

XVIII. AN ANNOTATED CATALOG OF THE CICHLID  
FISHES COLLECTED BY THE EXPEDITION OF THE  
CARNEGIE MUSEUM TO CENTRAL SOUTH  
AMERICA, 1907-10.

BY JOHN D. HASEMAN.<sup>1</sup>

During the last three years I had opportunity to examine most of the cichlids herein recorded from the basin of the Amazon, and from the principal rivers south and east of that basin. Owing in part to the lack of sufficient material, many species in the past have been founded on trivial characters. After studying such carefully both in the field and in the laboratory, I have relegated several of them to synonymy. Seventy-nine species are here recognized, of which I myself collected sixty-six. Both Pellegrin<sup>2</sup> and Regan<sup>3</sup> have dealt in detail with the American *Cichlidæ*. I have accepted the conclusions of Regan, unless otherwise stated in the text.

My thanks are due to Dr. C. H. Eigenmann, the Curator of Ichthyology at the Carnegie Museum, for the use of the literature, which he placed at my command, and for many valuable suggestions; to Mr. Witmer Stone and Mr. R. W. Fowler for enabling me to examine some of the types of the *Cichlidæ* named by Cope and preserved in the Academy of Natural Sciences of Philadelphia; and to Dr. W. J. Holland, for the opportunity to prepare this paper and for his editorial revision of the manuscript.

The following list contains the description of eleven new species and four new varieties.<sup>4</sup>

<sup>1</sup> This is the fourth paper relating to the Expedition to Central South America published in these ANNALS.

<sup>2</sup> Contribution à l'Étude Anatomique, Biologique, et Taxonomique des Poissons de la Famille des Cichlides, *Memoires Société Zoologique France*, XVI, 1904, 41-402.

<sup>3</sup> *Annals and Magazine of Natural History* (7), XV, 1905, 329-347; XVI, 1905, 60-77, 225-243, 316-340; XVII, 1906, 49-66. *Proceedings of the Zoölogical Society of London*, 1905, i, 152-168.

<sup>4</sup> Mr. Haseman presents in the following pages a list of the specimens taken at each place, with their lengths, the date of collection, and notes setting forth the character of the specimens of each locality, when they differ from the generalized



## Family CICHLIDÆ.

## Genus CHÆTOBRANCHUS Heckel.

1. *C. flavescens* Heckel.

*Geophagus badiipinnis* Cope.

No specimens were taken on the expedition.

2. *C. semifasciatus* Steindachner.

No specimens were taken by me on my journeys.

## Genus CHÆTOBRANCHOPSIS Steindachner.

3. *C. orbicularis* Steindachner.

No. 2499,<sup>5</sup> 12 cm., Santarem, Dec. 8, 1909.

No. 2500, 10 cm., Belem, Pará. Jan. 22, 1910.

These specimens do not have spots on their sides. They are scarcely distinguishable from the following.

4. *C. australis* Eigenmann and Ward.

No. 2497*a-b*, 6 and 6.5 cm., Campos Alegre, Rio Jauru, June 4, 1909.

No. 2498, 2 cm., Puerto Suarez, Bolivia, May 6, 1909.

The latter specimen has no spots on the cheeks and the vertical fins are spotted.

## Genus CICHLA Bloch and Schneider.

5. *C. ocellaris* Bloch and Schneider.

No. 2502*a-b*, 12 and 16 cm., São Antonio de Guaporé, Rio Guaporé, July 23 and 26, 1909.

No. 2503, 14.5 cm., Santarem, Dec. 12, 1909.

This specimen has D. XVI, 17, and three typical bars.

No. 2504, 25 cm., Manaos, Nov. 17, 1909.

Has D. XVI, 16. No cross-bars, and only two dark spots representing obsolescent cross-bars near the anterior and posterior base of the dorsal fin. Some of the scales in the pectoral region have brown spots.

No. 2505, 19 cm., Manaos, Nov. 17, 1909.

Has spots on the sides.

No. 2506, 5 cm., Villa Bella, Rio Beni, Bolivia, Oct. 5, 1909.

type of each species. It is quite probable that a more critical study of this large amount of material may lead to conclusions at variance with some of those here expressed.—C. H. EIGENMANN, Curator of Fishes.

<sup>5</sup> The numbers preceding the record of length are the numbers given in the Catalog of Fishes of the Carnegie Museum.

*Cichla argus* Valenciennes is a synonym of *C. ocellaris* Bloch and Schneider. *Cichla neiderleini* and *C. chacoënsis* Holmberg (1891) are synonyms of some species of *Crenicichla*. The genus *Cichla* is not found in the basin of the Rio de la Plata.

6. **C. temensis** Humboldt.

No. 2507a-b: a, 19.5 cm.; b, 16 cm.; Manaos, Nov. 15 and 17, 1909.

The specimen numbered 2507b has A. II, 10; D. XV, 16, and no distinct bars on the sides.

Genus UARU Heckel.

7. **U. amphiacanthoides** Heckel.

No. 2507, 12 cm., Manaos, Nov. 16, 1909.

8. **U. imperialis** (Steindachner).

*Habitat*.—Amazon near Rio Negro.

No specimens were taken by the expedition of the Carnegie Museum.

Genus ACAROPSIS Steindachner.

9. **A. nassa** (Heckel).

Nos. 2508a-e, 2.5-10 cm., Bastos, Rio Alegre, June 26, 1909.

Nos. 2509a-b, 5 cm., São Antonio de Guaporé, Rio Guaporé, July 28 and Aug. 3, 1909.

Nos. 2510a-b, 10 cm., Santarem, Dec. 11, 1909.

Nos. 2511a-b, 12.5 cm., Manaos, Nov. 27 and 29, 1909.

Genus ASTRONOTUS Swainson.

10. **A. ocellatus** (Agassiz).

*A. hypostictus* Cope.

Nos. 2512a-c, 12-17.3 cm., São Antonio de Guaporé, July 23-Aug. 11, 1909.

Nos. 2513a-b, 13 and 19 cm., Campos Alegre, Rio Jauru, June 4, 1909.

Nos. 2514a-b, 12 and 13.5 cm., Manaos, Nov. 15, 1909.

One of these specimens has nineteen dorsal and fourteen anal rays, six rows of scales on the cheeks, and thirty-one scales in a row below the lateral line.

The native name applied by the Guarani to this species is "Carassu."

11. **A. ocellatus zebra** Pellegrin.

*Habitat*.—Santarem. No specimens were obtained.

12. **A. orbiculatus**, sp. nov. (Plate LIII.)



No. 2515, *type*, 14 cm., Santarem, Dec. 7, 1909.

No. 2516, *cotype*, 13 cm., same place and date.

D. XII, 22; A. III, 16; eye 4.16 in head, less than the length of the snout and one-half of interorbital space; depth 1.75 to 1.8 in length; six rows of scales on the cheeks; nares nearer the eyes than tip of snout; head 2.8 in length of body; dorsal spines subequal from the fifth, which is slightly more than one-third the length of the head; scales 7-33-16; pores  $\frac{20-21}{13-15}$ ; caudal peduncle one-half as long as deep. Both the specimens on the posterior edge of the operculum have a fringe, which is orange in life and white in spirits, and the fringe has two rows of dark spots in it; there is a similar but smaller blotch above the base of the pectoral; four irregular black bands on the sides, one of which in one of the specimens is broken and forms a large black blotch in the region of the reflexed tip of the pectoral fin; both have dark spots under the pectoral fin near the origin of the same, and there are large ocellated caudal spots. The lateral bands are broader and fewer and hence there is less orange pigment between the bands than in *A. ocellatus*. The depth of *A. ocellatus* is two or more (more in all of my specimens), while in this species it is not more than 1.8.

Genus *ÆQUIDENS* Eigenmann and Bray.

13. ***A. tetramerus*** (Heckel).

Nos. 2517*a-c*, 5-6 cm., San Antonio de Guaporé, Rio Guaporé, July 31 and Aug. 3, 1909.

No. 2518, 4 cm., Bastos, Rio Alegre de Guaporé, June 26, 1909.

Of these four specimens, two most closely resemble typical *A. tetramerus*, one in some details resembles *A. guaporensis*, and No. 2518, which comes from the headwaters of the Guaporé, is very much like *A. paraguayensis*, and perhaps should be associated with that species, even though the caudal peduncle is slightly longer. As a rule, *A. tetramerus* grows to be larger than *A. paraguayensis*. No. 2519, 10 cm., Bragança, Pará, in a creek near salt water, Dec. 29, 1909.

No. 2520, 13.5 cm., Santarem, Dec. 11, 1909.

No. 2521, 14 cm., Manaus, Nov. 27, 1909.

No. 2522*a-b*, 4.8 and 9 cm., Corrego de Boa Ventura, headwaters of Rio Alegre, June 16, 1909.

No. 2523, 8.5 cm., San Joaquin, Bolivia, Sept. 4, 1909.



Nos. 2521-2523 do not have two entire rows of scales between the lateral line and the base of the first dorsal rays.

No. 2524, 12.3 cm., Manaos, Nov. 15, 1909.

D. XV, 9; A. III, 8; 3.5-27-8; depth 2.33; head 2.8; eye 3.5; four rows of scales on the cheeks; folds of the lower lips interrupted; six gill-rakers on lower anterior arch; interorbital space 2.75 in head; preorbital width equal to the diameter of the eye; dorsal and anal fins scaleless; dorsal spines subequal from the fourth, the last one of which is not quite one-half the length of the head; the pectoral fin as long as the head; snout a little longer than the postorbital portion of the head; no distinct bands, bars, or spots, excepting a few spots in the soft dorsal. There is a remarkable difference between specimens from different localities, but intermediate stages exist in the same rivers. There are so many intermediate forms that it appears to a collector that each genus consists of but one variable species. This species was not found in the La Plata basin.

14. **A. centralis** (Holmberg). Reported from Santiago de Estero.

No specimens were obtained by the Expedition of the Carnegie Museum.

15. **A. portalegrensis** (Hensel).

? *Heros centralis* Holmberg.

No. 2545*a-i*, 8-9 cm., Puerto Suarez, Bolivia, May 6-7, 1909.

One specimen has twelve dorsal rays.

No. 2546*a-b*, 3-8 cm., Arequa, Paraguay, Lake Ipacary, April 8, 1909.

No cross-bars; brown lines composed of spots along the rows of scales below the lateral line.

No. 2547, 9 cm., Sapucay, Paraguay, April 2, 1909.

No. 2548, 4.5 cm., Uruguayana, Rio Uruguay, Feb. 7, 1909.

No. 2549*a-b*, 5 and 7 cm., Sapucay, Paraguay, April 5, 1909.

No. 2550, 9.6 cm., Corrego de Boa Ventura of Rio Barbados, June 16, 1909.

Depth 1.75; the maxillaries not quite extending to the eyes.

No. 993, 6 cm., Puerto Suarez, Bolivia. (Steinbach Coll.)

No. 2552*a-e*, 1.7 to 7.3 cm., Cacequy, Rio Grande do Sul, Jan. 31 and Feb. 1, 1909.

The smaller specimens have only one row of scales on the soft dorsal, and the depth is contained 2.16 times in the length.

No. 2553*a-b*, 1.5-3 cm, Villa Hays, Paraguay, April 11-13, 1909.

No. 2554, 4.5 cm., Campos Alegre, Rio Jauru, June 3, 1909.

Depth is 1.84 of length.





No. 2555a-b, 6.5 and 7.1 cm., São Francisco, Bolivia, Paraguay basin, June 10, 1905.

Depth is respectively 1.84 and 2.16 in the length.

No. 2556a-b, 5.8 and 6.2 cm., Porto Alegre, Rio Grande do Sul, Jan. 19, 1909.

These specimens are identical with the specimens having three anal spines taken in the Rio São Francisco, which I identify as *Cichlasoma bimaculatum*. They were rare and were taken along with the common forms having four anal spines. *Cichlasoma bimaculatum* is the northern form, and as a rule has four anal spines, while *Æquidens portalegrensis* is the southern form and as a rule has three anal spines. I collected only one specimen with four anal spines in the La Plata basin, and I feel sure that it is an aberrant individual of the three-spined form. The only known specimen of *Acara guianensis* (Regan) similarly has but three anal spines. It should be associated with *C. bimaculatum*. Unless I am mistaken in these observations there would seem to be no line of demarcation between the genera *Cichlasoma* and *Æquidens*.

No. 2557a-f, São Luiz de Cáceres, Alto Rio Paraguay, May 24, 1909.

All of these specimens have depths less than 2 in the length.

One has four anal spines, but inasmuch as they were all of the same size and taken at one haul of the net, I feel sure that the four-spined specimen is simply an aberrant form.

No. 2558a-c, 5.5 to 6.5 cm., Salto das Cruzes, Rio Tieté, Sept. 22, 1908.

Two of these specimens have no caudal spots.

No. 2559, 8 cm., San Joaquin, Bolivia (Marmoré basin), Sept. 4, 1909.

No. 2560a-e, 1.6 to 6 cm., Corumba, Rio Paraguay, April 27, 1909.

No. 2561, 2 cm., Urucum Mts., near Corumba, May 2, 1909.

No. 2562, 3 cm., Uruguayana, Rio Uruguay.

This specimen, as well as some others, has the soft dorsal very faintly scaled. This fact, together with some erroneous cases of classification (for instance, the *Æquidens tetramerus* of Eigenmann [*Annals Carnegie Museum*, IV, 1907, 144] has scaled vertical fins, and is thus *Æquidens portalegrensis*), has extended the range of *A. vittata* and *A. tetramerus*, neither of which has been taken in the La Plata basin.

No. 2563, 2.5 cm., Puerto Suarez, Bolivia, May 7, 1909.

The basal halves of soft dorsal and anal, and the entire spinous



dorsal and anal black; only a few spots in the tip of the soft dorsal; head 2.5; depth 1.84; no white line from eye to snout; less than twenty-four scales in median lateral series.

I am inclined to think that *Heros centralis* Holmberg is a synonym of this species.

16. ***A. vittatus*** (Heckel).

*A. syspilus* Cope.

No. 2525a-b, 1.6 cm., Manaus, Nov. 30, 1909.

This species was not found in either the Guaporé or Paraguay basins.

I have examined the type of *Acara syspilus* (Cope). It is a synonym of *A. vittatus*.

17. ***A. guaporensis***, sp. nov. (Plate LIV.)

No. 2575, type, 5.4 cm., São Antonio de Guaporé, July 9, 1909.

Length to base of caudal 5.4 cm., greatest depth 2.8 cm.; length of head 2 cm.; preorbital width .45 cm.; diameter of eye 8 cm.; length of snout .8 cm.; interorbital space .8; A. III, 7; D. XV, 9; scales 3.5-25-9; pores  $\frac{11-14}{9}$ ; six or seven gill-rakers on the lower anterior arch; maxillaries extending to front margins of eyes; fold of the lower lip continuous; cheeks with three rows of scales; preoperculum scaleless; 1.5 scales between the lateral line and first dorsal rays; dorsal spines subequal from the fourth, which is one-half as long as the head; dorsal and anal rays extending to middle of caudal; pectoral fin 1.2 times the length of the head; ventral fins extending beyond the origin of anal; caudal fin round; caudal peduncle two-thirds as long as deep; fins all scaleless excepting the base of caudal; greatly arched from head to origin of dorsal; the dorsal posterior half of body much compressed; seven cross-bands, the third of which has a black spot between the eighth to twelfth pore of the lateral line; a small dark spot on the upper edge of base of caudal; fins spotless, but the edges of dorsal and anal very black; no spot or bar beneath the eyes.

This species appears to be intermediate between *A. tetramerus* and *A. paraguayensis* both in structure and habitat. *A. paraguayensis* is the southern form and is not found as far north as the Madeira basin. *A. tetramerus* ranges to the north and is not found in the Paraguay river.

18. ***A. awani***, sp. nov. (Plate LV.)

No. 2576, type, 14.5 cm., São Antonio de Guaporé, Rio Guaporé, July 31, 1909.



No. 2577, *cotype*, 13 cm., São Antonio de Guaporé, Rio Guaporé, July 23, 1909.

D. XV, 10; A. III, 8;  $\frac{16-17}{8-9}$ ; scales 3.5-24 to 26-9; depth almost 2; maxillaries not extending to the anterior margins of the eyes; diameter of eye 3.5 in head, almost 2 in the interorbital space, and equal to the preorbital width; snout one-half as long as the head, and distinctly longer than the postorbital portion of the head; preoperculum scaleless; four rows of scales on the cheeks; caudal peduncle two-thirds as long as deep; one and a half scales between the lateral line and the first dorsal rays; six gill-rakers on the lower anterior arch; pectoral fin one and a third times the length of the head; caudal scaled almost to its tip, but other fins scaleless; dorsal spines increasing until the last, which is more than one-half the length of the head; caudal round; a faint lateral band and seven cross-bars with a large dark spot on the third one; a dark spot on the upper edge of the base of caudal; fins dusky but spotless; no spot or bar beneath the eyes; fold of the lower lip not continuous. This species has a broader interorbital, longer dorsal spines, longer pectoral fins, thicker body, fewer scales between the lateral line and first dorsal rays, different coloration, and a greater depth than the same-sized *A. tetramerus*, its nearest ally.

I have dedicated this species to Awan, a Pawumwa Indian, who made his first acquaintance with a white man when aiding me with a seine in the Guaporé river. His name is the name of the vine from which they make the poison for their arrows.

19. ***A. dorsigera*** (Heckel).

*A. frenifera* Cope, *A. flavilabrus* Cope, *A. thayeri* (Steindachner).  
No. 2564*a-b*, 2 and 3.5 cm., Corumba, Rio Paraguay, April 27, 1909.  
No. 2565*a-f*, 2.5 to 3.3 cm., Puerto Suarez, Bolivia, May 7, 1909.  
No. 2566*a-c*, 2.4 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

No. 2567, 2.5 cm., San Joaquin, Bolivia, Sept. 4, 1909.

No. 2568, 2.5 cm., Rio Alegre, Aug. 3, 1909.

A. III, 7.

No. 2569, 3.5 cm., São Antonio de Guaporé, Rio Guaporé, Aug. 3, 1909.

Eye 3 in the head; a spot on the sides of the body below the sixth to tenth scale of the lateral line; twenty-two scales in a series below the lateral line; D. XV, 8; A. III, 8.



No. 2570, 3 cm., São Antonio de Guaporé, Aug. 11, 1909.

No dorsal spot.

No. 2571, 2 cm., Posada, Campos de Matto Grosso, June 21, 1909.

No dorsal spot.

No. 2572a-d, 2.7 to 3.5 cm., San Joaquin, Bolivia, Sept. 4, 1909.

Scales 2.5 to 3-23-8 or 9; gill-rakers five or six; depth 2; D. XV to XIV, 7; A. III, 7. These specimens are slightly deeper and have no spot on the dorsal spine, but in these characters there are complete series of intergradations between the extremes or end variations. Some have slightly scaly soft dorsals, and this varies with size. Cope's figure and description of *A. flavilabrus* is exactly like my specimens from San Joaquin, excepting that it has one more dorsal spine. *A. frenifera* is said to have more scales in the lateral line, but inasmuch as my specimens vary from twenty-two to twenty-six, it is also within the limits of the variation of *A. dorsigera*. *A. thayeri* is said to have a scaly dorsal, but some of my small ones are also slightly scaly. In other details all of the species are identical and I do not hesitate in considering them as synonyms of *A. dorsigera*. I found only one of Cope's many specimens to belong to this species. The remainder are *Cichlasoma bimaculatum*.

20. **A. paraguayensis** Eigenmann and Kennedy.

No. 2526, 5 cm., Campos Alegre, Rio Jauru, June 2, 1909.

No. 2527a-d, 7 and 8 cm., Sapucay, Paraguay, April 2 and 5, 1909.

No. 2528a-d, Bastos, June 29, 1909.

No. 2629a-b, 3.5 to 6 cm., Arequa, Paraguay, Lake Ipacary, April 18, 1909.

No. 2530, 5 cm., Soã Francisco, Bolivia (Paraguay basin), June 10, 1909.

No. 2531a-g, 2 to 5 cm., Villa Hays, Paraguay, April 11 and 13, 1909.

No. 2532a-b, 4 to 4.5 cm., Asuncion, Paraguay, March 28, 1909.

No. 2533a-e, 1.5 to 3 cm., Corumba, Rio Paraguay, April 27, 1909.

No. 2534a-k, 1-3 cm., Puerto Suarez, Bolivia, May 6 and 7, 1909.

No. 2535a-k, Posada, in Campos de Matto Grosso, June 29, 1909.

No. 2536, 4.3 cm., São Luiz de Cáceres, Rio Paraguay, May 26, 1909.

No. 2537, 4 cm., Santa Rita, Rio Santa Rita, June 12, 1909.

No. 2538a-b, 5 and 7 cm., San Joaquin, Bolivia, Sept. 5, 1909.

No. 2539a-m, 3 to 7 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

No. 999, 3 cm., Puerto Suarez, Bolivia (Steinbach Coll.).



No. 2541, 1.6 cm., Asuncion, Paraguay, March 29, 1909.

In several of these specimens the snout is as long as the post-orbital portion of the head; pectorals 1.16 times the length of the head; depth 2.16 to 2.33; D. XIV, 8 to 10; A. III, 6 to 8; scales 3-22 to 24-7 or 8; pores  $\frac{15}{8}$ ; head 2.66; eye 3; five gill-rakers on the lower anterior arch.

21. **A. flavescens** (Cope).

*Habitat*.—Ambiacu. No specimens were obtained.

22. **A. subocularis** (Cope).

No. 2542a-b, 6.5 and 7.8 cm., Manaos, Nov. 29, 1909.

No. 2543, 11 cm., Manaos, Nov. 27, 1909.

This specimen has prolonged dorsal and anal rays, which extend beyond the tip of the caudal. Vertical fins more or less white-spotted. No. 2544a-c, 1.3 to 3 cm., Manaos, Nov. 29, 1909.

In some cases the fold of the lower lip is slightly interrupted. This character has little value in any of the cichlids examined. There are complete series of all the stages from a free to an interrupted fold in the same locality amongst specimens of the same size. The snout of the smaller is two-fifths the length of the head. The larger specimens agree with Regan's description.

23. **A. zamorensis** (Regan).

*Habitat*.—Ecuadorian Amazonia. No specimens were obtained.

24. **A. duopunctata**, sp. nov. (Plate LVI.)

No. 2573, *type*, 9.5 cm., Manaos, Nov. 29, 1909.

No. 2574, *cotype*, 7.5 cm., Manaos, Nov. 29, 1909.

D. XV, 9 to 11; A. III, 7; scales 3-26-9; pores 9-10; depth 2.25 to 2.33; head about 3; eye 3 in head; less than preorbital, and equal to the interorbital in the smaller, and less than the interorbital space in the larger specimen; three rows of scales on the cheeks; two rows of scales between the lateral line and the first dorsal rays; caudal peduncle seven-eighths as long as deep; pectoral fin distinctly longer than the head; snout as long as the postorbital portion of the head; maxillaries not quite extending to the vertical from anterior margin of eye; fold of lips not continuous; preoperculum scaleless; dorsal and anal fins scaleless; six gill-rakers on the lower anterior arch; the fourth dorsal spine a little more than one-third the length of the head, and the last dorsal spine fully one-half the length of the same; the dorsal spines almost subequal from the fifth; dorsal and anal rays extending beyond



the middle of the caudal, and ventrals reaching to the origin of anal; an indistinct lateral band passing the base of a large black spot on the lateral line beneath the last dorsal spines; some white to blue scales in and in front of a spot on the upper half of base of caudal; fins dusky, but not distinctly spotted; a white streak or band between the lateral line and lateral band, both in front of and behind the lateral spot; three or four bluish lines in front of the eyes, and about three lines of bluish spots on the cheeks, and some blue spots on the operculum.

This species appears to be more like *A. sapayensis* (which was considered by Pellegrin to be *A. rivulata*) than *A. zamorensis*, the only blue-spotted *Æquidens* so far reported from the basin of the Amazon, but blue spots are not specific characters. *Geophagus brasiliensis* and *G. gymnogenys* show all stages in the development of blue markings in the same locality. If the distinction drawn by Regan is of specific importance then my specimens represent good species, but I am inclined to believe that when more material is collected intermediate forms will be taken, and *Æquidens sapayensis*, *zamorensis*, and *duo-punctata* will prove to be synonyms of *A. rivulata*. I have not seen any of the other species, and as I obtained only two specimens, this species may stand for the present.

#### Genus CICHLASOMA Swainson.

##### 25. *C. bimaculatum* (Linnæus).

No. 2578, 10 cm., Manaos, Nov. 27, 1909.

No. 2579a-b, 5 and 9.5 cm., Prazeres, Rio Sapon, Bahia, Feb. 11, 1908.

Only one row of scales between the lateral line and the first dorsal rays; all fins spotless and uniformly dark brown.

No. 2580a-g, 4.5 to 9.5 cm., Barreiras, Rio Grande, Bahia, Jan. 4, 1908.

Only the smallest one has spots on the vertical fins.

No. 2581a-o, 3 to 6.5 cm., Lagoa do Porto, Cidade da Barra, Bahia, Dec. 24, 1907.

No. 2582, 8 cm., Rio Paqui, Bahia, Nov. 14, 1907.

Dark brown pigment under the scales along the sides. Some of the Bahian examples have white spots on the scales of the sides.

No. 2583, 9 cm., Rio do Sonno, Goyaz, Feb. 1, 1908.

D. XV, 10; A. III, 9; scales 3-25-8; depth 2; head 3; pores 7; fins spotless and uniformly dark brown; coloration of the body that of typical specimens, from which it differs in having only three anal spines, spotless fins, and only one row of scales between the lateral line and the first dorsal rays.



No. 2584, 4.5 cm., Penedo, Rio São Francisco, March 22, 1908.

No. 2585a-b, 4 and 4.5 cm., Santarem, Dec. 9, 1909.

These specimens have a larger eye, rounder body, ocellated caudal spot, black lines along the rows of scales of sides, no distinct cross-bar, eye greater than the snout and equal to the interorbital space; the vertical fins are well scaled on their basal halves, in contrast to the Penedo specimen, which has a much more slender body, smaller eye, and eight distinct cross-bars on the sides. One of the Santarem specimens has five anal spines. I have not described the Penedo specimen as new, because all of the intermediate stages are found in the Rio São Francisco.

No. 2586a-h, 4 cm., Cidade da Barra, Lagoa Pereira, Dec. 23, 1907.

No. 2587, 5 cm., Alagoinhas, Rio Catu, Bahia, March 4, 1908.

No. 2588a-d, 5.5 to 6 cm., Joazeiro, Rio São Francisco, Nov. 28, 1907.

No. 2589a-d, 3.5 to 5 cm., Propria, Rio São Francisco, below the falls, March 30, 1908.

One has only three anal spines and twenty-three scales in the first series below the lateral line.

No. 2590a-m, 2.5 to 6.5 cm., Lagoa Salgado, Rio Salitre, Bahia, Nov. 10, 1907.

I cannot distinguish this species from *A. portalegrensis*, except for its having as a rule four anal spines. One spine more or less does not always have either generic or specific significance.

26. **C. festivum** (Heckel).

No. 2591a-h, 2.5 to 6 cm., Campos Alegre, Rio Jauru, June 2, 1909.

No. 2592a-g, 2 to 7 cm., Bastos, Rio Alegre of Guaporé, June 26, 1909.

No. 2593a-b, 4 and 4.5 cm., Santarem, Dec. 9, 1909.

No. 2594a-d, 3 to 4.5 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

No. 2595a-e, 2.8 to 5 cm., São Antonio de Guaporé, July 30-Aug. 10, 1909.

No. 2596, 5 cm., Santarem, Dec. 15, 1909.

No. 2597, 7 cm., Manaus, Nov. 29, 1909.

No. 2598, 4.5 cm., San Joaquin, Bolivia, Sept. 4, 1909, in a lake.

No. 2599a-e, 2.8 to 4 cm., São Luiz de Cáceres, Rio Paraguay, May 23-27, 1909.

27. **C. facetum** (Jenyns). (Plate LVII.)

*C. autochthon* Günther, *C. oblongum* Castelnau.

The following specimens have the fold of the lower lip continuous.



As I have said before, this character has no value for distinguishing species.

No. 2607*a-l*, 6-10 cm., São João da Barra, Rio Parahyba, June 26, 1908.

The largest one has depth 1.75; head 2.67; eye 3.8.

No. 2608*a-w*, 2.5 to 6 cm., Bom Jardim, Minas, Rio Grande of the Parana, July 7, 1908.

No. 2609, 5.5 cm., Iporanga, Rio Ribeira, Dec. 1, 1908.

The color-bands are very distinct, and the basal halves of rayed dorsal and anal and the spinous dorsal and anal, ventrals, and tip of caudal are black.

No. 2610*a-m*, 4.5 to 9 cm., Muniz Freire, Rio Itapemerim, June 19, 1908.

No. 2611*a-m*, 2 to 7 cm., Entre Rios, Rio Parahyba, July 2, 1908.

No. 2612*a-d*, 3.5 to 6.5 cm., Rio Grande, Minas, Aug. 18, 1908.

No. 2613, 5 cm., Barra de Pirahy, Rio Parahyba, July 12, 1908.

No. 2614*a-p*, 3 to 9 cm., Campos, Rio Parahyba, June 14, 1908.

The largest specimen has A. VII, 9, and the depth is less than 2 in the length.

No. 2615*a-b*, 5.5 cm., Morretes, Parana, Jan. 3, 1909.

Heavy black lateral bands; depth more than two in the length; snout is longer and more slender than in a typical specimen; diameter of the eye less than the length of the snout and the interorbital space. Such specimens as a rule come from fast-flowing water, while the rounder-bodied, shorter-snouted, and larger-eyed form comes from lagoons and gentle currents.

No. 2617, 8 cm., Porto Alegre, Rio Grande do Sul, Jan. 24, 1909.

This specimen has four rows of scales on the cheeks and some of the rows on the sides have the scales with black and some with white centers.

No. 2618*a-l*, 2 to 5 cm., Campos, Rio Parahyba, June 13, 1909.

No. 2619*a-c*, 4.5 to 7 cm., Jaguará, Rio Grande, Minas, Aug. 18-19, 1908.

No. 2620*a-f*, 4 to 5.7 cm., Cachoeira, Rio Jacuhy, Jan. 26, 1909.

No. 2621*a-b*, 2.5 cm., Santa Rita de Jacutinga, Minas; in a lagoon above the high waterfall in the Rio Preto of Rio Parahyba, July 9, 1908.

No. 2622*a-b*, 6.5 and 12.3 cm., Lagoa Feia, Tocas, June 27, 1908.

No. 2623, 5 cm., Muniz Freire, Rio Itapemerim, June 18, 1908.



No. 2624a-b, 3 cm., Barra do Pirahy, Rio Parahyba, July 5, 1908.

No. 2625a-b, 3.5 and 4.5 cm., Xiririca, Rio Ribeira, Dec. 5, 1908.

No. 2626, 8 cm., Iporanga, Rio Ribeira, Dec. 1, 1908.

Eye goes 3.75 in head.

The following specimens have the folds of the lower lip interrupted.

No. 2627, 9 cm., Campos, Rio Parahyba, June 14, 1908.

No. 2628, 8.5 cm., Iporanga, Rio Ribeira, Dec. 1, 1908.

No. 2629a-f, 1.5 to 7 cm., Cachoeira, Rio Grande do Sul, Rio Jacuhy, Jan. 26, 1909.

No. 2630, 3.3 cm., Uruguayana, Rio Uruguay.

It has brown pigment lines along the rows of scales of the sides.

No. 2631, 2.5 cm., Santa Isabel, Rio Negro, Uruguay, Feb. 12, 1909.

No. 2632, 7 cm., Bom Jardim, Minas, Rio Grande, above the falls, July 7, 1908.

No. 2633a-c, 3.5 to 7 cm., Montevideo, Arroyo Miguelete, Feb. 7, 1909.

There is not as much difference between *C. facetum*, *C. autochthon*, and *C. oblongum* as there is between a large series of either *Crenicichla lepidota* or *Geophagus brasiliensis*. The only difference is a free or an interrupted fold, and there are all stages between these two extremes. These species are found in the same localities. Several other species of cichlids have both a free fold and an interrupted fold. In view of all this these names must be considered as synonyms.

28. ***C. coryphænoides*** (Heckel).

*C. temporale* Günther.

No. 2635a-c, 14 cm., Manaos, Rio Negro, Dec. 2, 1909.

No. 2637a-b, 14 and 15 cm., Manaos, Rio Negro, Nov. 15, 1909.

Depth 1.87; head 3; diameter of eye 3.75 in head; interorbital space 2.25 in head; fold of lower lip interrupted; scales 5-31-12; three or four scales between the lateral line and the base of first dorsal ray; D. XVI, 12 or 13; A. VI or VII, 9; ventrals extending about to middle of anal; pectorals four-fifths the length of head; caudal peduncle three-fifths as long as deep; dorsal and anal rays extending almost to tip of caudal; uniform dark brown, excepting white pectoral fins; a dark spot above the eye and another one above the lateral line, between the eleventh to the thirteenth dorsal spine, and a third indistinct spot at the base of the caudal; these three spots connected by a faint band; lines of pigment along the rows of scales of the lower half of the body; last rays of the dorsal with some small dark spots.



In about half of the details the specimens listed above agree with *Cichlasoma coryphænoides* and in the rest with *C. temporale* as described by Regan. As my specimens are intermediate in size, I regard *C. temporale* as a synonym of *C. coryphænoides*.

29. **C. biocellatum** Regan.

This species appears to be good, but I did not secure it.

30. **C. severum** (Heckel).

No. 2600a-e, 4 to 6.5 cm., São Antonio de Guaporé, Aug. 10, 1909.

No. 2601a-c, 4.5 and 6.5 cm., Santarem, Dec. 9, 1909.

One of these has no spots on the sides, and one has fifteen dorsal spines.

No. 2602a-d, 3.2 to 5 cm., São Antonio de Guaporé, July 30, 1909.

No. 2603a-e, 4.5 to 14 cm., São Antonio de Guaporé, July 23-Aug. 3, 1909.

D. XIV, 14.

No. 2604a-c, 2.5 to 3.5 cm., Bastos, Rio Alegre, June 26, 1909.

No. 2605a-c, 12 cm., Manaus, Nov. 15, 1909, 2605d, Santarem, Dec. 7, 1909.

One has no spots or cross-bars. The largest specimen has a tumid head like some males of *G. brasiliensis* (Quoy and Gaimard).

The specimen, 8.5 cm., from Santarem, has neither spots nor bars, but brown lines of pigment in each row of scales and four rows of scales on the cheeks.

31. **C. psittacum** (Heckel).

*Habitat*.—Amazon and Orinoco Rivers.

No specimens were taken by me.

32. **C. spectabile** Steindachner.

No. 2634a-b, 7 and 10 cm., Santarem, Dec. 15, 1909.

The diameter of the eye is equal to the length of the snout in the smaller specimen and less than the same in the larger one; depth 2.2 in the smaller and 1.9 in the larger one; obscure cross-bars and a distinct lateral band from the eye to the caudal spot; soft dorsal of the smaller one with a few brown spots; three or four more scales in the first row above the lateral line than in the first row below it; soft fins scaly at the base only.

No. 2636, 6 cm., Santarem, Dec. 6, 1909.

Scales above the lateral line a little smaller than those below it.



This specimen is intermediate between *C. spectabile* and *C. kraussi* as described by Regan; and if the scales above the lateral line of *C. kraussi* are not very much smaller than those below it, these specimens indicate that it is a synonym of *C. spectabile*.

Genus CRENICARA Steindachner.

33. *C. punctulata* Günther.

*Habitat*.—Amazonia and Guiana.

No specimens were obtained by the Expedition of the Carnegie Museum.

34. *C. maculata* (Steindachner).

No. 2638, 3 cm., mouth of Rio Machupo in Rio Guaporé, Aug. 27, 1909.

35. *C. altispinosa*, sp. nov. (Plate LVIII.)

No. 2639a, *type*, 5 cm., collected at night along a sand-bank in the Rio Marmoré, below the mouth of the Rio Guaporé, Sept. 19, 1909.

No. 2639b, *cotype*, 5.1 cm., same place and date.

No. 2640a-h, *cotypes*, 3.2-5.2 cm., taken in a large lake near San Joaquin, Bolivia, Sept. 4, 1909.

Body round and compressed; large ctenoid scales, two lateral lines composed of scales of the same size as those above and below it; jaws equal; mouth small; maxillaries not exposed and not extending to the front edge of the eyes; operculum and checks scaly, but the preoperculum scaleless and finely denticulated. Gill-rakers short, about six on the lower anterior arch. Caudal slightly emarginate. Ventrals behind the pectorals and in some cases extending beyond the origin of the anal. Teeth small, conical, and arranged in two rows in each jaw. P. 13; D. XV, 8 to 10; A. III, 7 or 8; depth 2.2; head 3; nares indistinct and not greatly different from the pores on the snout, situated about half-way between the eyes and the tip of the snout; eyes 2.8 in the head, a little greater than the length of the snout or the interorbital space; depth of preorbital three-fifths the diameter of the eye; four series of scales on the cheeks; scales 4-24-9 (in the first series below the lateral line); pores  $\frac{16-18}{8-10}$ ; greatly arched from the snout to base of the dorsal; the fourth dorsal spine much the longest and thirteen-sixteenths the length of the head; dorsal spines about subequal from the sixth to the last, none or them more than three-fifths the length of the head, the first two shortest,



the third, fourth, fifth, and sixth longest. The origin of the dorsal is above the opercular cleft; soft dorsal and anal scaleless, extending scarcely beyond the base of the caudal; pectorals about one and one-fourth times the length of the head; caudal peduncle as long as deep.

Dark bands beneath the eyes, continued above the eyes and meeting half-way between the eyes and the origin of the dorsal; dark operculum; fins usually colorless, the membranes between the first five dorsal spines sometimes black, and the edges of the anal and caudal sometimes dark; six dark lateral bands extending from the dorsal to near the lower part of the side; in some cases each row of scales has a more or less distinct dark brown line; in some cases there are white bands or lines from the eyes to the snout.

This species is easily distinguished from *Crenicara punctulata* by its color, shape, scales, teeth, and long fourth dorsal spine. Some of these characters almost warrant the erection of a new genus for its reception.

Genus CRENICICHLA Heckel.

36. *C. semifasciata* Heckel.

? *Batrachops scotti* Eigenmann, ? *Crenicichla ocellata* Perugia.

*Habitat*.—Basin of the Rio de la Plata. No specimens were taken by the expedition of the Carnegie Museum.

37. *C. reticulata* (Heckel).

D. XXII, 10; A. III, 8; pores  $\frac{25}{12}$ ; scales 9-66-19; eye 4.5 in the head; interorbital 2.67; depth 4.33; head 3.33; four rows of teeth in the upper jaw and three in the lower; few spots in the dorsal fin; edge of dorsal and caudal dark; indistinct lateral bands, and each row of scales on the sides with a dark line.

No. 2642, 9 cm., Villa Bella, Rio Beni, Bolivia, Oct. 5, 1909.

I have compared specimens of *Crenicichla punctulata* Regan from Guiana with this species and find them identical.

38. *C. simoni*, sp. nov. (Plate LIX.)

No. 2646, *type*, 7.5 cm., Rio Paraguay at São Luiz de Cáceres, May 24, 1909.

No. 2647, *cotype*, 6.5 cm., same locality, May 26, 1909.

No. 2648a-b, *cotypes*, 5.6 cm., Puerto Suarez, Bolivia, May 6, 1909.

No. 2649, *cotype*, 5 cm., Corumba, Rio Paraguay, April 27, 1909.

No. 2650, *cotype*, 4.3 cm., Villa Hays, Paraguay, April 13, 1909.



D. XXII, 11; A. III, 7; pores  $\frac{23-24}{14-15}$ ; scales 8 or 9-61 to 66-15 to 19; teeth in three rows in each jaw; depth 4; head 3.25; eye 4; snout 4; diameter of eye 1.33 in the interorbital space; three rows of scales between the lateral lines; caudal peduncle three-fifths as long as deep; maxillaries extending almost to the middle of the eyes; eight gill-rakers on the lower anterior arch; depth of preorbital not more than one-third the diameter of the eye; last row of teeth faintly depressible; in some of the specimens the spinous dorsal does not have two rows of spots, but all have three rows of spots in the rayed dorsal; anal uniformly dusky; caudal with a dark margin at the end of a whitish band, which extends from the upper basal margin to the end of the median caudal rays; the other fins colorless; a small dark ocellated spot at the base of the caudal; sides and back crossed by from eight to eleven double dark bands; each row of scales on the sides with spots on the scales; a dark band from the eye to end of the operculum. *C. cyanota* Cope has a more slender body and no dorsal spots, while *C. reticulata* (Heckel) has a much smaller eye. This species differs from the previously described Paraguayan forms in color, in the larger size of the eye in comparison with the interorbital space, and in the number of scales and spines. It is more closely allied to *C. cyanota*.

I have dedicated this species to Mr. Fleciano Simon of Corumba, who assisted me in various ways while I was collecting in the Rio Paraguay.

I find that the teeth of adult *C. vittata* and *iguassuënsis* are just as firm as in the supposed species of the genus *Batrachops*, which is based on large specimens. The last row of teeth of *C. lacustris* are one-half depressible and in *C. dorsocellata* are not depressible. *C. lepidota* and *saxatilis* have several rows of depressible teeth. As a rule the species of the genus *Batrachops* have three rows of teeth, but some have as many as six. The number of rows of teeth varies a great deal in all of the species of *Crenicichla*. Hence I consider the genus *Batrachops* as not tenable.

39. ***C. cyanota* Cope.**

No. 2643, 5.5 cm., Santarem, Dec. 9, 1909.

No. 2644a-c, 5.5 cm., San Joaquin, Bolivia, Sept. 4, 1909.

No. 2645, 7 cm., San Joaquin, Bolivia, Sept. 6, 1909.



Some have only sixty-four scales in the first series below the lateral line; some have D. XXIII, 11; the diameter of the eye is equal to the interorbital space and the length of the snout; depth about 5; scales on the sides of the body with brown spots arranged in the form of lines; four series of teeth in the upper jaw and three in the lower jaw.

40. **C. lepidota** Heckel.

No. 2651a-b, 9.3 and 12 cm., Cachoeira, Rio Jacuhy, Rio Grande do Sul, Jan. 26, 1909.

D. XVI, 14.

No. 2652a-b, 8.5 and 12.7 cm., Porto Alegre, Jan. 24, 1909.

One has a color-band below the eye like that of the type of *Batrachops scotti*.

No. 2653a-e, 4.3 to 9.8 cm., Cacequy, Rio Cacequy, Feb. 1, 1909.

As a rule the dorsal has sixteen spines. One specimen has a row of black spots along the edge of the entire dorsal, and the anal and caudal are uniformly black.

No. 2654a-b, 9.5 and 13 cm., Puerto Suarez, Bolivia, May 6, 1909.

One has prolonged dorsal and anal rays, which extend to the tip of the caudal.

No. 2655a-c, 14 cm., Porto Alegre, Jan. 22, 1909.

No. 2656a-b, 12 cm., Porto Alegre, Jan. 20-21, 1909.

These two specimens have some white scales.

No. 2657a-b, 5 and 11 cm., Sapucay, Paraguay, April 21, 1909.

No. 2658a-b, 13.5 and 14 cm., São Antonio de Guaporé, Rio Guaporé, Aug. 3, 1909.

These have unspotted black vertical fins.

No. 2659a-d, 5 to 7 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

These, as is often the case, have bars in the vertical fins.

No. 2660a-b, 7 and 8 cm., Uruguayana, Rio Uruguay, Feb. 7, 1909.

No. 2661a-c, 5.3 cm., Puerto Suarez, Bolivia, May 6, 1909.

No. 2662a-b, 5.5 cm., Arequa, Paraguay, Lake Ipacary, April 8, 1909.

No. 2663, 4.5 cm., Asuncion, Paraguay, March 28, 1909.

No. 2664, 4.1 cm., São Antonio de Guaporé, Rio Guaporé, Aug. 9, 1909.

D. XVI, 12; A. III, 9; pores  $\frac{20-22}{9}$ ; scales 45 to 57; depth 4.25;

head 3; eye 4; caudal peduncle as long as deep; three series of teeth in the lower jaw. This specimen is less compressed, rounder, and a little more slender than a typical *C. lepidota* of the same size.



No. 2665a-b, 2.3 and 3 cm., Cacequy, Rio Grande do Sul.

No. 2666, 7.5 cm., Joazeiro, Rio São Francisco, Nov. 28, 1907.

This specimen has been bleached in denatured alcohol and has many white spots in the fins and scales; no band beneath the eye; the dorsal has twelve rays, which is often the number in this species. No. 2667, 8 cm., Urucum Mts., near Corumba, May 2, 1909.

This specimen is very dark; head 2.67; the dorsal fin is edged with black, beneath which is a lighter streak, and the base is dark brown.

No. 2668a-b, 4.5 to 5.5 cm., Bastos, Rio Alegre, June 26, 1909.

More slender and less compressed than typical *C. lepidota*.

No. 2673a-d, 4.5-8.3 cm., São Antonio de Guaporé, July 30-August 3, 1909.

D. XVII, 15; A. III, 10; pores  $\frac{24}{9}$ . All of the specimens from the Guaporé river have about 45 scales in a median lateral series. Head 3; depth 4.5; eye 4 and equal to the snout and interorbital space; opercular band continuous along the side of body to base of caudal.

No. 2674a-b, 5.5-9 cm., San Francisco, Bolivia (Paraguay basin), June 10, 1909.

These specimens are identical with the Bastos specimens, both of which were preserved in formalin.

No. 2675a-b, 6 and 6.5 cm., Campos Alegre, Rio Jauru, June 3, 1909.

These have faint lateral and transverse bands.

No. 2676a-h, 4-6 cm., São Luiz de Cáceres, May 24, 1909.

No. 998, 6 cm., Puerto Suarez, Bolivia (Steinbach collection).

No. 2678a-d, 4-5 cm., Corumba, Rio Paraguay, April 27, 1909.

One has a distinct lateral band and another has a black caudal.

No. 2679, 8 cm., Salto das Cruzes, Rio Tieté, Sept. 22, 1908.

D. XVIII, 15; A. III, 9; pores  $\frac{23}{9}$ ; depth 3.75; head 2.8; eye 5 in the head; fins and body uniform dark brown with spots above the base of pectorals, at base of caudal, and in base of soft dorsal.

No. 2680, 5-6 cm., Cidade da Barra, Bahia, Lagoa Pereira.

Three of these specimens have the edges of the vertical fins very dark; four of them have spots in the vertical fins, an ocellated caudal, and pectoral spots. The following table will show the difference between the two forms of *C. lepidota* found in the Rio São Francisco:



The four specimens with dorsal  
and caudal spots.

D. XVI, 14 or 15;

A. III, 8;

Depth 4.33;

Head 3;

Pores  $\frac{21}{9}$ ;

Scales 34-37.

Three specimens without spots  
and with dark margins on fins.

D. XVI, 13;

A. III, 8;

Depth 4.17;

Head 3;

Pores  $\frac{22}{9}$ ;

Scales 39 or 40.

These two end variations show marked differences, but complete series of intergradations are found in the same localities. None of the São Francisco specimens have bars beneath the eyes, and all are smaller in size and more slender than typical specimens.

No. 2682, 7 cm., Santa Rita, Rio Preto, Bahia, Jan. 24, 1908.

No. 2683, 7 cm., Rio Itapicurú.

D. XVI, 12; A. III, 8; pores  $\frac{21}{9}$ ; scales 36; depth 4.33; head 3; eye 4.25.

No. 2684a-e, 4.3-5.2 cm.; Cidade da Barra, Lagoa do Porto, Dec. 24, 1907.

No. 2685, 5 cm., Rio Zinga, State of Bahia, Nov. 7, 1907.

This specimen is more like a typical *C. lepidota* than the São Francisco form, but it has no bars beneath the eyes.

No. 2686a-c, 3.5-7.5 cm., Rio Paqui, State of Bahia, Nov. 14, 1907.

No. 2687a-f, 8.5 cm., Queimadas, Rio Itapicuru, March 2, 1908.

No. 2688, 9.2 cm., Propria, Rio São Francisco below the falls, March 30, 1908.

D. XVI, 12; A. III, 9; scales 38; depth 4; head 2.8; eye 4.5 in the head, 1.5 in the snout and 1.25 in the interorbital space; vertical fins white-spotted; ocellated caudal and pectoral spots; fins not dark-edged; a dark lateral band, above which are five vertical bars; four series of teeth in each jaw.

No. 2689a-b, 5.5 and 6.5 cm., Santa Rita, Rio Preto, Bahia, Jan. 24, 1908.

The smaller specimen has 34 scales in the first series below the lateral line, the caudal peduncle is as long as deep, the vertical fins are unspotted, and the lateral band has five vertical bars above it. The larger specimen has white spots on some of the scales and on the vertical fins.

No. 2690, 4 cm., Uruguayana, Rio Grande do Sul, Feb. 6, 1909.



No. 2691, 3.2 cm., Boqueirão, Rio Grande, Bahia, Jan. 9, 1908.

No bar beneath the eye, and thirty-six scales in the series below the lateral line.

No. 2691, 7 cm., Lagoa Pereira, Cidade da Barra, Bahia, Dec. 26, 1907.

The fins are spotted; there are forty scales in the first row below the lateral line.

No. 2693, 5-8 cm., sixty-seven specimens like the above sample from the same place, Dec. 23, 1907.

Ten of these have no spots on the vertical fins, which are black-edged, and one has forty-four scales in the first row below the lateral line. Fifty-four specimens have spots on their sides and on their vertical fins and ocellated caudal and pectoral spots. Three specimens are intermediate between these two forms.

No. 2694*a-b*, San Joaquin, Bolivia, From a large lake between the Rios Machupo and Marmoré, Sept. 4, 1909.

D. XVII, 13 or 14; A. III, 9 or 10; 43 or 45 scales in the first series below the lateral line; pores  $\frac{21-23}{8-9}$ ; one with four series of teeth in the upper jaw and the other with two series in each jaw; teeth easily depressible posteriorly; head 2.67 to 2.8; depth 3.5; eye 4 in the head, equal to the length of the snout and the interorbital space; maxillaries extending to below middle of the eyes; lower jaw slightly the longer; caudal peduncle not quite so long as deep; nostrils nearer the eyes than to the tip of snout; preorbital width not more than one-third the diameter of the eye; ten or eleven gill-rakers on the lower anterior arch; two rows of scales between the lateral lines and three rows between the lateral line and the last dorsal spine; pectorals and ventrals two-thirds the length of the head. A faint lateral band, above which are six faint vertical cross-bars; a small ocellated spot at the base of the caudal and another above the base of the pectorals; a bar on the operculum and another on the head beneath the eyes; vertical fins with alternating white and dark broken bars.

These specimens differ from typical *C. lepidota* in having only two series of teeth in the lower jaw. The rows of teeth in this species vary otherwise from three to six.

**41. *Crenicichla saxatilis* (Linnæus).**

No. 2695*a-c*, 8-9.5 cm., Santarem, Rio Amazonas, Dec. 9-15, 1909.

No. 2696*a-e*, 2-17.3 cm., Bragança, Pará, in a creek, Dec. 29, 1909.

No. 2697*a-d*, 13-20 cm., Belem, Pará, Dec. 19 and 27, 1909.



No. 2700, 3.5 cm., Manaus, Nov. 30, 1909.

*Crenicichla proteus* (Cope) is a synonym of *C. saxatilis*.

42. ***Crenicichla saxatilis lucius*** Cope.

No specimens were obtained.

43. ***Crenicichla jaguarensis***, sp. nov. (Plate LX.)

No. 2723, *type*, 5.2 cm., Jaguará, Rio Grande of the Paraná, Minas, Aug. 18, 1908.

No. 2724, *cotype*, 4.3 cm., taken at the same place and date.

It has four anal spines.

D. XIX, 11; A. III, 8, and IV, 7; depth 4.67; head 3; eye 4.33 in head, equal to the snout in the smaller specimen and two-thirds of it in the larger one, equal to the interorbital space in both; three series of teeth in the lower jaw, and four in the upper; pores  $\frac{22-25}{10-12}$ ; fifty to fifty-two scales in the first series below the lateral line; maxillaries extending to, or a little beyond, the anterior margins of the eyes; nostrils nearer the eyes than to the tip of the snout; depth of preorbital one-half the diameter of the eye; scales denticulated, excepting on the head and the lower part of the abdomen and thorax; two to two and a half rows of scales between the lateral line and the last dorsal spine, and two rows between the lateral lines; six or seven gill-rakers on the lower anterior arch; last dorsal spine about half the length of the head; caudal peduncle as long as deep; soft dorsal and anal not extending beyond the base of the caudal; pectorals two-thirds, and the ventrals five-eighths, the length of the head.

Brownish, with a black band around the snout and continued back of the eye on the operculum and indistinctly on the sides of the body, where it breaks up into about eleven short median cross-bars; the dorsal fin with two or three irregular series of dark spots; the anal and caudal with a few indistinct spots; all of the fins more or less dark-edged; a dark bar beneath the eye, slanting back toward the middle of the preoperculum; no spot above the pectorals; a very faint caudal spot at the end of the broken lateral line.

This species resembles *C. lacustris* more than either *C. saxatilis* or *lepidota*, but, as the description shows, it is as different from these three species as they are from each other.

44. ***Crenicichla lacustris*** Castelnau.

No. 2701, 8.5 cm., Xiririca, Rio Ribeira da Iguapé, Dec. 8, 1908.

No. 2702a-e, 7.2-11.5 cm., Morretes, Paraná, Jan. 4, 1909.



One has A. III, 10.

No. 2703a-i, 4.5-9 cm., Campos, Rio Parahyba, June 14, 1908.

One of these has about seventy-five scales in the first row below the lateral line.

No. 2704, 6.8 cm., Muniz Freire, Espirito Santo, Rio Itapemerim, June 18, 1908.

45. **Crenicichla iguassuënsis**, sp. nov. (Plate LXI.)

No. 2725, *type*, 14 cm., Porto União da Victoria, Rio Iguassú, Dec. 28, 1908.

No. 2726a-b, *cotypes*, 9.5 and 13 cm., same place and date.

One has no fin-spots and both have less prolonged snouts.

No. 2727a-b, *cotypes*, 1 and 7 cm., same place and date.

Interorbital space less than the diameter of the eye, which is almost equal to the length of the snout; eye 4 in the head; no bands on the sides and no bar beneath the eye.

No. 2728, *cotype*, 14 cm., same place and date.

D. XX to XXII, 11; A. III, 8 or 9; pores  $\frac{23 \text{ or } 24}{10-17}$ ; scales 54 to 64 in the row below the lateral line; eye 4 to 5.33 in the head; snout 3 to 3.5; caudal peduncle 2 in the greatest depth and one-fourth longer than its own depth; diameter of the eye about .6 of the distance from the eye to the tip of the lower jaw in the type and about equal to the same in two of the smallest specimens; preorbital about three-fourths the diameter of the eye; edge of preoperculum vertical; four or five rows of teeth in each jaw; snout pointed and almost cylindrical in shape; in some cases the maxillaries extend to, but not past, the front edge of the eyes; two rows of scales between the lateral lines, in most of the specimens each row of scales has faint brown spots on them; bars, composed of spots (as described for *Batrachops scotti*) are found below the eyes in the larger specimens in some cases, but none occur in the younger ones; some have four or five distinct broad double dark brown bands over their backs and sides, while others are mottled like *C. lacustris*; no band on the operculum; as a rule the vertical fins are spotted with two or more series of dark brown spots, but in one example the fins are all colorless; all have a more or less dark ocellated caudal spot at the middle of the base of the caudal; the dorsal and anal scarcely extend to the middle of the caudal; the nostrils are nearer the eyes than to the tip of the snout.

This species is easily distinguished from *C. lacustris*, its nearest ally, by its pointed snout, narrower interorbital, spine, teeth, and color differences.



This fish is locally known as "*peixa da pedra*."

46. *Crenicichla macrophthalma* Heckel.

No. 2705, 6 cm., Manaus, Nov. 29, 1909.

D. XX, 9 to 11; A. III, 7 to 9; head 3 to 3.33; pores  $\frac{21-22}{10}$ ; 57 to 70 scales in the first series below the lateral line; depth 5 to 6; eye 4 in the head, equal to, or more than, the interorbital space, and equal to the length of the snout; nostrils about equidistant between the eyes and the tip of the snout or a little nearer the former; brownish, with a black band around the snout and continued back of the eyes on the operculum; some with faint lateral bands and cross-bars and nearly all with either spots or cross-bars on the caudal and some faint spots on the dorsal fin; some with dark margins on the vertical fins; all with a small more or less ocellated caudal spot.

I regard *Crenicichla wallacei* Regan as the young of *C. macrophthalma*. Young specimens from the Guaporé, Amazon, and Essequibo are identical. The extent of the maxillaries varies considerably. No. 2706a-g, 3.2-4.8 cm., São Antonio de Guaporé, Rio Guaporé, Aug. 10, 1909.

No. 2708, Villa Bella, Rio Beni, Bolivia.

Almost colorless and with the preoperculum more denticulated than in the other specimens.

No. 2707, 3.7 cm., Bastos, Rio Alegre, June 26, 1909.

This specimen is very slender, its depth being 7 in its length; head 3; eye 3.5 in the head, a little greater than the snout, 1.33 times the interorbital space and 3 times the preorbital width; maxillaries not quite extending to the front margins of the eyes; pores  $\frac{24}{9}$ ; two and one-half to three rows of scales between the lateral lines, and one row or less between the last half of the upper lateral line and the base of the dorsal; A. III, 7; D. XIX, 9; three rows of more or less depressible teeth in each jaw; eight gill-rakers on the lower anterior arch; scales about sixty in a median row below the lateral line; caudal peduncle one and one-half to two times as long as deep; nostrils nearer the eyes than to the tip of the snout; dark brown with a band around the snout extending back of the eyes to the base of the caudal, where it ends in a small black spot.

This species replaces *C. vittata* in the Amazon. The only marked



differences between these two species are the number of scales in the lateral series and the number of spines and rays.

47. **Crenicichla santaremensis**, sp. nov. (Plate LXII, fig. 1.)

The *type*, No. 2719, is 9.8 cm. long, and one *cotype*, 2720, is 7.8 cm. long. They were taken in a grassy lagoon along the margin of the Amazon, three miles above Santarem, December 15, 1909.

D. XXI, 11; A. III, 6 or 7; depth 5; head 2.7; eye 3.33; preorbital one-third the diameter of the eye; snout one-third the length of the head; pores  $\frac{23}{14}$ ; interorbital space three-fifths the diameter of the eye; scales 68 to 75 in the first series below the lateral line; twelve rows of scales between the lateral line and the first dorsal spine; three rows of scales between the lateral line and the first dorsal ray, and two and one-half rows between the lateral lines; caudal peduncle slightly longer than deep; nine gill-rakers on the lower anterior arch; scales all well denticulated, excepting a small patch in front of the ventral fins; maxillaries extending beyond the front margin of the eye by one-fourth of its diameter; nostrils much nearer the eye than to the tip of the snout. Each scale in the lateral lines edged with black; a faint broad light brown lateral band crossed by four broad vertical bands; vertical fins in part edged with dark, but no spots or bars.

In some of the details this species resembles *C. macrophthalma*, but *C. santaremensis* has a much longer eye, a much narrower interorbital and preorbital in comparison with the diameter of the eye; the nostrils are much nearer the eye than to the tip of the snout; the scales are all denticulated, excepting a few in front of the ventrals; the snout and head are longer. The description of *C. macrophthalma* agrees much better with *C. wallacei* than with these specimens.

48. **Crenicichla vittata** Heckel.

No. 2709a-b, 5.3 and 6.8 cm., Corumba, Rio Paraguay, April 27, 1909.

No. 2710a-c, 2.3-3.2 cm., Villa Hays, Paraguay, April 3, 1909.

One has D. XXII, 14; less than eighty-four scales in the first series below the lateral line; fins slightly colored, the maxillaries almost extending to the front edge of the eyes.

No. 2711, 6 cm., Campos Alegre, Rio Jauru, June 24, 1909.

No. 2712, 6.3 cm., Corumba, Rio Paraguay, May 9, 1909.

No. 2713a-e, 5-22.2 cm., Uruguayana, Feb. 5, 1909.

D. XXII, 14; A. III, 9; pores  $\frac{29}{13}$ ; scales 81; depth 4.5; head 3.1;



snout 2.5 in the head; eye 6 in the head; interorbital space 4.5 times in the length of the head. This species was not found in the Amazon.

49. **Crenicichla dorsocellata**, sp. nov. (Plate LXIII.)

No. 2721, type, 18 cm., Campos, Rio Parahyba, June 15, 1908.

D. XXII, 13; A. III, 9; pores  $\frac{25-27}{11-13}$ ; depth 5; head 3; eye 6.33; scales 62 in the first row below the lateral line; preoperculum almost entire; maxillaries extending to below the first third of eye; scales ctenoid, excepting on the ventral side and on top of the head; dorsal and anal rays not extending beyond the middle of the caudal; three rows of scales between the lateral lines and five rows between the lateral line and the first dorsal rays; caudal peduncle longer than deep; dorsal and anal fins rather high, being about one-half the length of the head; nostrils much nearer the eye than the tip of the snout; lower jaw distinctly the longer; five rows of teeth in the lower jaw and seven in the upper; ten gill-rakers on the lower anterior arch. Dark bar below the eye composed of faint spots; a small black spot at the base of the caudal; a faint broad lateral band from the eye to the base of the caudal; a very large distinctly ocellated dorsal spot between the fourteenth to the eighteenth spines; vertical fins slightly dark-edged, but not distinctly spotted; uniformly brown above, and white on the ventral side; in life the body is covered with red dots, which disappear in alcohol.

The nearest relative is *C. vittata*, from which it is easily distinguished by the large dorsal spot, eye 6.33 in head, more series of teeth, longer fin-rays, and maxillaries extending beyond the front edge of eyes.

No. 2722, 4.1 cm., Santarem, Igarapé de Irura.

D. XXII, 11; A. III, 7; eye 4; pores  $\frac{21}{10}$ ; scales 57; depth 5.5; no spot beneath the eye; a dark ocellated spot on dorsal spines. This small specimen differs in many details from the type. It also resembles *C. macrophthalmia* and perhaps should be associated with it.

50. **Crenicichla acutirostris** Günther.

This species appears to be distinct, but I took no specimens.

51. **Crenicichla strigata** Pellegrin.

D. XXIII, 15; A. III, 11; pores  $\frac{26}{16}$ ; scales about 115; depth 5.5 to 6; head 3.25; eye 5.5 to 6 in head; snout 3.5 in head; interorbital space equal to length of snout and almost twice the diameter of the eye;



a broad lateral band from the eye to the tip of the caudal; four zigzag lines between and behind the eyes, two of them end at the upper edge of the operculum and the other two run along the sides near the base of the dorsal, where they unite with several short cross-bars on either side of the dorsal fin; fins dark-edged, but unspotted; no distinct caudal spot; scales faintly denticulated; five series of teeth in the upper and four in the lower jaw.

No. 2714a-b, 14 and 15 cm., Belem, Pará, Jan. 15, 1910.

52. **Crenicichla lugubris** Heckel.

No. 2717, 17 cm., Manaos, Nov. 18, 1909.

D. XXII, 16; A. III, 12; pores  $\frac{27}{15}$  or 16; scales 115 to 124 in first series below the lateral line; depth 4.5 to 5; head 3.5; snout 3 in head; eye 5.5 in the head.

No. 2718, São Antonio de Guaporé, July 26, 1909.

This example has faint traces of brownish spots on the under side of the head and both have traces of bars under the eyes, otherwise as described by Regan.

53. **Crenicichla cincta** Regan.

No. 2715, 17 cm., Belem, Pará, Jan. 15, 1910.

D. XXII, 15; A. III, 12; head 3; eye 5; depth 4.67; scales about 115; pores  $\frac{30}{15}$ ; color as given by Regan excepting that there are no spots in the dorsal.

54. **Crenicichla lenticulata** Heckel.

*C. ornata* Regan.

No. 2641a-d, 19-24 cm., Manaos, Nov. 15-Dec. 2, 1909.

D. XXII or XXIII, 17; A. III, 12; pores  $\frac{27-29}{17}$ ; scales 113 to 130; depth 5; head 3.33; eye 5.5 to 6.

The shorter one is colored like Regan's figure, but the larger one has no spots on the head, and the spots on the fins as well as on the body are broken up into blotches.

*C. ornata* Regan is a synonym of *C. lenticulata* Heckel. Regan's type is a smaller individual.

55. **Crenicichla johanna** Heckel.

No. 2716, 27 cm., São Antonio de Guaporé, Aug. 3, 1909.

D. XXII, 18; pores  $\frac{26}{17}$ ; scales 129; depth 4.5; head 3.5; eye 5.67 in head; uniform dark brown with no spots or bars.



Genus RETROCOLUS Eigenmann and Bray.

56. *Retroculus lapidifer* (Castelnau).

No specimens were taken by me. *Habitat*.—"Amazonas."

Genus HETEROGRAMMA Regan.

57. *Heterogramma agassizi* (Steindachner). (Plate LXIV.)

No. 2729, Manaos, Nov. 30, 1909. 3.6 cm.

Snout four-fifths as long as the diameter of the eye; D. XV, 6; A. III, 6; scales 2.5-23-8; depth 2.75; head 3; pores  $\frac{12}{3}$ ; diameter of eye equal to the interorbital space and four times the preorbital width; vertical fins red- and white-spotted; no caudal spot; a faint lateral band, but no cross-bars; a bar below the eye; pectoral fin about as long as the head; no distinct gill-rakers on the lower branch of the first arch; last dorsal spine seven-elevenths the length of the head; caudal peduncle seven-eighths to as long as deep.

No. 2730a-b, 1.2-2.5 cm., Santarem, Dec. 11, 1909.

Last dorsal spine five-ninths as long as the head; snout a little shorter than the diameter of the eye; lateral line in some cases with only a few pores and in others almost complete; D. XV, 7; A. III, 7; head 3; eye 3; depth 3 to 3.33; two rows of scales on the cheeks, and none on the preoperculum; scales 2-22 to 25-7; pectoral fin as long as the head; caudal peduncle as long as or a little longer than deep; a dark lateral band from the eye to base of caudal, with faint caudal spots and median lateral spots in a few cases; bands from the eyes to the mouth; only three have bars from beneath the eyes to the interoperculum; vertical fins with ashy white bars and spots; scales speckled with brown spots; depth of preorbital not one-half the diameter of the eye. These specimens do not agree with the description of the typical specimen. No. 2731a-c, 1.7-2.1 cm., San Joaquin, Bolivia, September 4, 1909.

Lateral lines incomplete; snout much shorter than the eye; last dorsal spine not quite one-half the length of the head; depth 2.8; head about 2.8; diameter of eye more than one-third the length of the head; no gill-rakers on the first arch; caudal peduncle about as long as deep; coloration like a typical specimen plus a spot on the lateral band.

58. *Heterogramma tæniatum* (Günther). (Plate LXV.)

No. 2732a-c, 2-3.6 cm., Bragança, Pará, Dec. 29, 1909.

One gill-raker on the lower anterior arch (one specimen with no



gill-rakers on the first arch); the snout in the largest specimen as long as the diameter of the eye; no distinct cross-bars; a lateral band and a caudal spot; last dorsal spine one-half as long as the head; no lines or stripes on the scales of the lower half of the body. No. 2733a-c, 2-2.5 cm., São Antonio de Guaporé (B. A. Maciel's rubber forest), Aug. 11, 1909.

These specimens might equally well be placed under *H. corumbæ* Eigenmann and Ward. One has no signs of lateral scale-stripes, one has faint signs of stripes, and one has stripes which resemble somewhat those of *H. corumbæ*. In some the lateral line is almost wanting, while others have twelve or more pores independently of whether there are lines on the sides, as in *H. corumbæ*, or not, as in *H. tæniatum*. One of these specimens has two lateral spots on the lateral line where it is intersected by the cross-bands. The most of the specimens of this genus have black membranes between the first two or three dorsal spines.

No. 2734a-d, 1.8-2.2 cm., São Antonio de Guaporé, Rio Guaporé, July 9, 1909.

Twelve pores in the lateral line; caudal peduncle four-fifths to as long as deep; snout shorter than the diameter of the eye.

No. 2735, Rio Tapajos at Santarem, Dec. 10, 1909.

No. 2736, 2.7 cm., Santarem, Dec. 15, 1909.

A slender lateral band and faint cross-bands; caudal spot; barred and spotted fins; all of the scales dusky-edged above and below the lateral line, but there are no stripes like those in typical *H. corumbæ*. No. 2737, 3.8 cm., São Luiz de Cáceres, Rio Paraguay, May 27, 1909.

Prolonged dorsal and anal rays; red and white spots with a pinkish tinge on the vertical fins; a caudal spot and lateral band; bars below the eyes and another from the eyes to the mouth; caudal peduncle about seven-eighths as long as deep; snout about equal to the diameter of the eye, which goes 3.5 times in the head, and is greater than the interorbital space; depth of the preorbital about one-fourth the diameter of the eye; depth 2.75 in the length; two or three gill-rakers on the lower branch of the anterior arch; scales 2-23-7; pectoral fin about as long as the head; three rows of scales on the cheeks and none on the preoperculum; last dorsal spine eight-thirteenths as long as the head; maxillaries extending to below anterior third of the eyes; D. XVI, 6; A. III, 6; membranes between the first dorsal spines not black.



No. 2738a-e, 1.7-1.9 cm., São Antonio de Guaporé, July 28-31, 1909.

No. 2739, 1.5 cm., Manaus, in a creek, Nov. 29, 1909.

No. 2740a-b, 1.1 cm., Posada, Campos de Matto Grosso, swampy plains of Rio Alegre, June 21, 1909.

They have caudal spots, bars below the eyes, dorsal dark-edged, and one has a faint lateral band with a spot on it.

The last seven specimens agree equally well with *H. corumbæ* or *H. tæniatum*, and not exactly with either. None have the typical stripes of *H. corumbæ*, but in other details they are nearly identical.

*Geophagus amænus* is a synonym of this species.

59. **Heterogramma tæniatum pertense**, var. nov. (Plate LXVI.)

No. 2741, type, 2.7 cm., Manaus, Nov. 29.

Depth 3.37; head 3.25; eye 2.67 in the head, greater than the snout and the interorbital space, and fully three times the preorbital width; membranes between the first dorsal spines not black; vertical fins red- and white-spotted; each row of scales both above and below the lateral line with dark-edged scales. Otherwise like *H. tæniatum*.

No. 2742, 2.2 cm., Santarem, Rio Tapajos, Dec. 10, 1909.

Like the above specimen except that there is no distinct lateral band.

60. **Heterogramma corumbæ** Eigenmann and Ward. (Plate LXVII.)

No. 2752, 2.5 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

Indistinct stripes along the scales of the lower half of the body.

No. 2753, 3 cm., Corumba, Rio Paraguay, May 9, 1909.

Only two faint stripes behind the base of the pectorals; depth 3; head 2.5; caudal peduncle three-fourths as long as deep; upper lateral line with twelve developed pores; diameter of the eye 3 in the head; A. III, 5; otherwise as described by Regan.

No. 2754, 2.3 cm., Villa Hays, Paraguay, April 13, 1909.

The stripes typical of this species are very distinct, but the vertical fins are almost colorless.

No. 2755, 3 cm., São Luiz de Cáceres, Rio Paraguay, May 27, 1909.

61. **Heterogramma ortmanni** Eigenmann.

No. 2757a-k, 1.7-3 cm., Bastos, Rio Alegre of the Guaporé, June 26, 1909.

No. 2756, 3.1 cm., Manaus, Nov. 30, 1909.

A. III, 5; D. XV, 6; depth 2.5; head 3; interorbital space 3.33 in the head; last dorsal spine a little more than half the length of the head; otherwise like the typical form.



This species, from the Amazon basin and Guiana, differs but little from the Paraguayan *H. corumbæ*.

62. ***Heterogramma trifasciatum*** Eigenmann and Kennedy. (Plate LXVIII.)

No. 2743, 2.8 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

Depth 3; head 3; diameter of eye 2.75 to 3; spines subequal from the fourth, which is fully one-half the length of the head, membranes between the dorsal spines greatly prolonged; prolonged ventral rays white and extending beyond the base of the caudal; caudal peduncle a little deeper than long; a broad lateral band; soft dorsal and anal spotted; a band in front of the eye and another one beneath the same; scales 2.5-23-8; an oblique band or stripe from the pectoral to the origin of the anal.

No. 2744*a-b*, 2-2.3 cm., Villa Hays, Paraguay, April 13, 1909.

Head 2.5; vertical fins spotless; anal and ventrals with black margins.

No. 2745*a-e*, 1.4-3 cm., São Luiz de Cáceres, May 26, 1909.

The smallest one is almost colorless.

No. 2746*a-b*, 1.5-3 cm., Campos Alegre, Rio Jauru, June 4, 1909.

No. 2748*a-j*, 1.8-2.5 cm., Bastos, Rio Alegre of the Rio Guaporé, June 26, 1909.

Twenty-two scales in the series below the lateral line; caudal peduncle as long as deep in some cases. These specimens are slightly more slender and less compressed than the typical Paraguayan forms, but otherwise they are identical.

No. 2750*a-i*, 1.2-2.8 cm., São Antonio de Guaporé, July 31-Aug. 11, 1909.

Color very faint; a faint spot in the middle of the lateral band; vertical fins spotless; preorbital one-fourth the diameter of the eye; lateral line incomplete; depth 3.2; pectorals as long as, or longer than, the head; little or no signs of oblique stripes from the pectorals to the origin of the anal. These specimens are intermediate between the typical form and the variety *macielense*.

No. 2758*a-b*, 1.7-2 cm., Campos Alegre, Rio Jauru, June 2, 1909.

No. 2759, 2 cm., São Luiz de Cáceres, Rio Paraguay, May 23, 1909.

63. ***Heterogramma trifasciatum macielense***, var. nov. (Plate LXII, fig. 2.)

No. 2751*a-d*, 1.3-3.1 cm., São Antonio de Guaporé, July 9, 1909.



The largest specimen has D. XII, 7; the last dorsal spine is a little more than one-half the length of the head; depth 3.2; head not quite 3; eye 2.75 in the head and greater than the length of the snout and the interorbital space; depth of the preorbital about one-third the diameter of the eye; twelve or thirteen pores in the upper lateral line; scales 3-27-7; a dark lateral band; a very faint stripe from the pectorals to the anal in the largest specimen, but no stripes in the smaller ones; the membranes between the dorsal spines twice as long as the spines; fins spotless; no caudal spot. This variety is quite different from the typical Paraguayan form, but all stages of intergradation are present, and I have described it only as a variety in order to note the difference from the typical forms, which are also found in the Rio Guaporé.

64. **Heterogramma borellii** Regan. (Plate LXIX.)

*H. pleurotænia* Regan.

No. 2760a-c, 2.2-2.5 cm., Villa Hays, Paraguay, April 11, 1909.

Last dorsal spine two-fifths the length of the head; depth 2.27 to 2.5; D. XV or XVI, 6; A. III, 5 or 6; three series of scales on the cheeks; lateral line incomplete; maxillaries extending a little beyond the front edge of the eyes; no distinct gill-rakers on the lower anterior arch; head 2.84 to 3 in length; interorbital space 2.6 in the head; pectorals not quite as long as the head; caudal rounded; a heavy oblique bar from the eye to the interoperculum; anal and ventral fins dark-edged; fins spotless, or as in *H. pleurotænia*.

No. 2761, 3 cm., Corumba, Rio Paraguay, April 27, 1909.

D. XV, 6; A. III, 6; head 3; depth 2.5; last dorsal spine one-half the length of the head; scales 3-23-8; a black bar beneath the eyes; a dark broken lateral band traversed by faint cross-bars; anal and dorsal rays very long.

No. 2762, 2 cm., Corumba, Rio Paraguay, April 27, 1909.

D. XVI, 6; A. III, 7; vertical fins with black margins; base of the dorsal with a series of black blotches; the bars beneath the eyes almost meeting on the ventral side; last dorsal spine two-fifths the length of the head; a broken lateral band composed of seven blotches.

No. 2763a-e, 2.4 to 3.8 cm., Puerto Suarez, Bolivia, May 6, 1909.

Dark brown in color with blue spots on the head; the soft dorsal and the anals with a few spots; depth about 2.5; interorbital 3.67 in the head; last dorsal spine two-fifths the length of the head; a broken lateral band traversed in some cases by faint cross-bands.



No. 2764a-h, 2.4 to 3.8 cm., Puerto Suarez, Bolivia, May 6, 1909.

Dark brown with blue spots on the head; a broken lateral band with faint cross-bands; depth 2.33 in the largest specimen; head about 3; last dorsal spine two-fifths to one-half the length of the head; three or four series of scales on the cheeks.

After a careful study of these specimens I do not hesitate to regard *H. pleurotania* Regan as a synonym of *H. borellii* Regan.

65. **Heterogramma ritense**, sp. nov. (Plate LXX.)

No. 2765a-d, Santa Rita, Rio Santa Rita of the Paraguay basin, June 12, 1909.

The type, No. 2765a, is 2.5 cm. long; the *cotypes*, Nos. 2765b-d, are 2 to 2.4 cm. long.

D. XV, 6; A. III, 6; depth 2.2; head 2.5; eye 3 in head, greater than the length of the snout and the interorbital space; preorbital about one-third the diameter of the eye; three rows of scales on the cheeks; three gill-rakers on the lobe and two on the lower branch of the first gill-arch; upper lateral line with seven to nine pores, the lower branch wanting; preoperculum scaleless; maxillaries extending to the front margins of the eyes; scales 2.5-21-7 (21 in a median lateral series); caudal peduncle half as long as deep; pectorals about as long as the head; seven more or less distinct cross-bands, but no lateral band; small caudal spot; faint band from the eyes to the mouth; bars beneath the eyes continued above the eyes on the top of the head; fins, excepting the base of the dorsal, which is black, colorless; dorsal spines about subequal from the fourth, which is one-half the length of the head.

The coloration, shorter and deeper body, fewer scales, gill-rakers, and shorter caudal peduncle separate this species from its nearest ally, *H. borellii*.

Genus GEOPHAGUS Heckel.

66. **Geophagus surinamensis** Bloch.

No. 2815, 6.3 cm., Santarem, Rio Tapajos, Dec. 6, 1909.

Nineteen dorsal spines, the fifth of which is more than one-half the length of the head.

No. 2817, 7 cm., Belem, Pará, Dec., 1909.

No. 2818a-b, 11 cm., São Antonio, Rio Guaporé, Aug. 10, 1909.

D. XVII, 11; A. II, 7; scales 8-34-11; pores  $\frac{21}{13}$ ; depth 2.5; head 3.25; fifteen gill-rakers on lower anterior arch; caudal peduncle one and



one-fourth times as long as deep; snout 2; eye 4; alternating light and dark bands on caudal fin; the other fins spotless.

No. 2819, 12 cm., Alcobaca, Rio Tocantins, Jan. 10, 1910.

The dorsal fin has eighteen spines, and is scaly at its base.

No. 2820a-c, 2.5 to 12.2 cm., Santarem, Dec. 12, 1909.

Vertical fins spotted, one with eighteen dorsal spines; the prolonged white ventral rays reach almost to base of caudal.

No. 2821, 16 cm., São Antonio de Guaporé, Rio Guaporé, July 23, 1909.

67. *Geophagus brasiliensis* Quoy & Gaimard.

No. 2768, 12 cm., Entre Rios, Rio Parahyba, June 10, 1908.

No. 2769a-t, 3.3 to 10.5 cm., Cachoeira, Bahia, Rio Paraguassú, April 14, 1908.

D. XV or XVI, 12; depth 2.33 to 2.5; caudal peduncle not quite as long as deep.

No. 2770a-h, 3.2 to 9.3 cm., Entre Rios, Rio Parahyba, June 1, 1908.

No. 2771, 9.9 cm., Campos, Rio Paraguay, June 15, 1908.

No. 2772a-e, 7-10 cm., Raiz de Serra near Santos, July 26, 1908.

Caudal peduncle longer than deep; depth 2.5.

No. 2773a-c, 11.2 to 12.7 cm., Porto Alegre, Rio Grande do Sul, Jan. 20, 1909.

These specimens are slightly deeper; the snout is shorter; D. XV, 11; the caudal peduncle is not as long as deep, in contrast to the Entre Rios specimens. They appear to be transitional between *G. brasiliensis* and *G. brachyurus*.

No. 2774a-c, 2.7 to 11.5 cm., Entre Rios, Rio Parahyba, June 2, 1908.

No. 2775a-u, 2.3 to 8.7 cm., Campos, Rio Parahyba, June 14, 1908.

D. XIV, 12; caudal peduncle three-fourths as long as deep; pectorals extending slightly beyond the origin of the anals; depth 2.25; head 2.75; eye 3.5 in the head.

No. 2776a-b, 10 and 11 cm., Porto Alegre, Rio Grande do Sul, Jan. 22, 1909.

No. 2777a-e, 6.8 to 9.3 cm., Raiz da Serra, Rio Mogy near Santos, July 27 and 28, 1908.

These specimens are more slender than examples having the same length taken in lagoons and slowly flowing water.

No. 2778a-s, 2.5 to 8.2 cm., Muniz Freire, Espirito Santo, Rio Itapemerim, June 9 and 18, 1908.



No. 2779a-d, 2.2 to 6 cm., São João da Barra, Rio Parahyba, June 24, 1908.

No. 2780, thirty-nine specimens, 1 to 8 cm., Campos, Rio Parahyba, June 13 and 15, 1908.

No. 2781a, 1.8 cm., Xiririca, Dec. 5, 1908.

No. 2781b-i, 3.4 to 4 cm., Iguapé, Rio Ribeira, Dec. 15, 1908.

No. 2782a-k, 2.5 to 6.4 cm., Minas, Rio Doce, May 26, 1908.

No. 2783a-b, 2.7 cm., São João da Barra, Rio Parahyba, June 22, 1908.

No. 2784a-c, 2.5 to 4.5 cm., Tocas, Lagoa Feia, June 27, 1908.

No. 2785, 3.5 cm., Rio Pelão, near Santos, July 31, 1908.

No. 2786a-f, 2.3 to 3.5 cm., Minas, Rio Doce, May 27, 1908.

No. 2787, 1.8 cm., Xiririca, Rio Ribeira da Iguapé, Dec. 5, 1908.

No. 2788, 11.2 cm., Lagoa Feia, Rio de Janeiro, June 16, 1908.

This specimen is very dark, and has peculiar tubercles on the gill-arches, which appear to be eggs, but are not.

No. 2789a-c, 4 to 9 cm., Morretes, Paraná, Jan. 2, 1909.

The largest specimen has the caudal peduncle longer than deep; depth 2.5, like the Raiz da Serra specimens, which also came from a rapid rocky stream.

No. 2790a-c, 3.4-4 cm., Morretes, Paraná, Jan. 4, 1909.

These smaller specimens are much more like the typical *C. brasiliensis*, having deeper bodies and shorter caudal peduncles than the larger examples from the same place; hence I infer that the change in the shape and form with age in such environment is due to individual adaptation and is not a fixed characteristic.

No. 2791, 11 cm., Porto Alegre, Rio Grande do Sul, January 21, 1909.

This specimen agrees with *G. brachyurus* in all details, excepting the length of the pectorals, a very variable character.

68. ***Geophagus brasiliensis iporangensis***, var. nov. (Plate LXXI.)

No. 2792a-e, 4.5-8.7 cm., Iporanga. From a mountain stream of the Rio Ribeira da Iguapé, Dec. 1, 1909. *Type*, No. 2792a.

D. XV, 11; A. III; depth 2.5; head 2.75; snout 2.12; diameter of eye 4 in the head; equal to the preorbital and interorbital space; maxillaries extending about midway between the posterior nares and the front margins of the eyes; fold of the lower lip interrupted; five series of scales on the cheeks; nine gill-rakers on the lower anterior arch; scales 4-28-9; one to two scales between the lateral line and the first dorsal rays; dorsal spines increase till the last one, which is two-fifths



the length of the head; soft fins scaleless; fin truncate; caudal peduncle one and one-fourth times as long as deep; pectorals not extending to the anal spines; fins almost spotless, being dark at their bases and black-edged; end of caudal peduncle and base of the caudal black, appearing like a large spot; a dark median lateral spot and a few or no blue spots on the head and the body.

The type is 8.7 cm. long and is an extreme in color and shape. There is greater difference between these specimens and the same-sized typical *G. brasiliensis* than there is between *G. brasiliensis* and *brachyurus*. If the intermediate stages did not exist, these specimens might warrant giving them specific rank.

69. ***Geophagus brasiliensis itapicuruënsis***, var. nov. (Plate LXXII.)  
No. 2793a-g, 7-11.3 cm., Queimadas, Rio Itapicurú, March 2, 1908.

Caudal peduncle three-fourths as long as deep; one with D. XIII, 13; depth 2; head 2.63; eye 4; snout 2.1; interorbital space 3 in head; scales 5-26-8; dorsal, anals, and ventrals edged with black, only a few spots on the last dorsal and anal rays; four broad lateral bands with a median lateral spot on one of them below the ninth to the tenth scales of the lateral line; ten gill-rakers on the lower anterior arch; the long dark lateral spot is characteristic of all specimens from the Itapicurú. These specimens spawn like the sun-fish. The type is 11.3 cm. long.

No. 2794, 10.5 cm., Rio Paiaia, near Bom Fim, Nov. 8, 1907.

D. XIV, 12; A. III, 8; depth 2.5; head 2.75; eye 3.8; snout 2.16; scales 4-27-8; pores  $\frac{19}{10}$ ; gill-rakers on the lower anterior arch; caudal peduncle seven-eighths as long as deep; pectoral fins extend to the anal spines; vertical fins with a few spots, otherwise dark; no blue spots on the body; four heavy broad black cross-bands on sides and a heavy band below the eye; five rows of scales on the cheeks.

No. 2795, 9.5 cm., Rio Zinga, near Bom Fim, Bahia, Nov. 7, 1907.

Depth 2.33; head 3; caudal peduncle seven-eighths as long as deep. The shorter caudal peduncle, color, and rounder body are characteristic of all specimens from the Itapicurú. The form from the Paraguassú is intermediate between this variety and the typical Parahyban form.

70. ***Geophagus balzanii*** Perugia.

No. 2797, 4.5 cm., Campos Alegre, Rio Jaurú, June 21, 1909.



No. 2798, 6.5 cm., Uruguayana, Rio Uruguay, 1909.

No. 2799a-e, 2.8-5.4 cm., Corumba, Rio Paraguay, April 27, 1909.

The smallest specimen has a caudal peduncle as long as deep: depth 2-2.4 in length of body.

No. 2800, 7.5 cm., Corumba, Rio Paraguay, April 28, 1909.

No. 2801a-e, 7.8-12.2 cm., São Luiz de Cáceres, Upper Rio Paraguay, May 27, 1909.

D. XIII or XIV, 13; A. III, 9; pores  $\frac{22}{9}$ ; depth 1.8; head 2.8; eye 4 in head; snout 1.67 in head; some have the fold of the lip interrupted, and some have soft dorsal not scaly, and some are fairly well scaled at their base.

No. 2802a-e, 3-5 cm., Puerto Suarez, Bolivia (Steinbach Collection).

Depth 2.33; head 2.8; snout 3 in the head; eye 2.5; interorbital space 3.5; preorbital 4; caudal peduncle about as long as deep, soft dorsal ranging from scaleless to fairly well scaled.

The young of this species appear to be different from the adults, which also have the soft dorsal ranging from scaleless to scaled (in one case some of the membranes between the last dorsal spines are scaly); some have spotted vertical fins and others do not, and some have the fold of the lower lip interrupted, while others are continuous. In view of all this the genus *Satanoperca* does not appear to be tenable.

71. ***Geophagus brachyurus* Cope.**

No. 2871a-e, 5-6 cm., Uruguayana, Rio Uruguay, Feb. 7, 1909.

D. XII to XIV, 9 to 10; depth about 2.33; head 3; eye 3.5 to 4 in head, a little more than the preorbital and a little less than the interorbital width; scales 4-24 to 27-8 or 9 (counted in a median lateral series); eight gill-rakers on lower anterior arch; three or four rows of scales on the cheek; caudal peduncle about as long as deep; nares half-way between tip of the snout and the eyes; sides with about six double bands, the third having a dark spot; band below eyes meeting on top of head; vertical fins more or less white-spotted, some specimens with white bands on the spinous dorsal. One has a pectoral fin which reaches almost to the base of the caudal; at least the outer halves of the ventrals dark blue; some with brown pigment at the bases of the scales along the sides; two series of scales between the lateral line and first dorsal rays.

No. 2812a-e, 1-4 cm., Cacequy, Rio Grande do Sul, Feb. 1, 1909.

The very pointed snout is four-fifths the length of head; vertical fins



almost colorless; one scale between lateral line and first dorsal rays. No. 2813a-b, 2.5-4 cm., Cachoeira, Rio Grande do Sul, Jan. 26, 1909.

No. 2814, 7 cm., Porto Alegre, Rio Grande do Sul, Jan. 21, 1909.

D. XIV, 9; A. III, 8; depth 2; eye almost 4; preorbital about equal to interorbital and 4 in head; fold of lower lip not continuous; maxillaries not extending to the eye; eight to ten gill-rakers on the lower anterior arch; scales 5-24-10 (counted in a median lateral series); caudal peduncle .75 as long as deep; seven rows of scales on cheek; one scale between lateral line and first dorsal rays; caudal emarginate; pectorals extending beyond the origin of anal; bar through the eye and rather obscure cross-bars with a lateral spot; blue lines between the cheeks and preoperculum and some blue spots on the cheeks and the operculum; fins blue-black, especially the dorsal and ventrals, without spots; some faint bars on the dorsal; each scale with dark brown, which appears as broken lateral bands. Most of my specimens do not have pearly spots on the sides.

*Geophagus brachyurus* is very similar to *G. brasiliensis*, changing into the longer form, *G. gymnogenys*, on the one hand, and into *G. balzanii*, the rounder one, on the other. The extremes are quite distinct, but when one has all of the intermediate stages he could consider the three species identical. I have left them separate for convenience in speaking of the local variations.

*Geophagus australe* Eigenmann (1907) is identical with the smaller specimens of *G. brachyurus* except for the lateral spot, which is often lost with age.

## 72. *Geophagus cupido* Heckel.

No. 2822a-d, 6.4-11 cm., São Antonio de Guaporé, Rio Guaporé, Aug. 10, 1910.

Snout 2.25; D. XVI, 10 and 11; three specimens have the fold of the lower lip interrupted, and one has it continuous; eye equal to the preorbital and the interorbital space.

No. 2823 a-b, 4.3 cm., São Antonio de Guaporé, Rio Guaporé, July 26, 1909.

The dorsal spine membranes are black-edged; the interorbital space is less than the diameter of the eye.

No. 2824, 6.5 cm., São Antonio de Guaporé, Rio Guaporé, July 31, 1909.

No. 2825, 5 cm., Santarem, Dec. 6, 1909.



Snout and interorbital space less than the diameter of the eye.

No. 2826a-b, 7 and 9 cm., Villa Bella, Rio Beni, Bolivia.

D. XV, 10; A. III, 9; depth 2.25; head 3.25; eye 3; snout 2.16; scales 6-29-13; eight gill-rakers; pores in lateral line  $\frac{18}{13}$ ; indistinct cross-bands; caudal distinctly emarginate.

No. 2827, 10 cm., Bastos, Rio Alegre of Guaporé, June 26, 1909.

73. **Geophagus gymnogenys** Hensel.

*G. brachyurus* Cope *partim*, *G. camurus* Cope.

No. 2803a-d, 11 and 12 cm., and a lot of young fish which came out of the mouth of some older one, Porto Alegre, Rio Grande do Sul, Jan. 22, 1909.

Depth 2.66; head 3.33; snout 2.2; scales nearly all gone from the cheeks (excepting parts of two or three rows); eight gill-rakers on lower anterior arch, pectorals longer than the head, reaching to the anal spines; the males with swollen heads.

No. 2804a-c, 10.8-11.5 cm., Porto Alegre, Jan. 24 and 27, 1909.

D. XIII or XIV; A. III, 8; depth 2.6; head 3+; eye about 4; scales 4-29-9.

No. 2505a-j, 7-10 cm., Porto Alegre, Jan. 20, 1909.

The females are always less highly colored.

No. 2806a-m, 3-9.7 cm., Porto Alegre, Jan. 21, 1909.

No. 2807a-b, two females, 5.7 and 7 cm., and some young, Cachoeira, Rio Grande do Sul, from Rio Jacuhy, Jan. 27, 1909.

The young ones were seen entering the mouth of an adult, which upon removal from the water ejected them. This same specimen has six complete rows of scales on the cheeks, and the loss of scales cannot be associated with the breeding season.

No. 2808a-c, 2.8-8.3 cm., Cachoeira, Rio Grande do Sul, Rio Jacuhy, Jan. 29, 1909.

These specimens also have five or six rows of scales on the cheeks. If there are no scales their absence is due to the death of the fish before it was placed in alcohol. Those which were put into alcohol alive have scales, while those taken from the market always had few or no scales on the cheeks.

No. 2809a-d, 3-6 cm., Uruguayana, Rio Uruguay.

No. 2810a-g, 4-7 cm., Cacequy, Rio Ibicuhy, Rio Grande do Sul, Feb. 2, 1909.

These specimens (both sexes) are more slender and much less colored



than the Porto Alegre specimens; all have scales on the cheeks and nearly all have a bar through the eye, faint bars and a spot on the sides. (Some of Cope's specimens labeled *G. brachyurus* belong to this species. *G. camurus* is also a synonym.)

74. ***Geophagus dæmon* Heckel.**

*G. acuticeps* Heckel.

No. 2842, 5.3 cm., Manaos, Nov. 29, 1909.

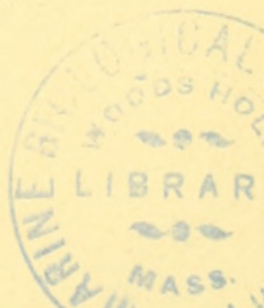
Twenty-one gill-rakers on lower anterior arch; depth 2.5; head 3; eye equal to the interorbital, a little more than the preorbital and a little less than the snout, all of which are about one-third of length of head; seven rows of scales on cheeks; A. III, 8; D. XIII, 12; scales 5-28-9 (in a median lateral series); caudal peduncle one and one-fourth times as long as deep; the pectoral fin reaching to anal; dorsal spines about subequal from the fifth, which is about two-thirds as long as the head; soft dorsal and anal not scaly at base; fold of upper lip continuous (another case where the fold of the lower lip is not of diagnostic character); caudal fin truncate; two rows of scales between lateral line and first dorsal rays. Olivaceous, with seven more or less distinct cross-bands and a faint caudal spot; soft dorsal and caudal with faint white and dark bars and spots; three or four spots in soft anal.

No. 2843a, 13 cm.; Manaos, November 27, 1909.

D. XIII, 11; A. III, 7; depth 2.5; head 3; pores  $\frac{19}{11}$ ; twenty-nine scales in a median lateral series; pectoral fin reaching past anal spines and much longer than the head; snout about 2 in head; interorbital space 3 in head; preorbital equal to the eye; caudal peduncle distinctly longer than deep; anal, ventral, and dorsal rays prolonged, those of soft dorsal reaching far beyond the tip of caudal and about four-fifths of the length of the body to base of caudal; two silvery blue lines from eye to mouth and several blue spots on head and scales of sides of body; soft vertical fins with bars and spots; a caudal spot; gill-arches in bad condition, but there are sixteen to nineteen gill-rakers on lower anterior arch; last dorsal spine about the length of the head; dorsal spines subequal from the fifth.

No. 2483b, 11.5 cm., Manaos, Nov. 15, 1909.

D. XIII, 12; pectoral fins much longer than the head; the dorsal spines increasing to the last one, which is two-thirds the length of the head; eighteen or nineteen gill-rakers on lower anterior arch; scales





4-31-9; eye 3.25 in head; snout 2.16 in head; depth 2.67; caudal peduncle one and one-fourth times as long as deep; fold of lower lip continuous; soft dorsal and anal scaleless; 2.33 scales between lateral line and first dorsal ray.

When variations due to size are considered, I am unable to draw any distinction between *G. acuticeps* and *G. dæmon*. *Geophagus jurupari* and *dæmon* are very closely related in the same manner as are *G. brasiliensis*, *gymnogenys*, *brachyurus*, and *balzanii*.

75. ***Geophagus jurupari* Heckel.**

*G. pappaterra* Heckel.

No. 2828, 17.3 cm., Bastos, Rio Alegre, June 28, 1909.

D. XVI, 10; A. III, 7; depth 2.67; head 3; eye 4.5 in head, 2.75 in snout; 2 in preorbital and 1.33 in interorbital space; pectoral fin as long as the head and extending slightly beyond the origin of the anal; six rows of scales on the cheeks; caudal peduncle one and one-fifth times as long as deep; sixteen gill-rakers; fourteen rows of scales between the dorsal and pectoral fins, of which the middle rows have thirty-one scales; dorsal and anal fins scaleless; dorsal spines only slightly increasing from the fifth to the last, which is half as long as the head. In life this specimen was yellowish-brown with a dark band from the operculum to the base of caudal, where it ends in a black spot on the upper half of base of caudal; six black spots beneath base of dorsal, these spots being remains of cross-bars seen in smaller specimens; fins uniformly dark in color; no blue spots on the head; two scales between the lateral line and first dorsal rays. This specimen differs a great deal from *G. jurupari*, but the series of smaller specimens makes me feel sure that *G. pappaterra* is a synonym of *G. jurupari*.

No. 2829, 15 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

D. XV, 10; A. III, 7; depth 2.5; head 3; snout about 2; eye 4.5; scales 4-29-10; pores  $\frac{19}{10}$ ; seventeen and eighteen gill-rakers on the first two lower anterior arches; caudal peduncle about as long as deep; preorbital one and two-thirds times the diameter of the eye; interorbital space one and one-fourth the diameter of the eye; pectorals about the length of the head and extending to the origin of the anal; fold of lower lip subcontinuous; vertical fins with a few spots; median lateral band with broken cross-bands; spines about subequal from the fourth, which is not quite half as long as the head.



No. 2830, 8.5 cm., San Joaquin, Bolivia, in a muddy lake near Rio Marmoré, Sept. 4, 1909.

D. XIV, 10; A. III, 7; depth 2.33; head 2.75; eye 3.75; snout 2; scales 4-29-10 (counted in a median row); sixteen gill-rakers; five or six faint broken cross-bands; small spot on upper part of base of caudal; a few spots in base of soft dorsal; pectoral fins extend to anal spines; last dorsal spine a little more than half of length of head. No. 2831, 15.5 cm., Manaos, Nov. 29, 1909.

D. XVI, 9; sixteen gill-rakers; twenty-nine scales in a median lateral series; pectorals reaching past the first anal spine; head with blue spots; very faint broken lateral band and a small caudal spot; edge of dorsal black; caudal peduncle as long as deep; vertical fins with a few white spots. This specimen had a small one in its mouth.

No. 2832, 14 cm., Manaos, Nov. 27, 1909.

D. XV, 10; A. III, 6; sixteen gill-rakers; several of the scales on the sides have silvery white spots, otherwise like the above specimen. No. 2833, 8.3 cm., Santarem, Rio Tapajos, Dec. 6, 1909.

Fifteen gill-rakers; caudal peduncle not quite as long as deep; a stripe between the eyes and another across the head just back of the eyes; six or seven cross-bands; dorsal and anal fins spotted; a small caudal spot; pectorals not quite reaching the anal.

No. 2834, 4.3 cm., São Luiz de Cáceres, Rio Paraguay, May 24, 1909.

A. III, 8; scales 30; caudal peduncle as long as deep; pectorals extending to origin of anal; three stripes between the eyes and one back of them; the faint lateral band crossed by about seven broken bands; vertical fins spotted; two light brown bands from the eye to the mouth; sixteen gill-rakers.

No. 2835a-c, 4.1-6.5 cm., Bastos, Rio Alegre, June 27, 1909.

D. XIV, 11; caudal peduncle longer than deep; sixteen gill-rakers; scales thirty; lateral band crossed by six faint bands; two or three stripes between and back of eyes; two stripes from the eyes to mouth.

No. 2836, 4 cm., Bastos, Rio Alegre, June 26, 1909.

No. 2837, 3.5 cm., Campos Alegre, Rio Jauru, June 3, 1909.

No. 2839, 3.5 cm., Posada, Campos de Matto Grosso (swampy plains in headwaters of Rio Guaporé), June 21, 1909.

Depth of body equals length of head, 2.67 in length of body; D. XIV, 10; A. III, 6; scales 29; caudal peduncle not quite as long as deep; six very distinct cross-bars and a median lateral band; dorsal fin barred and spotted, other fins plain; stripes between the eyes; two



bars from the eyes to the snout; very dark brown in color; sixteen gill-rakers.

No. 2840a-b, 5.5-7 cm., Rio Jauru, June 2, 1909.

The cross-bands are very distinct both above and below the median lateral band; two blue stripes from eyes to mouth; vertical fins spotted.

No. 2841, 13.5 cm., Santarem, Dec. 6, 1909.

Caudal peduncle one and one-fourth times as long as deep; seventeen gill-rakers; very faint lateral and cross-bands; two stripes between eyes; vertical fins spotted; a few blue spots on the operculum; dorsal spines subequal from the fourth, which is a little more than half of the length of the head; head 3 in length; depth 2.75; pectorals just reaching to origin of anal.

It is interesting to note that all fishes from clear or dark water full of plants are always darker in color than those from muddy rivers or along clean sand-bars. Also, cross and lateral bands tend to break up into lateral spots or else to disappear entirely in the adult. In view of the specimens and observations taken in the field, I do not hesitate to consider *G. pappaterra* identical with *jurupari*. It was based upon a very large specimen and is one of the end variations of *G. jurupari*. All of the intervening stages exist in the same locality.

Genus BIOTÆCUS Eigenmann and Kennedy.

76. **B. opercularis** (Steindachner).

No specimens were taken by the expedition.

Genus SYMPHYSODON Heckel.

77. **Symphysodon discus** Heckel.

*S. æquifasciatus* Pellegrin.

No. 2844a-d, 10.5-12.5 cm., Manaos, Nov. 15, 1909.

No. 2845, 10 cm., Santarem, Dec. 6, 1910.

These specimens vary greatly in coloration in life. If put into alcohol after they have been dead for some time, the brilliant colors all entirely disappear. Pellegrin's variety *æquifasciatus* came from the market, and I consider it to be the same as *S. discus*.

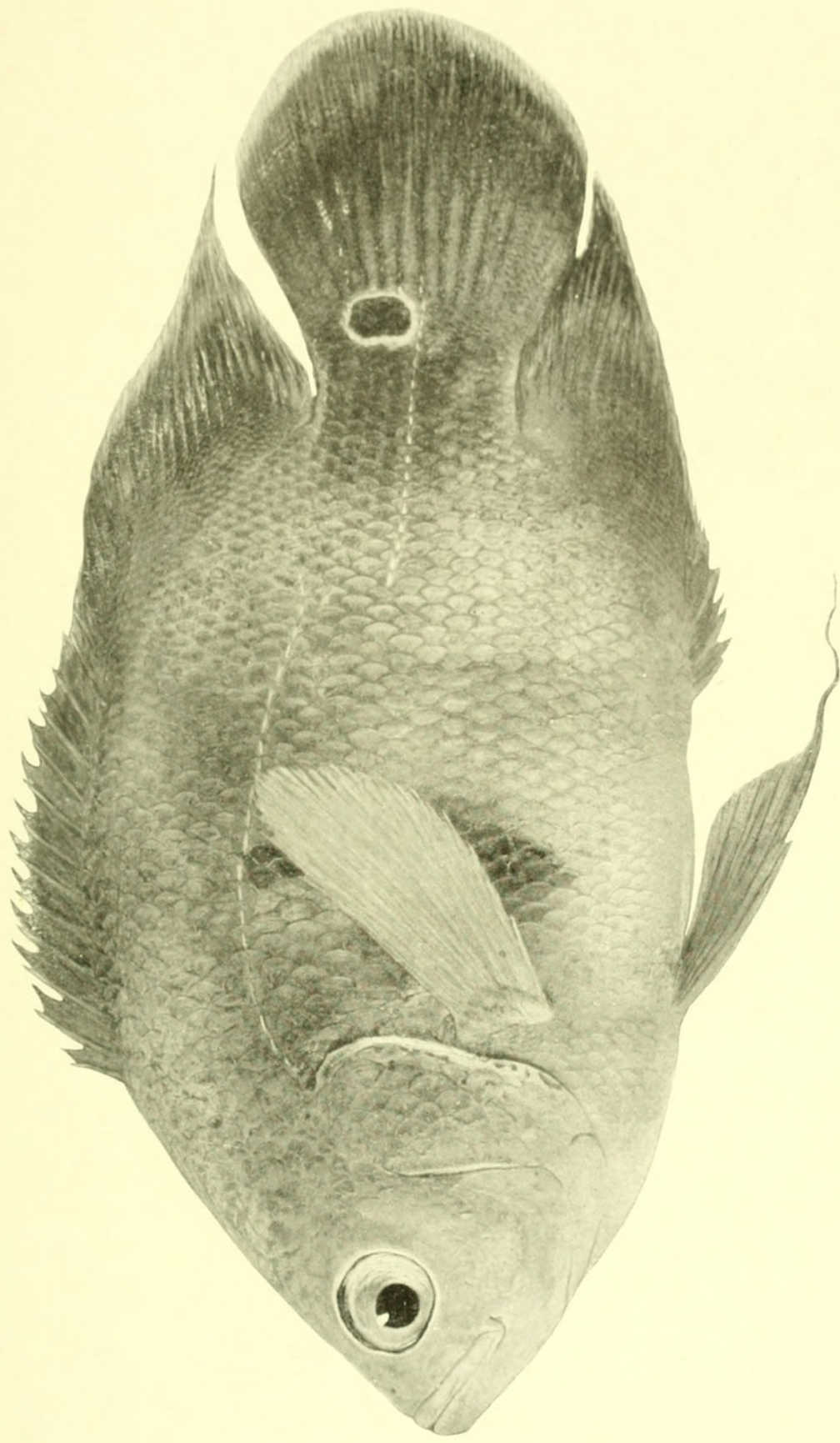
Genus PTEROPHYLLUM Heckel.

78. **Pterophyllum scalare** (Cuvier & Valenciennes).

*P. altum* Pellegrin.

No. 2846, 4-6 cm., Santarem, Dec. 7-15, 1909.





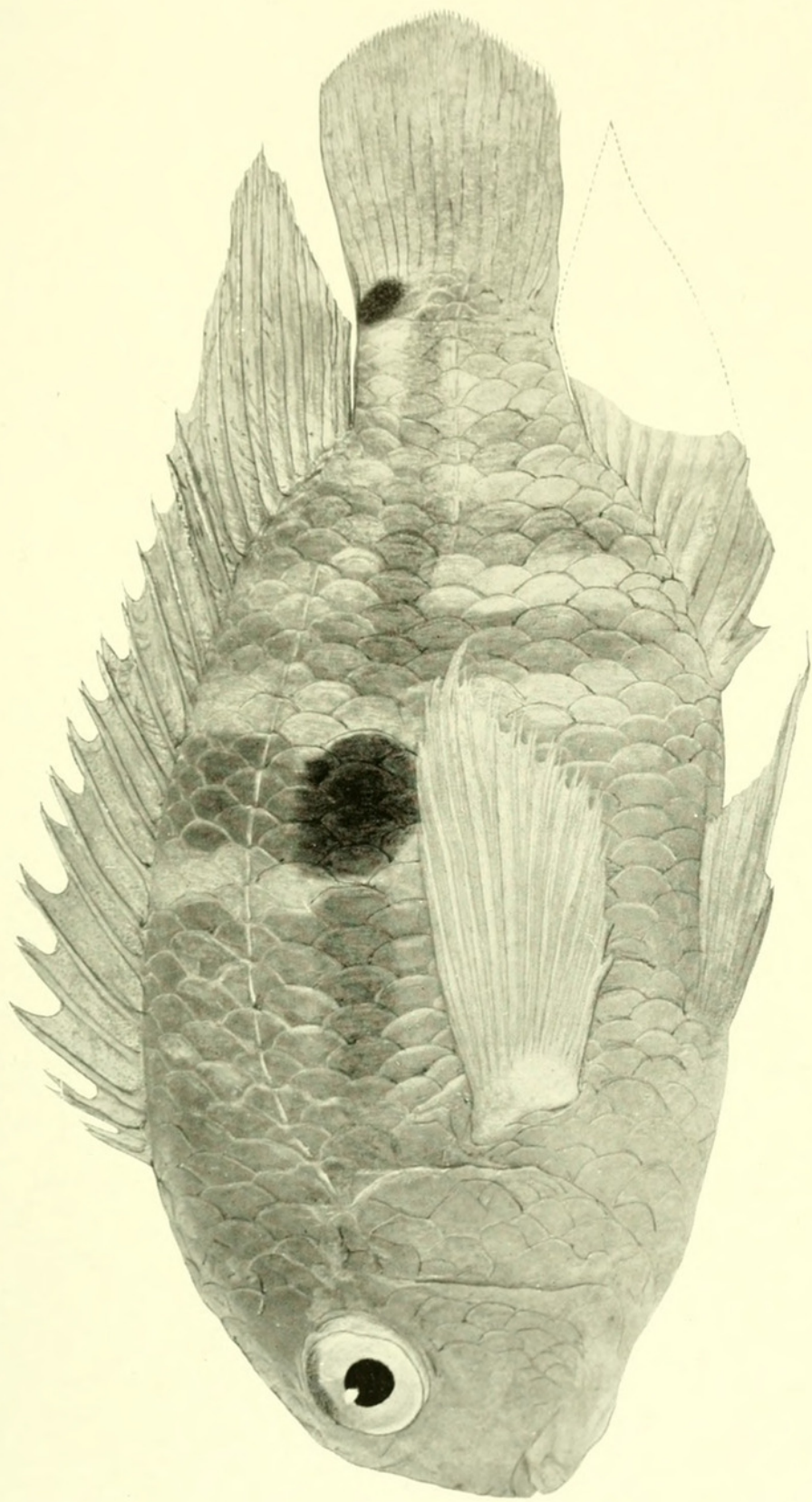
*Astronotus orbiculatus* Haseman. Type. 180 mm. C. M. Cat. No. 2515.





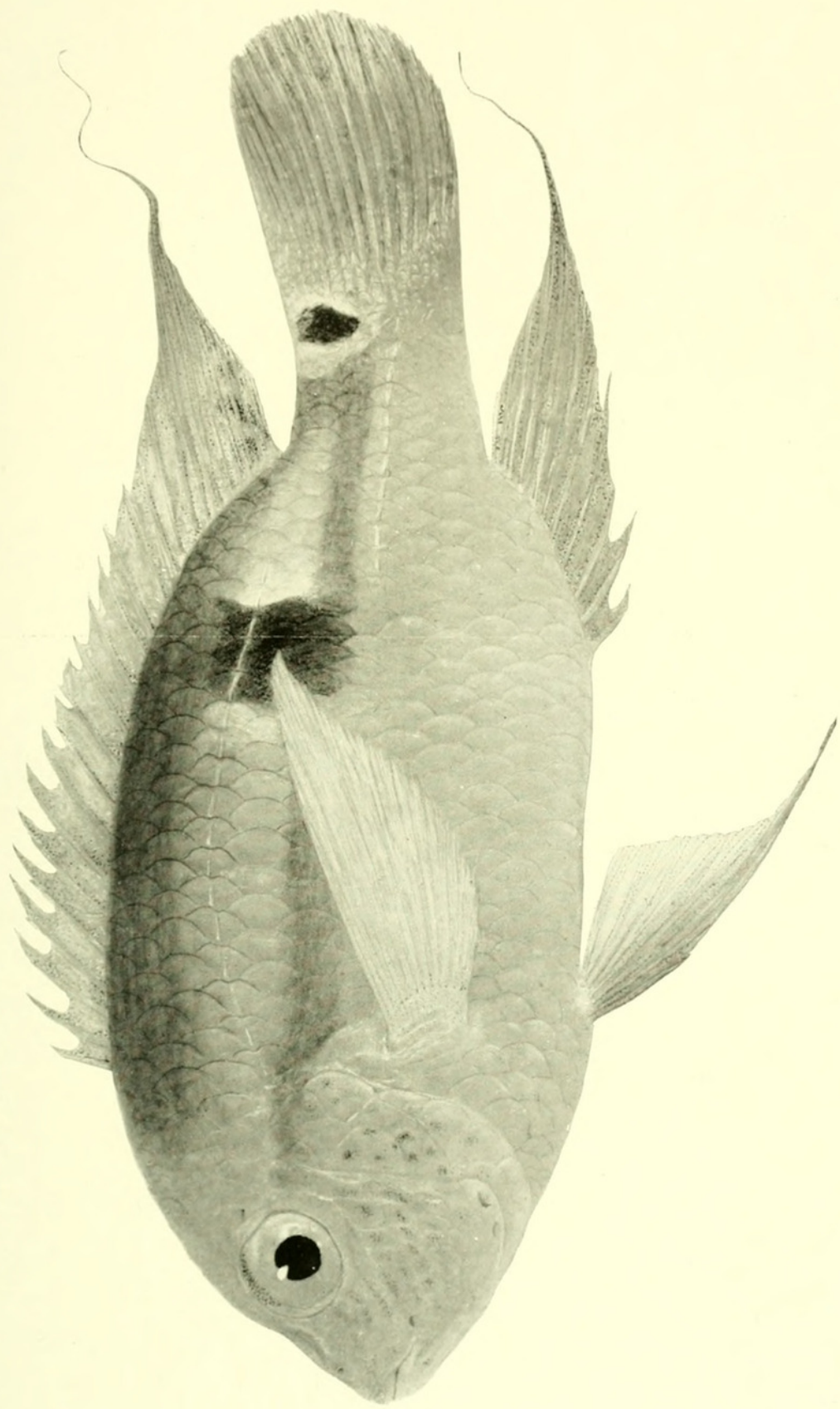
*Aequidens guaporensis* Haseman. Type. 75 mm. C. M. Cat. No. 2575.





*Aequidens awani* Haseman. Type. 181 mm. C. M. Cat. No. 2576.





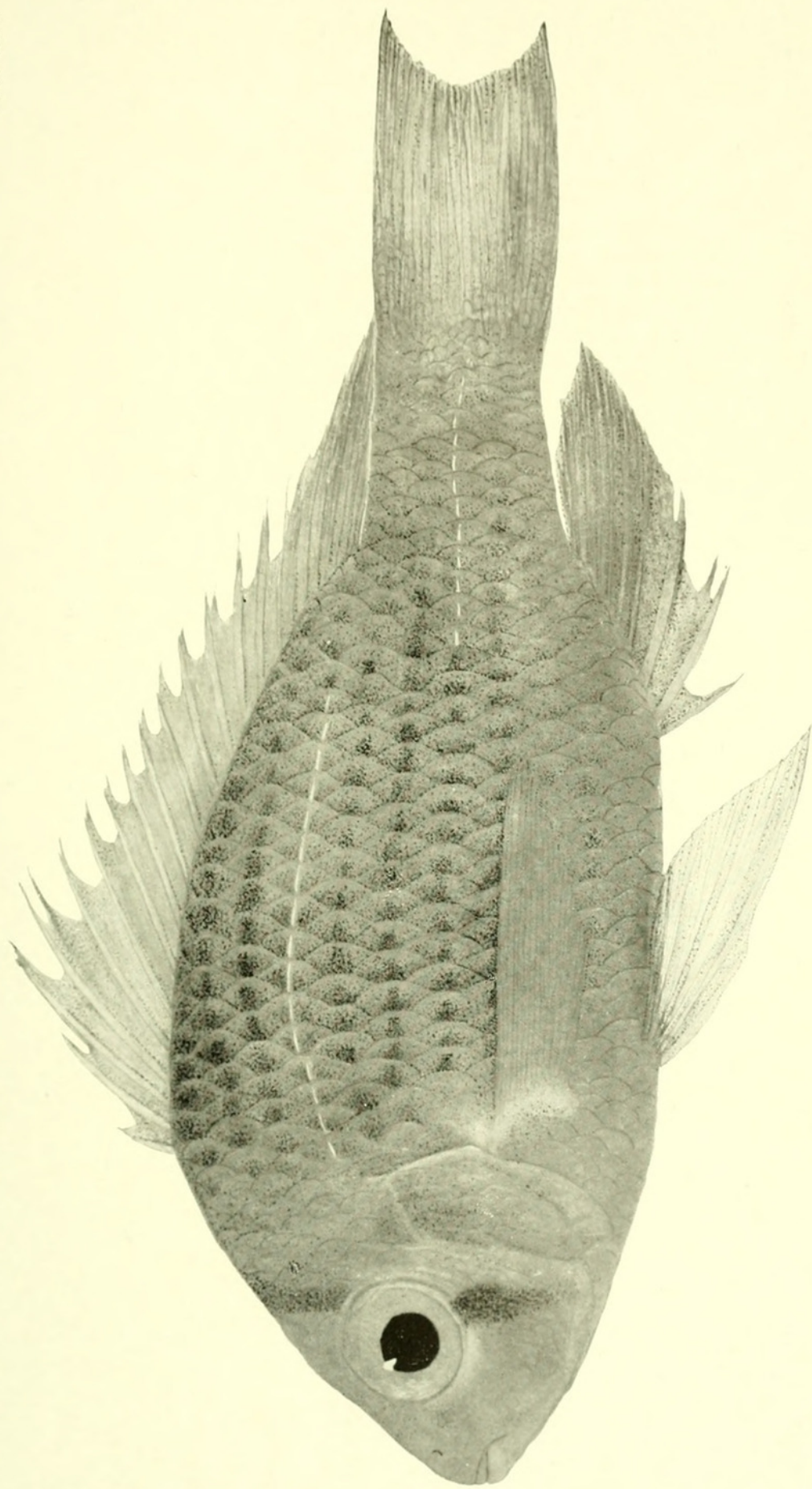
*Aequidens duopunctata* Haseman. Type, 131 mm. C. M. Cat. No. 2574.





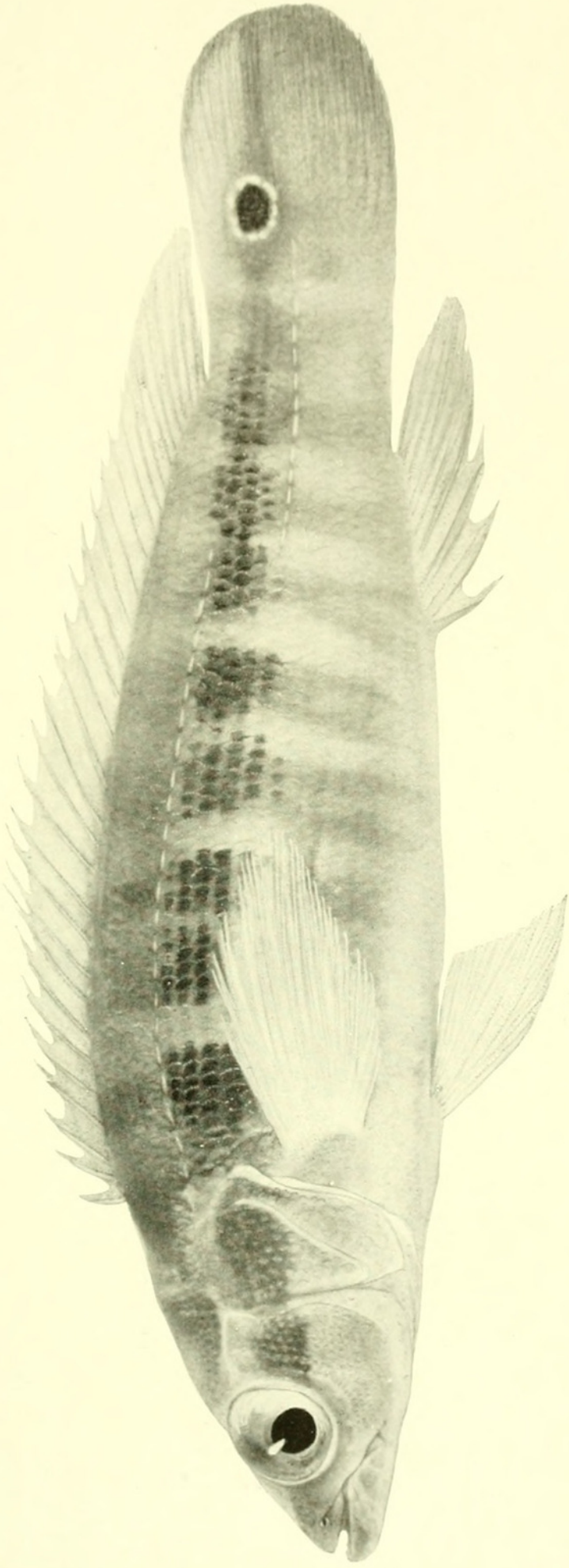
*Cichlasoma facetum* Jenyns. 83 mm. C. M. Cat. No. 2615.





*Crenicara altispinosa* Haseman. Type, 71 mm. C. M. Cat. No. 2639.

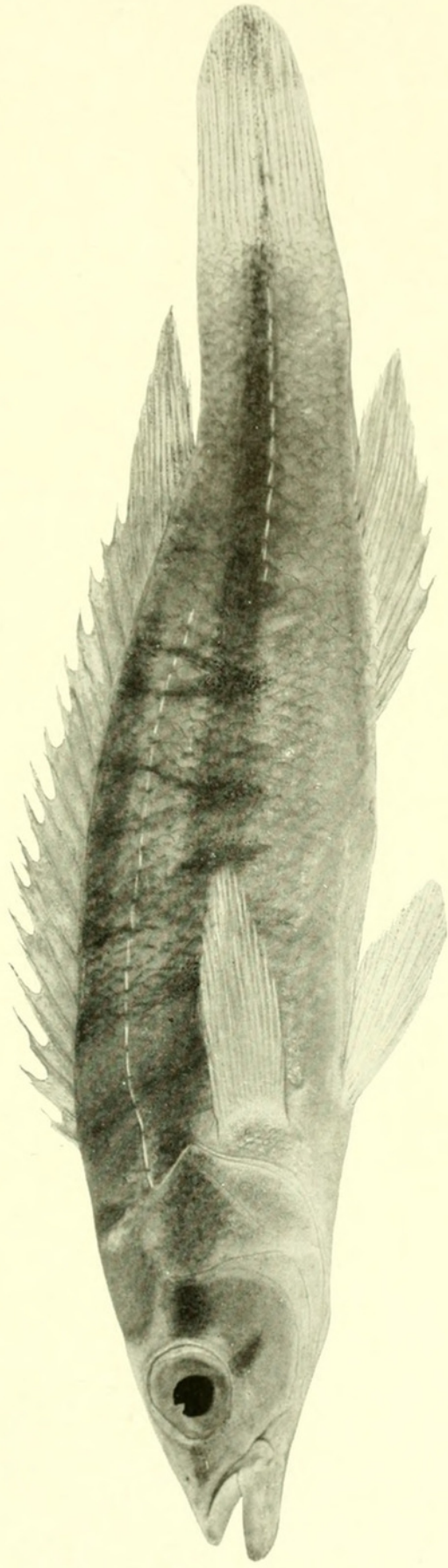




*Crenicichla simoni* Haseman. Type. 92 mm. C. M. Cat. No. 2646.

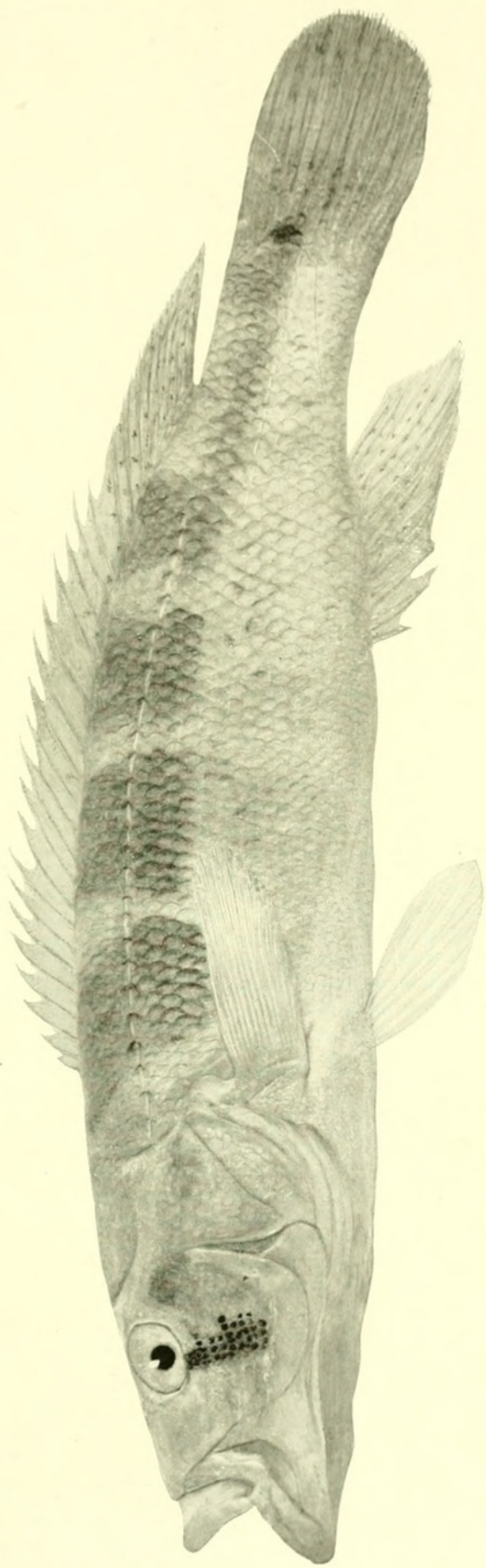






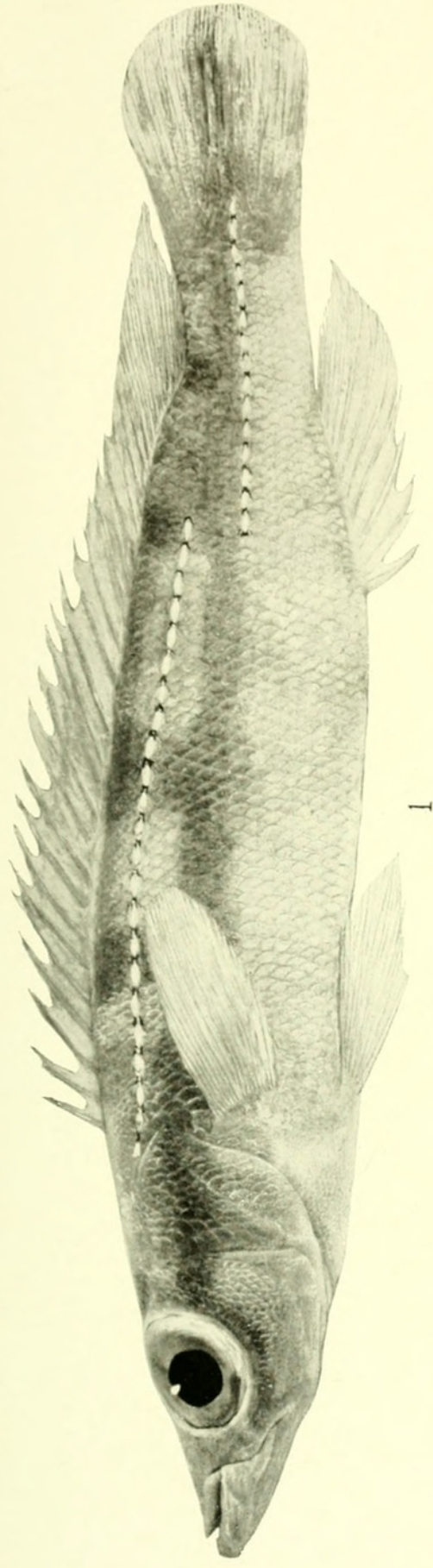
*Crenichthys jaguarensis* Haseman, Type, 65 mm. C. M. Cat. No. 2723.





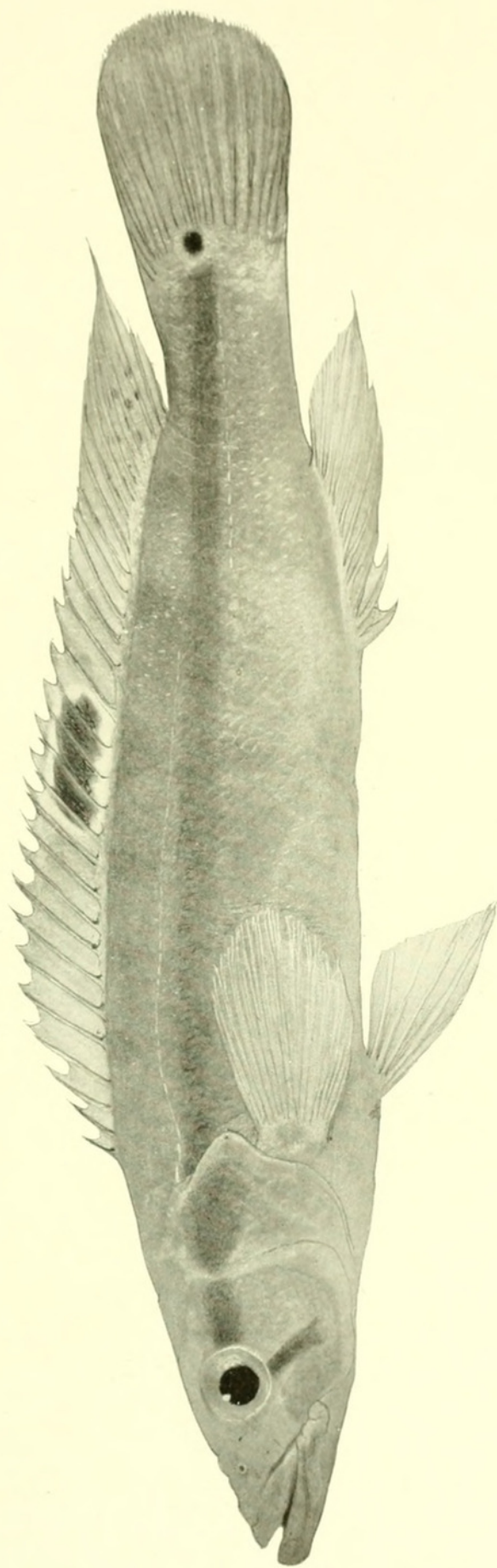
*Crenicichla iguassuensis* Haseman. Type. 170 mm. C. M. Cat. No. 2725.





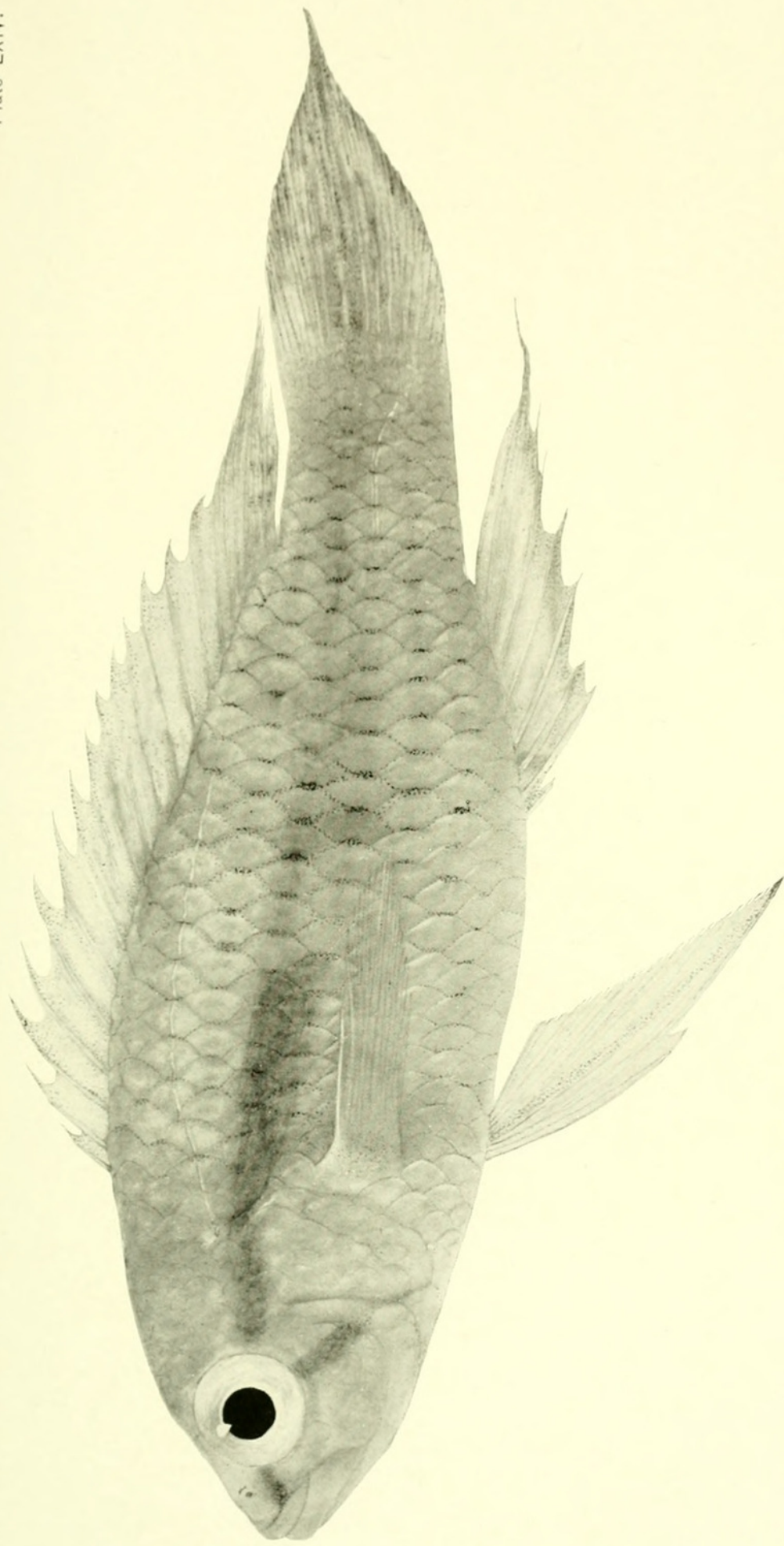
1. *Crenicichla santaremensis* Haseman. Type. 115 mm. C. M. Cat. No. 2719.  
2. *Heterogramma trifasciatum*, var. *maciliense* Haseman. Type. 21 mm. C. M. Cat. No. 2751.





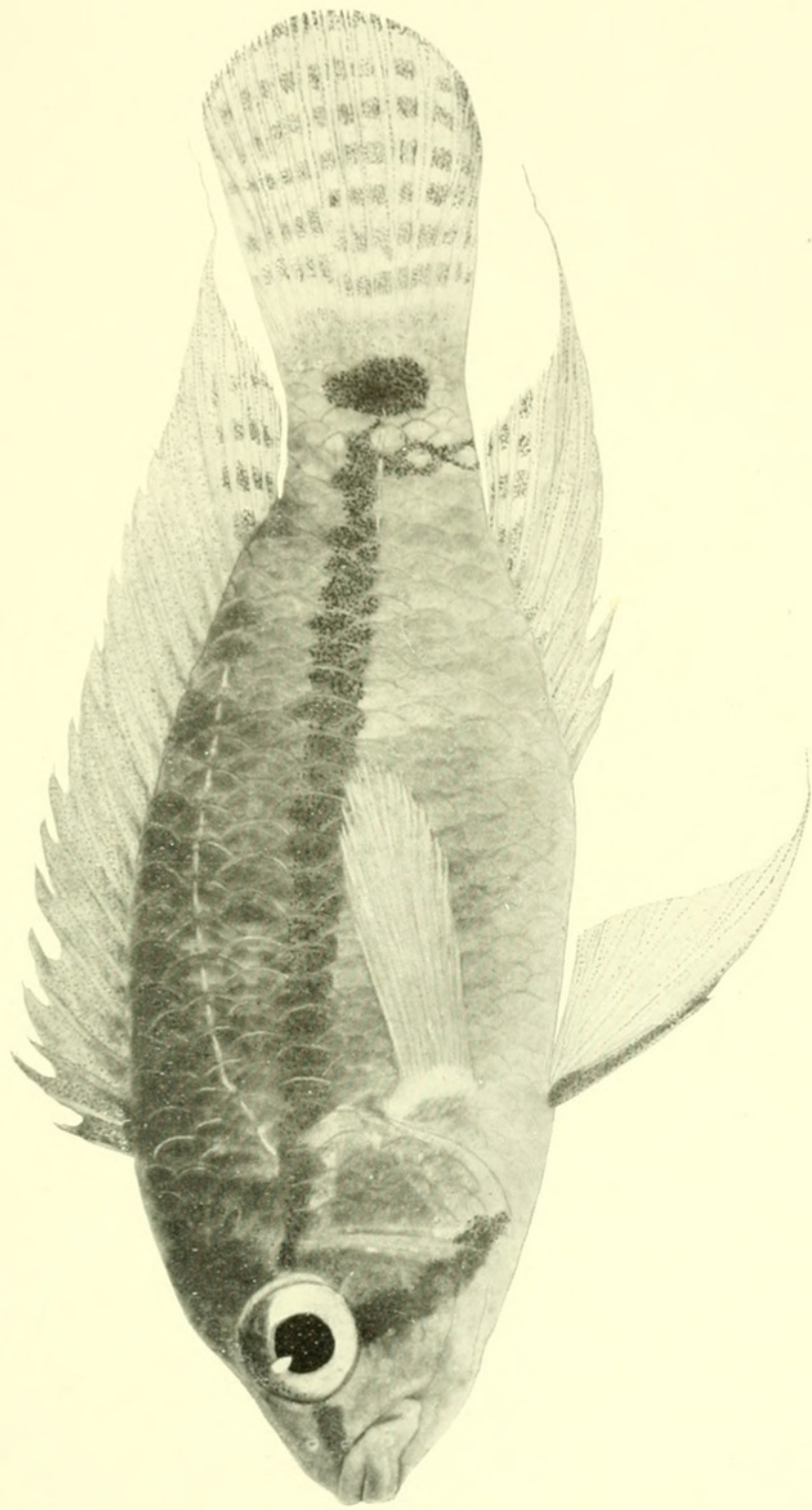
*Crenicichla dorsocellata* Haseman. Type. 215 mm. C. M. Cat. No. 2721.





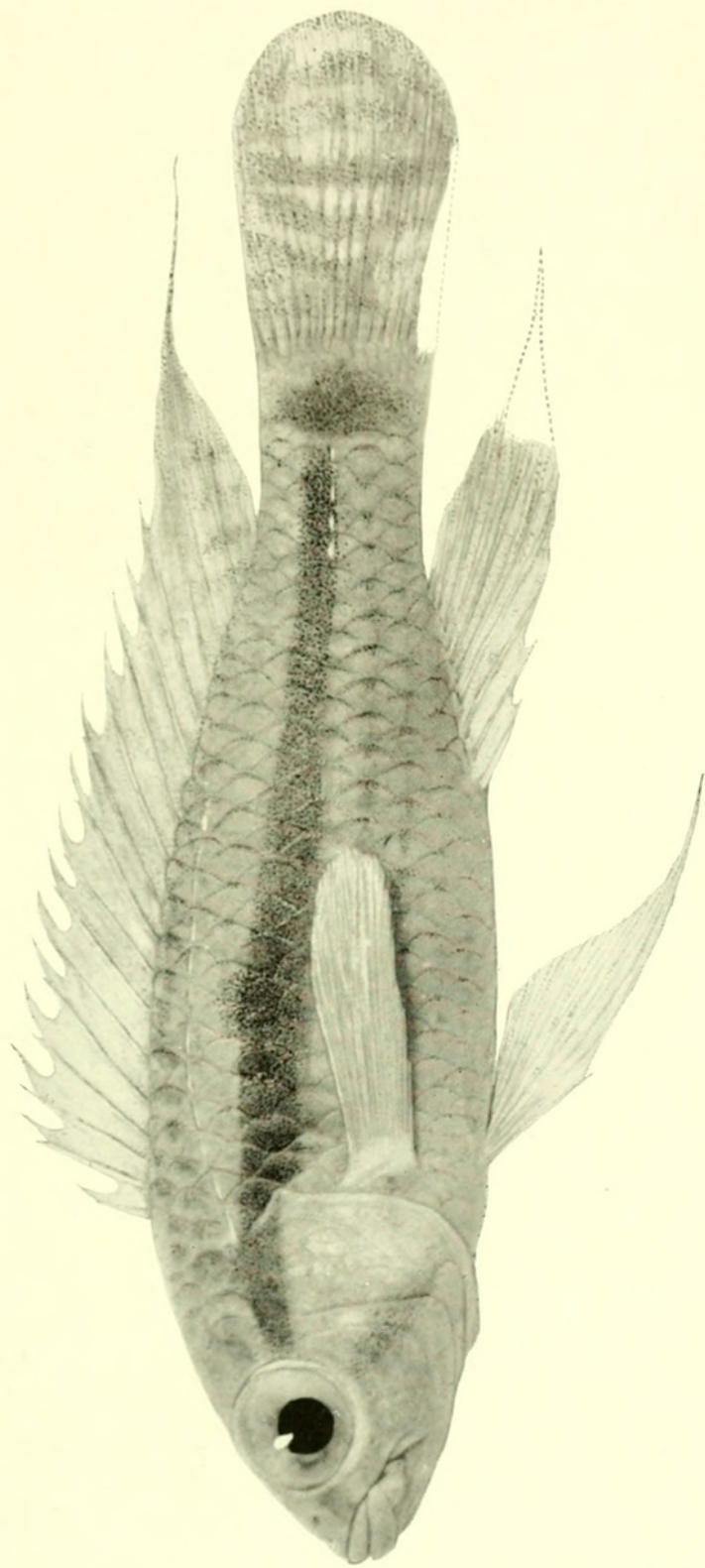
*Heterogramma agassizi* (Steindachner). 50 mm. C. M. Cat. No. 2729





*Heterogramma tenuatum* (Günther). 50 mm. C. M. Cat. No. 2732.



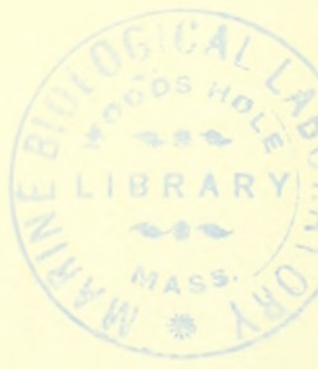


*Heleroogramma taniatum*, var. *perlense* Haseman. Type. 37 mm. Car. Mus. Cat. No. 2741.

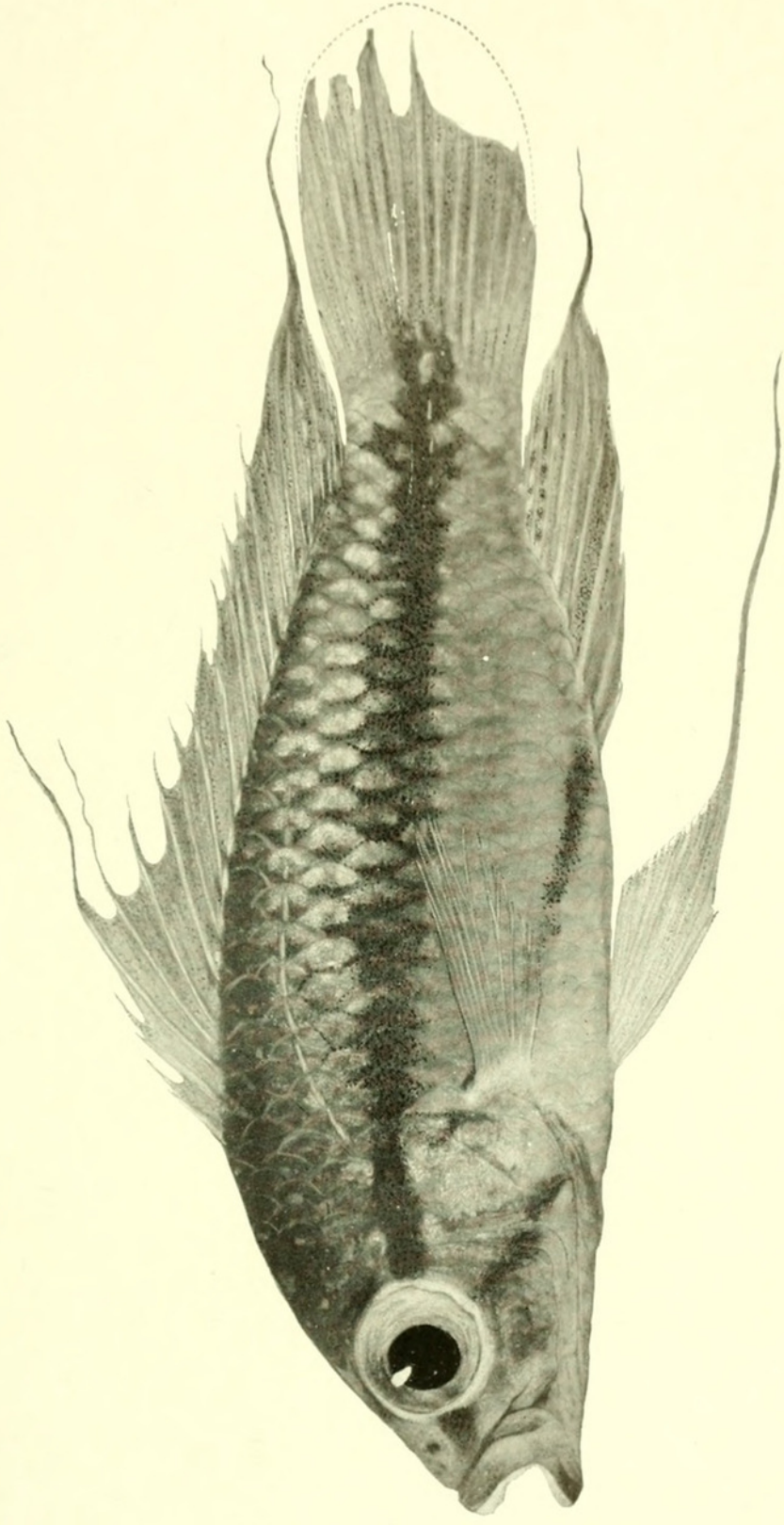




*Heterogramma corumbæ* Eigenmann and Ward. 31 mm. C. M. Cat. No. 2754.

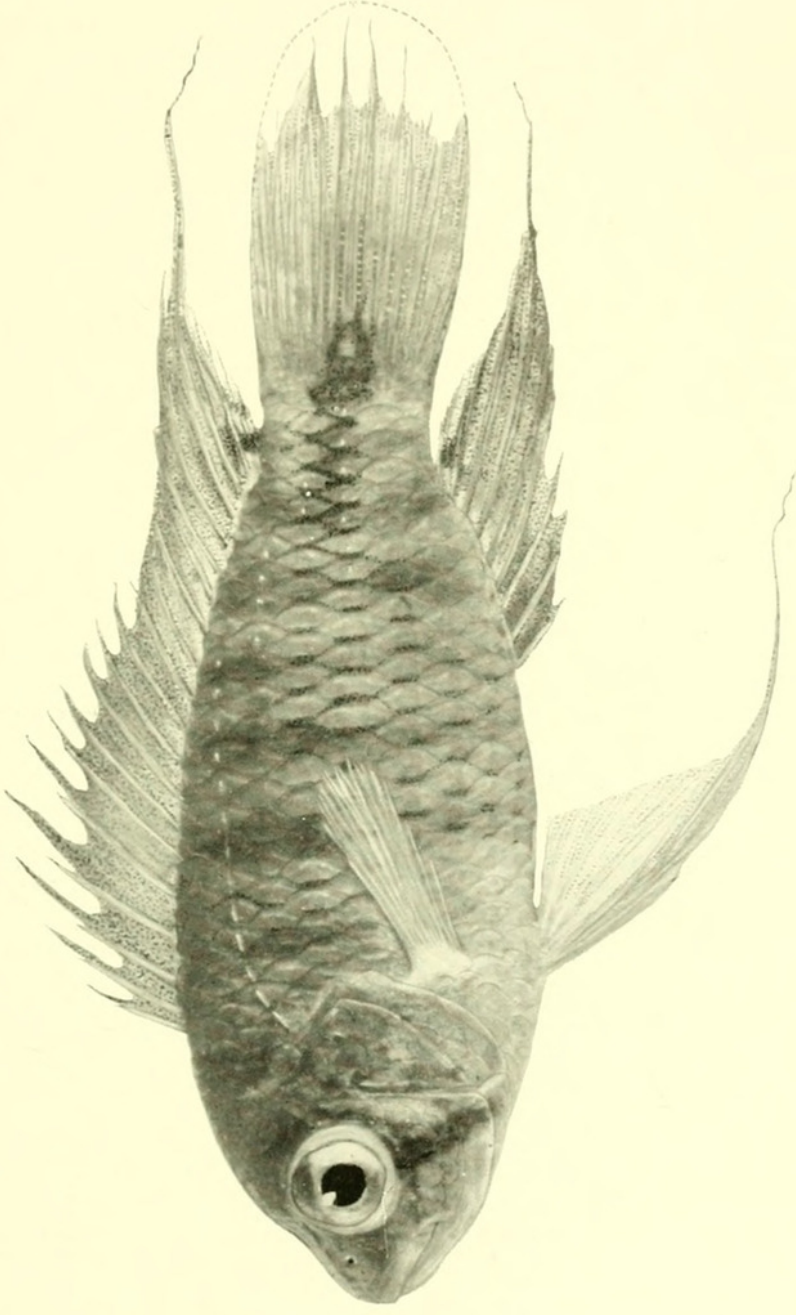






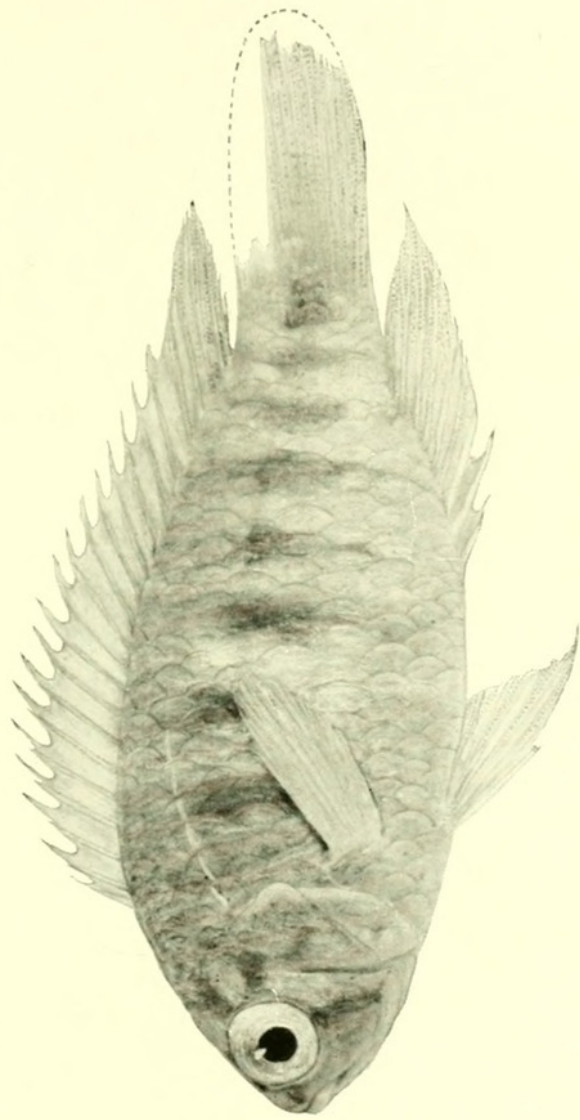
*Heterogramma trifasciatum* Eigenmann and Kennedy. 39 mm. C. M. Cat. No. 2743.





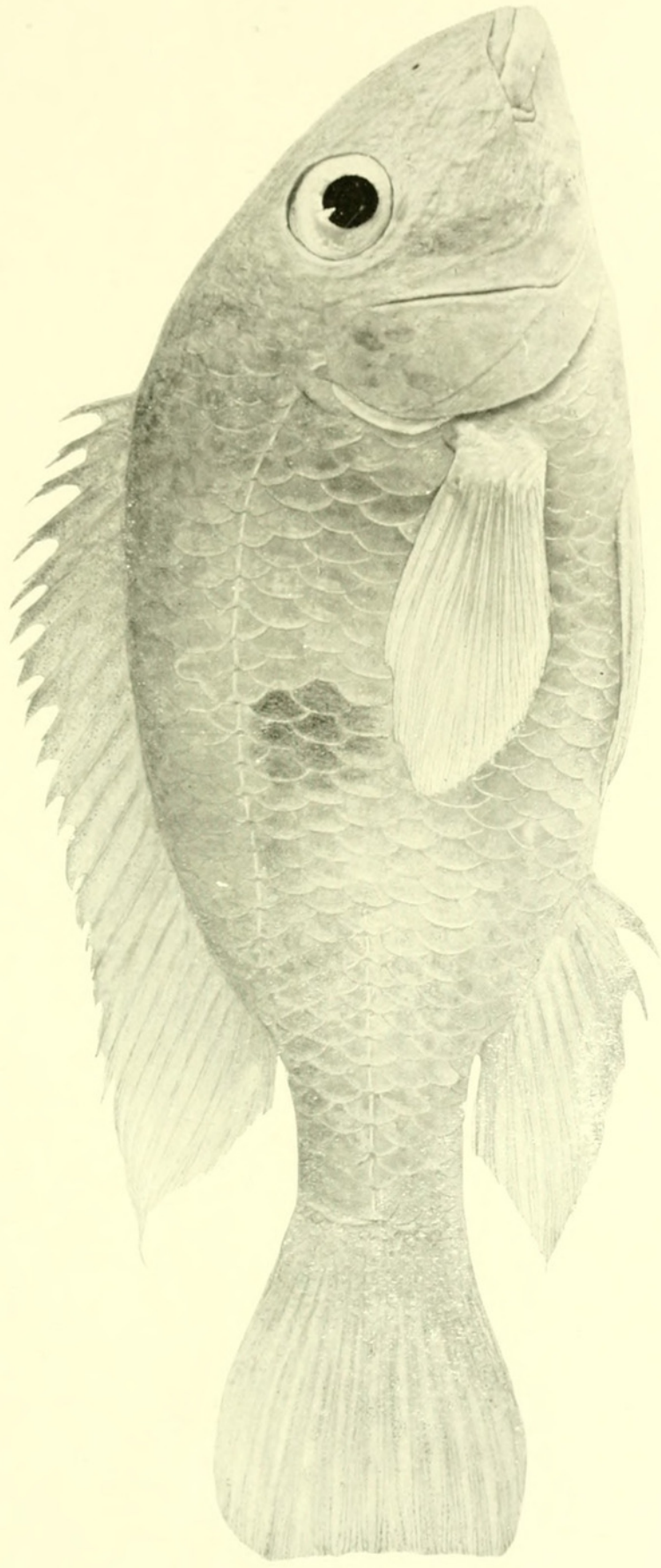
*Heterogramma borellii* Regan. 44 cm. C. M. Cat. No. 2761.





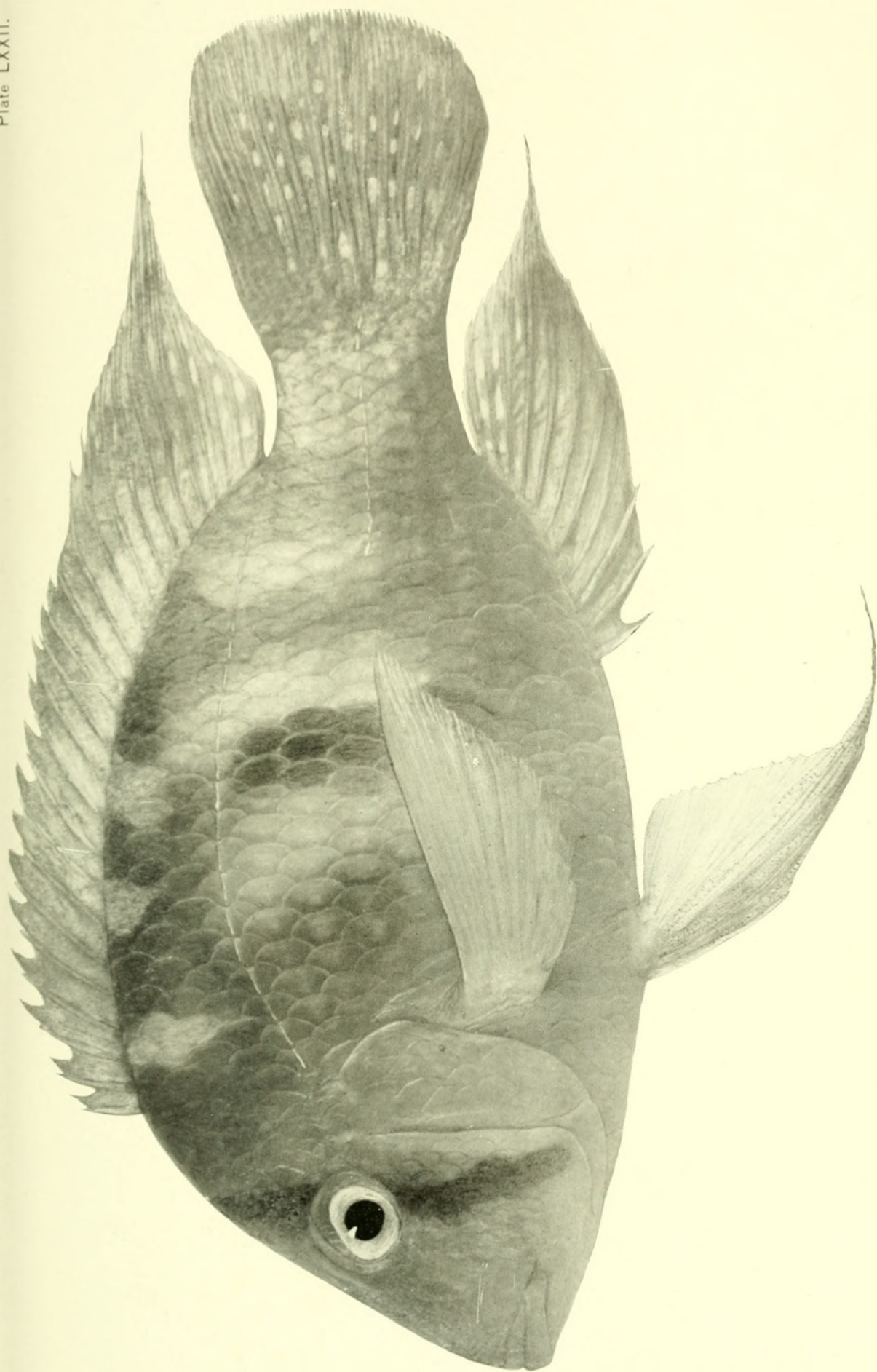
*Heterogramma rilense* Haseman. Type. 36 mm. C. M. Cat. No. 2765.





*Geophagus brasiliensis*, var. *iporangensis* Haseman. Type. 113 mm. C. M. Cat. No. 2792a.





*Geophagus brasiliensis*, var. *ilapicurruensis* Haseman. Type. 143 mm. C. M. Cat. No. 2793a.





Haseman, John D. 1911. "An annotated catalog of the cichlid fishes collected by the expedition of the Carnegie Museum to central South America, 1907-10." *Annals of the Carnegie Museum* 7(3-4), 329-373.

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