).

This species is known only from Panama, where it occurs but rarely. Four specimens were seen, 18 to 20 cm. long; they agree well with Günther's diagnosis. Head  $4\frac{1}{2}$  to 5 in length; depth  $3\frac{1}{2}$  to  $3\frac{1}{2}$ . Eye  $3\frac{2}{3}$  to  $3\frac{1}{2}$  in head; maxillary  $1\frac{9}{10}$  or 2. Pectorals long, pointed, 4 to  $4\frac{1}{2}$  in length. Origin of dorsal nearer caudal than scapula by half length of head. A. 55, 59, 61, 62 in our specimens; D. 11, 12, 13, 14. Scutes 27 or 28. Teeth in jaws strong, incurved, in a single series.

Color light olivaceous above, bright silvery below angle of gill-opening. A faint bluish streak sometimes present along upper edge of silvery area. No dark humeral spot. A broad black vertebral band. End of snout and tip of lower jaw black. Fins translucent, with dark specks along the rays.

75. *Opisthopterus macrops* (Günther).

Occurring but rarely. Three specimens were obtained, each about 225 mm. long.

The species is readily distinguished from *O. dovii* by its much larger eye, more oblique mouth, strongly concave occipital profile, and deeper body with much stronger ventral curvature. The teeth are much smaller than in *O. dovii*, and there is a conspicuous humeral spot, lacking in the latter. In the specimens taken, the head is  $4\frac{2}{3}$  or  $4\frac{2}{3}$  in length, the depth  $2\frac{5}{8}$  to 3. Eye  $2\frac{2}{3}$  to  $2\frac{3}{4}$  in head. Front of dorsal slightly nearer root of caudal than scapula, farther forward than in *O. dovii*. Pectoral  $4\frac{1}{2}$  to  $4\frac{2}{3}$  in length. Scutes 27. D. 13 or 14. A. 62. Coloration as in *O. dovii*, but with a large black humeral spot.

Not heretofore reported since the discovery of the type at Panama by Capt. J. M. Dow.

76. *Odontognathus panamensis* (Steindachner).

Only the type specimen is known.

## Family ENGRAULIDIDÆ.

77. *Anchovia miarcha* (Jordan & Gilbert).

Collected by Prof. Frank H. Bradley in the Pearl Islands, Bay of Panama (JORDAN & GILBERT, 1882 *n*, p. 622); not seen by us.

78. *Anchovia ischana* (Jordan & Gilbert).

Three specimens taken, the largest 63 mm. long.

79. *Anchovia curta* (Jordan & Gilbert).

Numerous specimens were taken. Some of these have the lateral streak "somewhat indistinct," as given in the original description of the species, while others have the streak much better marked, with well-defined edges. It widens on the caudal peduncle and wholly disappears anteriorly.

80. *Anchovia opercularis* (Jordan & Gilbert).

A specimen of this species is recorded by Gilbert (1890 *b*, p. 449) from Albatross Station 2802, Panama Bay, in 16 fathoms.

81. *Anchovia lucida* Jordan & Gilbert.

Five specimens were taken, the largest 57 mm. in total length.

In the original description of this species the cheek is described as being over half the length of the head. This is evidently a mistake, and should probably read, cheek over half the post-orbital part of the head. This would agree with the specimens taken.

82. *Anchovia rastralis* (Gilbert & Pierson).

## PLATE VIII, FIG. 14.

*Stolephorus rastralis* GILBERT & PIERSON (JORDAN & EVERMANN, 1898, p. 2811).

Head 3.16 (3.1 to 3.3); depth 3.8 (3.5 to 4.2); eye 3.4 in head (3.33 to 4). D. 14 (12 to 15) A. 26 to 32. Length 5 to 8 cm.

Body much compressed and deep; belly sharply keeled in front of ventrals; dorsal outline much less curved than ventral. The lower profile rises very rapidly from a point opposite middle of pectorals to tip of snout, the shape of head thus closely resembling that of *Cetengraulis*. Maxillary reaching almost but not quite to gill-opening; snout high, compressed, its length  $\frac{1}{2}$  to  $\frac{3}{4}$  diameter of eye. Gill rakers averaging in larger examples 51+64, in smaller specimens 44+50; the largest about as long as eye. Insertion of dorsal fin variable, but never posterior to a point midway between base of caudal and middle of eye; pectoral fins reaching to or nearly to insertion of ventrals; the latter not to vent.

Color olivaceous, the lower part of sides with violet reflections; sides of head silvery; a conspicuous silvery lateral band, varying in width from about one and one-third times length of orbit in the largest examples to less than one-half the orbit in the smaller specimens. The band is widest before

dorsal, and tapers to half or less than half its greatest width on caudal peduncle, where it frequently disappears in the young. In larger specimens the ventral edge of this band is frequently ill-defined anteriorly. Top of head with widely spaced black specks. A dark vertebral streak, more or less of which often consists of two narrow lines. Tips of caudal lobes often blackish; fins otherwise unmarked.

Differing from closely allied species in the following characters: From *A. lucida*, in the much longer head, more compressed body, well defined lateral stripe, and smaller eye; from *A. compressa*, in the longer head and wider lateral band; from *A. panamensis* and *A. mundeola*, in the much more numerous gill rakers, and the more anterior position of the dorsal relatively to the anal, the origin of the anal being under the middle of the dorsal, while in *A. panamensis* the origin of the two fins lie in the same vertical.

### 83. *Anchovia naso* (Gilbert & Pierson).

*Stolephorus naso* GILBERT & PIERSON (JORDAN & EVERMANN, 1898, p. 2813).

Head 3.3–3.5 in length; depth 4.7–5.8; eye 4.5–5 in head. Anal 22–24; dorsal 14 or 15; lateral line about 35.

Dorsal and ventral outlines weakly arched; body slender, compressed, its greatest depth 1.5 in head; belly carinated in front of ventrals, and sometimes behind them in larger specimens. Head long and slender, its greatest width 1.5 to 1.7 in its length, the lower profile much more oblique than the upper. Snout long, compressed, bluntly rounded, its length exceeding the small eye. Cheek with a very acute posterior angle. Opercle narrow, oblique. Maxillary rather bluntly pointed, failing to reach gill-opening by about one-half diameter of pupil. Teeth on the maxillary quite prominent and directed forward. Gill-rakers short, 17–20 in number; the longest  $1\frac{1}{2}$  in eye. Scales large, thin, deciduous, only a few scattering ones remaining on our specimens. Dorsal fin inserted midway between front or middle of orbit and base of median caudal rays. Origin of anal under or slightly behind middle of dorsal; length of anal base about equal to the distance from front of orbit to base of ventral fin. Pectorals not reaching ventrals, their length about one-half length of head. Length of ventrals equaling or slightly exceeding distance from tip of snout to middle of pupil.

Color light olive, with the usual bright reflections; a large dark patch of brown dots on occiput; a double series of dots along median line posterior to dorsal, this absent in some specimens; large specimens with a bright well defined silvery streak, slightly narrowing anteriorly and on caudal peduncle, its greatest width about equaling diameter of eye. In the young, this band is fainter and narrower. A conspicuous series of black dots at base of anal.

Characterized by the slender form, well defined silvery streak, sharply carinated breast, the small eye, and the very long, compressed, deep and rather bluntly rounded snout. Most closely resembling *A. starksi*, from which it differs in smaller eye, longer snout, and slightly longer anal. Length 40 to 52 mm.

### 84. *Anchovia starksi* (Gilbert & Pierson).

*Stolephorus starksi* GILBERT & PIERSON (JORDAN & EVERMANN, 1898, p. 2813).

Head 3.3 to 3.6; depth 4.8 to 5.5 in length, 1.3 in head. Eye 3 to 3.5 in head. Dorsal 15 or 16; anal 17 to 22; scales about 41. Vertebrae 40 (counted in one example only).

Body long and slender, slightly deeper and more compressed than in *A. ischanus*, which much resembles this species. Dorsal outline very little arched; ventral outline nearly straight from gill opening to insertion of anal fin, the lower profile of head oblique, nearly straight. Belly compressed, keeled for anterior two-thirds of its length in front of base of ventrals.

Head long and pointed, its width  $1\frac{1}{2}$  times in its length. Maxillary abruptly widened opposite the mandibular joint, tapering posteriorly to a blunt point, which reaches almost to the gill-opening, its length equal to length of base of anal. Snout long, sharp, and projecting, abruptly compressed in its

terminal portion as seen from above, its length two-thirds diameter of orbit, or slightly more. Branchiostegal membranes united at base for a very short distance. In four examples examined as to this point, the gill-rakers are as follows: 20+25, 23+24, 21+23, 19+30; the longest contained  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in eye. Scales large, thin, deciduous, a few only remaining on the specimens at hand. Origin of the dorsal fin equally distant from the base of the caudal fin and the tip of snout or front of eye. Anal inserted under beginning of posterior third of base of dorsal. Pectorals not reaching ventrals, the latter extending three-fifths distance to front of anal.

Color light olive, with broad, well defined, lateral silvery streak of nearly uniform width, usually narrowing anteriorly and on middle of caudal peduncle, its width in our largest specimens five-sixths diameter of eye. The silvery streak has a slight golden tinge. A narrow dark vertebral line, which widens on the nape. Occiput blackish.

This species differs from *A. cultrata* in its slenderer body, shorter snout, wider opercle and smaller teeth; the belly is also not sharply carinate, the dorsal is more anteriorly placed, the ventrals are farther back, and the silvery streak is wider anteriorly. It differs from *A. delicatissima* in its longer, slenderer head and body, smaller eye, longer, sharper snout, and much wider, better defined silvery streak.

Length 4 to 6 cm. Named for Mr. Edwin Chapin Starks.

#### 85. *Anchovia panamensis* (Steindachner).

This species was found to be rather common.

Dr. Steindachner seems to have had both *A. panamensis* and *A. mundeola*, as his description covers both in many respects. His count of scales would apply better to *A. mundeola* than to *A. panamensis*, which has 38 to 41. The length of head,  $4\frac{2}{3}$ , applies better to *A. panamensis*, that of *A. mundeola* being generally about 4 in length of body. Otherwise there seem to be no differences.

#### 86. *Anchovia mundeola* (Gilbert & Pierson).

*Stolephorus mundcolus* GILBERT & PIERSON (Jordan & Evermann, 1898, p. 2812).

Head 4.15 (4 to 4.25); depth 3.77 (3.40 to 4.25); eye 3.44 in head (3.12 to 3.70). Dorsal 13 or 14; anal 33 (33 to 35); scales 36 (36 to 39). Dorsal and ventral contours about equally and gradually rounded from the middle region of body to the tip of snout and base of caudal fin. Snout short, high, compressed, blunt at tip, its length  $1\frac{1}{3}$  in eye. Eye very large. Maxillary broad, tapering to a sharp point which reaches margin of gill-opening. Gill-rakers 17+21 to 22+24; the longest  $1\frac{1}{2}$  to 2 in eye. Anterior insertion of dorsal fin varying from a point midway between base of caudal and middle of eye to a point midway between the caudal and tip of snout. In ten examples its insertion is before that of the anal. Anal fin long, averaging 33 rays; its origin beneath the anterior third of the dorsal; length of base shorter than in *A. panamensis*, being  $3\frac{1}{5}$  in length, while in the latter its length is contained  $2\frac{1}{5}$  in length. Pectorals long, reaching well beyond the insertion of the ventrals, equaling length of head behind front of pupil; a large axillary scale. Ventrals scarcely reaching vent.

Color uniformly light olive with silvery reflections; a faint, narrow, silvery stripe, sometimes scarcely distinguishable. Sides of head plain silvery. Upper margin of orbital rim black. Dorsal region blackish. A faint, narrow, dark line on each side of the light mid-dorsal streak. Caudal slightly dusky. Fins otherwise unmarked.

This species is closely allied to *A. panamensis* and *A. compressa*, but may be distinguished from the former by its longer head, larger eye, greater depth, fewer scales along the lateral line, and its much shorter anal base; also by the much fainter lateral silvery stripe. The eye is contained 14 to 16 times in length, excluding the caudal; while in *panamensis* the length contains the eye 16 to 20 times.



From *A. compressa* it differs in the relative length of the head and maxillary. In *A. mundeola* the maxillary is contained in the head  $1\frac{1}{4}$  times (1.19 to 1.37); in *compressa*  $1\frac{1}{2}$  times (1.30 to 1.81). In *mundeola* the head is contained 4.15 times in the length; in *compressa* 4.44 times.

Since the publication of the above description, as cited, the material has been further studied by Chloe Lesley Starks, whose results we are permitted to incorporate below.

Twenty-seven specimens were measured, ranging in size from 72 to 120 mm. in length. In *A. panamensis* the head measures .21 to .25 of the length exclusive of the caudal; in *A. mundeola* .24 to .26. The depth of *panamensis* is .24 to .26; of *mundeola* .24 to .27. The size of the eye is the most striking difference between the two species, holding well from  $.05\frac{3}{4}$  to  $.06\frac{3}{4}$  in *panamensis* and from .07 to  $.07\frac{1}{2}$  in *mundeola*. The maxillary measures about the same throughout (doubtless some tips are broken). In *panamensis* the snout measures about .04 and in *mundeola* from .04 to .05. Gill-rakers and also the rays in the dorsal and anal fins number about the same in the two species. The length of anal base in *panamensis* seems generally longer, running from .35 to .39 of length, while in *mundeola* it runs from .33 to .36. The number of scales varies from 39 to 41 in *panamensis*; from 36 to 39 in *mundeola*.

The extremes of the two species differ greatly in appearance, and no difficulty is encountered in separating them; but a few specimens seem to come so nearly intermediate that it is difficult to know to which form to assign them. When collected the two species were easily separable on account of the faint, silvery, lateral stripe of *mundeola*, but since preservation it has so faded in both species that it cannot be considered.

These two species may prove to be the same, but since *A. mundeola* has been described, it will be better to consider the two as distinct, until enough material can be obtained to settle the point beyond question.

*Measurements in Hundredths of Length to Base of Caudal.*

Length without caudal, in mm.	Head.	Depth.	Eye.	Maxillary.	Snout.	Base of anal.	Number of gill-rakers.	Number of anal rays.	Number of dorsal rays.	Number of scales.
ANCHOVIA PANAMENSIS.										
77	24	$25\frac{1}{3}$	6	18	4	36	16 + 22	34	13	40
89	23	25	$6\frac{1}{3}$	$18\frac{1}{3}$	4	38	16 + 22	32	13	40
92	22	26	$6\frac{2}{3}$	19	4	36	15 + 18	32	12	41
86	21	24	$5\frac{3}{4}$	$17\frac{1}{3}$	4	38	16 + 22	32	13	39
71	23	24	6	18	4	37	16 + 22	33	13	41
88	23	25	6	$17\frac{1}{3}$	4	38	16 + 24	35	14	39
89	23	24	$6\frac{2}{3}$	17	4	39	17 + 22	33	13	40
109	24	26	$6\frac{2}{3}$	19	4	35	16 + 25	30	14	40
105	24	26	$6\frac{2}{3}$	$18\frac{2}{3}$	4	36	18 + 22	32	13	39
79	25	26	$6\frac{3}{4}$	20	4	35	15 + 19	32	14	40

*Measurements in Hundredths of Length to Base of Caudal.*

Length without caudal, in mm.	Head.	Depth.	Eye.	Maxillary.	Snout.	Base of anal.	Number of gill-rakers.	Number of anal rays.	Number of dorsal rays.	Number of scales.
ANCHOVIA MUNDEOLA.										
84	25	25 $\frac{1}{3}$	7 $\frac{1}{3}$	19	5	36	16 + 23	30	13	39
83	25 $\frac{1}{3}$	24 $\frac{1}{3}$	7	19 $\frac{1}{2}$	4 $\frac{1}{3}$	35	16 ± 22	33	13	38
91	25 $\frac{1}{3}$	25	7	19	4 $\frac{1}{2}$	36	16 ± 19	31	13	37
87	25	26 $\frac{1}{3}$	7	21	5	34	16 + 19	31	13	39
78	25	24	7	20	4 $\frac{1}{2}$	35	17 + 22	32	13	38
104	26	25 $\frac{1}{3}$	7	19	4 $\frac{1}{3}$	35	17 + 23	33	13	37
108	24	27	7	18	4	36	20 + 24	35	14	37
102	24 $\frac{1}{2}$	27	7	18 $\frac{1}{3}$	4	36	16 + 25	33	12	37
93 $\frac{1}{2}$	25	26	7	20 $\frac{1}{3}$	4 $\frac{1}{2}$	34	17 + 23	32	13	39
101	24 $\frac{1}{2}$	26	7 $\frac{1}{3}$	19	4 $\frac{1}{2}$	34	17 + 22	33	12	37
82	26	26	7	21	5	33 $\frac{1}{2}$	16 + 17	31	13	37
116	25	28	7	20	5	34	17 + 22	31	13	39
120	24	27	7	19	4	34	16 + 23	32	14	37
108	24 $\frac{1}{3}$	27	7	20	4 $\frac{2}{3}$	35 $\frac{1}{2}$	18 + 22	31	14	36
75	25	26	7 $\frac{1}{3}$	20	4 $\frac{1}{3}$	35	17 + 23	31	13	38
103	25	26 $\frac{1}{3}$	7 $\frac{1}{3}$	21	4	33	17 + 24	30	12	37
107	25	26	7 $\frac{1}{3}$	20 $\frac{1}{3}$	4	35 $\frac{1}{3}$	20 + 23	31	14	36

**87. *Anchovia spinifera* (Cuvier & Valenciennes).**

PLATE VIII, FIG. 15.

Two specimens were taken in shallow water by means of a cast-net.

Head 4 in length; depth 4; dorsal 16; anal 38; scales 42. Form moderately slender, the dorsal outline ascending in nearly a straight line from snout to front of dorsal, where it reaches the greatest height; thence descending at about the same angle in a straight line to caudal peduncle; ventral outline evenly curved from tip of lower jaw to caudal peduncle. Abdomen somewhat compressed, not serrated.

The head is rather long, and has a sharp conical snout. The upper posterior outline of the gill-opening is very oblique. A line drawn from snout to angle of opercle would nearly parallel the oblique maxillary. The subopercle projects beyond the opercle in a triangular process. The eye is placed within the first two-fifths of the head. The maxillary is slender, and not angulated on its upper outline towards its posterior end. It is widest near angle of mouth, and ends in a rather sharp point near lower edge of gill-opening. The teeth are small but sharp. The gill-rakers are slightly shorter than the orbit; about 15 + 17 in number.

The origin of the anal is about under the middle of dorsal. The pectorals extend to or slightly past the middle of the outer ventral rays.

Owing to the action of formalin, these specimens have little of their original color left. Where scales remain, the lower parts of the sides are bright silvery, rather abruptly shaded to olive above. Apparently no lateral stripe was present. The caudal and the first rays of dorsal are tipped with black. In life, the caudal and dorsal were otherwise bright yellow.

*Measurements in Hundredths of Length to Base of Caudal.*

Length without caudal, in mm.	Head.	Depth.	Eye.	Maxillary.	Snout.	Length of anal base.	Longest dorsal ray.	Longest anal ray.	Longest pectoral ray.
96	26	25	5½	22	4	38	20	15	17½
99	26	26	5½	22	4½	39	19	14	17

88. *Anchovia macrolepidota* (Kner & Steindachner).

Very abundant, reaching a large size and used for bait. The body is closely compressed, and very minute teeth persist in the maxillaries even in adults.

89. *Cetengraulis mysticetus* Günther.

Abundant; often used as bait in hand-line fishing. It reaches a length of 20 cm. Our specimens have been compared with *C. edentulus* from Jamaica, and are found to differ from this closely related Atlantic representative in the slightly longer head, slenderer body and caudal peduncle, smaller eye, and shorter anal fin. The anal has an average of but one less ray, instead of three less, as given by Jordan & Evermann, 1896, p. 450.

In the original description, the gill-rakers on the lower part of arch are said to number 42. Dr. Boulenger has kindly reexamined for us the three types in the British Museum, and finds in each from 55 to 60 gill-rakers. The number in the specimens at hand ranges from 53 to 66. In these specimens, the pectorals usually do not reach the ventrals, either terminating some distance from them, or rarely approximating them.

The color in life is light olivaceous or olive-green above, passing into the bright silvery of sides and lower parts. No lateral stripe. Caudal margined with dusky.

*Measurements in Hundredths of Length without Caudal.*

Species.....	CETENGRAULIS MYSTICETUS					CETENGRAULIS EDENTULUS				
	<i>Panama</i>					<i>South Atlantic</i>				
Length without caudal, in mm.....	149	153	144	145	152	106	96	101	109	104
Head.....	36	36	37	37	35½	34	33	33	33	33
Depth.....	31	30	31	29	30½	31½	33	33	34½	32
Orbit.....	8	7½	7½	8	7½	8	9	8	8½	9
Maxillary .....	21	21½	22	21½	21	20	20	19	20	20
Snout .....	4	4	4	4½	4	5	5	5	5	5
Greatest length from preopercular ridge to gill-opening.....	14	15	15	14	15	12	12	12	11	12
Number of dorsal rays..	15	15	15	15	14	14	14	15	15	15
Number of anal rays....	22	23	23	22	22	24	24	23	23	23
Number of scales .....	42	40	43	43	42	39	40	41	40	41

90. *Cetengraulis engymen* Gilbert & Pierson.

*Cetengraulis engymen* GILBERT & PIERSON (Jordan and Evermann, 1898, p. 2815).

This species differs from *C. mysticetus* in the much narrower union of the gill membranes, the less numerous gill-rakers, and in the longer snout. Head 3 to 3.3 in length; depth 4 to 4.9; eye 4 in head; dorsal 14 or 15; anal 20 to 23; vertebrae 41. Body compressed, fusiform, not so deep as in *mysticetus* or *edentulus*. The dorsal and ventral outlines are about equally and regularly curved in the larger specimens; in the smaller specimens the ventral contour is more nearly straight. Belly trenchant, but not carinate nor serrate; caudal peduncle moderate, its depth being contained 1.5 times in its length. Head similar to *mysticetus*; the snout longer, contained 5.5 to 7 times in head, 1½ times in eye (the snout is contained 8 to 9 times in head, in *mysticetus*). Both jaws bear minute teeth, those on the maxillary largest. Branchiostegal membranes united for only  $\frac{2}{3}$  to  $\frac{3}{4}$  of the distance between tip of mandible and mandibular articulation; wholly free from the isthmus. Tip of mandible directly beneath the anterior border of orbit. Gill-rakers long, nine-tenths diameter of eye, 20 to 30 on the upper limb, 25 to 30 on the lower limb; in five examples as follows, 25+30, 27+25, 30+26, 25+30, 23+29 to 20+25.

The origin of the dorsal is midway between base of median caudal rays and a point varying between front and middle of the eye. Insertion of anal below the posterior fourth or third of the dorsal, its length equaling the distance from the posterior border of the eye to insertion of pectoral. The pectoral is short,  $2\frac{1}{4}$  to  $2\frac{1}{3}$  in head, failing to reach the insertion of the ventrals by half or nearly half its length. Caudal deeply forked, its median rays  $2\frac{1}{2}$  to 3 times in head.

Color uniformly silvery, with a distinct, well defined lateral silvery band, extending from upper angle of gill-opening to base of caudal; its greatest width equals the diameter of orbit, becoming narrower on caudal peduncle.

Length 38 to 57 mm.



91. *Lycengraulis poeyi* (Kner & Steindachner).

Seven specimens were taken, the largest 198 mm. in total length.

In some of the specimens the pectorals scarcely reach to the base of the ventrals, while in others they reach a very little past this point. The gill-rakers become shorter and somewhat thicker with age.

We have compared these specimens with a single specimen of *L. grossidens* from Pernambuco, Brazil. The latter specimen seems to differ from *L. poeyi* in having a slightly longer maxillary, a greater distance separating the tip of snout from lower angle of cheek, and in the slightly larger teeth, which are more uneven and more widely spaced.

*Measurements in Hundredths of Length without Caudal.*

Species.....	LYCENGRAULIS POEVI.					L. GROSSIDENS.
	<i>Panama.</i>					<i>Brazil.</i>
Length without caudal, in mm.....	186	159	153	189	198	169
Head in 100ths of length.....	23½	23	23½	23	23½	24
Depth.....	26	24	24	25	24	25
Eye.....	5	5	5	5	4¾	4¾
Maxillary .....	18	17½	18½	18	18	20½
Origin of dorsal from snout.....	56½	56	54½	55	54½	55½
Greatest distance from eye to gill-opening	15	14	14⅓	14½	14	15½
Snout to lower angle of cheek.....	18½	18½	18	18	19	20½
Dorsal rays .....	15	14	15	14	14	15
Anal rays.....	24	25	24	24	25	24
Gill-rakers.. ..	14+20	15+19	14+20	14+20	12+19	14+18
Scales.....	40	40	41	41	40	39

## Family SYNODONTIDÆ.

92. *Synodus evermanni* Jordan & Bollman.

Dredged by the "Albatross" in Panama Bay, at Stations 2795 and 2797, 33 fathoms; not seen by us. The species is also known from "Albatross" Stations 2831, 3043, 3044, off the coast of Lower California, in depths of 12 to 74 fathoms; and Station 2998, Gulf of California, 40 fathoms.

93. *Synodus scituliceps* Jordan & Gilbert.

*Synodus jenkinsi* JORDAN & BOLLMAN, 1889, p. 153.

Two specimens seen, one of which is 40 cm. long, and is preserved. The head is remarkably long,  $3\frac{2}{3}$  in length. Five rows of scales between lateral line and median series before dorsal; seven rows between lateral line and median series before anus; sixty scales in lateral line; six rows on cheeks. These characters would range the specimen under the nominal species *S. jenkinsi*, which we are unable, however, to distinguish from *S. scituliceps*. Specimens from Mazatlan with short head (typical *S. scituliceps*) have five or six rows of scales on the cheeks (never four as originally described), and have the anterior dorsal rays reaching or not reaching tip of posterior ray when depressed. In these, the head varies from  $3\frac{3}{4}$  to  $4\frac{1}{3}$  in length, no specimen before us having the head as small as described for the type of *S. scituliceps* ( $4\frac{3}{5}$ ).

The species was also seen at Acapulco (Dec. 20), several specimens being observed lying on the sandy bottom near the wharf. They lie rigidly in a straight line, and their colors harmonize so well with that of the sand that they are detected with difficulty. One specimen, on coming to rest after swimming a short distance, disappeared in the sand, leaving only the tip of the snout exposed. It did not enter head first, but settled into the sand with its whole length at once, apparently throwing up the sand by motions of its pectoral and ventral fins.

## Family PÆCILIIDÆ.

94. *Pœcilia elongata* Günther.

Very abundant in the brackish sloughs about Panama. We found it also in the market, where numerous specimens were taken from 5 to 18 cm. in length. These are all females, no males being seen. All of the specimens examined have young in the oviduct, about 18 mm. in length, apparently about ready to be set free. They have four or five narrow, distinct cross-bars on the body. The scale-pouches have also a narrow, dark border, which shows through the scales as in the adult.

We here supplement the original description, from specimens 10 to 18 cm. in length. Head  $3\frac{1}{3}$  to  $4\frac{2}{5}$  in length; depth  $3\frac{1}{2}$  to 4. Eye  $3\frac{1}{2}$  to  $4\frac{1}{5}$  in head, slightly less than half the interorbital width in the larger specimens, slightly more than half in specimens 10 cm. long. Interorbital width half head. Height of caudal peduncle  $1\frac{1}{4}$  to  $1\frac{2}{5}$  in head, diminishing in height but slightly (sometimes not at all) from dorsal to caudal base. Scales in six specimens 30, in six specimens 31, in four specimens 32. Nine specimens have 10 dorsal rays, two have 9; eight specimens have 9 anal rays, four have 8.

After removing and drying the jaws, a narrow band of very fine villiform teeth, behind the dark-tipped slender outer teeth of each jaw, may be seen by the aid of a lens.

95. *Pæcilia boucardii* Steindachner.

Very abundant in fresh and brackish water. Found in every pond and stream in the savannah about Panama. They agree very well with Dr. Steindachner's description of the typical specimens, which were taken about Colon.

The black spots on the caudal are quite variable in size. In most specimens the caudal fin and even the posterior part of the caudal peduncle, is profusely covered with rather large black spots. There are elongate or elliptical spots between the rays, and smaller indistinct spots are on the rays. In a few specimens the spots are small and diffused, those on the rays being most persistent. The young, 25 to 40 mm. long, have only small indistinct spots.

96. *Anableps dowei* Gill.

Not seen by us.

The types of the species have been ascribed to Panama, this locality being based on the following ambiguous statement by Gill (1861 *a*, p. 3): "There has recently been sent to the Smithsonian Institution from Panama, by Captain J. M. Dow, a new species of the genus *Anableps*." While this specimen was sent from Panama, it was apparently not captured at that point, as witness the following statement published by Dow (1861, p. 30): "Some time since, while in the bay of La Union, State of San Salvador, I caught . . . a couple of what I supposed was *Anableps tetrophthalmus*; but upon sending them to my friend, Professor Baird, of the Smithsonian Institution at Washington, was somewhat surprised and gratified to hear that they were of an entirely new species . . . *A. dowii*." On a subsequent trip, Dow obtained (l. c.) from the same locality several specimens, which were likewise sent to the Smithsonian Institution (see Jordan and Gilbert, 1882 *i*, p. 373). Others are recorded by Günther (1866 *a*, p. 338) from Chiapam and Guatemala, and still others (Günther, 1864 *b*, p. 27) are said to have been collected by Captain Dow on the "Pacific Coast of Panama."

There seems to be no warrant for changing the spelling of the specific name, as has been done, to *dowi*, *dowii* or *dovii*. It appears as *dowei* in three places in the original description, a fact which sufficiently indicates the deliberate intention of the author concerning it.

## Family ESOCIDÆ.

97. *Tylosurus scapularis* Jordan & Gilbert.

Several specimens seined in fresh water at Miraflores. Four specimens preserved, the largest 41 cm. in length, the others 23.

In these specimens the caudal peduncle is not compressed, as described for the type, but is about as wide as deep. The body is somewhat depressed, especially in the ventral region. The description of the type states that the eye "is contained 8 or 9 times in the length of the upper jaw" (this agrees with our specimens), "and

$3\frac{1}{2}$  times in rest of head." This last doubtless should read postorbital part of head. The eye in our specimen is contained  $4\frac{1}{2}$  to nearly 5 times in head without upper jaw. The description states that the anterior dorsal rays are "as long as from eye to edge of opercle." This should read to edge of preopercle or to anterior edge of opercle.

The lateral band tapers to a point at each end. It is nearly confined to the posterior third of the body, and does not reach to the caudal rays. In the large specimen it is dusky silvery and has ill-defined edges, while in the small ones it is well defined and bright silvery. It is bordered above with a dark streak, very conspicuous in the younger specimens, but diffused and only slightly darker than the body in the large specimen.

98. *Tylosurus stolzmanni* (Steindachner).

Two specimens were taken, 51 and 62 cm. in entire length. Besides these we have in the Museum of Stanford University a specimen from Mazatlan of about the size of our smaller specimen. These are larger than the type (477 mm. in length), from the description of which they differ in some minor respects.

In our specimens the body is as broad as high at the region of the ventrals. The interorbital space is a little wider than diameter of eye, which is contained 12 times in length of head. The anal base is a little longer than the dorsal base. The insertion of the ventrals is nearer the caudal base than the posterior border of the eye by from 1 (in the larger specimen) to 3 times the diameter of the eye.

This is probably the species recorded by Boulenger (1899, p. 2) from the Gulf of Panama, under the name *Belone truncata*.

99. *Tylosurus fodiator* Jordan & Gilbert.

Not uncommon at Panama. Like other gars, it is called Aguja by the native fishermen.

100. *Tylosurus pacificus* (Steindachner).

Three specimens were collected, which agree very well with the description of the type.

Family HEMIRHAMPHIDÆ.

101. *Hyporhamphus unifasciatus* (Ranzani).

Two specimens collected at Panama by Captain J. M. Dow have been identified by Jordan and Gilbert (1882*i*, p. 373) with the short-nosed half-beak, *H. poeyi* (= *H. unifasciatus*). The species is also recorded from Panama by Jordan & Bollman (1889, p. 180).



102. *Hyporhamphus roberti* (Cuvier & Valenciennes).

One small specimen taken, about 15 cm. in length.

103. *Hemirhamphus saltator* sp. nov.

PLATE IX, FIG. 16.

*Hemirhamphus balao* JORDAN, 1885, p. 370 (Panama); not of Le Sueur.

Head from tip of upper jaw,  $4\frac{1}{3}$  in length from the same point to base of caudal; depth  $6\frac{1}{3}$  to  $6\frac{9}{10}$ . Dorsal 13 or 14; anal 11 or 12; scales 53 or 54.

Body compressed, the sides vertical and parallel. Mandible from tip of upper jaw  $4\frac{1}{3}$  to  $4\frac{1}{2}$  in length. Diameter of eye slightly exceeding interorbital width, 4 to  $4\frac{1}{2}$  in head. Pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in head. Insertion of ventrals midway between base of caudal and anterior third of pectoral fin. Last ventral ray produced, and longer than first ray. Front of anal a little anterior to middle of dorsal base; the posterior end of anal base coterminous with that of dorsal. Posterior ray of dorsal produced; anterior rays about a third higher than those of anal.

Color uniform bright silvery on lower part of sides, dusky silvery above. An inconspicuous, dark, narrow lateral streak extends from upper angle of gill-opening to just above middle of caudal. Top of head and upper jaw dark. Dorsal and caudal dark; pectorals dusky; ventrals colorless, except a slight dusky tinge towards ends of outer rays; anal white.

This species is closely related to *H. brasiliensis* from the West Indies, with which it has been identified. It differs from that species in the smaller eye, longer mandible, and longer pectoral fin. The insertion of the ventrals is more anterior; the horizontal length of the opercle is greater; the anterior rays of the dorsal are lower, and there are one or two more scales in a horizontal series.

Eight specimens were taken, from 41 to 46 cm. in entire length.

*Measurements in Hundredths of Length without Caudal.*

Species.....	HEMIRHAMPHUS SALTATOR							HEMIRHAMPHUS BRASILIENSIS										
	Panama							Jamaica							Havana			
Locality.....																		
Length from tip of upper jaw to base of caudal, in mm.....	266	242	256	277	251	213	252	283										
Head from tip of upper jaw in tooth of length	24	23½	23½	23½	24	23½	24	23	211	209	210	215	190	207	198	191	192	24
Depth.....	14½	16	16½	15½	15½	15½	15½	16	18	17	17½	16	18	17	17½	16½	17	16
Eye.....	5½	5½	5½	5½	5½	5½	6	5½	6	6	6	5½	6	6½	6	6	6	6½
Mandible from tip of upper jaw.....	30	brok'n	30½	broken	broken	30½	32½	25	26	24	26	26½	30	25½	brok'n	27½	27½	broken
Insertion of ventrals from caudal base.....	36	36	36	35½	35½	35½	35½	36	33½	35	34½	35	33	34½	34	33½	34½	33
Length of anal base.....	8½	8	9	8	8½	8	9	8	8	8½	8	8½	8	8	8	8½	8½	8½
Length of opercle.....	7	6½	7	7	7	7	7	7	6½	6	6½	6½	6½	6½	5½	6½	6½	6½
Length of pectoral.....	18	19	20	20	20	21	20½	20	17½	17	16½	16	17½	17	17	17½	16½	16½
Length of highest dorsal rays.....	9	8½	9	9	8½	9	9	9	10½	10	brok'n	10	10	9½	9½	10	9½	broken
Number of dorsal rays...	14	13	14	13	13	13	14	14	14	13	13	15	13	13	14	13	15	
Number of anal rays.....	11	11	12	11	12	11	12	12	12	12	12	12	12	12	12	12	13	
Scales.....	54	54	54	53	53	54	54	54	52	52	52	51	51	53	51	52	52	

## Family EXOCETIDÆ.

104. *Fodiator acutus* (Cuvier & Valenciennes).

Abundant in Panama Bay; many were seen flying, and four specimens were taken, 145 to 158 mm. in length. They agree well with the description of the type.

105. *Cypselurus callopterus* (Günther).

Two specimens were collected, 25 and 31 cm. in length. They agree well with Dr. Günther's description and plate.

106. *Exonautes rufipinnis* (Cuvier & Valenciennes).

Only the type of *Exocætus dowi* Gill, 1863, p. 167, (= *E. rufipinnis*), is known from the vicinity of Panama.

## Family FISTULARIIDÆ.

107. *Fistularia depressa* Günther.

A single large specimen was taken in the market at Panama.

We have examined specimens from Japan, Honolulu, the Philippines, and La Paz, L. C., and can distinguish no differences between them. In the figure of this species given by Dr. Günther (Shore-fishes, Challenger, Plate XXXII), the greatest width between the diverging ridges on the anterior part of the snout is indicated at a point too far forward. In our specimens the ridges are farthest apart at the beginning of the anterior  $\frac{2}{7}$  or  $\frac{1}{4}$  of the snout. The interorbital area appears to be more concave in small specimens (25 cm. in length) than in the larger ones. In the latter the interorbital is contained  $5\frac{1}{2}$  in the postorbital part of the head. In specimens 50 cm. in length the orbit (measuring the extreme length between the bones surrounding the eye) is from  $9\frac{1}{4}$  to  $9\frac{3}{4}$  in the head, and the length of the maxillary is  $9\frac{1}{2}$ . In a specimen 69 cm. in length, the maxillary is contained 10 times and the eye 11 times in the head.

A large number of small specimens 25 to 28 cm., and one specimen 41 cm. in length from Honolulu, are plain brown on the back, while a larger specimen 61 cm. long has blue spots, as in our Panama specimen. Four specimens from La Paz, 51 cm. long, all show blue spots. The following color description was taken from our Panama specimen in the fresh condition.

Olive-brown on upper parts, white below. A pair of narrow blue stripes, interrupted anteriorly and posteriorly, begin at the nape, diverge backward and cross the lateral line just in front of the point where it becomes straight, then run just above and parallel to the lateral line as far as the tail. Another pair of streaks, made each by a series of blue spots, runs close along each side of mid-dorsal line, from a

point above axil of pectorals to front of dorsal. Behind dorsal a single series of spots occupies the median line of back.

108. *Fistularia corneta* sp. nov.

PLATE X, FIGS. 18 AND 18a.

Five specimens, each 62 cm. long, were seen in the Panama market; two of these were preserved. Besides these, we have in the collection of Stanford University several small specimens from Panama, collected by the "Albatross," and several small ones from Mazatlan.

Head 3 in length. Depth of body, a short distance in front of dorsal fin,  $\frac{4}{5}$  the depth at occiput. At insertion of ventral fins the width of the body is twice its depth. The extreme length of the orbit is contained 9 times in the length of the head; maxillary  $13\frac{2}{5}$  to  $13\frac{3}{5}$ ; interorbital width (bone)  $3\frac{3}{4}$  to 4 in postorbital part of head. Length of pectoral, from base of upper ray to tips of longest rays,  $6\frac{2}{3}$  to 7 in head; ventrals 11.

The maxillary is rather short, and has a concave posterior border. The upper lateral ridge of snout is serrated on its posterior three-fifths. On the anterior half of the serrated portion, the serrations become abruptly finer and more crowded. The two superior ridges of the snout are rather wide apart posteriorly, and very gradually approach each other anteriorly. They are scarcely divergent or even parallel in the large specimens, but in the small ones they diverge slightly on the anterior half of the snout. The distance between them is everywhere much greater than their distance from the upper lateral ridge. The area between the upper lateral ridge and the superior ridges is generally smooth, sometimes somewhat uneven, but never roughly sculptured. The interorbital area is flat and roughly sculptured on each side, and its middle third is depressed to form a smooth channel.

The pectoral reaches about one-third of the distance between the base of its upper ray and the insertion of the ventrals. The dorsal and anal fins are exactly opposite and equal in length; their base 4 times their distance from the middle caudal rays. The skin is everywhere smooth; the lateral line is not armed with bony plates.

In the five specimens seen at Panama (fresh) the back was a uniform dark brown. In the small specimens from Panama and Mazatlan there is usually a lighter stripe, with ill-defined edges, on each side of the back, a short distance above the lateral line, and following its course to the base of the caudal fin.

This species differs from *F. depressa* in having a shorter maxillary, a larger eye (in specimens of the same size), and particularly in having a much wider interorbital space. There is no trace of blue markings in our material.

We have several specimens of *F. petimba* from Formosa and Japan, which agree well with the description given by Dr. Günther (Shore-fishes, Challenger, p. 68) under the name *F. serrata*. They differ from *F. corneta* in having the superior ridges of the snout very close together and parallel for nearly their whole length. (They are spoken of as *ridges*, though they appear, in this species especially, as a single, raised, flat area posteriorly, the sides of which are left in relief as ridges anteriorly.) The distance between them is everywhere much less than their distance from the upper lateral ridge. The area between the upper lateral ridge and the superior ridges is roughly sculptured with radiating lines, as shown in the illustration accompanying the description cited above (Plate XXXII). The interorbital area is



deeply concave and without flat supraorbital areas. The serrations of the upper lateral ridge are coarse. The skin is rough to the touch, and the lateral line is armed with small, bony, stellate plates, which become larger posteriorly.

We have no specimens of *F. tabacaria*, but from current descriptions it is different from *F. corneta*. It seems always to have blue spots and to have few or no serrations on the upper lateral ridge. It has not been recorded from the Pacific.

#### Family SYNGNATHIDÆ.

##### 109. *Siphostoma auliscus* Swain.

Two specimens, 122 and 88 mm. long, were taken in the Rio Grande, at Miraflores, near Panama. We have compared them with two small specimens of *S. auliscus* from Magdalena Bay, I. C., and find the only difference to be the more anterior anal opening in the smaller specimen, in which it occupies the ring just anterior to dorsal. In the other specimens it is in the same ring with the front of dorsal. The Panama specimens are darker and more mottled. Each body ring has a broken vertical white streak, and on about every fifth ring is a faint dark streak.

##### 110. *Hippocampus ingens* Girard.

Three specimens taken, 5, 8, and 10 cm. long. The smaller two, a male and a female, are rough with papillæ, and have many dermal flaps. The largest one, a female, is almost perfectly destitute of these, though upon close examination with a lens very small, white papillæ are to be seen.

Two specimens from Mazatlan in the collection of the Stanford University have been examined. One is smooth, the other covered with dermal flaps.

#### Family ATHERINIDÆ.

##### 111. *Kirtlandia pachylepis* (Günther).

This species and *K. gilberti*, referred to the genus *Menidia* by Jordan and Evermann (1896, pp. 798 and 801), the former afterwards transferred to the genus *Thyrina* by these authors (1898, p. 2840), belong to the genus *Kirtlandia*. We have compared them with *K. vagrans*, the type of the genus. Like the latter, they have crenate scales, which are, however, smooth, not "very rough to the touch," as described by Jordan and Evermann. Our specimens of *K. vagrans* and *K. pachylepis* have no scales on the dorsal. The base of the anal has a row of rather long scales. Both the dorsal and anal of *K. gilberti* are scaleless.

Nine specimens of *K. pachylepis* were collected. They differ from Günther's description only in the slightly longer head, and in a greater range of fin-rays.

Head and depth 5 in length of body without caudal. Eye and snout about equal,  $3\frac{1}{2}$  in head. Angle of lower jaw slightly in advance of front of orbit. Inter-

orbital space one-fourth or one-fifth wider than eye. Jaws with a band of villiform teeth. Pectorals reaching nearly to tip of ventrals. Anal and soft dorsal conterminous. Scales 41 to 43. About 27 scales on back in a series between occiput and spinous dorsal. Fins unmarked. Snout and a small area on top of head behind eye dusky. Back dusky, with small brown punctulations, which narrowly border each scale. Lateral streak dark above, shading downward into silvery, widest under the dorsals. A dark line on back from dorsal to occiput, composed of a single row of dark brown dots; more conspicuous in the smaller specimens.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal, in mm....	115	99	97	99	109	100	97	97	82
Head.....	20½	20½	20	20	21	20½	20	20½	20
Depth.....	20½	21	20	20½	20	20½	19½	20½	19½
Eye.....	7	6	6½	6	6	6½	6	6½	6½
Snout.....	6½	6	6	6	6	6	6	6	6
Insertion of ventrals from snout...	43	41	43	41	42	42	42	42½	40½
Length of anal base.....	24	24½	25½	25½	24	26½	23½	25½	25
Length of pectoral.....	28½	28	27	29	27½	28	27	27	26½
Number of dorsal rays.....	V-1,8	IV-1,7	V-1,8	IV-1,8	V-1,7	V-1,7	IV-1,7	V-1,7	V-1,7
Number of anal rays.....	1,21	1,22	1,21	1,21	1,23	1,23	1,21	1,21	1,21
Scales.....	42	43	43	42	44	42	43	41	42

112. *Kirtlandia gilberti* (Jordan & Bollman).

Of this species we obtained nine specimens, which we have examined in connection with thirteen co-types collected at Panama by the "Albatross."

Only two of these have six dorsal spines, as described for the type; fifteen of them have 5; and five of them have 4. The origin of the first dorsal in the type is described as being at a point midway between the posterior margin of the head and the base of the caudal. We find that it varies from this to a point half the diameter of the eye nearer to the occiput. The longest spine (probably owing to a slip of the pen) is alleged to be  $4\frac{1}{5}$  in the head. This should read  $3\frac{1}{5}$  to  $3\frac{1}{2}$ . The longest ray of the soft dorsal exceeds the length of the snout by from one-fourth to one-half the diameter of the eye. The origin of the anal varies in position from a point midway between base of caudal and posterior base of pectoral (as described), to a point midway between base of caudal and middle of upper pectoral ray; the width at base is generally somewhat greater than "distance from tip of snout to base of pectorals." The scales are crenate, but smooth to the touch. The dorsal and anal are scaleless.

The edges of the lateral band are well defined, and a much darker streak composes its upper edge. It is widest under the dorsals, thence narrows on the caudal peduncle and widens at base of caudal fin. Its termination is rounded.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal, in mm....	103	105	110	103	98	103	97	93	95
Head.....	22	21	22	20½	20½	21	21	21	20½
Depth.....	17	17	17	17	17½	17½	17½	16½	17
Eye.....	6	6	6	6	5½	6	6	6	6
Origin of anal from caudal base..	36	37	37	38	40	38	38	38	38
Origin of first dorsal from caudal.	44	43	44	43	43	45	42½	43	43
Length of pectoral.....	19	18½	18	19	18	18	19	18	18½
Length of anal base.....	19	20½	20½	21	21	20	20	21	20
Number of dorsal spines.....	v	iv	v	v	iv	v	iv	v	v
Number of dorsal rays.....	1,9	1,8	1,9	1,9	1,8	1,9	1,9	1,9	1,9
Number of anal rays.....	1,19	1,19	1,19	1,21	1,20	1,20	1,20	1,19	1,20
Number of scales.....	51	49	49	50	50	50	49	50	51

*Fin Formulae of the Co-Types.*

Dorsal .....	vi-1,9	v-1,9	iv-1,9	vi-1,9	v-1,9	v-(broken)	
Anal.....	1,22	1,20	1,20	1,22	1,22	(broken)	
Dorsal .....	v-(broken)	v-1,8	iv-1,9	v-1,9	v-1,9	v-1,9	v-1,9
Anal.....	1,20	1,20	1,20	1,21	1,20	1,20	1,19

**113.** *Atherinella panamensis* Steindachner.

PLATE IX, FIG. 17.

A single specimen obtained, 13 cm. in entire length.

We add the following details to Dr Steindachner's excellent description:—Head  $4\frac{1}{2}$  in length; depth  $4\frac{1}{2}$ . Eye  $3\frac{2}{3}$  in head; snout  $3\frac{2}{3}$ ; interorbital width  $2\frac{3}{4}$ . The enlarged outer teeth of the upper jaw are in two series only in front of jaw, in one series laterally. Pectoral  $2\frac{3}{4}$  in length. The insertion of the ventrals is nearer the tip of the lower jaw than the base of the caudal by half the length of the head.

## Family MUGILIDÆ.

**114.** *Mugil cephalus* Linnaeus.

Taken by Gilbert at Panama in 1883 (Jordan, 1885, p. 371); not recorded by other observers.

**115.** *Mugil thoburni* Jordan & Starks.

Recorded (as *Mugil incilis*) from Panama (Jordan & Gilbert, 1882 n, p. 624) and from Chiapam (Steindachner). The types of the species were collected by the "Albatross" at the Galapagos Islands.

116. *Mugil curema* Cuvier & Valenciennes.

This species comes into the Panama markets in abundance. We have compared six specimens with others from the Atlantic and can distinguish no differences between them.

*Measurements in Hundredths of Length without Caudal.*

Locality.....	<i>Panama.</i>						<i>Jamaica.</i>		<i>Key West.</i>		
Length without caudal, expressed in mm.	205	212	240	250	192	190	201	231	145	118	230
Head.....	27	26	26½	26	26	26	26	26½	26	27	24
Depth.....	25	24	26	22	25	25	26	26	27	27	26
Interorbital (bone only).....	9	9½	10	9	9	9½	10	10	9½	9	9
Insertion of ventral spine from snout .....	40	38	40	39	40	40	40	39½	39½	39	38
Front of spinous dorsal from snout .....	49½	49½	52	48½	50½	51	49½	52	50½	51	50
Tip of pectoral from snout.....	46½	44	45	44½	45½	47	45½	45	45½	47½	43½
Length of pectoral.....	19½	18½	18½	18½	18½	20	19	18½	19½	21	19
Length of anterior dorsal rays	11½	10½	11½	11½	12½	12	12	12	12½	13½	11
Length of anterior anal rays...	12½	12	12	12	12	12½	12¼	12	13	14	12
Number of dorsal spines and rays.....	IV-1,8	IV-1,7	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8
Number of anal spines and rays	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9
Scales from above upper pectoral ray .....	38	37	37	38	37	37	37	36	36	37	37

117. *Mugil hospes* Jordan & Culver.

Abundant at Panama. It is at once separated from *M. curema* by the longer pectoral. We found the small crustacean nearly always present in the mouth of the Panama specimens, as it was in the type and co-types from Mazatlan.



*Measurements in Hundredths of Length without Caudal.*

Locality .....	<i>Panama.</i>								<i>Mazatlan</i>
									(TYPE.)
Length without caudal, in mm.	212	193	212	222	230	190	217	219	170
Head (without opercular flap)	28	28	26½	27	27	27	26½	27	28
Depth .....	26	27	23½	24½	22½	24	24½	23	23
Interorbital (bone).....	11	10½	10½	10	10	10½	10	10	10
Insertion of ventral spine from snout.....	41	42	39½	41	39½	40½	41	40½	39½
Front of spinous dorsal from snout.....	51½	53½	51	51½	51½	52	51	51	50
Tip of pectoral from snout....	52½	53½	51	51½	51½	52½	52½	52½	50½
Length of pectoral.....	23½	25½	23	24	24	25	24	23½	23
Length of anterior dorsal rays..	12	13	12½	12½	12½	12½	12½	12	12½
Length of anterior anal rays...	12½	13	12½	13	12½	13	13	13	13½
Number of dorsal rays and spines .....	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8
Number of anal rays and spines	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9	III,9
Scales .....	37	37	38	36	37	38	36	36	38

118. *Chænomugil proboscideus* (Günther).

Probably not so common as farther north. Two large specimens and several small ones were collected, the latter found in rock-pools, in company with *Querimana harengus*.

*Measurements in Hundredths of Length without Caudal.*

Length in mm.....	191	154	76	56	48
Head.....	26	27½	28	29	30
Depth .....	29	31	34	32	31
Eye.....	6	6½	7½	8	8
Insertion of first spine of spinous dorsal from snout	56	56	56	57	55
Insertion of first spine of soft dorsal from snout ...	78	78	78	77	78
Insertion of anal spine from snout.....	75	75	70	73	72
Length of pectoral.....	23	23	25	25	26
Length of ventral .....	15	16	18	18	18
Number of dorsal rays and spines.....	IV-1,8	IV-1,8	IV-1,8	IV-1,8	IV-1,8
Number of anal rays and spines.....	III,10	III,10	III,10	III,10	III,10
Scales .....	39	41	40	40	40

119. *Querimana harengus* (Günther).

This little mullet was taken in abundance in the rock-pools. There is considerable variation among the specimens, as the table of measurements will show. Nothing can be found, however, that would indicate more than one species among them. Out of fifty specimens examined, four were found with three anal spines. In each of these cases, a spine had replaced a ray, as only nine rays were present instead of the ten always found in two-spined examples.

*Measurements in Hundredths of Length without Caudal.*

Length in mm., without caudal...	47	40	45	43	45	45	41	44	41
Head .....	30	32½	32	31	31	29	28	32	28
Depth.....	28	30	29	30	29	26	26	27	26
Eye.....	7	8	8	7	7½	8	7½	8	8
First dorsal from snout.....	53	55	55	53	53	51	51	53	51
Second dorsal from snout.....	75	76	75	76	76	74	72	74	72
Insertion of ventral spine from snout.....	44	46	44	44	44	41	42	46	42
Anal from snout.....	70	73	73	71	71	68	70	71	69
Length of pectoral.....	21	21	21	20½	20½	20	19	19	19
Length of anal base.....	16	14½	15	15	16	15	16	15	15
Spines and rays of dorsals .....	IV-1, 8	IV-1, 9	IV-1, 8	IV-1, 8	IV-1, 8	IV-1, 8	IV-1, 8	IV-1, 8	IV-1, 8
Spines and rays of anal.....	II, 10	II, 10	II, 10	II, 9	II, 9	II, 10	II, 10	II, 10	II, 10
Scales .....	36	36	38	37	36	38	38	37	37

## Family SPHYRÆNIDÆ.

120. *Sphyræna ensis* Jordan & Gilbert.

Not uncommon in the market at Panama, where nine specimens were collected. These agree very well with the description given by Dr. Steindachner (1879*b*, p. 4) under the name *S. forsteri*, he having confused it with that East Indian species.

*Measurements in Hundredths of Length without Caudal.*

Length in mm., from tip of snout to base of caudal.....	293	298	305	359	310	290	290
Head from tip of snout.....	32	31½	31½	30½	31½	32	31
Depth.....	14½	13	13	13½	13½	14	13½
Orbit.....	5½	5½	5	5	5½	5½	5¾
Insertion ventral spine from tip of snout.....	41	40	40½	39½	40½	42	41
Spinous dorsal from snout.....	43½	43	43½	43	44	44	44
Soft dorsal from snout.....	72½	70½	69½	70	71½	70½	70½
Length of pectoral.....	13	13	12½	13	12½	13	13
Longest dorsal ray.....	11	11½	11½	11½	11	11½	11½
Longest anal ray.....	10½	10½	10	10½	10½	10½	10½
Number of dorsal rays and spines.....	V-1,8	V-1,9	V-1,9	V-1,6	V-1,9	V-1,9	V-1,9
Number of anal rays and spines.....	11,7	11,8	11,8	11,8	11,8	11,8	11,8
Number of scales.....	108	111	109	108	109	112	110

## Family POLYNEMIDÆ.

121. *Polydactylus approximans* (Lay & Bennett).

Common but much less abundant than *P. opercularis*, and much less valuable than the latter as a food-fish.

*Measurements in Hundredths of Length without Caudal.*

Length in mm.....	217	193	191	206	205
Head.....	31	32	32	32	32
Depth.....	29	29	30	28	29
Maxillary.....	14	14½	14	14½	14
Spinous dorsal from snout.....	37	39	39	39	39
Distance from front of spinous dorsal to soft dorsal..	27	28	30	27	27
Length of pectoral.....	28	28	29	31	28
Longest detached ray.....	41	42	45	45	39
Longest dorsal spine.....	22	22	Broken	24	22
Longest dorsal ray.....	21	19	21	22	20
Dorsal.....	VIII-1,12	VIII-1,12	VIII-1,12	VIII-1,12	VIII-1,12
Anal.....	III,14	III,14	III,13	III,13	III,14
Scales.....	60	61	60	61	62

122. *Polydactylus opercularis* (Gill).

Taken with hook and line in great abundance. It is eagerly sought after by the native population, by whom it is highly prized. It is one of the most important food-fishes, and on some days equals or exceeds in numbers all others combined.

The type is described as having only eight free pectoral rays, but that was doubtless based on erroneous observation.

*Measurements in Hundredths of Length without Caudal.*

Length in mm. ....	280	280	290	242	205	178
Head .....	31	29½	30½	30	30	30
Depth.....	25	24	25	25	25½	27
Maxillary .....	18	17½	17½	17	17½	17½
Spinous dorsal from snout.....	36	36	35	35½	35	34½
Distance from front of spinous dorsal to soft dorsal.....	25	26	28	28	26½	26½
Length of pectoral .....	21	20	21	20½	22	22
Longest detached ray.....	31	31½	32	33½	32	35
Longest dorsal spine.....	20	20	19½	20	20½	20
Longest dorsal ray.....	18	17½	18	18	18	17½
Dorsal.....	VIII-1, 12	VIII-1, 12	VIII-1, 12	VIII-1, 12	VIII-1, 12	VIII-1, 12
Anal.....	III, 13	III, 13	III, 13	III, 13	III, 13	III, 13
Scales .....	66	69	68	70	68	69

## Family HOLOCENTRIDÆ.

123. *Myripristis occidentalis* Gill.

Two specimens were taken among the islands in the bay. The species differ from *M. pacilopus* more than has been previously indicated. The teeth are much larger, and the vomerine patch is lance-shaped rather than anchor-shaped. The anterior rays of the dorsal and anal are longer, making these fins more angulated and their posterior margins more nearly vertical. Scales thirty-nine or forty in the lateral line, somewhat smaller than indicated in the type description.

The color of the back is of a clearer reddish brown, less slaty than in *M. pacilopus*, and with bluish reflections on each scale. The silver begins on the row of scales below the lateral line rather than above, and is richer in coppery and greenish reflections. The dorsal is lighter, and there are no dusky bands at base of caudal and below the lateral line, as in *M. pacilopus*. The ventrals have lighter or



colorless tips. In one specimen the ventrals are immaculate, in the other a slightly dusky tinge is present. The three specimens of *M. pæcilopus* have the tips of the ventrals darker, running from dusky to black. There is a dark pigment spot above pupil in *M. occidentalis*, which is absent or very slightly dusky in *M. pæcilopus*.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm...	45	46
Head.....	35	35
Depth ...	37	36
Eye.....	15	15
Snout.....	7½	7½
Length of pectoral.....	22	24
Length of ventral.....	22	23
Height of soft dorsal.....	18	16
Height of anal .....	18	16
Length of caudal .....	24	24
Number of dorsal rays.....	X-I, 14	X-I, 14
Number of anal rays.....	IV, 12	IV, 12
Scales .....	3-40-7	3-39-7

124. *Myripristis pæcilopus* (Gill).

Three specimens taken.

Very small villiform teeth on jaws, vomer, and palatines; the palatine patches very long and narrow, the vomerine patch anchor-shaped, its length about three times its width across lateral arms. The median backwardly extending limb is narrow and pointed.

Color of back slaty brown, passing into bright, iridescent silvery at the upper part of the band of scales which bears the lateral line. Upper end of opercle with bluish reflections. Directly below the lateral line is a narrow, straight, dusky streak, commencing three or four scales from gill-opening and ending a little behind tip of pectoral. Tips of ventrals varying from slightly dusky to black. Base of caudal with a dusky band. Spinous dorsal dark or nearly black. Other fins colorless.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm...	50	44	45
Head.....	34	35½	35
Depth.....	35	33	35
Eye.....	14	15	15
Snout.....	7½	8	8
Length of pectoral.....	20	21	21
Length of ventrals.....	20	20	21
Height of soft dorsal.....	15	15	15
Height of anal.....	15	15	16
Length of caudal.....	22	23	23
Number of dorsal rays.....	X-1, 14	X-1, 14	X-1, 14
Number of anal rays.....	IV, 12	IV, 12	IV, 12
Scales.....	3-35-7	3-35-7	3-34-7

125. *Holocentrus suborbitalis Gill.*

Taken in abundance in the rock-pools. Our specimens do not materially differ from the description of the type. The statement that "the tail behind the vertical fins nearly equals a ninth of the total length" should doubtless read "the height of the caudal peduncle behind the vertical fins nearly equals a ninth of the total length." The length of the tail behind the vertical fins is about 3½ in the total length.

*Measurements in Hundredths of Length without Caudal.<sup>1</sup>*

Length without caudal in mm.....	153	145	150	112	110	65	68
Head.....	32	32	32	32	31	35	34½
Depth.....	37	37	38	38	37	39	38
Orbit.....	11	12	11½	12	12	14	14
Maxillary.....	13	13	12½	13	13	15	14½
Preopercular spine.....	8½	8½	8	7	6½	5½	7
Third anal spine.....	19	17	19½	21	20	22	22
Third dorsal spine.....	17	17	18½	19	17½	20	19
Base of soft dorsal.....	13½	14½	14	13½	14	14½	14½
Length of pectoral.....	22	23	24	25	25	27	27
Length of ventral.....	21	22	24	24	24	26	25
Dorsal.....	XI-13	XI-14	XI-14	XI-14	XI-14	XI-14	XI-14
Anal.....	IV, 9	IV, 9	IV, 9	IV, 9	IV, 9	IV, 9	IV, 9
Scales.....	39	38	38	38	37	37	37

<sup>1</sup>In this table, the head is measured to the angle formed by largest opercular spine and edge of subopercle. The preopercular spine is measured along its upper edge from its angle with preopercle.

## Family MULLIDÆ.

126. *Upeneus grandisquamis* Gill.

Several specimens collected in the Panama market. This large series enables us to add the following range of variations to the original description:

Head  $3\frac{1}{5}$  to  $3\frac{1}{2}$  in length without caudal; depth 3 to  $3\frac{2}{3}$ . Eye  $4\frac{1}{2}$  to 5 in head; snout 2 to  $2\frac{1}{6}$ . The fin counts in our eleven specimens are constantly VIII-1, 8 for the dorsal, and I, 6 for the anal. The third dorsal spine is longer than the fourth, but does not project beyond it. Sometimes it does not reach its tip.

Dr. Gill's measurement of the length of the spinous dorsal fin includes the membrane which connects the last spine to the body. As most specimens have this membrane broken, we have considered the base of the fin to extend to the base of the last spine. The base of the first dorsal equals or sometimes slightly exceeds the interval between the dorsals, the latter equaling or sometimes slightly exceeding the base of the second dorsal. The interval between the dorsals contains 4 scales along the median line.

The following color description was taken from a fresh specimen: Red above, silvery below; 2 silvery streaks along the sides anteriorly, follow the rows of scales above and below the lateral line, and are continued forward on the head to a point behind the eye. Other silvery streaks follow the rows of scales, but are much less conspicuous. Dorsal and caudal deep orange-red with wide translucent margins.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal, in mm..	160	154	145	142	121
Head.....	32	30	31	$29\frac{1}{2}$	30
Depth.....	32	29	29	29	30
Snout.....	15	14	14	14	14
Eye.....	7	$6\frac{1}{2}$	7	$6\frac{1}{2}$	$7\frac{1}{2}$
Length of 3d dorsal spine.....	21	21	20	$19\frac{1}{2}$	19
Length of pectoral.....	25	$23\frac{1}{2}$	25	23	24
Height of second dorsal.....	12	$12\frac{1}{2}$	13	13	13
Spinous dorsal from snout.....	40	$38\frac{1}{2}$	39	38	38
Front of first dorsal to front of second dorsal.....	29	30	28	29	$28\frac{1}{2}$
Number of gill-rakers.....	6+11	6+11	6+11	6+12	6+11
Number of dorsal rays.....	VIII-1,8	VIII-1,8	VIII-1,8	VIII-1,8	VIII-1,8
Number of anal rays.....	1,6	1,6	1,6	1,6	1,6
Scales.....	2-30-5	2-30-5	2-31-5	2-31-5	2-30-5

## Family SCOMBRIDÆ.

127. *Sarda chilensis* Cuvier & Valenciennes.

Abundant in the market for two or three days, but not again seen. We preserved one specimen, 46 em. in length.

Eighteen gill-rakers are attributed to the horizontal limb of the anterior branchial arch by Jordan & Evermann, 1896, p. 872. They also describe the maxillary as not reaching the eye. In our specimen there are but nine gill-rakers including one rudiment; and the maxillary extends to below the posterior border of the eye.

128. *Scomberomorus sierra* Jordan & Starks.

This species is brought into the market daily, and is one of the most important food fishes. We preserved six specimens.

If it is distinct from its East Coast relative, *S. maculatus*, it is separated by only slight characters, and a large series from both shores will have to be compared accurately to define the species. The chief character that has been alleged to separate the two is the more backward position of the dorsal in *S. sierra*. Our material shows this character to be valueless.

We have but three specimens of *S. maculatus*. From these, *S. sierra* seems to differ in being a little more slender, and in having the spots rounder and more numerous below the lateral line. As the appended table indicates, the size of the head and eye may average smaller, the number of dorsal rays less, and the number of gill-rakers more. *S. sierra* has 3 or 4 rows of spots below the lateral line, while *S. maculatus* has but two, or at the most, the beginning of a third.

We do not admit to our list *S. concolor*, recorded without comment from the Gulf of Panama, by Boulenger, 1899, p. 3. Aside from this record, *S. concolor* has been known only from Monterey Bay, California.



*Measurements in Hundredths of Length without Caudal.*

Species .....	SCOMBEROMORUS SIERRA						S. MACULATUS			
	<i>Mazatlan</i> (TYPE.)		<i>Panama</i>				<i>Florida</i>			
Length without caudal.....	307	305	305	325	305	350	282	285	205	185
Head.....	22	22	23	22	22	22	22½	23	23½	24
Depth.....	21½	20	20½	20	20	19	18½	22	22½	22
Orbit.....	4	4	4	4	4	4	4	4	4½	4½
Maxillary .....	12½	12	12	12	12	12½	12	13	13	13½
Snout to first dorsal.....	26	26½	27	26	25½	26	26½	26½	26½	27
Snout to second dorsal...	55½	54	55	54	54½	53	55	52	54½	53
Snout to anal.....	57	56½	60	57	57	57½	58	56	57	57
Length of pectoral.....	13½	14	14	14	14	14	13½	14	13½	13
Height of soft dorsal.....	12	12	12	13	12	12½	11	Broken	Broken	Broken
Height of anal.....	Broken	12	11½	12	11	12	11	“	“	“
Length of caudal.....	28	27	28	27	28	28	26	27	“	“
Number of dorsal rays ...	XVIII-16-IX	XVII-16-IX	XVII-16-IX	XVII-17-IX	XVII-16-VIII	XVIII-16-IX	XVII-17-VIII	XVII-18-IX	?-17-VIII	XVII-17-IX
Number of anal rays.....	11-15-IX	11-15-IX	11-15-IX	11-16-IX	11-16-VIII	11-16-VIII	11-15-VIII	11-16-IX	11-15-IX	11-16-IX
Number of gill-rakers.....	3+12	3+12	3+11	4+13	4+11	4+10	3+11	2+10	3+11	3+9

## Family TRICHIURIDÆ.

129. *Trichiurus lepturus* *Linnaeus*.

Recorded from Panama by Jordan and Bollman, 1889, p. 180.

## Family NEMATISTIIDÆ.

130. *Nematistius pectoralis* *Gill*.

Probably rare as far south as Panama; only three or four seen.

The following measurements are from a specimen 30 cm. in length.

Head  $3\frac{2}{3}$  in length; depth  $3\frac{1}{5}$ . Eye 5 in head; snout  $3\frac{7}{8}$ ; maxillary  $2\frac{1}{10}$ ; interorbital (bone)  $3\frac{3}{4}$ . Dorsal VIII-I, 26; anal I, 16. Gill-rakers 3+9, the longest two-thirds the diameter of the eye.

## Family CARANGIDÆ.

131. *Oligoplites saurus* (*Bloch & Schneider*).

Not uncommon in the market, though much less abundant than *O. mundus*.

The top of head and nape are smooth and without conspicuous pores in *saurus* and there is no membrane connecting the anterior branchiostegal rays of the two sides. Our material shows that no reliable character can be drawn from the comparative size of the lowest suborbital bone and the next above. In *saurus* the lowest suborbital seems constantly narrower than the one above it, but they vary greatly in size, sometimes differing on opposite sides of the same specimen. Larger specimens have proportionately deeper bodies, so this character also must be used with caution.

We have compared our material with specimens from the Atlantic, and can appreciate no difference whatever.

Measurements in Hundredths of Length without Caudal.

Locality .....	Panama								Masatlan, Mex.		Jamaica			Florida	
	200	202	209	212	217	215	232	228	232	113	177	192	202	204	106
Length without caudal in mm.	22	21½	21	22	21½	22	22	22	22	21½	22	23	22	23	22
Head .....	27½	27½	27	27½	27	30½	29½	29½	30	27	26	26½	27	27½	26
Depth .....	4½	4½	4½	4½	4½	4½	5	4½	4½	5	4½	4½	4½	5	5
Eye .....	12	12	12	12½	12	12½	12	11½	12	12½	12	12½	12	12½	13
Maxillary .....	10½	10½	11	11	11	11	10½	10½	11	11	11½	12	11	12	12
Snout to posterior margin of eye	49	49	49	49	49	50	49	49	50	48	49	52	49	51	49
Snout to soft dorsal .....	50	50	49	49	50	50	49½	49	50	48	49	51	50	51½	50
Length of pectoral .....	13½	13½	13	13½	13½	14	14	13½	14½	14	13	13½	13	13½	13½
Length of caudal .....	21	22	22½	22	22	23	23	22	23	21	21	22	22½	22½	.....
Height of dorsal .....	11½	11½	11	12	11½	11½	11	11	11½	13	11½	11½	12	12½	11
Height of anal .....	9½	9½	9½	10	10	10	9	10½	10½	10	9½	9	9½	9½	8½
Number of dorsal rays .....	VI-1, 20	V-1, 20	V-1, 20	IV-1, 20	V-1, 20	VI-1, 20	V-1, 20	IV-1, 20	V-1, 20	V-1, 20	VI-1, 19	V-1, 20	V-1, 20	V-1, 20	IV-1, 20
Number of anal rays .....	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 19	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20	II-1, 20
Gill-rakers above angle of arch.	5	4	4	5	5	5	5	5	5	5	4	4	4	4	5
Gill-rakers below angle of arch.	14	14	14	14	14	14	15	14	14	15	14	14	14	14	15

132. *Oligoplites altus* (Günther).

PLATE XI, FIG. 20.

One specimen taken in the Panama market.

Head  $4\frac{1}{3}$  in length without caudal; depth  $3\frac{1}{4}$ . Eye  $4\frac{1}{2}$  in head; snout  $3\frac{3}{4}$ ; maxillary  $1\frac{2}{3}$ . The interorbital width equals the diameter of the eye. Dorsal V-1, 19; anal II-I, 20.

Body moderately deep, as in specimens of *O. saurus* of equal size; contour very slightly angulated at front of soft dorsal and anal. Mouth large, the maxillary reaching slightly past eye. The bands of teeth on jaws are wider than in either *O. saurus* or *O. mundus*, and differ from them in having the outer row of the lower jaw composed of slender movable teeth which are more or less in contact and project above the other teeth. They are bluntly rounded as viewed from the side, but are laterally compressed to a sharp cutting edge. The width of the mandibular band of teeth anteriorly is about a fourth of the diameter of the eye or one-fourth wider than maxillary near the posterior end. The premaxillary band is somewhat narrower. The patch of vomerine teeth is rounded in front and acutely pointed behind; its length about half the diameter of the eye, its width about two-thirds of its length. The palatine patches are about half as wide as the vomerine patch. Gill-rakers moderately slender, their length about two-thirds eye. Top of head and nape with pores, as in *O. mundus*. Anterior branchiostegal rays connected across isthmus by a thin transparent membrane.

The anterior rays of dorsal are a little longer than those of anal. The last rays of dorsal and anal are produced; those of anal a little longer, barely reaching to the short anterior caudal rays. Pectoral about  $1\frac{2}{3}$  in head; its tip reaching slightly past tips of ventrals. Origin of ventrals nearer front of anal (behind detached spines) than tip of lower jaw by about half eye. Caudal lobes subequal.

Color not unlike *O. mundus*. Back slaty-brownish, lower parts and sides silvery. Top of head to tip of snout dark; tip of mandible black. Pectoral fin dusky on inner face, growing darker or black at base. Dorsal and caudal dusky, median rays of caudal darker at tips. Ventral and anal white.

This species differs from *O. mundus* in having a smaller mouth, a more slender body, and in the character of the teeth in the lower jaw. Dr. G. A. Boulenger has kindly re-examined for us the type of *O. altus* in the British Museum, and informs us that the top of the head is densely beset with pores, and the anterior branchiostegal rays of the two sides are joined by membrane. There can be no question, therefore, as to the correct identification of our specimen.



*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm.....	225
Head.....	23
Depth .....	30
Eye .....	5
Maxillary.....	14
• Snout to posterior margin of eye.....	11½
Snout to soft dorsal.....	49
Snout to first anal ray.....	50
Length of pectoral.....	16
Length of caudal.....	27
Longest dorsal ray.....	12½
Longest anal ray.....	10½
Number of dorsal rays.....	V-I, 19
Number of anal rays.....	II-I, 20
Number of gill-rakers .....	4†10

**133. *Oligoplites refulgens* sp. nov.**

PLATE XI, FIG. 19.

Head  $4\frac{3}{5}$  in body without caudal; depth  $4\frac{4}{7}$ . Eye  $4\frac{1}{4}$  in head; maxillary  $2\frac{1}{4}$ ; snout  $3\frac{1}{2}$ . Inter-orbital width little exceeding diameter of eye. Dorsal V-I, 20; anal II-I, 19.

Body more elongate than in other members of the genus; the ventral and dorsal outlines similar and symmetrical, without angles at origin of dorsal and anal fins.

Head pointed; its greatest width  $2\frac{1}{4}$  in its length; its depth at point of occipital crest a little anterior to edge of opercle,  $1\frac{1}{4}$  in its length. Mouth comparatively small; its outline curved upward anteriorly and downward posteriorly; lower jaw slightly the longer; maxillary scarcely reaching to below middle of eye. Teeth on jaws in narrow bands which are scarcely as wide as exposed portion of maxillary anteriorly. Bands on vomer and palatines wide, that on vomer about  $1\frac{3}{8}$  as long as it is wide, its greatest width in its anterior third or fourth; palatine bands at least twice as wide as those on jaws. Tongue with minutely granular patches.

Head entirely scaleless. Scales on body about as in the most conspicuously scaled examples of *O. saurus*. Top of head and nape smooth as in *O. saurus*, without the conspicuous pores of *O. mundus* and *O. altus*.

Insertion of ventrals about midway between base of first anal spine and the vertical from anterior orbital rim; their tips reaching over half way to second anal spine. Pectoral extending to tips of ventrals. Longest anterior dorsal ray a little longer than longest anal ray. Last ray of dorsal and anal elongate, that of the anal the longer, reaching rudimentary caudal rays. Caudal rather short, the lobes equal; its longest ray  $1\frac{1}{5}$  in head.

Sides bright silvery; top of head and snout nearly black; extreme tip of lower jaw black. Two very dark brown or blackish bands run parallel along the back and upper part of sides; the

lower sharply defined below by the silvery of the sides, passing gradually above into dusky silvery. The upper band is uniform in color and joins its fellow of the opposite side, forming a well defined median band on back as viewed from above. Dorsal spines and anterior part of soft dorsal blackish; anal slightly dusky anteriorly, its spines white. Ventrals white; pectoral dusky on inner face, growing darker towards base. Upper and lower edges of caudal dusky; the upper the darker.

A single specimen, 22 em. in entire length, was taken in the Panama market.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal.....	203
Head.....	21½
Depth.....	22
Eye.....	5
Maxillary.....	9½
Snout to posterior edge of eye.....	11
Snout to soft dorsal.....	49
Snout to anal ..	51
Length of pectoral.....	12½
Length of caudal.....	18
Length of longest anterior dorsal ray....	8½
Length of longest anterior anal ray.....	7
Number of dorsal rays.....	V-1, 20
Number of anal rays .....	II-1, 19
Number of gill-rakers.....	6+17

134. *Oligoplites mundus* Jordan & Starks.

In the Panama market this species is more abundant than any other of the genus.

*O. mundus* resembles *O. altus*, and differs from that division of the genus to which *O. saurus* and *O. refulgens* belong in having the top of its head and nape closely covered with pores, which open into short canals ramifying beneath the skin.

In a large specimen from Mazatlan, about 16 inches in length, these pores and canals are very conspicuous and extend posteriorly in a patch on side of back to a point above the anterior third of the pectoral fin. *O. mundus* and *O. altus* have also the anterior branchiostegals connected across the isthmus by a thin, but tough transparent membrane. The bands of teeth on the jaws are wider, the body is deeper, and the caudal is longer.

*Measurements in Hundredths of Length without Caudal.*

Locality.....	Panama					Algodo- nes Lagoon, Mex.	Mazal- lan, Mex.	
Length without caudal in mm.....	198	210	205	208	174	209	151	385
Head.....	25	25½	26½	26	26	26	25½	24½
Depth.....	35	34	36	35	36½	34	33	35
Eye.....	5	5½	5¼	5	5½	5	5½	4
Maxillary.....	17½	17½	17½	18	18	17½	17	16
Tip of snout to posterior edge of eye.....	11½	11½	12	12	12	12	12	10½
Tip of snout to soft dorsal.....	51	52½	53	53	53	52	51	51
Tip of snout to anal.....	52	53	54½	55	55	52½	52	51
Length of pectoral.....	16½	17½	17	16½	16½	17½	16	16
Length of caudal.....	25	27	28	26½	27	27	25½	24½
Height of dorsal.....	15½	16	16	16	15	16	15	14
Height of anal.....	15	15	15	14	14	15	14	13½
Number of dorsal rays.....	IV-1, 19	IV-1, 20	IV-1, 20	V-1, 19	IV-1, 18	V-1, 20	IV-1, 19	V-1, 20
Number of anal rays.....	II-1, 19	II-1, 20	II-1, 19	II-1, 19	II-1, 18	II-1, 20	II-1, 19	II-1, 20
Number of gill-rakers above angle.....	3	3	4	4	3	4	3	4
Number of gill-rakers below angle.....	10	11	10	10	9	10	10	10

**135. *Trachurops crumenophthalmus* (Bloch).**

Occasionally brought to market, where numerous specimens were collected. It was also observed at Acapulco. We are unable to find any differences between specimens from the Atlantic and the Pacific.

The head varies from  $3\frac{1}{8}$  to  $3\frac{1}{3}$  in length; the depth from  $3\frac{1}{4}$  to  $3\frac{2}{3}$ ; the pectoral from  $3\frac{1}{5}$  to  $3\frac{2}{5}$ . Orbit  $2\frac{5}{8}$  to  $3\frac{1}{6}$  in head; maxillary  $2\frac{1}{4}$  to  $2\frac{2}{3}$ ; ventral 2 to  $2\frac{1}{4}$ . Plates and scales along the entire lateral line vary from 86 to 91.

**136. *Hemicaranx atrimanus* (Jordan & Gilbert).**

Of frequent occurrence in the Panama market, where it appeared sometimes in considerable numbers.

As the original description was taken from a single specimen, we append the following notes giving a wider range of variation.

Head  $3\frac{3}{4}$  to  $4\frac{1}{4}$  in length; depth  $2\frac{1}{3}$  to  $2\frac{3}{4}$ ; length of pectoral  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; chord of curve of lateral line  $3\frac{1}{2}$  to 4; straight part of lateral line  $1\frac{5}{8}$  to 2. Orbit  $3\frac{1}{3}$  to  $4\frac{1}{3}$

in head; maxillary  $3\frac{1}{4}$  to  $3\frac{2}{5}$ ; ventrals  $1\frac{4}{5}$  to  $2\frac{1}{6}$ ; highest dorsal spine 3 to  $3\frac{1}{2}$ ; second dorsal ray  $1\frac{3}{4}$  to 2. Length 23 to 36 cm.

The following color description was taken from a fresh specimen: Back deep blue, with faint traces of cross-bars. Snout and opercles dusky. Cheeks dusky yellow, with coarse brown specks. Lower part of sides silvery, with some dusky shading and without yellow. Caudals and pectorals light lemon-yellow, the caudal narrowly edged with black. Pectorals with a jet-black blotch involving base and axil of fin and basal portion of all except the lowest rays. Dorsal, anal and ventrals orange-yellow, more or less dusky; dorsal inconspicuously margined with black.

137. *Hemicaranx zelotes* Gilbert.

PLATE XII, FIG. 22.

*Hemicaranx zelotes* GILBERT (JORDAN & EVERMANN, 1898, p. 2845).

Closely related to *atrimanus*, with which it agrees in having a large jet-black area on axil and base of pectorals. It differs from *atrimanus* in the following characters: The more rounded profile of snout; the lower spinous dorsal; the longer maxillary; the higher, shorter curve in the lateral line; the wider scutes, which are also fewer in number; the darker coloration of body and fins.

Head 4 to  $4\frac{2}{3}$  in length; depth,  $2\frac{2}{3}$  to  $2\frac{3}{5}$ ; D. VII-1, 26 to 29; A. II-1, 23 to 25; P. 20 to 22. Scutes 51 to 53 (over 60 in *atrimanus*).

Body regularly elliptical, its greatest depth about in the middle of its length, exclusive of caudal peduncle. Head small; anterior profile more decurved, the snout hence blunter than in *atrimanus*; depth of head just behind eye about five-sixths its length. Jaws subequal, the tip of the lower slightly projecting; maxillary narrow, not quite reaching anterior margin of pupil, about  $3\frac{1}{6}$  in head ( $3\frac{1}{3}$  in *atrimanus*). A single series of small, close-set subequal teeth in each jaw; no teeth on vomer, palatines, or tongue. Orbit considerably greater than snout,  $3\frac{1}{3}$  to  $3\frac{4}{7}$  in head. Interorbital width (taken at anterior margin of orbit) slightly less than orbit. Occiput with an evident carina. Distance from snout to first dorsal spine greater than length of pectorals.

Spinous dorsal very low, the highest spine considerably less than orbit (greater than orbit in *atrimanus*). A well developed antrorse spine before the dorsal. Soft dorsal and anal similar, not falcate; the rays decreasing in size from the first; the highest ray of the soft dorsal 2 to  $2\frac{1}{2}$  in head; the highest ray of the anal about  $2\frac{1}{8}$  in head. Dorsal and anal depressible into a sheath of scales, the last 3 or 4 rays uncovered. Caudal fin wide, well forked, the upper lobe the longer, the longest ray not quite one-fourth total length of body. Pectoral fin long, falcate, but much shorter than in *atrimanus*,  $3\frac{1}{8}$  to  $3\frac{5}{7}$  in body ( $2\frac{2}{3}$  to  $2\frac{4}{7}$  in *atrimanus*). Ventrals  $2\frac{2}{3}$  to  $2\frac{3}{5}$  in head. Scales as in *atrimanus*.

Lateral line with a very strong curve anteriorly, the height of the curve  $2\frac{3}{8}$  to  $3\frac{1}{8}$  in its length; its length  $2\frac{1}{8}$  to  $2\frac{1}{4}$  in the straight portion. The entire length of the straight portion is furnished with scutes, which are very small in front and behind. The scutes are considerably wider and lower than in *atrimanus*: the widest about one-half the diameter of orbit (about one-third diameter of orbit in *atrimanus*).

Coloration much as in *atrimanus*, but darker and the fins without yellow. Blackish olive above, dusky silvery below, top of head and snout black. Spinous dorsal black; soft dorsal and anal black, except a narrow light streak at base. Caudal dark, margined with black; pectorals very dark, black on inner face, the extreme lower rays light. A large jet-black blotch covers the base of the pectorals and extends for about one-fifth of the whole length of the fin; the axil is also black.

Four specimens were obtained in the market at Panama; none others were seen.



138. *Hemicaranx furthii* (Steindachner).

Only the types known, from Panama. Probably not distinct from *H. leucurus*.

139. *Hemicaranx leucurus* (Günther).

Only the type known, from Panama.

140. *Caranx vinctus* Jordan & Gilbert.

But few specimens were seen, four of these preserved. They agree well with the description of the type. The measurement of the eye in the original description is evidently of the entire orbit. Between the adipose eyelids, the eye is 5 to 5½ in head.

141. *Caranx hippos* (Linnaeus).

We have compared seven specimens from Panama and Mazatlan with five specimens from Jamaica and Cuba. The Pacific examples seem to differ slightly in having an average larger number of gill-rakers and more plates in the straight part of the lateral line. In five of the seven Pacific specimens, the ventrals end considerably in advance of the vent; in one specimen they reach the vent, and in one they extend beyond it. The Atlantic specimens all have the ventrals reaching to or a little past the vent. The Panama specimens are all a little more slender than the Atlantic or Mazatlan specimens. It is not probable that these differences have any importance for classification.

Measurements in Hundredths of Length without Caudal.

Locality .....	Panama					Mazatlan, Mex.		Jamaica				Cuba
Length in mm. without caudal .....	252	204	260	261	254	185	177	200	200	193	172	228
Depth at base of ventrals .....	32	34	30½	32½	31	36½	36	35½	36	36	35	38
Distance from base of ventrals to 1st detached anal spine.....	20½	21½	21½	22	21	21½	19	20½	21	20½	20	20½
Distance from vent to base of ven- tral fins.....	14½	16½	16	16½	15	15	14	14	14½	14	13½	13½
	Ventrals reach vent.					Ventrals end a little before vent.		Ventrals cover vent.		Ventrals reach to or a little past vent.		

Table of gill-rakers and plates of straight part of lateral line.

Locality.....	Panama					Mazatlan		Jamaica				Cuba
	16+2	16+2	16+1	16+2	15+2	16+1	16+1	14+2	15+2	14+2	15+2	
*Gill-rakers .....	16+2	16+2	16+1	16+2	15+2	16+1	16+1	14+2	15+2	14+2	15+2	14+2
Plates .....	39	42	41	37	38	39	38	33	35	36	32	36

142. *Caranx caballus* (Günther).

Frequently appearing in considerable numbers; seven specimens preserved. These, in addition to three specimens from Mazatlan, have been compared with four specimens of *C. crysos* from the Atlantic (two from Jamaica; one from Woods Hole, Mass.; one from Florida).

*C. caballus* seems to be more slender, the depth varying from  $3\frac{1}{4}$  to  $3\frac{1}{3}$  ( $3$  to  $3\frac{1}{8}$  in *C. crysos*). The former has two or three of the plates on the caudal peduncle lengthened antero-posteriorly. Counting from a point opposite the base of the last dorsal ray to opposite the beginning of the short outer rays of the caudal, they number four or five in *C. caballus*, and seven or eight in *C. crysos*.

The two species do not differ in length of the pectoral or in the number of plates in the straight part of the lateral line, as has been alleged. In both, the pectoral varies from  $2\frac{3}{4}$  to  $3\frac{1}{8}$  in the length, and the plates from 47 to 50.

143. *Caranx marginatus* Gill.

Common in the Panama market. We supplement the description given by Jordan and Evermann (1896, p. 922) as follows:

Head from  $3\frac{1}{7}$  to  $3\frac{1}{4}$  in length; depth  $2\frac{3}{4}$  to 3. Dorsal in four specimens VIII-I, 21; in two specimens VIII-I, 20. Anal in four specimens II-I, 16; in two specimens II-I, 17. Eye (iris) 4 to  $4\frac{1}{3}$  in head; maxillary 3 to  $3\frac{1}{5}$ , reaching to below posterior border of pupil. The gill-rakers number 4 or 5 + 14 or 15. Pectoral  $2\frac{5}{8}$  to 3 in body. Arch of lateral line  $1\frac{2}{5}$  to  $1\frac{3}{5}$  in its straight portion. Plates in straight part of lateral line in two specimens 30, in three specimens 31, in one specimen 32.

We have specimens in the collection of Stanford University from Mazatlan, Socorro Island and the Galapagos Islands, which agree with our Panama specimens in all respects.

Doubtless all of the records of the occurrence of *C. latus* in the Pacific are referable to either *C. marginatus* or *C. medusicola*. *C. marginatus* differs from *C. medusicola* and *C. latus* in having a slenderer form, and fewer plates in the lateral line.

We have re-examined the two type specimens of *C. medusicola* from Mazatlan, and also several specimens from Clarion Island. None of them exceed 7 inches in length. From *C. latus* of the same size (of which we have specimens from Key West, St. Lucia and Bahia, Brazil), *C. medusicola* differs in the following respects:

\* Gill-rakers given for lower arch only; the rudiments enumerated separately in each case.

The maxillary is shorter,  $2\frac{2}{5}$  to  $2\frac{1}{2}$  in head (2 to  $2\frac{1}{5}$  in *C. latus*). The preorbital is wider, in the narrowest part two-thirds the diameter of the eye (half eye in *C. latus*). The snout is longer, from  $2\frac{9}{10}$  to 3 in head ( $3\frac{2}{5}$  to  $3\frac{3}{5}$  in *C. latus*). The gill-rakers are more numerous, 4 + 17 or 18 (4 + 14 or 15 in *C. latus*). It has 1 or 2 more soft rays in the dorsal and anal, 22 or 23 dorsal rays, 18 anal rays (20 or 21 dorsal rays, and 16 or 17 anal rays in *C. latus*). One of the Mazatlan specimens is deeper than any specimen we have seen of *C. latus*, the others are of the same depth.

The figure of *C. medusicola* given by Jordan (1895*b*, plate 34), shows the characters of this species very well, except that the preorbital is not wide enough. In the original description, the number of the dorsal spines, gill-rakers, and lateral plates is wrongly given. The first dorsal has 8 spines, the plates to the bend in the lateral line number from 36 to 38.

*Measurements in Hundredths of Length without Caudal.*

Species.....	C. MEDUSICOLA				C. LATUS		
	<i>Mazatlan</i> (TYPES.)		<i>Clarion</i> <i>Island</i>		<i>Bahia,</i> <i>Brazil</i>	<i>Key West,</i> <i>Florida</i>	
Length without caudal in mm.....	98	123	133	139	103	111	108
Head.....	31½	30½	32	32½	33	32½	32
Depth.....	46½	42½	40	42½	43	43	43
Snout.....	10½	10½	11	11½	9	9	9
Least width of preorbital.....	4	4	4½	4½	3	3	3
Maxillary.....	12½	12	13	12½	15	15	15½
Eye.....	8	7½	7½	7½	8	8	8
Chord of curve of lateral line.....	30	30	30	30	28	30	30
Straight part of lateral line.....	41½	41½	42	42	45	43	45
Number of soft dorsal rays.....	22	22	22	23	21	20	21
Number of anal rays.....	18	18	18	18	17	16	17
Plates in straight part of lateral line.....	36	36	37	38	37	36	35

144. *Gnathanodon speciosus* (Forskåt).

Appearing infrequently; on two occasions many large ones were brought to market. Our five specimens all have 19 rays in the dorsal and 16 in the anal.

145. *Citula dorsalis* (Gill).

Frequently brought to market. We preserved seven specimens from 24 to 36 cm. in length. To the description given by Jordan and Evermann (1896, p. 930), we make the following additions and corrections, based upon our material.

Depth from  $1\frac{4}{5}$  to 2 in length. Eye  $4\frac{1}{3}$  to  $4\frac{2}{3}$  in head; snout  $2\frac{3}{4}$  to 3. Pectoral one-fourth to one-fifth longer than head. Ventrals reaching well past vent, about half the distance from their insertion to the third anal spine. Length of gill-rakers a little over half diameter of eye, their number  $6 + 16$ . In three specimens the dorsal rays number 19 and the anal 17; in three the dorsal is 18 and the anal 16, and in one the dorsal is 19 and the anal 16. Scales in the straight part of lateral line 48 (not 58).

146. *Alectis ciliaris* (Bloch).

But few of this species were seen. We have compared our material with a single specimen from Jamaica and can appreciate no differences.

147. *Vomer setipinnis* (Mitchill).

Brought into the market almost daily, sometimes in large numbers. We preserved nine adult specimens and several young; the latter were taken in the tide-pools.

We have compared our adult specimens with three specimens from Beaufort, N. C., and a single large specimen from Jamaica. From the former, ours differ in the following respects: The body is more slender, the declivity of the anterior profile is less steep, the space between the eye and the angle of profile above eye is shorter, the bases of the anal and soft dorsal are shorter, and the scutes on the caudal peduncle are larger. They differ from the Jamaica specimen only in having larger scutes. We have compared the young with specimens of the same size from Galveston and find them similar. The specimens from Beaufort seem to occupy a position between the Panama specimens and *V. spixii*.

Our material from the Atlantic is so meagre that we are unable to decide whether the species from the Pacific is distinct or not.



## Measurements in Hundredths of Length without Caudal.

Locality .....	Beaufort, N. C.				Jamaica		Panama					Galveston	
Length without caudal in mm.....	150	164	138	248	159	225	204	172	204	63	66	65	66
Head.....	33	33	33½	33	34½	32	34	33½	32½	39	38	38	38
Depth.....	55	57	58	51½	50½	50	48½	52	51	68	63	66	65
Maxillary .....	13	13	13	13½	13½	13	13	13	13	14	13	14	14
Eye.....	8	7½	7½	8	8	7	7	8	7½	9½	9	10	9½
Eye to middle of upper curve of head	16½	16	17	13½	13	13	12½	13	12½	18	17	19	19
Eye to anterior tip of maxillary...	15	15½	15½	14	14½	13½	13	14	13½	18	17	20	18
Least distance from eye to anterior profile .....	6½	6½	7	6½	7	7	7	7	6½	7½	7	7½	7
Eye to opercular angle .....	11½	12	11½	12½	13	12½	13	12½	12½	13½	12	11	12
Straight part of lateral line from base of middle caudal rays.....	40	41	41	41	39	41½	42	40½	43	40	38	37	37
Chord of curve of lateral line.....	34½	31	33	33	32	32	30	31	31	29	28	32	33
Length of soft dorsal base.....	45	46	46	44½	42½	44½	43	44	44	46	45	45	46
Length of anal base.....	53	54	52	48	48	48	48	48	48	55	52	54	53
Length of pectoral.....	34	35	37	34	38½	37	38	40	38	37	36	35	34
Length of caudal .....	Broken.	.....	.....	29	29	28	29	30	28	30	28	32	30

148. *Selene ørstedii* Lütken.

Common; brought into the market almost daily with *S. vomer*. It may be at once distinguished from all other members of the genus by the occipital region being scarcely angulated, and by the comparatively large ventral fins.

The following description is from a specimen 31 cm. in length.

Head  $2\frac{2}{3}$  in length; depth  $1\frac{2}{3}$ . Eye 4 in head; snout 2; maxillary  $3\frac{1}{2}$ . Dorsal VI, I, 18; anal II, I, 15. The profile of snout is less nearly vertical than that of head in front of eye, with which it forms a slight angle just below the level of the eye. In smaller examples the angle is less noticeable. The upper profile forms a broad even curve from just above eye to spinous dorsal. The outline of the body is angulated at front of soft dorsal and anal.

Teeth small, blunt, and not much crowded, in bands on jaws and palatines, in a quadrangular patch on vomer. Preorbital space contained 3 times in postorbital space. Gill-rakers contained  $2\frac{1}{2}$  times in diameter of eye; their number 4+14.

The pectoral reaches to above eleventh or twelfth anal ray, or to within twice the diameter of the eye of the base of the middle caudal rays. The ventrals reach to the first detached anal spine; in specimens 21 cm. in length, they reach to the first anal ray; in specimens 11 cm. long, they reach to the caudal rays and are about half the length of the entire body. Anterior dorsal and anal rays filamentous. Second dorsal spine as long as the maxillary, reaching when fin is depressed, two-thirds the distance between its base and the front of the soft dorsal. In a specimen 11 cm. in length it is longer than the head by a distance equal to the diameter of the eye.

Color silvery with bluish reflections above. Spinous dorsal and front of soft dorsal dusky; other fins colorless. In specimens 21 cm. in length or less, the distal half or more than half of the ventrals is black.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm....	243	150	160	86
Head.....	37	37	39	42
Depth.....	60	66	68	73
Eye.....	9½	9	9	10
Snout .....	19	20	20½	22
Length of pectoral .....	46	47	46	43
Length of ventrals.....	11½	20	17	60
Length of caudal.....	36	38	40	37
Length of dorsal base.....	45	48	47	45
Length of anal base.....	43	43	44	45
Number of dorsal rays .....	VI-1, 18	VII-1, 17	VII-1, 18	
Number of anal rays.....	II-1, 15	II-1, 15	II-1, 15	II-1, 15

149. *Selene vomer* (Linnaeus).

Common at Panama. We have compared our specimens with others from Florida and Jamaica, and find only individual differences.

150. *Chloroscombrus orqueta* Jordan & Gilbert.

Frequently taken in abundance. We have compared our specimens with the original description (Jordan & Gilbert, 1882, *o*, p. 646) and with specimens of *C. chrysurus*.

The depth is very variable; in our most slender specimens the depth is  $2\frac{2}{3}$  in the length, while in the deepest specimen (of the same length) it is  $2\frac{1}{3}$ . Between these extremes are all intermediate shapes.

151. *Trachinotus rhodopus* Gill.

Not abundant; eight specimens preserved, from 15 to 36 cm. in length.

We have compared them with a single specimen of *T. glaucus* from Key West. In addition to the less vertical snout noted by Dr. Gill, they differ in having much longer, slenderer, and more numerous gill-rakers. The scales appear to be smaller, and the dorsal and anal are probably slightly longer.

The dorsal formula in seven specimens is VI, I, 20, in one specimen VI, I, 19; the anal in three specimens III, 19, in five specimens III, 18. The gill-rakers are long and slender, and do not greatly taper in size from their base to their tips.

They number 14 or 15 on the lower limb of the arch, and in length are from three-fifths to two-thirds the diameter of the eye.

The character of width or position of the cross-bars is without value. In one of our small specimens, the second bar on one side occurs directly midway between the first and second bars on the reverse side, while the third bar is only a little behind the second bar of the reversed side. The first two bars are not always nearer together than the others, as described by Jordan and Evermann. The bars are not so conspicuous in our small specimens as in the large ones, but they are evident.

In our specimens of *T. glaucus*, the dorsal formula is V, I, 19, the anal III, 17. The gill-rakers are short and thick at the base and taper rapidly to a point. They number 9 on the lower part of the arch, and in length are but one-third the diameter of the eye.

*Measurements in Hundredths of Length without Caudal.*

Species .....	TRACHINOTUS RHODOPUS			TRACHINOTUS GLAUCUS
	<i>Panama</i>			<i>Key West</i>
Length without caudal in mm.....	227	221	232	226
Head .....	27	26½	27	26½
Greatest depth at angle of dorsal.....	51	54	49	53
Eye .....	6½	6½	6½	6½
Snout.....	6½	7	7	6½
Maxillary.....	9½	10	9½	9
Interorbital (bone).....	9	9½	9½	9½
Pectoral fin .....	23	24	23	21½
Ventral fin.....	10	10½	11½	11½
Upper caudal lobe .....	50	53	51	Broken
Length of gill-rakers .....	3½	4	4	2¾
Height of caudal peduncle .....	8½	8½	9	9
Number of dorsal spines.....	VI, 1	VI, 1	VI, 1	V, 1
Number of dorsal rays .....	20	20	20	19
Number of anal spines and rays.....	III, 18	III, 19	III, 19	III, 17
Number of gill-rakers on lower limb of arch .....	15	15	14	9

152. *Trachinotus culveri* Jordan & Starks.

A single specimen was taken in the market.

This species seems to differ from *T. falcatus* in having a slightly shorter dorsal and anal. Our Panama specimen and the type and co-type from Mazatlan have the following fin counts: Dorsal VI, I, 18; VI, I, 18; VI, I, 17; anal III, 16; III, 17; III, 16. In twelve specimens of *T. falcatus*, three have 20 soft rays in the dorsal, nine have 19; in the anal, nine specimens have 18 soft rays, three have 17. As the largest specimen of *falcatus* in our possession is but 8 cm. in length, other comparisons are unsatisfactory.

*T. culveri* differs from *T. kennedyi* in having a deeper, more angulated body and in having the mouth more oblique. The anterior end of the premaxillary is on a level with a point a little above the lower rim of the orbit in *T. culveri*, while it is slightly below the orbit in *T. kennedyi*.

153. *Trachinotus kennedyi* Steindachner.

Frequently brought to market but never in large numbers. Six specimens were preserved, 28 to 31 cm. in length.

They are smaller than the specimens from which Dr. Steindachner wrote his excellent description, and differ slightly as follows: Head  $3\frac{1}{8}$  to  $3\frac{1}{2}$  in length; depth  $1\frac{3}{4}$  to  $1\frac{4}{5}$ . Eye 4 to  $4\frac{2}{3}$  in head; interorbital width  $2\frac{1}{2}$ . The maxillary reaches to below the middle of the eye or only slightly beyond that point.

154. *Trachinotus paloma* Jordan & Starks.

One adult specimen taken, 31 cm. in length. We have in addition a large specimen from Magdalena Bay and several small ones (including the types), from 5 to 10 cm. in length, from Mazatlan and San Juan Lagoon, Mexico. For comparison we have a single large specimen and two smaller ones of *T. carolinus* from the Atlantic.

*T. paloma* differs from *T. carolinus* in having a smaller eye,  $5\frac{2}{3}$  to  $5\frac{1}{2}$  in head in adult,  $3\frac{4}{5}$  to  $4\frac{1}{5}$  in young ( $4\frac{4}{5}$  in *carolinus* in adult, 3 to  $3\frac{1}{2}$  in young). The gill-rakers are longer, their length contained 6 times in the postorbital part of the head in the adult (10 times in the adult of *carolinus*). They number the same in the two species, 4 + 9 or 10. The snout is longer,  $3\frac{1}{2}$  in head (4 in head in *carolinus*), and the maxillary is shorter, 3 in head ( $2\frac{3}{4}$  in *carolinus*). The anal lobe seems to be shorter,  $1\frac{1}{4}$  in head,  $1\frac{4}{5}$  in anal base (in *carolinus* it equals head and is  $1\frac{1}{2}$  in base of anal). We find little difference in size of head between the two species, though such was alleged to exist in the original description of *T. paloma*.

155. *Nomeus gronovii* (Gmelin).

Recorded from Panama by Dr. Eigenmann (1894, p. 629), who states that they were taken in "rocky pools at Panama." It has not been taken by other observers.



156. *Peprilus palometa* (Jordan & Bollman).

This species was frequently brought to the Panama market. As the type of the species was only 7 cm. in length, we supplement the original description by the following taken from specimens 19 to 23 cm. in entire length.

Head  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in length without caudal; depth  $1\frac{7}{10}$  to  $1\frac{9}{10}$ . Eye  $4\frac{1}{3}$  to  $4\frac{2}{3}$  in head; maxillary  $3\frac{1}{2}$ ; dorsal III, 44 to 46; anal III, 41 to 43. Lateral line 100. Gill-rakers 5 + 16 or 17.

Body compressed and deep, the dorsal and ventral outlines similar in contour behind the head. Dorsal profile of head more convex than ventral; the snout blunt. Mouth small and oblique, the maxillary barely reaching past the anterior orbital rim. Teeth in a single row on jaws; none evident on vomer or palatines. Gill-rakers about half as long as the diameter of the eye.

A few scales present on head under and behind the eye, and a few at upper end of opercle; head otherwise naked. Scales on body smooth, crowded, and loosely attached; those of lateral line more firmly attached. Dorsal, anal, and caudal fins covered with fine crowded scales.

In the co-types, with which we have compared our specimens, no lobes are evident on the dorsal and anal fins. In the adult specimens, the lobes are well developed, though variable in length; they are generally longer in the larger specimens. The spines of dorsal and anal are scaled over, as are the rays. Anal lobe much longer than that of dorsal, often reaching to below the tips of the last anal rays, or to base of caudal fin. Dorsal lobe sometimes extending to opposite tip of pectoral, sometimes reaching further back. Dorsal and anal rays behind the lobes of about equal height, generally a little higher than the diameter of eye, though often less than that in the smaller specimens. Tip of pectoral generally reaching to half way between its base and tips of middle caudal rays. Pelvic bones ending as a short sharp spine. Upper lobe of caudal the longer, sometimes filamentous.

Color bluish brown on back, silvery on lower parts of body. Top of head and snout colored like the back. Opercle with dusky brown areas. Dorsal, anal and caudal variously dusky. Pectoral dusky behind base; the rays sparsely covered towards their ends with rather large brown dots.

*Measurements in Hundredths of Length without Caudal.*

	Co-types Panama Bay					Panama Market									
	50	57	58	132	135	136	136	156	168	168	168	170	174	175	
Length without caudal in mm.....															
Head .....	36	37	37	32	30½	31	29½	29	29½	27½	28½	29	29		
Depth.....	48	50	50	54	52	53	56	56	56	51	53	53	53	56½	
Eye .....	10½	10½	10½	7½	7½	7½	6¾	6¾	6½	6½	6¼	6¼	6¼	6½	
Snout .....	8	7½	7½	7½	7½	7½	7	7	7	7¼	7	7	7	6¾	
Maxillary .....	11	11	11	9	8½	9	8	8	8	8	8	8	8	8	
Dorsal lobe from base of third ray.....	Broken	.....	.....	29	35	31	Broken	30	35	35	32	29	Broken	Broken	
Anal lobe from base of third ray.....	No lobes are evident	.....	.....	46	52	43	49	53	60	60	51	Broken	Broken	58	
Length of pectoral .....	33	31	Broken	39½	41½	43	43	43	40	40	40½	39	42	42	
Upper lobe of caudal .....	Caudal broken	.....	.....	40	48	45	Broken	39	59	59	48	42	45	45	
Scales in lateral line* .....	100	98	98	95	100	101	98	100	95	95	100	99	97	97	
Number of dorsal rays.....	III, 45	III, 46	III, 44	III, 46	III, 45	III, 44	III, 45	III, 46	III, 45	III, 44	III, 46	III, 45	III, 45	III, 45	
Number of anal rays .....	III, 43	III, 43	III, 43	III, 42	III, 43	III, 42	III, 42	III, 42	III, 41	III, 42	III, 42	III, 41	III, 41	III, 42	
Gill-rakers .....	5+16	5+17	5+16	5+16	5+16	5+16	5+16	5+16	5+17	5+17	5+15	5+16	5+16	5+15	

\* Scale counts cannot be very accurate, as many of the specimens have scales missing.

157. *Peprilus snyderi* sp. nov.

PLATE XII, FIG. 23.

Head  $3\frac{1}{2}$  in length without caudal; depth  $2\frac{3}{8}$ . Eye  $5\frac{3}{8}$  in head; snout  $3\frac{1}{4}$ ; maxillary  $3\frac{3}{4}$ . Scales 110. Dorsal III, 45; anal III, 43. Gill-rakers 5 + 16.

Dorsal and ventral outlines of body similar, the body not greatly compressed, more elongate than in any other American species. Snout blunt. The occipital crest forms a sharp ridge on top of head. Mouth rather small, the maxillary barely reaching to the vertical from anterior edge of eye; jaws subequal. Teeth small and close-set in a single even series, those of lower jaw fitting inside those of upper jaw when mouth is closed. Gill-rakers moderately slender, half as long as the diameter of the eye, their number 4 or 5 + 14 to 16. Top of head with a network of sensory canals ramifying over it, the most conspicuous branch vein-like above anterior part of eye. Branching canals also extend more or less over the scales of back above lateral line, sometimes reaching nearly to dorsal spines.

Head entirely scaleless except the cheeks and upper part of opercles. Dorsal, anal and caudal with very small, crowded scales, extending nearly to the ends of the rays. Pectoral scaleless. Body completely invested with rather loosely attached scales.

Dorsal and anal fins with moderate lobes, that of anal slightly longer than that of dorsal, about equal to the length of head without snout. Base of anal a little shorter than that of dorsal. Tip of pectoral nearly reaching to the vertical above notch behind anal lobe, its length greater than that of the head by the diameter of the eye. Pelvic girdle ending as a small sharp spine. Caudal longer than pectoral by nearly half eye.

Color bluish brown on back, changing to a warm Vandyke brown on naked parts of head. Caudal a rich dark brown similar to that of head. Pectoral brown at base, toward end of rays dusky, with dark points. Other fins dusky. One specimen is more silvery than the others, and may represent more nearly the original coloration. Top of head brown. Caudal, dorsal and anal slightly dusky.

The type is 255 mm. in entire length. The species came to market on but two days of our visit of six weeks. Seven specimens in all were seen and preserved.

The species is named for our friend and associate, Professor John O. Snyder, who has helped us materially in the preparation of this report.

*Measurements in Hundredths of Length without Caudal.*

	Type						
Length without caudal in mm.....	200	215	211	187	180	187	192
Head .....	28½	28	27	28	29	28	28½
Depth .....	37	38	37½	39	41	37½	39
Eye .....	5½	5½	5½	5½	5½	5½	5½
Snout .....	7½	7½	7½	8	8	7½	7½
Maxillary .....	8	7½	8	8½	8½	8	8½
Longest dorsal rays .....	19½	19½	19	22	21½	20	22
Longest anal rays .....	20	21	20	24	23	21	23
Length of pectoral.....	32	32	31	33	32½	32	33
Length of caudal.....	34	34	33	36	34	35	35
Number of scales.....	107	112	106	.....	111	108	109
Number of dorsal rays .....	III, 45	III, 45	III, 43	III, 44	III, 44	III, 45	III, 44
Number of anal rays.....	III, 43	III, 42	III, 43	III, 42	III, 42	III, 43	III, 42
Number of gill-rakers.....	5+16	4+14	4+16	4+16	4+14	4+15	4+14

**158. *Peprilus medius* (Peters).**

The Panama record of this species (Jordan, 1885, p. 375) needs verification. The specimens obtained may have belonged to one of the forms above recorded, both of which were at that time unknown. Only the type of *P. medius* is now extant.

## Family CHEILODIPTERIDÆ.

**159. *Apogon dovii* Günther.**

Abundant about the rocky islands in Panama Bay.

The species varies in color from light to dark red, with much or little black pigment. The caudal may be translucent or blackish, the soft dorsal is translucent, or may be tipped with black, or may be largely black with only the posterior rays whitish. The anal and ventral fins may also be translucent, or with the terminal portions more or less largely black. Young specimens are marked with a very conspicuous round or elliptical black spot on the end of the caudal peduncle, and a rather poorly-defined dusky streak around the snout and across the opercle. The streak wholly disappears and the caudal spot becomes very faint and diffuse with age.



There seem to be no differences, save those of color, between *A. dovii* and *A. retrosella*. The fin-rays, general proportions, and squamation seem alike in the two. The fin-formula is: dorsal VI-I, 9; anal II, 8. The lateral line traverses 24 or 25 large scales to the base of the caudal fin, and 5 or 6 scales of reduced size on the fin itself. Between the lateral line and the base of the spinous dorsal are  $2\frac{1}{2}$  rows of scales (as in *retrosella*). In *A. atricaudus* there are  $4\frac{1}{2}$  or  $5\frac{1}{2}$  rows, in *A. atridorsalis*  $3\frac{1}{2}$  rows between the lateral line and the spinous dorsal.

*Measurements in Hundredths of Length without Caudal.*

Species .....	APOGON DOVII			A. RETROSELLA	
	Panama			Mazatlan, Mex.	San Benito Id., Mex.
Length without caudal in mm.....	70	62	60	76	55
Head.....	40	41	40	40	42
Depth .....	35	$34\frac{1}{2}$	34	34	34
Eye ... ..	12	13	$12\frac{1}{2}$	13	12
Interorbital (bone) .....	9	9	$8\frac{1}{2}$	$8\frac{1}{2}$	9
Snout .....	10	10	$9\frac{1}{2}$	9	9
Maxillary .....	21	21	$20\frac{1}{2}$	21	21
Third dorsal spine .....	$15\frac{1}{2}$	$15\frac{1}{2}$	17	17	17
Second dorsal ray .....	22	23	24	25	24
Second anal spine .....	$9\frac{1}{2}$	10	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$
Second anal ray .....	21	20	20	21	21
Pectoral .....	24	24	25	25	24
Ventral .....	20	19	$20\frac{1}{2}$	22	20
Caudal .....	29	29	28	28	29

Family CENTROPOMIDÆ.

160. *Centropomus undecimalis* (Bloch).

Frequently found in the Panama market.

We are unable to follow Dr. Jordan (1895 *b*, p. 452) in recognizing the Pacific form as a distinct species (*C. viridis*). The separation is based on the supposed greater length of the appendages to the air-bladder in *viridis*, and the shorter second anal spine. We find, however, that the third anal spine projects beyond the second in Atlantic specimens as well as in those from the Pacific, and there seems to be no

difference between them in this respect. The appendages to the air-bladder vary widely in length, from a trifle less than the diameter of the eye to twice the diameter, in our Panama specimens. In the few individuals we have been able to examine from the Atlantic (Havana and Jamaica), the appendages vary from  $1\frac{1}{5}$  to  $1\frac{1}{2}$  times the orbital diameter. It is highly improbable, therefore, that this character possesses any significance.

161. *Centropomus nigrescens* Günther.

Only a few small specimens seen.

162. *Centropomus pedimacula* Poey.

Very abundant at Panama.

We have had for comparison a single specimen from the Atlantic, which shows a slightly longer anal spine and a slightly wider interorbital space than any of our Pacific examples. In all other characters there seems to be perfect agreement with our Panama specimens. We believe that the slight differences found are well within the range of variation of the species, and shall therefore not recognize *Centropomus medius* (the Pacific form) as distinct in any degree. A full series from the Atlantic may eventually prove, however, that these characters have a higher value than we have assigned to them, and necessitate specific separation of the two forms.

*C. grandoculatus* is certainly not separable from *C. medius* (= *pedimacula*). The scale-counts of different authors vary widely in this group, as some have included a number of the scales overlying the base of the caudal fin, and others cease the enumeration at a point corresponding to the base of the median rays. In this paper we have adopted the latter course, and find very uniformly 47 or 48 tubes in specimens from Mazatlan, Panama and Havana, including those from the San Juan Lagoon, Mexico, upon which is based the description of *grandoculatus* given by Jordan and Evermann. The first dorsal fin contains uniformly 8 spines, as in all other species of the genus. The describers of *grandoculatus* seem to have neglected the first spine, which is very short and often concealed by the scales. Other characters assigned to *grandoculatus*, such as the form of the body and the size of the eye, have no significance. The amount of black on the ventral fins is also subject to wide variation, and has no distinctive value. In young specimens, the black is usually very distinct, but in adults it grows fainter and often disappears.

163. *Centropomus unionensis* Bocourt.

PLATE XIII, FIG. 27.

Abundant in Panama Bay.

The species is closely related to *armatus* and *robalito*, but has shorter anal spines and weaker ridges and spines on head than in either species. It agrees with *robalito* in the slender, flexible dorsal spines, the second one of which is very short, in the anterior position of the vent and in the pale lateral line; with *armatus* in the small number of gill-rakers, and the increased number of scales in a vertical series above the lateral line. The second anal spine scarcely extends beyond the tip of the longest

anal ray, and extends beyond the third anal spine a distance less than half the diameter of the pupil. The interspinous membrane is not dusky. The dorsal spines are slenderer even than in *robalito*; the third is not heavier than the fourth, and is usually shortened a little, giving a rounded contour to the fin, which is sometimes, however, sharply angular. The second dorsal spine is very short, varying from one-fourth to one-sixth the length of the third. The distance from the vent to the base of the first anal spine equals that between the tip of the snout and some point between the hinder margin of the pupil and the hinder margin of the orbit. The preorbital and the horizontal and vertical limbs of the preopercle are very weakly spinous, the spines being scarcely perceptible in some specimens. There are 2 stronger spines, as usual, at the preopercular angle. The ridges on top of head are low and narrow; the median pair are most widely separated at a point over the middle of the occiput. There are 5 or 6 developed gill-rakers on the vertical limb of the outer arch, 11 or 12 on the horizontal limb, besides 2 or 3 rudiments on each. There are 47 or 48 scales in the lateral line in advance of the base of the caudal, and  $7\frac{1}{2}$  in a vertical series between the middle of the soft dorsal and the lateral line. The lateral line is uniformly pale.

*Measurements in Hundredths of Length without Caudal.*

Length in mm. without projecting lower jaw or caudal...	254	251	244	255	239	250
Head without lower jaw.....	41	40	39½			
Depth .....	28	28	28			
Eye.....	5¼	5	5			
Interorbital (bone only).....	5¾	6	5½			
Maxillary .....	14	13½	14			
Third dorsal spine .....	17½	17½	18			
Fourth dorsal spine.....	17	17½	17½			
Fifth dorsal spine.....	14½	14½	14			
Second anal spine .....	18½	19	18			
First anal ray .....	15½	16	16			
Second dorsal ray .....	broken	15½	15			
Pectoral .....	23½	24½	23½			
Ventral.....	21½	21	21½			
Caudal .....	broken	about	24			
Caudal peduncle (height).....	11½	12	11			
Vent from front of anal .....	16	14½	15	14½	15½	14½
Distance from anal to base of ventral spine.....	38	38½	39			
Longest gill-rakers .....	4	3½	4			

164. *Centropomus armatus* Gill.

PLATE XIII, FIG. 26.

Abundant in Panama Bay; distinguishable at sight by the excessively developed second anal spine with the black interspinous membrane, and by the strong, inflexible dorsal spines.

The species is placed by Boulenger (1895, p. 370), in the synonymy of *C. ensiferus*, but this is wholly inadmissible, as has been pointed out by Jordan and Evermann (1896, p. 1123).

*C. ensiferus* agrees with *armatus* in the strongly spinous bones of the head, and in its greatly developed second anal spine and black membrane; but it differs conspicuously in the slender, flexible dorsal spines, and in the course of the cranial ridges and the shape of the included areas. In the three specimens of *ensiferus* before us from the Atlantic, there are but 5 or 6 scales in a vertical series between lateral line and middle of second dorsal fin. The gill-rakers in these specimens are as follows: 9+17, with 3 additional rudiments on each limb; 9+17 with 4 rudiments above, 5 below; 8+16, with 4 rudiments on each limb. The distance from the middle of the vent to the base of the first anal spine equals, or a little exceeds, that from tip of snout to hinder edge of pupil. The second anal spine extends to opposite the edge of the scaly area on base of caudal, and is contained  $3\frac{9}{10}$  to  $3\frac{5}{8}$  times in the length. The character and direction of the ridges on top of head are very characteristic, and are well shown by the accompanying figure (Pl. XIII, fig. 24).

In *C. armatus*, the second anal spine is longer than in any other Pacific species, to be compared in this respect with *C. ensiferus* only. The fifteen specimens secured by us vary little in the length of this spine, which extends, when depressed, to opposite the base of the caudal in young specimens, well beyond that point in adults. The third anal spine usually exceeds slightly the longest soft ray. The membrane between the second and third anal spines is jet-black in the young, and is usually blackish in varying degree in adults. In none of our specimens has the pigment entirely disappeared, but it is not improbable that it occasionally does so. The dorsal spines are much stronger than in any other known species, and are wholly constant in this regard. The third spine is the strongest, and is inflexible; it is but little longer than the fourth, which projects beyond a line joining the third and fifth, giving a rounded contour to the fin. There is considerable variation in the height of the spines, the fourth spine, when depressed, reaching occasionally to or beyond the origin of the second dorsal, but usually falling short. The second spine is proportionally long,  $2\frac{1}{2}$  to  $3\frac{1}{4}$  in the third spine. The dorsal formula is VIII-I, 10 (11 articulated rays in one specimen); the anal III, 6. The vent is posteriorly placed, the distance from its center to the base of the first anal spine about equaling the distance from the tip of the snout to the middle of the eye. The preorbital has 5 to 7 strong retrorse spines; an equal number of still stronger spines are in the "humeral" process; preopercular spines much larger than in *robalito* or *unionensis*.

The median pair of ridges on top of head are very strong. From the middle of the occiput they diverge a little, both anteriorly and posteriorly, and are separated



at their posterior ends by a distance equaling the diameter of the pupil; anteriorly they converge, meeting at a point opposite the front of the eye.

The gill-rakers are long and slender, the longest two-thirds to five-sevenths the diameter of the eye, there being 5 or 6 movable ones on the vertical limb, and 11 or 12 on the horizontal limb, besides 2 or 3 immovable rudiments on each limb. There are 51 or 52 tube-bearing scales in the course of the lateral line, corresponding in number with the approximately vertical series along the back. Each vertical row under the middle of the second dorsal fin contains  $7\frac{1}{2}$  or  $8\frac{1}{2}$  scales in the fifteen specimens examined. The lateral line is pale, but is accompanied above and below by short stitch-like lines of black pigment, one pair for each scale.

*Measurements in Hundredths of Length without Caudal.*

Length in mm. from tip of snout to caudal base..	207	222	230
Head without lower jaw .....	$39\frac{1}{2}$	40	39
Depth.....	27	29	$27\frac{1}{2}$
Eye .....	6	6	$5\frac{1}{2}$
Interorbital (bone only) .....	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$
Maxillary .....	14	14	$14\frac{1}{2}$
Third dorsal spine .....	$17\frac{1}{2}$	$17\frac{1}{2}$	17
Fourth dorsal spine.....	$17\frac{1}{2}$	$18\frac{1}{2}$	$16\frac{1}{2}$
Fifth dorsal spine.....	15	$15\frac{1}{2}$	$14\frac{1}{2}$
Second anal spine .....	$27\frac{1}{2}$	27	27
First anal ray .....	18	18	18
Second dorsal ray .....	$17\frac{1}{2}$	18	17
Pectorals .....	26	27	27
Ventrals .....	$23\frac{1}{2}$	23	22
Caudal.....	26	25	25
Caudal peduncle (height).....	$11\frac{1}{2}$	12	$11\frac{1}{2}$
Vent from front of anal.....	$12\frac{1}{2}$	$12\frac{1}{2}$	14
Distance from anal to base of ventral spine.....	39	36	$37\frac{1}{2}$
Longest gill-rakers .....	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$

165. *Centropomus robalito* Jordan & Gilbert.

PLATE XIII, FIG. 25.

Very abundant at Panama.

Dr. Boulenger places this species in the synonymy of *C. ensiferus*, and Jordan and Evermann consider the two probably identical. They are easily distinguishable, however, by the different size and the direction of the ridges on the top of the head, by the larger serrations in *C. ensiferus*, the longer anal spines, and the rounded contour of the spinous dorsal. The membrane between second and third anal spines seems to be constantly blackish in *ensiferus*, and is usually pale in *robalito*. From *C. armatus*, *robalito* differs strikingly in the longer, more flexible, dorsal spines, the angular contour of the spinous dorsal fin, the ridges on head with the shape of the enclosed areas, the shorter anal spines with the light interspinous membrane, the more anterior position of the vent, the more numerous gill-rakers, the larger scales, and the uniformly light color of the lateral line. The third anal spine fails to attain the tip of the succeeding soft ray. The second spine extends beyond the third for a distance equaling one-half to three-fourths the diameter of the eye; it sometimes attains the base of the caudal fin, but more frequently fails to do so. The dorsal spines are long and flexible, the third little heavier than the fourth. The fin is sharply angulated at the tip of the third spine, which usually reaches a straight line joining the tips of the succeeding spines. The second spine is very short, contained 4 to  $4\frac{1}{2}$  times in the third. The distance from the vent to the base of the first anal spine nearly equals that from tip of snout to hinder margin of orbit, varying a little from that measurement in either direction. The spines on the margin of the pre-orbital and preopercle are distinct and strong, but less so than in *armatus*.

The median pair of ridges on head are stronger than in any other species, and enclose a narrower space, which is widest opposite the posterior ends of the ridges and is regularly wedge-shaped, the ridges meeting at a point opposite the nostrils. The gill-rakers are long and slender, the longest two-thirds the diameter of the orbit. They are more numerous than in *armatus*, 7 or 8 movable ones on the vertical limb and 15 or 16 on the horizontal limb, with 2 or 3 rudiments at each end of the series. There are 46 to 49 scales in the lateral line in advance of the base of the caudal fin, and 5 or 6 scales in a vertical series between the lateral line and the middle of the second dorsal. The lateral line is uniformly pale.

In the fresh state the ventrals are rich golden yellow, whitish at the base, with white pigment at tips, best marked on the inner rays. Anal lemon-yellow, including the membrane between the spines, which is rarely dusky; the base of the fin and the last two rays are translucent. The spinous dorsal is translucent dusky, not distinctly black; the soft dorsal similar, translucent at base. The caudal is dusky translucent, slightly tinged with straw color, the latter best marked on the lower lobe. The pectorals are translucent.

*Measurements in Hundredths of Length without Caudal.*

Length in mm. without projecting lower jaw or caudal .....	192	261	250	240	242	222	242
Head without lower jaw .....	40	39½	39½				
Depth .....	27½	28	27				
Eye .....	6½	5½	5½				
Interorbital (bone only).....	4¾	4¼	4½				
Maxillary.....	13½	14	13½				
Third dorsal spine .....	19	18	18				
Fourth dorsal spine .....	18	15½	16½				
Fifth dorsal spine .....	15	13	14				
Second anal spine .....	24	20	20				
First anal ray .....	17½	16	16				
Second dorsal ray .....	18½	17	18				
Pectoral.....	25½	24	25				
Ventral .....	23½	22	23½				
Caudal.....	27½	.....	25				
Caudal peduncle (height).....	12½	12¼	12				
Vent from front of anal.....	15½	16½	16	16	16½	17½	17
Distance from anal to base of ventral spine.....	39	40	41				
Longest gill-rakers .....	5	4¼	4½				

## Family SERRANIDÆ.

166. *Petrometopon panamensis* (Steindachner).

This species is seldom brought to the market, though it is very abundant about the islands in Panama Bay.

The excavation in the frontal bones for the reception of the posterior processes of the premaxillaries is not so deep as in *P. guttatus*. It more nearly resembles in this respect *Epinephelus louti*, as figured by Boulenger (1895, p. 173).

To the type description we add the following range of measurements, taken from specimens 19 to 28 cm. in length: Head  $2\frac{2}{3}$  to  $2\frac{2}{3}$  in length, without caudal. Eye  $5\frac{1}{4}$  to 6 in head; interorbital width (bone)  $9\frac{1}{2}$ ; snout  $3\frac{3}{4}$  to 4. The fin formula seems to be constant as described: Dorsal IX, 14; anal III, 8. The small canines anteriorly in each jaw are sometimes paired on one or both sides.

167. *Epinephelus analogus* Gill.

Abundant among the islands in Panama Bay, brought to market in considerable numbers.

No variation has been reported in the number of dorsal spines, which seems to be constantly ten. In a specimen 20 cm. long, the upper parts were dusky-olive, the under parts lighter, the cross-bars very faint. The spots were brownish-red. The dorsal and the upper caudal rays were colored like the back; the fins otherwise were slaty-blue with a whitish margin, all of them spotted like the soft dorsal. In specimens 8 to 10 cm. long, the dark bars are distinctly six in number, one on the nape, two below the spinous and two below the soft dorsal, and one on the tail. They are well marked above the lateral line, but fade out on lower part of sides. The round dark spots are confined to the bands, where they are arranged in pairs, forming two vertical series in each band; the two middle bands contain five pairs each.

168. *Epinephelus labriformis* (Jenyns).

Abundant in the Panama market.

In our smallest specimens, 6 and 15 cm. long, there is no trace of the numerous gently undulating pale lines running upward and backward, described by Steindachner (1876, *b*, p. 5) in a specimen 75 mm. long. In none of our specimens was the inside of mouth salmon-yellow, as described by Jordan (1895, *b*, p. 444); the lips were faintly tinged with yellow. The distal half of the upper pectoral rays was deep red, shading below into the yellow of the lower rays. The black saddle on caudal peduncle seems to be constantly present. The number of articulated dorsal rays is constantly 17, as given by Jenyns and Gill.

169. *Promicrops guttatus* (Linnaeus).

Very large specimens are frequently brought to market.

170. *Alphestes multiguttatus* (Günther).

Abundant in Panama Bay, the young very numerous in the tide-pools. The young have fewer spots, mostly confined to the head, while the sides of the body are marked by wavy longitudinal dusky streaks, which are much darker where they traverse certain vertical areas, thus producing a number of vertical bars, which soon disappear. The dark streak behind the maxillary is more conspicuous than in adults. In specimens less than 35 mm. long, the preopercular angle is provided with a large furcate spine, with a long posterior and a short anterior limb. The posterior limb rapidly diminishes in size, while the anterior limb elongates and becomes appressed to the preopercular margin, forming the antrorse spine characteristic of the genus.

As has been pointed out, this species is well distinguished from *A. afer*, by differences in color and in the contour of the head and body. We find no differ-



ence, however, in the relative lengths of the second and third anal spines, and very little difference in the length of the gill-rakers. *A. multiguttatus* has the gill-rakers a trifle longer than in *A. afer*, but they do not exceed two-thirds the length of the gill-filaments.

171. *Mycteroperca bouleengeri* Jordan & Starks.

Probably rare; only two specimens taken, each about 23 cm. in length.

We make the following corrections to the original description, and to the description given by Jordan and Evermann (1896, p. 1175):

Head  $2\frac{2}{3}$  in length ( $2\frac{7}{8}$  in type, 30 cm. long); depth  $3\frac{1}{3}$  ( $2\frac{9}{10}$  in type). In our specimen, and in the type and co-types (3 specimens) from Mazatlan, the dorsal is constantly XI, 16, the anal III, 11. Scales 23–90–44; ctenoid posteriorly, becoming cycloid anteriorly. Snout 4 in head; eye  $5\frac{1}{2}$  ( $6\frac{1}{5}$  in type); longest anal ray 2 ( $1\frac{4}{5}$  in type); third dorsal spine 3.

172. *Hypoplectrus lamprurus* (Jordan & Gilbert).

Only the type is known, obtained by Gilbert in 1881, at Panama.

173. *Paralabrax humeralis* (Cuvier & Valenciennes).

Young specimens of this species are recorded from Panama by Steindachner (1876, b, p. 4) as *Serranus albomaculatus*.

174. *Diplectrum radiale* (Quoy & Gaimard).

Occasional in the Panama market, not taken by us about rocky reefs or islands. There are constantly 10 series of scales on the cheeks running obliquely downward and forward;  $5\frac{1}{2}$  to 6 scales in a series between lateral line and base of dorsal near the middle of the length; and seven articulated rays in the anal fin. There is but little variation in the size and spination of the preopercular lobe, the species being readily distinguishable from *D. macropoma* and *D. euryplectrum* by this character alone.

175. *Diplectrum macropoma* (Günther).

No specimens of this species were secured by us. It seems to occur abundantly a short distance from the shore, where it was dredged by the "Albatross" in depths of from 7 to 33 fathoms. A single specimen was said to be found by them in the Panama market. Its range seems to be co-extensive with that of the tropical fish-fauna in general, as it was obtained by the "Albatross" in 1889 at Station 3014, off Guaymas, Gulf of California, 29 fathoms, and at Station 3039, off Magdalena Bay, Lower California, 47 fathoms.

The species is very close to *D. radiale*, but differs constantly in the wider preopercular lobe, the larger scales on cheeks (6 or 7 rows), and the larger head and deeper body. There are constantly 7 anal rays. The colors in life have not

been recorded; but there are no distinct blue spots on the dorsal, in our material, and in general the coloration seems to have been less variegated than in *D. radiale*.

176. *Diplectrum euryplectrum* Jordan & Bollman.

Known only from moderate depths in Panama Bay, where it was dredged by the "Albatross" in 1888, in 33 to 51½ fathoms.

It is a deeper species than *radiale*, with much wider preopercular lobe, 8 series of scales on the cheeks, and constantly 8 anal rays. There is no trace of blue spots on the soft dorsal, which is marked by a very characteristic narrow black bar along the base. The coloration in the fresh state has not been reported. Judging from alcoholic specimens, it is probable that the species differs widely from *radiale* in that respect. It was not taken in the Gulf of California with its companion species, *D. macropoma*.

177. *Prionodes fasciatus* Jenyns.

This species is abundant among the Galapagos Islands, and on the coast of Mexico, but has been recorded but once from Panama Bay (Pearl Islands and Panama, Jordan & Gilbert, 1882, *n*, p. 625). It was not seen by us.

178. *Paranthias furcifer* (Cuvier & Valenciennes).

Not seen by us; recorded from Panama by Steindachner (1876, *b*, p. 6; as *Serranus creolus*), and by Gilbert (see Jordan, 1885, p. 377).

*Rhegma* Gilbert.

*Rhegma* GILBERT (JORDAN & EVERMANN, 1898, p. 3169).

Allied to *Rypticus*, *Grammistes* and *Gramma*, having the large ctenoid scales and interrupted lateral line of *Gramma*, and the peculiar physiognomy, attachment of gill-membranes, and fin structure of the *Rypticinae*.

Scales of moderate size, thin, not embedded, minutely ciliated; lateral lines 2, the upper near base of dorsal, ceasing under origin of posterior fifth of soft dorsal, the lower line beginning slightly in front of the end of the upper line, running along middle of caudal peduncle; the tubes very short, borne on much smaller intercalated scales, and not forming a continuous line. Head largely scaled, the snout and jaws naked.

Gill-membranes united anteriorly, forming a narrow free fold across the isthmus. Branchiostegals 7. Pseudobranchiæ well developed; a wide slit behind last gill-arch; gill-rakers short, broadly triangular, strongly toothed. Upper margin of opercle, above its angle, wholly attached by membrane to the shoulder girdle, as in the *Rypticinae*. Mouth large, protractile, the lower jaw protruding, the maxillary broadly exposed, with a narrow supplemental bone along its upper edge. Teeth all villiform, in broad bands on jaws, vomer and palatines, the inner teeth on jaws slightly longer than the others and depressible. Tongue smooth. Large mucous pores on under side of mandible, and slit-like pores present on edge of preorbital and around front of eye. Anterior nostril near edge of preorbital, provided with a short tube; posterior nostril without tube or raised rim, immediately in front of eye. A short free triangular flap on upper edge of each orbit. Upper portion of preopercle with a single strong plectroid spine, directed backward and downward; bones of the head otherwise unarmed, the preorbital and preopercle with entire edges, the opercle without spines or ridges.

Ventrals small and anterior in position, as in the *Rypticinae*, consisting each of 1 strong spine, and 5 branched rays, their base being in front of base of pectorals; no enlarged scale behind base of ventrals. Vertical fins low, with rounded lobes, their basal portions well scaled; dorsal with 7 low strong spines and 22 profusely branched rays; anal with 3 spines and 18 rays. One species, apparently the type of a distinct sub-family, *Rhegmatinae*.

179. *Rhegma thaumasium* Gilbert.

PLATE XV, FIG. 31.

*Rhegma thaumasium* GILBERT, l.c., p. 3170.

Head  $2\frac{1}{3}$  in length; depth 3; eye 5 in head; D. VII, 22; A. III, 18. Scales 45 in a longitudinal series along middle of side.

Body elongate, moderately compressed, with very short, deep, caudal peduncle. Anterior profile strongly arched, slightly depressed above orbits. Interorbital space very narrow, convex, its width two-thirds diameter of orbit. Mouth large, slightly oblique; lower jaw the longer, its tip entering the profile.

Dorsal spines low, strong, increasing backward, the last spine one-fourth longer than diameter of orbit. Anal spines short and strong, the middle spine longest.

Lateral line curved strongly upward from its origin to below third dorsal spine; thence running parallel with the back to below middle of second dorsal, from which point it gradually approaches the base of the dorsal, where it terminates under the fifth ray from the last; along its anterior course it is separated from base of dorsal by from 4 to 6 scales (in oblique series). Scales minutely ctenoid except on head, breast, and belly, on nape under anterior dorsal spines, and on base of pectoral. Top of head scaled forward to interorbital space, the anterior scales here, as well as those on cheek, much reduced in size, embedded, so that their outlines cannot be distinguished.

The following measurements of the type specimen are given:

	mm.	One-hundredths of length to base of caudal.
Total length.....	85	
Length to base of caudal.....	70	
Greatest depth.....		33
Least depth of caudal peduncle.....		$15\frac{1}{2}$
Length of caudal peduncle.....		8
Distance from tip of upper jaw to end of opercular flap.....		37
Length of snout.....		6
Diameter of eye.....		$7\frac{1}{2}$
Interorbital width.....		$3\frac{3}{4}$
Tip of snout to end of maxillary.....		19
Length of pectoral.....		27
Tip of snout to base of upper pectoral ray.....		35
Tip of snout to base of ventrals.....		31
Length of ventrals.....		13
First anal spine.....		$3\frac{1}{2}$
Second anal spine.....		6
Third anal spine.....		$4\frac{1}{2}$
First soft anal ray.....		$8\frac{1}{2}$
Longest soft anal ray.....		15
First dorsal spine.....		4
Last dorsal spine.....		9
Longest dorsal ray.....		15
Caudal.....		23

Color, nearly uniform warm brown on head, body and fins; a dusky opercular blotch; soft dorsal, anal and caudal only narrowly margined with white.

One specimen known, from Panama.

180. *Rypticus nigripinnis* Gill.

Not rare. The upper preopercular spine is minute, but seems to be constantly present. The second dorsal spine is usually a little longer than the first, and is united for its entire length by membrane with the succeeding soft ray.

Family LOBOTIDÆ.

181. *Lobotes pacificus* Gilbert.

PLATE XIV, FIG. 28.

*Lobotes pacificus* GILBERT, (JORDAN & EVERMANN, 1898, p. 2857).

*Lobotes auctorum* STEINDACHNER, 1876 *b*, p. 6; Panama. Not of Günther.

*Lobotes surinamensis* JORDAN & GILBERT, 1882 *d*, p. 110; Panama. GILBERT, 1882, p. 112; Punta Arenas. JORDAN, 1885, p. 378; Panama. BOULENGER, 1899, p. 2; Rio Tuyra, Darien.

The *Lobotes* of the Pacific Coast of Central America is distinguished from the other known species, *L. surinamensis* and *L. erate*, by the small size of the preopercular serrations, those at the angle not elongated and spine-like, even in the young.

Head  $2\frac{3}{4}$  in length; depth  $2\frac{1}{5}$  to  $2\frac{1}{10}$  (to base of caudal rays); depth of caudal peduncle  $2\frac{1}{2}$  in head. Dorsal XII, 15; anal III, 11; pectoral 15. Scales 46 (+ 6 on base of caudal)  $\frac{1}{8}$ ; vertebrae 12 + 12. Body more elongated than *L. surinamensis*, agreeing in this respect with *L. erate*, the depth less than half the length. Upper profile deeply concave at occiput, thence strongly convex to front of dorsal. Head shorter and narrower than in *L. surinamensis*, the interorbital width but slightly longer than snout,  $3\frac{9}{10}$  to 4 in head ( $3\frac{1}{3}$  to  $3\frac{2}{3}$  in head in *L. surinamensis*). Eye small,  $6\frac{2}{3}$  to  $7\frac{1}{3}$  in head, 2 or  $2\frac{1}{10}$  in interorbital width. Mandible strongly protruding, but without symphyseal knob. Maxillary narrow, not concealed in closed mouth, its tip reaching vertical from middle of pupil,  $2\frac{2}{7}$  to  $2\frac{9}{10}$  in head.

Upper jaw with a moderate villiform band of teeth, in front of which is a single series of conical close-set canines. Lower jaw with a single series, similar to outer series of upper jaw, and behind them a very narrow band of villiform teeth which grow slightly larger towards symphysis. Palate toothless.

Posterior margin of preopercle vertical, the angle protruding little or not at all. In five young specimens, 175 to 275 mm. long, the preopercular teeth are fine, acute, short and inconspicuous, about as in species of *Pomadasys*. They increase but little in size towards the angle, where they are never spine-like; below, they are perceptible only in the immediate vicinity of the angle, the remainder of the horizontal limb being entire. In the adult the vertical limb is finely and evenly toothed, the angle and lower limb slightly roughened or entire. Opercle with two short spinous points, behind the lower of which a narrow tongue-shaped process of the subopercle extends to near the edge of opercular membrane. The humeral process is very weakly toothed, contrasting with the strongly serrate condition in *L. surinamensis*. Branchiostegals 6.

Gill-rakers short, two-fifths diameter of eye in young, comparatively shorter in adults, 5 on vertical limb, all but one of which are broad firmly fixed tubercles, 14 on horizontal limb, the anterior two or three tubercular.



Spinous dorsal low, with gently rounded outline. Notch between dorsals shallow, the eleventh spine two-thirds the length of the longest, which is contained 2 to  $2\frac{1}{3}$  times in head in the young, 3 times in adults. When declined, the spines are partially received within a scaly groove. Soft dorsal, anal and caudal with basal portions densely scaled, and with series of scales running up on membrane to beyond middle of fin. Soft dorsal and anal of equal height, forming bluntly rounded lobes, the longest rays of which are about half head in adults,  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in head in young. Third anal spine about half length of longest ray. Pectorals shorter than ventrals, 2 to  $2\frac{1}{3}$  in head; ventrals  $1\frac{1}{2}$  in head in young, shorter in adults.

Scales less strongly ctenoid than in *L. surinamensis*. Tubes of lateral line mostly simple, occasionally with one to three branches.

Color grayish or brownish, with plumbeous or silvery reflections. The youngest specimens show faintly the dark streaks so conspicuous in young of *L. surinamensis*, viz: a pair running backwards from interorbital space; a pair from upper posterior border of eye converging towards front of dorsal; a broader band from eye downwards and backwards across cheeks. Soft dorsal, anal and caudal uniform blackish, or the caudal with an ill-defined lighter edge. Pectorals translucent; ventrals blackish.

Abundant at Panama, where it is known as *Berrugate*.

#### Family PRIACANTHIDÆ.

##### 182. *Pseudopriacanthus serrula* (Gilbert).

Only the type known, from Albatross Station 2797, Panama Bay, 33 fathoms (Gilbert, 1890 *b*, p. 450).

#### Family LUTIANIDÆ.

##### 183. *Hoplopagrus guentheri* Gill.

This species had not been taken previously farther south than Mazatlan. We secured one large specimen with dynamite among the rocky islands in the Bay. It must be very rare at Panama.

#### Lutianus.

The characters relied upon to separate *Neomanis*, *Lutianus*, *Genyoroge* and *Evoplites*, seem wholly lacking in distinctive value. The band of temporal scales may be narrow or wide, and may be isolated or may be surrounded by bands of smaller scales. All degrees of scaling of top of head are found among the Asiatic species, and considerable variation among the American members of the group. The temporal ridge never joins the orbital rim, but terminates at varying distances between that and the median crest. Its approximation to the median crest depends in part upon its production anteriorly, and this is in many species a question of age. No groups can be separated by this character, nor can the natural affinities of the species be determined by its aid. A third character is derived from the emargination of the preopercle, into which may fit a knob of the interopercle. Most American species have this weakly developed or absent, but *L. jordani* forms an obvious transition between the two conditions, and this will doubtless be made more complete by an examination of the Asiatic forms. *Lutianus* (*Evoplites*) *viridis* is evidently the descendant of an Asiatic form, and has the notch and knob strongly developed.

The temporal ridges do not join the median frontal ridge, though they are continued well forward and approach it.

In this paper we have used the oldest name, *Lutianus*, for all American species.

184. *Lutianus jordani* (Gilbert).

PLATE XIV, FIG. 29.

*Neomanis jordani* GILBERT (JORDAN & EVERMANN, 1898, p. 1251).

Head  $2\frac{3}{4}$  to 3 in length; depth  $2\frac{2}{3}$  to  $2\frac{3}{4}$ ; eye  $4\frac{1}{2}$  in head; dorsal X, 14; anal III, 9; scales  $5\frac{1}{2}$  above lateral line, 43 to 47 oblique series running downwards and backwards.

Body deep, with regular curves, the two profiles nearly equal. Snout short, with gently rising upper profile,  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in head. Eye large, its diameter much greater than the width of the preorbital at middle of length, where it is one-seventh length of head. Maxillary reaching slightly beyond front of pupil, its length equaling that of snout and half eye,  $2\frac{2}{5}$  in head. Least width of preorbital half the diameter of the eye. Temporal ridge ceasing about middle of orbit, much nearer orbital rim than median crest, but not confluent with either. Mandibular teeth in a villiform band, which is of moderate width anteriorly and tapers rapidly on sides. An outer series of distantly placed moderate canines. Teeth in premaxillaries similar to those below, the canines small, a pair on each side enlarged, but small for this genus. Vomerine teeth in a kite-shaped tract, rapidly reaching its greatest width, then tapering slowly backward for twice the distance. The anterior margins are gently concave, the posterior deeply so. Preopercular margin with a rather deep emargination above the angle. The interopercle forms a slight protuberance opposite the preopercular notch, the prominence failing to fill the notch, as it does in *viridis* and other species of the "*Genyoroge*" group. Above the emargination, the edge is very minutely and finely serrulate, at the angle provided with a few short slender rather distant teeth. Gill-rakers strong, those above angle short, all but one tubercular, the one at angle abruptly lengthened, about half diameter of eye; seven developed on horizontal limb of arch. Posterior nostril elliptical.

Five or six series of scales on cheeks, the band running upward to level of upper margin of orbit. A single narrow band of scales on occiput, separated by a naked space from those on nape. Top of head, snout, mandible, preopercle, maxillary, and inferior half of interopercle naked. Scales above lateral line in series parallel with the lateral line; those below lateral line in horizontal series. Scales on the breast not much reduced, as large as those on opercle. Basal half of dorsal and anal with series of scales which form a sheath at base; basal three-fourths of caudal densely scaled.

Dorsal spines heavy, not flexible, the fourth the longest,  $2\frac{1}{2}$  to  $2\frac{2}{3}$  in head. Second and third anal spines about equal, half the length of snout and eye. Soft dorsal and anal low, rounded, the longest ray (measured from free edge of sheath) about one-third head. Caudal lunate, the middle rays three-fourths the outer,  $1\frac{3}{4}$  in head. Pectorals very long, nearly reaching vertical from vent,  $1\frac{1}{4}$  in head. Ventrals  $1\frac{3}{4}$  in head.

Color: Back and top of head deep olive; lower half of sides and below dark reddish-purple. Many of the scales on sides with a silvery spot near the margin, producing faint lengthwise stripes. Fins reddish-purple, the basal portions of soft dorsal and caudal tinged with olive. Iris silvery, with an inner and an outer orange circle. No blue lines on the head. Inner lining of gill-membranes and the shoulder girdle largely orange-red. Pectoral fins orange-brown.

Of rare occurrence at Panama, but occasionally taken in considerable numbers. It is a small species, reaching a length of about 40 cm.

185. *Lutianus novemfasciatus* Gill.

Occasional; reaching a large size.

186. *Lutianus argentiventris* (Peters).

With the exception of *L. guttatus*, the most abundant species of the genus. The species is marked by the very slender sharp snout, the profile being concave in front of the nape, convex behind it. The snout is three-eighths to four-elevenths the length of the head, and equals the length of the maxillary; it is not depressed anteriorly. The blue stripe below eye is conspicuous only in the young. It may extend, without interruption, from the tip of the snout along entire side of head to opercular margin. It is more often limited to the anterior part of the head, and becomes variously broken up into a series of dashes or dots.

187. *Lutianus colorado* Jordan & Gilbert.

Not abundant; reaching a large size.

188. *Lutianus guttatus* (Steindachner).

The most abundant species of the genus; never reaching a large size. This species has the temporal region more extensively scaled than in other American representatives of the genus in the Pacific. The usual temporal band of large scales is present, in addition to which are bands of small scales in front of and behind it.

189. *Lutianus aratus* (Günther).

Less abundant than other species of the genus; several specimens secured. The maxillary reaches past the *middle* of the eye.

190. *Rabirubia inermis* (Peters).

A single mutilated specimen was found. The species must be one of the rarest known, as but three specimens have been noted by collectors. The figure published by Jordan (Proc. Calif. Acad. Sci., 2nd Ser., Vol. V, 1895, Plate XXXIX), errs in the number and obliquity of the dark streaks above the lateral line. Nineteen or twenty of these can be distinguished on the specimen from which the drawing was made, and the streak from last dorsal spine runs to the tenth scale of the lateral line. The anal fin contains ten rays in each of the Panama specimens known.

191. *Xenichthys xanti* Gill.

Brought to market in abundance. The best description of this species is that given by Jordan and Gilbert (1882 *a*, p. 325) under the name of *X. xenops*. The following details may be added.

Eye 3 to  $3\frac{1}{6}$  in head. Scales 52 to 54; those on head and nape less coarsely ctenoid than elsewhere. The fourth dorsal spine is as long as the third, or sometimes a little longer; the fifth is but slightly shorter. In the declined fin, the fifth spine reaches past the tips of all the other spines anterior to the tenth; the pectoral does not reach the vertical from the vent. In the six specimens counted, the dorsal was constantly XI, I, 18, the anal III, 17.



We have compared this species with *X. agassizii* from the Galapagos Islands, and find it to differ in having fewer scales, a larger eye and a shorter pectoral fin. *X. agassizii* has 58 to 61 scales; the eye is contained  $3\frac{1}{2}$  to  $3\frac{2}{3}$  times in the head; the pectoral reaches to beyond the origin of the anal.

#### Family HÆMULIDÆ.

##### 192. *Hæmulon scudderi* Gill.

The most abundant species of the genus at Panama.

In eight half-grown specimens, five have 11 dorsal spines, three have 12 dorsal spines. In thirty-six young specimens, with the streaks and caudal spot still conspicuous, thirty-three have 11 dorsal spines, three have 12 spines. The articulated dorsal rays are 16 or 17 in number; the anal rays 7 or 8. In twelve specimens from Mazatlan, ten have 12 spines, two have 11.

In young specimens, are three well-developed streaks and one rudimentary one. The uppermost starts on the median line of occiput, runs to the spinous dorsal, and is continued along each side of the base of the dorsal, gradually growing fainter and disappearing before reaching the second dorsal. A pair begin just inside the nostrils, run just above the eyes, diverging backward to a point opposite the origin of the dorsal, thence converging to the base of the last dorsal ray, behind which the pair unite on upper median line of caudal peduncle, on which they reach base of upper caudal rays. Another pair begin at tip of snout and extend backward through eye to middle of caudal peduncle, where they become faint or entirely disappear. A faint streak extends backward from upper margin of orbit to beginning of lateral line, along the anterior part of which it may be faintly indicated. A large black oval spot three-fourths the size of the eye is half on the caudal peduncle, half on the base of the fin. Comparing these streaks, which disappear in adults, with the permanent coloration in *H. macrostomum*, we find them characterized by the rudimentary condition of the streak along (or just below) the lateral line, and the total absence of a streak, present in *macrostomum*, running from above eye along sides just above the lateral line.

*H. scudderi* differs from its Atlantic representative *H. parra*: (1) In having usually 11 dorsal spines instead of 12; (2) In having longer falcate pectoral fins, which extend beyond the tips of the ventrals, and are nearly devoid of scales; (3) In the greater compression of occiput and nape, forming a crest which may be traced in adults to the interorbital space; (4) In the greater compression of the snout, which is also produced upward at tip, so that in adults the upper profile of snout and head as far as occiput is concave. In *H. parra*, the dorsal spines are normally 12. In but one specimen of *parra* out of sixteen examined, have we found 11 spines, a number which seems not to be recorded for the species. The pectoral fins are short and rounded, not reaching tips of ventrals. They are very densely covered with scales to their tips, both membranes and rays being completely invested. The ventrals also are much more densely scaled than in *scudderi*. The occiput, nape and snout are transversely broadly rounded in both young and old specimens, while



the upper profile forms an uninterrupted even curve from tip of snout to front of dorsal, and beyond. The fin and scale formula does not differ from that in *scudleri*, except as noted. There are 52 scales in the lateral line, corresponding with the number of vertical series above it.

*Measurements in Hundredths of Length without Caudal.*

Species .....	HÆMULON SCUDDERI		HÆMULON PARRA	
	Panama		Havana, Cuba	
Length without caudal in mm. ....	205	200	205	198
Head.....	36	35½	36	34½
Depth. ....	40	37	37	37
Eye .....	7¼	7½	9	9
Snout .....	14½	14	15	14
Interorbital (bone).....	9	9	7½	7½
Maxillary .....	15	14½	15	14
Third dorsal spine .....	15½	15	16	15
Second anal spine .....	15	14½	13½	13
Length of pectoral.....	28	29	23	21
Length of ventrals.....	22	22	21	20
Length of upper lobe of caudal....	26	27	20½	20
Height of caudal peduncle .....	11	10½	11	10

193. *Hæmulon steindachneri* (Jordan & Gilbert).

Frequent in the market and about the islands in the bay.

A detailed and wholly satisfactory description of this species is given by Steindachner (1876 *a*, p. 15) under the name *Hæmulon caudimacula*.

194. *Lythrulon flaviguttatum* (Gill).

*Lythrulon opalescens* JORDAN & STARKS (JORDAN, 1895, p. 459, Pl. XL; Mazatlan).

Abundant in the Panama market; often taken with dynamite about the islands in the bay. We have compared our specimens with the type of *L. opalescens*, and find no differences between them. The following account of *opalescens* is based on a re-examination of the type, the published description being faulty in several respects:

Head  $3\frac{2}{5}$ ; depth  $2\frac{3}{4}$ ; dorsal XII, 17; anal III, 10 (the last ray cleft to the base, the parts somewhat separated, the posterior half again forked, both joining the last

interhæmal); snout  $3\frac{2}{3}$  in head; maxillary  $2\frac{3}{5}$ ; eye (between eyelids)  $3\frac{2}{3}$ ; interorbital width (between edges of frontal bone) 4; longest (fourth) dorsal spine 2; longest dorsal ray  $3\frac{1}{3}$ ; second anal spine  $2\frac{2}{3}$ ; scales 6 or 7-53-14. Gill-rakers 9+17 on one side, 9+19 on the other.

For comparison, we subjoin a statement of measurements and counts based on five Panama specimens of *flaviguttatum*, each about the same length as the type of *opalescens*.

Head  $3\frac{2}{5}$  to  $3\frac{3}{5}$  in length; depth  $2\frac{5}{7}$  to  $2\frac{7}{8}$ ; dorsal XII, 16; XIII, 16; XII, 17; XII, 17; XII, 17; the anal has 3 spines and either 10 or 11 rays; when there are 10 anal rays, the last ray is divided to the base and the two halves are well separated. Snout  $3\frac{2}{5}$  to  $3\frac{2}{5}$  in head; eye (between eyelids)  $3\frac{2}{3}$  to 4; bony interorbital width  $3\frac{5}{8}$  to 4; longest (fourth) dorsal spine 2; longest dorsal ray  $3\frac{1}{4}$  to  $3\frac{1}{3}$ ; second anal spine  $2\frac{2}{5}$  to  $2\frac{2}{3}$ ; scales 6 or 7-51 to 53-13 or 14; gill-rakers usually 10+18 or 9+19, in one specimen 11+20.

#### 195. *Orthostœchus maculicauda* Gill.

Seldom seen by us.

Well described and figured by Steindachner (1870 *b*, p. 12, Pl. VI) as *Hemulon mazatlanum*. The outline of the spinous dorsal is, however, widely different from that shown in the figure. It is convexly rounded throughout, not concave behind the highest portion of the fin, the second spine exceeds the seventh, and the third is usually slightly longer than the fifth. There is usually a faint indication of the caudal spot.

#### 196. *Anisotremus pacifici* (Günther).

Rather common in the Panama market.

The general color is dusky silvery, with four very faint dusky cross-bars, which correspond in position and extent with the more conspicuous bars of *A. dovii*. The soft dorsal, anal and ventrals are blackish, the caudal and pectorals yellowish.

The species is characterized by the very short, blunt and wide snout, the narrow preorbital, the very large eye, the short pectoral, and the short dorsal and long anal fins almost devoid of scales. The soft dorsal and anal fins are also rounded in contour, the middle dorsal rays being longer than the anterior rays, and the anal fin not emarginate, as it is in *dovii*.

The head is contained  $2\frac{9}{10}$  to  $3\frac{1}{10}$  times in the length to base of caudal; the depth  $2\frac{1}{5}$  to  $2\frac{2}{5}$ . Eye 4 in head. The preopercular margin is indented above the projecting angle, on which the teeth are moderately or scarcely at all enlarged. Below the angle, the teeth are again reduced and point downward and backward. The normal fin-formula is: dorsal XI, 14; anal III, 10. We find in one specimen only, dorsal XII, 13; and in one other, anal III, 9. The second anal spine is contained  $1\frac{2}{5}$  to  $1\frac{4}{5}$  times in the head; the third anal spine  $2\frac{7}{8}$  to  $3\frac{1}{3}$  times. The soft dorsal and anal have short series of scales on basal half only of interradiar membranes, the rays, together with the entire distal half of fins, being naked. In both

*dovii* and *cæsius*, these fins are densely sealed to their tips. The pectorals are short, not nearly reaching vertical from tips of ventrals, their length  $1\frac{2}{3}$  in head. The scales on the back are in series parallel with the lateral line, but lose their regularity under the soft dorsal. There are  $5\frac{1}{2}$  or  $6\frac{1}{2}$  series between the lateral line and the base of the spinous dorsal, and 46 to 48 scales in the lateral line.

197. *Anisotremus cæsius* (Jordan & Gilbert).

This species, known hitherto only from the types taken at Mazatlan and one specimen from Acapulco, was found to be abundant among the islands in Panama Bay. It is readily distinguished from its nearest relatives in the Pacific by its uniform coloration, its longer dorsal fin, and its very long falcate pectoral. The preorbital is also wider, four-fifths diameter of eye. None of our specimens show trace of dark bars. The description of the types answers well to our specimens, but the maxillary extends to middle of eye, instead of "not quite reaching to front of eye." Of nine specimens examined, all had 12 dorsal spines; there were eight with 16 dorsal rays, one with 15; seven with 10 anal rays, two with 9. The third anal spine is longer than in *dovii* or *pacifici*, protruding beyond the wide basal sheath for two-fifths length of head. The caudal is much more deeply forked and the upper lobe more decidedly the longer; the median caudal rays are slightly less than half the upper.

198. *Anisotremus dovii* (Günther).

Occasionally brought to market.

The normal fin-formula in this species is: dorsal XI, 14; anal III, 9. We have no specimen with 12 spines, but this variation is to be expected. The soft dorsal varies to 15, but apparently not to 16. The type was described as having 12 dorsal spines and 16 rays. The vertical fins are sealed to their tips, but the anterior half of each ray, with a narrow strip of the membrane preceding it, is naked. Where the rays fork distally, they become entirely invested. There are  $6\frac{1}{2}$  horizontal series of scales between the lateral line and the middle of the spinous dorsal. The pectorals do not extend to opposite tips of ventrals,  $1\frac{1}{3}$  in head.

This species is very close to *A. pacifici*, but differs in the longer sharper snout, larger dorsal and anal spines, greater sealiness of the fins, the presence of but 9 anal rays, and the intenser color of the bands.

199. *Anisotremus interruptus* (Gill).

We have two specimens, one 23 cm., the other 43 cm. long. They throw no additional light on the relation of *interruptus* to its Atlantic representative *surinamensis*. In both specimens, the scales above the anterior portion of the lateral line are conspicuously enlarged, an oblique series downward and backward from first dorsal spine containing but 7 scales. Specimens of *surinamensis* have somewhat smaller scales, and are darker in color, especially on the fins. These are slight differences, however, and may well prove inconstant. The species *interruptus* should be accepted only provisionally.

200. *Anisotremus tæniatus* Gill.

Occasional in the market; of more frequent occurrence about the rocky islands in the Bay.

The species is undoubtedly distinct from its Atlantic representative *A. virginicus*, although some of the characters which have been relied upon to distinguish the two are of no value. Thus, the gill-rakers are alike in both and the eye does not differ in size. The second anal spine is variable in both; in *tæniatus*, its tip usually fails to reach the tip of the soft rays, in *virginicus* it usually reaches beyond their tips.

The most striking difference is in the color, as has been sufficiently described by previous authors. In addition, we note that the fins in *virginicus* are more densely scaled, this being especially well marked with the pectorals. The anterior portion of the spinous dorsal differs widely in contour: in *virginicus*, the third spine is longest, the second five-sixths or more than five-sixths the length of the fourth; in *tæniatus*, the fourth spine is usually the longest, the second very short, not more than four-sevenths the length of the fourth. Our material is not sufficient to enable us to determine the limits of variation in the relative lengths of the dorsal spines. The pectoral seems to be slightly longer in *tæniatus*, and the preorbital a little narrower, but these differences are unimportant.

*Measurements in Hundredths of Length without Caudal.*

Species .....	ANISOTREMUS TÆNIATUS		ANISOTREMUS VIRGINICUS	
	Panama		Key West, Fla.	Jamaica
Length without caudal in mm. ....	170	193	180	143
Head.....	33	33	33	34½
Depth.....	49	48	49	49
Eye.....	8½	8	8	9
Snout.....	12	12	12	12½
Maxillary.....	9	9½	9½	9½
Interorbital.....	9	9	9	9½
Second dorsal spine.....	10	9½	12½	12½
Third dorsal spine.....	15½	16	16	17
Fourth dorsal spine.....	16½	17	15	16½
Second anal spine.....	16	16½	15½	16½
Length of pectoral.....	36	36	34	36
Length of ventral.....	23	22	23½	24
Upper lobe of caudal.....	29	29	28	29



201. *Brachydeuterus nitidus* (Steindachner).

Four specimens taken. They agree with Dr. Steindachner's description in most particulars.

Head 3 to  $3\frac{1}{4}$  in length without caudal; snout 3 to  $3\frac{1}{4}$  in head; eye 4 to  $4\frac{1}{5}$ ; interorbital (bone) 5. Scales 48 to 50. Two of our specimens have 9 anal rays, one has 14 dorsal rays; the others have 8 anal and 15 dorsal rays. The upper lobe of the caudal is conspicuously longer than the lower lobe.

202. *Brachydeuterus leuciscus* (Günther).

Very abundant; the young and half-grown specimens exhibit the same bewildering variety of form and general appearance for which the species is noted in other parts of its range. Compared with adults, the young appear much slenderer, with longer sharper snout, smaller mouth, and less arched frontal region. The preorbital usually appears much wider; but in all these respects there is wide variation among young of the same size. It reaches the length of 31 cm.; adults vary little in appearance, and approach nearly the even contour of *Pomadasis panamensis*. The pectoral is never falcate, and equals the distance from tip of snout to upper preopercular margin.

203. *Pomadasis panamensis* (Steindachner).

This species was very abundant at Panama. Our material shows few variations from Dr. Steindachner's description.

Eye  $4\frac{1}{5}$  to  $5\frac{1}{8}$  in head; interorbital  $4\frac{1}{2}$  to 5; second anal spine  $2\frac{1}{3}$  to  $2\frac{2}{5}$ . The maxillary reaches a vertical from the anterior margin, or the anterior third, of the pupil. Dr. Steindachner's statement that the third dorsal spine is from 2 to  $2\frac{1}{6}$  times as long as the second is doubtless a slip of the pen. The third dorsal spine in our specimens varies from 3 to  $3\frac{1}{2}$  times the length of the second.

204. *Pomadasis bayanus* Jordan & Evermann.

*Pristipoma humile* KNER & STEINDACHNER, 1864, p. 222, Pl. I, fig. 1. STEINDACHNER, 1879 *a*, p. 33. Not *Pristipoma humilis* BOWDICH.

*Pomadasis bayanus* JORDAN & EVERMANN, 1898, p. 1331.

One specimen, 36 cm. long, was taken in the Rio Grande River, at Miraflores, a point above tide-level, where the water is perfectly fresh. A small specimen is in the museum of Stanford University, collected at San José del Cabo, Mexico, by Mr. J. F. Abbott. The records do not show whether this specimen was taken in the river at San José, or in the sea.

The species is very close to *P. croco*, agreeing with it in general shape and color, and in fin and scale formulæ. Both species have normally 13 dorsal spines. *P. bayanus* has a longer snout, larger mouth and shorter second anal spine. The latter varies greatly with age. In our smaller specimen, it reaches far beyond the tip of the soft rays, to the base of the anal, and is contained 4 times in the length; in the larger specimen, it fails to reach the tip of anal rays, and is contained  $6\frac{1}{2}$  times

in the length. The dorsal contains 13 spines, 12 rays; the anal III, 7. The scales are very irregular, and difficult to enumerate. We count 52 pores in the lateral line, in each specimen. The head is contained 3 times in the length ( $2\frac{1}{8}$  is a misprint for  $3\frac{1}{8}$  in Jordan & Evermann's description, *l. c.*).

The eye is contained 5 times in head in the larger specimen,  $3\frac{3}{4}$  times in the smaller; snout  $2\frac{9}{10}$ ; maxillary  $2\frac{3}{5}$  in large specimen,  $2\frac{4}{5}$  in the smaller; fourth dorsal spine  $2\frac{4}{5}$  and  $2\frac{1}{5}$ ; second anal spine 2 and  $1\frac{2}{5}$ . The base of the second dorsal is one-half the base of the spinous dorsal. The gill-rakers are short and weak, 13 on horizontal limb of arch, 3 or 4 of the anterior being rudimentary, immovable.

Striking characters of this species are: the ploughshare-shaped snout, narrowing upward and forward to form a ridge, which terminates in the acutely angulated premaxillaries; and the small accessory scales, which are larger than such scales are apt to be, are more irregular in shape, and are scattered more widely over the surface of the other scales.

205. *Pomadasis macracanthus* (Günther).

A common species in the market. The following additions to current descriptions are from specimens 18 to 26 cm. in length.

Head  $2\frac{3}{5}$  to  $2\frac{3}{4}$  in length; depth  $2\frac{3}{4}$  to  $2\frac{5}{8}$ . Eye  $4\frac{1}{2}$  to  $4\frac{5}{8}$  in head; snout  $2\frac{7}{8}$  to  $3\frac{1}{8}$ ; interorbital (bone) 5 to  $5\frac{3}{4}$ . Three of our specimens have 13 dorsal rays, three have 14. The anal has constantly 8 soft rays, as described by Günther, the last split ray counting as 1; not 7 rays, as given by Jordan and Evermann (1898, p. 1332). Pectoral 3 to  $3\frac{1}{2}$  in length.

Our specimens have the scales rather strongly etenoid, not smooth as described by Günther.

206. *Pomadasis branicki* (Steindachner).

A single specimen was obtained. The dorsal spines seem to be indifferently 13 or 14 in number. There are 14 in our specimen.

207. *Orthopristis chalceus* (Günther).

Very common; seen daily in the markets.

The dorsal spines are usually 12 in number, only one of our specimens has 13; the articulated rays are usually 15 (exceptionally 16). We have found no specimen with 14 rays, as recorded by Steindachner (1870 *b*, p. 3, Pl. II; as *Pristipoma kneri*). The anal rays are usually 11 in number (exceptionally 12). The tubes in the lateral line (corresponding with the series of scales above the lateral line running obliquely downward and backward) are 52 to 54 in number. The diameter of the eye equals the width of the preorbital,  $4\frac{2}{5}$  in the head; pectoral  $1\frac{1}{5}$  to  $1\frac{1}{10}$ ; snout  $2\frac{4}{5}$  to  $2\frac{9}{10}$ ; the maxillary extends beyond the front of the eye. Brownish streaks follow the centers of the rows of scales, alternating with narrower grayish blue streaks along the margins of the rows. No pale streak below the dorsal and no darker cross-bands in any specimens seen by us.

208. *Orthopristis brevipinnis* (Steindachner).

PLATE XV, FIG. 30.

Four specimens, from 28 to 31 em. long, were obtained by us in the Panama market; no others were seen.

The species has been made the type of a distinct genus (*Isaciella* Jordan & Fesler), differing from *Orthopristis* in the presence of accessory scales, from *Microlepidotus* in the larger scales, the presence of accessory scales on the bases of the larger ones, and the shorter spinous dorsal. A re-examination of *Microlepidotus inornatus* (Magdalena Bay, Albatross collection) shows however that the scales have been incorrectly enumerated in that species. They are in reality of the same size as the scales in *brevipinnis*, there being 60 in the lateral line. There are furthermore numerous small accessory scales on the bases of the larger ones. The dorsal and anal are sealed in *inornatus*, almost as fully as in *brevipinnis*. The two species are very closely related, differing principally in the relative sizes of the two dorsal fins. This difference is not greater than that occurring between species of *Pomadasis* or *Anisotremus*, and seems not worthy of generic recognition. In one specimen of *O. inornatus* from Mazatlan, we find 15 dorsal spines. The only character to separate the two species as a generic group (*Microlepidotus*) distinct from *Orthopristis*, is the possession of the small accessory scales on the sides. This character appears also in *Brachydeuterus*, where *elongatus* and *axillaris* possess it highly developed, while *nitidus* and *corvinaeformis* are without it. We have no indication of the condition in the type of *Brachydeuterus (auritus)*. Should the latter have no accessory scales, the subordinate group consisting of *elongatus* and *axillaris* would be without distinctive name. We have preferred to reduce *Microlepidotus* to the rank of a subgenus, of equal value with *Evapristis*, which forms a transition between it and the ordinary forms of *Orthopristis* with naked fins and no accessory scales.

Steindachner's description of the type of *brevipinnis* (1870a, p. 10, Pl. V) refers unquestionably to the present species, but the accompanying figure is so poor and inaccurate as to suggest a very different fish. Prominent among the unfortunate features in this drawing are: the upper contour, which should be evenly curved from snout to caudal peduncle; the dorsal spines, which should be longer and slenderer; the soft dorsal, which is much more completely sealed; the streaks above the lateral line, which are much less oblique, much wider, more irregular and wavy, and less numerous; the series of scales below the lateral line, with their accompanying streaks, which should be horizontal, instead of oblique.

The usual fin formula is: dorsal XIII, 17; anal III, 13 or 14. The third dorsal spine is the longest,  $2\frac{1}{3}$  to  $2\frac{1}{2}$  in the length of the head. The lateral line contains 60 to 62 tubes.

The scales in the species of *Orthopristis* are more nearly uniform in size than current descriptions would seem to indicate. *O. forbesi*, from Albemarle Island, Galapagos Group, is said to have 80 to 85 series of scales. Examination of one of the types makes it evident that the vertical rows were counted, instead of the oblique rows. The number of oblique rows corresponding to the pores in the lateral line is 65.

## Family SPARIDÆ.

209. *Calamus brachysomus* (Lockington).

*Chrysophrys calamus* GÜNTHER, 1869, p. 421 (Panama).

Known from the Gulf of California, from Panama, and from Santa Helena Bay, near Guayaquil (Boulenger, 1898-9, Vol. XIV, p. 7).

Several small specimens were seen in the market and a number of large individuals were taken by the aid of dynamite about the islands. Four specimens were preserved, ranging in length from 23 to 43 cm.

Its southern representative, *C. taurinus*, is a more slender species and has shorter dorsal spines and a shorter pectoral. Two specimens of *taurinus* which we have examined from the Galapagos are darker in color, especially about the head, and have the inner base of the pectoral blackish.

The original description of *C. brachysomus* contains numerous errors and cannot be relied upon. To the description given by Jordan and Evermann (1898, p. 1453), we make the following additions:

Head  $3\frac{1}{5}$  to  $3\frac{1}{3}$  in length; depth 2 to  $2\frac{1}{4}$ . Eye  $3\frac{3}{5}$  to  $4\frac{1}{2}$  in head; snout  $1\frac{3}{5}$  to  $1\frac{4}{5}$ . The maxillary reaches to below the anterior orbital rim. There are but five very small, short gill-rakers on the lower branchial arch. In our specimens, the dorsal is constantly XII, 12 and the anal III, 10. The third dorsal spine is contained  $1\frac{7}{8}$  to  $2\frac{2}{5}$  times in the head; the second anal spine is generally longer than the third, but does not reach to its tip in the declined fin. Its length is  $3\frac{1}{5}$  to  $4\frac{1}{2}$  in head.



*Measurements in Hundredths of Length without Caudal.*

Species .....	BRACHYSOMUS			TAURINUS		
	Panama			La Paz, L. C.	Galapagos Islands	
Length without caudal in mm. ....	286	177	175	255	286	216
Head.....	31½	31	31	31	34½	31½
Depth .....	48	46	49	46	43	42½
Eye .....	7	8	8½	7½	7½	8
Preorbital (least depth).....	14½	12	12	13½	14½	11½
Interorbital (bone).....	8	8	8	8	8¼	8
Snout .....	19	17	18½	19	20	17½
Maxillary .....	13	12	12	13½	15	12½
Pectoral .....	37	37	40	37½	35	36
Third dorsal spine .....	16½	16	16	17	12	13
Second anal spine .....	7	8	9½	7	7	6½
Ventral.....	22	23½	24	22	18	22
Caudal .....	26	29	31	Broken	26	31
Caudal peduncle (height) .....	9	10½	11	9	9	9

## Family GERRIDÆ.

210. *Eucinostomus californiensis* (Gill).

*Diapterus dowii* GILL, 1863, p. 162.

We found this species very common at Panama, and carefully selected a series of about twenty specimens, with a view to exhibiting all the variations to which it is subject. We have also a large number of specimens from other localities.

Our extensive series seems to prove *E. dowii* to be invalid. It is alleged to differ from this species in having the maxillary groove "linear" instead of "broad and semi-oval"; in having the scales 5-47-10 instead of 6-44-13, and in having the "spinous dorsal blackish at the margin" rather than "fins immaculate."

Our specimens show all intermediate stages of the maxillary groove, from linear to broadly U-shaped. In some individuals the groove is as wide at the anterior or open end as at the middle, but in most of them it is more or less constricted anteriorly by the encroachment of the scales on each side. In one specimen the groove is wholly closed in front by the meeting of these scales. The scale-formula in our

specimens is 5-44 or 45-10. The margin of the spinous dorsal varies in color from dusky to black, but we have some small specimens, collected by the Albatross, in which the fins may be said to be immaculate.

Our specimens of the young up to 65 mm. in length show light brown cross-bars on back. One at the nape runs obliquely downward and backward to the upper end of gill-opening; one at the front of the spinous dorsal runs obliquely downward and forward to lateral line, nearly meeting the one at the nape; between these there is a shorter vertical bar, and more posteriorly are several bars running downward and forward, which become more or less indefinite along the middle of their length. One or two of these bars are represented by the spots on the upper edge and at the middle of the caudal peduncle.

Our material from the Atlantic is so meager that we are unable to discuss relationships between *E. californiensis*, *E. harengulus*, and *E. pseudogula*.

*Measurements in Hundredths of Length without Caudal.*

Locality .....	Panama							Chatham I., Galapagos
Length without caudal expressed in mm.....	149	153	150	154	149	95	80	156
Head .....	32	33	31	32	31	33	33	30
Depth.....	37	38	37	37	36	36	38	32
Eye (inside of adipose eyelid)..	10	10	10	9	9	10	10	9
Pectoral .....	34	32	32	32	33	33	32	32
Second dorsal spine .....	19	19	18	18	17½	18	17	17½
Second anal spine .....	9	9	7½	8	8	9	9	8½
Caudal .....	27	28	26	27	27	26	.....	28
Ventrals .....	17	18	17	16	17	18	18	16
Snout .....	11	10	10½	11	10	11½	10	10½
Number of dorsal rays.....	IX, 9	IX, 9	IX, 9	IX, 9	IX, 9	IX, 9	IX, 9	IX, 9
Number of anal rays.....	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7	III, 7
Scales .....	5-44-10	5-44-10	5-45-10	5-45-10	5-44-10	5-44-10	5-45-10	5-45-10

211. *Xystæma cinereum* (Walbaum).

Panama records are by Günther, 1869, p. 391 (as *Gerres squamipinnis*); and Jordan, 1885, p. 384.

212. *Gerres aureolus* Jordan & Gilbert.

Known only from the type taken by Gilbert at Panama in 1881.

213. *Gerres peruvianus* Cuvier & Valenciennes.

We found this species very common at Panama. From *G. olisthostomus* it differs in having the premaxillary groove scaleless, a smaller eye, smaller and crowded teeth, and a higher sheath of scales to dorsal and anal. From *G. aureolus* (as described) it differs in having the eye not larger than length of snout or width of interorbital, and in having the second dorsal spine much stronger than the others, and much more than half length of head (second dorsal spine of *G. peruvianus* is from  $1\frac{1}{10}$  to  $1\frac{1}{5}$  in head).

214. *Gerres brevimanus* Günther.

Probably not common; we collected five specimens ranging in entire length from 23 to 36 cm. The species may be at once distinguished from all other American species by the short pectoral, which never reaches the vertical from the vent, and which equals in length the post-nasal part of the head.

The lips are much thickened, especially the lower one. In the smaller specimen the breadth of the lower lip at its widest part is contained  $3\frac{3}{5}$  times in the diameter of the eye. In the largest one, it is contained  $2\frac{1}{5}$ . Between these there is a regular gradation, with the exception of the next to the largest specimen (31 cm. long), in which the lips are much wider than in any other. In this, the lower lips are thickened until they meet on the median line, and appear as a medially divided flap, which extends backward to below the corners of the mouth, where it is truncated. We cannot determine whether this is a sexual character, as our specimens unfortunately have been eviscerated.

The upper profile of the head is concave above the eyes and convex above the nostrils; the snout is blunt, in the large specimens projecting beyond the tip of the lower jaw a third of the diameter of the eye, in the small specimens somewhat less. The eye varies much with the size of the fish and is contained (inside of the adipose eyelid) from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  times in the length of the head. Its width nearly equals the length of the snout in the smallest specimens; in the largest ones it is contained from  $1\frac{1}{3}$  to  $1\frac{4}{5}$  times in the snout.

The gill-rakers are very short, 9+13 in number. The exposed portion of the maxillary varies in length from  $4\frac{1}{4}$  to  $4\frac{3}{4}$  in the length of the head. The ventral spine is stout and blunt, about six-tenths of the longest ventral ray. The second anal spine does not project beyond the third, which about equals the soft rays. The third dorsal spine projects beyond the second, sometimes beyond the fourth.

The streaks along the rows of scales are scarcely fainter than in *G. lineatus*; those above the lateral line are as conspicuous as those below.

Günther's statement that the length of the head is twice and a half in the length of the body is evidently a misprint. It should read thrice and a half.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm. ....	170	210	227	247	278
Head.....	30	31½	31½	31½	31
Depth at base of first dorsal spine.....	45	43	45	42½	45
Eye between adipose eyelids .....	8½	7½	8	7	7
Snout .....	9	10½	11	12	10
Exposed portion of maxillary .....	6	6	7	8	8
Interorbital.....	10	9½	10	11	10½
Length of pectoral.....	24	25	24	23	24½
Length of ventrals.....	25	26	24	24	24½
Second dorsal spine.....	23	21	22	20	19½
Second anal spine.....	19	17½	18	16	17
Caudal .....	36	38	35	34	34
Number of dorsal rays .....	IX, 10	IX, 10	IX, 10	IX, 10	IX, 9
Number of anal rays.....	III, 8	III, 8	III, 8	III, 8	III, 8
Scales .....	6-40-11	6-39-11	6-39-11	6-40-11	6-39-11

## Family KYPHOSIDÆ.

215. *Kyphosus elegans* (Peters).

Abundant in the market; also taken by us about the rocky islands. No specimens of *K. analogus* were observed, though these were carefully looked for. It is probable that Panama records of *K. analogus* refer to *elegans*. The differences separating these closely related species are well shown by our specimens. The scales are comparatively large, there being 63 to 68 in the lengthwise series above the lateral line. The anal is more elevated than the dorsal, the height of its anterior rays being contained 1½ times in the base of the soft portion of the fin. There seem to be constantly 13 rays in the second dorsal and 12 in the anal (instead of 12 in one and 11 in the other).

Our specimens vary widely in color. One is almost uniformly deep bronze on head, body, and fins, there being only faint traces posteriorly of the lighter streaks which in other specimens follow the centers of the rows of scales. Other specimens approach more nearly the bright coloration found in *K. analogus*, some of the streaks being noticeably blue.

216. *Sectator ocyurus* (Jordan & Gilbert).

Seen on two occasions only, but present then in considerable numbers.

We have the following corrections to make in the original description: The eye is contained 4½ to 4⅔ times in the head (not 4). The scales on the breast are



much reduced in size. The base of the spinous dorsal is two-thirds (not nearly equal to) the length of the soft dorsal or anal. The soft dorsal contains 15 (not 13) rays.

### Family SCIÆNIDÆ.

#### 217. *Isopisthus remifer* Jordan & Gilbert.

Abundant; known only from Panama. This species is probably distinct from its very close Atlantic representative, *I. parvipinnis*, but no specimens of the two have been directly compared, and the characters alleged to distinguish them are in need of verification. *I. remifer* is said to have longer pectoral fins and more numerous rays in the anal fin. In seven specimens at hand, however, the pectoral is shorter than the description of the type would indicate, equaling the length of the head behind the front of the pupil, and contained  $1\frac{1}{8}$  to  $1\frac{2}{5}$  in the length of the head. They agree in this character wholly with the type of *I. parvipinnis* (see Jordan, 1883, p. 289), and with its synonym *I. affinis* Steindachner. *I. remifer* is said to have 19 rays in the anal, as contrasted with 16 or 17 in *parvipinnis*. The only reliable information concerning the condition in *parvipinnis* is derived from Steindachner's description and figure of *I. affinis*. In two specimens examined by him, the anal fin contained 16 and 17 rays. In seven specimens of *I. remifer*, the anal counts are as follows: 16, 17, 17, 18, 18, 18, 18. In the type of *remifer*, there are said to be 19 rays. It is impossible to pronounce upon the distinctness of these two species until adequate Atlantic material is at hand for comparison.

The dentition has been insufficiently described by all observers. It differs in no essential respect from that characteristic of *Cynoscion*. The mandible contains an outer series of minute teeth, closely associated with an inner series of elongate canine-like teeth of considerable size. The canines are not definitely 3 in number, as described by Steindachner, but vary from 6, the normal number, to 2 or 3, the missing ones having become accidentally detached. The canines are largest along the middle of the side of the mandible, and cease before reaching the symphysis, the tip of the mandible being occupied by a double series of very small teeth. On the sides of the upper jaw is an outer row of slightly enlarged teeth, and a narrow band of villiform teeth behind it. Anteriorly the band disappears and gives place to a short inner series, the median pair of which are enlarged to form the very conspicuous fangs.

The scales agree in size in the two species, there being 52 to 55 enlarged scales along the lateral line, and above the lateral line 70 to 75 oblique series running downward and backward.

*Isopisthus* seems to differ inadequately from the genus *Archoscion*, being distinguished only by the longer interval between the dorsal fins.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm. ....	221	202
Depth .....	25	24
Head from tip of upper jaw .....	32	32
Eye .....	7	7
Maxillary .....	14	14 $\frac{1}{2}$
Least width of suborbitals (bone).....	1 $\frac{3}{4}$	1 $\frac{3}{4}$
Interorbital (bone).....	6	6
Length of third dorsal spine.....	12 $\frac{1}{2}$	13 $\frac{1}{2}$
Length of fifth dorsal ray .....	12 $\frac{1}{2}$	13 $\frac{1}{2}$
Length of fifth anal ray .....	11	12 $\frac{1}{2}$
Length of pectoral.....	21 $\frac{1}{2}$	22 $\frac{1}{2}$
Length of ventrals .....	16	17
Length of caudal .....	17 $\frac{1}{2}$	18
Height of caudal peduncle .....	9	9

218. *Cynoscion prædatorius* (Jordan & Gilbert).

Occasionally coming into the market in considerable numbers, reaching a length of 75 to 110 cm. It is strongly distinguished from all other species of *Cynoscion* by its more oblique mouth and heavier mandible. As this character seems to us insufficient to warrant generic separation, we do not recognize the nominal genus *Buccone* based upon it.

In twelve specimens, three have 18 dorsal rays, seven have 19 rays, one specimen has 20 rays and one but 15. The last-mentioned seems normal in every way. There is no distinct sheath at the base of the soft dorsal. The anal fin contains 2 spines (not 1, as described) and 9 rays.

The scales above the lateral line increase in size posteriorly to below the middle of the soft dorsal, and decrease somewhat on the very slender caudal peduncle. There are 65 to 70 oblique rows running downward and backward. The posterior nostril is obovate in shape.

219. *Cynoscion squamipinnis* (Günther).

Not rare in the Bay of Panama.

As stated by Steindachner, the scales along the lateral line are decidedly larger than the others. There are 47 to 50 of these enlarged scales, and an equal number of oblique rows of scales running downward and backward above the lateral

line. The enumeration of scales in current descriptions (70 and 85) is based on the vertical series above the lateral line.

The spinous dorsal is shorter than in any other species of the genus, containing constantly 8 spines, of which the first is short, firmly attached to the second, and the eighth usually adnate to the back. The pectorals reach to or nearly to the vertical from the tips of the ventrals.

220. *Cynoscion othonopterus* Jordan & Gilbert.

Obtained at Panama by Gilbert (Jordan, 1885, p. 383); not seen by others.

221. *Cynoscion reticulatus* (Günther).

CORBINA RALLADA.

Abundant; not reaching a large size.

222. *Cynoscion albus* (Günther).

CORBINA AMARILLA.

Abundant at Panama, reaching a large size, specimens 220 cm. long coming frequently to the market. This species and *C. stolzmanni* reach the largest size, and are the most important food-fishes of the genus at Panama. *C. albus* is readily distinguished from other Panama species by the nearly naked dorsal and anal, the lanceolate caudal, the large scales, and the long pectorals. From *C. stolzmanni*, it is additionally distinguished by the wider head, the blunt snout, with its decurved upper profile, by the longer, slenderer caudal peduncle and by the presence of much brassy yellow on the lower half of the sides, this being especially marked in adults. The median caudal rays are also much more produced than in *C. stolzmanni* of the same size, and the lateral line is more arched anteriorly. Opercle largely black on its inner face.

D. IX or X-I, 19 to 22. A. II, 8 or 9. Lateral line with 53 or 54 pores (counted to base of caudal); 57 to 60 oblique rows of scales running downward and backward above the lateral line. Head  $3\frac{1}{7}$  to  $3\frac{1}{2}$  in length; maxillary  $2\frac{1}{3}$  in head. Usually 9 movable gill-rakers on horizontal limb of arch. The sheath of scales at the base of the dorsal fin is much wider than in *C. stolzmanni*. Series of scales accompany the first few rays of dorsal and anal, the remainder of each fin being naked. The posterior nasal opening is narrowly elliptical or ovate, much wider than in *C. stolzmanni*.

223. *Cynoscion stolzmanni* (Steindachner).

CORBINA BLANCA.

Abundant in the Panama market, reaching a length of 220 cm.; the most highly prized representative of the genus at Panama.

We have little to add to Steindachner's excellent description. The depth is contained  $4\frac{1}{2}$  times, rather than 4 times, in the length; both dorsal and anal are scaled on one or more of their anterior rays. The species has normally 10 dorsal spines (rarely 9).

The second dorsal and caudal are margined with blackish. The upper half of the axil of the pectoral is black. The membranous fold behind the mandibular teeth is black, contrasting strongly with the rest of the mouth. The gill-cavity is largely blackish, especially the lining membrane of the opercle. The ventrals, pectoral and anal fins are without dusky markings, except on the inner face of the upper pectoral rays.

224. *Cynoscion phoxocephalus* Jordan & Gilbert.

This strongly marked form is known as yet only from Panama Bay, where we have found it to be abundant.

The dentition differs in no essential respect from that found in other species of *Cynoscion*. All of the teeth are smaller, including the anterior pair of canines in the premaxillaries. The arrangement differs somewhat from that ascribed to the type. The premaxillary teeth are in a band throughout, which contains everywhere more than two series. Along the sides of the jaw, the outer series consists of stronger conical teeth which are scarcely larger than those behind them. Anteriorly the band widens, and bears along its posterior edge a converging pair of small canines. The mandibular band is widest near the symphysis, where it consists of three series, those of the outer series somewhat stronger than the others. Laterally, the band rapidly narrows, at first to two series, the inner of strong conical teeth, the outer very small; then the outer series disappears, those of the remaining series increasing in size toward the angle of the mouth.

The scales above the lateral line are in 85 to 90 oblique series, downward and backward. Those of the lateral line are enlarged, as usual in the genus, but are so concealed by smaller scales, that they are difficult to enumerate.

The spinous dorsal is more elevated than in other species of the genus, the third spine often reaching the tip of the last spine when depressed. The last dorsal spines are very delicate, one or more of them often lacking; the spines are normally 10 in number. The second dorsal is without a definite scaly sheath; small scales encroach on the thickened base of its anterior rays.

The posterior nostril is a narrowly oblong slit, scarcely larger than the anterior pore-like opening.

In life, grayish silvery above, with bluish and greenish reflections, silvery below; mouth cavity orange-yellow; opercular lining jet-black. A black humeral blotch, concealed by gill-cover. Anal and lower caudal lobe tinged with yellow; fins otherwise translucent-dusky.



225. *Sagenichthys mordax* sp. nov.

PLATE XVI, FIG. 32.

This species, which comes rather abundantly to the market at Panama, has been identified heretofore with *Sagenichthys ancylodon* from the Atlantic. No satisfactory material from opposite sides of the Isthmus has ever been compared, and none from the Atlantic is now available to the authors. But if current descriptions of *S. ancylodon* are at all reliable, there can be no question as to the validity of the form here described, which is distinguished by the greatly enlarged scales along the course of the lateral line, and by the much smaller size of the scales covering the body generally, as shown by the number of oblique rows above the lateral line. The gill-rakers are shorter than in *S. ancylodon*.

Dorsal X, I, 28-30; anal II, 9 or 10. Head  $3\frac{1}{4}$  in length; depth  $4\frac{1}{2}$ . Snout  $4\frac{1}{4}$  to  $4\frac{1}{2}$  in head; eyes (between edges of adipose eyelids)  $6\frac{1}{2}$  in head in adults 38 cm. long,  $5\frac{1}{2}$  to  $5\frac{3}{4}$  in specimens 25 cm. long. The width of the bony interorbital space is slightly greater than the distance from the tip of the snout to the posterior nostril, slightly less than 5 times in the head. In younger specimens, it equals the length of snout as far as posterior nostril.

The maxillary is longer in young specimens, its length contained 2 to  $2\frac{1}{2}$  times in the head; in larger specimens  $2\frac{1}{2}$  to  $2\frac{2}{7}$ . The premaxillaries have an outer series of arrow-shaped teeth, which are very long toward the center of the jaw, and decrease in size regularly toward the angle of the mouth. Anteriorly, behind the outer row, is a short series of three teeth on each side the median line, one of the anterior pair, or rarely both, greatly elongate, much exceeding any of the other teeth in size. Along the posterior half of each premaxillary, there is a narrow inner band of small cardiform teeth, which retain the form of the canines, each tooth having a distinctly lancet-shaped head, and a longitudinally-ridged stalk. Near the hinder end of the band, the outer row of canines become so reduced as to be indistinguishable from the teeth lying behind them. The sides of the mandible contain an inner series of large arrow-shaped canines, and a single outer series of slender teeth, similarly provided with arrow-shaped tips. Anteriorly on each side, the inner series of canines terminates, and an outer series of still larger canines develops, consisting normally of four teeth on each side the symphysis, of which the second pair are the largest. These are not continuous with the outer series of small teeth which occupy the sides of the jaw, as the latter bend around behind the anterior canines, where the two series overlap. The larger canines are subject to frequent injury, and are rapidly replaced by others occupying the same position. The lower jaw projects so that the anterior mandibular canines close outside the upper lip.

The gill-rakers are proportionately longer in young specimens, in which the longest is one-third to two-fifths the diameter of the eye. There are 7 to 9 movable rakers on the horizontal limb of the outer arch.

The dorsal spines are very slender and weak. The membrane behind the tenth spine joins the base of the eleventh, which is attached for its entire length to the first soft ray. All the fins are densely scaled to their tips. The caudal fin is doubly concave, the median rays greatly protruding in the young, less so in adults. The pectoral fins are very long, extending nearly twice as far as the ventrals,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in the head in specimens 12 inches long (injured in larger specimens). Ventrals  $2\frac{1}{8}$  in head.

The scales are very small, those above the lateral line arranged in about 105 oblique series running downward and backward. The scales bearing the pores of the lateral line are much enlarged, 47 to 50 in number, counted to the base of the median caudal rays. These enlarged scales are covered and in part concealed by small scales similar to those above the lateral line.

In life, grayish brown above, with bluish and greenish reflections, bright silvery below. The dorsal and caudal are dusky, the caudal often with narrow blackish margin, but without any deepening of color in the lower lobe. Ventrals and anal unmarked. Upper half of axil black, the inner face of the pectoral dusky, especially in its upper portion. Gill-cavity more or less dusky.

*Measurements in Hundredths of Length without Caudal.*

Length to caudal base, in mm. ....	345	292	229
Depth .....	22	22	21
Head from tip of upper jaw .....	31½	31	30½
Eye between adipose eyelids .....	4¾	5	5½
Maxillary .....	14½	15	14½
Least width of suborbital (bone only)...	1½	1½	1½
Interorbital width above middle of eye...	7	6½	6½
Length of third dorsal spine.....	11	9½	11
Length of soft dorsal base.....	37	38	36
Height of anal .....	11	11	12½
Length of pectoral.....	20½	21	24
Length of ventrals .....	13	14	14½
Length of caudal (middle rays).....	17	19	21
Least height of caudal peduncle.....	8	8½	8

226. *Nebris occidentalis* *Vaillant*.

GUAVINA.

*Nebris zestus* JORDAN & STARKS (JORDAN & EVERMANN, 1898, p. 1417).

Abundant.

In *Sagenichthys*, *Isopisthus* and *Nebris*, we have genera each of which is represented by one species on the Pacific coast of Central America, and a supposedly different, but very closely related representative form in the Atlantic. Unfortunately, we have no Atlantic material for comparison in any of these cases. This is to be regretted the more, as no direct comparisons have ever been made, and the distinctive characters relied upon may prove to be fictitious.

*Measurements in Hundredths of Length without Caudal.*

Length from tip of upper jaw to caudal base in mm.....	246	224
Depth.....	26	24
Head, from tip of upper jaw .....	31	32
Eye.....	3½	3½
Maxillary .....	14	14
Least width of suborbital.....	4	4
Interorbital (bone) .....	10	11
Length of third dorsal spine .....	10	9½
Length of fifth dorsal ray.....	10½	11
Length of longest anal ray.....	13	13½
Length of pectoral .. ..	27	29
Length of ventrals.....	19	18
Length of middle caudal rays .....	22	22
Least height of caudal peduncle.....	9	8½

227. *Larimus argenteus* (Gill).

BOCATUERTA BLANCA.

Very abundant.

In this species, a vertical line from the corner of the closed mouth passes midway between the front of the orbit and the tip of the snout. The length of the snout is two-fifths that of the maxillary. The gape is arched, with the convexity behind. The anterior (lower) margin of the mandible is also strongly arched with its convexity forwards. The eye is smaller than in any other species of the genus,  $4\frac{3}{4}$  to 5 in head, in adults.

In life, very brilliant silvery on sides and below, the upper parts faintly olive, with silvery, greenish and bluish reflections. The dorsal and anal are slightly dusky, the pectorals translucent, the anal and ventrals white or faintly straw-colored.

228. *Larimus effulgens* Gilbert.

PLATE XVI, FIG. 33.

*Larimus effulgens* GILBERT (JORDAN & EVERMANN, 1898, p. 1421).

Very close to *L. acclivis*, with which it agrees in almost all details of structure. The color is, however, bright silvery without trace of stripes, as in *L. argenteus*. The pectoral fin is also much longer.

Dorsal XI, 28 to 30; anal II, 6; pectoral 16; head  $3\frac{1}{10}$  to  $3\frac{1}{4}$ ; depth  $2\frac{2}{3}$  to 3; pores of lateral line 49 or 50.

Mouth slightly more oblique than in *Larimus acclivis*, much less so than in *L. argenteus*. Premaxillaries anteriorly on a level with middle of pupil (lower part of pupil in *L. acclivis*). Maxillary about reaching vertical from front of pupil,  $2\frac{1}{3}$  to  $2\frac{1}{4}$  in head. Teeth minute, close-set, even, in a single series in each jaw, none of them enlarged. Eye large,  $3\frac{1}{5}$  to  $4\frac{1}{5}$  in head. Interorbital space  $4\frac{1}{3}$  to  $4\frac{1}{2}$ . Preopercular margin membranous, with flexible ribs ending in minute spinules. Gill-rakers very long, two-thirds diameter of orbit, 19 or 20 on horizontal limb of arch.

Dorsal spines high and flexible, the first two not noticeably thickened. Tenth spine shortest. Third dorsal spine longest, 2 to  $2\frac{1}{3}$  in head. Soft dorsal very long, its base  $2\frac{1}{3}$  to  $2\frac{1}{2}$  in length. The longest dorsal ray equals length of snout and eye. Second anal spine very strong,  $2\frac{1}{5}$  to  $2\frac{1}{3}$  in head. Pectoral very long and narrow,  $1\frac{1}{10}$  longer than head, injured in most specimens. Ventrals reaching to or slightly beyond vent,  $1\frac{1}{3}$  in head. Caudal lanceolate, the middle rays much produced, as long as head. Tubes of lateral line much branched. Definite scaly sheaths along bases of dorsal and anal. Basal portions of membranes of vertical fins with series of scales.

Bright silvery, the back grayish. Lining of cheeks black, a small black blotch on upper third of axil. Ventrals, anal and lower caudal rays bright orange-yellow; fins otherwise dusky-translucent.

Rather common at Panama, where numerous specimens were secured.

### 229. *Larimus acclivis* Jordan & Bristol.

PLATE XVII, FIG. 34.

BOCATUERTA RALLADA.

A common species in the Panama market. Our material agrees with the types of the species in those points which are supposed to be distinctive of this Pacific form. The black streaks are conspicuous, and the second anal spine is constantly shorter than the soft rays,  $2\frac{1}{8}$  to  $2\frac{2}{5}$  in the head. The region about the pseudobranchiæ is largely black.

### 230. *Larimus pacificus* Jordan & Bollman.

Not seen by us; the type dredged by the Albatross in Panama Bay, Station 2802, 16 fathoms. It was subsequently dredged in the Gulf of California, Stations 3021 and 3026, 14 and 17 fathoms.

### 231. *Odontoscion xanthops* Gilbert.

PLATE XVII, FIG. 35.

*Odontoscion xanthops* GILBERT (JORDÁN & EVERMANN, 1898, p. 1426).

Head 3 in length; depth  $3\frac{2}{7}$ ; dorsal XII, 27; anal II, 8; pectoral 17; pores in lateral line 50.

Head and body elongate, compressed, narrow. Dorsal and ventral outlines nearly equally curved. Profile slightly depressed over front of orbits, the snout bluntish, not protruding. Jaws equal, the lower wholly included, the symphysis prominent, slightly passing the premaxillaries. Mouth very oblique, the maxillary reaching slightly behind middle of eye,  $2\frac{1}{3}$  in head. Tip of maxillary broad. Mental and rostral pores of moderate size, not conspicuous. A series of slender canines in lower jaw, preceded by an irregular outer villiform row, most evident toward symphysis. The series of canines turns inward and backward on the symphyseal protuberance, the innermost pair enlarged, directed backward. Upper jaw with a series of conical teeth, similar to those on sides of mandible, separated by a considerable interspace from an inner series of very small close-set teeth, directed backward. Eye very large, subcircular, the longest diameter  $3\frac{3}{4}$  in head; snout  $4\frac{1}{3}$ ; inter-



orbital width  $4\frac{2}{3}$ . A definite supraorbital ridge. Suborbitals narrow. Preopercular margin without definite spines, with minute crenulations, which end in spinous points. Gill-rakers long and slender, 16 on horizontal limb of arch, the longest two-fifths diameter of orbit.

Spinous dorsal very high, of weak flexible spines, none of which are thickened. The third spine is the highest, as long as snout and eye; eleventh spine shortest. Second anal spine strong, equaling length of snout and half eye. Pectorals short, not reaching tips of ventrals,  $1\frac{9}{10}$  in head. Ventrals not reaching vent, extending half way from their base to front of anal. Caudal apparently short and rounded; somewhat mutilated in the type, as are the soft dorsal and anal.

Scales large, weakly ctenoid, except on head, where they are cycloid. Maxillary, tip of mandible, and extreme tip of snout naked; head otherwise completely invested. A definite sheath of scales at base of soft dorsal. Soft portions of all the vertical fins with membranes scaled.

Dark steel-gray, with olive tinge above, silvery below, the lower parts coarsely punctate with brown. Blackish streaks follow the rows of scales, those below the lateral line broad, horizontal, conspicuous; those above lateral line narrower, less intense, the anterior ones directed obliquely upwards, those under soft dorsal nearly horizontal. Fins dusky, the anal, lower caudal lobe, and the terminal portion of ventrals black. Iris bright yellow. Roof of mouth and sides of mandible within orange-yellow, the membrane within mandibular teeth black. Tongue faintly yellow. A dusky yellow bar above and one below pseudobranchiæ, the gill-cavity otherwise silvery.

A single specimen, 19 cm. long, from Panama Bay.

### 232. *Corvula macrops* (Steindachner).

This species is frequent about the islands in Panama Bay. We collected five specimens, which we have examined in connection with a specimen collected at Mazatlan by the Hopkins Expedition.

These all seem to be darker and have more pronounced stripes along the rows of scales than Steindachner's figure (1876 *a*, Pl. II) of the type would indicate.

We may supplement the original description as follows: Head  $3\frac{1}{5}$  to  $3\frac{3}{5}$  in length; depth  $2\frac{5}{6}$  to  $3\frac{1}{10}$ . Eye  $3\frac{5}{6}$  to 4 in head; snout 4 to  $4\frac{1}{4}$ . Two specimens have 52 transverse series of scales; one has 53; three have 54. The anal is constantly II, 10; the dorsal as follows: three specimens, XI, I, 25; one specimen XI, I, 24; one specimen XI, I, 26.

### 233. *Elattarchus archidium* (Jordan & Gilbert).

Frequently taken on sandy shores.

The dorsal formula has been incorrectly given. There are 11 (rarely 10) dorsal spines, and 26 or 27 articulated rays. In eight specimens, the second dorsal contained rays as follows: 26, 26, 26, 26, 27, 27. The diameter of the eye is constantly less than the interorbital width and is contained  $4\frac{3}{4}$  to 5 times in the head; interorbital width  $3\frac{4}{5}$  to  $4\frac{1}{5}$ . The caudal is strongly emarginate or shallowly lunate.

Along the sides of the mandible, there is a series of minute teeth along the outer edge of the row of canines (as in *Cynoscion*); as we approach the symphysis these increase in size until they come to equal those of the inner series, which decrease rapidly in size along this part of the jaw. Two irregular series are thus formed, which turn backward on the symphyseal knob, the pair of large canines being

the last teeth of the inner series. Along the front and sides of the upper jaw are two series, an outer row of enlarged canine-like teeth (smaller, however, than the large teeth along the middle of the mandible), and an inner row of slender curved cardiform teeth curving directly backward. Those along the front of each jaw are larger and more widely spaced than the others. Behind the middle of the premaxillary, the inner series develops into a narrow band. The canines diminish in size laterally and become finally indistinguishable from the teeth of the band.

A specimen of this species secured by the Albatross in San Juan Lagoon, near Guaymas, Gulf of California, has been compared with our material; no differences appear to exist. In this specimen, also, there are 26 rays in the second dorsal fin.

234. *Bairdiella ensifera* (Jordan & Gilbert).

A common fish in the markets. It is well separated from *B. icistia* by the shorter snout, more oblique mouth, more projecting lower jaw, stouter dorsal spines, longer and stouter second anal spine, shorter soft dorsal and rounded spinous dorsal.

Dorsal X, I, 22 in two specimens; X, I, 23 in three specimens; X, I, 24 in three specimens. Snout equals diameter of eye, or is slightly shorter; it is contained from  $4\frac{1}{3}$  to  $4\frac{3}{4}$  times in head. Anterior margin of premaxillary on a level with a point slightly above lower edge of pupil. The tip of the lower jaw projects a very little beyond the upper.

Dorsal spines all stout, the second the stoutest; the fourth the longest, the fifth and sixth only slightly reduced in length, the others reduced rapidly to the tenth. The posterior outline of the extended spinous dorsal is convex above and concave below. The second anal spine reaches nearly to below the caudal base, the length from  $1\frac{1}{3}$  to  $1\frac{1}{2}$  in head.

In three specimens of *B. icistia*, the dorsal formula is IX, I, 28; X, I, 27; X, I, 26. The snout is a little longer than eye, its length from 4 to  $4\frac{1}{5}$  in head. Anterior margin of premaxillary on a level with a point midway between lower part of eye and lower part of pupil. Tip of lower jaw included. Dorsal spines all slender; the second not stouter than the others, the third the longest. The posterior outline of the extended spinous dorsal is concave, the fin being sharply angulated at the tip of the third spine. The tip of the second anal spine scarcely reaches past the vertical from the tips of the last dorsal rays; its length  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in head.

235. *Bairdiella armata* Gill.

Frequent. In six specimens the dorsal formula is X, I, 23; in five it is X, I, 22 (not XI, I, 21, as described by Jordan and Evermann, 1898, p. 1436).

The longest rays of the caudal fin are just below the middle; above these the fin is slightly concave, below it obliquely truncate. This shape is not well marked in some specimens.

The following color notes are from a fresh specimen: Fins all yellow; ventrals, pectorals, and caudal orange-yellow; spinous dorsal with a large black blotch above; soft dorsal and caudal with dusky margins. Mouth and gill-cavity light yellow.

236. *Bairdiella chrysoleuca* (Günther).

Not uncommon.

An examination of younger specimens than those from which are drawn current descriptions of this species, sheds little additional light on its relations to *B. aluta*. The type of the latter is 19 cm. long. We have at hand one specimen of *chrysoleuca* 19 cm., and one 165 mm. long. In these, the eye is  $4\frac{1}{2}$  to 5 in head (not 4, as in *aluta*). The fin counts ascribed to *aluta* are outside the range of variation of *chrysoleuca*, as is also the number of scales in the lateral line. The soft dorsal in *chrysoleuca* varies from 21 to 23 rays (not 18, as in *aluta*); the anal contains 9 rays (not 8) and the lateral line traverses 49 to 51 scales (not 44), the count being made to the base of the middle rays of the caudal. If the account of *B. aluta* is reliable in these respects, the species is certainly distinct.

In our specimens of *chrysoleuca*, the head is contained  $3\frac{1}{8}$  to  $3\frac{1}{8}$  in the length; the depth  $2\frac{5}{7}$  to  $3\frac{1}{7}$ . The width of the preorbital is contained  $1\frac{2}{3}$  times in the diameter of the eye; the longest gill-raker is three-fifths diameter of pupil. The second dorsal spine is much stouter than the third and is not flexible. The filamentous ray of the ventral fin does not nearly reach the vent.

237. *Stellifer oscitans* (Jordan & Gilbert).

Frequently brought to market. We preserved six specimens, from 18 to 24 cm. in entire length. To the original description, we add the following:

Head  $3\frac{1}{4}$  to  $3\frac{3}{5}$  in length; depth 3 to  $3\frac{1}{8}$ . Eye equals prenasal part of snout (measuring around contour of snout), 5 to  $5\frac{3}{5}$  in head. Snout (distance from tip to front of eye)  $3\frac{1}{2}$  to 4 in head. Three of our specimens have 24 rays in the soft dorsal, and three have 23. One specimen has but 10 spines in the first dorsal fin.

238. *Stellifer furthi* (Steindachner).

Common. A large number collected in the Panama market. We add the following to the original description: Head  $3\frac{1}{4}$  to  $3\frac{3}{5}$  in length; depth 3 to  $3\frac{1}{4}$ . Eye  $4\frac{2}{3}$  to 5 in head; interorbital  $2\frac{4}{5}$  to 3; second anal spine 2 to  $2\frac{1}{2}$ ; ventral spine  $2\frac{1}{4}$  to  $2\frac{3}{5}$ . The maxillary reaches to below a point midway between the posterior edge of pupil and the posterior edge of orbit.

The color of a fresh specimen is as follows: Body light gray above, lower parts of sides silvery, tinged with pinkish salmon. All fins light yellow; soft dorsal with a narrow black margin.

In Jordan and Evermann's description of this species (1898, p. 1441), occur the following statements: "Highest dorsal spine  $1\frac{3}{5}$  in head," "ventrals  $2\frac{1}{5}$  in head." This seems to have been incorrectly transcribed from Steindachner's description, which gives the length of the third (the highest) dorsal spine as  $1\frac{3}{5}$  times the second and about  $2\frac{1}{2}$  in the head; the ventral spine  $2\frac{1}{2}$  in the head.



239. *Stellifer illecebrosus* Gilbert.

PLATE XVIII, FIG. 36.

*Stellifer illecebrosus* GILBERT (JORDAN & EVERMANN, 1898, p. 1442).Head 3 to  $3\frac{1}{5}$  in length; depth  $2\frac{9}{16}$ . D. XIV, 20 or 21; A. II, 11; P. 19 or 20.

Body compressed, rather deep, both outlines curved, the dorsal more than the ventral. Head broad and depressed, but less so than in other species of *Stelliferus*, the interorbital width equaling distance from tip of snout to front of pupil,  $3\frac{2}{5}$  in head. Greatest width of head  $1\frac{9}{10}$  to  $2\frac{1}{10}$  in its length. Upper profile depressed above the orbits, the snout rather bluntly rounded, overlapping the premaxillaries but little. Mouth large, moderately oblique, the gape curved. Maxillary reaching vertical from middle of pupil, or slightly behind this point, its length, measured from front of premaxillaries,  $2\frac{3}{4}$  to  $2\frac{5}{8}$  in head. Teeth in lower jaw uniform in size, in a villiform band of moderate width, which does not conspicuously increase towards symphysis. Premaxillary teeth in a similar villiform band, with an outer row of enlarged canines, which decrease in size towards the angle of the mouth. Lips thin, but somewhat thicker than in other species of the genus. Five large pores in mandible, and five in snout immediately behind premaxillaries, the inner pair being concealed by overhanging lobes. Back of these are three minute pores. Horizontal diameter of eye  $5\frac{1}{7}$  to  $5\frac{3}{8}$  in head; length of snout 4 to  $4\frac{1}{4}$ ; least width of preorbital half the diameter of orbit. Vertical limb of preopercle with 8 or 9 rather slender spines, which increase in size towards angle; usually three of those at the angle are enlarged and radiate regularly, or the lowermost may be directed abruptly downwards. The horizontal limb is entire or provided with small flexible spines, loosely attached and projecting but little beyond the integument. Gill-rakers short, slender, the longest nearly half the longitudinal diameter of eye, 5 or 6 above angle of arch, 10 or 11 below.

Spinous dorsal high, the first two spines strong and rigid, the third to the eleventh weak and flexible, the twelfth to the fourteenth again stronger and rigid. Second spine nearly two-thirds the third which is the longest,  $1\frac{7}{8}$  in head. The fin diminishes slowly in height to the sixth spine, then more rapidly to the eleventh which is the shortest. The twelfth to the fourteenth progressively lengthen and belong to the second dorsal, the last being more than half the length of the longest ray.

Second anal spine long and slender, about two-thirds the height of the longest ray, equaling distance from tip of snout to front of pupil. Last ray of anal under the third before the last of the dorsal. Pectorals reaching to or nearly to the vertical from the vent,  $1\frac{2}{5}$  in the head. Ventrals short, the outer ray filamentous,  $1\frac{3}{8}$  in head. Caudal double-truncate, sublanceolate, the middle rays projecting much beyond the outer,  $1\frac{1}{4}$  in head.

Scales cycloid on top and sides of head, elsewhere ctenoid. Lateral line more arched than the back, becoming straight slightly behind front of anal fin. Soft parts of all the vertical fins scaled to their tips. Pectorals and ventrals with series of scales along the membranes.

Color in life, plain silvery gray above, silvery below. Dorsals and upper portion of caudal dusky translucent. Pectorals light straw-color. Ventrals mesially orange-yellow, the inner ray, the outer ray, and the tips of all the rays bright white. Anal deep yellow, the rays margined with black. Lower caudal rays yellow. Gill-cavity dusky, without yellow.

Three specimens from the Bay of Panama, the largest 255 mm. long.

As stated below, under *Eques viola*, the last portion of the original published description of *S. illecebrosus* (Jordan & Evermann, 1898, p. 1442), including the color and some structural details, refers instead to *E. viola*, and should be transferred to the description of that species. There should be stricken from the description of *S. illecebrosus* all after the 11th line from the bottom of p. 1442. The statement subsequent to this point: "This species is related most nearly to *Stellifer minor*, in some respects intermediate between *Stellifer* and *Bairdiella*" refers, however, to *illecebrosus*,



but was not included in the original manuscript, a copy of which is furnished above. On page 1439 of the volume cited, in the key to species, under the head of *S. illecebrosus*, occurs the statement "coloration dark." This should read "coloration silvery."

240. *Stellifer ericymba* (Jordan & Gilbert).

This little fish is common in Panama Bay. Many specimens were preserved, the largest not exceeding 16 cm. in length.

We have examined in connection with our specimens the description given by Jordan and Evermann (1898, p. 1444) and find it satisfactory.

241. *Stellifer zestocarus* Gilbert.

PLATE XVIII, FIG. 37.

*Stellifer zestocarus* GILBERT (JORDAN & EVERMANN, 1898, p. 1445).

Head  $3\frac{1}{8}$  to  $3\frac{1}{4}$  in length; depth  $2\frac{6}{7}$  to 3. Pores in lateral line 47 to 50; dorsal XII, 19; anal II, 10.

Comparatively deep and compressed, with narrow head, large oblique mouth, the greatest width of head  $1\frac{3}{4}$  to  $1\frac{5}{8}$  in its length. Anterior profile rising in an even convex curve to front of dorsal, depressed very little if at all above the orbits. Greatest depth under front of spinous dorsal. Length of caudal peduncle, measured from base of last anal ray,  $1\frac{3}{8}$  in head; from last dorsal ray,  $1\frac{2}{3}$ . Least depth of caudal peduncle  $2\frac{5}{7}$  in head.

Head extremely soft, the bones cavernous. Snout bluntish, not projecting beyond the premaxillaries, its length  $4\frac{1}{2}$  to  $4\frac{1}{2}$  in head. Lower jaw included, the tip produced into a short but distinct symphyseal knob. Mouth large, very oblique, the maxillary (measured from front of snout), equaling length of snout and eye,  $2\frac{2}{3}$  in head. Teeth in narrow villiform bands in both jaws, widest in sides of premaxillaries. None of the teeth enlarged. Lips thin. Mental and rostral pores minute. Interorbital space transversely convex,  $2\frac{1}{2}$  to  $2\frac{9}{10}$  in head. Supraorbital ridges prominent. Preopercle with a wide membranous border, which is strengthened near the angle with diverging ribs. A single rather stiff spine directed backwards, immediately above the angle. Gill-rakers numerous, long and slender, about 20 on horizontal limb of arch, the longest half the diameter of orbit. Eye large, elliptical, the long axis oblique, the greatest diameter  $3\frac{2}{3}$  or  $3\frac{4}{5}$  in head, equaling distance from tip of snout to front of pupil.

Fins high, densely scaled, including the spinous dorsal. First and second dorsal spines rather strong and stiff, the third and succeeding spines flexible. Third spine longest,  $1\frac{2}{3}$  in head. The ninth spine is shortest, the tenth and eleventh longer, belonging to the soft dorsal. The last three spines are stronger and rigid. Second anal spine long and rather slender,  $2\frac{1}{3}$  to  $2\frac{2}{3}$  in length of head. Longest anal ray  $1\frac{2}{3}$  to  $1\frac{3}{4}$  in head. Anal basis long, equaling length of snout and eye. Caudal double-truncate, almost lanceolate, the middle rays much produced,  $1\frac{1}{4}$  or  $1\frac{1}{2}$  in head. Pectorals long, reaching beyond vent,  $1\frac{1}{8}$  in head. Ventrals not nearly reaching vent,  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in head.

Scales thin, deciduous, weakly ctenoid. Head completely scaled.

Nearly uniform grayish silvery above, bright silvery below. Fins slightly dusky. Mouth and gill-cavities silvery white. A blackish blotch in the region of the pseudobranchiæ.

Seven specimens from Panama Bay, the longest about 15 cm. long.

242. *Ophioscion typicus* Gill.

Not common; eight specimens were taken 14 to 21 cm. in length. The description of this species by Jordan and Evermann (1898, p. 1448) was evidently

taken from a young specimen. We make the following additions to the original description:

Head  $3\frac{1}{3}$  to  $3\frac{3}{5}$  in length. Eye  $4\frac{1}{4}$  to 5 in head; snout  $3\frac{3}{4}$  to 4; interorbital (bone)  $3\frac{3}{4}$  to 4; maxillary 3 to  $3\frac{1}{3}$ ; third dorsal spine  $1\frac{5}{6}$  to  $2\frac{1}{6}$ .

In addition to the differences already noted as distinguishing this species from *O. strabo*, we note the lighter pectorals and ventrals, which are colorless or only slightly dusky. In *O. strabo* the pectorals are dark, and the ventrals, with the exception of a white outer ray, are nearly black.

### 243. *Ophioscion simulus* Gilbert.

PLATE XIX, FIG. 38.

*Ophioscion simulus* GILBERT (JORDAN & EVERMANN, 1898, p. 1449).

Dorsal X-I, 26; anal II, 7; pectoral 18 or 19; pores in lateral line 50; smaller scales not here enumerated cover the base of the caudal fin. Head  $3\frac{3}{5}$  in length, equaling depth.

Body more elongate and less compressed than in other species, the head especially characterized by rounded outlines; preorbitals turgid; snout blunt, scarcely at all compressed, evenly rounded in all directions. Top of head everywhere transversely convex, not at all depressed over the orbits. A scarcely noticeable depression at occiput, with the exception of which the profile rises slowly and evenly to the front of the dorsal fin. Predorsal region transversely evenly convex, not compressed to a ridge, except immediately in front of first dorsal spine. Dorsal and ventral outlines about equally curved, the base of anal fin but little more oblique than the normal contour at that point. Mouth wide, broadly U-shaped as seen from below, overpassed by the bluntly rounded snout for a distance (taken axially) equal to half diameter of pupil. The cleft of the mouth is moderately oblique, the maxillary reaching the vertical from middle of pupil. Length of maxillary (measured from front of premaxillaries)  $3\frac{1}{3}$  in head. Mandible with a broad band of villiform teeth of uniform size. Pre-maxillaries with a similar broad villiform band, preceded by an outer series of small canines, close-set, smaller in size than in related species. Preorbital of moderate width, swollen and turgid as in *Pachyurus*, its width  $6\frac{1}{3}$  in head. Posterior nostril large, circular, without trace of raised membranous edge. Anterior nostril vertically elliptical, small, with raised margin. Oblique diameter of eye,  $4\frac{2}{3}$  in head. Preopercular margin with 14 to 16 spinous teeth (in the type specimen), the upper ones minute, increasing in size towards preopercular angle, around which they evenly radiate. None of them are conspicuously enlarged, and the lowermost is not directed abruptly downward. Gill-rakers short, the longest about equaling diameter of posterior nostril, 7 movable ones on upper limb of arch, 13 below.

First dorsal high, of very slender flexible spines, except the first two. The second spine is strong and rigid, as long as the fourth, contained  $1\frac{3}{4}$  times in the head; the third spine the longest, reaching when declined to base of the spine of second dorsal, its length  $1\frac{2}{3}$  in head. From the third, the spines decrease rapidly, so that the distal margin of the fin is subvertical. The tenth spine is the shortest, its membrane reaching base only of the eleventh, which belongs to the second dorsal and is two-thirds as long as diameter of the eye. Second dorsal high, the longest ray equaling length of snout and eye. Caudal subanceolate, mutilated so that its exact shape cannot be ascertained. The middle rays are considerably longer than the outer, and are at least three-fourths length of head. Second anal spine long and strong, its measured length  $1\frac{2}{3}$  in head, slightly greater than that of first soft rays, which however project beyond it. Outer ventral ray produced in a very short filament, about one-fourth diameter of eye. Ventral spine  $2\frac{2}{3}$  in head, the longest ray, exclusive of filament,  $1\frac{1}{2}$  in head, reaching five-sevenths distance from its base to vent. Pectorals  $1\frac{1}{3}$  in head, reaching vertical from tips of ventrals.

Lips, gular membranes, and under side of snout naked, head and body otherwise scaled. Scales on mandible, and a small patch on base of anterior branchiostegals, cycloid; those in advance of nostrils cycloid, or very weakly ctenoid; scales otherwise strongly ctenoid. Second dorsal and anal with a definite low scaly sheath at base, consisting of a single series of small scales and in addition series of scales on the membranes, extending two-thirds distance to tip. Caudal scaled to tip. Lateral line with a long low curve, the height of which equals half diameter of orbit.

Color steel-gray above, without dark streaks, white below, the cheeks and lower portion of sides with much brown specking, sometimes confined to the margins of the scales. Mouth white within. Lining of opercles blackish. Fins dusky, the distal part of ventrals black, the outer ray white. Anal with the anterior rays tipped with black.

A single specimen 187 mm. long.

This species is closely related to *O. scierus*, but differs in the longer, less compressed body, the plain coloration, the turgid preorbitals, less arched lateral line, and smaller canines.

#### 244. *Ophioscion strabo* Gilbert.

This species is listed, without remark, by Boulenger (1899, p. 3) from Rio Tuyra, and other rivers on the western slope of the Isthmus of Darien. The species was not seen by us. These Panama specimens should be carefully compared with the closely related species *typicus* and *simulus*, which are known from Panama and closely resemble *O. strabo*.

#### 245. *Ophioscion imiceps* (Jordan & Gilbert).

This species seems to be rather rare at Panama. During our stay of six weeks we secured twelve specimens. Like other species of the genus, *O. imiceps* varies greatly in length of snout and diameter of eye.

Head  $3\frac{1}{5}$  to  $3\frac{3}{5}$  in length; depth  $2\frac{5}{7}$  to  $3\frac{1}{5}$ . Eye  $4\frac{2}{3}$  to  $5\frac{1}{2}$  in head; snout  $3\frac{5}{6}$  to 4; interorbital width  $3\frac{4}{5}$  to  $4\frac{1}{5}$ ; second dorsal spine  $2\frac{1}{3}$  to 3; third dorsal spine  $1\frac{3}{4}$  to 2.

#### 246. *Ophioscion scierus* (Jordan & Gilbert).

PLATE XIX, FIG. 39.

Common.

The snout projects beyond the mouth for a distance varying from one-third to one-half the diameter of the eye. It increases in sharpness with its length.

Interorbital width (bone)  $4\frac{1}{4}$  to  $4\frac{1}{2}$  in head (not  $5\frac{1}{3}$ ); snout  $3\frac{1}{2}$  to  $3\frac{3}{5}$ ; eye  $5\frac{1}{4}$  to  $5\frac{5}{8}$ . Gill-rakers short, barely movable, 12 on horizontal limb of arch. Soft dorsal with a distinct, rather wide sheath of scales at base; each interradiial membrane with a series of scales, rapidly diminishing in size from the base upward, reaching half way to margin of fin. Anal similarly scaled, the basal sheath less clearly defined.

Second dorsal spine very stout, conspicuously stronger than any of the succeeding spines, all of which are slender and weak. The eleventh spine is twice the length of the tenth. The second anal spine is very robust, twice the width of the second dorsal spine, reaching to opposite the tip of the fifth soft ray. Soft dorsal rays 24 or 25.

Opercular lining blackish.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm. ....	198	150	150	153	171	161	147	163
Head .....	31	30½	32	31½	31	31	30½	30½
Depth.....	31	31½	32	32	31	32	30	31
Eye.....	5¼	6	6	6½	6	6½	6	6
Snout.....	8½	8½	8¾	8½	9	8	8	9
Interorbital width .....	7½	7	7¼	7½	7¾	7	7	7½
Length of pectoral .....	23	24	26	24	24	24	24	23
Length of third dorsal spine .....	16½	19½	19	18½	17½	18	19½	16½
Length of second anal spine .....	15½	18	17	17	17	17	18	16½

**247. *Sigmurus vermicularis* (Günther).**

Frequently brought into the market, where we collected nine specimens.

Head from  $3\frac{1}{10}$  to  $3\frac{1}{4}$  in length. Eye  $5\frac{1}{4}$  to  $5\frac{1}{5}$  in head; snout  $3\frac{7}{8}$  to 4; length of third dorsal spine  $1\frac{3}{4}$  to  $1\frac{5}{8}$ ; interorbital (bone only)  $4\frac{3}{4}$  to 5. The dorsal formula is as follows: In one specimen IX, I, 27; in four specimens X, I, 27; in four specimens X, I, 26. The anal is constantly II, 8.

**248. *Sciæna deliciosa* (Tschudi).**

According to Jordan and Eigenmann (1889, p. 406), a few specimens of this species, said to have been taken at Panama, are in the Museum of Comparative Zoology at Cambridge, Mass. There are no other references to the occurrence of this Peruvian species at Panama, and the record is in need of verification.

**249. *Micropogon altipinnis* Günther.**

## CORBINA LUNA.

Head  $3\frac{1}{8}$  to  $3\frac{1}{8}$  in length; depth  $3\frac{1}{2}$  to  $3\frac{1}{2}$ . Eye 6 to  $6\frac{1}{3}$  times in head; snout projecting beyond the mouth for a distance equaling one-fourth eye. Snout  $3\frac{1}{8}$  in head. Anterior nostril very small, circular, with a narrow membranous border, widened posteriorly to form a short flap. Posterior nostril obliquely elliptical, its greatest diameter one-third eye. Maxillary reaching vertical from front or middle of pupil,  $2\frac{1}{3}$  in head. Anterior premaxillary teeth of the outer row noticeably larger than those behind them. Usually four pairs of slender mandibular barbels. Upper preopercular serræ very small, increasing in size toward the angle. At the angle, separated from these by a wide interval, is a very strong spine directed downward and backward, below which is a similar but shorter spine directed more obliquely downward. The gill-rakers are very short, the longest two-fifths the horizontal diameter of the pupil, 15 or 16 present on the horizontal limb of the arch.

The dorsal fin contains constantly 11 spines, the last longer than the one preceding. In eight specimens the soft rays number 20, 21, 21, 21, 21, 21, 22, 22. The spinous dorsal is very high, the third spine extending to base of first or second ray of soft dorsal; its length is contained  $1\frac{1}{3}$  to  $1\frac{1}{3}$  times



in the head. The low scaly sheath along the base of the soft dorsal disappears shortly before reaching the end of the fin. The second anal spine is nearly or quite equal to the length of the snout. Pectorals extending well beyond the ventrals,  $1\frac{2}{3}$  in the head. Outer ventral ray filamentous,  $1\frac{3}{8}$  in head. Caudal with the middle rays longest, the outline of the fin concave above the middle, convex below it.

Scales above the lateral line in very oblique series downward and backward, normally 40 or 41 in number; in one specimen there were but 35 rows, in another 43. An occasional scale is intercalated between these series as they approach the lateral line, the number of pores slightly exceeding the series.

Color as usual in the genus. Upper part of axil dusky. Opercular lining dusky, becoming black posteriorly, where it contrasts strongly with the silvery opercular membrane.

This is a common species at Panama. Our description is based on specimens 31 to 36 cm. long.

250. *Umbrina xanti* Gill.

Recorded from Panama by Günther (1868, p. 426, as *U. analis*), and by Gilbert. Not seen by us.

251. *Umbrina dorsalis* Gill.

Infrequent; four specimens secured.

Dorsal X, I, 29, 29, 31, 31. Anal II, 7, 7, 7, 8. Eye  $4\frac{1}{3}$  to  $4\frac{1}{2}$  in head; snout  $3\frac{1}{5}$  or  $3\frac{5}{8}$ . Preopercular margin scarcely serrate, provided with a rather thick membranous border with small flexible teeth.

252. *Menticirrus nasus* (Günther).

*Menticirrus simus* JORDAN & EIGENMANN, 1889, p. 437.

Frequent in the Panama market. The twelve specimens before us differ in the size of the eye and the form of the snout sufficiently to demonstrate the identity of *M. simus* and *M. nasus*, which have been separated on differences similar to those here found.

Head  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in length; depth  $4\frac{1}{5}$  to  $4\frac{1}{2}$ . Eye equals snout in front of anterior nostril, and is contained  $5\frac{1}{4}$  to  $5\frac{1}{2}$  in head; snout  $3\frac{1}{4}$  to  $3\frac{1}{2}$ . The third dorsal spine is the longest and is contained  $4\frac{1}{4}$  to  $4\frac{3}{4}$  in the length. When the fin is depressed, its tip reaches variously from the base of the first ray of the second dorsal to the base of the fourth. Above the lateral line, there are 50 oblique series of scales running downward and backward.

The nostrils are larger than in *M. panamensis*, the anterior nostril round or very slightly oval, distant half its diameter from the posterior nostril. A dermal flap is attached to its posterior edge, and extends back to the posterior nostril. The posterior nostril varies in shape from widely to narrowly elliptical. Its posterior end is usually pointed and reaches the beginning of the adipose eyelid.

The caudal is S-shaped; its upper angulated lobe extends beyond the lower rounded lobe a distance equal to the diameter of the eye.

253. *Menticirrus panamensis* (*Steindachner*).

The most abundant species of the genus at Panama. Fourteen specimens were preserved, the largest 33 cm. in length. The following additions may be made to Dr. Steindachner's description, in the light of our large series.

Dorsal X, I, 20 or 21; anal I, 9. Depth  $4\frac{1}{6}$  to  $4\frac{5}{6}$  (rather than nearly 4 as stated by Steindachner) in length without caudal; head 3 to  $3\frac{1}{4}$ . Eye 7 to 8 in head; snout  $3\frac{1}{2}$  to 4. The anterior nostril is round, and is separated from the posterior nostril by a space equal to half its diameter. To its posterior edge is attached a dermal flap, which extends back to the posterior nostril. The latter is a little broader than the former, and twice as long. It ends at a distance equal to its length from the orbital edge (exclusive of the adipose eyelid). The outer series of teeth in the upper jaw consists of from 6 to 10 irregularly spaced canines, those in the front of the jaw much enlarged.

When the spinous dorsal is depressed, the tip of the third dorsal spine reaches to, or a very little past, the front of the second dorsal. The length of the third spine is contained in the length of the body 5 to  $5\frac{1}{2}$  times; it equals the caudal and is contained  $1\frac{1}{3}$  to  $1\frac{1}{4}$  in the pectoral (Steindachner describes it as equal to the pectoral). The caudal is conspicuously S-shaped; the upper lobe shorter than in other species; its tip not extending beyond the lower rounded lobe.

*M. panamensis* differs from *M. nasus* in having a longer head, smaller eye, smaller nostrils placed farther from the eye, larger canines, and shorter dorsal spines. The anal base is longer, the fin is not so much rounded in outline. There are two less dorsal rays and one more anal ray; the upper angulated lobe of the caudal does not project beyond the rest of the fin. *M. panamensis* probably reaches a larger size.

254. *Menticirrus elongatus* (*Günther*).

Frequently seen, but less abundant than *M. panamensis*.

255. *Polyclemus dumerili* (*Bocourt*).

Very abundant in the Panama market during the early part of January. The species has been admirably described by Dr. Steindachner (1875 *b*, p. 31) under the name *Genyanemus fasciatus*. It may be well to note that the pectoral and ventral fins are densely scaled, as well as the soft portions of the vertical fins. Below are given the colors in the fresh state.

Silvery gray on back, sometimes tinged with deep reddish yellow. Lower half of sides, including belly and under side of caudal peduncle, salmon-red. Breast and area about ventrals dusky silvery. Bars jet-black. Sides and top of head dusky. Opercular lining blackish. Under side of head generally, including opercular membrane and under side of snout, tinged with salmon. Dorsal, caudal and pectoral fins straw-color, made dusky by minute points. Soft dorsal with a narrow black margin. Spinous dorsal largely blackish. Anal orange-yellow. Ventrals dusky yellow.

256. *Polyclemus rathbuni* (Jordan & Bollman).

Only the types reported by Jordan and Bollman (1889, p. 162) from Panama.

257. *Polyclemus goodei* (Gilbert).

PLATE XX, FIGS. 40, 40a.

*Paralonchurus* (*Zaclemus*) *goodei* GILBERT (JORDAN & EVERMANN, 1898, p. 1480).

The homodont dentition and elongate form of this species seem hardly sufficient for generic separation from *Polyclemus*. Its nearest relative is probably *P. peruanus*, Steindachner, a form with deeper body, but with scaly vertical fins and with the outer row of teeth but very little enlarged.

Head  $3\frac{1}{2}$  to 4 in length; depth 4 to  $4\frac{1}{8}$ ; dorsal XI, 25 to 27, the spines varying from X to XII; anal II, 7; 45 to 48 rows of scales running obliquely upwards and forwards from the lateral line.

Elongate, with broad heavy head, the temporal region swollen, protuberant. Snout very high and blunt, its anterior profile vertically rounded, little protruding beyond the premaxillaries. Length of snout  $3\frac{1}{2}$  to  $3\frac{2}{3}$  in head. Rostral and mental pores very large, arranged as usual. The symphyseal pore is bounded laterally by two membranous wings, continued forward from the mandibular margins, bearing many barbels. This is the condition also in *Paralonchurus petersi* and in *Polyclemus fasciatus*, no "multifid barbel" being present. The barbels in *P. goodei* are much larger and more numerous than in any other species known to us. They are widely spaced, form a conspicuous series along the inner margin of the mandible, and become crowded into a dense fringe along the anterior half of the margin of the interopercle.

Mouth oblique, the maxillary reaching the vertical from the posterior edge of pupil, a trifle less than one-third head. Teeth slender, villiform, none of them enlarged, those in the lower jaw in a narrow band, in the upper jaw in a much wider band. Teeth nearly all with brown tips. Mouth very protractile. Eye large,  $2\frac{1}{3}$  in interorbital width, one-fourth postocular part of head. Preopercle with a membranous edge minutely crenate, spinulescent. Branchiostegal membrane very wide. Pseudo-branchiæ covered by membrane, partially concealed. Gill-rakers undeveloped, represented by soft tubercles, of which there are 6 or 8 on the horizontal limb of arch. Two or three next the angle are sometimes slightly longer and movable.

Dorsal spines slender and flexible, the third the longest, equal to length of snout and half eye. Tenth spine shortest. Soft dorsal and caudal densely covered with scales to their tips. No differentiated sheath at base of soft dorsal. Anal fin without scales. First anal spine minute, the second slender but not flexible, one-half to two-thirds length of longest ray. Caudal fin with the lower lobe longest, convex, the upper lobe concave. Longest caudal rays  $1\frac{3}{4}$  in head. Pectorals broad, reaching vertical from tips of ventrals, but not nearly to vent,  $1\frac{1}{2}$  in head. The ventral spine is inserted slightly behind the vertical from the base of the lowest pectoral ray. Outer ventral ray produced into a filament about one-fourth total length of fin. The longest non-filamentous ray,  $1\frac{1}{2}$  in head.

Scales strongly ctenoid. Lateral line with a low wide curve, which grows abruptly steeper in its posterior part, the lateral line becoming straight behind the middle of the anal fin. The scales of the lateral line are enlarged, but are almost wholly concealed by smaller scales.

Color dark grayish brown above and on sides, with greenish and bluish reflections; white below. Back and sides with four broad inconspicuous cross-bars extending downward and slightly backward; the first from predorsal region to base of pectorals; the second from end of spinous dorsal; the third from base of eighth to twelfth, the fourth from twentieth to twenty-fifth rays of soft dorsal. Basal portion of the anal fin, and the outer ventral rays yellow, the distal portions dusky; other fins dusky, the pectorals darker on the inner face, black at axil. Lining of opercle dusky.

Rare at Panama, eight specimens were obtained during a close inspection of the markets for six weeks. Longest specimen 28 cm.

*Measurements in Hundredths of Length without Caudal.*

			TYPE
Length without caudal in mm. ....	201	226	230
Depth .....	25	26	26
Length of head .....	26½	27½	27
Diameter of eye .....	4	4	4
Greatest width of preorbital .....	4	4	4
Width of interorbital .....	8	8½	8½
Length of snout .....	8	8	8½
Length of third dorsal spine .....	13	Broken	11
Length of longest anterior dorsal rays.....	8½	8	8
Length of third anal ray .....	12	12	12
Length of pectoral .....	24	25	24
Length of ventrals .....	18½	21	20
Length of caudal .....	23	22	22
Height of caudal peduncle.....	10½	10	10

258. *Paralonchurus petersi* *Bocourt.*

PLATE XX, FIG. 41.

Rare; but four specimens seen.

The genus *Paralonchurus*, of which *petersi* is the type and the only known species, is well separated from related forms by the cycloid scales and the anterior insertion of the ventral fins. The base of the ventral spine falls in the vertical from the base of the uppermost pectoral ray. The species carries to an extreme the physiognomy peculiar to this section of the family, the eyes being very small, the snout long and depressed, with very large pores, and the fins excessively developed.

Head  $3\frac{1}{2}$  to  $3\frac{1}{2}$  in length; depth 4 to  $4\frac{1}{4}$ . Dorsal X-I, 33 or 34. Anal II, 8. Lateral line 49 or 50. Interorbital space equaling or slightly exceeding length of snout,  $3\frac{2}{3}$  in head. Eye  $3\frac{1}{2}$  to  $3\frac{1}{2}$  in interorbital width. Distance from front of premaxillaries to tip of maxillary equaling that from tip of snout to posterior edge of pupil,  $2\frac{9}{10}$  to 3 in head. Vertical width of preorbital under front of orbit equals half interorbital width.

The snout projects beyond the premaxillaries for a distance equaling two-thirds the diameter of the eye; it is flattened from above and bluntly rounded from side to side. There is an evident depression above the orbits. Mouth larger than in related species, the maxillary reaching a vertical slightly behind the eye. The teeth are in bands of about equal width in the two jaws, increasing slightly in size toward the inner side of the mandibular band and the outer side of the premaxillary



band. Upper jaw with an outer series of enlarged teeth, the basal four-fifths of each tooth finely ridged lengthwise, the terminal one-fifth abruptly smooth, separated from the ridged portion by a shallow transverse groove. This structure is very similar to that found in *Sagenichthys*, except that the terminal portion is flattened and lance-shaped in the latter, but remains conical in *Paralonchurus*. It is interesting to note that most of the teeth are light brown in color, as is usual with arrow-shaped teeth. The finer teeth in *Paralonchurus* seem to show a similar structure to that just described.

Pseudobranchiæ are perfectly evident in this genus, never wholly concealed, though covered by the integument. Gill-rakers very short, little movable, 6 developed on the horizontal limb of the arch. Free edge of mandibular ramus with a series of delicate cilia, which are continued forward along the sides of the median pore at the chin. Preopercular margin delicately denticulate, with flexible teeth.

Pectorals very large, twice as long as the ventrals, reaching the vertical from the vent, or the front of the anal fin. The caudal fin is unsymmetrically lanceolate, the longest rays being those just below the middle of the fin, the outline not incurved above or below these. The longest caudal rays equal the longest of the pectoral fin. The outer ventral rays are produced, extending half-way to the front of the anal.

Scales all cycloid, perfectly smooth, those of the lateral line enlarged, covered with very small scales. The caudal is scaled on its middle rays, the other fins wholly scaleless.

In life, the back is grayish-brown, with light blue and bronze reflections; under parts whitish. All the fins, except the spinous dorsal, are deep bright blue, appearing light brown by transmitted light; the blue color persists in spirits. Posterior border of pectoral fins black; inner ventral ray light brownish yellow, the outer filamentous ray whitish; anal with a narrow black margin. Branchiostegal membranes, gular membrane and lips with some yellow. Inside of mouth and gill-cavity, and lining of shoulder girdle orange-yellow. Lining of opercles jet-black, of cheeks dusky.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm. ....	252	238
Head .....	30	30
Depth .....	22½	23½
Eye .....	2½	2½
Snout .....	9	9
Greatest width of preorbital .....	4	4
Interorbital (bone).....	9	9
Length of pectoral.....	29	30
Length of third dorsal spine.....	10	9
Length of longest anterior dorsal rays....	8	7½
Length of third anal ray .....	11	12
Length of ventrals .....	14	14½
Length of caudal .....	26	27
Height of caudal peduncle.....	9	9½

259. *Eques viola* Gilbert.

PLATE XXI, FIG. 42.

*Eques viola* GILBERT (JORDAN & EVERMANN, 1898, p. 1486).

The present species and *Stellifer illecebrosus* were originally published in Jordan and Evermann's *Fishes of North and Middle America*, Vol. II, pp. 1442 and 1486, from manuscript furnished by Dr. Gilbert. While being typewritten, the last manuscript pages of the two descriptions were unfortunately interchanged, with the result that the color, as well as various anatomical details ascribed to *E. viola* belong to *Stellifer illecebrosus* and *vice versa*. In the original description of *E. viola* (t. c. p. 1486), all should be stricken out after the word "reaching" on the fourth line from the bottom of that page. The following description exactly follows the original manuscript:

Head  $2\frac{9}{10}$  to  $3\frac{1}{5}$  in length to base of caudal; depth  $2\frac{5}{7}$  to  $3\frac{1}{2}$ . D. IX or X, 38 to 41; A. II, 7 or 8; P. 17 to 19. Scales 50 to 54 (oblique series).

Body narrowly wedge-shaped in section, sharply compressed towards dorsal outline, widening below. Lower outline of head horizontal, straight; ventral outline a gentle convex curve to base of anal, which is moderately oblique; lower outline of caudal peduncle slightly concave. The anterior upper profile rises steeply in a very gentle curve to front of dorsal, thence more obliquely to front of soft dorsal, where the depth of body is greatest.

Snout compressed, with rather prominent blunt tip, which slightly overhangs the mouth. Tip of snout and of mandible swollen, provided with large mucous pores, a series of five in the mandible, two transverse series of five each in the snout, of which the posterior lateral pair is minute. Mouth horizontal or very slightly oblique, the maxillary reaching about to vertical from hinder margin of pupil, its length measured from tip of snout  $2\frac{3}{5}$  or  $2\frac{3}{4}$  in head. Teeth in lower jaw in a wide villiform band, a few of the outer series anteriorly slightly enlarged. Premaxillary teeth in a wide villiform band, the outer series enlarged, forming moderate canines, larger than those in front of mandibular band. Interorbital space narrow, its width contained 5 to  $5\frac{1}{3}$  times in the head. Eye large, 4 to  $4\frac{1}{3}$  in head. Preopercle entire, the membranous border sometimes minutely crenulate; opercle ending posteriorly in two concealed points, the included opercular membrane covered with fine scales. Gill-rakers short and weak, 5 above the angle, 9 to 11 movable ones below, the longest about four-ninths eye.

Mandible, gular and branchiostegal membranes, and more or less of the snout naked, the scales extending forward in some specimens to beyond the nostrils, in others scarcely beyond the front of orbits. Head otherwise scaled. Lateral line following outline of back, strongly curved anteriorly. The pores of the lateral line are minute, placed on small scales, irregularly wedged in between the larger ones. Above the lateral line are very oblique series running downwards and backwards, and also vertical series. There are about 50 of the former and 90 to 95 of the latter. Scales all ctenoid except those on anterior part of breast, on lower anterior part of cheeks and on interopercle. Vertical fins densely covered to near their tips with small ctenoid scales. Pectorals and ventrals with series of scales on the membranes.

Spinous dorsal short, usually nearly triangular in outline, the second spine the longest, the others rapidly decreasing to the last or next to the last. Longest spine usually as long as snout and eye, sometimes shorter. Soft dorsal long and low, increasing in height backwards, the longest ray about  $3\frac{1}{3}$  in head. Depth of caudal peduncle equaling its length behind dorsal fin. Anterior insertion of anal fin about under middle of soft dorsal, the length of caudal peduncle behind anal  $1\frac{2}{3}$  to  $1\frac{1}{3}$  in head. Second anal spine strong, its length equaling distance from tip of snout to front or middle of pupil and nearly reaching the tips of the soft rays. Caudal convex, the lower lobe slightly longer than

the upper. Pectorals short and broad,  $1\frac{2}{3}$  to  $1\frac{3}{4}$  in head, the upper angle rounded, not reaching as far back as the ventrals, which equal them in length. Axillary scales of ventrals and pectorals very little developed.

Color varying from uniform deep bronze-purple on body and fins, to brownish gray with silvery reflections. Lower parts of head and body somewhat lighter. Tip of mandible white.

Ten specimens, the longest 189 mm., were taken around San José Rock, in the Bay of Panama.

In this species, three slender interneurals, not connected with dorsal spines, lie in advance of the neural spine of the second vertebra. Four interneurals giving attachment to dorsal spines, lie crowded between the neural spines of the second and third vertebræ, the anterior one being very broad. Three interneurals follow, interposed between the third and fourth neurals, and three more between the fourth and fifth.

#### Family CIRRHITIDÆ.

##### 260. *Cirrhites rivulatus Valenciennes.*

The only Panama record for this species is that by Günther (1868, p. 421), based on a specimen secured by Captain Dow. It was not seen by us.

#### Family POMACENTRIDÆ.

##### 261. *Chromis atrilobatus Gill.*

PLATE XXI, FIG. 43.

This species is very abundant about the islands in Panama Bay, where numerous specimens were secured.

It is a strikingly elegant fish in form and color. The upper parts are brownish, shading to silvery on lower sides of head and trunk. The yellowish silvery blotch at base of last dorsal rays and on the contiguous portion of the back is very conspicuous. A jet-black bar, wider in its upper portion, crosses base of pectoral fin and involves its axil. It often fails to reach the lower rays of the fin. The pectoral fin is translucent, unmarked. The ventrals are translucent or slightly dusky. The anal is light or variously dark, but is without distinctive markings. The spinous dorsal is uniformly dusky, the anterior two-thirds of the soft dorsal, including the ray which forms the tip of the lobe, jet-black, with a narrow white margin. The last three or four dorsal rays are translucent. The outer half of each caudal lobe is jet-black, with a narrow translucent margin, the entire central portion of the fin translucent.

The body is slender, tapering regularly backward from the front of dorsal. The top of head is everywhere transversely convex. The longitudinal contour shows a slight but well-defined depression above the eyes. The teeth are in wide bands in each jaw, the outer series conical, stronger than the others. The spinous dorsal is rather low and of nearly uniform height. The soft dorsal and anal are distinctly



angulated. Both caudal lobes are produced into filaments, the upper the longer. The fin is very deeply forked, the median rays but one-fourth the longest rays of the upper lobe. The lateral line is discontinued at the anterior edge of the yellow blotch below last dorsal rays. It contains 19 or 20 scales. Each of the scales of the median series on caudal peduncle is distinctly pitted, and contains a small tube which is apparently imperforate, and represents the vanishing stages of the lateral line which formerly occupied this region. The median series of scales on the trunk contains 28 to 30 scales. Between the lateral line and the dorsal sheath are  $2\frac{1}{2}$  rows of scales.

The dorsal contains 12 spines and 13 rays; the anal fin 2 spines and 12 rays.

*C. atrilobatus* resembles strikingly in coloration *C. notatus* from Japan; but the latter is deeper, and has 13 dorsal spines, larger scales, and a black-edged anal fin.

#### 262. *Pomacentrus rectifrenum* Gill.

A large number of adult specimens, 15 to 18 cm. long, are referred to this species.

Two very closely related, yet distinct, species were found associated around rocky islands in Panama Bay. They were separated in the field by their slightly different color and proportions, characters to which we can now add a slight but perfectly constant difference in the fin-counts. Owing to the absence, among our Panama material, of series illustrating changes which occur with age, and to the lack of adults from any other region, our identification of one of these forms with the Mexican species *rectifrenum* is subject to some uncertainty. The second form is described below as a new species (*P. gilli*). Our specimens of *rectifrenum* are almost uniformly light brown, with darker edges to the scales. The head is darker than the trunk, and the ventral and vertical fins are black. The pectorals are distinctly blackish, with a light blotch on the upper rays near the base. A small black spot occupies the extreme base of the uppermost ray. In the majority of specimens, no traces persist of blue spots, but in others of full size, there are very distinct blue spots on the sides and top of head, and on the scales covering the anal fin. In one specimen 14 cm. long, there are in addition distinctly visible the vertical blue streaks on the scales of the sides, which are characteristic of the young of *rectifrenum*.

There are constantly 15 soft dorsal rays, and 13 anal rays, the last split ray being in each case reckoned as one. These numbers hold in our Panama specimens (thirteen in number), and are also found in two young specimens of *rectifrenum* (all to which we have access) from Mazatlan. In Gill's description of the types of *rectifrenum*, he assigns to it 16 dorsal rays and 15 anal rays. It is reasonable to suppose that the split ray at the end of each fin was by him reckoned as two rays. In giving an account of some of the type material furnished him by Dr. Gill, Dr. Günther gives 15 dorsal and 14 anal rays. In their description of the species, Jordan and Evermann assign 13 rays to each fin, but this is certainly an error.



In the adult, the preorbital is very wide, equaling or exceeding the diameter of the eye; the interorbital space is very wide and strongly arched; the margin of the preorbital is smooth or nearly so for some distance behind the angle of the mouth. There are 20 scales traversed by the lateral line, and 26 or 27 in a series along middle of trunk.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal expressed in mm. ....	127	125	122	109	122	121
Head .....	32½	32	31	32	33½	33
Depth.....	52	60	55½	52½	61	55
Orbit .....	9	9	8¼	9	8½	9
Interorbital .....	12½	12½	12	12	12½	12½
Preorbital at end of maxillary .....	8	8	8	8	8½	8½
Longest dorsal rays .....	24	25	26	26	24	24
Longest anal rays .....	22	23	23	23½	23	24
Length of pectoral.....	27½	30	28½	29	30	29
Length of ventral.....	28	29	28½	32	30	29
Upper lobe of caudal.....	30	29	29	31	30	30
Height of caudal peduncle .....	16	16	16	16½	16½	16
Scales along middle of body.....	26	27	27	27	27	27

263. *Pomacentrus gilli* sp. nov.

PLATE XXII, FIG. 44.

Very closely related to *P. rectifrenum*, but differing constantly in the uniformly translucent pectorals, the larger eye, the narrower and flatter interorbital space, the narrower preorbital, which is serrated to a point opposite to or in advance of the angle of the mouth, and in the shorter dorsal and anal fins.

Adult specimens, 14 cm. long, are brownish olive, or darker brown, on head and body, including the bases of the vertical fins. Each of the scales on back and sides has a distinct black edge. The vertical fins and the ventrals are black, or in some specimens yellowish. The pectorals are translucent yellow in life, with the upper rays colored like the rest of the fin. There is a blue spot at the base of the upper pectoral rays. Each scale on the sides of the head and on the base of the anal fin is marked with a pinkish blue spot. These are fainter in adults, but were not wholly lost in any of our specimens. The smallest specimen procured is 11 cm. long. The spots are here more generally distributed. Large spots are present on the scales of the four lower series of the trunk, and on the scales in front of the pectoral base. Small spots are present on the scales of the caudal peduncle and on scattered scales on the top of the head and the sides of the trunk, especially evident above the lateral line. The scaly portions of the caudal, the soft dorsal and the pectorals are also marked with small blue spots less conspicuous than those on the anal fin. A few scales on middle of sides show vertically elongated spots, indicating the probable presence in the young of vertical streaks along the rows of

scales, as in *P. rectifrænum*. There is no indication in our specimens of blue streaks on the head, but such may well be present in the young.

Head  $3\frac{1}{5}$  to  $3\frac{1}{10}$  in length; depth  $1\frac{3}{4}$  to  $1\frac{1}{2}$ . D. XII, 14; A. II, 12. The lateral line traverses 20 scales (19 in one specimen); 26 or 27 scales in a series along the middle of the sides; 9 scales in a series between lateral line and anus, 3 between lateral line and front of dorsal. There are fewer accessory scales on top of head than in *P. rectifrænum*.

The preopercular margin is sharply serrate to or slightly below the angle; the horizontal limb is smooth. Preorbital sharply serrate with slender retrorsely curved spines, which occur as far forward as the angle of the mouth, or slightly beyond that point.

The preorbital is narrower than in *P. rectifrænum*, its greatest width, opposite angle of mouth, equaling two-thirds diameter of orbit.

The soft dorsal and anal fins contain constantly 14 and 12 rays, the last split ray being counted as one. Thirteen specimens have been examined as to this point. *P. rectifrænum* has constantly one more ray in the dorsal and anal. The soft dorsal and anal fins are pointed in all our specimens, whereas they are bluntly rounded in *P. rectifrænum*. The ventrals have the outer ray filamentous, extending beyond the vent, usually exceeding the length of the pectoral fin, and equaling the length of the head.

The species is abundant among reefs and islands in Panama Bay. A single specimen was secured at Acapulco.

We take pleasure in naming this species for Dr. Theodore Gill, to whom is due much of our early knowledge of Panama fishes.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal expressed in mm.....	107	105	104	102	107	83
Head .....	34	32½	34	33	33	34
Depth.....	56	52	56	53	53	54
Orbit .....	9	9	9½	9	9½	10
Interorbital .....	10	9½	10	10	9½	10
Preorbital at end of maxillary .....	6	6½	6½	6½	6½	6
Longest dorsal rays .....	26	25	28	26	26	28
Longest anal rays .....	24	25	27	25	26	27
Length of pectoral.....	31	31	31½	32	31	30
Length of ventral .....	31	30	30	32	31	32
Upper lobe of caudal.....	32½	31	32	31	32	31
Height of caudal peduncle.....	16½	15	16	16	16	16
Scales along middle of body.....	27	26	26	26	27	26

264. *Pomacentrus flavilatus Gill.*

Not seen by us; recorded by Boulenger (1899, p. 3) from the Gulf of Panama.

265. *Nexilarius concolor* (Gill).

Abundant along rocky shores.

This species shows remarkable resemblance to *Glyphisodon declivifrons*. So far as known, the two do not occupy the same waters, *G. declivifrons* being known only from the coast of Mexico, *N. concolor* from Panama. For description of our Panama material, see Jordan and Evermann (1898, p. 1559).

266. *Glyphisodon saxatilis* (Linnaeus).

Very abundant everywhere about rocks.

The sides of body show five well-defined dark bars, as described, but the "sixth faint bar" at base of caudal is usually absent.

Specimens have been compared with material from the Atlantic, and from the Hawaiian Islands.

267. *Microspathodon dorsalis* (Gill).

Seen abundantly at Acapulco and Panama. At Acapulco, on December 20th, numerous small specimens of a very brilliant blue were seen about the rocks of the mole. A larger specimen, 130 mm. long, was obtained. In this, the general color is slaty-black, without blue tinge. The blue on the centers of the scales on trunk has already disappeared, but the pair of larger blue spots on the nape, those above the first, sixth and fifteenth scales of lateral line, and the confluent pair immediately behind last dorsal ray are conspicuous. All the larger scales of occiput and postorbital region are marked each by a blue spot, the spots irregular in size and shape. An occasional scale on the nape is similarly marked. There is an oblong blue spot on the eye above the pupil. An interrupted blue line runs from supraorbital rim anteriorly above the nostril, the two lines converging toward the tip of the snout, but not reaching it. A second broader streak runs forward from below eye to the depression separating tip of snout from preorbital. A third short streak runs backward from the angle of the mouth, continued by a series of two or three blue spots on successive scales. A blue bar crosses the inner base of the upper pectoral rays. Outer margin of ventrals blue. Margins of dorsal and anal narrowly blue to or nearly to the tips of the lobes. Upper and lower margins of caudal pale, the edge narrow and light blue in color near the base of the fin, wider and translucent opposite the middle of the lobes. Soft dorsal and anal fins have the post-lobular margins transparent, this edge widest and best marked on last dorsal rays. Pectorals have a wide terminal translucent bar, occupying about one-third of the fin. The lower region has a generally distributed bluish tint in life.

A larger specimen from Panama, 175 mm. long, is no further advanced toward the mature condition. The color is dark slaty-blue, with broad white margins to the pectorals, and narrower margins to the other fins. The larger sky-blue spots still persist, three above the lateral line, a saddle behind dorsal, and a larger spot on each

side of the nape. A profusion of small blue spots cover the top and sides of the head, one above the eye and one behind it being larger than the others. A series of spots form a distinct line below the eye, extending forward on the preorbital. A blue spot surrounds the nostril. The tip of the snout, the anterior (lower) edge of the preorbital, the angle of the mouth and the mandible are blue. There is a very narrow blue margin to the spinous dorsal and to the anterior half of the anal fin. A large blue spot on upper margin of eye-ball.

In older specimens, the conspicuous blue spots and streaks have largely vanished, but the smaller blue spots on sides of head may remain in specimens 25 cm. long. The blue spot on the upper edge of the eye-ball persists in all our specimens.

The ground color varies with the color of the bottom, adults from sand or coral being light gray in tint (*M. cinereus*), while others are blackish or slaty blue.

#### Family LABRIDÆ.

##### 268. *Harpe diplotænia Gill.*

Abundant among the islands in Panama Bay.

##### 269. *Halichæres sellifer Gilbert.*

Two specimens were secured, 19 and 24 cm. long. They agree in most details with the description given of the type, the single specimen heretofore known. In both Panama specimens, however, the outer caudal rays are shorter than the middle rays, the posterior margin of the fin being gently convex, even when the fin is spread. In the type, 29 cm. long, the caudal was found to be "truncate or slightly emarginate, the outer rays scarcely produced." The outer caudal rays doubtless become longer with increasing age, as in many of the Labridæ. The outer ventral rays are also shorter in our specimens, where they are less than twice the length of the inner rays, and fail to reach the vent. This also may depend upon the age of the specimens.

In the Panama specimens, the head is contained  $3\frac{2}{5}$  to  $3\frac{1}{2}$  in the length; the depth 3 to  $3\frac{1}{5}$ . The depth of the caudal peduncle is  $1\frac{7}{9}$  to  $1\frac{8}{9}$  in the length of the head. The snout  $2\frac{3}{4}$  or  $2\frac{9}{10}$  in the head.

The dorsal fin contains 9 spines and 11 rays, the anal fin 3 spines and 12 rays in each specimen. The first anal spine is greatly reduced and concealed in the membrane, and might easily give occasion to a statement that but 2 spines were present.

The colors were essentially as in the type of the species, but were somewhat less brilliant, the bright red of the sides being here of a duller brownish red tint. Following is a description of the coloration of our smaller specimen.

In life, each scale has a basal band of bright blue, the scales otherwise brownish, margined on all sides (including the base) with light yellow or olive.



There are blue spots on the opercles, and two parallel blue streaks from the eye toward the snout. A streak, or a series of spots, on the suborbital ring. Opercles with a pinkish ground color. There is a blackish half-bar under the posterior portion of the spinous dorsal, the bar narrowing rapidly below, and disappearing on middle of sides; it is directed toward the vent, and seems to be more posteriorly placed than in *H. nicholsi*. There is a pinkish bar in front of the base of the pectoral. Caudal yellow. Dorsals brownish red, with a blue margin, and blue streaks running obliquely downward and backward. The anal is yellowish at the base, becoming brownish red toward the margin. There is a narrow blue edge, a blue spot at the base of each ray, and two parallel blue lines anteriorly, which divide that portion of the fin into basal, middle and terminal thirds. The ventrals and pectorals are translucent, the outer ventral rays translucent, margined externally with blue.

270. *Halichæres macgregori* sp. nov.

PLATE XXIII, FIG. 45.

One specimen 87 mm. long was taken in company with *Pseudojulis notospilus* in a rock-pool on the Panama reef. It was not recognized at the time as a species distinct from *notospilus*, and no color notes were taken.

Head 3 in length; depth  $3\frac{5}{7}$ ; depth of caudal peduncle equals distance from tip of snout to middle of eye. Snout  $2\frac{6}{7}$  in head; eye 5. D. IX, 11; A. III, 12.

Anterior canines  $\frac{4}{3}$ , those in the lower jaw subequal, the outer canines of the upper jaw smaller than the others, but evidently enlarged. A well-developed posterior canine on each side of the upper jaw, this accompanied on one side of jaw by a smaller tooth more posteriorly placed.

The dorsal spines are slender but pungent. The last dorsal ray is split to the base. The first anal spine is reduced to a mere rudiment, which can be detected only on dissection. The last anal ray is split to the base, each half being again partially divided. The caudal is evenly rounded behind. The ventral spine is three-fifths the length of the outer ventral ray, the inner branch of which is longer than the outer, but is not filamentous and does not project beyond the contour of the fin. The ventrals do not quite reach the vertical from the hinder margin of the pectorals, and extend only two-thirds the distance from their base to the origin of the anal. The pectorals cover six scales in a series behind their base.

The scales in front of the dorsal fin fail to cross the median line, the naked space being very narrow posteriorly, but widening rapidly toward the nape. The scales are reduced in size, but are arranged in series continuous with those below and behind them. The scales of the breast are moderately reduced in size, a series anterior to base of ventrals containing 8 scales.

The lateral line is continuous, the posterior portion running on the third series below the anterior portion. The tubes of the posterior portion are simple, those of the anterior portion divided to form two or rarely three branches. Above the dorsally lying portion of the lateral line is a single horizontal series of scales of full size. Above each scale of this series, and forming with it a very oblique row running upward and forward, are four much smaller scales which decrease rapidly in size upward. The uppermost of these are inserted on the base of the dorsal fin, and constitute an incipient sheath. Similar series of reduced scales running downward and forward are found along the anterior portion of the anal fin. There are 7 horizontal series of full-sized scales between the lateral line and the anterior portion of the anal fin.

No trace remains of the brilliant colors which this fish undoubtedly displayed in life. In spirits, the ground color is grayish olive, slightly darker along the back. Many scales have each a

dark brown spot at base, those so marked forming rather definite large groups, which correspond on the two sides of the fish. A series of four such groups, separated by narrow interspaces, lie along the lower half of the sides. Behind the eye, are three or four narrow wavy dark lines, the lower two joined more or less by irregular cross-branches. A faint dusky streak runs forward from eye to snout, a faint spot below the eye, and a well marked horizontal dusky streak on lower part of cheeks, turning downward and backward across preopercle. A narrow brown streak runs downward and backward across prepectoral area, but fails to reach the median ventral line.

Spinous dorsal dusky, a small blackish blotch at tip of membrane between first two spines. A very conspicuous elliptical jet-black spot on basal portion of first four rays of the soft dorsal; the spot is faintly ocellated with whitish, above this a faint curved dusky streak, then the translucent margin of the fin. Behind the spot, the dorsal is marked with oblique cross-bands of dusky and whitish. The caudal appears uniformly dusky. The anal is dusky, with a narrow translucent margin. The spine and outer ventral ray are dusky, the rest of the fin whitish. The pectorals are uniformly translucent.

Named in honor of Richard C. McGregor, a member of the expedition to Panama, to the success of which he materially contributed.

271. *Halichæres dispilus* (Günther).

The types came from Panama, where the species was also secured by the Albatross (Jordan & Bollman, 1889, p. 182). It has been reported also from Acapulco and Mazatlan.

272. *Pseudojulis notospilus* Günther.

The dark bands across the back are in the number of 8, the first being on the nape, the eighth on the caudal peduncle. Those in front of the soft dorsal become progressively fainter, the anterior three, and the one on caudal peduncle, commonly disappearing in adults.

The species is very abundant in all rock-pools about Panama.

273. *Thalassoma lucasanum* (Gill).

This species has been recorded from Panama by Günther (1864 *b*, p. 26) without comment. It has not been obtained there by other investigators.

Family SCARIDÆ.

274. *Pseudoscarus perrico* (Jordan & Gilbert).

Occasionally taken about the rocky islands in Panama Bay. Five specimens were secured, ranging in length from 23 to 38 cm. The adipose hump on top of head is variable in its development among individuals of the same size. Our specimens are eviscerated, so we are unable to determine whether the development of the hump is dependent on sex.

The following color-notes were taken from a fresh specimen 263 mm. long: Scales on body with the central portion blue, surrounded by brown. Under parts whitish. A wedge-shaped blue spot immediately behind the eye; 4 narrow blue

streaks radiate from above the eye; 4 or 5 small spots of blue on the interorbital space; one or more blue streaks in front of eye, and a broad patch below eye. Teeth green. Dorsal fin narrowly margined with bright green; below this the fin is brownish golden, with an imperfect median green band, which is most distinct posteriorly; a basal series of green spots is present. The caudal has the central rays green, the outer ones yellow, edged with green. The anal is largely green, the margin being more brightly colored than the rest of the fin. The pectorals are brownish yellow, margined posteriorly with a translucent band; the upper ray has a greenish margin. The ventrals are greenish white.

There is considerable variation in the size and shape of the green streaks about the eye. Those below the eye are usually wider than those elsewhere, the middle group often coalescent to form a wide blotch. One pair, from upper anterior margin of orbit, sometimes extends well across the top of the head, meeting or nearly meeting on the median line.

#### Family EPHIPPIDÆ.

##### 275. *Chætodipterus zonatus* (Girard).

This species comes abundantly to the Panama market, but seems not to reach a large size. The longest specimen seen was less than 30 cm. in length, and had not developed the thick bony masses on cranium such as appear in the adult of *C. faber*.

*C. zonatus* differs from its Atlantic representative *C. faber* principally in the lower lobes of the vertical fins, the shorter ventrals, and the smaller scales. The coloration of the two is essentially the same, there being no difference in the number and arrangement of the bands. These may, however, be a little wider in *zonatus*, which has also a more conspicuous black blotch on the pectoral. The fin-rays are the same in the two species, the dorsal rays varying from 21 to 23, the anal rays from 18 to 20.

The lateral line contains the same number of pores in the two species, 48 to 50, but the scales are notably smaller in *zonatus*, and are less regularly arranged. The smaller scales on the head and on the vertical fins are also noticeably smaller in *zonatus*. The widest portion of the black band which connects the front of the dorsal to the front of the anal has 11 or 12 scales in a longitudinal series across it; in *faber* there are usually but 6 or 8 scales across the widest portion of the band. In *zonatus*, there are 18 to 20 scales in an oblique series on sides between axil and tip of pectorals; in *faber*, there are but 12 or 13 scales on corresponding part of sides.

A specimen of *zonatus* 50 mm. long is very light grayish olive, the bars very faintly indicated or wholly absent. The sides of head and body are marked with scattered sharply-defined brown spots and blotches mostly smaller than pupil. Those on head are arranged in a series along the line of the dark band. On the lateral line, below last dorsal spines, a circular area of the ground color, as large as the eye, is occluded by a brown line. The third dorsal spine is slightly shorter than in *C. faber* of the same size.



*Measurements in Hundredths of Length without Caudal.*

	C. ZONATUS	C. FABER
Length in mm. ....	176	172
Head (to edge of membrane).....	31½	32
Snout .....	12	13½
Interorbital width .....	12½	12
Diameter of iris.....	8	8½
Depth opposite first anal spine .....	75	77
Longest dorsal ray .....	43	70
Longest anal ray.....	38	54
Longest pectoral ray .....	19½	19
Longest ventral ray .....	27½	35

**276. *Parapsettus panamensis* Steindachner.**

Not rare in the Panama market, where numerous specimens were obtained.

In addition to the short graduated dorsal spines, this genus differs from *Chaetodipterus* in having no transverse fold behind the upper lip, which is therefore technically as well as actually non-protractile. The shoulder-girdle agrees with *Chaetodipterus*. The alisphenoids are much more developed, meeting each other mesially, and closing the cranial cavity in front. The interorbital septum contains a well-developed osseous lamina, which comes in contact posteriorly with the strong, compressed, vertical limb of the basisphenoid. The latter fails to meet the parasphenoid below.

## Family CHÆTODONTIDÆ.

**277. *Chaetodon nigrirostris* (Gill).**

PLATE XXIV, FIG. 47.

Two adults of this apparently rare species were taken by the use of dynamite near one of the rocky islands in Panama Bay.

In addition to the distinctive color-markings, this species has the scales on the cheeks enlarged, the exposed surfaces much higher than wide, arranged in four horizontal more or less wavy series, but not in quincunx order. The preopercle is strongly striated.

The head and the lower half of body are silvery, more or less washed with light yellow, each scale having often a brownish spot at base, these forming three faint lengthwise stripes along the scale-rows. The base of the anal, and the upper half of the trunk are light brownish purple. A jet-black bar encircles upper part of snout, but does not include the upper lip, nor the region behind the vertical from the



nostril. A black blotch above and behind each orbit, fails to meet its fellow by a distance about equaling the diameter of the pupil. A narrow black orbital ring encroaches on the eye-ball. A wedge-shaped black bar has its apex at front of dorsal, its base being separated from the orbital region by a transverse whitish bar which crosses the head behind the eyes. The wedge-shaped bar is bordered behind by a wide silvery band. The opercular membrane is jet-black, as is also the membrane covering the shoulder girdle. A few of the scales covering the supraclavicle are edged or blotched with black. A jet-black bar crosses the base of the upper three-fourths of the pectoral, and is continued into a broader axillary band, which likewise fails to involve the lower rays. A broad black bar begins at base of fifth or sixth dorsal spine, includes the basal half of soft dorsal and is continuous with a wedge-shaped bar on caudal peduncle, the apex of the wedge failing to reach the lower edge of the peduncle, but directed toward the margin of the last anal rays. The remainder of the vertical fins are translucent dusky, unmarked. The ventrals are dusky; the pectorals translucent yellowish.

We have not admitted to our list the Atlantic species *Chaetodon capistratus*, recorded without comment from Rio Tuyra, Darien, by Boulenger (1899, p. 3).

#### 278. *Chaetodon humeralis* Günther.

The young are abundant in tide-pools, and adults are present in large numbers among the rocky reefs and islands in the Bay.

Our youngest specimen is 28 mm. long, and is in the last phases of the "*Tholichthys*" stage. The color scheme of the adult is plainly indicated, but the head is wholly scaleless and is entirely covered with sculptured shields. One of these extends from the occiput on to the nape, in the form of a dagger-shaped spine, which fails to reach front of dorsal by a distance equaling about one-fourth its length. The angle of the preopercle is produced into a rounded squamous process, which extends more than half way to the insertion of the ventral fins. Two similar squamous lobes are attached to the upper portion of the shoulder girdle, their posterior margins being free. The upper is larger and less evenly rounded than the lower, and is separated from it at the point traversed by the lateral line. The margins of these lobes and the preopercular margin are very finely but sharply serrulate. Similar but smaller squamous processes are attached to the horizontal limb of the preopercle and to the inner edge of the dentary, lobes on one side of the head corresponding to indentations on the other, those of the two sides closely joining below and wholly concealing the isthmus and the branchiostegals. The cheeks are firmly cuirassed, like the rest of the head.

The colors are the same as in adults with these exceptions: The ventrals are black. The vertical black bar at base of caudal is faintly indicated. The caudal fin, and the soft dorsal and anal fins are translucent, unmarked, thus contrasting strongly with their barred condition in the adult. The broad bar across posterior portion of trunk is continued definitely on to posterior portion of spinous dorsal, and

on to the basal portion of anal spines. There is at no time any ocellus, but a distinct intensification of the black of the posterior bar occurs over a small rounded area immediately below the last dorsal spines.

With increasing size, there appears first the black bar on dorsal and anal, contemporaneously with the broadening of the bar on caudal peduncle. A definite white bar then forms behind the latter, on the basal portion of the caudal fin. Before the sharp differentiation of this bar, white pigment occupies its future position, but covers a wider area, gradually thinning out posteriorly, visible on the entire basal third of the fin. As soon as it becomes concentrated into a narrow bar, a faint dusky margin develops posteriorly, this widening to form a bar, which develops most rapidly on the lower half of the fin. The bars on dorsal and anal are at first near the middle of the fin, leaving a wide translucent margin, but later migrate distally.

The largest of our immature specimens is 55 mm. long. At this stage, the middle dark caudal bar is still much narrower than the basal bar, and there is no trace of the succeeding two bars (white and black).

#### 279. *Pomacanthus zonipectus* (Gill).

Much less abundant than *Holacanthus passer*, with which it was found associated. But two individuals were seen.

In adults, the upper profile is continued forward in an even curve to front of nape. From this point, the occipital region is deeply concave, the profile becoming again convex above ocular region and snout. The color has been well described by Dr. Jordan (1895 *b*, p. 484) from Mazatlan examples.

An immature specimen, 63 mm. long, shows the characteristic coloration of the young, which has been described by Jordan and Gilbert (1881 *c*, p. 358), under the name *Pomacanthus crescentalis*. The third yellow band behind the head cuts the bases of soft dorsal and anal fins three or four rays in advance of the posterior ends, instead of running from end to end, as described. It curves forward on the two fins, meeting the anterior yellow band to form a broad loop, which is wider than the bands and blue in color. The dorsal continuations of all save the caudal band are blue. A blue bar is present midway between the first and second, and the second and third yellow bars behind head; no other blue bars are present. The basal two-thirds of the caudal fin is jet-black, save for the narrow vertical yellow bar which divides that area equally. The outer third is translucent, with a narrow dusky bar near the anterior edge of the tract.

#### 280. *Holacanthus passer Valenciennes*.

Abundant among rocky islands in Panama Bay.

Gill's type of *H. strigatus*, a synonym of *H. passer*, must have been an immature specimen. In such we find a conspicuous narrow blue streak running from nape to upper posterior margin of orbit, thence faintly downward in a broken line toward base of preopercular spine. This streak disappears entirely in adults. In the young,

a second blue streak connects upper anterior margins of orbits, then extends vertically downward behind angle of mouth. The transverse portion of this streak persists in adults and becomes greatly widened.

An oval area in front of dorsal fin contains a number of small bright blue spots, usually one for each scale. The scales behind the white bar are widely margined with blue in adult specimens, but in none do we find traces of the blue cross-bars described by Gill. These may be found in younger specimens than have come to our hands. In adults, that portion of spinous dorsal in front of the white cross-bar is bright yellow. The rest of the fin is deep brown like the body, passing into brownish yellow in the falcate lobe, and as a submarginal band in front of this and behind it. Behind the anterior yellow area, the fin is narrowly margined with bright blue, the margin becoming much wider on the vertical part of the fin. In the young, the dorsal is similarly colored, but the blue margin is wider and includes also the anterior spines, and is everywhere followed by a submarginal yellowish brown band. The anal is similarly marked. The caudal fin and nearly half of the caudal peduncle are light lemon-yellow, the fin posteriorly with a narrow dark brown edge. Pectorals and ventrals lemon-yellow, without other markings. The white bar on sides extends from base of dorsal, below fifth to seventh spines, downwards to a point opposite middle of base of pectorals. It is usually widest in its upper third, narrowing rapidly below. In adults, the dorsal lobe reaches nearly to edge of caudal.

The genus *Angelichthys* Jordan and Evermann, characterized by the absence of spines on the preorbital, by the coarser spines on the ascending limb of the preopercle and by the greater length of the dorsal and anal lobes, should doubtless be considered a section of *Holacanthus*.

### Family TEUTHIDIDÆ.

#### 281. *Teuthis crestonis* Jordan & Starks.

This species is very near *T. matoides*, from the Hawaiian Islands and the Western Pacific generally, and may prove to be undistinguishable from that widely distributed form. It agrees in most details of shape, color and fin-rays, but appears to differ in having the spine on the side of the tail distinctly smaller, and in having the sides of the body mottled, but not streaked. In specimens 8 to 20 cm. long, the caudal spine is four to five hundredths of the length from snout to base of caudal. In specimens of *T. matoides* from Honolulu, 10 to 23 cm. long, the caudal spine is five to six hundredths of the length. In eight specimens from Panama, the fin-rays are: Dorsal IX, 25, 25, 26, 26, 26, 26, 26, 27; anal III, 23, 24, 24, 25, 25, 25, 25, 25.

*T. bahianus* from the Atlantic has a still larger caudal spine, which is seven to eight hundredths of the length.

*T. crestonis* is abundant in the tide-pools of the Panama reef, and among the islands in the Bay. It is recorded from Panama Bay also by Boulenger (1899, p. 3).



## Family BALISTIDÆ.

282. *Balistes polylepis* Steindachner.

Not uncommon at Panama; three specimens were collected which agree very well with Steindachner's description of the type and co-types from the west coast of Mexico.

It may be distinguished from *B. carolinensis* by the smaller scales, deeper body, more elevated and convex interorbital, less sharply angulated anal, and the shorter caudal lobes. Our three specimens of *B. carolinensis* all have 24 anal rays, while *B. polylepis* has 25 or 26; the lateral series of scales of *carolinensis* are 55 or 56 in number, those of *polylepis* 69 to 73. *B. carolinensis* has the depth of the body contained twice in the length, *polylepis*  $1\frac{3}{4}$  to  $1\frac{4}{5}$  times; in *carolinensis* the caudal lobes are somewhat longer, more slender and of equal length, while in *polylepis* the lower lobe is the shorter.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal, in mm.....	194	207	211
Head .....	33	$32\frac{1}{2}$	32
Depth.....	57	57	59
Orbit .....	$7\frac{1}{2}$	7	7
Snout.....	26	26	26
Interorbital .....	11	$10\frac{1}{2}$	11
Length of pectoral.....	13	13	$13\frac{1}{2}$
Height of anterior part of soft dorsal.....	$26\frac{1}{2}$	$26\frac{1}{2}$	27
Height of anterior part of anal.....	$22\frac{1}{2}$	22	23
Length of middle caudal rays .....	20	19	20
Dorsal rays .....	III, $\frac{r}{2}$ 28	III, 27	III, 27
Anal rays.....	26	25	25
Scales, from upper part of gill-opening...	69	73	70

283. *Balistes naufragium* Jordan & Starks.

The commonest Balistoid in Panama Bay; many specimens were taken about the rocky islands.

We have re-examined the type of the species, from Mazatlan, and correct here a few slight errors in the original description:

Dorsal III, 26; anal 24; scales 50. Head to lower end of gill-slit  $2\frac{5}{8}$  in body. Snout  $1\frac{1}{8}$  in head; eye  $5\frac{3}{4}$ ; longest dorsal ray  $1\frac{2}{5}$ ; longest anal ray  $1\frac{3}{4}$ ; pectoral  $1\frac{1}{8}$ .



The groove before eye is very faint, scarcely to be made out in some of our Panama specimens. Dorsal very slightly falcate in the type and in larger specimens; in small and half-grown examples only, is it sharply angulated. The anal is rather sharply rounded. In life the sides are marked with many narrow vertical wavy blue lines.

The species is easily distinguished from *B. polylepis* by the thicker body, the larger scales, the darker and more variegated coloration, the much reduced preocular groove, and the less falcate fins. In *B. polylepis*, the upper margin of the dorsal fin is deeply concave for the whole length; in *B. naufragium*, the greater part of the upper margin is convex, a few only of the anterior rays projecting, making that part of the fin concave. The caudal lobes are also much shorter in this species, while the middle rays are more produced. The plates are much more roughly granular, and are fewer in number. The lips are much thicker and more deeply plicate, the peripheral folds being densely papillose. The ventral stay is more robust, and the circumoral area is devoid of plates.

*Measurements in Hundredths of Length without Caudal.*

Locality .....	Panama					Mazatlan (Type)
Length without caudal, in mm.....	261	216	180	302	165	255
Head .....	33½	34	35	34	35	34½
Depth.....	55	56½	58	57	58	56
Orbit .....	7	7	7½	6½	7	6½
Snout .....	27	28½	28	28	27	30
Length of pectoral.....	13½	13½	15	13½	14	15
Height of anterior rays of soft dorsal.....	25	26	24	24	23	24½
Height of anterior rays of anal .....	21	20	21	20	19	21
Length of middle caudal rays .....	19	21	22	19	21	21
Number of dorsal rays.....	25	26	26	26	26	26
Number of anal rays .....	24	23	23	24	23	24
Series of scales .....	51	50	51	51	52	50

284. *Balistes verres* sp. nov.

PLATE XXVI, FIG. 49.

We describe as new the species that has commonly been referred to *B. capistratus* on the Pacific coast of Central America. *B. capistratus* was probably based on East Indian material, but we have had for comparison specimens from the

Hawaiian Islands only. From these, *B. verres* differs in having smaller scales and a greater number of dorsal and anal rays. Specimens from Panama and Mazatlan have the scales 58 to 65; the dorsal has 30 to 32 rays, and the anal 28 or 29. Five specimens of *B. capistratus* from Hawaii have 50 or 51 oblique series of scales (counted from the upper end of the gill-opening); the dorsal has 29 or 30 rays; the anal 25 to 27 rays. The caudal of the Hawaiian specimens is truncate, with the outer rays not produced. The caudal is noticeably lunate in the Panama and Mazatlan specimens. Bleeker's plate shows that his specimen from the East Indies has 50 series of scales, 30 rays in the dorsal fin, and 27 in the anal.

The following description is from the type of *B. verres*:

Head to lower angle of gill-opening  $3\frac{1}{5}$  in length, without caudal; depth 2. Eye  $5\frac{1}{3}$  in head; snout  $1\frac{1}{7}$ ; interorbital width  $3\frac{1}{3}$ . Dorsal III, 31; anal 28. Scales from upper end of gill-opening 64.

Teeth with their inner cutting edge produced, the lower ones shutting inside of the upper. The groove before the eye is scarcely longer than the eye. The length of the gill-opening is twice the diameter of the eye, and about equal to the length of the longest pectoral ray.

Groove of spinous dorsal a little longer than first dorsal spine, two-thirds the length of the base of the soft dorsal. Anal base shorter than dorsal base by three-fifths the length of the eye. Anterior part of dorsal a little higher than that of anal. Caudal lunate, the outer rays about one-fourth longer than the middle rays.

Posterior part of sides with 9 or 10 lengthwise series of small antrorse spines. A row of very small pores extends irregularly backward from eye nearly to the front of soft dorsal.

Color in alcohol: upper parts of body brownish slate-color, lighter below. Anterior edge of upper lip, and lower lip and chin light yellowish. A scarcely discernible streak extends backwards across cheek from angle of mouth. Other specimens have this streak very conspicuous, as in *B. capistratus*. Caudal blackish; spinous dorsal dusky, other fins light yellowish.

*Measurements in Hundredths of Length without Caudal.*

Locality .....	Panama			Mazatlan		
	(Type)					
Length without caudal, in mm. ....	212	281	191	315	250	194
Head .....	32	34	33	31	33	32
Depth.....	50	52	52	48	51	49
Eye.....	6	5	6	5	$5\frac{1}{2}$	$6\frac{1}{2}$
Snout .....	28	30	$27\frac{1}{2}$	$27\frac{1}{2}$	30	28
Height of anterior part of dorsal.....	15	$14\frac{1}{2}$	$13\frac{1}{2}$	15	16	16
Height of anterior part of anal.....	$13\frac{1}{2}$	$13\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	14	$14\frac{1}{2}$
Length of pectoral.....	$11\frac{1}{2}$	11	11	10	12	12
Length of caudal (middle rays) .....	15	$16\frac{1}{2}$	$16\frac{1}{2}$	15	16	15
Number of dorsal rays.....	31	31	32	32	30	31
Number of anal rays .....	28	29	29	29	28	29
Scales.....	64	65	62	61	61	58

## Family Teuthioidea

285. *Xesurus hopkinsi* sp. nov.

PLATE XXV, FIG. 48. \*

Two large specimens, 41 and 43 cm. in length, were taken at Panama, and cannot be referred to any of the described species. For comparison we have specimens of *X. punctatus* from Mazatlan, Clarion Island, and San Benedicto Island; *X. laticlavus* from the Galapagos Islands; and the type of *X. clarionis* from Clarion Island. We have not sufficient material to decide upon the validity of the last-named species, and for present purposes will consider it distinct from the others.

The outlines of the body are evenly curved. The snout projects but slightly as compared with the other species, and the upper anterior outline is shallowly concave. From before eye to dorsal, the profile is regularly rounded and without a projection at nape.

Dorsal VIII, 26 or 27; anal III, 23. The head is smaller than in the other species, 26 or 27 hundredths of the length. In seven specimens of *X. punctatus*, the head averages  $31\frac{1}{4}$  hundredths of the length; in three specimens of *laticlavus*,  $31\frac{1}{3}$  hundredths; in *clarionis*, 30 hundredths. The mouth is smaller; the maxillary forms but  $6\frac{1}{4}$  hundredths of the length (in *punctatus*,  $7\frac{5}{7}$  hundredths; in *laticlavus*,  $8\frac{2}{5}$  hundredths; in *clarionis*, 8 hundredths). The teeth are much smaller, though they number the same as in the other species, 8 or 9 on each side of the upper jaw. The eye is smaller, 4 or  $4\frac{1}{2}$  in the snout, 5 hundredths of the length (in *punctatus*  $6\frac{5}{7}$  hundredths; in *laticlavus*,  $7\frac{5}{8}$  hundredths; in *clarionis*,  $6\frac{1}{2}$  hundredths).

The pectoral is broad and rounded at its tip, reaching to above the base of the second anal spine, when forced into a horizontal position. It seems to incline obliquely upward in its normal position. The ventrals nearly reach the first anal spine, and are about two-thirds the length of the pectorals. The dorsal and anal are as in related species. In the larger specimen, the first dorsal spine has become almost entirely concealed beneath the skin, the first anal spine wholly concealed.

The posterior part of the body is rather thickly covered with sharp spines, the bases of which are expanded as rough plates. The spines are somewhat inclined forward and are occasionally bifid (some specimens of other species have scattered rough plates which sometimes bear low sharp keels, but never high spines). The three bony shields on the caudal peduncle bear thick blunt spines, their points broad and smooth, as though worn.

Color light slaty on lower parts, dark above. One specimen is faintly spotted with black on nape and opercles.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal, in mm.....	360	335
Head .....	27	26½
Depth .....	51	49
Maxillary .....	6¼	6¼
Eye .....	5	5
Horizontal limb of preopercle from behind fold in mandible..	11	12
Vertical limb of preopercle.....	13	13
Length of pectoral.....	26	25
Length of ventral.....	16	16
Length of fifth dorsal spine.....	12	11
Longest anal rays.....	12	12
Height of caudal peduncle just behind base of dorsal .....	11½	12
Length of longest caudal ray in upper lobe .....	24½	23½

## Family TETRAODONTIDÆ.

286. *Spheroides angusticeps* (*Jenyns*).

Not seen by us; recorded from Panama by Jordan and Gilbert (1882 *n*, p. 631) from the Bradley collection, and by Jordan and Bollman (1889, p. 183).

287. *Spheroides lobatus* (*Steindachner*).

Obtained at Panama by the Albatross; not seen by us.

288. *Spheroides testudineus* (*Linnaeus*).

Probably rather rare at Panama, where four specimens were taken. Compared with others from Jamaica, they seem to show a slight difference in the length of the head and snout, but our series is insufficient for the verification of this distinction. Our specimens are much bleached, so that nothing can be made out except the pattern of coloration, which agrees with that of the Jamaica specimens. No satisfactory comparisons can be made as to the size of spots, or the distinctness of markings.

This species differs from *S. annulatus* in having the interorbital space (bone) narrower, the dorsal and anal shorter, the spots a trifle larger, and the termination of the dorsal and the anal further from the caudal, the insertion of the fins being more anterior and the base shorter. As the interorbital increases in width with age, only specimens of about the same size should be compared in this respect.



*Measurements in Hundredths of Length without Caudal.*

Locality .....	Panama			Jamaica			
Length without caudal in mm. ....	164	150	135	168	137	133	151
Head from teeth to middle of gill-opening.....	32	33	33	34	35½	34	34
Depth at occiput .....	21½	23	21	23	25	22	22½
Orbit.....	7	7½	6	6	7	7	7½
Interorbital (bone).....	7½	8	8	7	7½	7½	7½
Snout (from teeth) .....	16½	16½	17½	18	18	18	17½
Length of dorsal .....	18	18	17½	16½	17	18	17½
Length of anal.....	15	15	14	13½	14	15	15
Length of caudal.....	24	25	24	25	25	24	25
Termination of dorsal from caudal.....	14	13	14	14½	13	14	14
Termination of anal from caudal .....	13	13	13½	13½	13½	13	13½
Number of dorsal rays .....	8	8	8	8	8	8	8
Number of anal rays.....	7	7	7	7	7	7	7

289. *Spheroides annulatus* (Jenyns).

Appearing frequently in the Panama market. The young are common also in the tide-pools, associated with the young of *Tetraodon hispidus*. In the young, the concentric rings are less variable and less interrupted than in adults. The ground color of the back is generally not broken up into small spots, as is so frequently the case in adults. The spots on the sides are usually larger and fewer in the young, or are sometimes entirely absent. The caudal is rather abruptly blackish upon its posterior half, the other fins are colorless.

One specimen, 15 cm. in total length, differs from all the others in the somewhat more prominent sharper spines, and the very different coloration. Upon the middle of the back is an S-shaped marking, the extremities of which are equidistant respectively from the eye and the front of the dorsal, the interval being in each case twice the diameter of the eye. Around it are very irregular incomplete rings. A curved line runs from just behind the eye to the middle of the gill-opening and another from the nape to above the base of the pectoral fin. Across the snout and caudal peduncle are irregular lines. The sides have fewer spots than is usual, and the fins are as here described for the young. The measurements of this specimen are the third listed in the appended table.

We have examined specimens from Mazatlan, La Paz, and the Galapagos Islands. Some of the larger northern specimens (*S. politus*) have the color of

the back broken up into smaller spots than in the southern specimens, though some of the smaller northern specimens are like the southern in this as in other respects. *Spheroides politus* has been recorded from Panama (Jordan & Bollman, 1889, p. 183) and from Santa Helena Bay (Boulenger, 1898-99, Vol. 14, p. 8). We consider it identical with *annulatus*. The Galapagos specimens vary greatly in depth of color. One has the back, pectoral, dorsal, and caudal very dark brown, almost black, while the anal is dark. The color of the back grades in other specimens to light brown, while the fins are nearly colorless. One specimen differs from the others in having a very concave interorbital.

*Measurements in Hundredths of Length without Caudal.*

Locality .....	Panama				Galapagos				La Paz, Mex.	Mazatlan, Mex.
Length without caudal in mm.....	200	158	121	170	185	200	116	215	114	92
Head from teeth to middle of gill-opening.....	37	36½	36½	34	35	34	35	36	36½	35
Depth at occiput .....	24	24	24½	25	24	24	24	24	23	22
Orbit.....	5½	7	5½	7	6	4½	8	5½	6	7
Interorbital (bone).....	13	12	9	10½	12	11½	10	13	10	7½
Snout (from teeth) .....	20½	19	16½	16½	18½	18	18	20	18	18
Length of dorsal.....	18	18	18	20	19	19	19	19	18	17
Length of anal.....	16½	16½	15	18	16½	17	16½	16½	15½	16
Length of caudal.....	24	26	26	25	24	24	25	24	25	25
Distance from tip of dorsal rays to caudal .....	9½	8½	10	8	7	8	9	8	9	10
Distance from tip of anal rays to caudal.....	9½	8	9½	7½	8	7½	9	7	10	10
Number of dorsal rays .....	8	8	8	8	8	8	8	8	8	8
Number of anal rays.....	7	7	7	7	7	7	7	7	7	7

290. *Spheroides furthii* (Steindachner).

A rare species, not taken by us; recorded from Panama by the describer, and by Jordan (1885, p. 393) from the Gilbert collection.

*Guentheridia* gen. nov. (*Tetraodontidae*).

Type, *Tetrodon formosus* Günther, 1870, p. 283.

This genus differs from *Spheroides* in the character of the olfactory organ, which is a transversely-placed tube, open at each end to its full diameter. The outer end is squarely, the inner obliquely, truncate, making the upper margin of the tube

very narrow. The inner surface of the tube is closely covered with large cup-shaped pits, visible to the naked eye. To these pits the olfactory nerve is distributed; they are undoubtedly the end organs of the nerve.

Similar pits are developed in the genus *Tetraodon* (*erethizon*, *setosus*, *aerostaticus*, *perspicillaris*, *hispidus*), where they occupy the inner surface of the nasal flaps; but they are not found in other genera. The nasal organ of *Tetraodon* could be formed from that of *Guentheridia* by cutting through the upper edge of the tube, thus leaving two lobes springing from a common base.

The American species of *Spheroides*, nearly all of which we have examined, have the olfactory tubes with small openings, and without cup-shaped pits on their inner surfaces; the latter are smooth, or are sometimes provided with one or two slight folds of skin.

#### 291. *Guentheridia formosa* (Günther).

Common at Panama, twelve specimens being secured. In addition to these we have examined six specimens collected by the Albatross at Panama in 1888. We found no young of this form, though the young of *Tetraodon hispidus* and *Spheroides annulatus* were common in the tide-pools.

The color pattern is variable. In some examples the spots are almost evenly distributed over the back and upper part of the sides, with no indication of concentric arrangement. Other examples have the spots confluent into smooth concentric rings, arranged with the smallest ring in the middle of the back. Between the examples with scattered spots and those with smooth rings are all intermediate stages—some with the spots arranged concentrically but not united, some with them more or less united, forming rings with uneven contour. The spots vary also in size. Sometimes they are little more than half the size of the eye, and are separated by interspaces of the gray ground color of about their own width, sometimes they are as large as the eye, or larger, and are so closely set that the ground color shows only as narrow lines between them. In one specimen some of the spots have fused into small irregular rings about twice the size of the eye, and enclose small spots of the ground color. The top of head has transverse rows of spots or solid bars. The latter are sometimes united in pairs, forming wider and fewer bars.

*Tetraodon formosus* was described from a single specimen from South America. The type description is not detailed, so the identification with this Panama form must be considered provisional, until direct comparison can be made with the type.

#### 292. *Tetraodon hispidus* Linnaeus.

*Arothron erethizon* JORDAN & GILBERT, 1882, p. 631.

This species is not rare about the rocky islands in Panama Bay, where numerous specimens were obtained, ranging from 15 to 330 mm. long. The long quill-like spines protrude only when the fish is inflated. When retracted, the position of the spines is indicated by the pores in the skin.

In our smallest specimens, the belly is white, the back brown with small white spots, one at the base of each spine; along lower margin of sides are light spots of larger size, enclosed in a network of dusky lines. In slightly larger specimens, the white spots on back have disappeared, and the under parts are covered with a close black reticulum, the lines of which show a tendency to a lengthwise arrangement. This tendency becomes dominant in specimens about 3 cm. long, the lower parts then marked with parallel black lines of varying width and intensity, which occasionally anastomose. The white dorsal spots soon reappear, and the lengthwise streaks begin to fade, wholly disappearing in adults.

We have had for comparison numerous young and adult specimens from the Hawaiian Islands, and two young individuals from Japan. No differences are discoverable, so we have been forced to conclude that *T. hispidus* is identical with *T. erethizon*, and is a species of universal distribution in the tropical Pacific.

293. *Eumycterias punctatissimus* (Günther).

PLATE XXIII, FIG. 46.

Not rare among the rocky islands in Panama Bay.

The white spots are always numerous and crowded, especially on the lower part of the sides, but they vary considerably in size, and the brown lines forming the network enclosing them are sometimes wider, sometimes narrower. The belly is always white. The sides and top of the head, the nape and the whole dorsal line, are marked with numerous small blue spots, usually surrounded each by a darker ring; the eye is occasionally, but very rarely, surrounded by blue radiating streaks. Young specimens are sometimes marked by an obscurely ocellated dusky area below the dorsal fin, but no trace of this persists in adults. The youngest specimen, 12 mm. long, is a uniform warm brown, without trace of spots. The basal fourth of the caudal fin is usually covered with fine white spots, the remainder of the caudal and all the other fins, translucent, unmarked.

The vertical fins are short, with evenly rounded margins. The pectorals are strongly emarginate, with the upper lobe the longer. The dorsal and anal each contains 9 rays (rarely 10). There is a short nasal tube widely open at the summit.

Family DIODONTIDÆ.

294. *Diodon holacanthus* Linnæus.

Three specimens were secured, 115, 179, and 280 mm. long. All show the characteristic black cross-bars and blotches ascribed to this species. Round black spots are also present on the lighter spaces of the back, and on the postocular area, where they are largest. Small black spots are present on the snout in the two smaller specimens, but are lacking in the larger one. In all of the specimens, large black spots are present over the ventral region, one in the axil of each spine. They are



more prominent in the youngest example than in the older ones, but their shape is less definite. The fins are immaculate in all, and the upper lobe of the pectoral is notably longer than the lower lobe, a character which becomes more pronounced in the older specimens. So far as our specimens are concerned, there is no indication that with increasing age there is an approach to *D. hystrix*. The species should be held distinct until a full intermediate series is obtained.

Family SCORPÆNIDÆ.

295. *Scorpæna histrio* *Jenyns*.

Taken by the Albatross at Panama (Jordan & Bollman, 1889, p. 182).

296. *Scorpæna pannosa* *Cramer*.

Only the type known; taken by the Albatross at Panama.

297. *Scorpæna mystes* *Jordan & Starks*.

Of frequent occurrence in the Panama market, the collection containing numerous specimens from 10 to 30 cm. long.

In the type of *S. mystes*, the supraocular cirrus is longer than the diameter of the eye, but this is a very variable feature. In the majority of our Panama specimens, the cirrus is shorter than the diameter of the pupil, and in some individuals no trace of it can be found. Two Panama specimens have it long, as in the type; in a third it is long on one side and short on the other. In one adult co-type from Mazatlan, it is short, as is also the case in a young specimen from La Paz, L. C. The variation is dependent on neither age nor sex.

The nearest relative of *S. mystes* is the representative form *S. plumieri* of the Atlantic. The differences alleged to separate the two are slight. In all the specimens we have examined, those from the Pacific can be distinguished by the darker duller coloration, and the wider shallower grooves and pits on the top of the head. *S. plumieri* is currently described as having a long supraocular cirrus. From the following statement, however, it is evident that the species varies in this regard as does its Pacific representative: "Junge individuen besitzen blos wenige, oder selbst keine Hautlappen, und einem jungen Weibchen fehlen auch die tentakeln über dem Auge." (Kner, *Novara Fische*, 1866, p. 115).

298. *Scorpæna russula* *Jordan & Bollman*.

Dredged by the Albatross at Stations 2795 and 2797, in Panama Bay, 33 fathoms; only the types known.

## Family TRIGLIDÆ.

299. *Prionotus xenisma* Jordan & Bollman.

Dredged at Albatross Stations 2795 and 2805, in Panama Bay, 33 and  $51\frac{1}{2}$  fathoms; the types only known.

300. *Prionotus loxias* Jordan.

Only the types known; dredged at Albatross Station 2805, Panama Bay,  $51\frac{1}{2}$  fathoms.

301. *Prionotus quiescens* Jordan & Bollman.

The types were dredged by the Albatross in Panama Bay, in depths of 7 to  $51\frac{1}{2}$  fathoms.

302. *Prionotus albirostris* Jordan & Bollman.

The types from Albatross Station 2795, Panama Bay, 33 fathoms.

303. *Prionotus horrens* Richardson.

This species is very similar in general appearance to *P. ruscarius*, with which it has been frequently confused. The two agree in having a continuous sharp ridge running from the margin of the snout across preorbital and cheek to the preopercular spine, this ridge bearing several strong bramble-like spines standing out from the head at right angles, and hooked backward. In this respect, both species differ conspicuously from *P. tribulus*, in the adults of which the rostral spine, the spine on the middle of preorbital, and that on the middle of cheek become inconspicuous or wholly wanting. *P. tribulus* cannot be considered a representative Atlantic species of either of these Pacific forms, for the relationship is not so close as has been assumed.

*P. horrens* seems to be less abundant than *P. ruscarius*. We secured four adults at Panama. Three others have been reported by Jordan and Bollman (1889, p. 182) from Albatross Station 2800, in Panama Bay. Aside from these, the species is known only from the Gulf of Fonseca, where the types were obtained. The following description is drawn from the seven specimens above noted:

Head  $2\frac{2}{7}$  to  $2\frac{3}{8}$  in length to base of caudal; depth 4 to  $4\frac{1}{2}$ . Snout equaling maxillary,  $2\frac{1}{2}$  to  $2\frac{1}{3}$  in head; eye  $5\frac{1}{3}$  to 6; interorbital width 4. Dorsal X, 11; anal 9. Snout depressed, the longitudinal profile nearly straight, the sides concave, flaring strongly outwards to the sharp ridge at its lower margin. Beneath the ridge, the surface of the preorbitals is horizontal, continuous with that of the widely exposed dentigerous portion of the premaxillaries, and with the lower surface of the head. The snout is squarely truncate, or the preorbitals, especially in the young, may project slightly beyond its tip. They are never strongly produced, as in *P. ruscarius*, and permit a wide strip of the premaxillaries to be seen from above in the closed mouth.

The interorbital space is wide and flat, bounded by bluntly rounded supraocular ridges, which are usually low, but vary somewhat. This space is never deeply concave, as in *P. ruscarius* and *P. tribulus*.

The head is very finely granular, the radiating ridges delicate and very numerous, the minute granules almost uniformly covering the bones. The anterior margin of the preorbitals is minutely serrulate or granular, the posterior tooth sometimes larger than the others, projecting spine-like. Immediately behind the rounded portion of the preorbital, from which it is separated by a notch, is a strong compressed spine directed outward and backward. Behind this, on the ridge already mentioned, is a series of similar spines increasing in size posteriorly. One of these is on the center of the preorbital, one on the center of the cheek, the third at the base of the preopercular spine. These spines decrease but little with age; but it may be possible that none of our specimens is fully grown. The preocular, supraocular, occipital, nuchal, opercular and humeral ridges and spines offer nothing peculiar. No spines immediately behind the eye. A single pair, similar to the occipital spines, located slightly in advance of the latter, on the blunt postocular ridge. No trace of a postocular groove.

The anterior nostril has a broad short flap arising from its posterior margin. Mouth large, the maxillary reaching a vertical which passes through spine on middle of cheek and traverses the orbit midway between its anterior margin and the front of the pupil. Mandible with a small but evident symphyseal knob, much better developed than in *P. ruscarius*, the intermandibular space anteriorly acute. Vomerine and palatine patches of teeth varying greatly in width, the vomerine patch greatly constricted mesially, but not wholly divided in any of our specimens. The vomerine patch about equals in length one of the palatine patches. Gill-rakers varying in length from two-fifths to four-fifths diameter of pupil. They are usually heavy, club-shaped; 6, or rarely but 5 movable ones are developed on horizontal limb of arch. The membrane between the opercular spines is partly covered with cycloid scales.

Scales thin, smooth or weakly ctenoid in the young, wholly smooth with entire edges in adults. The scales of the lateral line have their exposed portions roughened with minute projections, the free edges coarsely spinous in the young. The size and roughness of these scales vary widely in different individuals. The sides of body are wholly scaled, save for a narrow naked strip in the axil of the pectorals and ventrals. The breast is variously scaled, but less completely so than in *P. ruscarius*. The scaled tract is sometimes limited to a narrow medial band, with a constriction opposite the base of the ventrals; when wider than this, it is in adults still bounded in front and on the sides with distinct naked margins. There are 52 scales in the lateral line, and about 100 vertical series above the lateral line.

The dorsal spines are slender and flexible, none of them roughened or serrulate on their anterior margin. The first spine is but little shorter than the second (the longest); the free margin of the fin is slightly concave. The eighth is the last spine to bear movable membrane, the ninth being thick and short, declined, firmly embedded in the integument, and the tenth little more than a conical bony nodule, which is sometimes entirely concealed. The caudal is truncate when spread, rarely slightly emarginate. The pectorals are very short, barely reaching the vent in adults, slightly beyond that point in the young. In the very immature type (115 mm. long), the pectoral is figured as extending to a point opposite the fourth anal ray. The posterior margin of the fin is evenly rounded, the sixth to the eleventh rays the longest. Detached pectoral rays very long and slender, the uppermost about as long as the rest of the fin, extending well beyond tips of ventrals. In adults, the tips of ventrals fall a little short of the tips of the pectorals, and neither fin reaches the vent.

The dorsal contains invariably 10 spines and 11 soft rays; the anal has but 9 rays. As noted above, the last dorsal spine (or tubercle) is sometimes concealed.

Color in spirits: dusky brown above, an obscure broad dark bar extending downwards from anterior part of spinous dorsal, and a second, more distinct, from posterior part of soft dorsal. A dusky shade on cheeks, continued on to lower side of head, where it widens from the cheek spine backward to behind tip of maxillary. Lower parts bright white. Spinous dorsal dusky, especially on its anterior half, where there may be disconnected traces of a distinct black margin. Gill-cavity blackish; peritoneum white.

The soft dorsal has its rays faintly barred, the posterior half darkest, the margin irregularly blackish. Caudal with much white pigment, the terminal fourth with a series of oblong black blotches, occupying the membranes between the rays. The remainder of the fin has two or three irregular cross-series of smaller roundish black spots. The anal is white, some of the rays occasionally margined with black. Ventrals white, sometimes black-margined. Pectorals dusky at base, becoming black toward middle of fin; the distal half is occupied by a conspicuous white cross-bar, beyond which is a narrow bar of black. The white cross-bar does not involve the upper or the lower rays.

*Measurements in Hundredths of Length without Caudal.*

Total length in mm. ....	232	213	224	152
Length to base of caudal in mm.....	185	171	182	121
Greatest depth .....	25	24½	24½	28
Least depth .....	9½	9¼	9	9
Length of caudal peduncle .....	17	17	17	18
Head .....	43½	40	40	44
Snout .....	19½	18	18½	19½
Orbit .....	7½	7½	7½	8½
Interorbital width .....	11½	10½	10½	12
Maxillary .....	19½	18	18	20
Greatest width of snout without spine.....	24	23	23	26
Snout to first dorsal spine .....	43½	40½	40	44
Base of spinous dorsal .....	23½	21½	20½	23½
Base of soft dorsal .....	24	24½	26	23
Longest caudal ray .....	26½	24½	24½	29
Middle caudal rays .....	24½	22½	22½	26½
Upper pectoral ray .....	18	18½	17½	20½
Fifth pectoral ray .....	28	27	25½	29
Ninth (longest) pectoral ray .....	32	31	29	33
Upper detached ray .....	31½	30	31	35½
Second detached ray.....	27	24	24	28½
Third detached ray .....	21	18½	20	24
Snout to first anal ray.....	66½	65	64	65
Base of anal.....	19	20	20½	20½
Ventral spine.....	14	14	14	16½
Outer ventral ray .....	19	18	18	21
Inner ventral ray.....	24	21½	22½	24



304. *Prionotus ruscarius* sp. nov.

PLATE XXVII, FIGS. 50, 50a.

*Prionotus horrens* JORDAN, 1895 *b*, p. 492 (Mazatlan); JORDAN & EVERMANN, 1898, p. 2172 (Panama; Magdalena Bay); not *Prionotus horrens* RICHARDSON.

*Prionotus birostratus* JORDAN, 1885, p. 387; JORDAN & HUGHES, 1886, pp. 332, 337; not *Prionotus birostratus* RICHARDSON.

This species strongly resembles *P. horrens*, with which it is found associated. It differs in the coarsely granular head, which is usually strongly birostrate, the concave interorbital space, the strongly ctenoid scales, the more numerous rays in the vertical fins, and in the shape of the pectoral.

Like *P. horrens*, this species has a ridge extending from edge of preorbital backward to base of preopercular spine. The ridge is less sharp than in *horrens*, being scarcely keel-like in our younger specimens, and decidedly rounded in a large individual 34 cm. long. The rostral plates are usually produced into rounded lobes, with a deep emargination between them; but the lobes vary greatly. Where the lobes are large, the premaxillaries are wholly or almost wholly concealed, when viewed from above. In the largest specimen the lobes project but little, and the premaxillaries are exposed.

The ridges and granules are much coarser than in *P. horrens*, more nearly resembling *P. tribulus*. The ridges are everywhere easily discernible. The spines are slightly smaller than in *P. horrens*, but occupy the same positions and are for the most part similarly developed. The supraocular spines are usually smaller, with two present above each orbit, a minute one projecting into a notch in the immediate bony rim of the orbit, and a larger one farther removed from the rim, on the rounded supraocular ridge. But one supraocular spine is present in *P. horrens*. The humeral, opercular and occipital spines and ridges are sharper and stronger in *P. ruscarius*.

Head  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in length to base of caudal; depth  $4\frac{2}{3}$  to  $4\frac{3}{4}$ ; snout  $2\frac{1}{2}$  to  $2\frac{1}{3}$  in head (to edge of opercular flap); eye  $5\frac{1}{3}$  to 6; interorbital width 4 to  $4\frac{1}{2}$ . Dorsal X, 12; anal 11.

Interorbital space deeply concave, as in *P. tribulus*. Anterior nostril with a slender flap, longer than in *P. horrens*, reaching when depressed to or beyond anterior margin of nostril. The maxillary usually fails to reach vertical from spine on middle of cheek. The intermandibular space is rounded anteriorly; there is little or no trace of a symphysial knob. Vomerine patch of teeth constricted mesially in young specimens, wholly divided into two separate patches in adults. Each half of vomerine patch about equals one of the palatine bands. Gill-rakers 6 (movable), the longest about three-fourths diameter of pupil. The membrane between the opercular spines is covered with cycloid scales.

Scales thick and firm, strongly ctenoid on back and sides, becoming cycloid on belly and breast, and on anterior portion of nape. The scales of the lateral line are less roughened than in *P. horrens*, the edges not strongly spinous. The breast is almost completely scaled, a small tract immediately behind the isthmus, and a narrow area at base of each ventral, naked. There are 50 to 52 scales in the lateral line, and about 100 vertical series above the lateral line.

The dorsal spines are flexible, but stronger than in *P. horrens*. The first and second spines are about equal, the succeeding ones rapidly shortened, the margin of the fin straight. The ninth spine bears a movable membrane. The tenth is immovably imbedded, very strong, the basal tubercle

bearing a well-developed, backwardly directed spinous process. The lower caudal lobe is slightly longer than the upper; the margin is concave rather than truncate, when the fin is spread. The pectorals are very short, reaching to or slightly beyond the vent in adults, a little longer in the young. The fin is sharply angulated above, the third and fourth rays the longest; the posterior margin from the fourth to the ninth rays is vertically truncate or slightly emarginate; the whole contrasting strongly with the evenly rounded fin of *P. horrens*. The detached rays are short, the upper not nearly reaching the tips of the ventrals.

The dorsal contains invariably 10 spines and 12 soft rays; the anal has 11 rays in all of the eighteen specimens examined, except in one which had 10.

Color in spirits: dark brown on back and sides, white below; a faint ill-defined dark bar under spinous dorsal, and one slightly more distinct under posterior half of soft dorsal. Gill-cavity blackish. Dorsals translucent, the spinous dorsal blackish toward tip anteriorly; posterior part of soft dorsal dusky at base, the fin with a more or less distinct blackish margin, which does not involve the tips of the rays. Caudal translucent dusky on basal portion, with faint dark blotches arranged in one or two irregular cross-rows. In the terminal third, the rays become charged with much white pigment and the intervening membranes are black. Anal and ventrals translucent, unmarked. Pectorals dusky on basal half, becoming blackish toward middle of fin. The distal half of the third to the ninth rays with a broad whitish bar, broadly margined with black.

This species is now known from Panama, Mazatlan and Albatross Station 3041 (Magdalena Bay, L. C.).

*Measurements in Hundredths of Length without Caudal.*

Total length in mm.....	153	225	270	202
Length to base of caudal in mm.....	119	177	222	157
Greatest depth.....	25½	22½	20½	24
Least depth.....	8	8	8	8
Length of caudal peduncle.....	15	16½	15	14½
Head (to edge of flap).....	42	39	36½	40
Snout.....	19	17½	17	17½
Orbit.....	8½	7½	7	8
Interorbital width.....	10½	9½	9	10
Maxillary.....	18	17	15½	17
Greatest width of snout without spine.....	25	21½	20	22
Snout to first dorsal spine.....	41	37½	34½	38½
Base of spinous dorsal.....	24	23	20½	23½
Base of soft dorsal.....	24½	27	25	25
Longest caudal ray.....	27½	28	24½	30
Shortest caudal ray.....	26	24	21½	26½
Upper pectoral ray.....	25	27	23	25
Longest (fourth) pectoral ray.....	33	33	29	33½
Ninth pectoral ray.....	31	31½	28	32½
Upper detached ray.....	26	26	23	27½
Middle detached ray.....	21	22	19	23
Lower detached ray.....	16	16½	14½	20
Snout to first anal ray.....	60	58	58	61½
Base of anal.....	26	26½	25½	25
Ventral spine.....	14½	14½	13	14½
Outer ventral ray.....	20	19	17½	20½
Inner ventral ray.....	28½	25½	23	28

## Family GOBIIDÆ.

305. *Philypnus lateralis* Gill.

Abundant in the Rio Grande at Miraflores. In life, the scattered spots on the sides and the streaks about eye were reddish in color.

In their List of American Gobiidæ, Eigenmann and Eigenmann (1888, p. 52) distinguish the Atlantic and Pacific species of *Philypnus* (*P. dormitor* and *P. lateralis*) by the size of the scales, the length of the head, and the number of anal rays. In going over this ground later, Jordan and Evermann (1898, p. 2195) state: "The only constant difference between this species [*P. lateralis*] and *Philypnus dormitor* seems to be the brighter coloration of *lateralis*."

We have examined in this connection five specimens of *P. dormitor*, and thirteen specimens of *P. lateralis*. These bear out in the main the differences assigned by Eigenmann. In *P. dormitor*, the head averages shorter, although the extreme of variation includes some measurements of *P. lateralis*. The scales are smaller in *P. dormitor*, although here again there is an overlapping in the formulæ. But in *P. dormitor* the anal rays are constantly 10, while in *P. lateralis* they are constantly 11. Below are data for individual specimens examined:

## P. LATERALIS.

	Mazatlan				Panama									
Head.....	$2\frac{4}{5}$	$2\frac{4}{5}$	$2\frac{4}{5}$	$3\frac{1}{10}$	$2\frac{5}{8}$	$2\frac{5}{6}$	$2\frac{6}{7}$	$2\frac{5}{6}$	3	$2\frac{5}{6}$	$2\frac{5}{6}$	$2\frac{3}{4}$	$2\frac{5}{6}$	$2\frac{3}{5}$
Scales .....	52	54	55	56	52	56	55	55	54	54	53	56	53	51
Scales in cross-series.....	.....	.....	.....	.....	17	20	19	17	18	17	17	18	16	17
Anal .....	11	11	11	11	11	11	11	11	11	11	11	11	11	11

## P. DORMITOR.

	Havana	Jamaica		Tampico, Mex.	
Head.....	$3\frac{2}{7}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$
Scales .....	56	56	59	59	61
Scales in cross-series .....	19	19	18	21	20
Anal .....	10	10	10	10	10

We have not sufficient material to enable us to decide whether there are any constant differences in coloration. The young of both species are marked by a longitudinal band, interrupted, or narrowed at intervals by incursions of the ground color. The only young specimen of *P. dormitor* in our possession shows three conspicuous cross-bars on the back: one under posterior portion of spinous dorsal, continued on the fin as a jet-black bar traversing its posterior and distal half; the second, immediately behind the soft dorsal; the third, much narrower, just in advance of the caudal fin. These become faint in adults, but we find traces of them in all our specimens. Where traces of these bars exist in Pacific material before us, they are very faint, even in brightly colored young, and do not involve the spinous dorsal.



306. *Dormitator maculatus* (Bloch).

Abundant at the mouth of the Rio Grande. Of the two forms recognized by Eigenmann as occurring in the Atlantic, our material agrees almost exactly with the second, which he had from Gurupa and Rio Grande do Sul.

Our younger specimens, 10 to 15 cm. long, are slender, with the upper profile usually noticeably depressed above the eyes. The head is 3 to  $3\frac{1}{6}$  in the length, the depth  $3\frac{2}{5}$  to  $3\frac{4}{5}$ . Highest anal ray  $1\frac{2}{5}$  to  $1\frac{4}{5}$  in head. Distance from snout to base of first dorsal spine equaling distance from first dorsal spine to base of last anal ray; it is sometimes slightly greater, sometimes slightly less than this distance, but always approximates it.

The color was light grayish, with numerous oblique dark bars running downward and forward from the back. A blue spot surrounded by a black area above the base of the pectoral. Base of pectoral with a blue or black cross-bar. A dark bar downward from eye to angle of mouth, and four parallel longitudinal dark streaks across cheeks and opercles. The spinous dorsal was broadly edged with bright red in life.

Two adults, 255 mm. long, have the depression above the eyes less marked, the head larger,  $2\frac{3}{4}$  in length, the depth much greater,  $2\frac{2}{3}$  in length, and the coloration plain dark brown on body and fins, save the red margin to the dorsals. Distance from snout to base of first dorsal spine equals distance from the latter to base of third anal ray.

It is probable that this widely-distributed brackish-water species is subject to local variations in different parts of its range, variations which are not geographically progressive and are incapable of systematic recognition. According to this view, the resemblance of the Panama and Rio Grande do Sul specimens is a chance one, depending upon independent local variation from the common stock.

A number of small specimens from the Rio Presidio at Mazatlan, Mex., do not agree precisely with either form, though they stand nearer the one here described. But the head averages somewhat smaller ( $3\frac{1}{8}$  to  $3\frac{1}{2}$  in length), and the distance from snout to first dorsal spine is about equal to that between first dorsal spine and middle of anal. There seems to be no basis for the division of these specimens into three groups, as indicated by Jordan and Evermann (1898, p. 2197).

307. *Eleotris pictus* Kner & Steindachner.

*Eleotris aequidens* JORDAN & GILBERT, 1881*f*, p. 461.

Abundant in muddy overflow ponds and ditches at Miraflores, where a few specimens were obtained. These agree perfectly with Kner and Steindachner's description and figure, also with typical *E. aequidens* from Mazatlan. Both show the characteristic mottlings of white or bluish white on the under side of the body. The black bars on the sides of the head are not visible in the larger individuals, but are very apparent in young specimens 50 to 125 mm. long. They consist of a short narrow line on each side of occiput, more or less broken up into series of dots, and of two rather broad dark bars diverging backward from eye. The upper bar extends

to the upper end of the pectoral base, but is not well marked posteriorly. The lower runs backward and slightly downward across cheeks to the preopercular margin. The lower part of cheeks is crossed nearly vertically by three broad dark shades separated by two narrow light streaks. In none of our specimens, do we note the bar described by Kner and Steindachner beginning at the angle of the mouth and joining the second bar at preopercular margin. All of the fins are dark, rather finely barred with blackish and lighter. The spinous dorsal has usually a rather wide translucent margin, and a submedial lengthwise translucent streak.

The teeth are equal or nearly so. In young specimens, a slight enlargement of the outer mandibular teeth can often be detected.

In specimens of *Eleotris pisonis* from Havana (Rio Almendares), the outer series in the upper jaw are slightly enlarged, more noticeably on the sides than in the front of the jaw. A few of the posterior teeth near the middle line of the upper jaw are also slightly enlarged. In the medial portion of the mandibles, the anterior row is slightly larger. The inner mandibular series is also enlarged, the teeth increasing in size laterally where the band narrows to a single series.

In *E. abacurus*, the teeth are similar to those of *E. pisonis*, but the canines are much larger. Both outer and inner series are enlarged in the upper jaw, the inner series less so, and the teeth are declined. It is extremely probable that *E. abacurus* is a synonym of *E. amblyopsis*.

308. *Alexurus armiger* Jordan & Richardson.

A single specimen, 172 mm. long, slightly larger than the type. This is the second individual to be reported, and extends the known habitat of the species from La Paz, L. C., to Panama.

The type description needs modification in the following respects: The diameter of the eye is contained  $9\frac{1}{2}$  times, the length of the snout 5 times in the length of the head. There are broad bands of villiform teeth in each jaw, the outer series enlarged to form small canines. In the upper jaw, these increase in size laterally, and extend as far as does the villiform band. The inner teeth are not enlarged. In the mandible, the outer canines are confined to the central portion of the jaw, numbering only about 5 on each side of the symphysis. The teeth of the inner mandibular series are also enlarged, but less so than the outer, and are directed backward.

The cheeks and opercles are wholly covered with cycloid scales similar to those on the occiput. They do not overlap, and are more or less embedded and concealed.

As indicated in the published drawing of the type (Jordan, 1895 *b*, Pl. XLVIII), the rays of the procurrent portion of the caudal fin are unbranched and not articulated.

In the Panama specimen, the fin rays number: dorsal VI, 14, anal 11.

309. *Gymneleotris seminudus* (Günther).

Only the type known from Panama.

**310. *Gobius soporator* Cuvier & Valenciennes.**

The most abundant fish of the tide-pools among the rocks.

**311. *Gobionellus sagittula* (Günther).**

Not seen by us; the species was described from specimens taken on the Pacific Coast of Central America, and has been recorded from Panama Bay by Jordan (1885, p. 387) and by Boulenger (1899, p. 3; Rio Tuyra, Darien).

**312. *Gobionellus microdon* (Gilbert).**

PLATE XXVIII, FIG. 51.

This species has been known hitherto from two immature specimens taken in a brackish lagoon a short distance south of Guaymas, in the Gulf of California. We now report it from the Panama region, where two specimens were secured in the Rio Grandé, at Miraflores, a point entirely above the action of the tides. One specimen is immature, only slightly larger than the types, the other is 113 mm. long, apparently adult. These enable us to correct the original account of the species in respect to the dentition and the coloration.

The teeth are minute in both jaws. Those in the mandible are in a narrow band, with the outer series very slightly enlarged, inserted on the extreme outer edge of the jaw, and directed almost horizontally. They are not separated by an interspace from the rest of the band. Those in the upper jaw are extremely minute, in a wider band than those in the mandible, the outer series stronger than the others, but scarcely longer. Here again, there is no interspace between the stronger series and the rest of the band. In *G. sagittula*, the upper jaw contains an outer series of strong conical teeth, separated by a well-defined interspace from a narrow inner series of small villiform teeth; the villiform band in mandible is somewhat wider, of slightly coarser teeth, with an outer series less enlarged, and with two or three pairs of strong conical teeth in the inner series next the symphysis.

Color in spirits: light greenish olive, the snout and interorbital region brownish; a narrow black streak extending backward from eye; a second narrowly V-shaped streak on opercle. A series of five to seven vertically oblong blotches or bars on middle of sides. In the young specimen, these are distinctly band-like, and reach nearly to upper and lower profiles of body. In the adult, they are much shortened, and the anterior ones are obscure. Alternating with these bars above, is a series of blotches extending half way to middle line of sides, becoming confluent in the dorsal region with a brown reticulum which encloses variously-shaped areas of the ground color. A series of three brown blotches occupies the naked predorsal strip.

Dorsals whitish, each with three or four irregular lengthwise streaks, slightly looped from ray to ray. The caudal has a number of narrow cross-bars composed of series of small spots on the membrane. Other fins are colorless, or nearly so. A bright green spot is on the base of the tongue in life.

*Measurements in Hundredths of Length without Caudal.*

Total length in mm. ....	87
Head.....	23½
Snout.....	6½
Maxillary .....	10
Eye.....	5
Interorbital width (bony) .....	2¼
Depth .....	19
Depth of caudal peduncle.....	9
Distance from snout to dorsal .....	31
Distance from first dorsal spine to first ray.....	19
Base of second dorsal.....	39
Snout to anal .....	55
Base of anal.....	37
Highest dorsal spine .....	24
Length of caudal.....	34
Length of pectorals .....	21½
Length of ventrals.....	21
Transverse rows of scales.....	65
Dorsal spines .....	VI
Dorsal rays.....	14+1
Anal rays.....	14+1

**313. *Garmannia paradoxa* (Günther).**

PLATE XXVIII, FIG. 52.

Abundant in tide-pools on the Panama reef, where numerous specimens were obtained.

Females are light olivaceous in color, with nine or ten dark cross-bars, two of which are on head, one opposite base of pectorals, two under spinous dorsal, three under soft dorsal, one on caudal peduncle and sometimes a fainter one at the base of the tail. The bars are usually wider than the interspaces, and each contains a number of small spots of the light ground color, arranged in one or more vertical series. A narrow horizontal black line traverses each bar at middle of sides. The dorsals are coarsely speckled, the caudal finely barred. The anal is blackish, the pectorals and ventrals faintly dusky; a small blackish blotch is sometimes present at



base of upper pectoral rays. The under side of the head is coarsely spotted, usually with two parallel cross-bars. Males are much darker, sometimes nearly uniformly blackish, with all the fins black.

Six spines have been erroneously attributed to this species. Seven are present in all specimens examined by us, including the one obtained by the Hopkins Expedition to Mazatlan (see Jordan, 1895, p. 497, Pl. LIX). The normal fin-formula is dorsal VII, 12; anal 10. In ten specimens counted, one had 11 dorsal rays and one had 13; in all others, the normal formula was found. The first dorsal spine is constantly produced into a filament, which usually fails to reach the middle of the soft dorsal, but extends beyond the first dorsal ray.

The dentition has not been correctly described. There is in the upper jaw a moderate band of villiform teeth, along the front of which is a series of strong curved canines, which decrease in size regularly toward the angles of the mouth. Behind the band, in the middle of the jaw, are four much slenderer canines, directed backward, all evenly spaced. In the lower jaw, the teeth are in a villiform band, with an outer and an inner series of strong canines. Laterally, these all give place to a single close-set series of teeth, which are but little larger than those of the villiform band. The canines of the inner series increase in size laterally and are directed obliquely backward. The outer canines are stronger than the inner, and decrease in size laterally.

The scales are large and strongly ctenoid, covering the body behind the vertical from the second to fourth ray of second dorsal. There are about 16 cross-series of scales, the anterior series containing about 12 scales each.

The head is contained  $3\frac{1}{3}$  in the length to base of caudal;  $4\frac{1}{6}$  to  $4\frac{1}{4}$  in the total length.

#### 314. *Enypnias seminudus* (Günther).

PLATE XXIX, FIG. 53.

Fifteen specimens were secured of this rare species, which had not been reported since the discovery of the types in 1861. Examination of our material shows that the species is widely separated from typical *Gobius*, and also from *Garmannia*, possessing the following characters:

The dorsal spines are constantly 7 in number instead of 6, the number assigned in current descriptions. There is a pair of thick barbels on the chin, each of which springs laterally from the edge of the median frenum of the lower lip. The body is much more completely scaled than is the case with *Garmannia paradoxa*. The belly is naked, and has continuous with it a naked strip extending up into the axil of the pectoral fin. The head and nape are also naked, a narrow naked strip extending backward along base of spinous dorsal. Otherwise, the scales cover the body, the scaly area narrowing anteriorly behind the base of the pectoral fin. Anteriorly, the scales are very small and are arranged irregularly. They increase in size posteriorly, and are there inserted in regular series. There are about 50 or 60 scales in a line along middle of sides.

In this species, as in *Garmannia paradoxa*, we fail to find the "2 small curved canine teeth on each side of lower jaw." The mandible contains a broad band of rather coarse villiform teeth, with an inner and an outer series of enlarged canines. The upper jaw is similar, but contains no enlarged inner series.

None of the dorsal spines are filamentous or elongate. They are constantly seven in number, the last two much more widely spaced than the preceding five. The last membrane joins the base of the first soft ray.

The head is large, with swollen cheeks and a blunt nose. Its length is contained  $3\frac{1}{5}$  to  $3\frac{1}{4}$  times in length to base of caudal,  $3\frac{3}{4}$  to  $3\frac{1}{5}$  times in total length. The greatest depth of body is contained  $4\frac{1}{5}$  times in length to base of caudal,  $5\frac{1}{6}$  in total length, in a female;  $4\frac{2}{3}$  ( $5\frac{2}{3}$ ) in a male.

In females, the body is obscurely cross-banded, a horizontal black line on each bar along dorsal outline, and another where each crosses middle line of sides. The soft dorsal and caudal are coarsely speckled in cross-series; a black bar at base of upper and one at base of lower caudal rays. A conspicuous black blotch at base of upper pectoral rays. Males are much darker than females, the fins all blackish and without cross-barring, the bars on sides little evident.

The normal fin-formula is D. VII, 15; A. 11. In fifteen specimens examined, all contained 7 dorsal spines, thirteen contained 15 dorsal rays (one had 12, and one 16 rays), fourteen contained 11 anal rays (one had 10 rays).

There is nothing in the squamation to distinguish this species generically from *Gobius*. The genus *Enypnias* may be based upon the 7 dorsal spines and the pair of mental barbels.

### 315. *Bollmannia chlamydes* Jordan.

Only the types known, from Albatross Stations 2800, 2802, 2803, 2804, 2805, Panama Bay, depths 7 to  $51\frac{1}{2}$  fathoms.

### 316. *Aboma lucretiæ* (Eigenmann & Eigenmann).

Only the type known, from Pearl Island, Bay of Panama.

### 317. *Microgobius emblematicus* (Jordan & Gilbert).

*Microgobius cyclolepis* GILBERT, 1891, p. 74.

About thirty specimens were secured in tide-pools on the Panama reef.

In spirits, the coloration is largely lost, the fish having the translucent olivaceous cast so characteristic of the typical members of this genus. On the back, along the base of the dorsal fins, are more or less distinct traces of five elongate dusky blotches, the intervals between which are narrower than the eye. Most specimens show a distinct, vertically oblong black humeral spot. The fins are translucent dusky, darker in males, in some of which the ventrals and anal are black. The spinous dorsal has occasionally one, or several, lengthwise series of small dark spots, one for each spine. The red streak on caudal is often represented by a pale line traversing obliquely the dusky fin. For the coloration in life, we can refer to the original description.

The species varies greatly in depth, in squamation, and in the length of the dorsal spines. The depth varies from  $4\frac{1}{5}$  to 6 in length to base of caudal. The scales grow larger posteriorly, and are there regularly arranged. More anteriorly, they are reduced in size and crowded, and are very difficult to enumerate. Different specimens vary greatly in size of scales, in amount of crowding and irregularity in the anterior part of the body, and also in the relative completeness with which the anterior part of the body is invested. The head, nape, and belly, and a strip along base of spinous dorsal are always naked. A narrow vertical strip immediately behind pectorals is usually scaleless. The scaly area of sides therefore narrows anteriorly and ends at a point about opposite the first dorsal spine. In some specimens the scales cease more posteriorly, opposite fourth or fifth dorsal spine. This condition does not differ essentially from that found in *Microgobius signatus*, the type of the genus, nor in *M. thalassinus*. The genus *Zalypnus*, based on *emblematicus*, must therefore be withdrawn. As above indicated, the enumeration of the rows of scales is attended with great difficulty, and cannot be made with any high degree of accuracy. In different specimens, our counts have varied from 45 to 70, the majority ranging between 55 and 65.

The third, fourth and fifth dorsal spines are usually somewhat produced, often extending to middle of dorsal base, or even beyond this point. In some specimens, apparently females, the fin is evenly rounded in outline, with none of the rays produced. *Microgobius cyclolepis* was based on a specimen, 5 cm. long, from the Gulf of California, said to differ from *M. emblematicus* in the lower spines, the larger scales, and in the presence of a round black humeral spot. Our present material shows that all of these characters fall within the range of variation of *M. emblematicus*, of which *M. cyclolepis* is doubtless a synonym.

The dentition is as follows: The upper jaw is provided with an anterior series of slender canines extending along the proximal half only of each premaxillary. Those nearest the center of each jaw are upright, backwardly curved toward their tips; the others are strongly curved (almost hooked) in the direction of the angle of the mouth. Behind the canines is a single series of minute villiform teeth, extending much farther laterally than do the canines. The mandibular teeth are arranged like those in the lower jaw, the outermost canine on each side larger than the others. Opposite the point where the anterior series terminates, the teeth of the posterior row are abruptly transformed into laterally curved canines, which replace on the sides of the jaw those of the anterior row.

In ten specimens, the fin-formula is as follows, the last ray of both dorsal and anal divided to the base and enumerated as one ray:

	Dorsal spines	Dorsal rays			Anal rays		
		16	17	18	16	17	18
Number of rays.....	VII	16	17	18	16	17	18
Specimens .....	10	1	6	3	1	7	2



One specimen with 18 rays in the dorsal has 17 in the anal. In all other cases the two fins agree. All specimens possess a sharp thin dermal fold which extends from the first dorsal spine, to the base of which it is attached, forward over nape and occiput to a point immediately behind the eyes. A similar fold exists in *M. signatus*, and will doubtless be detected in *M. thalassinus*. It does not exist in *M. gulosus*, which is in other respects less closely allied to the species under consideration, and will doubtless in time receive generic recognition. A similar fold is found in *Gobius nicholsi*, and again, in an exaggerated form in *Lophogobius cyprinoides*.

*M. emblematicus* is most nearly allied to *M. thalassinus*, which it seems to represent in the Pacific. No structural features which promise to be permanent are alleged to distinguish them, but we have no specimens of *thalassinus* at hand for comparison. It seems altogether probable that *M. eulepis*, from Fortress Monroe, is a synonym of *M. thalassinus*.

*Measurements in Hundredths of Length without Caudal.*

Total length in mm.....	48	50
Length to base of caudal in mm.....	38	40
Head.....	27	26½
Snout.....	5½	5½
Eye.....	7	7½
Interorbital width .....	1½	2
Maxillary .....	12	14
Depth of body.....	21	17
Depth of caudal peduncle.....	10	10
Longest dorsal spine .....	16	43
Longest dorsal ray.....	12	17
Longest caudal ray .....	26	28
Longest pectoral ray.....	18	18
Longest ventral ray .....	21	21

318. *Microgobius miraflorensis* sp. nov.

PLATE XXIX, FIG. 54.

A species with comparatively large ctenoid scales, with produced spinous dorsal, and with plain coloration. Resembling in general appearance *M. emblematicus*, but the body less elongate, the mouth larger, the caudal more produced, the scaling and the coloration entirely different. There is also lacking the cutaneous fold on nape and occiput.

Head 3½ in length; depth 5. Maxillary 1¾ in head; eye 3½. Dorsal VII, 17. Anal 17; the last ray split to the base, the two halves separated for half the distance found between distinct rays.



The body is rather elongate, the mouth large, oblique, the maxillary reaching slightly beyond the vertical from the posterior margin of the orbit. The interorbital space is very narrow and shallowly grooved, its width but half the diameter of the pupil. The gill-opening is produced below the level of the pectoral base. There are no fleshy appendages on the inner edge of the shoulder girdle.

The teeth are in a double row in each jaw, those of the outer series enlarged to form slender curved canines, as in other species of *Microgobius*. The outer series is confined to the anterior portion of each jaw, the inner series extending laterally beyond them. In the mandible, these lateral teeth are somewhat enlarged, replacing those of the outer series, which they do not equal in size.

The spines of the dorsal fin are all very slender and flexible, all but the first and seventh produced, but connected by membrane to their tips, the tip of the produced lobe reaching middle of soft dorsal when depressed. Soft dorsal and anal of equal extent, high, the last rays slightly overlapping the caudal. Pectorals and ventrals reach the same vertical, which is slightly behind the origin of the anal fin. The caudal fin is lanceolate, the middle rays produced, their length equaling the distance between the tip of the snout and the base of the middle pectoral rays.

The scales are large, all but the anterior ones regularly arranged and strongly ctenoid. Anteriorly, in the post-pectoral region, the scales become reduced in size, cycloid, and less regularly arranged. As nearly as they can be enumerated, there are 44 or 45 in a longitudinal series. The head and nape, a narrow strip along spinous dorsal, and the breast and belly are naked.

There were no bright colors in life, while in related species (except *gulosus*) there are blue, green and red. In spirits, the head and body are light grayish olive, with a soiled appearance due to minute punctulations and the faintly darker margins of the scales. The snout, and the marginal portions of the vertical fins, are more distinctly dusky. The sides are crossed by a number of extremely narrow dark lines, 4 or 5 of which can be counted on that part of sides corresponding to anterior halves of dorsal and anal. A more distinct narrow bar descends from the front of the spinous dorsal. Pectorals and ventrals colorless.

*Measurements in Hundredths of Length without Caudal.*

Total length in mm. ....	39
Length to base of caudal in mm.....	29
Head.....	29
Depth .....	21
Depth of caudal peduncle .....	8
Maxillary .....	17½
Eye .....	8
Interorbital width .....	2
Snout to first dorsal spine.....	35
Base of first dorsal .....	17
Base of second dorsal.....	38
Snout to origin of anal .....	54
Base of anal.....	37
Length of caudal.....	33
Length of pectoral .....	23
Length of ventral .....	25
Longest dorsal spine .....	39

319. *Evermannia zosterura* (Jordan & Gilbert).

Seven specimens were secured from the tide-pools of the Panama reef, where it was associated with the much more numerous *E. panamensis*. The species had been detected heretofore only at Mazatlan, Mex. In the Panama specimens, the normal fin-formula is D. IV, 14+1; A. 13+1. One specimen only varies from this in having the anal rays 14+1. In seven additional specimens from Mazatlan no variation exists.

*E. zosterura* agrees with *E. panamensis* in having a rather long flexible appendage to the shoulder-girdle, and in the presence of embedded scales; though both characters are denied in all published descriptions. The scales are very few in number, and can be detected only by the examination of detached portions of the skin under high magnification. There are thus no characters remaining to separate *Evermannia* from *Ilypnus*, save that the latter has five instead of four dorsal spines, with none of them filamentous or produced; the scales are also regularly arranged and are not concealed. These characters seem doubtfully sufficient for generic division, but the groups may be provisionally retained pending further examination of allied species. *Clevelandia* is somewhat less closely related. It is said to have no fleshy appendages to the shoulder-girdle, but in *C. ios*, which we have re-examined, there is an evident low sharp crest along the lower portion of the girdle, rising at about two points to form inconspicuous papillæ. This condition is quite different from that obtaining in *Evermannia* and *Ilypnus*, where a single long flexible finger-like process arises from the same locality in all of the species.

*Measurements in Hundredths of Length without Caudal.*

	♂	♀
Length of body in mm. ....	22	30
Length of head .....	33	32
Length of snout .....	6	7
Length of maxillary .....	15	13½
Diameter of orbit .....	5½	6+
Depth of body at ventral base .....	20	18
Distance from snout to spinous dorsal .....	42	43
Base of second dorsal.....	35	34
Distance from snout to anal .....	59	61
Base of anal.....	32	27
Length of pectoral fin.....	16	16½
Length of ventral fin .....	23	22
Length of caudal fin.....	26½	24

320. *Evermannia panamensis* sp. nov.

PLATE XXX, FIG. 55.

Head  $3\frac{1}{6}$  in length, depth  $5\frac{1}{2}$ . Dorsal IV, 16; anal 14; pectoral 19.

Body slender, highest opposite base of ventrals, which in preserved specimens protrude much below the general contour of the belly. The body tapers comparatively little posteriorly. The upper profile descends in a long even curve from the front of the dorsal to the tip of the snout, with an indentation in front of occiput. The lower jaw is curved upward toward tip, well included within the upper. The teeth are minute, slender, and slightly curved; in a narrow band on the extreme edge of each jaw, growing wider in front; the outer series is slightly enlarged. The maxillary extends beyond the orbit for a distance about equal to its diameter; its posterior extremity slightly behind the middle of the head. The eyes are small,  $6\frac{1}{2}$  in head, separated by a narrow space which is less than half their diameter.

The edge of the shoulder-girdle has one rather long flexible appendage, inserted opposite the fourth to sixth pectoral ray counted from below.

The first dorsal spine is filamentous in the male, extending in the type specimen to base of ninth soft ray, when depressed. The second spine is also somewhat produced, reaching in the type to slightly beyond the base of the second soft ray of dorsal. The third and fourth dorsal spines are shortened, but extend slightly beyond base of first soft ray. The first three spines are close-set and evenly spaced; the fourth is more widely separated from the third, the interval about equaling that separating the first from the third spine. The distance between the base of the fourth dorsal spine and the origin of the second dorsal equals the length of the snout. In females the first spine is usually produced, but less so than in males. In some specimens it fails to reach the base of the first soft ray.

The origin of the anal is opposite the interspace between the third and fourth dorsal rays. Its last ray is slightly posterior to the last dorsal ray. The last rays of the dorsal and anal overlap the base of the caudal. The caudal is produced, lanceolate, its length four-fifths that of head. Scales small, cycloid, partially embedded, not easily distinguishable.

Color in spirits: males dusky brown, somewhat lighter toward middle line of belly, the pigment dots on head much coarser and more widely spaced than those on sides of body. A faint vertical dark line below the eye. Pectorals, ventrals, dorsals, and upper half of caudal fin translucent, with dusky rays. Anal black, its upper half translucent, strongly contrasting. In life the upper half of caudal was yellow.

The females are lighter and less uniform in coloration. The ground color is light olive, the upper part of head and the dorsal region finely mottled with brown, the sides of body with narrow streaks following the lines which separate the myotomes. The dorsal fins have translucent membranes, and almost uniformly dusky rays. The caudal has the upper half plain or faintly cross-banded, the lower half translucent or faintly shaded, the coloration of the two halves never sharply distinguished as in the male; there is a faint submarginal dusky streak, better defined on upper half of fin; the margin is narrowly translucent or whitish. The basal two-thirds of anal fin is dusky, more intense toward middle of fin, the marginal third translucent or whitish. The pectorals and ventrals are translucent, the former with dusky rays, the latter unmarked.

This species is closely related to *E. zosterura*. It is more extensively scaled than the latter, and seems to attain a larger size. It has one or two more soft rays in the dorsal and anal fins. The male is readily distinguished by its striking and peculiar coloration. The females require careful inspection, but can be separated usually at sight by the coloration of the second dorsal fin, which is noticeably speckled in *E. zosterura*.

Forty specimens of this species were obtained in tide-pools on the Panama reef.

*Measurements in Hundredths of Length without Caudal.*

	♂	(Type) ♂	♀	♀
Length without caudal in mm.....	35	32½	31	32½
Length of head .....	33	33½	32½	32
Length of snout.....	8	7½	7	7
Length of maxillary .....	17½	17	15	13½
Diameter of orbit .....	5	5½	6	6
Interorbital width .....	1½	2	1½	1½
Depth of body at ventral.....	17½	17½	17	18
Least depth of caudal peduncle .....	8	8	7½	7½
Distance from snout to spinous dorsal.....	43	44	42½	41½
Distance between front of dorsals.....	15	16	16½	16½
Base of second dorsal.....	35	34½	35½	36
Distance from snout to anal.....	60	61	64	62
Base of anal.....	31	30	27	30
Length of caudal peduncle .....	10	10	8½	8
Height of longest dorsal spine .....	30	38	16	15½
Length of pectoral fin .....	14	16	16½	15
Length of ventral fin .....	19	23	22	21
Length of caudal fin.....	25	27	26	24

321. *Tyntlastes brevis* (Günther).

This species is known from the type, and from two partially digested specimens taken from the stomach of a *Centropomus* (Gilbert, 1890*b*, p. 451).

## Family ECHENEIDIDÆ.

322. *Echeneis naucrates* Linnæus.

Recorded from the Gulf of Panama by Boulenger (1899, p. 3).

323. *Remora remora* (Linnæus).

Obtained at Panama by Gilbert (Jordan, 1885, p. 372); not seen by us.

## Family OPISTHOGNATHIDÆ.

324. *Opisthognathus punctatum* Peters.

Recorded from Panama by Jordan (1885, p. 389) on specimens secured by Gilbert; not seen by others.



## Family DACTYLOSCOPIDÆ.

325. *Dactyloscopus zelotes* Jordan & Gilbert.

Only the type known, collected at Panama by Captain J. M. Dow.

## Family URANOSCOPIDÆ.

326. *Kathetostoma averruncus* Jordan & Bollman.

Known from the type, dredged in Panama Bay at Albatross Station 2800, in 7 fathoms (Jordan & Bollman, 1889, p. 163). Recorded by Garman (1899, p. 75) from depths of 56 to 210 fathoms.

## Family BATRACHOIDIDÆ.

327. *Batrachoides pacifici* (Günther).

Very abundant at Panama, appearing daily in the markets; the young abundant in the tide-pools of the reef. The youngest specimen obtained by us is 24 mm. long, and shows a well-developed adhesive disk between the ventral fins. In a specimen 30 mm. long, no trace of the disk remains. In the young, the ground color is much lighter than in adults, while the black cross-bars on body and fins are much more conspicuous.

In their account of this species, Meek and Hall (1885, p. 61) make two serious errors, which are repeated by Jordan and Evermann (1898, p. 2314). The scales are said to be etenoid, whereas they are perfectly smooth, with entire edges; and the anterior mandibular teeth are described as in two rows, while they are in a cardiform band, some or all of the outer and the inner series enlarged as strong conical canines. In the outer row there seem to be regularly two or three pairs of these canines.

The upper lateral line is interrupted under the middle of the soft dorsal, the lower line at a point slightly posterior to this: the two are then continued at the immediate base of dorsal and anal respectively, and are again interrupted near the ends of these fins, to reappear on caudal peduncle at their former levels; they are discontinued on the base of the caudal fin, but are each represented on the fin itself beyond the base by a series of two or three pores.

The smaller number of fin-rays and the much larger eye serve readily to distinguish this species from *surinamensis* and *boulengeri*. In dentition, it seems to agree more nearly with the latter.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm.....	208	235
Length of head .....	38	38½
Greatest width of head .....	32	33
Length of snout.....	8	8½
Diameter of eyeball .....	6	5½
Interocular width.....	8	10
Length of maxillary .....	20½	22½
Greatest depth of body .....	18	17
Depth of caudal peduncle.....	7½	7½
Snout to first dorsal spine.....	35½	37
Base of second dorsal (to base of last ray) .....	51	51
Snout to front of anal.....	55	58½
Base of anal (to base of last ray) .....	42	40
Length of caudal.....	18	17
Length of pectoral (from middle of axil) .....	18	17
Length of ventral .....	15	15

**328. *Batrachoides boulengeri* sp. nov.**

PLATE XXXI, FIGS. 57-57a.

*Batrachoides surinamensis* GÜNTHER, 1861 *b*, p. 174 (in part); GÜNTHER, 1868, p. 388. Not *Batrachus surinamensis* BLOCH & SCHNEIDER (Surinam).

Head  $2\frac{3}{5}$  to  $2\frac{1}{2}$  in length; greatest width of head  $3\frac{2}{7}$ ; depth  $5\frac{4}{5}$ . Interorbital width  $2\frac{4}{5}$  to  $2\frac{5}{8}$  in head; snout  $4\frac{1}{4}$ ; maxillary  $1\frac{3}{4}$  to  $1\frac{4}{5}$  in head. Eye  $3\frac{2}{3}$  to 4 in interorbital width, 10 to 11 in head. Dorsal III, 27 to 29; anal 25 or 26.

Head very strongly depressed, the posterior part of trunk strongly compressed, the depth and width about equal at a point opposite the tip of the pectoral fins. The arrangement of pores and barbels on the head is essentially as in *B. pacifici*, but the filaments are more numerous and larger. As in other species, the filaments are clustered, being for the most part the fringed margins of cutaneous flaps which occur in pairs on either side the organs of the lateral lines.

The teeth near mandibular symphysis are in a broad cardiform patch, with the outer series enlarged to form broad conical canines. The sides of the mandible are occupied by a single series of very strong conical canines, two or three of which near the middle of each ramus are much larger than those in front and behind; this series is continuous with the posterior series of the cardiform band, where they decrease rapidly in size, those nearest the symphysis being scarcely larger than the others of the band. Vomerine teeth normally eight in number, the median ones small, the others increasing rapidly, the outermost usually as large as the largest of the palatine series. Palatine teeth strictly in a single series, eleven in number on each side; they increase regularly from the anterior end backward to the sixth, which is the largest, the remaining five being subequal, and about as large as the third.

The premaxillary teeth are all finely villiform, in a narrow band which tapers laterally to a point, and is discontinued opposite the fourth or fifth of the palatine series. Opercle and subopercle each with two strong diverging spines, the lower in each case shorter than the upper.

The entire head, with the throat and breast and the pre-pectoral area are naked. The rest of the body, including the entire belly, is covered with elongate imbricated cycloid scales, the margins of which may be slightly crenate. As in other species of the genus, there are two lateral lines: the upper begins on a level with the upper opercular spine, runs parallel with the back for a distance slightly exceeding two-thirds the length of the trunk, to a point opposite the base of the eighteenth dorsal ray; it is there discontinued, to reappear at the extreme base of the dorsal fin, along which it is evident from the twentieth to the twenty-fifth ray; it is there again interrupted, reappearing at its former level, where it is continued to a point opposite the end of the dorsal fin. The lower lateral line curves around the lower base of the pectoral fin and up behind it, then runs nearly parallel with the base of the anal to its interruption at a point opposite the twelfth anal ray; it is then continued along the base of the anal to within a few rays of its end, when it reappears at its former level. Two short longitudinal series of filaments divide the basal portion of the caudal fin into thirds, and seem to represent a posterior continuation of the two lateral lines.

There is a deep glandular pocket behind the upper portion of the pectoral fin. On the inner face of each pectoral toward the base is a series of grooves, one in each interradial membrane; these are continued proximally as canals which penetrate the base of the fin.

The color is gray, very finely mottled with olive-brown. About seven dark bars cross the back and sides. The belly and under side of the head are whitish. The ventrals are whitish, the other fins colored like the body.

This species seems to resemble the Atlantic *B. surinamensis*, with which it has been identified by Dr. Günther. No specimens of *surinamensis* are at hand for comparison, but published descriptions indicate important differences between the two forms. According to Cuvier and Valenciennes (Hist. Nat. Poiss., Vol. XII, p. 488), *B. surinamensis* has a very small eye, the diameter of which is contained eight or ten times in the interorbital space; the palatine teeth are in two rows, the throat is scaly, and the two lateral lines disappear near the middle of the length of the trunk. Meek and Hall (1885, p. 61) state that the vomerine teeth are small, about fourteen in number, and the pectoral is without pores on its inner surface. All of these features are essentially different in the species here described, as has appeared in the above description. Authors are not agreed concerning the arrangement of the palatine teeth in *B. surinamensis*. They are variously described as in two rows, in one irregular row, or in a single series. We are also uncertain concerning the anterior mandibular teeth; Cuvier states that those of the anterior series of the cardiiform band are stronger than the others, while Günther describes a villiform patch, the outer teeth of which are not canine-like.

Through the courtesy of Dr. C. H. Eigenmann, we are enabled to give the following notes on the specimen of *B. surinamensis*, on which Meek and Hall based their account of the species. The specimen is 111 mm. long. It is numbered 2080 in the catalogue of the Indiana University Museum.

The longitudinal diameter of the eye is one-third the interorbital width. The palatine teeth are conic, irregular in size, in a single row. The vomerine teeth are 14 in number, increasing in size outward. The mandibular teeth are in a single series laterally, in a band in front, the anterior and the posterior series of the band

evidently enlarged. Upper jaw with a narrow band, the posterior row slightly enlarged. Region in front of ventrals naked. Lateral lines disappearing near middle of tail. No pores at base of pectoral rays on inner surface.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm.....	295	255
Length of head.....	35½	36
Greatest width of head.....	29	31½
Length of snout.....	8½	8½
Diameter of eyeball.....	3½	3½
Interocular width.....	12½	13
Length of maxillary.....	20½	21
Greatest depth of body.....	16	18
Depth of caudal peduncle.....	7	7
Snout to first dorsal spine.....	35	35½
Base of second dorsal.....	55	56
Snout to front of anal.....	50	50
Base of anal.....	47	49
Length of caudal.....	16	18
Length of pectoral from axil.....	16	17
Length of ventral.....	13½	15
Base of caudal to bend in upper lateral line.....	22	19
Base of caudal to bend in lower lateral line.....	27	22

329. *Porichthys margaritatus* (Richardson).

Taken by the Albatross in Panama Bay at Station 2802, at a depth of 16 fathoms. Also reported by Dr. Boulenger (1899, p. 3) from Rio Tuyra, Darien (as *P. notatus*).

330. *Porichthys greenei* sp. nov.

PLATE XXX, FIG. 56.

A small light-colored species, taken by us in the tide-pools of the Panama reef. It differs from all other species of the genus in the complete union of the dorsal and anal fins with the caudal, in the small head, and in the comparatively weak development of the phosphorescent spots.

Head  $4\frac{1}{4}$  to  $4\frac{1}{3}$  in length; depth  $5\frac{1}{2}$ . The mouth is oblique, the lower jaw longest, the maxillary extending beyond the eye, slightly more than half length of head. A pair of slender cutaneous slips at tip of snout. Tip of maxillary with a cutaneous flap, the free edge of which is fringed.



Mandible anteriorly with an outer series of small canines, behind which is a narrow band of short cardiform teeth. The latter pass toward sides of jaw into a single series of canines, enlarging toward angle of mouth and hooked backward and laterally. Premaxillaries with a single close-set series of slender conical teeth, a median pair slightly larger than the others, but scarcely canine-like. Vomer with a pair of widely separated canines, about equaling the large teeth in sides of mandible, and much larger than any of the palatine teeth. The latter are of small size, nearly uniform, ten to twelve in number. The eye is small, its diameter about equaling the bony interorbital width.

The lines of sense organs and phosphorescent organs of this species have been described by Dr. C. W. Greene (1899, p. 676), to whose paper we refer. As there stated, the rows agree very closely with those in *P. notatus* and *P. margaritatus*. The phosphorescent organs are, however, much smaller, proportionally, than in these species, and are less developed in the dorsal region and on top and sides of head. The following account gives the principal differences between *P. greenei* and the other species mentioned. In some minor details, it differs from the account given by Dr. Greene.

In the *dorsal* series, no phosphorescent spots are present. In the *lateral* series, there is no upper row of phosphorescent organs. In the *pleural* row, both sets of organs are constantly present; the sense organs are difficult to distinguish, as they are not accompanied by dermal filaments; the line is discontinued at a point opposite the twenty-first anal ray. Concerning the phosphorescent organs in this series in *P. notatus*, Greene says (l. c., p. 671): "The organs of this line ..... have no relation to the body segments." We find that the typical arrangement, in the three species known to us, gives two spots to each anal ray, along that part of the line which is parallel with the anal fin. The spots are not equally spaced, but are rather obviously arranged in pairs, though one member of a pair is occasionally undeveloped. Both *caudal* rows are well developed as in other species. The *gastrogular* row is always complete, but the sense organs are again difficult to detect, owing to the absence of filaments. In the *upper opercular* series, and in a row along the lower edge of the black subocular blotch, the phosphorescent organs are well developed; they are absent, however, or very sparingly developed on all other series on top and sides of head.

The dorsal and anal fins are longer than in other species, the dorsal containing 2 spines and 38 or 39 rays, the anal 35 or 36 rays. The membrane of the last dorsal spine joins base of first soft ray. The last two or three dorsal rays are shortened, and the last ray is joined for its full length with the upper ray of the caudal; there is thus a notch between the two fins. The anal is continuous with the caudal, without notch, as the last rays are not shortened.

As in other species, a gland is present in the axil of the pectorals; also a series of canals penetrating the base of the fin on the axillary side, as in *Batrachoides*, one for each interradiial membrane.

The color is translucent grayish or olive, with five broad dark cross-bars on back along base of dorsal fin, and a sixth on nape (including base of spinous dorsal); there are also one on occiput, one behind orbits and one on snout, the last three less intense and more or less joined. The basal portion of the pectoral fin is more or less dusky. Fins otherwise translucent, unmarked.

Twelve specimens were obtained. The species is named for Dr. Charles Wesley Greene.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm.....	76	75
Head .....	24	24
Snout .....	5	5
Interorbital space (bony).....	3+	3½
Eye.....	4	3½
Maxillary .....	13	12½
Depth.....	18	18½
Least depth at base of caudal.....	3½	4
Snout to dorsal .....	25	23
Distance between dorsals .....	4½	.....
Base of second dorsal.....	70	71
Snout to anal.....	37	37
Base of anal.....	63	61
Caudal.....	11	11
Pectoral .....	18	18
Ventral.....	11	12

331. *Thalassophryne reticulata* Günther.

Teeth on mandible, vomer and palatines similar, in single series, small, nearly uniform in size, antero-posteriorly compressed so as to resemble diminutive incisors. Sometimes single teeth are crowded out of line, but they are never in two definite series, not even, as alleged, on front of mandible. The maxillary teeth are similar, but very much smaller, in two rows or a narrow band.

The last dorsal and anal rays are inserted at a distance from base of caudal equaling more than half their length. They are joined by membrane for their entire length to the caudal peduncle and to the portion of the caudal fin which they overlap.

The type is described as having 24 rays in the dorsal and 24 in the anal fin; it is figured, however, with 25 rays in the dorsal. Nine specimens counted by us show uniformly 26 rays in the dorsal fin, 25 in the anal; a tenth specimen has 27 dorsal and 25 anal rays.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm.....	255	218
Length of head.....	31	31
Greatest width of head.....	30	30
Length of snout.....	6	6
Diameter of eyeball.....	3	3
Interorbital width.....	6	7
Length of maxillary.....	16	16
Greatest depth of body.....	19	19
Depth of caudal peduncle.....	5½	6
Snout to first dorsal spine.....	28	29
Base of second dorsal (to base of last ray).....	56	54
Snout to front of anal.....	44	46
Base of anal (to base of last ray).....	52	53
Length of caudal.....	18	20
Length of pectoral (from middle of axil).....	22½	23
Length of ventral (outer ray).....	14½	14½

332. *Thalassophryne dowi* Jordan & Gilbert.

This species seems to be rarely taken. A single specimen was obtained by us, 150 mm. long. The only others known are the three types from Punta Arenas, Costa Rica, and two specimens dredged by the Albatross in the Bay of Panama.

The lower half of the body is whitish, unmarked; the dorsal portion is blackish, relieved by the white lateral line and by a few irregular blotches of white, which are most numerous toward the middle of the sides. The head is blackish above and on sides, very finely marbled with gray. The lower lip and the front of the lower jaw are similarly marked; the gular membrane is slightly dusky; the under side of the head otherwise white. The eyes are seen with difficulty, being colored like the surrounding area. The anal is white, except some of the posterior rays, which are margined with black. The basal half of the dorsal is white or grayish, sharply contrasting with the black marginal half. The terminal half of caudal is jet-black, the basal half white, blotched more or less with brown. The ventrals are white; the pectorals white, marbled with brown on their basal portion. Teeth in premaxillaries small, in two series, the front tooth of the outer series on each side a strong conical canine. Sides of mandible with a single series of strong canines, which increase in size backward to the eighth or ninth, then suddenly diminish. On the front of the mandible, are two series of similar teeth. The vomer contains twelve canines, increasing in size laterally. The palatine teeth are in a single series, about twelve in number on each side large and small teeth regularly alternating in the series.

The head is contained 3¼ to 4 times in the length. It is cuboid in shape, with vertical checks and very oblique mouth; in appearance resembling *Astroscopus*. Greatest depth of head three-fourths its greatest width.

The last two or three rays in the dorsal and anal fins are progressively shortened, giving a rounded contour to the end of these fins. The last rays of each are united for their whole length by membrane to the caudal. In three specimens at hand the second dorsal contains respectively 30, 31, and 32 rays; the anal 29, 29, and 30.

Two pairs of filaments project from the free margin behind the upper lip, one in front of each eye, the second pair nearer the median line. A pair of similar filaments on lower lip near symphysis. No other filaments on head or body; but pairs of inconspicuous thick fleshy lobes close in front of the isolated sensory organs on the lower jaw, and on the sides and top of the head.

The opercular spine, and the spines of the dorsal fin are wholly enveloped in the integument. They contain a central canal, which opens in a shallow groove on the anterior face of the spine, at an appreciable distance below the tip.

The genus *Dactor* Jordan & Evermann (1898, pp. 2313 and 2325), of which this species is the type, seems to have little value, and is not here recognized. The characters assigned are the many rayed dorsal and anal fins, and the union of these with the caudal. Other species of *Thalassophryne* have 19, 20, and 26 rays in the dorsal fin; 18, 19, and 25 rays in the anal. It seems unwarrantable to distinguish from these generically a species containing 30 to 33 rays in the dorsal and 29 or 30 in the anal. As regards union of the dorsal and anal fins with the caudal, this occurs in varying degrees, and is not correlated with increased number of fin rays. *T. maculosa* (D. II, 19; A. 18) seems to have the fins wholly distinct; *T. amazonica* (D. II, 20; A. 18) has them completely joined; *T. reticulata* (D. II, 26; A. 25) has them almost wholly united.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm. ....	134
Length of head.....	27½
Greatest width of head.....	23½
Length of snout.....	4½
Diameter of eyeball.....	2
Interorbital width.....	6
Length of maxillary.....	13
Greatest depth of body.....	20
Depth of caudal peduncle.....	5½
Snout to first dorsal spine.....	25
Base of second dorsal (to base of last ray).....	61
Snout to front of anal.....	39
Base of anal (to base of last ray).....	58
Length of caudal.....	16
Length of pectoral (from middle of axil).....	18
Length of outer ventral ray.....	9



## Family GOBIESOCIDÆ.

333. *Gobiesox rhodospilus* Günther.

The types of this species are from Panama, but it was not seen by us. It is recorded by Boulenger (1898-9, Vol. XIV, p. 8) also from the Bay of Santa Helena, near Guayaquil.

*Gobiesox gyrinus* Jordan & Evermann (1898, p. 2331) is founded on Günther's description of specimens in the British Museum, to which he has applied the name *Gobiesox nudus* Bloch (see Günther, 1861*b*, p. 502). These specimens were partly from the West Indies, partly from the Island of Cardon (misspelled Cordova, *vide* Günther, 1868, p. 381) on the Pacific coast of Nicaragua, and are probably not conspecific. Günther's description (copied by Jordan and Evermann) was doubtless based upon the adult specimens from the West Indies, not upon the very immature Nicaraguan specimens.

## Family BLENNIIDÆ.

334. *Malacoctenus delalandi* (Cuvier & Valenciennes).

Not seen by us; known from Mazatlan to Guayaquil (Boulenger, 1898-9, Vol. XIV, p. 8). It is recorded by Günther (1861*a*, p. 371) from the "Pacific coast of Central America," where it was collected by Captain Dow.

335. *Mnierpes macrocephalus* (Günther).

This species has been taken several times at Panama, but was not seen by us. It is recorded by Boulenger (1899, p. 4) from Flamenco Island, Panama Bay.

336. *Auchenopterus monophthalmus* Günther.

A very abundant species in the tide-pools at Panama.

The sexes are readily distinguished by the coloration, and by the size of the mouth. In females, the lips, mandibles, and the lower portions of the cheeks and opercles are marbled or finely blotched with dark; the ventrals, the lower pectoral rays and the caudal are cross-barred. In males, all of these regions are plain, except the caudal, which may be faintly barred. In females, the mouth is small, the distance from tip of snout to tip of maxillary not exceeding (in adults) that from tip of snout to posterior edge of pupil. In males, the length of maxillary as measured above, exceeds the distance from tip of snout to posterior edge of orbit.

The first three dorsal rays form a detached fin, its posterior membrane joining fourth spine at or immediately above the base. The three spines are flexible, not pungent at tip, much weaker than the succeeding spines. The fourth spine becomes abruptly stiff and strong. So slender are the tips of the first and second spines that it is difficult to detect them where they terminate in the membrane. The first and second spines are about equal, and are somewhat longer than any of the spines in

the posterior portion of the fin. The third spine is shortened, but still is longer than the fourth. The dorsal formula is III, XXVI+1. In ten specimens examined, the anal fin contained constantly 2 spines and 20 rays, the last two rays being distinct, but closely approximated at the base.

The lateral line traverses 38 to 40 scales, including the scale which overlies the base of the caudal fin and is sometimes without tube. The arched portion of the lateral line contains 18 to 20 scales, the straight portion 19 to 21. The scales constituting the upper portion of the arch are slightly enlarged, and are perforated on the anterior two-fifths only by a tube which opens on the under surface of the scale. At the summit of the arch, a single series of scales intervenes between the lateral line and the base of the dorsal fin. At the beginning of the straight portion of the lateral line, it is separated by five horizontal rows from the base of the dorsal, and by five rows from the base of the anal.

The second dorsal fin is marked by seven dark bars, which are continued more or less definitely upon the back and sides, where every alternate band is more distinct, the fainter ones being often with difficulty distinguished. On the middle of sides, the bands are variously confluent and irregular. The dorsal ocellus occupies the next to the last dorsal bar; and is rarely accompanied by a second smaller ocellus developed in the last dorsal bar (in two out of eighty specimens). No small ocellated spots are present on the dorsal fin in advance of the main ocellus. The anterior dorsal fin is without ocellus, and is variously blotched with dusky; the first spine is light, with four narrow cross-bars in the female, plain in the male. The dorsal ocellus is found between the twentieth and twenty-second spines of the second dorsal, occasionally encroaching on the membrane between nineteenth and twentieth spines. The anal shows six or seven oblique dark bars, or is more frequently uniform blackish, with a white margin. The caudal, pectorals and ventrals are finely cross-barred in females, plain in males. In females, the lips, mandibles, and lower portion of cheeks and opercles are barred or freckled, these regions plain in the males. The opercle has a dark blotch; a dark shade is usually present below the eye. A dark blotch occupies the basal portion of some of the pectoral rays, this more specialized on the lower rays in females.

*Measurements in Hundredths of Length without Caudal.*

	♂	♂	♀	♀
Length in mm. ....	67	52	67	50
Length of head .....	30	31	31	29
Length of snout.....	8	8	8	7
Length of maxillary.....	16	16	13½	12½
Diameter of orbit.....	6	6	6	6
Interorbital width.....	4	4	3½	3
Greatest depth .....	24	23	25	24
Depth of caudal peduncle .....	9	8	8	8½
Length of first dorsal spine.....	9½	10	12½	11
Length of second dorsal spine.....	11	11½	13	11
Length of third dorsal spine .....	7	7	9	7½
Length of fourth dorsal spine .....	6	6½	7	7
Length of twenty-sixth dorsal spine.....	9½	9	11	10
Length of first anal spine.....	6½	6½	7½	7
Length of second anal spine.....	8	8	9½	8½
Length of longest anal ray.....	12	15	15½	13½
Length of caudal fin.....	23	23	24	22
Length of ventral fin.....	19	21	22	20
Length of pectoral fin.....	24	24	24	24

**337. *Hypsoblennius piersoni* sp. nov.**

PLATE XXXII, FIG. 60.

Resembling *H. gentilis* and *H. gilberti*, but with shorter spinous dorsal and much longer soft dorsal and anal.

Head 4; depth 5. D. IX, 25; A. II, 24; P. 16; V. I, 3.\*

The form is elongate, with very bluntly rounded snout, the mouth subinferior, as in the other species mentioned. There is a slender nasal tentacle, longer than in its nearest relatives. The orbital tentacle is as long as diameter of eye; above a short basal stalk, it is finely dissected to form five or six slender filaments, one or more of which may be branched. The mouth is very small, largely transverse, reaching posteriorly to a vertical midway between front and middle of pupil. No posterior canines. Gill-opening extending below to opposite lower edge of pectoral base; from this point, the margin of the branchiostegal membrane can be traced across the throat, but it is nowhere free.

\* In six specimens of *H. gilberti* from San Diego, the fin-formula stands:

Dorsal	XII, 17	XII, 18	XII, 18	XI, 19	XII, 19	XII, 19
Anal	II, 18	II, 19	II, 19	II, 19	II, 19	II, 20

In one specimen of *H. gentilis* from San Diego, we find D. XII, 16; A. II, 18.

The lateral line is conspicuously developed in its anterior part only, for a distance equaling the length of the head.

The dorsal spines are very slender, and increase regularly in length posteriorly, there being no notch between spinous and soft dorsals. It differs in this respect from related species, there being a distinct though not conspicuous notch in *H. gentilis* and *H. gilberti*.

The color is very light olivaceous, with black blotches and markings following the same pattern seen in *H. gilberti*. Along the back is a series of six quadrate blotches, below each of which is a similar smaller blotch, those anteriorly separated by a light streak corresponding in position to the lateral line. Below the middle of sides is a series of dark spots arranged in seven pairs, those of the anterior pairs developed as short vertical streaks. A few scattered smaller spots on head and sides of body. There is a narrow V-shaped bar on occiput, a broad bar downward from eye to angle of mouth, and a faint V-shaped mark on gular region. A conspicuous oval black blotch on front of spinous dorsal. The fin is translucent with dusky markings not in definite pattern. A conspicuous black point at the base of each anal ray. The anal is translucent, with a dusky lengthwise streak along the base of the distal third of the fin. Pectorals and ventrals translucent, with some dusky markings.

Named for Mr. C. J. Pierson, a member of the Panama Expedition, to whose untiring industry much of its success was due.

*Measurements in Hundredths of Length without Caudal.*

Length in mm. to base of caudal.....	32
Head.....	25
Snout .....	7
Eye.....	7+
Gape of mouth .....	7
Interorbital width .....	2½
Length of orbital filament.....	8
Depth of body.....	20
Depth of caudal peduncle.....	8
Length of dorsal base .....	80
Length of anal base.....	53
Length of pectorals.....	22
Length of ventrals.....	15
Length of caudal .....	15

338. *Hypsoblennius striatus* (Steindachner).

Abundant in the tide-pools of the Panama reef.

The following details may be added to the original account given by Steindachner (1877, p. 15, Pl. VIII, fig. 4):

The free tips of the rays and spines of the dorsal fin are white, the color less intense than that on anal margin. The edge of the membrane between the spines



and between the anterior dorsal rays is black, contrasting sharply with the white-tipped spines and rays. A well-defined elliptical spot of jet-black occupies the membrane between the first and second dorsal spines; it is nearly as large as the eye, and is margined with a whitish ring. The blackish blotch, mentioned by Steindachner, between third and fifth dorsal spines is diffuse and ill-defined, and sometimes extends beyond the limits assigned. There is a black spot at the base of each anal ray. The ventrals have the basal portion dusky, the distal third or half of each ray white. The supraorbital tentacle is crossed with red and whitish bars.

The usual fin-formula is dorsal XII, 16; anal 20: occasionally dorsal XII, 15; anal 19. The dorsal spines are constantly twelve, and the dorsal rays never as numerous as seventeen. Steindachner's type, described with seventeen dorsal rays, is figured with sixteen rays. The pectoral fin contains constantly fourteen rays, as figured, not fifteen, as stated in the description. The ventrals are described with one spine and two rays. They have constantly one spine and three rays. The spine is short but strong, and the inner ray is usually hidden in the integument enveloping the second ray, but is sometimes distinguishable externally. The ventral fins have been examined by us in *H. gilberti*, *scrutator*, *punctatus* and *gentilis*, and are found to contain constantly one spine and three rays.

The interorbital space is rather deeply grooved. The anterior nostril is in a short tube, the posterior rim provided with a cirrus. The long supraorbital tentacles are unfortunately omitted in Steindachner's drawing. The length of the gill-slit equals the distance from the tip of the snout to the front of the pupil, scarcely extending below to the level of lower base of pectorals.

A short lateral line extends to or into the second dark cross-band behind the head, its posterior portion more or less broken up into detached fragments. It gives off a few short and irregular branches above and below, each ending in an open pore.

We have examined the mandibular teeth in twenty specimens without finding a posterior canine, such as was reported by Steindachner in one of his typical examples.

### 339. *Hypsoblennius brevipinnis* (Günther).

The species is apparently rare, as but one young specimen was obtained.

### *Homesthes* Gilbert.

*Homesthes* GILBERT (JORDAN & EVERMANN, 1898, p. 2394) (*caulopus*).

Differing from *Hypsoblennius* chiefly in the presence of four articulated ventral rays instead of three as is usual in *Blenniinae*. We have examined the ventrals of *Hypsoblennius striatus*, *punctatus*, *ionthas*, *gentilis*, and *gilberti*, and have found them to consist constantly of one short strong spine and three simple articulated rays. In *Homesthes caulopus* there is one strong short spine and four well-developed simple jointed rays.

340. *Homesthes caulopus* Gilbert.

PLATE XXXII, FIG. 61.

*Homesthes caulopus* GILBERT, *l. c.*, p. 2394.

Head  $3\frac{2}{3}$  in length; depth at base of ventrals 4, at middle of abdomen  $3\frac{2}{3}$ ; least depth of caudal peduncle 3 in length of head; snout 4; eye 4 to  $4\frac{1}{8}$ ; longest dorsal spine  $2\frac{2}{3}$ ; last dorsal spine  $3\frac{1}{5}$ ; longest (tenth) dorsal ray 2; longest (fifteenth) anal ray  $2\frac{1}{2}$ ; ventrals  $1\frac{5}{8}$ ; longest pectoral ray  $1\frac{3}{8}$  to  $1\frac{2}{3}$ ; caudal  $1\frac{1}{2}$ . Dorsal XII, 15 or 16; anal II, 17; pectorals 14; ventrals I, 4.

Robust, moderately compressed, with wide heavy head and short bluntly rounded snout, the anterior profile of which is nearly vertical. In shape and general appearance much resembling *Hypsoblennius gilberti*. Mouth very wide, horizontal, short, the maxillaries reaching vertical from hinder edge of pupil, 3 to  $3\frac{1}{5}$  in head. Teeth as usual in this group, the posterior not enlarged or canine-like. Nostrils with slightly elevated margins, scarcely tubular, the hinder edge of anterior nostril produced into a conspicuous lacinate flap, about two-thirds as long as the diameter of orbit. A similar but larger orbital cirrus, divided nearly to the base into six or eight slender filaments. Interorbital space deeply grooved, without median ridge, opening posteriorly into the deep transverse groove which separates the orbital region from the somewhat swollen occiput, its width  $1\frac{1}{3}$  eye. The mucous canals of head give off transverse branches which open by numerous pores, which thickly beset the snout, subocular region, top of head, preopercle, and upper portion of opercle. Width of gill-slit equaling or slightly exceeding one-half length of head, confined to area above lower base of pectorals.

First dorsal spine over margin of preopercle; spinous dorsal low, of nearly uniform height, much lower than second dorsal, the spines rather strong at base, with weak reflexed tips; membrane of last dorsal ray joined to extreme base of rudimentary caudal rays. Anal low, rising slightly posteriorly, leaving a short free interval between its last ray and the caudal.

Lateral line strongly developed anteriorly for a distance equaling length of head; from that point it is only faintly visible, declining abruptly to middle of sides, along which it may be traced to base of caudal; the anterior portion gives off numerous pairs of short transverse lines, each of which ends in a pore; no pores or lines are visible posteriorly.

Blackish, without sharp markings, the sides with irregular light blotches, some of which are subcircular in outline and contain one or more black central specks; the light markings near the back are elongate and vertically placed, faintly outlining dark bars of the ground color; lower parts lighter. A vertical black blotch on cheek behind eye; no distinct bars on head; tentacles whitish. Fins all blackish; the anal, the ventrals, the lower caudal and pectoral rays deeper black; anal and caudal margined with white, some of the dorsal rays narrowly tipped with white.

Two specimens, 102 and 115 mm. long, from Panama Bay.

341. *Scartichthys rubropunctatus* (Cuvier & Valenciennes).

Recorded once from Panama (Jordan & Gilbert, 1882 *n.*, p. 628).

342. *Rupiscartes atlanticus* (Cuvier & Valenciennes).

There is no Panama record for this species, which is known, however, from the Mexican coast to Guayaquil (Boulenger, 1898-9, Vol. XIV, p. 8).

343. *Emblemaria nivipes* Jordan & Gilbert.

The type from Pearl Islands, Panama Bay; not seen by us.

## Family CERDALIDÆ.

344. *Microdesmus dipus* Günther.

Not seen by us. In addition to the type, this species is known only from a specimen recorded by Lockington (1881, p. 114), from La Paz, L. C.

Dr. G. A. Boulenger has kindly re-examined for us the type of the species, and writes: "There are four ventral rays. The fifteen anterior dorsal rays are simple and inarticulate; further back they gradually become branched and articulate, and are distinctly so from the eighteenth. The anal rays are all articulate and branched."

345. *Microdesmus retropinnis* Jordan & Gilbert.

PLATE XXXI, FIG. 59.

Seven specimens were obtained in rock-pools on the Panama reef.

The genus *Microdesmus*—with the two species *M. dipus* and *M. retropinnis*—has been described as having the ventrals reduced each to a single ray. Our material has shown, however, that in *M. retropinnis* a serious error was committed, for each ventral fin consists of a short slender spine and three slender unbranched rays, the inner of which is the longest. Through the great kindness of Dr. G. A. Boulenger, who has examined for us the type of *M. dipus*, we learn that that species also has "four ventral rays" (undoubtedly one spine and three rays).

In *M. retropinnis*, the dorsal fin contains 15 slender spines and 32 to 34 rays. Each of the rays is definitely articulated, and the majority of them are many times forked. The anal rays are all articulate and all but the first one forked.

We are informed by Dr. Boulenger that in *M. dipus* also the fifteen anterior dorsal rays are simple and inarticulate, while further back they gradually become branched and articulate, being distinctly so from the eighteenth back. In this species the anal rays are all articulate and branched.

In one specimen of *M. retropinnis*, we enumerate 58 vertebræ in addition to the hypural element. The latter is assisted by one spine in forming the basis for attachment of the caudal fin.

In six specimens the fins count as follows:

Dorsal.....	49	48	48	48	47	47
Anal .....	29	30	30	31	29	29

The scales are circular in outline, attached by their entire margin, and are non-imbricate. On the head and the anterior part of the body, they are closely crowded and are arranged in definite rows. Toward the tail, they are more widely spaced, and on the abdomen they are partially or wholly embedded and difficult to detect. They cover the entire head, including snout and branchiostegal membranes.

The margin of the upper jaw is formed by the premaxillaries, the broad max-



illary lying behind it. The teeth are strong and conic, with rather acute tips; those in the mandible are in two rows anteriorly which narrow to a single series laterally; those in upper jaw apparently in a single series.

346. *Cerdale ionthas* Jordan & Gilbert.

PLATE XXXI, FIG. 58.

Eighteen specimens were secured on the Panama reef. The genus *Cerdale* was described as differing from *Microdesmus* in having two rays in the ventral fin, but this was due to an error in observation. As in *Microdesmus*, the ventral fin contains one spine and three rays. The two genera seem to differ only in the much shorter body and fewer vertebræ in *Cerdale*. The vertebræ are 20+23 in number in addition to the hypural element. One hæmal spine assists the hypural in supporting the caudal fin.

The dorsal fin contains 12 slender spines and 30 to 32 branched articulate rays. The anal contains 27 to 29 branched rays (by error given 36 to 38 rays, instead of 26 to 28, in the original description and subsequently).

Following are the fin-counts in twelve specimens:

Dorsal.....	44	44	44	44	44	44	43	43	43	43	43	42
Anal .....	28	28	28	28	28	27	28	28	28	27	27	29

The pectoral fin contains fourteen rays.

The post-temporal is forked, and rather firmly joined to the skull. The supraclavicle is apparently absent. The actinosts are thin, flat, and very large, the three uppermost joining the hypercoracoid, the lower one joining the hypocoracoid. The opercular bones are all present.

The front of the mouth is formed by the premaxillaries only. The maxillaries are slender and much curved. The teeth are small and conic in both jaws, uniserial in the premaxillaries, biserial in front of mandible becoming uniserial laterally. No teeth on vomer or palatines.

The branchiostegal rays are five in number.

The restricted gill-openings can scarcely suffice to distinguish a family *Cerdalidae* from the *Blenniidae*.

Family OPHIDIIDÆ.

347. *Lepophidium prorates* (Jordan & Bollman).

Known only from type and co-types taken in Panama Bay.

348. *Otophidium indefatigabile* Jordan & Bollmann.

Recorded from Albatross Station 2797, Panama Bay, 33 fathoms (Gilbert, 1890 *b*, p. 453).



## Family FIERASFERIDÆ.

349. *Fierasfer dubius* Putnam.

A single specimen, 58 mm. long, was taken in a tide-pool at Panama. We think it better to use the name *dubius* rather than *affinis* (Günther) for this species. The type locality for *dubius* is the Pearl Islands, near Panama; while the locality of *affinis* is unknown, and the description inadequate. In our very small specimen, the head is one-eighth the length, the dorsal begins a head's length behind the occiput, the pectoral equals the maxillary and is half as long as the head. The outer mandibular teeth, and the teeth on front of vomer are slightly enlarged.

## Family BROTULIDÆ.

350. *Ogilbia ventralis* (Gill).

Not rare in tide-pools on the Panama reef. Heretofore known only from Mazatlan and Cape San Lucas.

The tip of the snout and the terminal portion of mandible are furnished with sharply elevated curving sensory ridges.

## Family BREGMACEROTIDÆ.

351. *Bregmaceros macclellandi* Thompson.

Dredged by the Albatross in Panama Bay, Station 2804, 47 fathoms; these are the types of *B. bathymaster*, Jordan and Bollman, 1889, p. 173 (see Jordan and Evermann, 1898 b, p. 2526).

## Family PLEURONECTIDÆ.

352. *Hippoglossina bollmani* Gilbert.

The types only known, from Albatross Stations 2804 and 2805, Panama Bay, 47 and 51½ fathoms.

353. *Paralichthys woolmanni* Jordan & Williams.

The type of this species was collected by the Albatross, in 1888, at Panama, and was first listed by Jordan and Bollman (1889, p. 182) as *P. adspersus* Steindachner. Later, when made the type of a new species, it was erroneously credited to the Galapagos Islands. The species is abundant at Panama, where we obtained numerous specimens, and is known to range as far north as the Gulf of California (Mazatlan, Guaymas, La Paz). Specimens from Mazatlan and La Paz have been distinguished under the name *P. sinaloe* Jordan and Abbott (see Jordan & Evermann, 1898, p. 2872), but seem to differ in no respect from *P. woolmanni*.

In ten specimens from Panama, the fin-rays and gill-rakers are as follows:

Dorsal .....	70	70	70	72	73	73	74	75	75	76
Anal .....	52	53	54	58	56	57	57	58	58	58
Gill-rakers.....	12	14	14	13	14	13	14	14	13	13

In nine specimens from Mazatlan (including the type of *P. sinaloæ*), the gill-rakers on horizontal limb of arch are constantly thirteen or fourteen in number, and the fin rays as follows:

Dorsal.....	72	72	73	73	73	73	74	76	76
Anal .....	56	57	56	58	58	59	56	60	61

The longest gill-raker in *P. woolmanni* is two-fifths to one-third as long as the diameter of the eye; on the vertical limb of the arch 4 or 5 are usually present, 1 or 2 of which may be immovable and rudimentary.

In the northern portion of its range, *P. woolmanni* is accompanied by the closely related *P. æstuaris*, which differs in its more elongate form, the longer, more numerous gill-rakers, the more numerous fin-rays, and the lighter, more nearly uniform coloration; a row of distinct small white spots follows the contour of the body, near the base of the vertical fins. *P. magdaleneæ* Abbott (Jordan & Evermann, 1898, p. 2871), is a synonym of *P. æstuaris*. We have compared the types of the two species.

*Measurements in Hundredths of Length without Caudal.*

Locality.....	Panama		Guaymas, Mex.
Total length in mm.....	272	270	260
Length to base of caudal in mm.....	219	219	208
Head (without opercular membrane)...	28½	29½	30½
Snout (to upper eye).....	6½	6+	7
Maxillary.....	14	14+	15
Upper eye.....	5	5+	5½
Interorbital width (total).....	2½	2½	2½
Greatest depth .....	45	46½	47½
Depth of caudal peduncle.....	12	12+	12½
Longest gill-raker .....	2½	2¾	2½
Length of caudal .....	24	23½	24
Length of ventral.....	8½	9	8½
Length of pectoral.....	14	14½	14
Longest dorsal ray.....	13	13	12½
Longest anal ray .....	13	13	12
Chord of arch of lateral line .....		15½	15

354. *Ancylopsetta dendritica* Gilbert.

PLATE XXXIII, FIG. 62.

*Hippoglossina sabanensis* BOULENGER, 1899, p. 4.

Infrequent; five specimens obtained.

In this species the tubes of the lateral line are profusely branched in adults, but the structure does not differ from that found in other flounders with branched tubes. We are unable, therefore, to recognize the genus *Ramularia* Jordan and Evermann (1898, p. 2633) based on this character. The species is closely related to *A. quadrocellata* Gill, from which it differs most strikingly in having the anterior dorsal rays not produced. This also we consider of less than generic importance.

Our specimens are smaller than the type. The depth is  $1\frac{5}{8}$  in the length. The interorbital width is about half the diameter of the upper eye. The length of the maxillary is contained  $2\frac{2}{3}$  to  $2\frac{3}{4}$  times in the length of the head. The color is blackish brown, becoming black on distal portion of vertical fins, which are narrowly margined with white. The fins are similarly colored on the blind side; the head and body of the blind side are also more or less washed with dark brown, especially around the margins. The ocellated spots are arranged as in *A. quadrocellata*, but the one above the arch of the lateral line is wanting. The central light spot is yellow in life.

In five specimens, the fin-rays are as follows:

Dorsal.....	77	79	79	82	84
Anal .....	64	<u>64</u>	65	67	67

This is the species described by Boulenger (1899, p. 4) from Rio Sabana, under the name *Hippoglossina sabanensis*.

355. *Platophrys constellatus* Jordan.

Taken by the Albatross in Panama Bay, at Stations 2795, 2796, 2797, at a depth of 33 fathoms (Jordan & Bollman, 1889, p. 183).

356. *Engyophrys sancti-laurentii* Jordan & Bollmann.

Panama Bay, Stations 2795 and 2805, depths 33 and  $51\frac{1}{2}$  fathoms; recorded by Garman (1899, p. 222).

357. *Syacium latifrons* (Jordan & Gilbert).

Known only from the types, which were taken at Panama.

358. *Syacium ovale* (Günther).

But few seen; nine specimens obtained. None of these show any tendency to increased width of interorbital space.

359. *Cyclopsetta querna* (Jordan & Bollman).

Abundant. In adult specimens, 255 mm. long, the colored side is uniform dusky brown on head, body and fins, the fins without dusky blotches.

The tubes of the lateral line are profusely branched above and below. An intricate network of branching tubes covers the preopercle and the postocular region of the head. The upper eye is distant from profile a distance less than diameter of pupil. The interorbital width in adults equals half the diameter of the eye.

360. *Azevia panamensis* (Steindachner).

Infrequent; but four specimens secured.

The scales on the colored side of the body are strongly ctenoid, those of the uncolored side perfectly smooth.

361. *Citharichthys platophrys* Gilbert.

Known from the type only; Albatross Station 2799, Panama Bay, 29½ fathoms.

362. *Citharichthys gilberti* Jenkins & Evermann.

Abundant; differing from *C. spilopterus* in the longer\* gill-rakers, which are also more numerous, in the slightly larger scales, and the slightly larger eye. In our specimens, the lateral line traverses 40 to 43 scales. In nine specimens of *C. spilopterus* from Havana, there are 45 to 47 scales in the lateral line. Our specimens of *gilberti* have thirteen or fourteen gill-rakers on horizontal limb of outer arch. Havana specimens of *spilopterus* have constantly eleven gill-rakers.

363. *Etropus crossotus* Jordan & Gilbert.

But few seen by us.

## Family SOLEIDÆ.

364. *Achirus klunzingeri* (Steindachner).

Common in Panama Bay.

Resembling *A. mazatlanus*, but differing in the smaller scales, the smaller eye and wider interorbital space, the larger mouth, the increased number of fin-rays, the finer, more numerous cilia (in specimens of equal size), and the more elongate form.

The color is almost uniform brown on body and fins; in lighter specimens only are the vertical fins faintly mottled or blotched with dusky. Ten to twelve faint dark hair-lines cross the body, often to be made out with extreme difficulty. Young specimens show numerous patches of fine black cilia on head and body, the larger patches arranged in two series nearly midway between the lateral line and the bases

\* By error, Jordan and Evermann (1898, p. 2686) state that the gill-rakers in this species are shorter than in *C. spilopterus*.



of dorsal and anal fins respectively. In older specimens, the cilia are less numerous, and usually disappear entirely in adults.

As in *A. mazatlanus*, the lower two-thirds of the opercle, as well as the sub-opercle and the preopercle on the blind side are naked; in *A. klunzingeri*, the scales on cheeks and upper part of opercles are non-imbricate and frequently smooth, especially in specimens of large size.

The eyes are small and distant, the interocular space usually wider than the diameter of the eye. The pectoral varies widely in length and in the number of rays, seven specimens showing respectively 5, 5, 4, 4, 4, 3 and 2 pectoral rays. In five specimens there are 71 to 76 oblique rows of scales running downward and backward to the lateral line. In five specimens of *A. mazatlanus*, there are 54 to 61 oblique rows. In three specimens of *A. klunzingeri*, there are 62 to 64 dorsal rays, 46 to 49 anal rays; in four specimens of *A. mazatlanus*, 52 to 55 dorsal rays, 40 to 43 anal rays.

*Measurements in Hundredths of Length without Caudal.*

Length to base of caudal in mm. ....	160
Head .....	27
Snout .....	8
Maxillary .....	10½
Eye.....	2⅔
Interorbital width .....	2½
Depth.....	64
Depth of caudal peduncle.....	20
Length of caudal fin.....	30
Length of pectoral .....	4
Longest dorsal ray .....	14½
Longest anal ray .....	15

**365. *Achirus fonsecensis* (Günther).**

*Solea fonsecensis* GÜNTHER, 1862, p. 475 (Gulf of Fonseca).

*Solea fischeri* STEINDACHNER, 1879 c, p. 13, Pl. II, fig. 8 (Rio Mamoni, near Panama).

*Solea panamensis* STEINDACHNER, 1877, p. 10, Pl. II (Panama).

This species is abundant in the Bay of Panama and appears frequently in the market. It has not been recorded south of this point, but extends to the northward as far as Mazatlan.

The pectoral fin is greatly reduced, containing usually two short divergent rays, which fail to equal the diameter of the orbit. In one of our specimens three

rays are present, four specimens have but a single ray each, while two specimens are without any trace of a pectoral fin. *A. fischeri*, based on a young specimen with one pectoral ray, and *S. panamensis*, based on an adult specimen without pectoral, are duplicated by our material, and are to be considered as synonyms of *A. fonsecensis*. The best description and figure are given by Steindachner under the name of *S. panamensis*. The figure should be reversed.

The scales along the lateral line are 60 to 65 in number, not about 85, as stated by Günther. In ten specimens, the fin-rays run as follows:

Dorsal.....	61	61	61	60	60	60	59	58	57	57
Anal.....	45	45	42	45	45	44	44	44	43	43

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm .....	150	158
Head .....	27½	27
Snout.....	9	8½
Maxillary.....	10½	10
Eye .....	3	2¾
Interorbital width .....	3	2½
Depth.....	61	70
Depth of caudal peduncle.....	20	18½
Length of caudal fin.....	29	26½
Length of pectoral fin.....	2½	3
Longest dorsal ray.....	14½	13½
Longest anal ray.....	15	13½

366. *Achirus scutum* (Günther).

Known only from Panama and the Gulf of Fonseca; not recognized until now since the original description. We found the species abundant at Panama, securing about thirty specimens, the largest 18 cm. long.

The species is strikingly marked with numerous narrow gray bars on a dark brown background, the bars varying in number from thirteen to twenty, often pursuing a wavy course and forking or coalescing with adjacent bars in a most irregular and intricate way. In some specimens, the irregularities are few in number. The dorsal and anal are marked like the body, but the caudal is much lighter, crossed by about four irregular dark bars which often break up into series of roundish spots.

The pectoral is usually shorter than the eye and contains three rays, of which the middle is the longest. In twenty-five specimens, eight were found with two rays, and three with four rays. In five specimens, the fin-rays are as follows:

Dorsal .....	56	55	54	54	53
Anal .....	44	43	43	42	43

In the original description, the anal fin is said to have 48 rays, but there must have been included by inadvertence the five rays of the right ventral fin, which is continuous with the anal fin. There are 70 to 80 oblique rows of scales running downwards and backwards above the lateral line. The blind side of the head in advance of the preopercle, and the anterior rays of the dorsal and anal fins are fringed with rows and clusters of filaments. These are not so long or so numerous as in *A. fonsecensis*.

*Measurements in Hundredths of Length without Caudal*

Length to base of caudal in mm.....	139	125
Length of head .....	28½	28
Length of snout.....	9	8½
Length of maxillary .....	10	10
Diameter of eye.....	4	4
Interorbital width .....	2½	3
Greatest depth.....	76	75
Depth of caudal peduncle.....	20½	20
Length of caudal fin .....	31	31½
Length of pectoral fin.....	3	3½
Longest dorsal ray .....	15½	17
Longest anal ray .....	16	17

367. *Symphurus atramentatus* Jordan & Bollman.

Known from specimens dredged by the Albatross in Panama Bay at Stations 2795, 2797 and 2805, depths 33 to 51½ fathoms; recorded by Garman (1899, p. 229).

368. *Symphurus elongatus* (Günther).

Occasional in the Panama market, reaching a large size, the largest specimen seen by us being 255 mm. long. In adults, the depth is contained 3½ to 3¾ in the length, thus much greater than has been ascribed to the species.

*Measurements in Hundredths of Length without Caudal.*

Length without caudal in mm. ....	225	233	189	170	137
Head.....	19	21	20	20½	20
Depth.....	28	27½	29	28	24½
Maxillary .....	5	5½	5½	5½	5
Snout to lower eye .....	5	5	5	4¼	3¾
Length of lower eye . . . . .	1¾	2	1¾	2	1½
Length of ventral.....	6	5½	6	6	6
Longest dorsal ray .....	7	7	7	7½	7
Longest anal ray .....	7	7	7	7½	7½
Length of caudal fin .....	8	8	8	10	10½
Height of gill-opening .....	7	6½	6½	7	6½
Scales .....	96	99	93	95	95
Dorsal rays .....	106	110	108	107	104
Anal rays .....	88	92	87	87	89

**369. *Symphurus atricaudus* (Jordan & Gilbert).**

A specimen of this species has been listed from Panama by Eigenmann (1894, p. 632). The record is in need of verification.

**370. *Symphurus leei* Jordan & Bollman.**

Recorded from Albatross Stations 2800, 2802, 2803 and 2804, depths 7 to 51½ fathoms.

**371. *Lophiomus caulinaris* Garman.**

Described by Garman (1899, p. 79) from Albatross Stations 3387 and 3391, off Panama, in depths of 127 and 153 fathoms. It had been previously recorded by Gilbert (1890 *b*, p. 454) as *L. setigerus*, from Station 2805, Panama Bay, 51½ fathoms.

**372. *Antennarius strigatus* Gill.**

Not seen by us.

**373. *Antennarius sanguineus* Gill.**

Not seen by us.

**374. *Zalieutes elater* (Jordan & Gilbert).**

Recorded from Stations 2794 and 2795, depths 62 and 33 fathoms (Gilbert, 1890 *b*, p. 455); and from Panama (Jordan & Bollman, 1889, p. 183).



## GENERAL REMARKS ON DISTRIBUTION.

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The ichthyological province to which Panama belongs extends to the northward as far as the Gulf of California and Magdalena Bay. Of the 374 species recorded from Panama, 204 are now known to occur in the Gulf of California, and further exploration will certainly increase this list. The two regions differ principally in the greater development at Panama of Siluroids and Sciaenoids, the majority of which fail to reach the northern limits of the province.

To the south of Panama, the faunal relations are as yet poorly defined. The coast of Ecuador is known to us principally from Boulenger's (1898-9) brief account of a collection from the Bay of Santa Helena, near Guayaquil. The marine species there listed belong almost exclusively to the Panama fauna, and include many characteristic forms. How much farther to the southward these extend their range is unknown. The coast of Peru is largely unexplored, but the very incomplete lists which we possess indicate an almost total absence of Panama species. When these coasts shall be adequately investigated, there will probably be discovered a rather sharp line of demarcation of faunas, corresponding with the interval between the areas of the South Equatorial and the Equatorial Counter Currents.

Much has been written concerning the close parallelism between the fish-faunas on opposite sides of the Isthmus of Panama, and the bearing of this upon the question of a water-way formerly open between the two oceans. A full bibliography of the subject is given by Gregory (1895), together with a résumé of the geological and biological evidence for the former existence of such an interoceanic connection, and a discussion of the probable date of its occurrence.

From the biological side, the subject is treated in a most satisfactory way by Faxon (1895), with whose views we find ourselves wholly in accord. The ichthyological evidence is overwhelmingly in favor of the existence of a former open communication between the two oceans, which must have become closed at a period sufficiently remote from the present to have permitted the specific differentiation of a very large majority of the forms involved. That this differentiation progressed at widely varying rates in different instances becomes at once apparent. A small minority of the species remain wholly unchanged, so far as we have been able to determine that point. A larger number have become distinguished from their representatives of the opposite coast by minute (but not "trivial") differences, which are wholly constant. From such "representative forms," we pass by imperceptible gradation to species much more widely separated, whose immediate relation in the past we cannot confidently affirm. Of identical species, occurring in both

oceans, our Panama list contains 43, as shown on the appended table of distribution. To these should be added the following forms, unrecorded as yet from Panama, but known from other localities on the Pacific Coast of North America:

<i>Manta birostris</i>	<i>Scomber colias</i>
<i>Trachurus picturatus</i>	<i>Remora albescens</i>
<i>Trachurus trachurus</i>	<i>Mola mola</i>
<i>Caranx lugubris</i>	<i>Diodon hystrix</i>
<i>Thunnus thynnus</i>	<i>Lampris luna</i>
<i>Germo alalunga</i>	

The total number of identical species which we recognize in the two faunas now separated by the Isthmus is therefore 54, as compared with the 71 enumerated by Jordan (1885). It is obvious, however, that the striking resemblances between the two faunas are shown as well by slightly divergent as by identical species, and the evidence in favor of interoceanic connection is not weakened by an increase in one list at the expense of the other. All evidence concurs in fixing the date of that connection at some time prior to the Pleistocene, probably in the early Miocene. When geological data shall be adequate definitely to determine that date, it will give us the best known measure of the rate of evolution in fishes.

Of the 82 families of fishes represented at Panama, all but 3 (*Cerdalidæ*, *Cirrhitidæ* and *Nematistiidæ*) occur also on the Atlantic side of Central America; while of the 218 genera of our Panama list, no fewer than 170 are common to both oceans. The well-developed families *Centropomidæ* and *Dactyloscopidæ* are peculiar to the two tropical faunas now separated by the Isthmus of Panama.

#### TABLE OF DISTRIBUTION.

The following table indicates the distribution of Panama fishes, in so far as they have been reported from the Gulf of California, the Galapagos Islands, the coasts of Ecuador and Peru, and the Atlantic Ocean. For the Gulf of California, we have depended upon Jordan (1895 *b*), Evermann and Jenkins (1891), and Gill (1862). For the Galapagos Islands, we have at hand a manuscript list by Messrs. Snodgrass and Heller. Ecuador is known to us principally through the list published by Boulenger (1898-9), and Peru through the paper by Abbott (1899 *a*). Very few characteristically South American forms extend their range northward to Panama; and very few species from the Indo-Pacific fauna reach the continental shore-line, though a somewhat larger number of the latter find their way to the series of outlying islands (Revillagigedos and Galapagos).

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Ginglymostoma cirratum</i> .....	+		+		+
<i>Mustelus lunulatus</i> .....	+				
<i>Galeus dorsalis</i> .....	+			+	
<i>Galeocerdo tigrinus</i> .....	+				+
<i>Carcharias æthalarus</i> .....	+				
<i>Carcharias velox</i> .....					
<i>Carcharias cerdale</i> .....					
<i>Carcharias azureus</i> .....					
<i>Scoliodon longurio</i> .....	+				
<i>Sphyrna tiburo</i> .....	+				+
<i>Sphyrna tudes</i> .....	+	+			+
<i>Sphyrna zygræna</i> .....	+				+
<i>Squalus sucklii</i> .....					
<i>Pristis zephyreus</i> .....	+				
<i>Rhinobatus leucorhynchus</i> .....					
<i>Zapteryx xyster</i> .....					
<i>Raja equatorialis</i> .....					
<i>Narcine entemedor</i> .....	+				
<i>Discopyge ommata</i> .....	+				
<i>Urolophus halleri</i> .....	+				
<i>Urolophus mundus</i> .....	+				
<i>Urolophus goodei</i> .....			+		
<i>Urolophus aspidurus</i> .....					
<i>Dasyatis longa</i> .....	+	+			
<i>Pteroplatea crebripunctata</i> .....	+				
<i>Aetobatus narinari</i> .....	+				+
<i>Myliobatis asperrimus</i> .....					
<i>Felichthys panamensis</i> .....	+				
<i>Felichthys pinnimaculatus</i> .....	+		+		
<i>Galeichthys lentiginosus</i> .....					
<i>Galeichthys peruvianus</i> .....				+	

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Galeichthys eigenmanni</i> .....					
<i>Galeichthys jordani</i> .....					
<i>Galeichthys xenauchen</i> .....					
<i>Galeichthys guatemalensis</i> .....	+				
<i>Galeichthys dasycephalus</i> .....					
<i>Galeichthys longicephalus</i> .....					
<i>Sciadeichthys troscheli</i> .....	+				
<i>Selenaspis dowi</i> .....			+		
<i>Netuma kessleri</i> .....			+		
<i>Netuma insculpta</i> .....					
<i>Netuma planiceps</i> .....					
<i>Netuma platypogon</i> .....				+	
<i>Netuma oscula</i> .....					
<i>Netuma elattura</i> .....					
<i>Tachysurus steindachneri</i> .....					
<i>Tachysurus emmelane</i> .....					
<i>Tachysurus furthii</i> .....					
<i>Tachysurus evermanni</i> .....					
<i>Tachysurus multiradiatus</i> .....					
<i>Cathorops hypophthalmus</i> .....					
<i>Cathorops gulosus</i> .....					
<i>Symbranchus marmoratus</i> .....					+
<i>Congrellus gilberti</i> .....					
<i>Congrellus nitens</i> .....					
<i>Congrellus proriger</i> .....					
<i>Muraenesox coniceps</i> .....	+				
<i>Neoconger vermiformis</i> .....	+				
<i>Myrophis vafer</i> .....	+				
<i>Myrichthys tigrinus</i> .....	+				
<i>Pisoodonophis daspilotus</i> .....					
<i>Ophichthus triserialis</i> .....	+	+			



Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Ophichthus zophochir</i> .....	+				
<i>Rabula panamensis</i> .....					
<i>Lycodontis verrilli</i> .....					
<i>Lycodontis dovii</i> .....	+	+			
<i>Muraena clepsydra</i> .....			+		
<i>Muraena lentiginosa</i> .....	+	+			
<i>Elops saurus</i> .....	+		+		+
<i>Albula vulpes</i> .....	+				+
<i>Sardinella stolifera</i> .....	+		+		
<i>Opisthonema libertate</i> .....	+	+			
<i>Ilisha furthi</i> .....					
<i>Opisthopterus dovii</i> .....					
<i>Opisthopterus macrops</i> .....					
<i>Odontognathus panamensis</i> .....					
<i>Anchovia miarcha</i> .....	+				
<i>Anchovia ischana</i> .....	+				
<i>Anchovia curta</i> .....	+				
<i>Anchovia opercularis</i> .....	+				
<i>Anchovia lucida</i> .....	+				
<i>Anchovia rastralis</i> .....					
<i>Anchovia naso</i> .....					
<i>Anchovia starksi</i> .....					
<i>Anchovia panamensis</i> .....					
<i>Anchovia mundeola</i> .....					
<i>Anchovia spinifera</i> .....					+
<i>Anchovia macrolepidota</i> .....	+				
<i>Cetengraulis mysticetus</i> .....					
<i>Cetengraulis engyмен</i> .....					
<i>Lycengraulis poeyi</i> .....					
<i>Synodus evermanni</i> .....	+				
<i>Synodus scituliceps</i> .....	+				

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Poecilia elongata</i> .....					
<i>Poecilia boucardii</i> .....					
<i>Anableps dowei</i> .....					
<i>Tylosurus scapularis</i> .....					
<i>Tylosurus stolzmanni</i> .....	+			+	
<i>Tylosurus fodiator</i> .....	+				
<i>Tylosurus pacificus</i> .....					
<i>Hyporhamphus unifasciatus</i> .....	+		+		+
<i>Hyporhamphus roberti</i> .....	+	+			+
<i>Hemirhamphus saltator</i> .....			+		
<i>Fodiator acutus</i> .....	+*		+		+
<i>Cypselurus callopterus</i> .....					
<i>Exonastes rufipinnis</i> .....				+	+
<i>Fistularia depressa</i> .....	+				
<i>Fistularia corneta</i> .....	+				
<i>Siphostoma auliscus</i> .....	+				
<i>Hippocampus ingens</i> .....	+		+		
<i>Kirtlandia pachylepis</i> .....					
<i>Kirtlandia gilberti</i> .....					
<i>Atherinella panamensis</i> .....					
<i>Mugil cephalus</i> .....	+	+		+	+
<i>Mugil thoburni</i> .....		+			
<i>Mugil curema</i> .....	+	+	+		+
<i>Mugil hospes</i> .....	+				
<i>Chænomugil proboscideus</i> .....	+	+			
<i>Querimana harengus</i> .....	+	+		+	
<i>Sphyræna ensis</i> .....	+				
<i>Polydactylus approximans</i> .....	+		+	+	
<i>Polydactylus opercularis</i> .....	+				
<i>Myripristis occidentalis</i> .....	+	+			
<i>Myripristis pœcilopus</i> .....	+				

\* San Luis Gonzales Bay (Albatross).

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Holocentrus suborbitalis</i> .....	+	+			
<i>Upeneus grandisquamis</i> .....	+		+		
<i>Sarda chilensis</i> .....	+			+	
<i>Scomberomorus sierra</i> .....	+	+			
<i>Trichiurus lepturus</i> .....	+		+		+
<i>Nematistius pectoralis</i> .....	+				
<i>Oligoplites saurus</i> .....	+		+		+
<i>Oligoplites altus</i> .....			+		
<i>Oligoplites refulgens</i> .....					
<i>Oligoplites mundus</i> .....	+				
<i>Trachurops crumenophthalmus</i> .....	+	+			+
<i>Hemicaranx atrimanus</i> .....					
<i>Hemicaranx zelotes</i> .....					
<i>Hemicaranx furthii</i> .....					
<i>Hemicaranx leucurus</i> .....					
<i>Caranx vinctus</i> .....	+				
<i>Caranx hippos</i> .....	+		+		+
<i>Caranx caballus</i> .....	+	+			
<i>Caranx marginatus</i> .....	+	+	+		
<i>Gnathanodon speciosus</i> .....	+				
<i>Citula dorsalis</i> .....	+				
<i>Alectis ciliaris</i> .....	+				+
<i>Vomer setipinnis</i> .....	+		+		+
<i>Selene ørstedii</i> .....	+				
<i>Selene vomer</i> .....	+				+
<i>Chloroscombrus orqueta</i> .....	+				
<i>Trachinotus rhodopus</i> .....	+				
<i>Trachinotus culveri</i> .....	+				
<i>Trachinotus kennedyi</i> .....	+				
<i>Trachinotus paloma</i> .....	+				
<i>Nomeus gronovii</i> .....		+			+

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Peprilus palometa</i> .....					
<i>Peprilus snyderi</i> .....					
<i>Peprilus medius</i> .....	+				
<i>Apogon dovii</i> .....	+				
<i>Centropomus undecimalis</i> .....			+		+
<i>Centropomus nigrescens</i> .....					
<i>Centropomus pedimacula</i> .....					+
<i>Centropomus unionensis</i> .....					
<i>Centropomus armatus</i> .....					
<i>Centropomus robalito</i> .....	+				
<i>Petrometopon panamensis</i> .....					
<i>Epinephelus analogus</i> .....	+	+			
<i>Epinephelus labriformis</i> .....	+	+	+		
<i>Promicrops guttatus</i> .....	+				+
<i>Alphestes multiguttatus</i> .....	+		+		
<i>Mycteroperca bouleengeri</i> .....	+				
<i>Hypoplectrus lamprurus</i> .....					
<i>Paralabrax humeralis</i> .....				+	
<i>Diplectrum radiale</i> .....	+				+
<i>Diplectrum macropoma</i> .....	+				
<i>Diplectrum euryplectrum</i> .....					
<i>Prionodes fasciatus</i> .....	+	+			
<i>Paranthias furcifer</i> .....	+	+			+
<i>Rhegma thaumasium</i> .....					
<i>Rypticus nigripinnis</i> .....	+				
<i>Lobotes pacificus</i> .....	+				
<i>Pseudopriacanthus serrula</i> .....					
<i>Hoplopagrus guentheri</i> .....	+				
<i>Lutianus jordani</i> .....		+			
<i>Lutianus novemfasciatus</i> .....	+				
<i>Lutianus argentiventris</i> .....	+	+			



Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Lutianus colorado</i> .....	+				
<i>Lutianus guttatus</i> .....	+				
<i>Lutianus aratus</i> .....	+				
<i>Rabirubia inermis</i> .....	+				
<i>Xenichthys xanti</i> .....	+				
<i>Hæmulon scudderi</i> .....	+		+		
<i>Hæmulon steindachneri</i> .....	+				+
<i>Lythrolon flaviguttatum</i> .....	+				
<i>Orthostœchus maculicauda</i> .....	+				
<i>Anisotremus pacifici</i> .....			+		
<i>Anisotremus cæsius</i> .....	+				
<i>Anisotremus dovii</i> .....	+				
<i>Anisotremus interruptus</i> .....	+	+	+		
<i>Anisotremus tæniatus</i> .....	+		+		
<i>Brachydeuterus nitidus</i> .....	+				
<i>Brachydeuterus leuciscus</i> .....	+		+		
<i>Pomadasis panamensis</i> .....	+				
<i>Pomadasis bayanus</i> .....	+				
<i>Pomadasis macracanthus</i> .....	+		+		
<i>Pomadasis branicki</i> .....	+			+	
<i>Orthopristis chalceus</i> .....	+	+			
<i>Orthopristis brevipinnis</i> .....	+				
<i>Calamus brachysomus</i> .....	+		+		
<i>Eucinostomus californiensis</i> .....	+		+		
<i>Xystæma cinereum</i> .....	+	+			+
<i>Gerres aureolus</i> .....					
<i>Gerres peruvianus</i> .....	+		+	+	
<i>Gerres brevipinnis</i> .....					
<i>Kyphosus elegans</i> .....	+	+			
<i>Sectator ocyurus</i> .....					
<i>Isopisthus remifer</i> .....					

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Cynoscion prædatorius</i> .....					
<i>Cynoscion squamipinnis</i> .....					
<i>Cynoscion othonopterus</i> .....	+				
<i>Cynoscion reticulatus</i> .....	+				
<i>Cynoscion albus</i> .....					
<i>Cynoscion stolzmanni</i> .....				+	
<i>Cynoscion phoxocephalus</i> .....					
<i>Sagenichthys mordax</i> .....					
<i>Nebris occidentalis</i> .....					
<i>Larimus argenteus</i> .....	+				
<i>Larimus effulgens</i> .....					
<i>Larimus acclivis</i> .....	+				
<i>Larimus pacificus</i> .....					
<i>Odontoscion xanthops</i> .....					
<i>Corvula macrops</i> .....	+				
<i>Elattarchus archidium</i> .....			+		
<i>Bairdiella ensifera</i> .....			+		
<i>Bairdiella armata</i> .....					+
<i>Bairdiella chrysoleuca</i> .....			+		
<i>Stellifer oscitans</i> .....					
<i>Stellifer furthi</i> .....					
<i>Stellifer illecebrosus</i> .....					
<i>Stellifer ericymba</i> .....					
<i>Stellifer zestocarus</i> .....					
<i>Ophioscion typicus</i> .....					
<i>Ophioscion simulus</i> .....					
<i>Ophioscion strabo</i> .....	+				
<i>Ophioscion imiceps</i> .....					
<i>Ophioscion scierus</i> .....	+				
<i>Sigmurus vermicularis</i> .....					
<i>Sciæna deliciosa</i> .....				+	

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Micropogon altipinnis</i> .....			+		
<i>Umbrina xanti</i> .....	+		+		
<i>Umbrina dorsalis</i> .....	+				
<i>Menticirrhus nasus</i> .....					
<i>Menticirrhus panamensis</i> .....	+				
<i>Menticirrhus elongatus</i> .....	+				
<i>Polyclemus dumerili</i> .....			+		
<i>Polyclemus rathbuni</i> .....					
<i>Polyclemus goodei</i> .....					
<i>Paralonchurus petersi</i> .....					
<i>Eques viola</i> .....					
<i>Cirrhites rivulatus</i> .....	+	+			
<i>Chromis atrilobatus</i> .....	+				
<i>Pomacentrus rectifrenum</i> .....	+		+		
<i>Pomacentrus gilli</i> .....					
<i>Pomacentrus flavilatus</i> .....	+				
<i>Nexilarius concolor</i> .....		+			
<i>Glyphisodon saxatilis</i> .....	+	+	+		+
<i>Microspathodon dorsalis</i> .....	+	+			
<i>Harpe diplotænia</i> .....	+	+			
<i>Halichæres sellifer</i> .....		+			
<i>Halichæres macgregori</i> .....					
<i>Halichæres dispilus</i> .....	+				
<i>Pseudojulis notospilus</i> .....	+	+	+		
<i>Thalassoma lucasanum</i> .....	+				
<i>Pseudoscarus perrico</i> .....	+	+			
<i>Chaetodipterus zonatus</i> .....	+				
<i>Parapsettus panamensis</i> .....			+		
<i>Chaetodon nigrirostris</i> .....	+	+			
<i>Chaetodon humeralis</i> .....	+		+		
<i>Pomacanthus zonipectus</i> .....	+				

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Holacanthus passer</i> .....	+	+	+		
<i>Teuthis crestonis</i> .....	+	+			
<i>Balistes polylepis</i> .....	+				
<i>Balistes naufragium</i> .....	+				
<i>Balistes verres</i> .....	+				
<i>Xesurus hopkinsi</i> .....					
<i>Spheroides angusticeps</i> ... ..	+	+			
<i>Spheroides lobatus</i> .....	+	+			
<i>Spheroides testudineus</i> .....					+
<i>Spheroides annulatus</i> .....	+	+	+		
<i>Spheroides furthii</i> .....					
<i>Guentheridia formosa</i> .....					
<i>Tetraodon hispidus</i> .....					
<i>Eumycterias punctatissimus</i> .....	+				
<i>Diodon holacanthus</i> .....	+				+
<i>Scorpæna histrio</i> .....		+			
<i>Scorpæna pannosa</i> .....					
<i>Scorpæna mystes</i> .....	+				
<i>Scorpæna russula</i> .....					
<i>Prionotus xenisma</i> .....	+				
<i>Prionotus loxias</i> .....					
<i>Prionotus quiescens</i> .....	+				
<i>Prionotus albirostris</i> .....	+				
<i>Prionotus horrens</i> .....	+				
<i>Prionotus ruscarius</i> .....	+				
<i>Philypnus lateralis</i> .....	+				
<i>Dormitator maculatus</i> .....	+				+
<i>Eleotris pictus</i> .....	+				
<i>Alexurus armiger</i> .....	+				
<i>Gymneleotris seminudus</i> .....					
<i>Gobius soporator</i> .....	+	+	+		+
<i>Gobionellus sagittula</i> .....	+				



Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Gobionellus microdon</i> .....	+				
<i>Garmannia paradoxa</i> .....	+				
<i>Enypnias seminudus</i> .....					
<i>Bollmannia chlamydes</i> .....					
<i>Aboma lucretiae</i> .....					
<i>Microgobius emblematicus</i> .....					
<i>Microgobius miraflorensis</i> .....					
<i>Evermannia zosterura</i> .....	+				
<i>Evermannia panamensis</i> .....					
<i>Tyntlastes brevis</i> .....					
<i>Echeneis naucrates</i> .....	+				+
<i>Remora remora</i> .....	+	+		+	+
<i>Opisthognathus punctatum</i> .....	+				
<i>Dactyloscopus zelotes</i> .....					
<i>Kathetostoma averruncus</i> .....					
<i>Batrachoides pacifici</i> .....			+		
<i>Batrachoides boulengeri</i> .....					
<i>Porichthys margaritatus</i> .....	+	+			
<i>Porichthys greeni</i> .....					
<i>Thalassophryne reticulata</i> .....					
<i>Thalassophryne dowi</i> .....					
<i>Gobiesox rhodospilus</i> .....			+		
<i>Malacoctenus delalandi</i> .....	+		+		+
<i>Mnierpes macrocephalus</i> .....	+				
<i>Auchenopterus monophthalmus</i> .....	+				
<i>Hypsoblennius piersoni</i> .....					
<i>Hypsoblennius striatus</i> .....					
<i>Hypsoblennius brevipiinnis</i> .....	+		+		
<i>Homesthes caulopus</i> .....					
<i>Scartichthys rubropunctatus</i> .....				+	
<i>Rupiscartes atlanticus</i> .....	+	+	+		+
<i>Emblemaria nivipes</i> .....					+

Panama	Gulf of California	Galapagos Islands	Ecuador	Peru	Atlantic Ocean
<i>Microdesmus dipus</i> .....	+				
<i>Microdesmus retropinnis</i> .....					
<i>Cerdale ionthas</i> .....					
<i>Lepophidium prorates</i> .....					
<i>Otophidium indefatigabile</i> .....		+			
<i>Fierasfer dubius</i> .....					
<i>Ogilbia ventralis</i> .....	+				
<i>Bregmaceros maclellandi</i> .....					
<i>Hippoglossina bollmani</i> .....					
<i>Paralichthys woolmani</i> .....	+				
<i>Ancylopsetta dendritica</i> .....	+				
<i>Platophrys constellatus</i> .....		+			
<i>Engyophrys sancti-laurentii</i> .....					
<i>Syacium latifrons</i> .....					
<i>Syacium ovale</i> .....	+				
<i>Cyclopsetta querna</i> .....					
<i>Azevia panamensis</i> .....	+				
<i>Citharichthys platophrys</i> .....					
<i>Citharichthys gilberti</i> .....	+		+		
<i>Etropus crossotus</i> .....	+				+
<i>Achirus klunzingeri</i> .....				+	
<i>Achirus fonsecensis</i> .....	+				
<i>Achirus scutum</i> .....					
<i>Symphurus atramentatus</i> .....	+	+			
<i>Symphurus elongatus</i> .....					
<i>Symphurus atricaudus</i> .....	+				
<i>Symphurus leei</i> .....					
<i>Lophiomus caulinaris</i> .....					
<i>Antennarius strigatus</i> .....	+				
<i>Antennarius sanguineus</i> .....	+				
<i>Zalieutes elater</i> .....	+				

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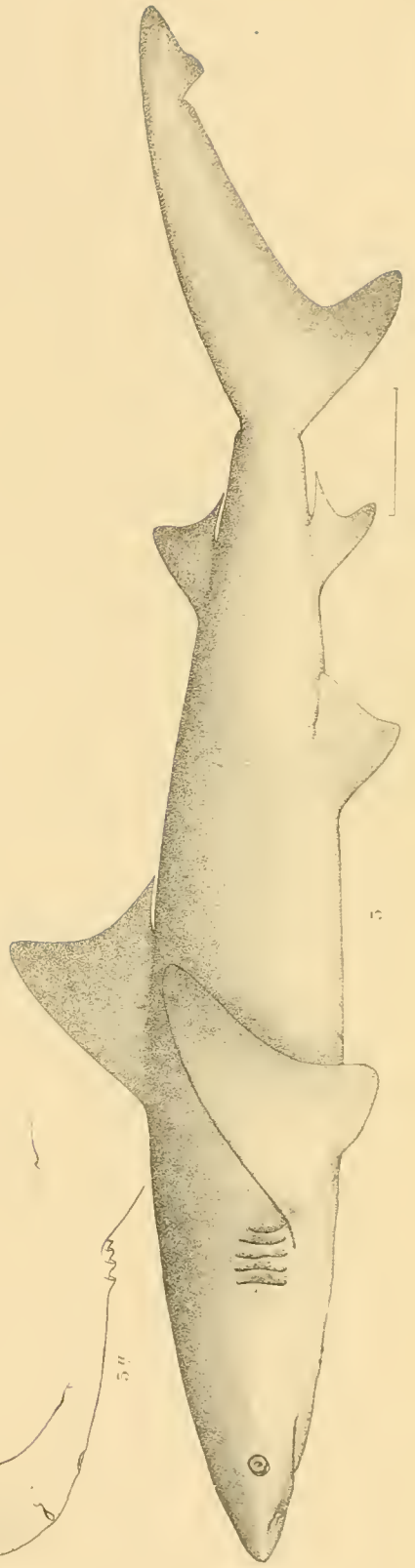
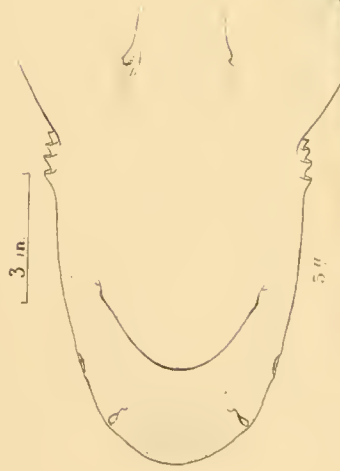
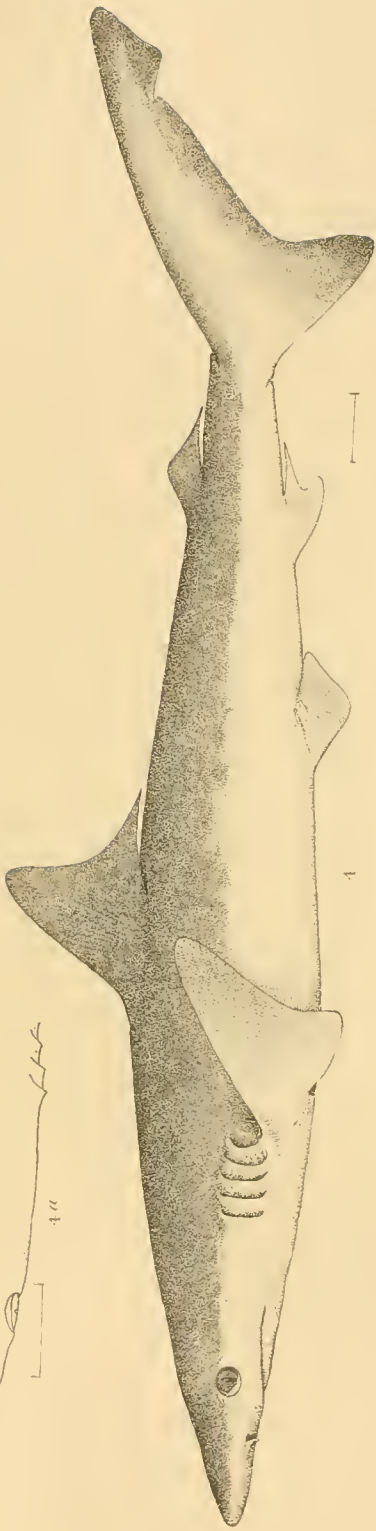
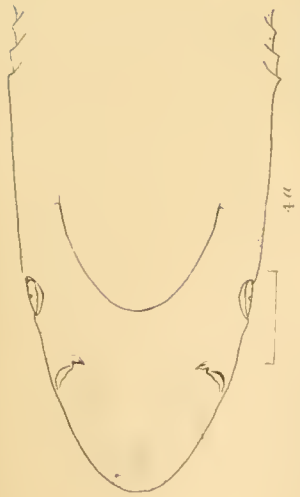




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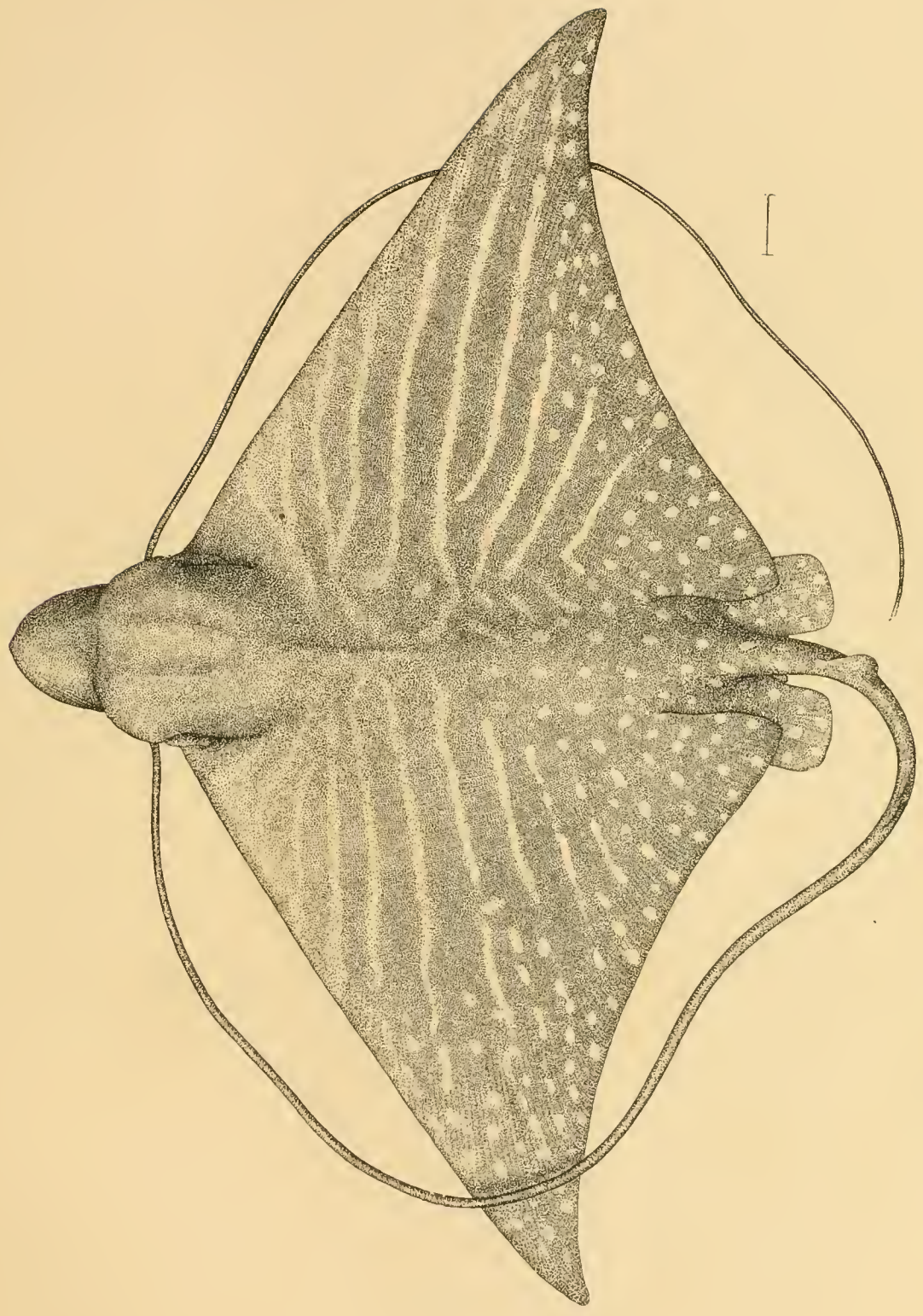


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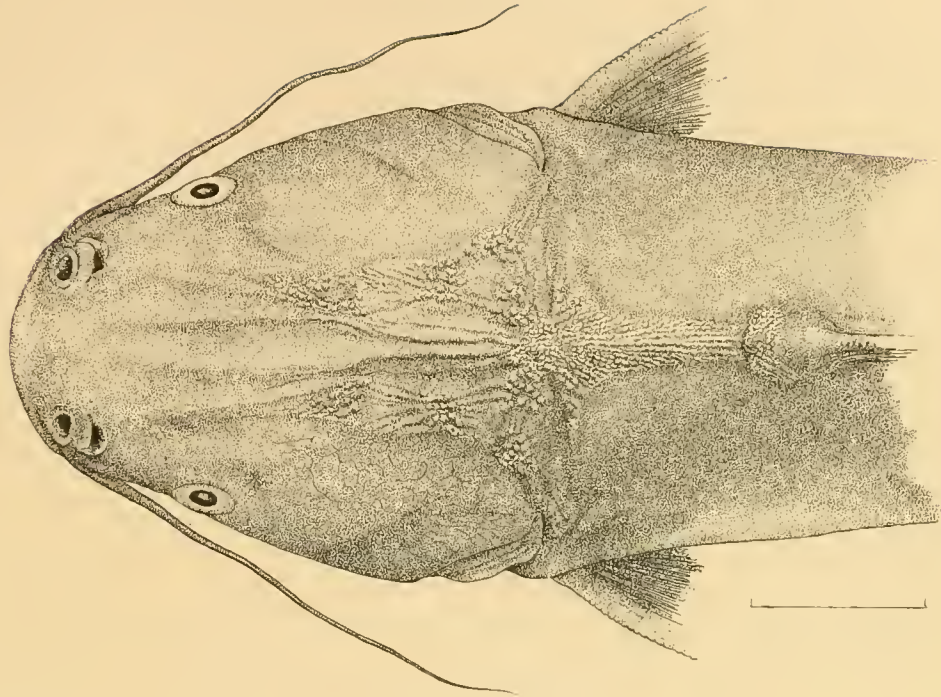




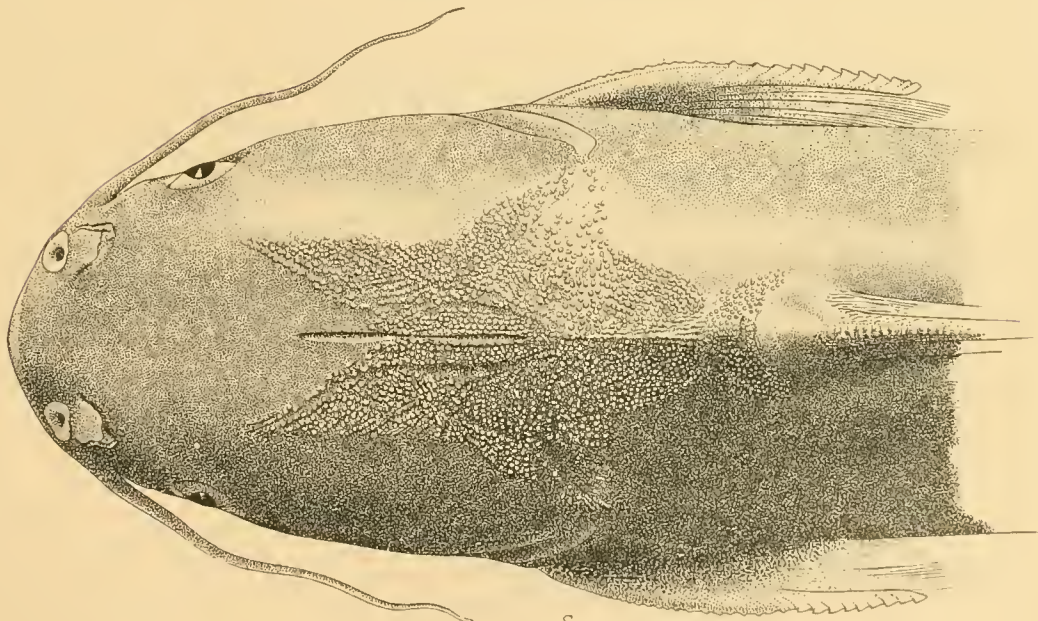
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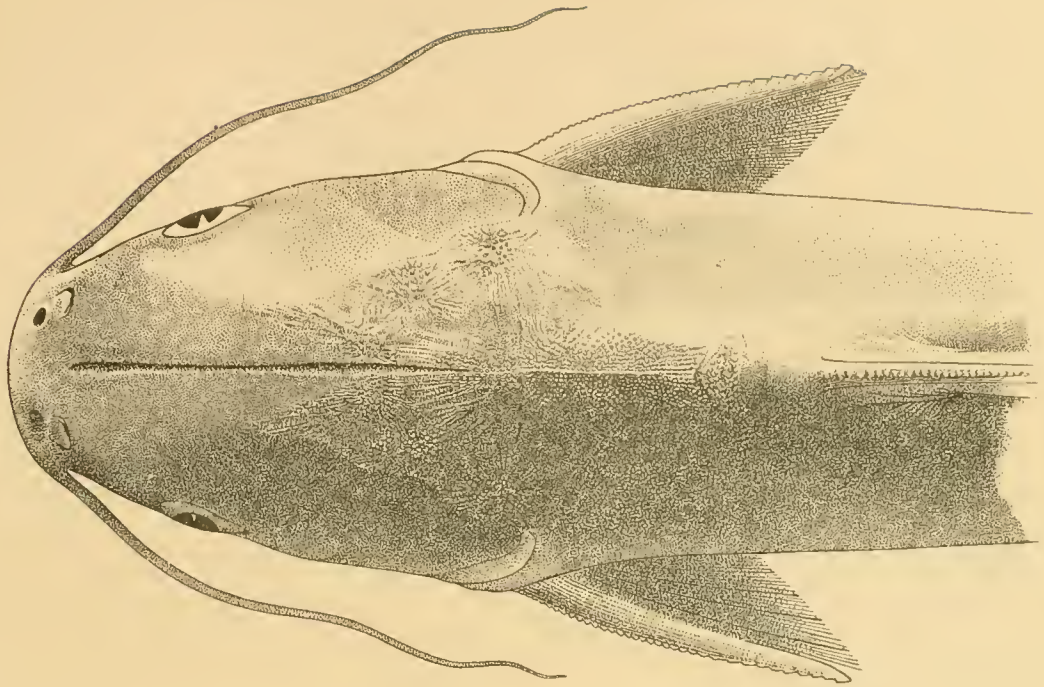




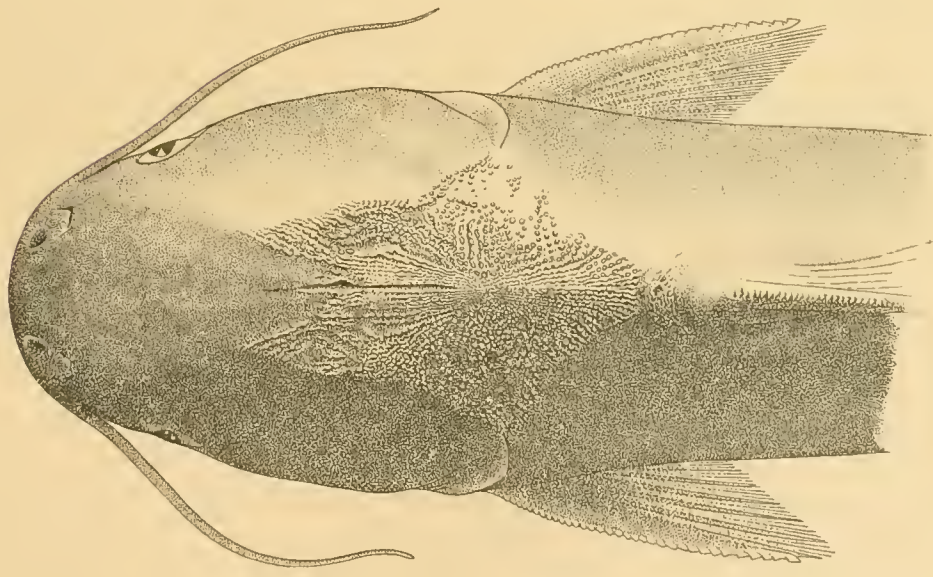
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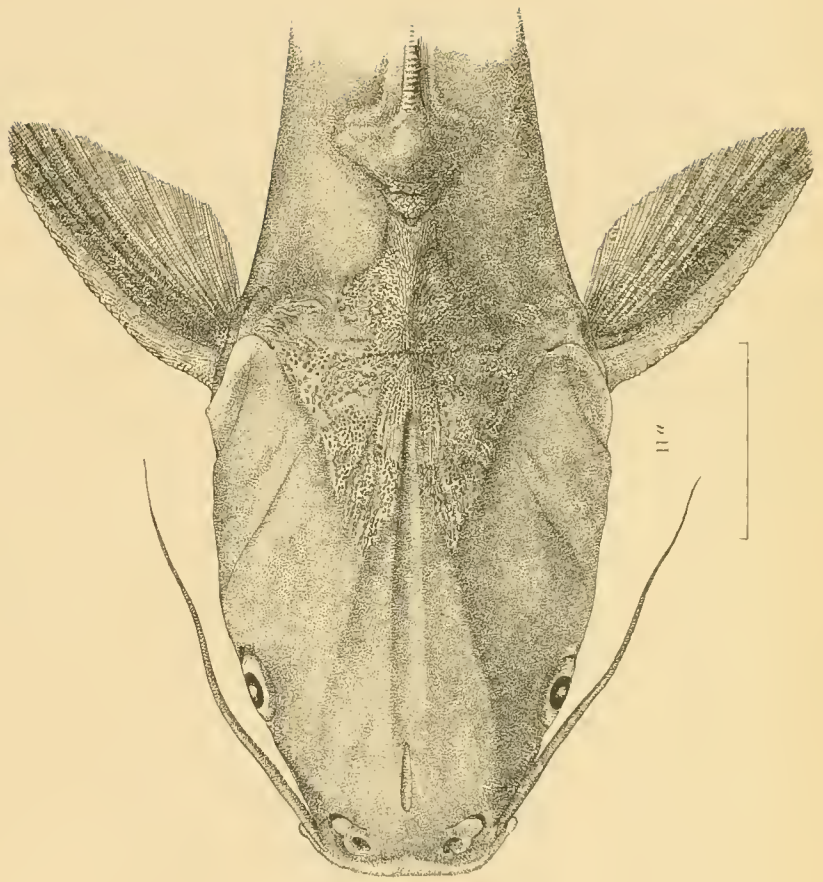
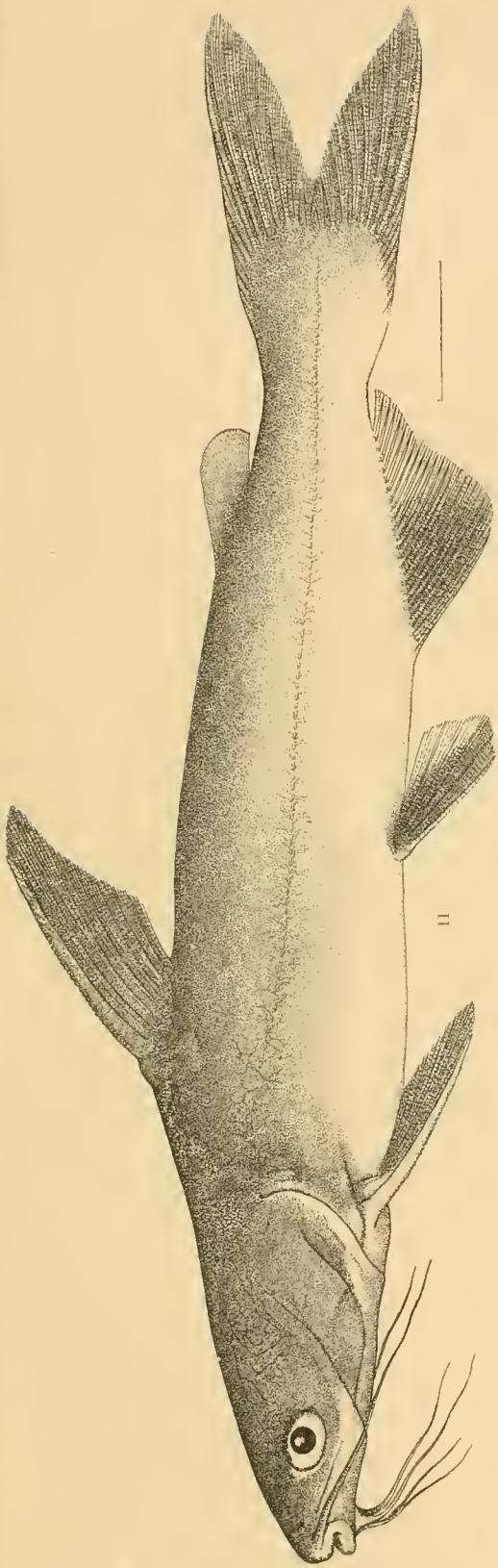
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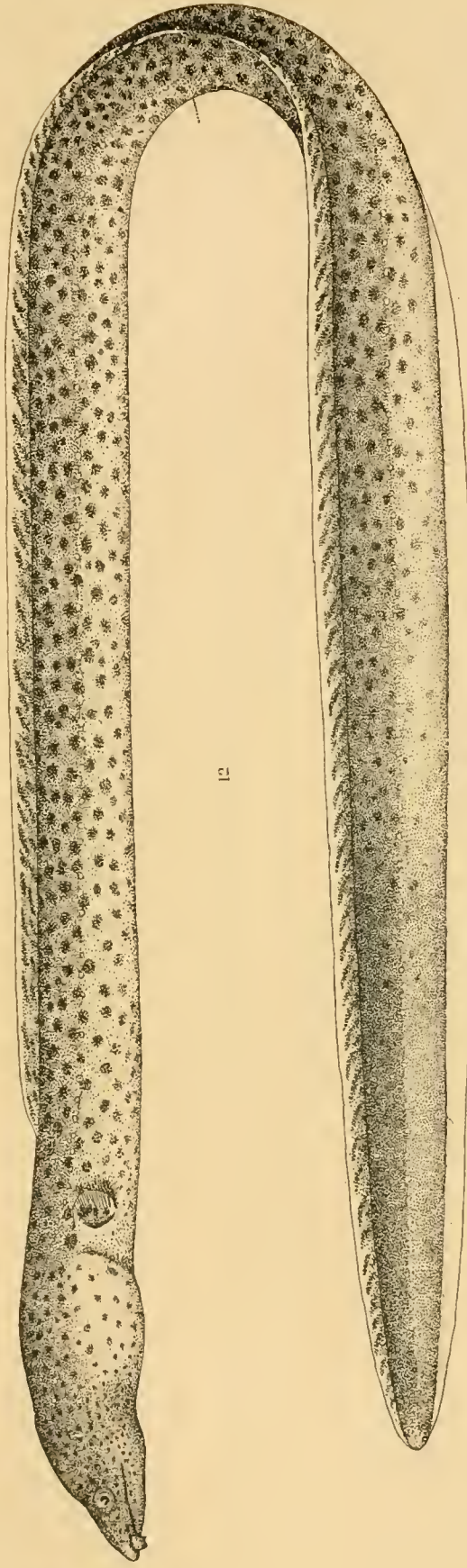




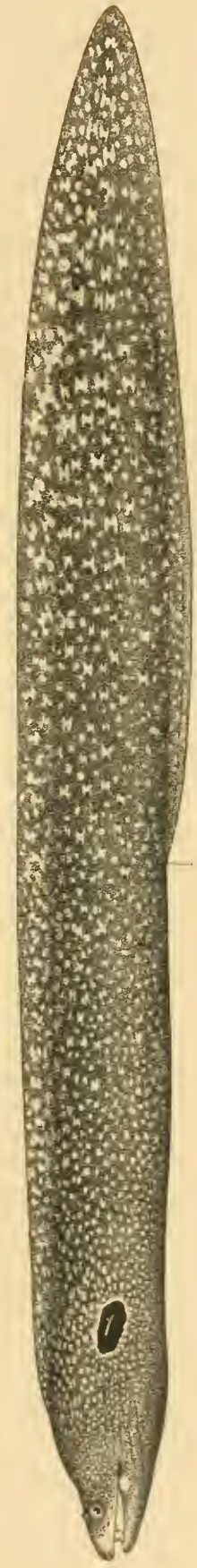
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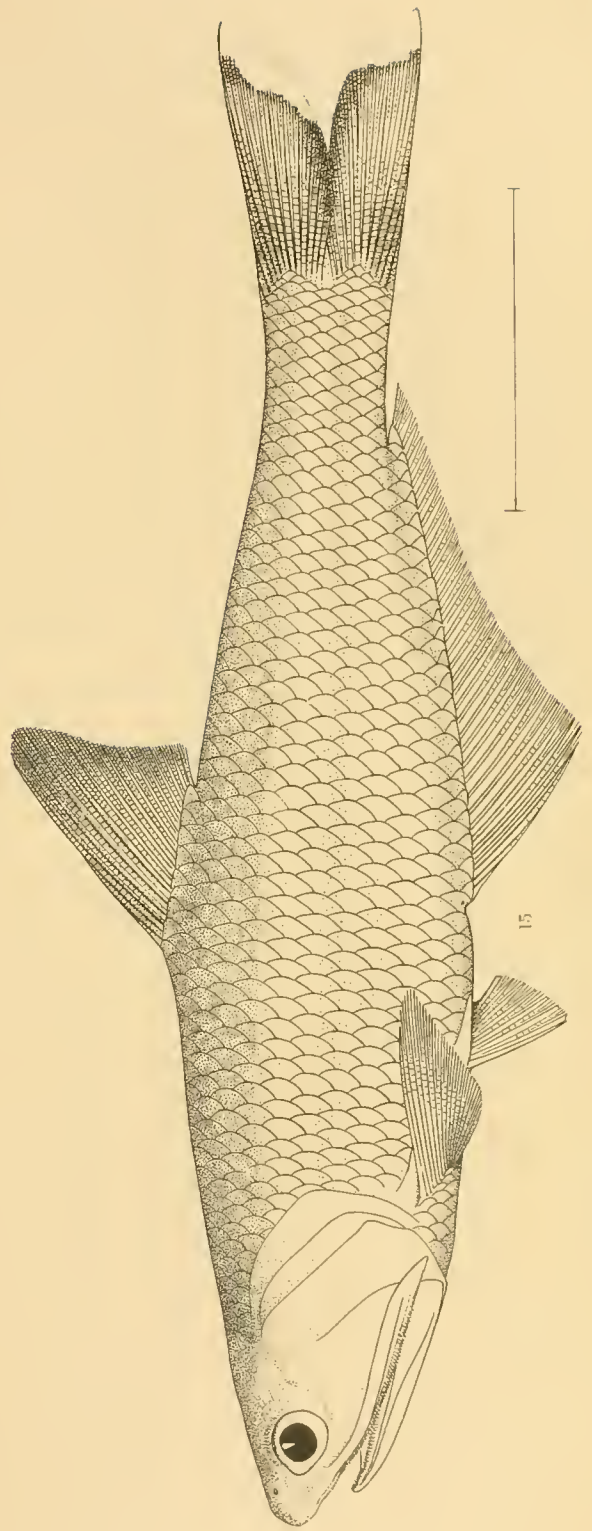
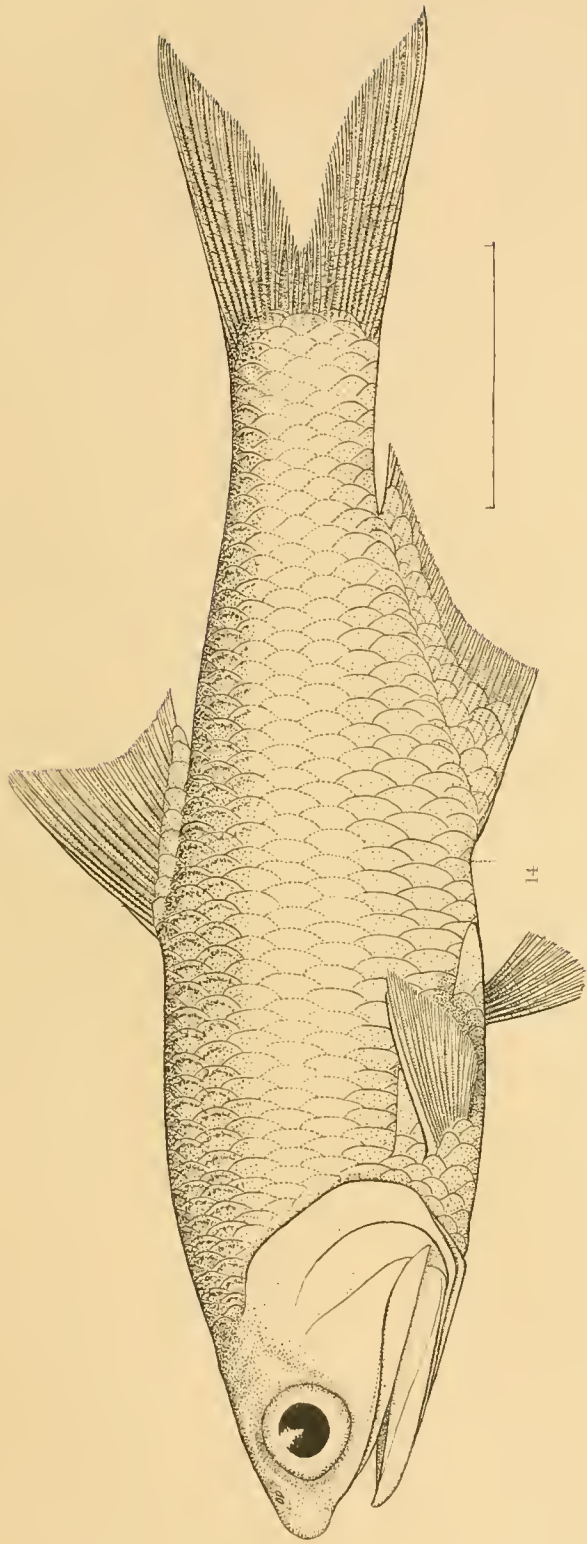




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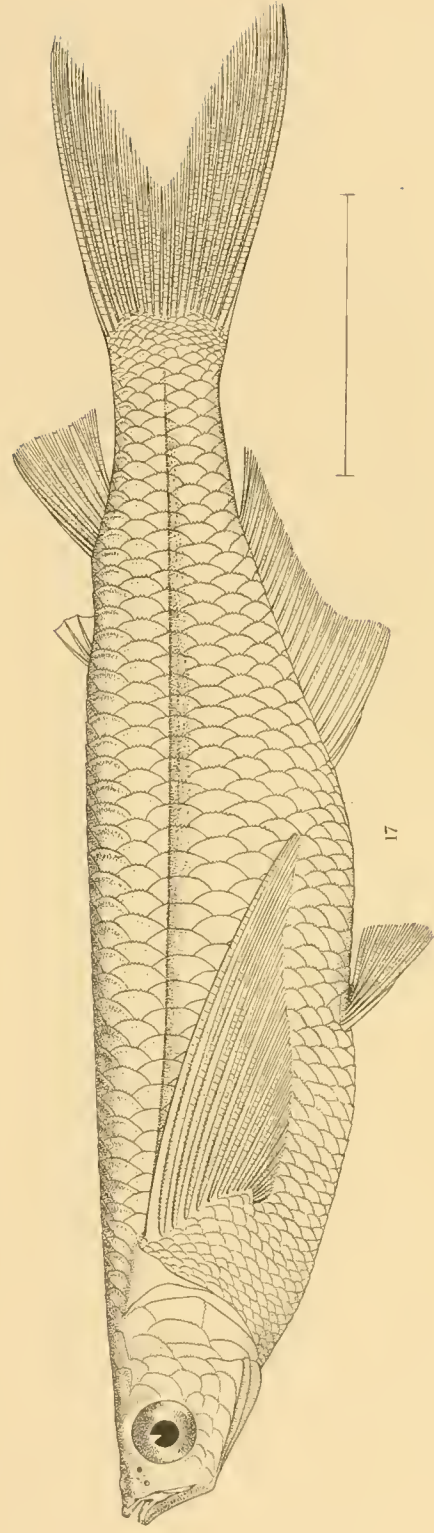
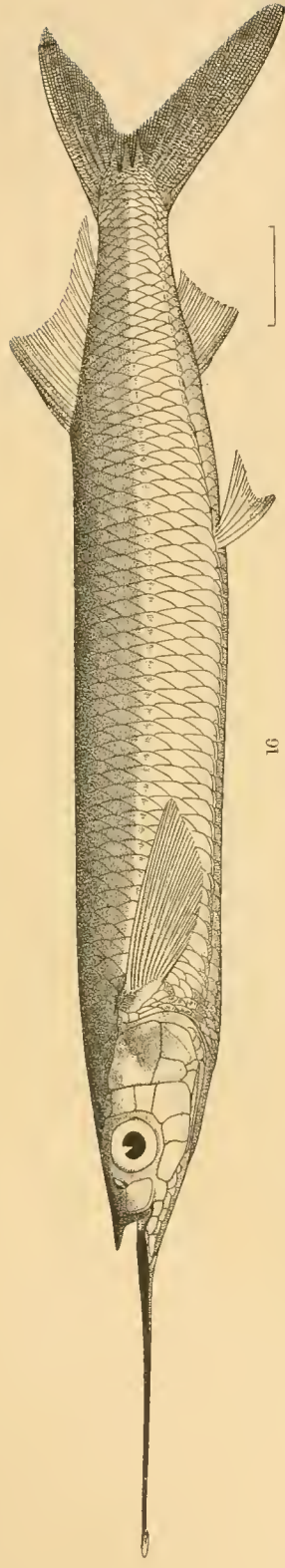




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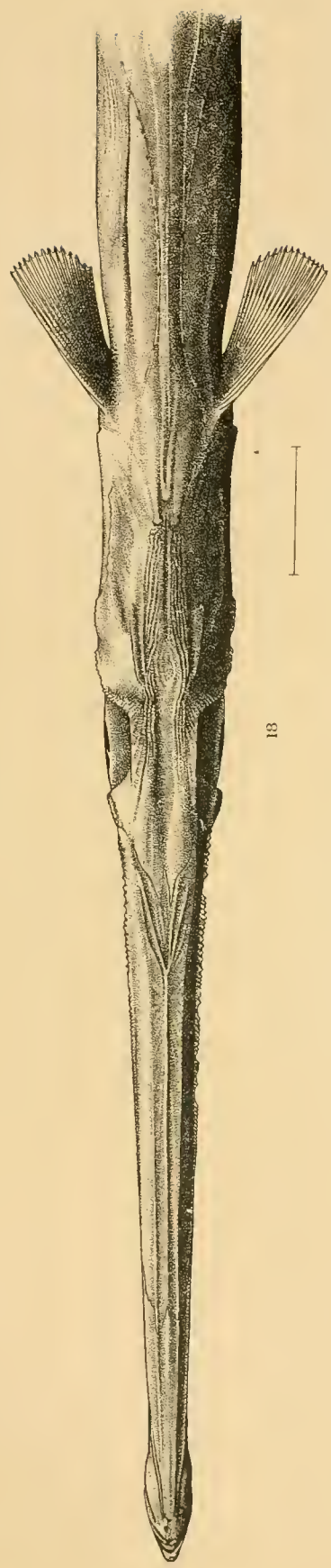
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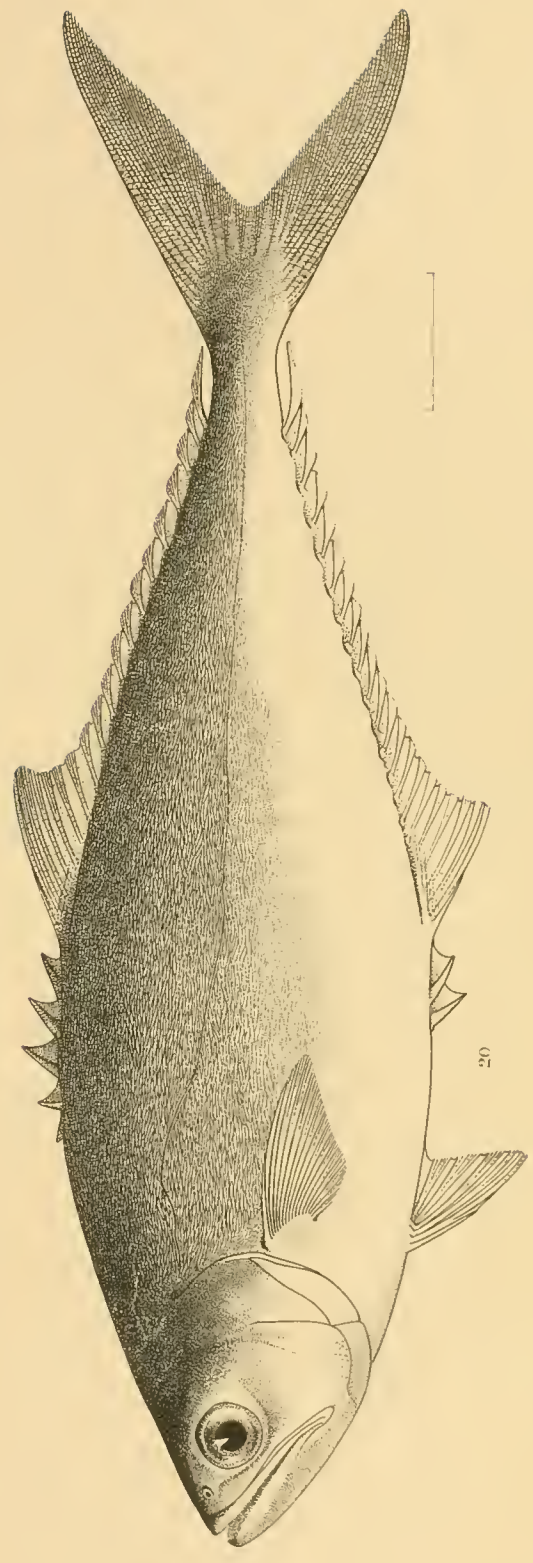




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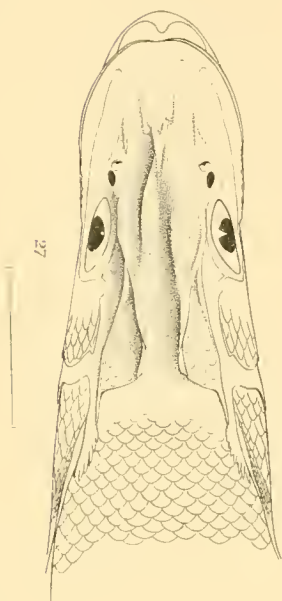
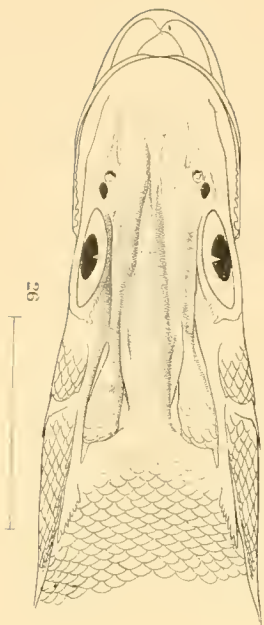
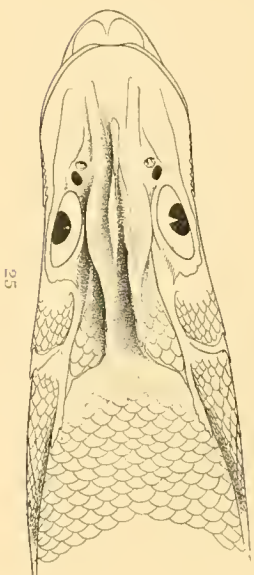
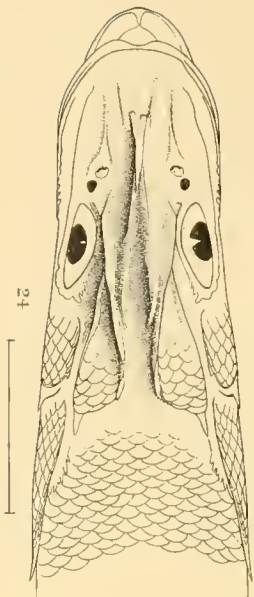
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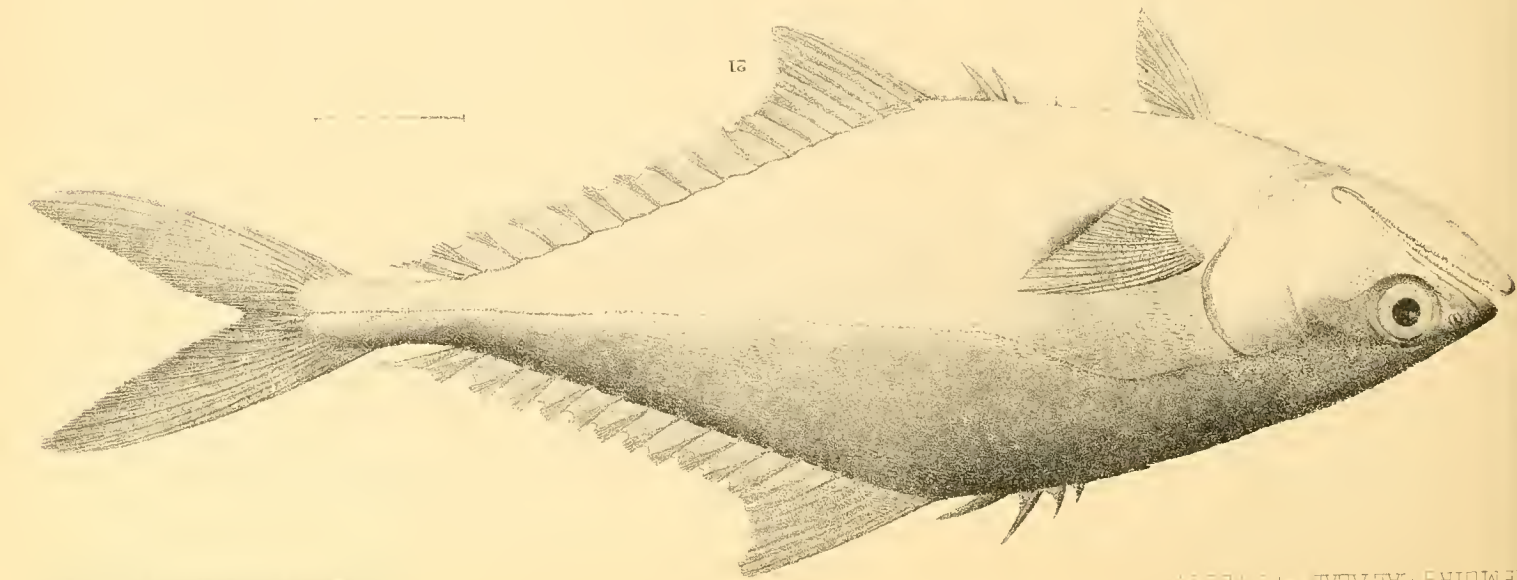
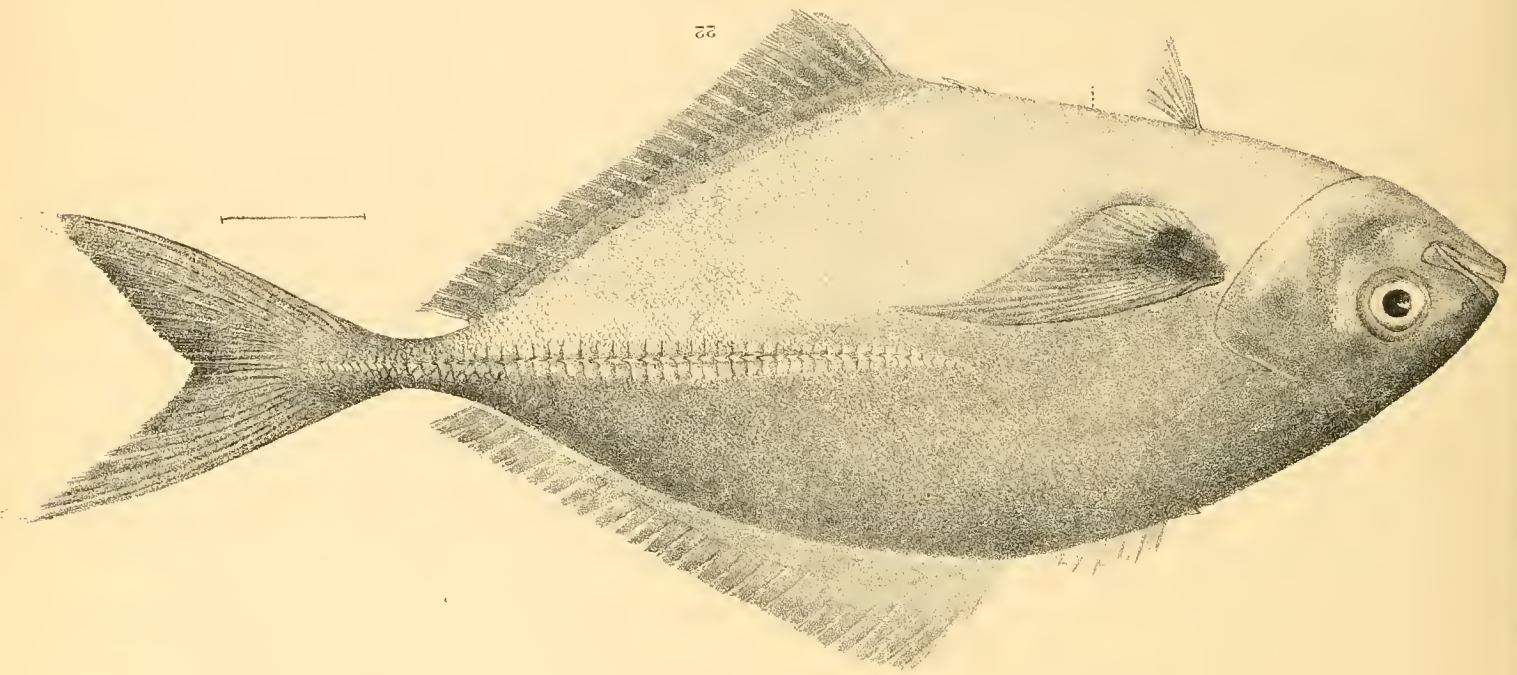
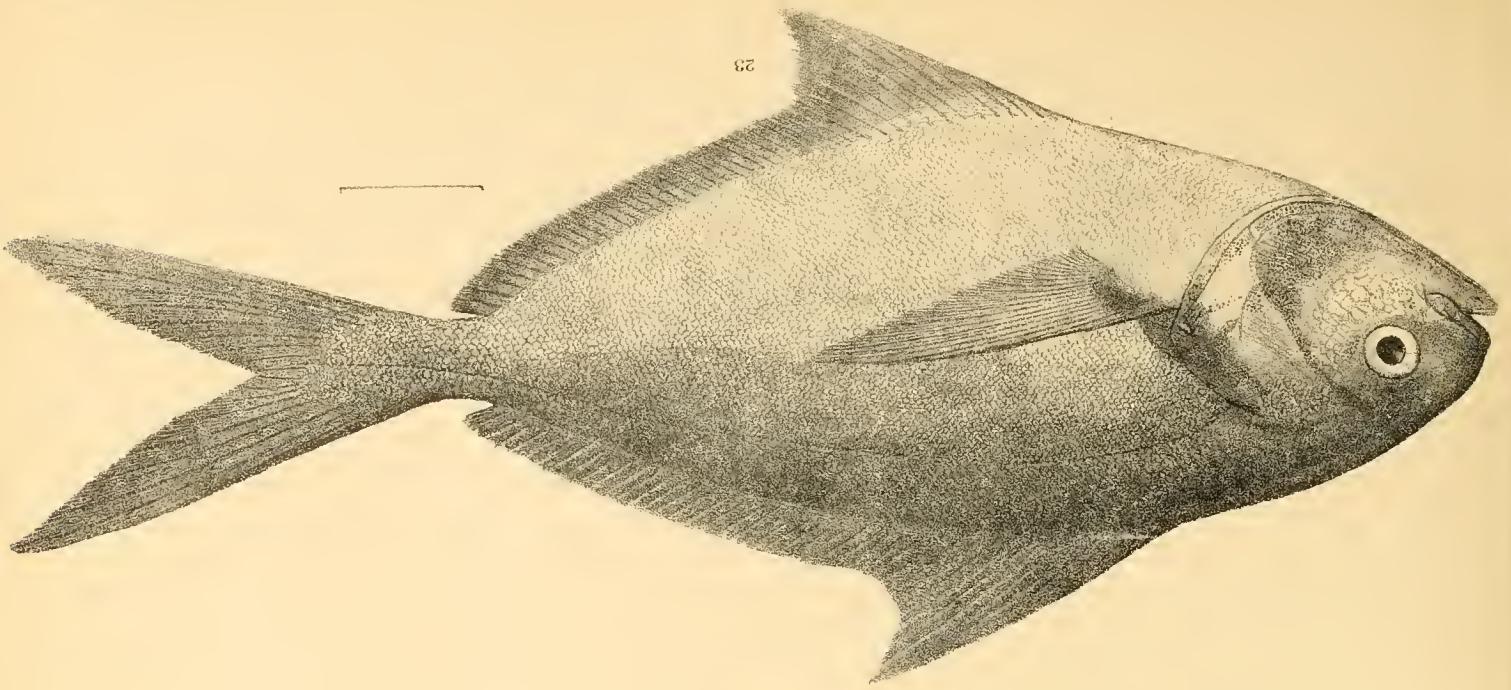


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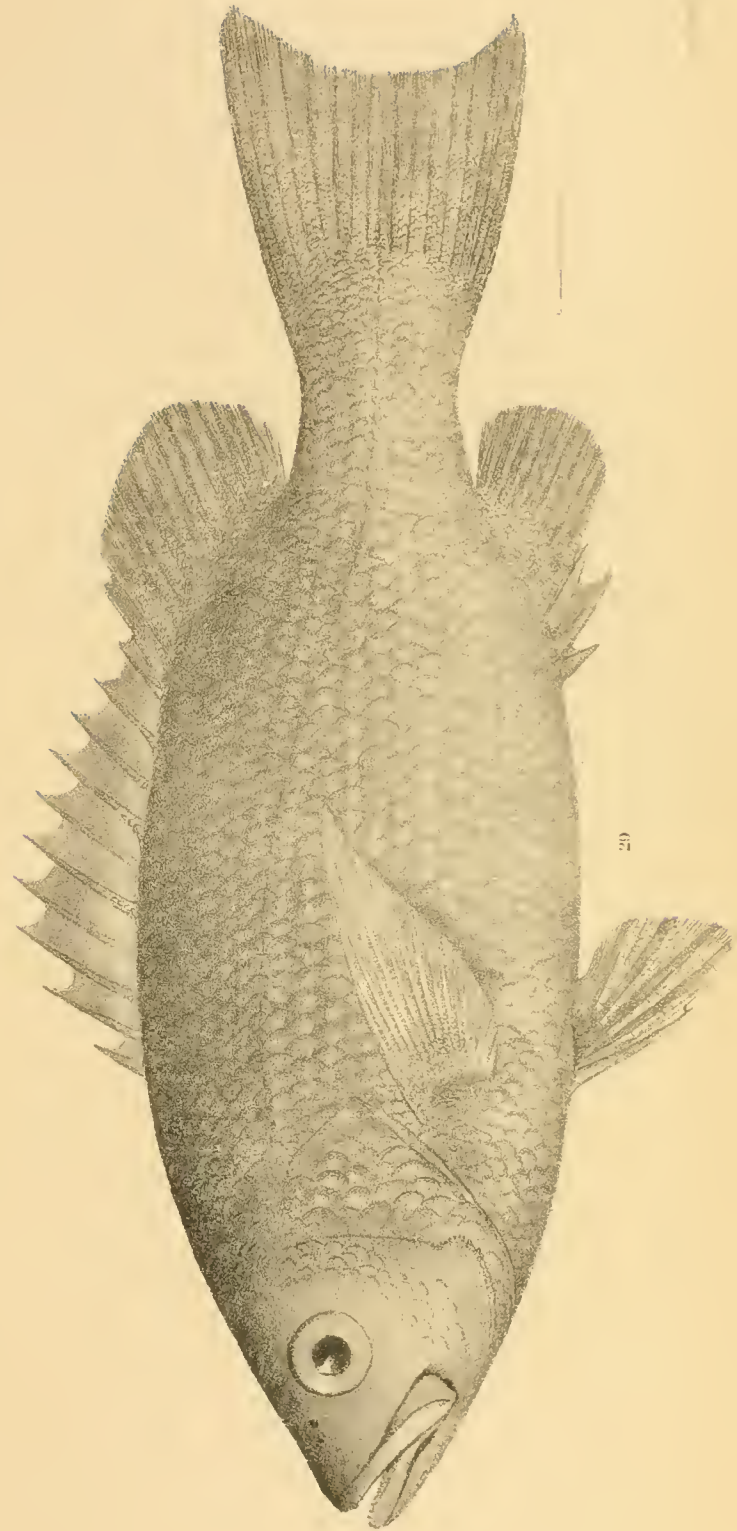
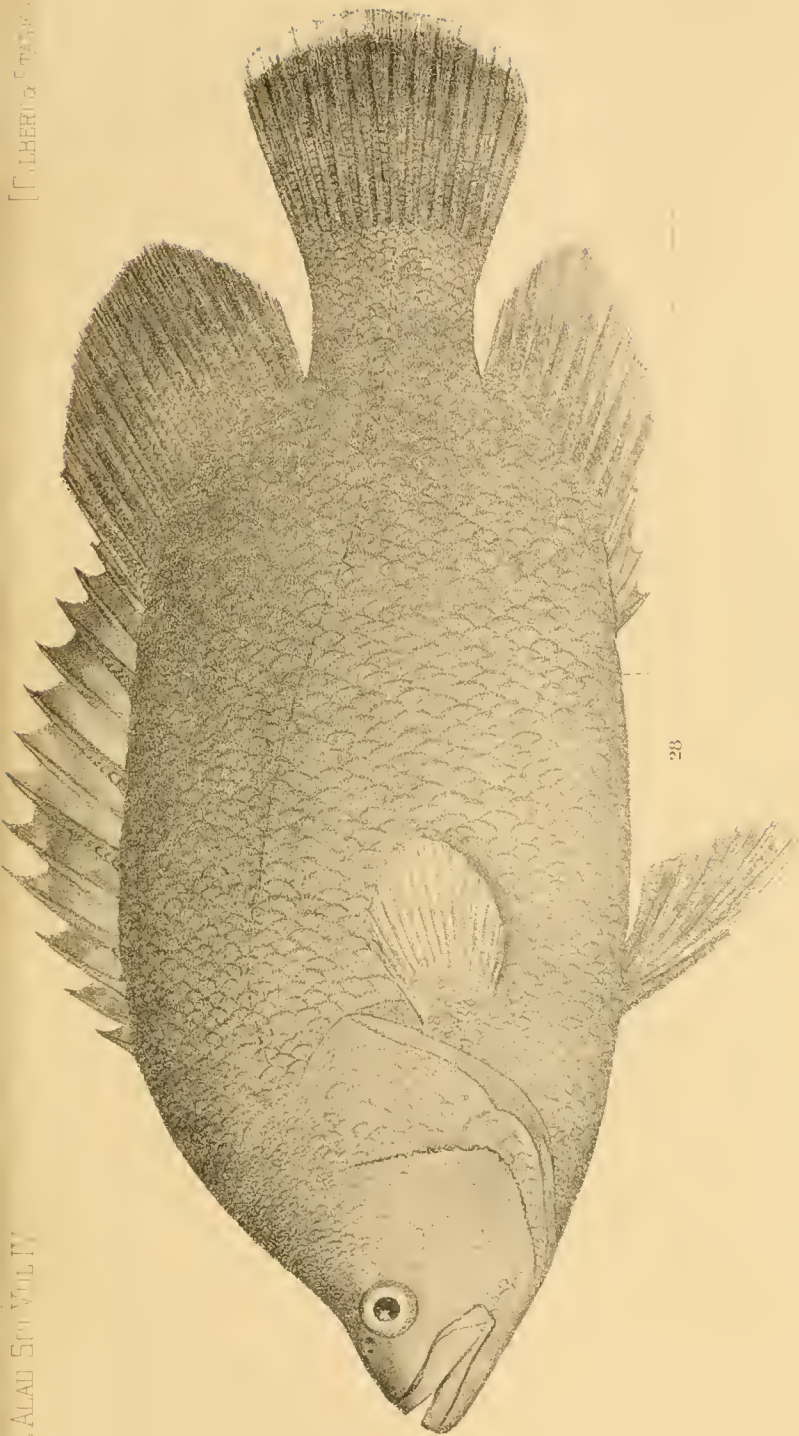






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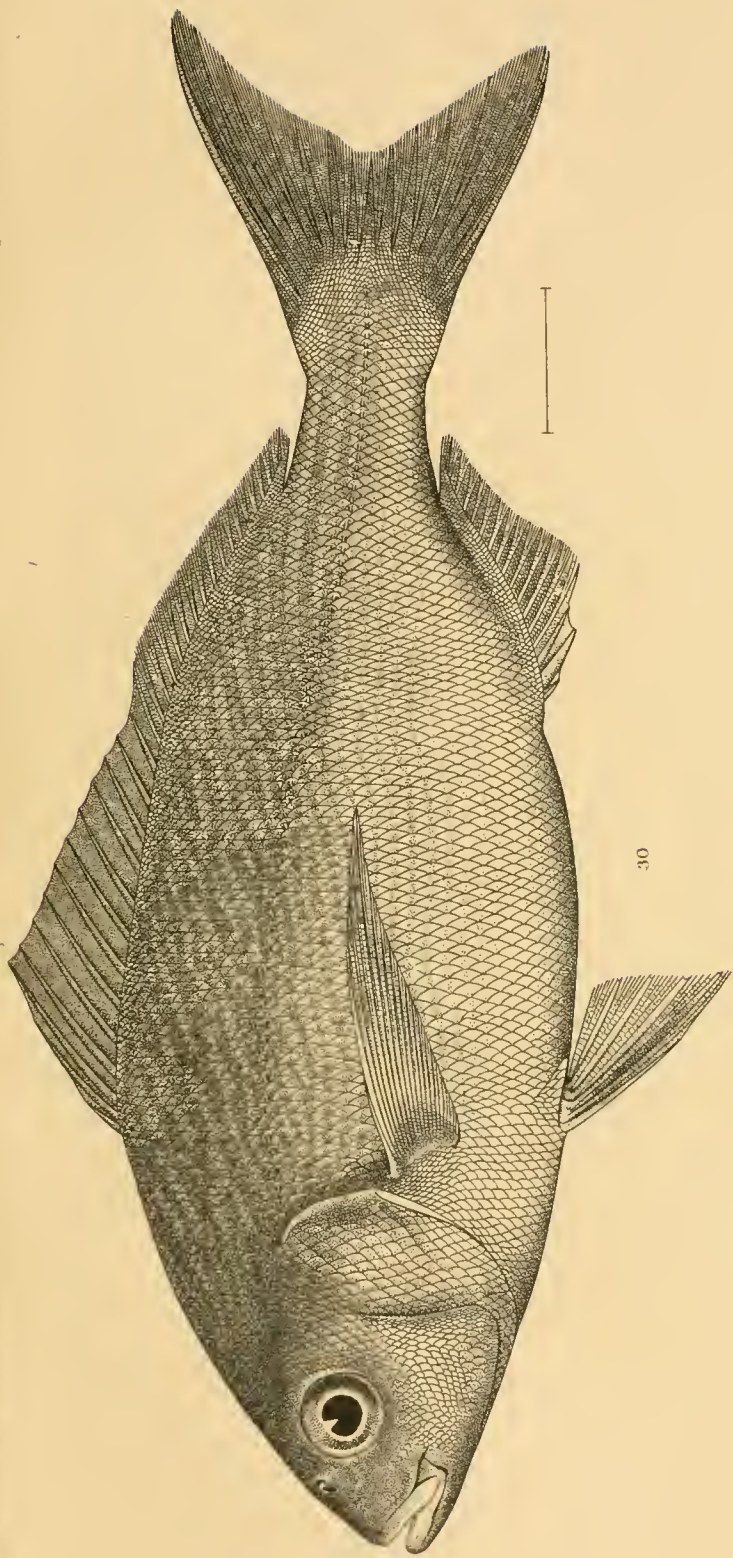




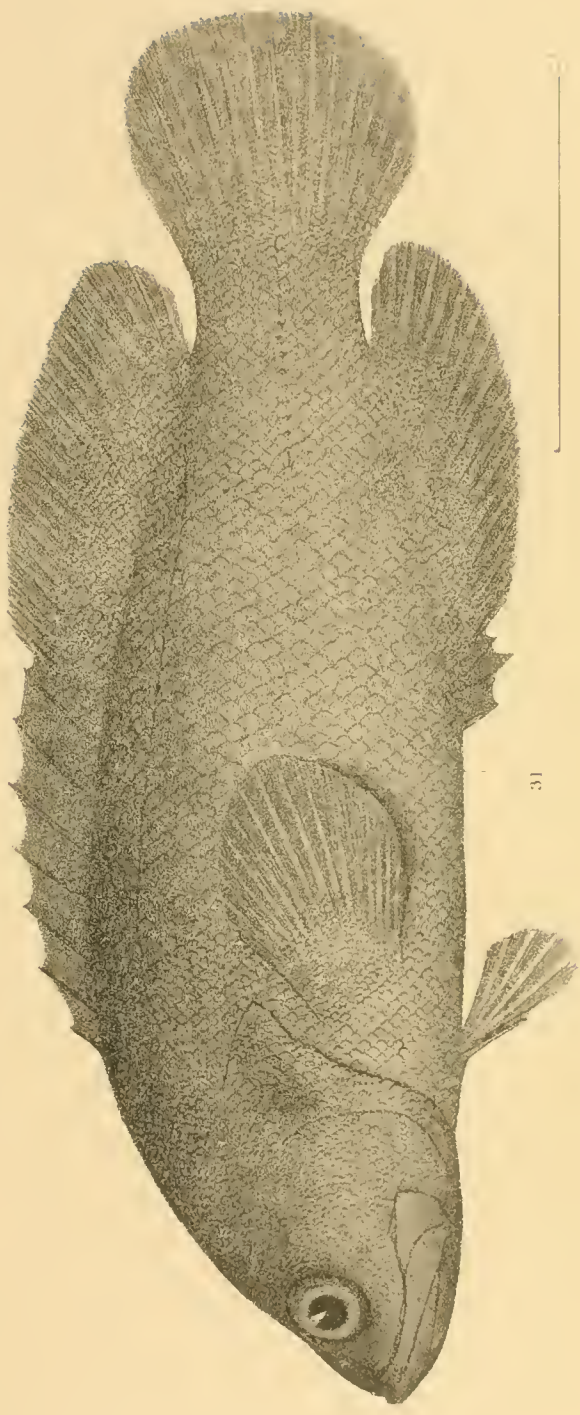


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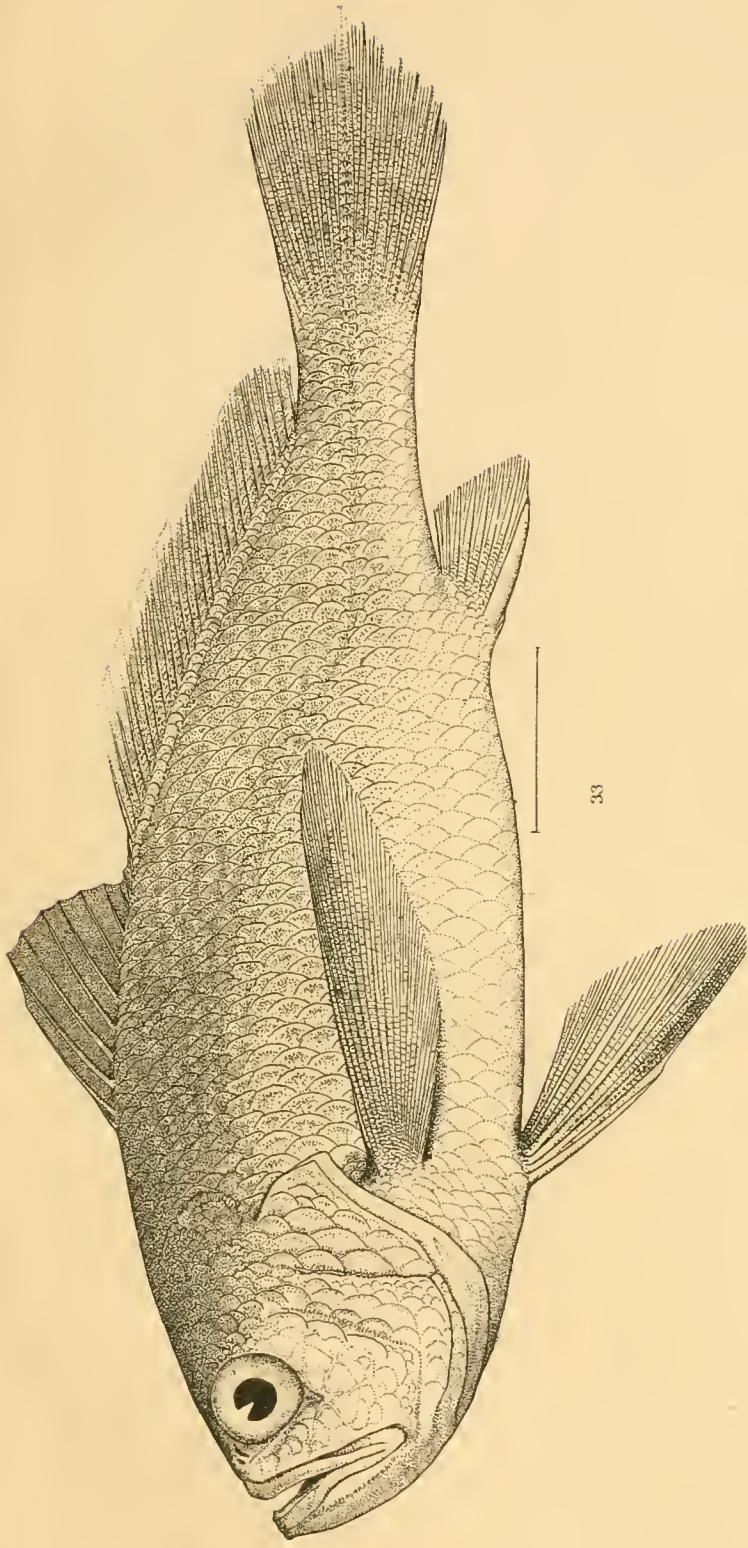




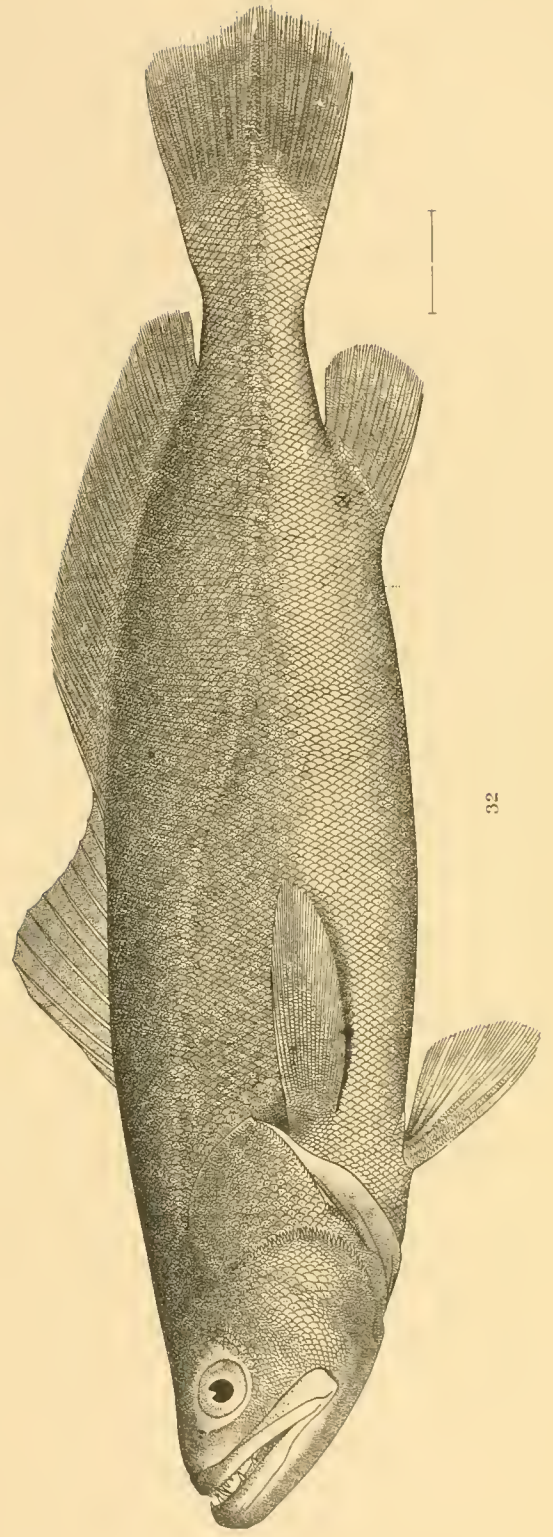


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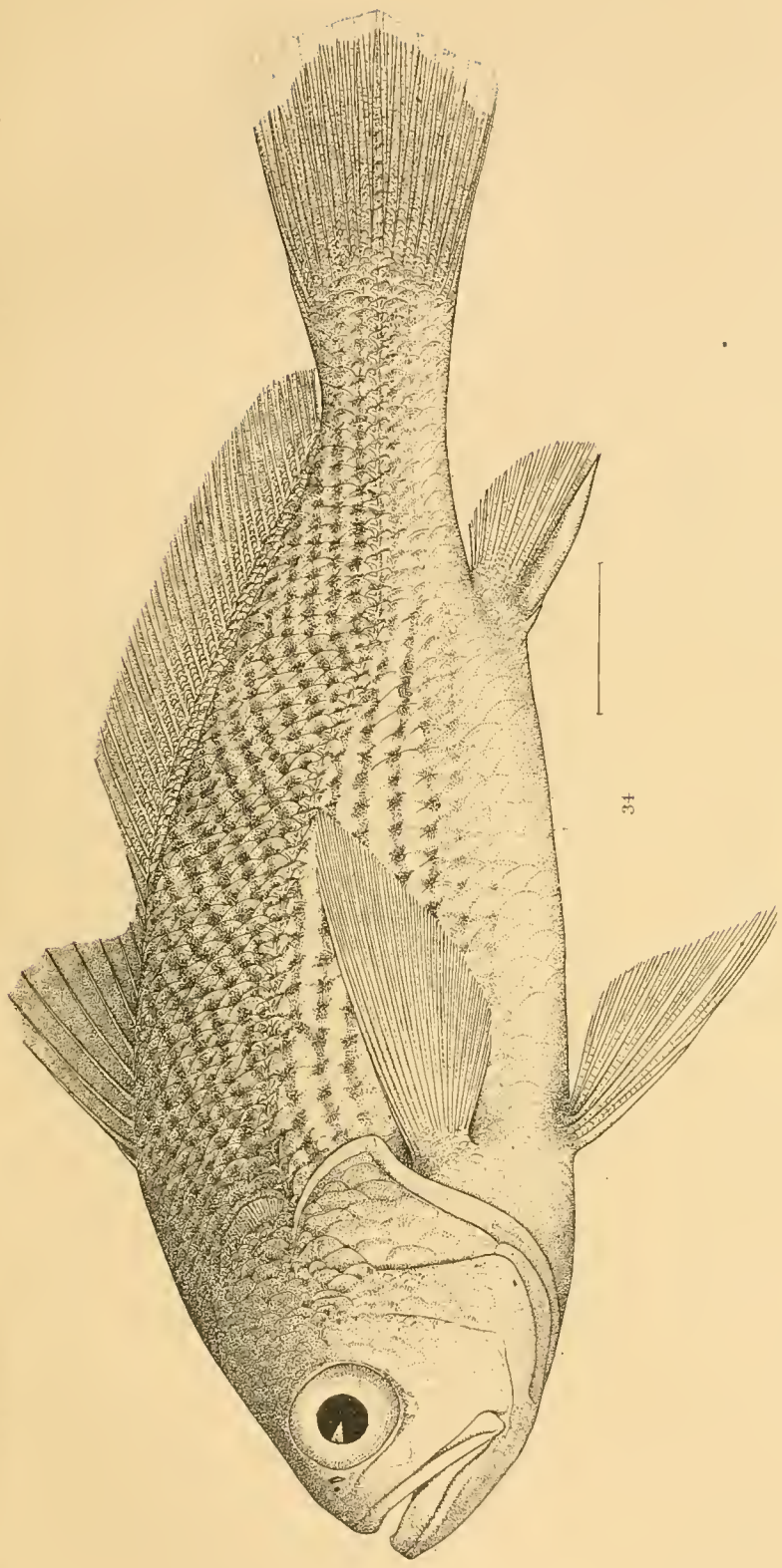




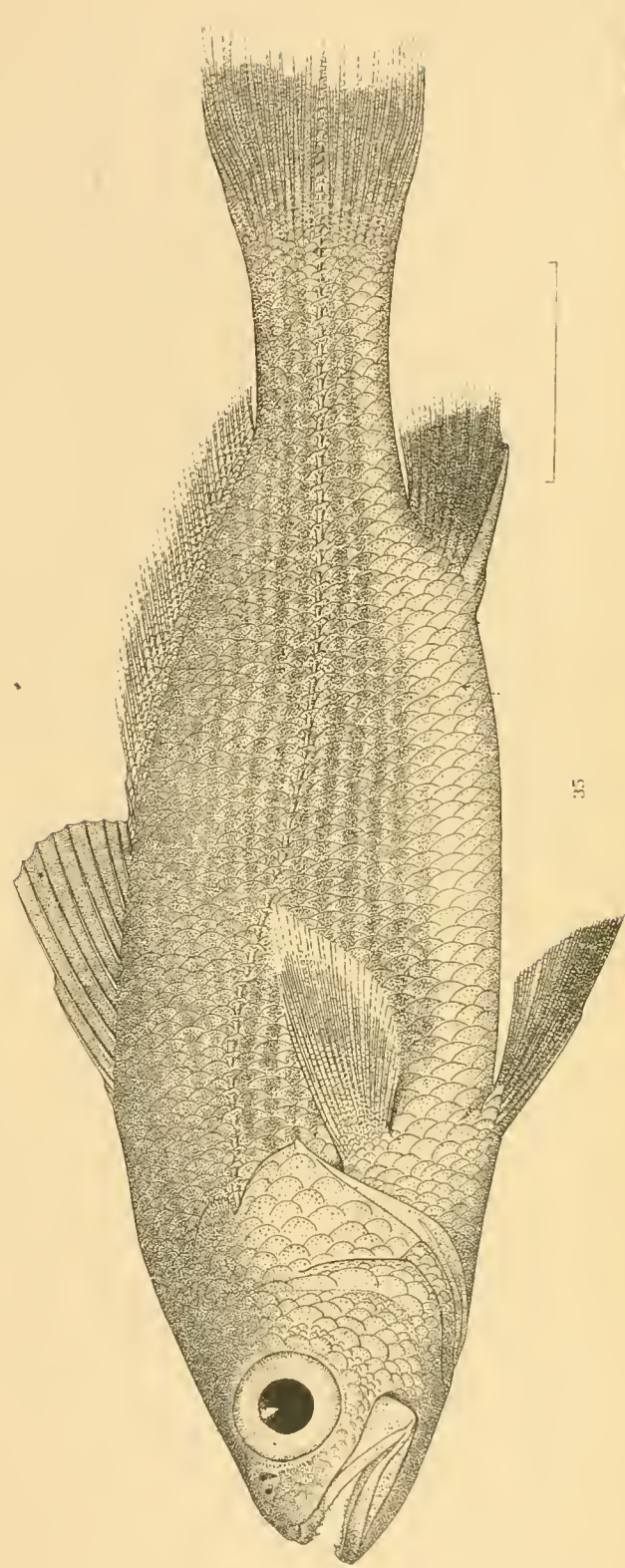
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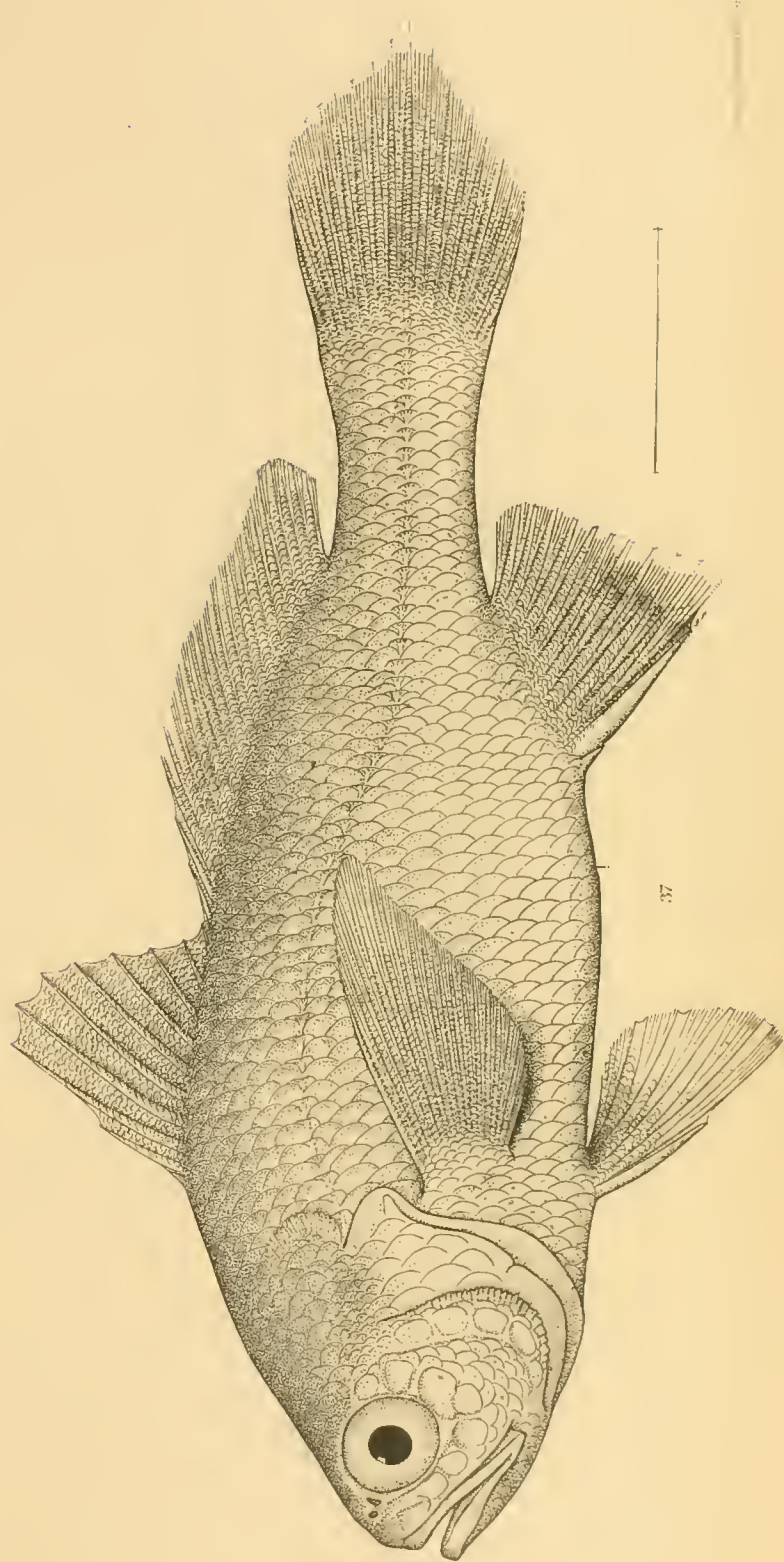
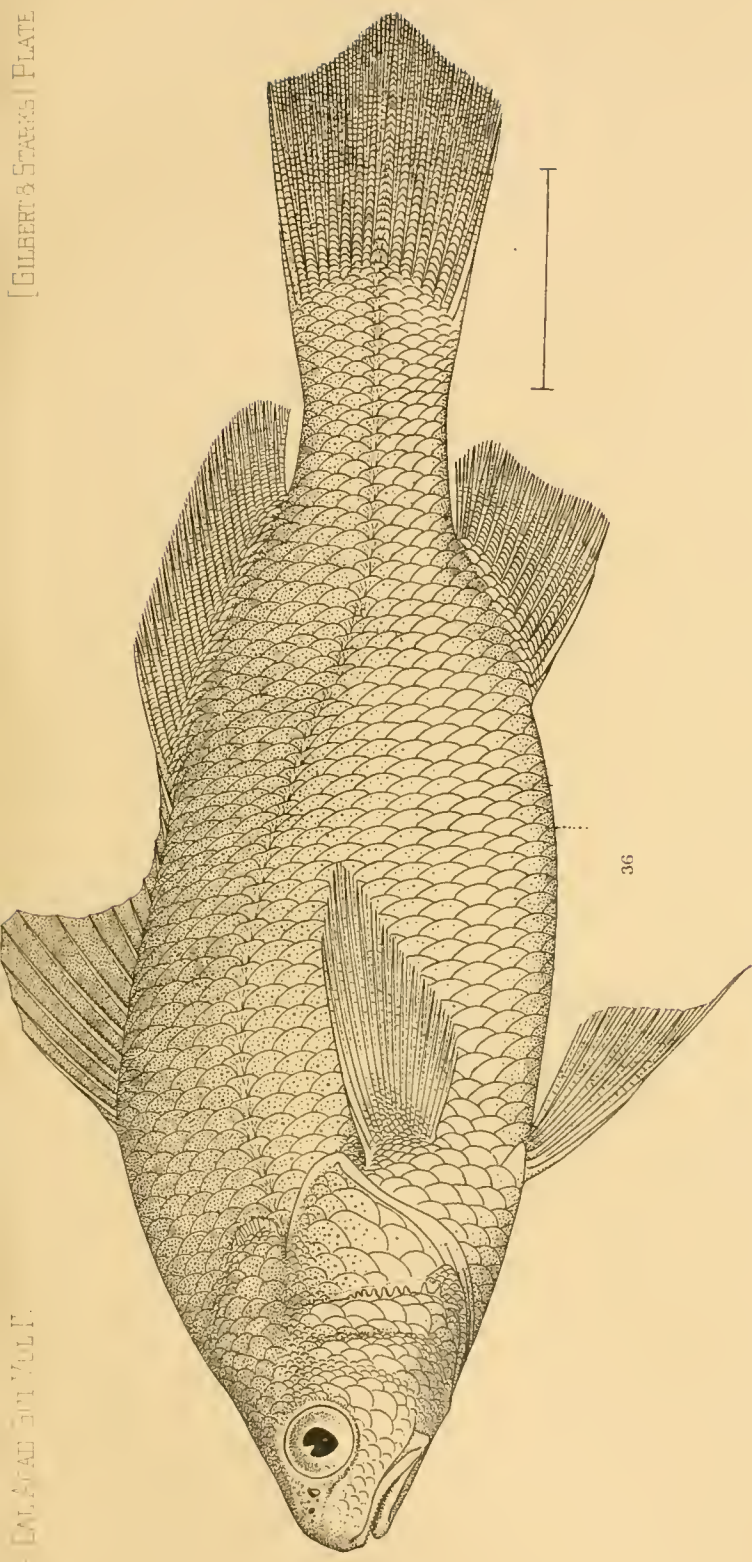


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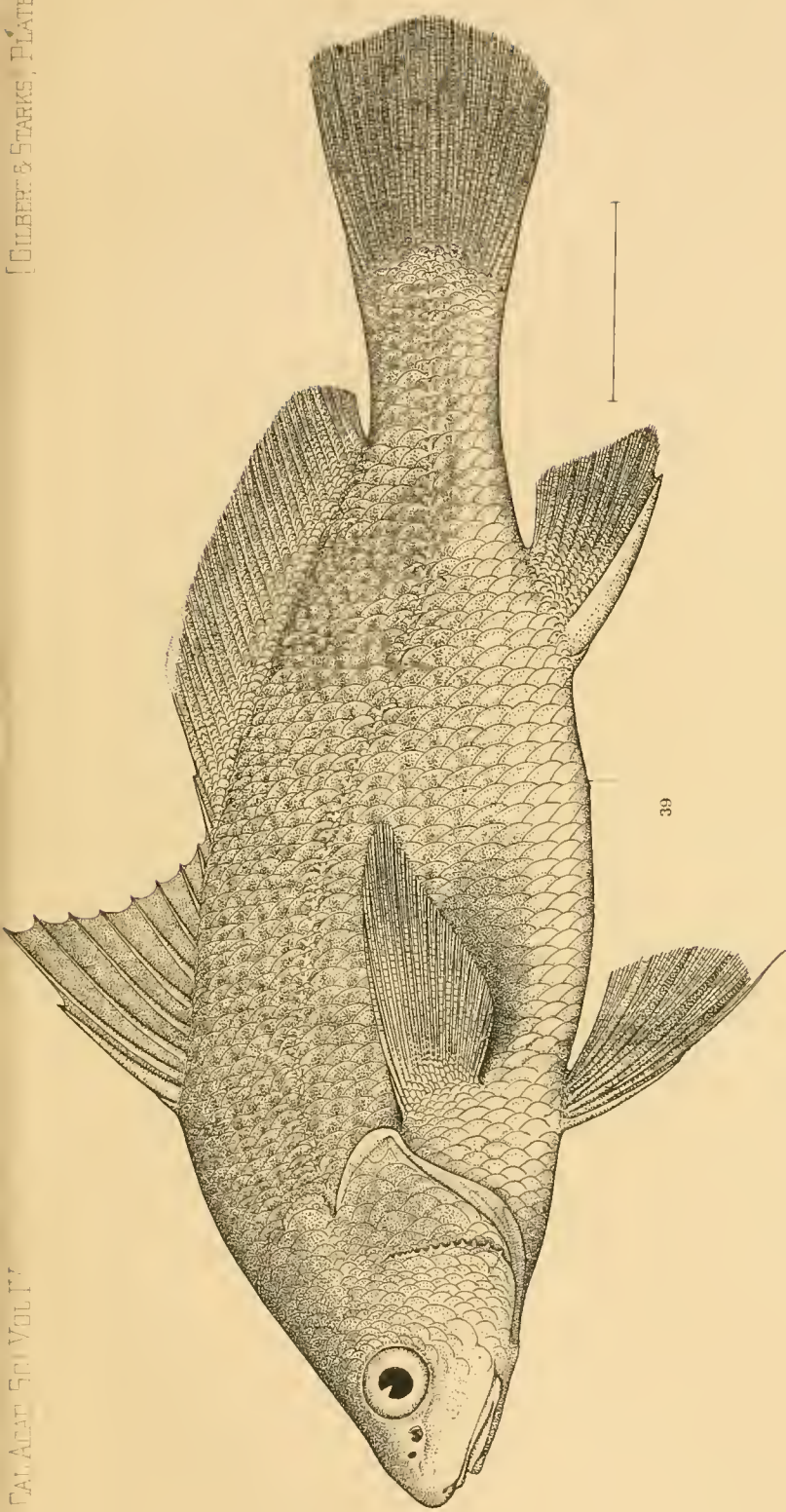




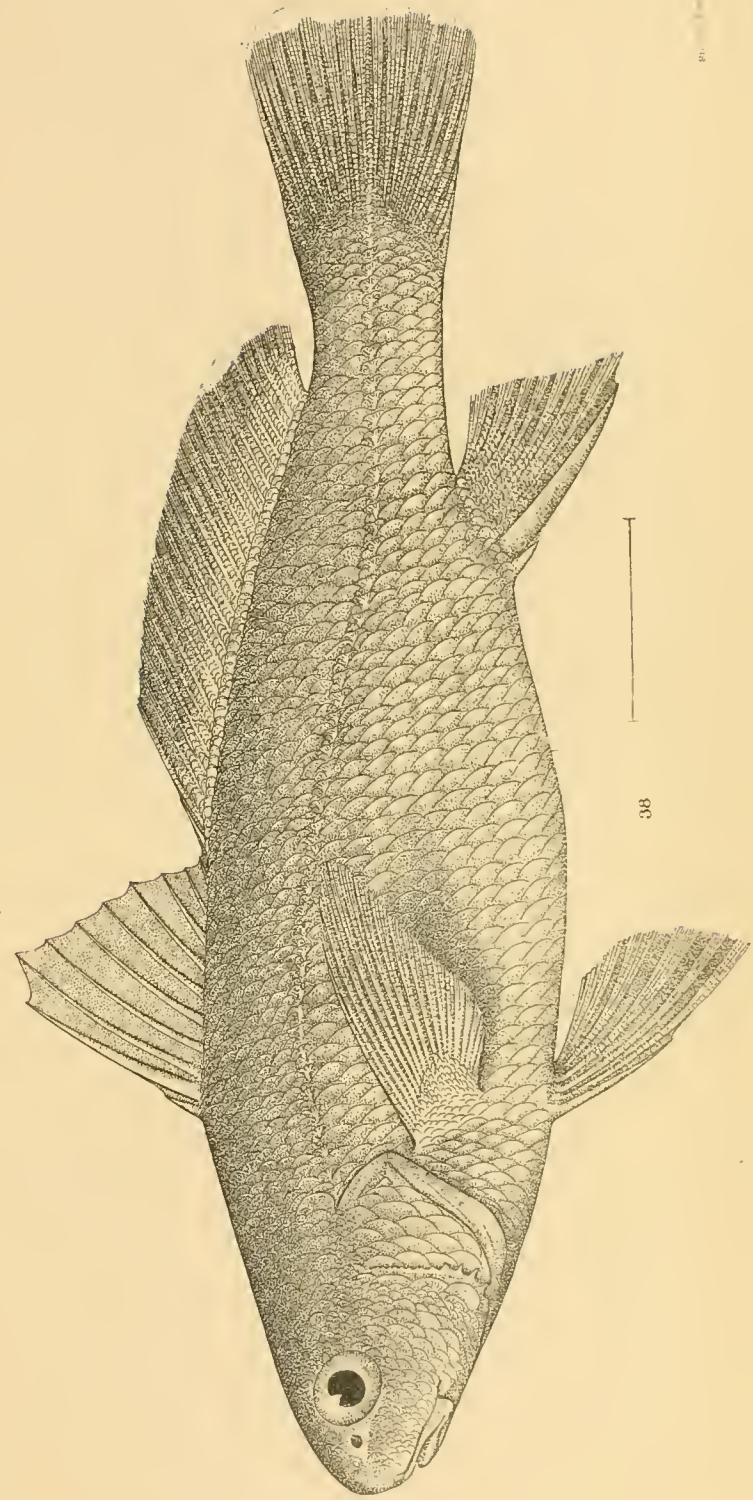


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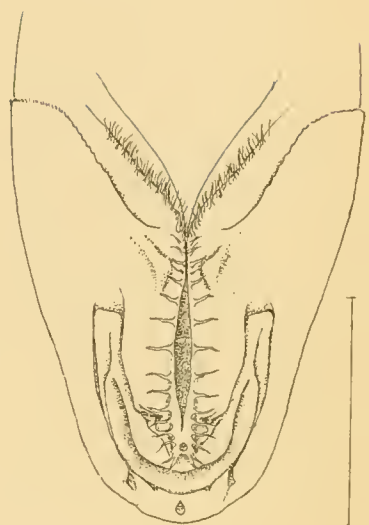
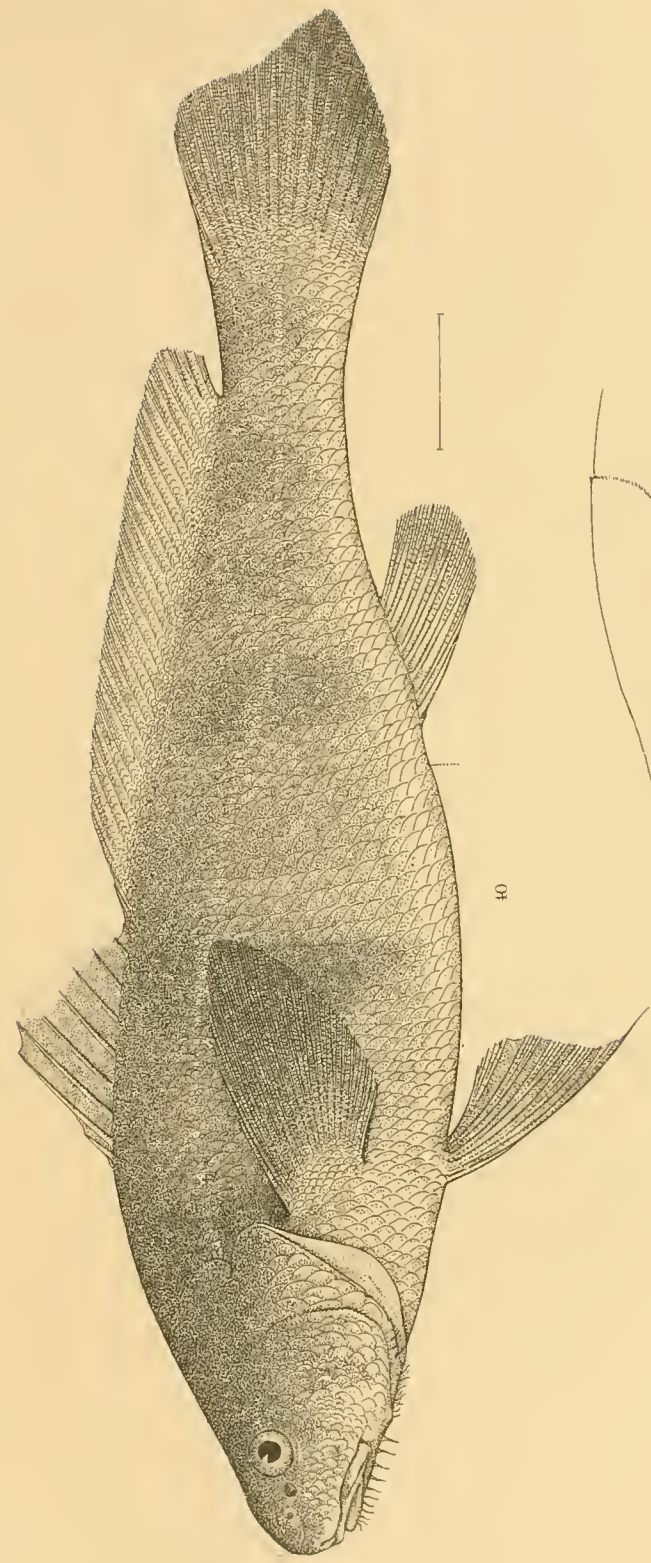
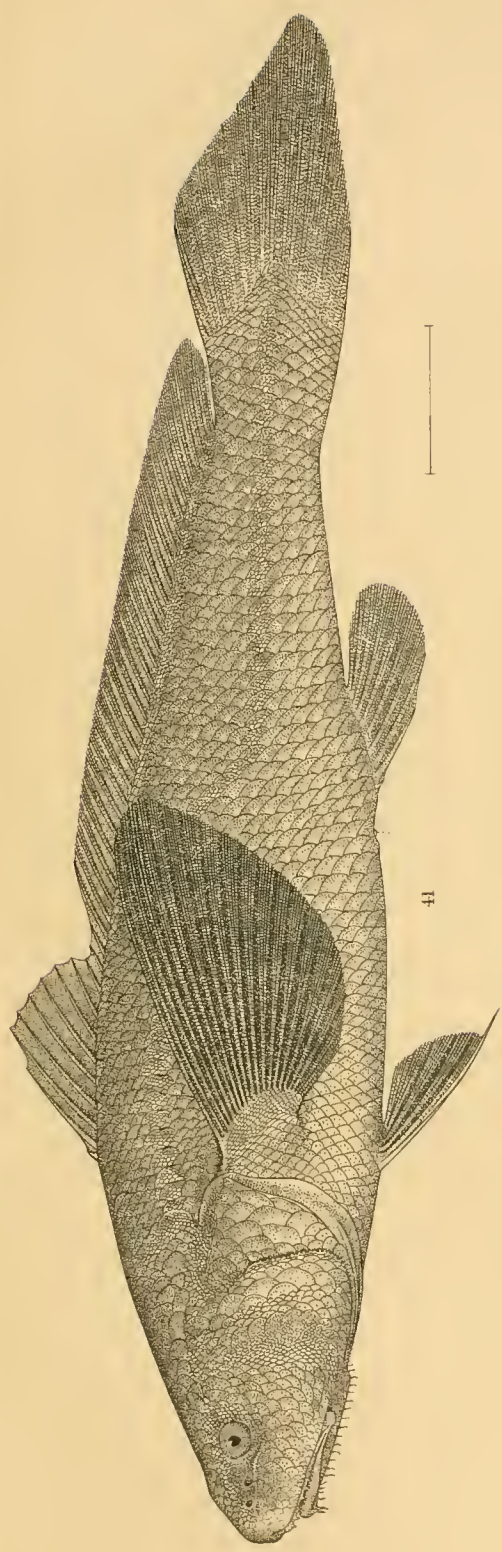






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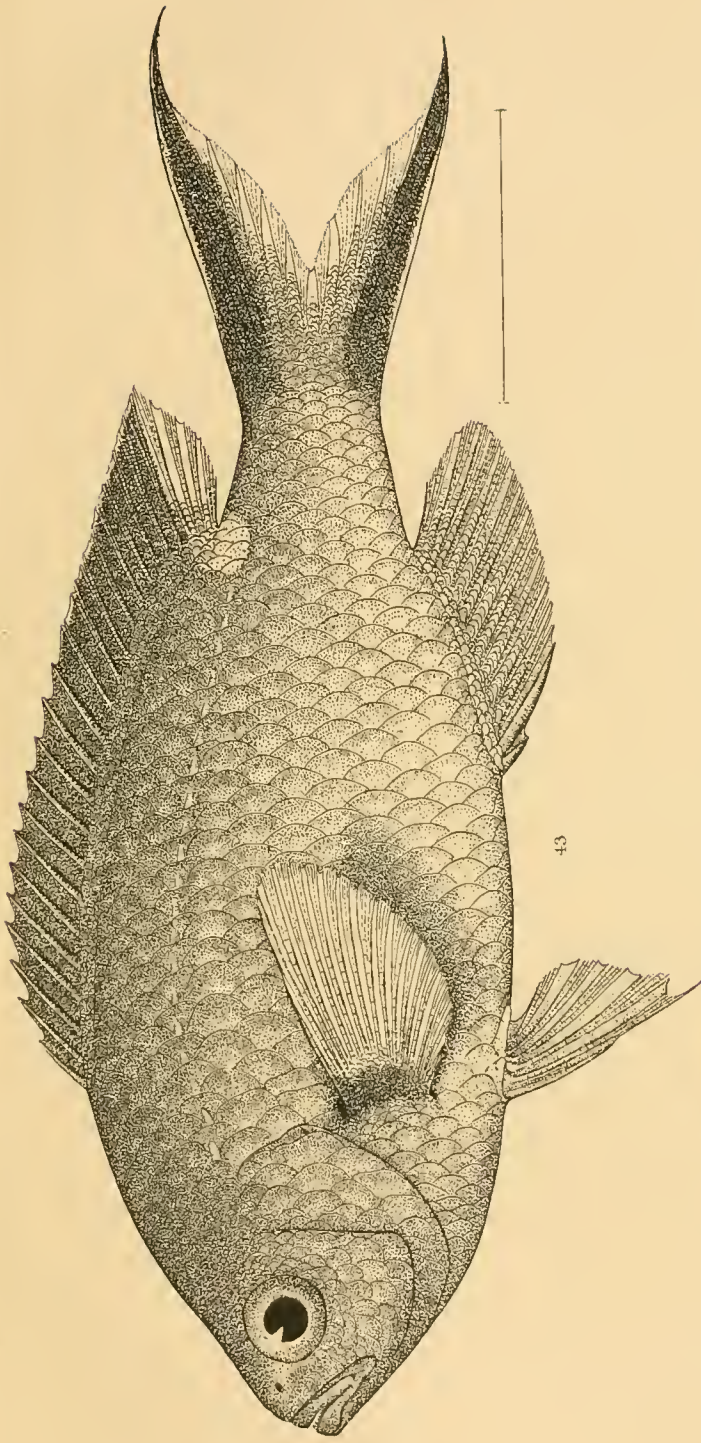




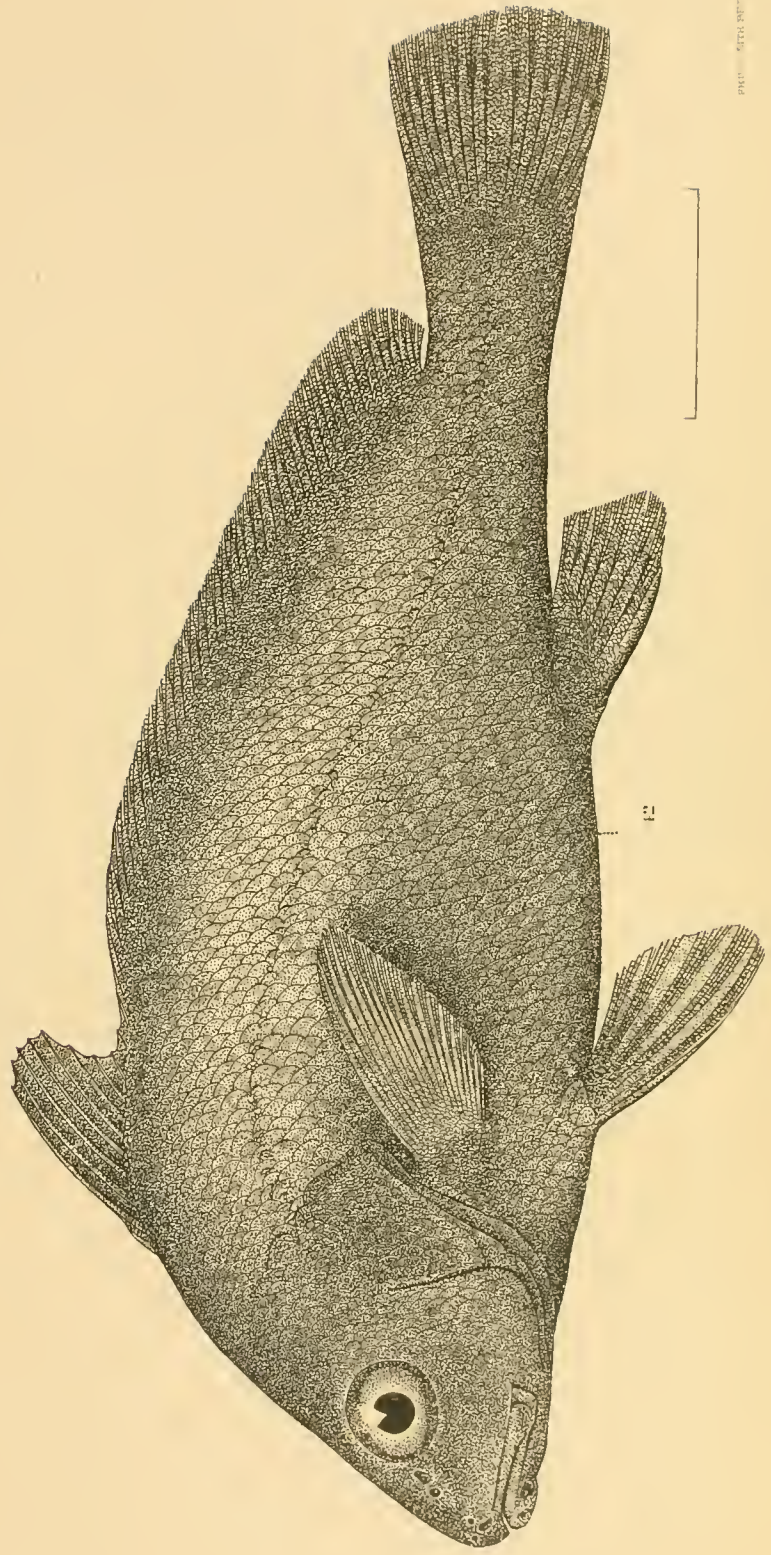


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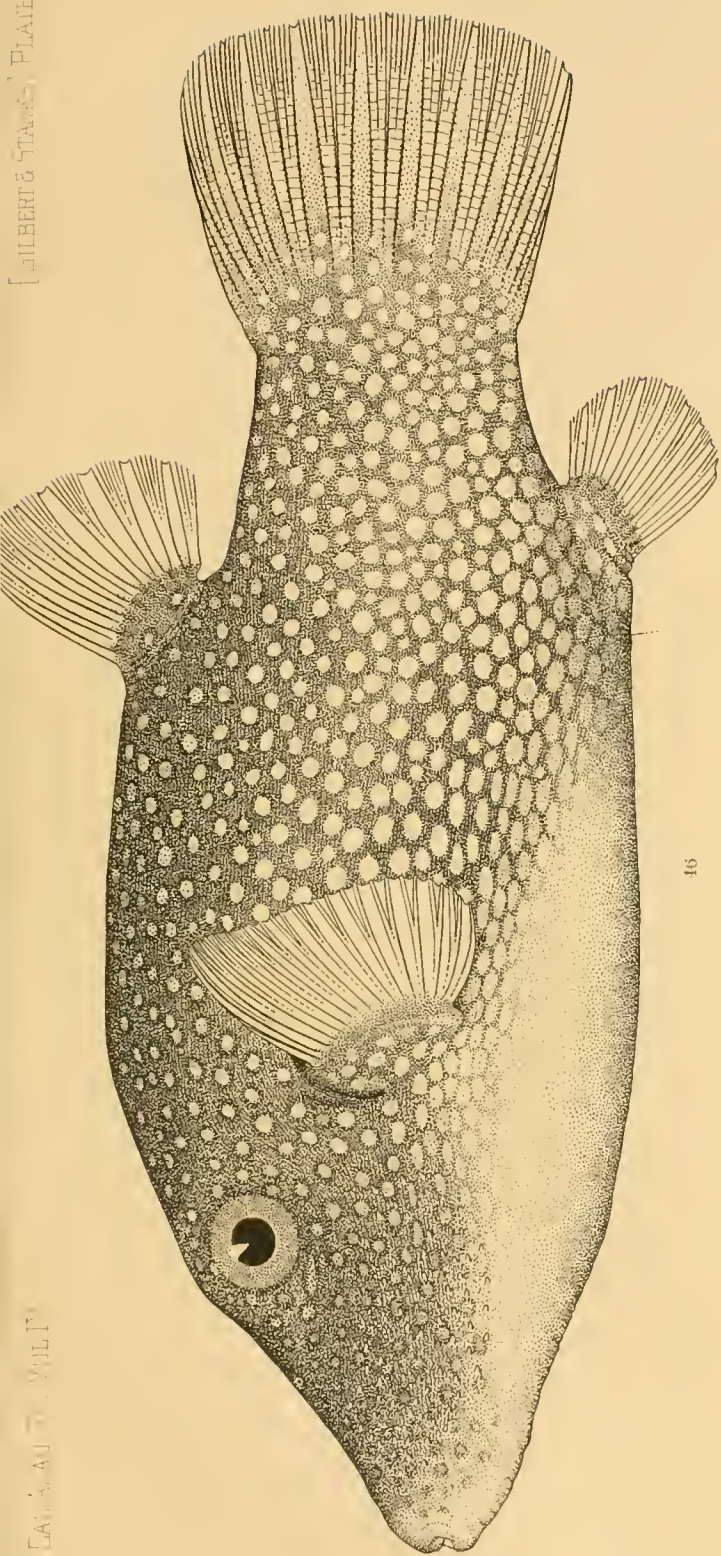




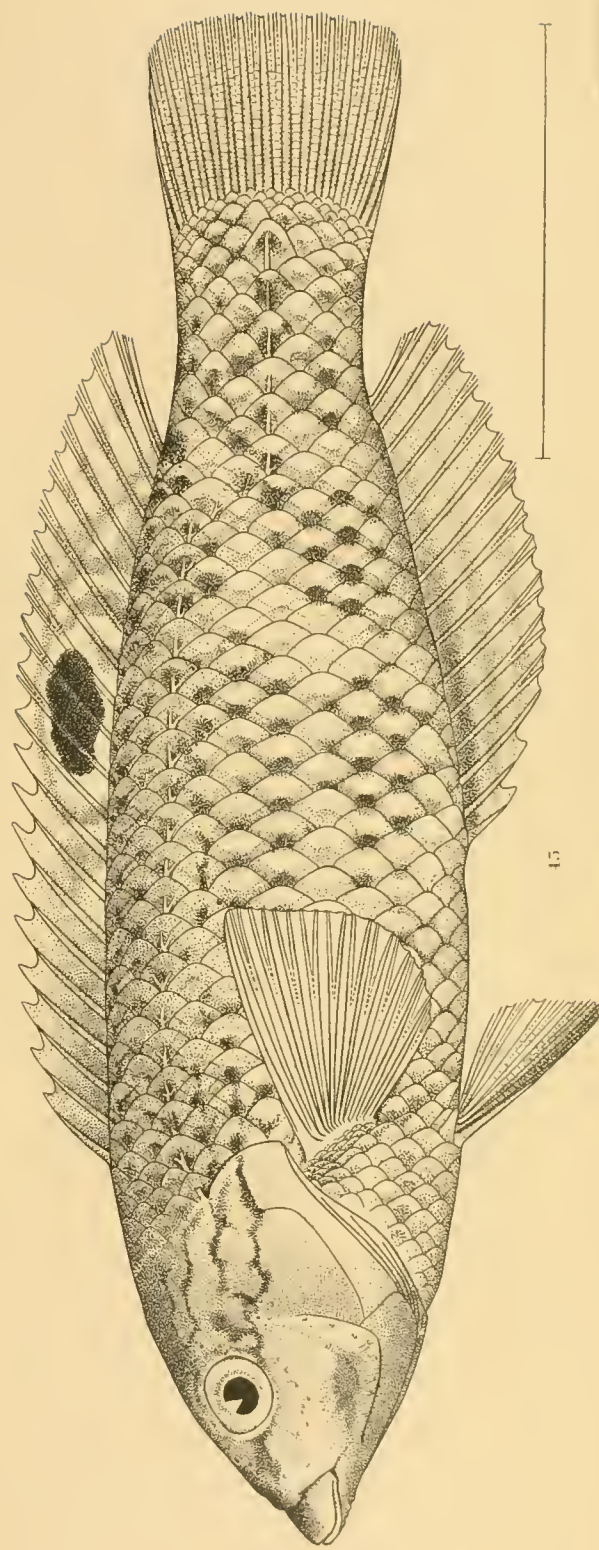


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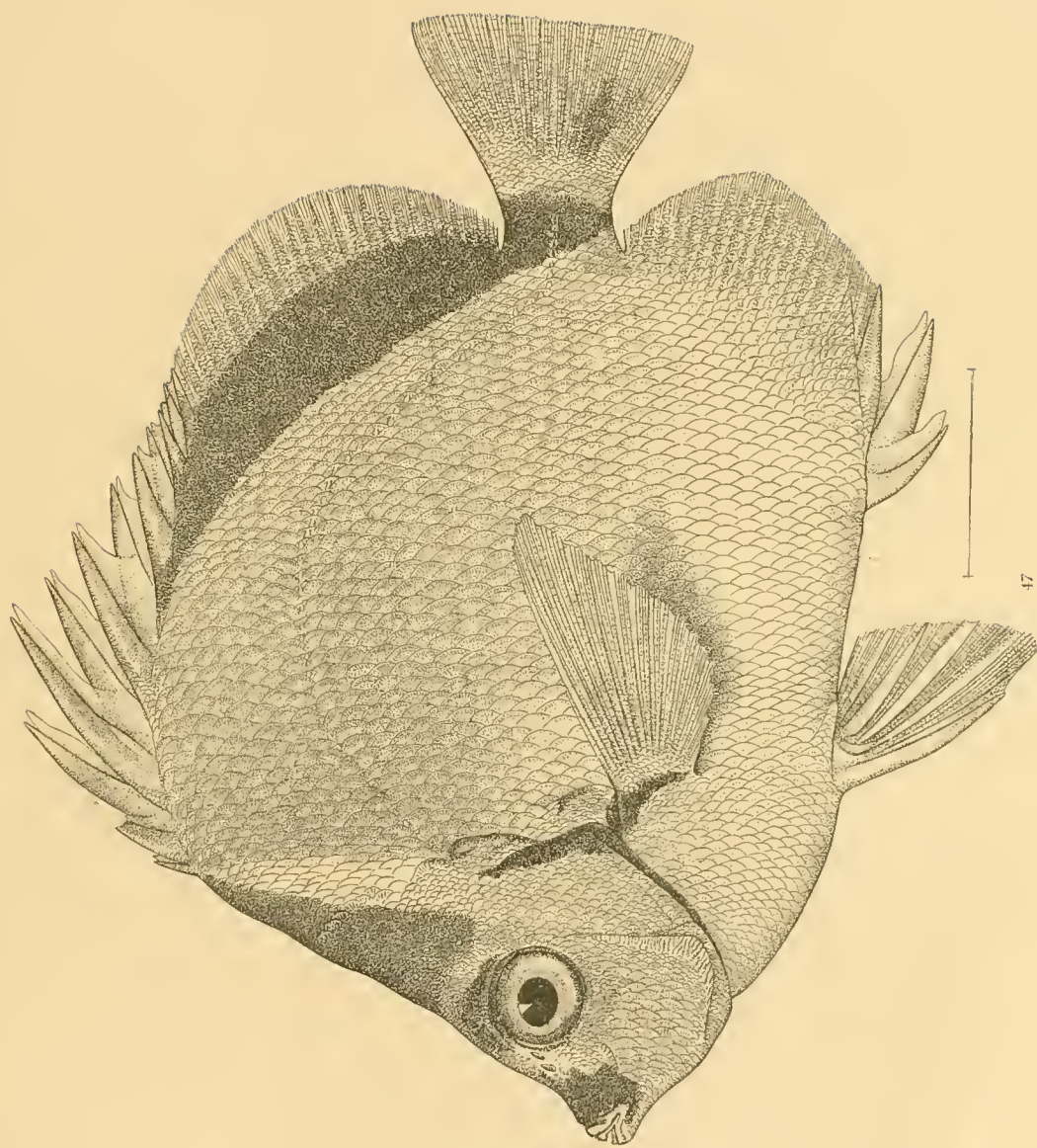




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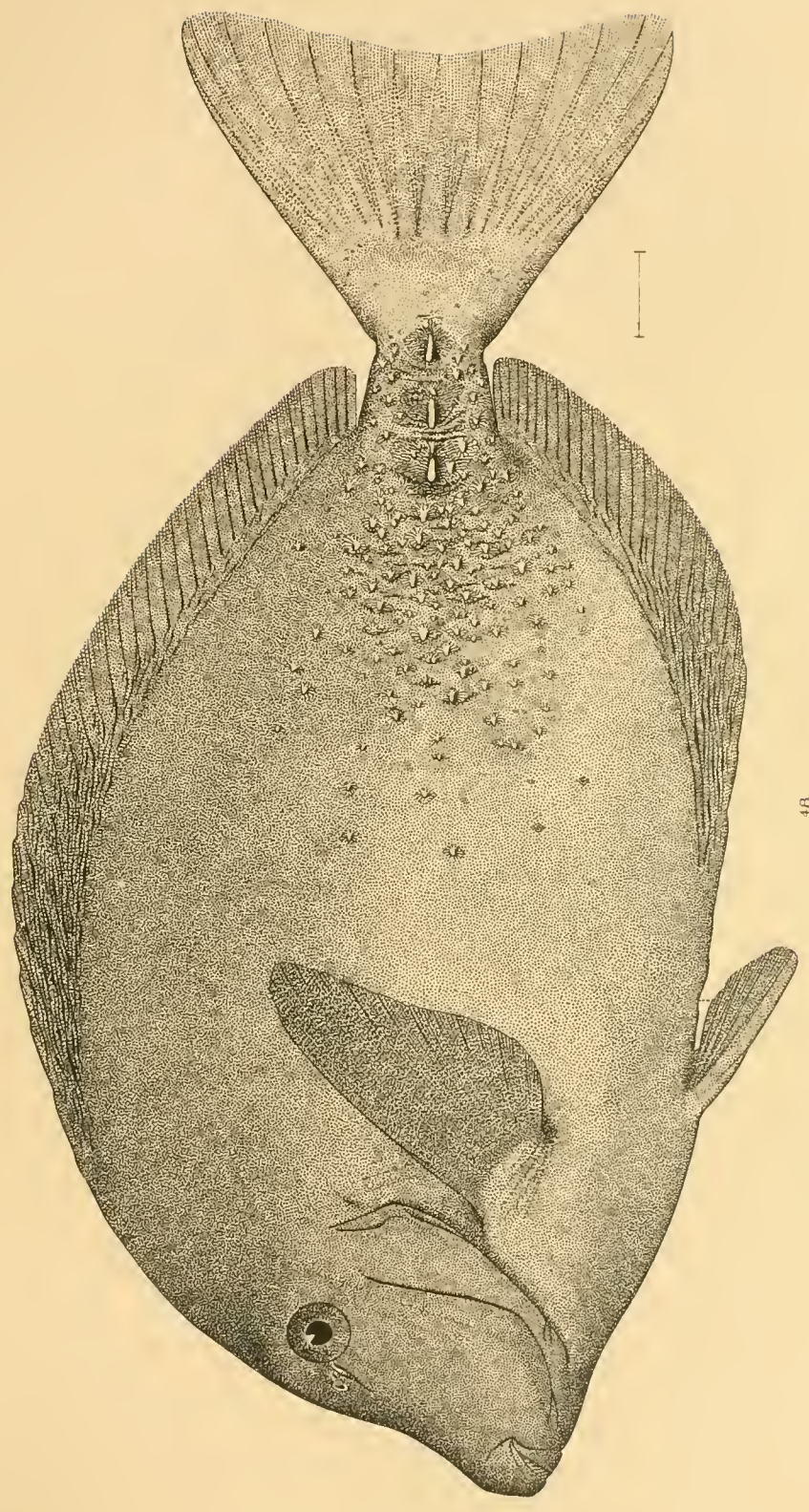




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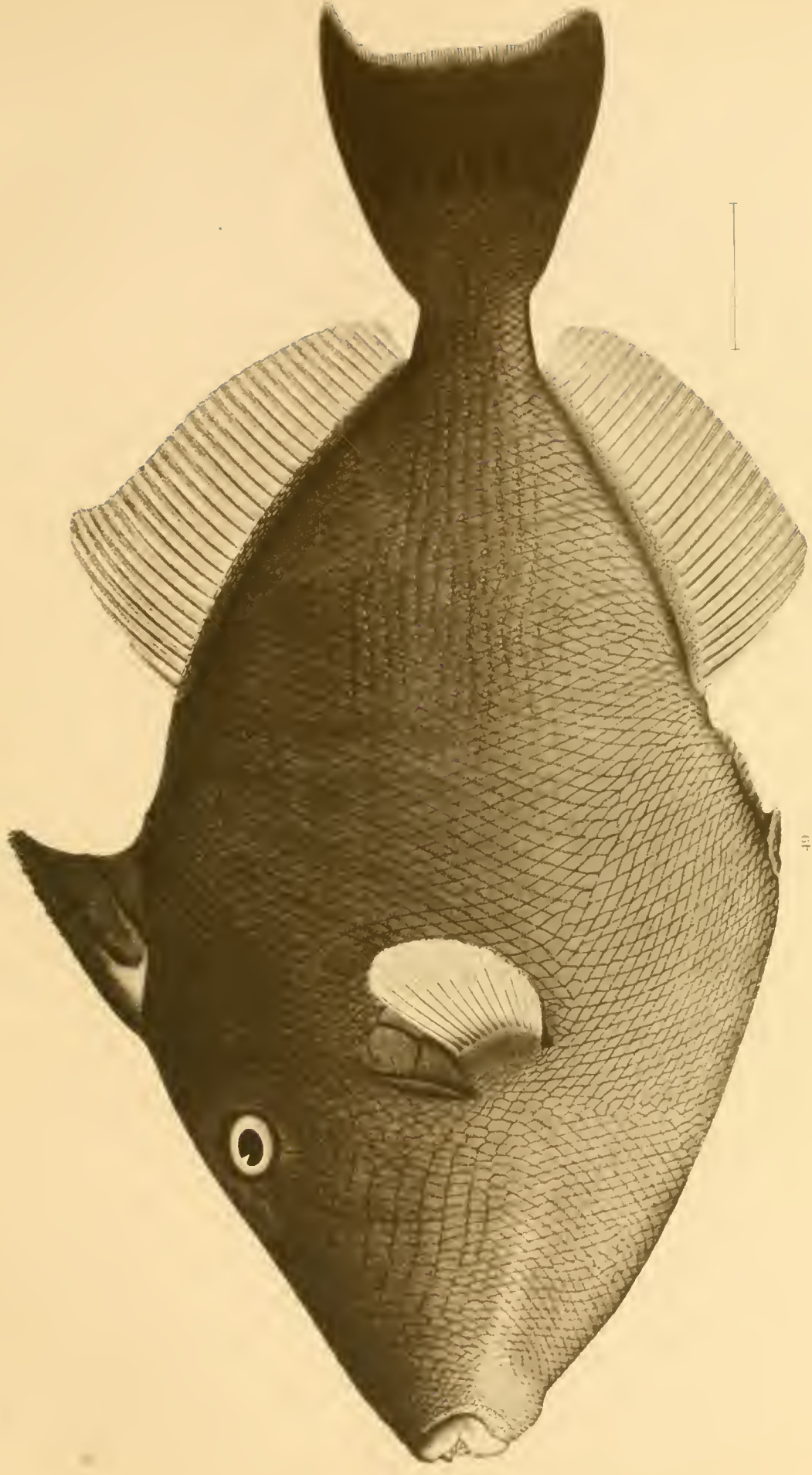




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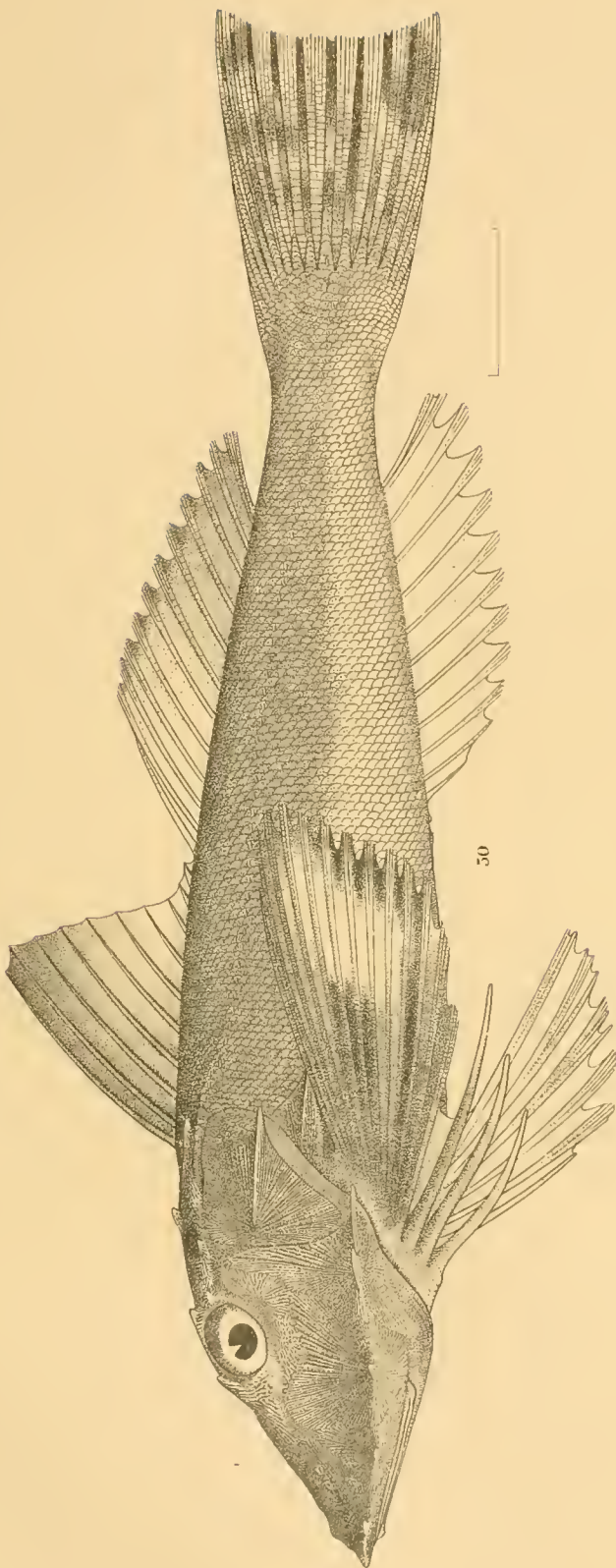


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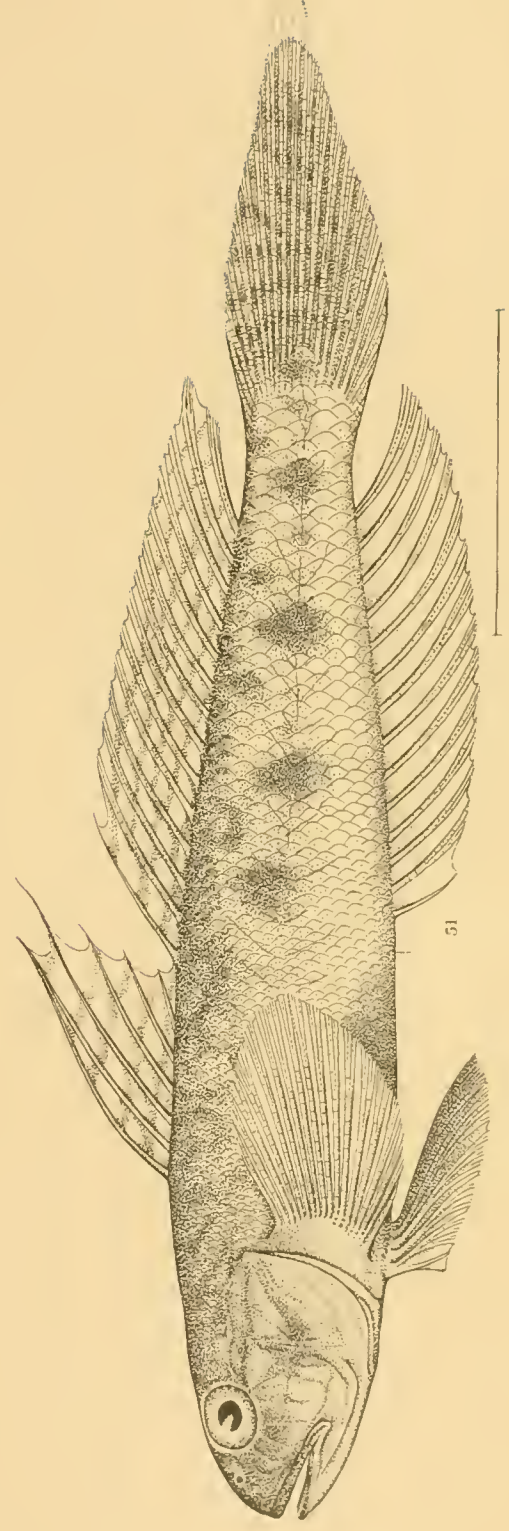
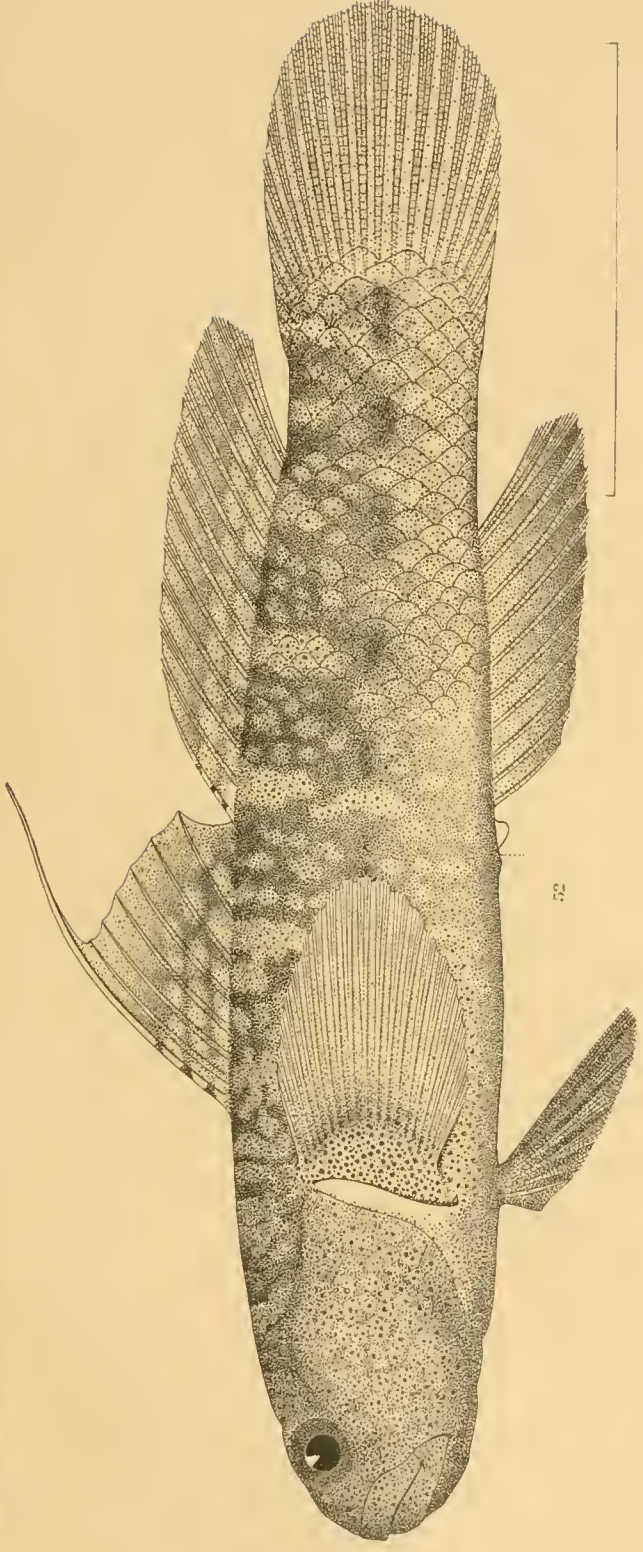






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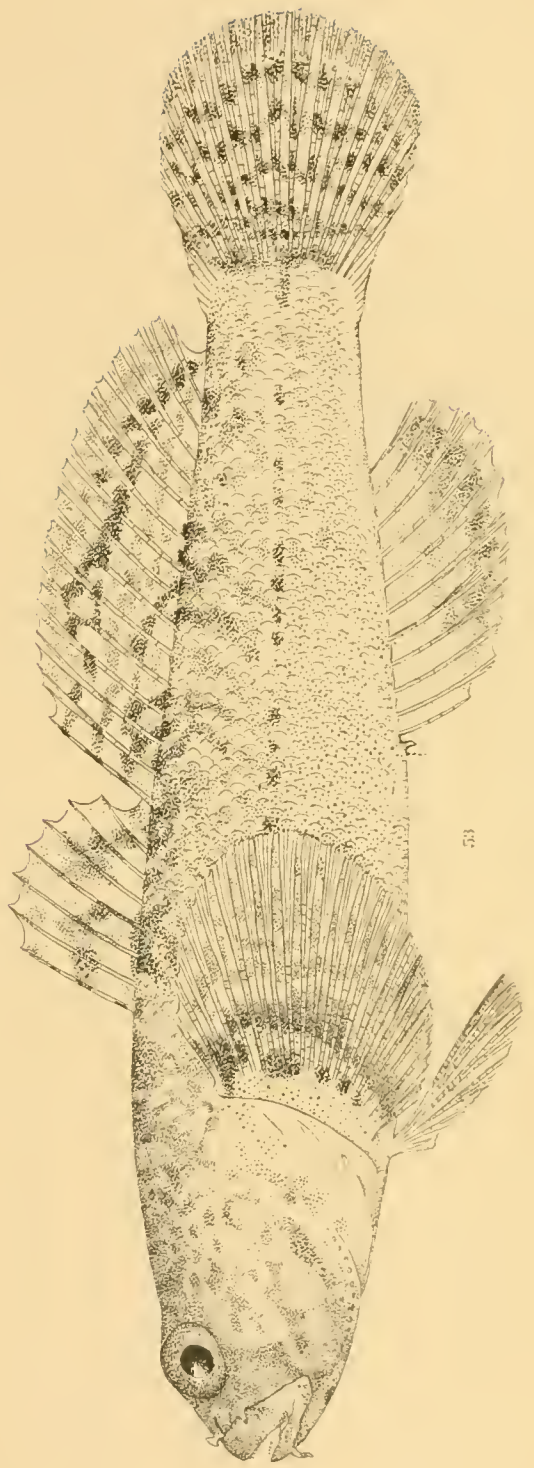
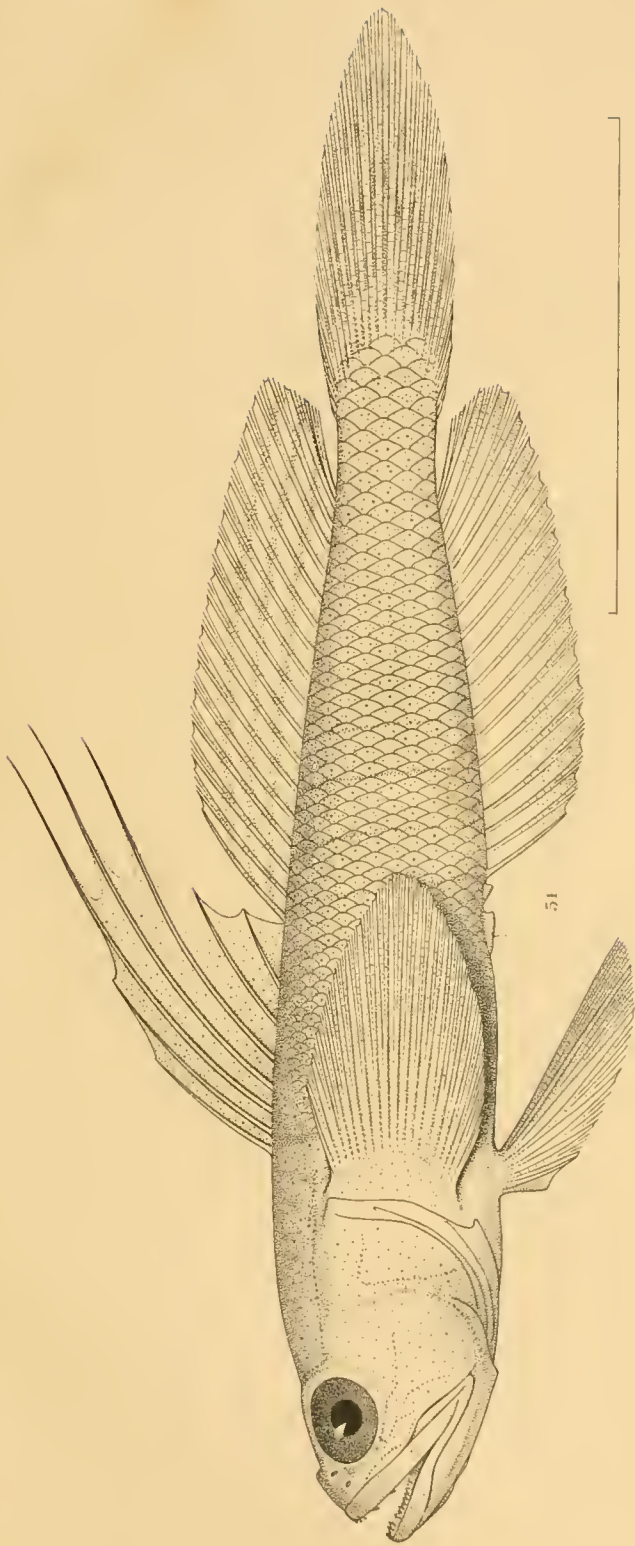






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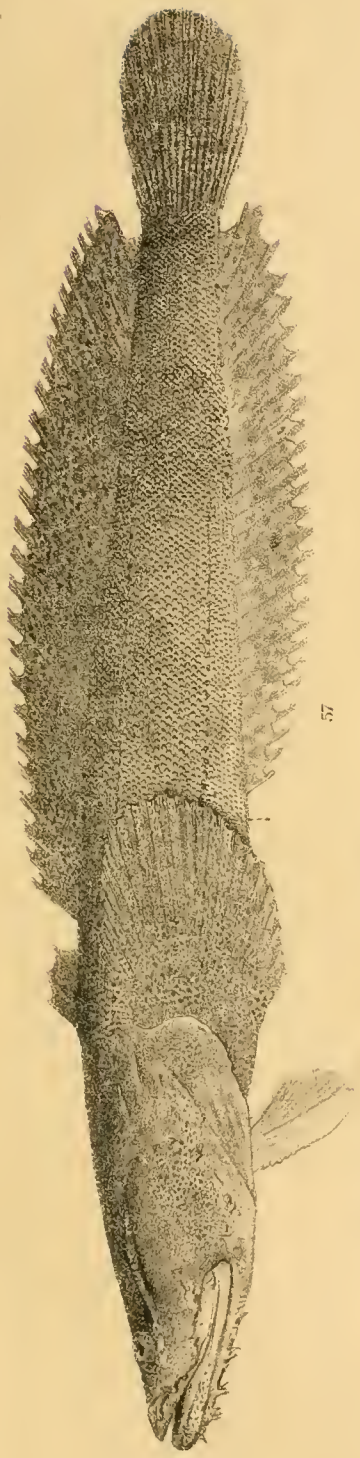




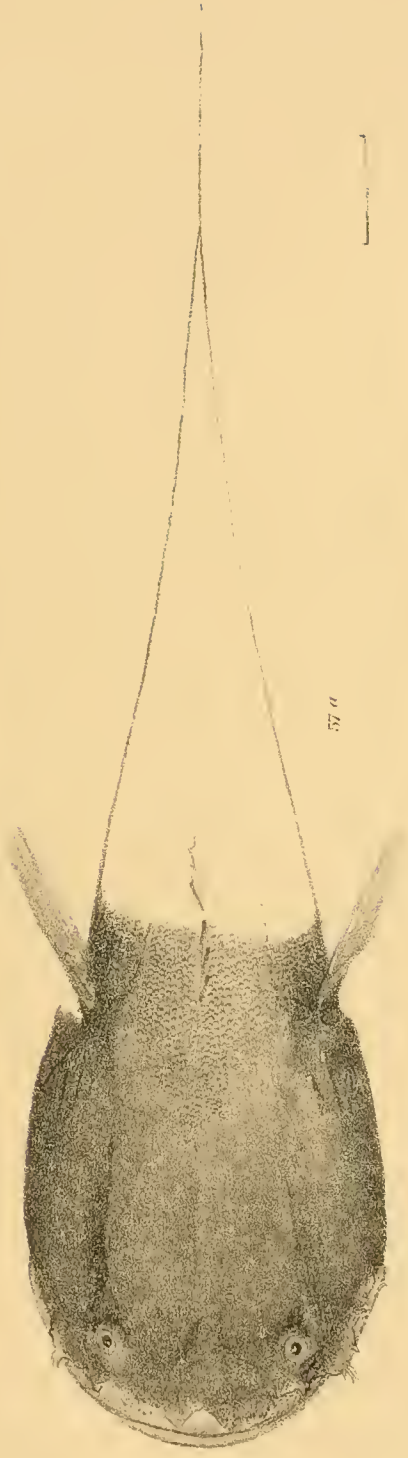


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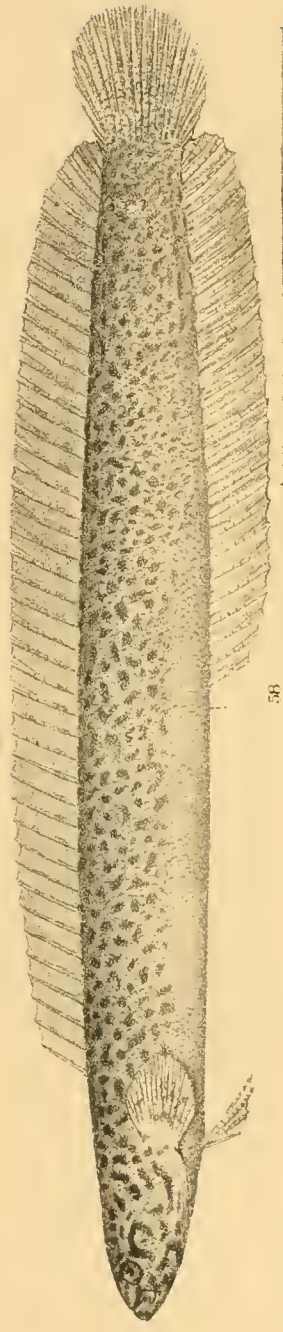
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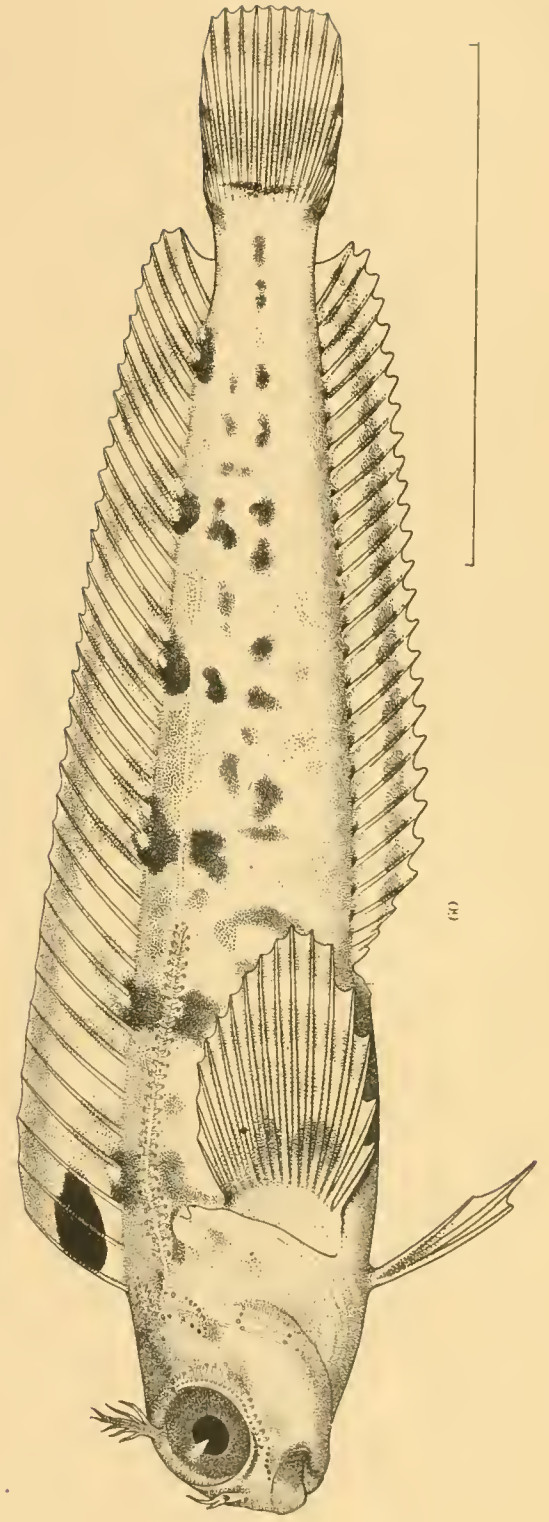
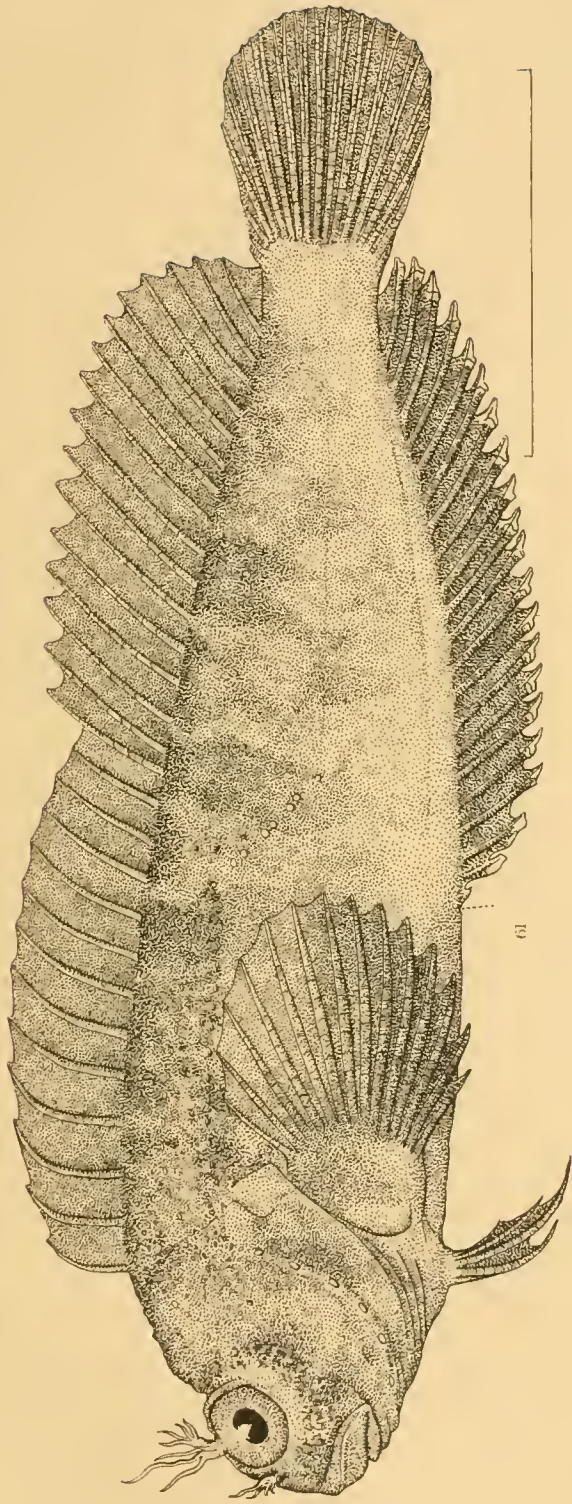




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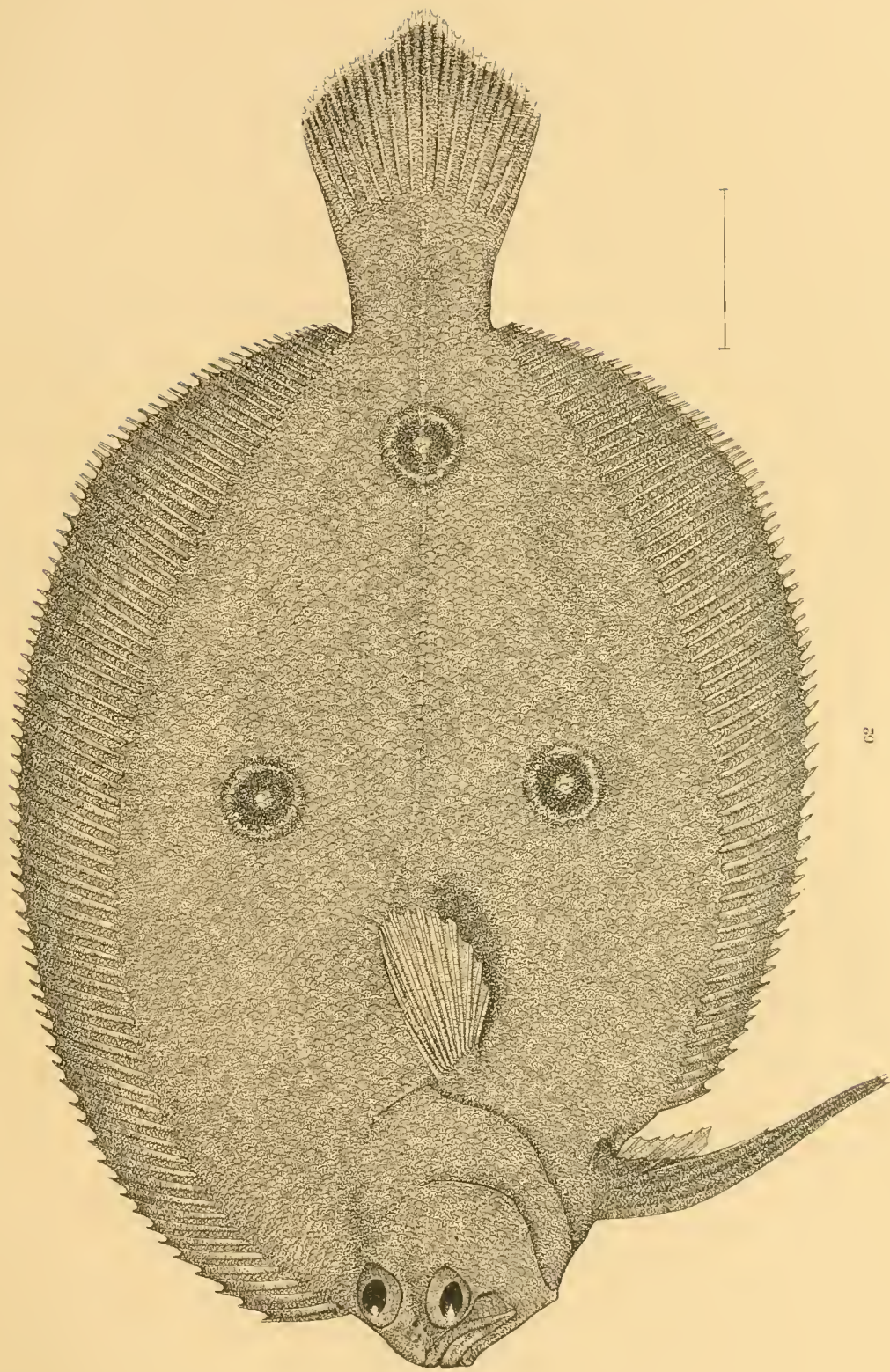


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## ERRATA.

- Page 5, 21st line, for "*Hemiramphus*" read *Hemirhamphus*.  
 Page 21, 10th line from bottom, for "*Fig. 7*" read *Fig. 8*.  
 Page 22, 17th line, for "*G. planiceps*" read *Netuma planiceps*.  
 Page 23, 2nd line, for "*G. platypogon*" read *Netuma platypogon*.  
 Page 24, 2nd line, for "*Fig. 8*" read *Fig. 7*.  
 Page 43, 7th line from bottom, for "*A. ischanus*" read *A. ischana*.  
 Page 74, 12th line from bottom, after "Jordan and Starks," insert Plate XII, Fig. 21.  
 Page 75, 14th line from bottom, for "*crumenophthalmus*" read *crumenophthalmus*.  
 Page 111, 20th line, for "*elongatus*" read *leuciscus*.  
 Page 128, 6th line, for "*Stelliferus*" read *Stellifer*.  
 Page 133, 21st and 22nd lines, for "*Menticirrus*" read *Menticirrhus*.  
 Page 134, 1st and 26th lines, for "*Menticirrus*" read *Menticirrhus*.  
 Page 135, 17th line, for "*Polyclemus fasciatus*" read *Polyclemus dumerili*.  
 Page 159, 4th line, for "*crethizon*" read *hispidus*.

Remove parentheses from names of authorities for the following species: *Mustelus lunulatus* (page 5), *Pristis zephyreus*, *Rhinobatus leucorhynchus* (page 14), *Zapteryx xyster*, *Raja equatorialis*, *Narcine entemedor*, *Discopyge ommata*, *Urolophus halleri* (page 15), *Urolophus goodci*, *Urolophus aspidurus* (page 16), *Pteroplata crebripunctata* (page 18), *Myliobatis asperrimus* (page 19), *Galeichthys peruvianus* (page 21).

Enclose in parentheses names of authorities for: *Galeus dorsalis* (page 7), *Scoliodon longurio* (page 12).

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