

VIII. THE FRESH WATER FISHES OF THE RIUKIU ISLANDS, JAPAN.

BY DAVID STARR JORDAN AND SHIGEHO TANAKA.

(PLATES XXII-XXIII.)

The Riukiu (*Liukiu*, *Loochoo*) Archipelago consists of a large number of small rocky islands beset by coral reefs, extending from Tanega-shima (*shima* meaning island, *jima* for euphony in composition) and Yaku-shima off the southern coast of Kiusiu (*Kyushyu*) in Japan. These form a curve in a south-southwesterly direction for about four hundred miles, approaching the island of Formosa (*Taiwan*). The archipelago is divided into three groups. In the northernmost the chief island is Amami-Oshima, about thirty miles in length. In the middle group the chief island is called Okinawa (*Okinawa-jima*) about fifty miles long, on which at its southern end is the chief town of the Archipelago, Naha. Near Okinawa is the small island of Kume. The third, or southern group, approaches Formosa and its chief island is Ishigaki-jima. Besides this island, which is about fifteen miles long, are the smaller islands of Iriomoto, about seven miles, and Yonakuni and Mihako each about five miles in length. In addition to these main islands there are a multitude of smaller islets, and many isolated rocks. On the larger islands are a few short rivers, the Kawa (or Kawagawa in composition), in which are many small fishes not hitherto studied by anyone. These for the most part are identical with those inhabiting similar streams in southern Japan, while most of the species are now restricted to small streams. The entire fauna so far as known was originally derived from marine types.

The collection of thirty-four species here recorded was obtained by Mr. H. Kuroiwa for the Imperial University of Tokyo. Specimens were brought by the junior author to Stanford University, where the present paper was written. A series of specimens is in the Imperial University, Tokyo, at Stanford University, and in the Carnegie Museum, the latter institution being made the depository of the type of the single new species, *Tridentiger kuroiwa*. The two species of domesticated *Cyprinidæ*, and the species representing the *Anabantidæ* apparently have been brought over from the mainland of

China or Japan. The streams examined are the Kominato River in Amami-Oshima; the Yabu and the Hizya in Okinawa; the Ara, Nakura, Todoroki, and Miyara in Ishigaki; the Kominato, Yakkachi, Kawauchi, and Futatai in Amami-Oshima; besides streams in Yonakuni.

Family MEGALOPIDÆ.

MEGALOPS Lacépède.

1. *Megalops cyprinoides* (Broussonet).

Clupea cyprinoides BROUSSONET, Ichthyol., 1782, pl. IX, Island of Tanna, South Pacific.

Native name: *Ashichin* (Ishigaki).

Eight specimens 115 to 200 mm. long were obtained; of these one on Amami-Oshima, in July, 1919; and all the rest in Ishigaki. Of the Ishigaki specimens, one was taken in purely fresh water, four in an inlet into which the Nakura River empties itself, and two in the Ara River.

Head 3.3 to 3.69 in length without caudal; depth 3.3 to 3.63; eye 3 to 3.46 in head; interorbital 4.47 to 5.23; snout 3.84 to 4.27; depth of caudal peduncle 2.65 to 3.17; maxillary 1.76 to 1.9. D. IV, 14 to 16; A. II or III, 22 to 24; scales in lateral line 36 to 38.

The species abounds in the tropical and subtropical regions of the Pacific, extending its range to southern Japan and China. It lives in brackish water, not infrequently entering rivers.

One specimen, Carn. Mus. Cat. of Fishes, No. 8291, 170 mm., from the Ara River, Ishigaki.

Family CHANIDÆ.

CHANOS Lacépède.

2. *Chanos chanos* (Forskål).

Mugil chanos FORSKÅL, Descript. Animal., 1775, p. 76, Red Sea at Djidda, Arabia.

Mugil salmoneus (Forster) BLOCH and SCHNEIDER, Syst. Ichth., 1801, p. 121, Pacific Ocean.

Native name: *Hanematsu* (Yonakuni).

Five specimens 90 to 170 mm. long were secured; of these three were caught in the ditches of the rice-fields in the village of Kateparu, Iniyako; one in the lower course of the Miyara River, Ishigaki; and one (Carnegie Museum Cat. Fishes, No. 8292) in Yonakuni in February, 1923.

The species is very common along the shores of islands in the Pacific and Indian Oceans in tropical and subtropical regions. It also occurs, though much more rarely, in southern Japan in swamps and ponds, which are more or less influenced by tides. The species of Hawaii and the west coast of Mexico, *Chanos cyprinella*, has been regarded as different, having smaller scales (91), a distinction we now fail to verify. *Chanos lubina* seems different.

Family PLECOGLOSSIDÆ.

PLECOGLOSSUS Temminck and Schlegel.

3. *Plecoglossus altivelis* Temminck and Schlegel.

Plecoglossus altivelis TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1866, p. 229, pl. CV, fig. 1, Nagasaki.

Native name: *Yazi* (Amami-Oshima).

Of eight specimens before us, ranging in length from 110 to 155 mm., five were from Amami-Oshima; and three from Kunchan, Okinawa. The species ranges southward in clear streams from the southern part of the Hokkaido throughout Japan and the Riukiu Islands, to Korea, China, and Formosa.

One specimen, Carn. Mus. Cat. Fishes, No. 8293, 95 mm., from Amami-Oshima. One specimen, Carn. Mus., No. 8294, 140 mm., from Okinawa.

Family FLUTIDÆ.

FLUTA Bloch and Schneider.

(*Les Monoptères* Lacépède).

4. *Fluta alba* (Zuiewuw).

Muraena alba ZUIEUW, Nov. Act. Ac. Sci. Petropol., 1793, p. 299, Pl. VII, fig. 2.

Le Monoptere javanois LACÉPÈDE, Hist. Nat. Poiss., II, 1798, p. 139, Java. (Name in French only.)

Monopterus javanensis BLOCH and SCHNEIDER, Syst. Ichth., 1801, p. 565, after Lacépède.

Native name: *Taho* (Amami-Oshima); *Too-unajaa* (Okinawa).

Four specimens, 250 to 300 mm. long, were secured in Okinawa in 1912. The species is widespread in the fresh waters and rice-ditches of China, Korea, Formosa, and southward to Siam, India, Java, and Borneo, and northward to southern Japan. It occurs very rarely about Tokyo and Kyoto.

One specimen, Carn. Mus., No. 8295, 250 mm., from Okinawa.

Family ANGUILLIDÆ.

ANGUILLA (Thunberg) Shaw.

5. *Anguilla japonica* Temminck and Schlegel.

Anguilla japonica TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 258, pl. CXIII, fig. 2, Nagasaki.

Native names: *Taa-unajaa*, *Unajaa*, or *Nohounajaa* (Okinawa). (*Noha* means mud.)

The relative proportions of the several parts of the body are very variable, so that definite distinctions among the species of *Anguilla* cannot very clearly be made out. The length of the pectoral compared with the length of snout and eye, is not constant. The species is found very abundantly in Japan, Korea, China, the Riukiu Islands, and Formosa. In Japan it is very common from the southern part of the Hokkaido southward, running up very scantily, however, in the rivers emptying into the sea of Japan.

One specimen, Carn. Mus., No. 8296, 320 mm., from Ishigaki.

6. *Anguilla marmorata* Quoy and Gaimard.

Anguilla marmorata QUOY and GAIMARD, Voy. Uranie, 1824, p. 241, pl. LI, fig. 2, Waigiu.

Native name: *Kawara-unai* (Ishigaki) for *Kawaunagi*, or *river-eel*.

Five specimens 195 to 375 mm. long; one from Hizya River, Okinawa; three from Ishigaki; and one from Miyako.

Preanal length in postanal 1.22 to 1.66. Length of head in the distance between verticals through the origins of dorsal and anal 1.04 to 1.21. The species is very variable in the relative proportions of the several parts of the body, as in *Anguilla japonica*; the head is in most cases a little shorter than the distance between verticals through the origins of dorsal and anal, but the contrary not infrequently occurs.

One specimen, Carn. Mus., No. 8297, 290 mm., from Ishigaki.

Family CYPRINIDÆ.

CYPRINUS Linnæus.

7. *Cyprinus carpio* Linnæus.

Cyprinus carpio LINNÆUS, Syst. Nat., Ed. X, 1758, p. 320, and of all authors.

Four specimens from a pond in Okinawa. They were taken from the rivers when young and reared in the pond.

D. III, 16 to 18; A. II, or III, 5. Scales in lateral line 31 to 35.

This species and the next have apparently been introduced from China or Japan.

One specimen, Carn. Mus., No. 8298, 180 mm., from Okinawa.

CARASSIUS Nilsson.

8. **Carassius auratus** (Linnæus).

Cyprinus auratus LINNÆUS, Syst. Nat., Ed. X, 1758, p. 322, China, Japan (domesticated variety).

Native names: *Taa-zu* or *Tatuthu* (Miyako), *taa* means rice-field and *zu* means fish. Here the species is locally indiscriminately called by the same name with *Kuhlia rupestris*.

Thirty-seven specimens were secured from various streams: twenty-three in Amami-Oshima; four in Yabu river, Okinawa; two in Ishigaki; five in Miyako; and three in Yonakuni in 1923.

D. III, 16 to 18; A. II or III, 5; scales 6-26 to 29-4 or 5.

The species is widely distributed throughout eastern Asia.

Twenty-two specimens, Carn. Mus., No. 8299; the largest 175 mm., from the Riukiu Islands.

Family COBITIDÆ.

MISGURNUS Lacépède.

9. **Misgurnus anguillicaudatus** (Cantor).

Cobitis anguillicaudatus CANTOR, Ann. Mag. Nat. Hist. (1) IX, 1842, p. 485, Chusan, China.

Cobitis rubripinnis TEMMINCK and SCHLEGEL, Fauna Jap., Poiss., 1846, p. 220, pl. CIII, fig. 1, Nagasaki.

Cobitis maculata TEMMINCK and SCHLEGEL, l. c., p. 221, fig. 2, Nagasaki.

Misgurnus punctatus OSHIMA, Ann. Zoöl. Jap., II, 1926, No. 1, p. 5, Hainan, China.

Native names: *Jojo* (Amami-Oshima); *Dongee* (Ishigaki); *Dojo* (Japan).

The specimens before us agree well with those from Japan, except that there is no spot at the upper base of caudal fin in the adults, but four small specimens, ranging in length from 35 to 50 mm., have that spot very distinct. The specimens from Japan also lack the spot at caudal base in very many cases. Dr. Oshima is right in recognizing that two species of *Misgurnus* occur in Formosa, while we believe that Japan has but a single species, *Misgurnus anguillicaudatus*. *Misgurnus decemcirrhosus* of Basilewsky from Peking is probably identical with *Misgurnus anguillicaudatus* from Japan. Dr. Cantor's originals, being the types from Chusan, China, were re-examined by Mr. Regan, at the request of Dr. Jordan (Jordan and Snyder, 1906) and seem to belong to the same species as the Japanese form. *Misgurnus decemcirrhosus* of Oshima is in all probability identical with *Cobitis bifurcata* or *Cobitis pectoralis* of McClelland from India, and is apparently not the same as the *M. decemcirrhosus* of Basilewsky.

Head 4.85 to 5.17 in length without caudal; depth 5.83 to 7.33; eye 5.6 to 7.5 in head; interorbital 5.6 to 7; snout 2.5 to 3.25; depth of caudal peduncle 1.56 to 1.87; D. 7 or 8; A. 7; p. 9 or 10; V. 6; C. (counting branched rays only) 19 or 15; scales in longitudinal rows, 138 to 145.

Our collection includes seven specimens from Amami-Oshima; two from Kume, near Okinawa; and sixteen from Ishigaki, the longest 110 mm.

One specimen, Carn. Mus., No. 8300, 80 mm., from Amami-Oshima.

One specimen, Carn. Mus., No. 8301, 80 mm., from Kume.

One specimen, Carn. Mus., No. 8302, 90 mm., from Ishigaki.

Family CYPRINODONTIDÆ.

ORYZIAS Jordan and Snyder.

10. *Oryzias latipes* (Temminck and Schlegel).

Pæcilia latipes TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1866, p. 226, pl. CII, fig. 5, Nagasaki.

Native names: *Tayu* (Amami-Oshima); *Takami* or *Takamigua* (Okinawa).

The specimens in hand came from Amami-Oshima and Okinawa and range up to 34 mm. in length. D. 6; A. 17 or 18; scales, 30.

The species ranges from southern and middle Japan southward through the Riukiu Islands and Korea to China and Formosa.

Five specimens, Carn. Mus., No. 8303, 25 to 34 mm., from Okinawa.

Family MUGILIDÆ.

MUGIL Linnæus.

11. *Mugil cephalus* Linnæus.

Mugil cephalus LINNÆUS, Syst. Nat., Ed. X, 1758, p. 316, European Oceans (based on Artedi).

Mugil albula LINNÆUS, Syst. Nat., Ed. XII, 1766, p. 520, Charleston, S. C.

Mugil japonicus TEMMINCK and SCHLEGEL, Fauna Jap., Poiss., 1846, p. 134, pl. LXXII.

Mugil borlandieri GIRARD, U. S. and Mex Bound. Surv., 20, 1859, Pl. X, figs. 1 to 4, St. Josephs Island, Indianola, Brazos, Santiago, Galveston, and the coast of Texas.

Three specimens, 105 to 150 mm. long, from Amami-Oshima. We still find no valid tangible differences between European and Oriental specimens identified as *Mugil cephalus*. In case differences are detected, the Japanese fish should stand as *Mugil japonicus*. *Mugil*

soiuy Basilewsky, Ichth. China, 1856, p. 226, pl. IV, fig. 3, (Tschili) seems to us to be identical with *Liza menada* Tanaka.

One specimen, Carn. Mus., No. 8304, 145 mm., from Amami-Oshima.

LIZA Jordan and Swain.

12. *Liza troscheli* (Bleeker).

Mugil troscheli BLEEKER, Tijdschs. Nederl. Ind., XVI, 1858-9, p. 277, East Indies.

A single specimen 130 mm. long from the Ara River, Ishigaki, Carn. Mus., No. 8305. The species occurs in Samoa, New Guinea, the East Indies, the Philippines, Formosa, and the Riukiu Islands.

Family CARANGIDÆ.

CARANX Lacépède.

13. *Caranx sexfasciatus* Quoy and Gaimard.

Caranx sexfasciatus QUOY and GAIMARD, Voy. Uranie., 1824, p. 358, pl. LXV, fig. 4, "les isles des Papous." (Young, two inches and three lines long.)

Caranx forsteri CUVIER and VALENCIENNES, Hist. Nat. Poiss., 1833, IX, p. 107, (Isle of France; Coast of Malabar; Celebes; New Guinea; New Ireland; Vanicolo).

Caranx flavoceruleus TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1866, p. 110, pl. I, fig. 2, Nagasaki.

Carangus rhabdotus JENKINS, Bull. U. S. Fish Comm., XXII, 1903, p. 466, fig. 16, Honolulu (5.5 inches long, half-grown).

Five specimens, 59 to 80 mm. long from Amami-Oshima, near mouth of river.

Head 2.93 to 3.02 in length without caudal; depth 2.42 to 2.52; eye 2.91 to 3.9; maxillary 2 to 2.40; pectoral 1.21 to 1.61; D. VIII—I, 19 to 21; A. II. I, 16 or 17; scutes 27 to 32.

The specimens before us are all young, with faint crossbands, of which the anteriormost runs across the eye; the next from nape to opercle; the third and fourth beneath first dorsal; and the last, the faintest of all, through the axil of second dorsal. A diffuse faint spot present on opercle and a small but distinct spot above the upper end of gill-opening; these spots being obsolete in some specimens. The species is widely distributed through the South Seas, the East Indies, the coasts of India, Hawaii, Formosa, the Riukiu Islands and Japan, where it is found north along the coast to Tokyo.

One specimen, Carn. Mus., No. 8306, 60 mm., from Amami-Oshima.

14. *Caranx ignobilis* (Forskål).

Scomber ignobilis FORSKÅL, Descript. Animal., 1775, p. 55, Red Sea.

Carangus hippoides JENKINS, Bull. U. S. Fish Comm., XXII, 1903, p. 663, fig. 15, Honolulu.

Two young specimens, respectively 74 and 78 mm. long, from Ara River, Ishigaki.

Head 2.73 to 3 in length without caudal; depth 2.4 to 2.63; eye 3.00 to 3.36 in head; snout 3.14 to 3.61; maxillary 2.35 to 2.57; pectoral 1.16 to 1.18; D. I, 8-I, 19 to 22; A. II, I, 15 to 18; scutes 30 to 32.

Of the five faint cross-bars as wide as diameter of the eye, the first is beneath anterior part of first dorsal; the second beneath posterior part of the dorsal and anterior part of second dorsal; the next two bands beneath the latter fin; and the last, the faintest of the bands, on the caudal peduncle; two very faint bars are present, one across the nape, and one across the eye; no spot on opercle or above gill-opening.

The young of *Caranx ignobilis* has been confounded with that of *Caranx sexfasciatus* by many recent authors, as the two species closely resemble each other. The young of the two, however, are distinguishable from each other by the subgeneric character of the scaly breast of *Caranx sexfasciatus*, which allies it to *Caranx latus* of America. The following key will separate the two at all ages:

- a. Breast entirely scaled; very small but distinct blackish spot above gill-opening; eight distinct cross-bands across head and body; third and fourth bands beneath first dorsal, the third more or less invading the nape. *sexfasciatus*
- aa. Breast naked, except a small patch of minute scales in front of ventrals; no spot above gill-opening; seven rather distinct cross-bands across the head and body; third band beneath anterior part of first dorsal not at all invading region of nape; fourth band beneath posterior part of first dorsal and anterior part of second dorsal. *latus*

The species is widely distributed in the South Seas, Panama, Hawaii, the East Indies, Red Sea, Formosa, the Riukiu Islands, and southern Japan. It runs a short distance up stream within tidal influence in Ishigaki.

One specimen, 70 mm., from Amami-Oshima, Carn. Mus., No. 8307.

Family APOGONIDÆ.

APOGON Lacépède.

15. *Apogon amboinensis* Bleeker. (Pl. XXIII, fig. 4).

Apogon amboinensis BLEEKER, Nat. Tijdschr. Ned. Ind., V, 1853, p. 329, Amboina.

Native name: *Santa'a* (Ishigaki).

Three specimens 70 to 80 mm. long, all full of ripe eggs, from the

lower portion of Miyara River, Ishigaki, agree very well with Bleeker's figures, (Atlas Ichth., pl. CCCXLVI (*Perc.*, pl. LXVIII) fig. 1). The species is found in the East Indies where according to Bleeker it occurs both in the sea and in rivers. It runs up Miyara River in waters influenced by the tide.

One specimen, Carn. Mus., No. 8308, 70 mm., from Miyara River, Ishigaki.

Family KUHLIIDÆ.

KUHLIA Gill.

16. *Kuhlia rupestris* Lacépède.

Centropomus rupestris LACÉPÈDE, Hist. Nat. Poiss., IV, 1803, pp. 252, 273.

Native names: *Miko* (Tanega); *Nukyu* or *Mikyu* (Amami-Oshima); *Mikyu* or *Nchu* (Okinawa); *Kawara-miihikari* (Ishigaki); *Taazu* (Miyako); where the species is locally called without discrimination by the same name as *Carassius auratus*; *Misoda* (Yonakuni).

Thirty-four specimens of the species 60 to 250 mm. long were obtained; ten in Futatsu River, Amami-Oshima; sixteen at Kunchan, Okinawa; four in Nakura River, Ishigaki; three in the upper stream of Miyara River; and one in Yonakuni.

Head 2.89 to 3.49 in length without caudal; depth 2.6 to 2.98; eye 2.91 to 4.18 in head; interorbital 3.18 to 3.68; snout 3.28 to 4.67; depth of caudal peduncle 2.31 to 3.58; maxillary 2.09 to 2.69. D. IX, I, 11; A. III, 10 or 11; scales in lateral line 39 to 42; gill-rakers below arch, 17.

We find two species of *Kuhlia* in this collection, these evidently corresponding to *Kuhlia rupestris* and *Kuhlia marginata* of Boulenger's Catalogue and of the Fishes of Samoa by Jordan and Seale. Whether additional species of this type exist, and if all of the assumed synonymy of either is correct, we are not certain.

Kuhlia rupestris has the caudal fin not deeply forked, the lobes blunt. Compared with *Kuhlia marginata* the snout is longer, about as long as the moderate eye; the mouth is smaller; the maxillary not reaching middle of eye; the body is a little deeper and the coloration is darker. The soft dorsal has a rather broad black band within its margin; each lobe of caudal has a black band crossing obliquely from the upper to the posterior margin; outer angles of the caudal pale; anal with a brownish band at base.

Three specimens, Carn. Mus., No. 8309, 90–240 mm., from Okinawa.

17. *Kuhlia marginata* (Cuvier and Valenciennes).

Dules marginatus CUVIER and VALENCIENNES, Nat. Hist. Poiss., III, 1829, p. 116, pl. 29, Java.

This species is found with the preceding (but less abundant) in streams throughout the Riukiu Islands. The back is almost plain

silvery; in others the body is everywhere closely and irregularly spotted above, as in *K. rupestris*, but less sharply. None of our examples show the black median cross-bar on the caudal shown in Cuvier's figure of *Dules marginatus*. *Kuhlia marginata* is slenderer than *Kuhlia rupestris*, and paler, with larger eye and smaller mouth, the snout not longer than eye, and the maxillary not reaching middle of eye. The soft dorsal, anal, and especially the caudal, are conspicuously margined with black. The gill-rakers, 16 to 18, below on lower limb of the arch, are the same in the two species. Both species are found in Samoa, and probably in the streams of the smaller islands throughout the South Seas. They are subject to considerable variation, especially in color.

Four specimens, Carn. Mus., No. 8310, 100-165 mm., from Okinawa.

Family LUTIANIDÆ.

LUTIANUS Bloch.

18. *Lutianus vaiensis* (Quoy and Gaimard).

Diacope vaiensis QUOY and GAIMARD, Voyage Uranie, 1824, p. 307, Waigiou.

Mesoprion kagoshima DÖDERLEIN, MS. in Steindachner and Döderlein, Fische Japans, 1883, p. 28, Kagoshima in Japan.

Native name: *Yamatobea* (Ishigaki).

Two specimens, respectively 90 and 95 mm. long, were taken in the lower part of the Miyara River, Ishigaki. The species ranges widely from north Australia, the South Seas and Indian Coasts, through the East Indies and Philippine Islands to the Riukiu Islands and southern Japan. It ascends the mouths of rivers for a short distance.

Carn. Mus., No. 8311, 95 mm., from Miyara River, Ishigaki.

19. *Lutianus argentimaculatus* (Forskål).

Sciæna argentimaculata FORSKÅL, Descript. Anim., 1775, p. 53, Djidda, Arabia.

Two specimens, respectively 160 and 165 mm. long, from the mouth of the Ara River.

D. X, 13 or 14; A. III, 7; scales above lateral line 50 or 51; caudal fin slightly emarginate. Color in formalin brownish, each scale darker at base; dorsal and caudal dusky; posterior margin of the latter and free margin of spinous dorsal darker; soft portion of dorsal darker inter-radially, becoming fainter toward free margin; anal and ventral dark dusky for the most part; anterior and posterior parts of the former, and the outer and inner margin of the latter, whitish; pectoral whitish, without markings.

The species is found abundantly from the South Seas and Red Sea through the Philippines and Formosa to the Riukiu Islands, where

it goes a short distance up the rivers. It also occurs very rarely in southern Japan, where it enters the lower portions of the rivers. It is well known under the name of "dokugyo" (meaning poison-fish), in Izu, Japan.

Carn. Mus., No. 8312, 165 mm., from the Ara River.

Family SPARIDÆ.

SPARUS Linnæus.

20. *Sparus macrocephalus* (Basilewsky).

Pagrus macrocephalus BASILEWSKY, Ichth. Chin. Bor., 1852, p. 222, pl. I, fig. 3, Peking.

Chrysophrys swinhonis GÜNTHER, Ann. Mag. Nat. Hist., (4) XIII, 1874, p. 155, Chifu, China.

Six specimens up to 190 mm. long were secured, one from Amami-Oshima and the others in the Ara River, Ishigaki.

A. III, 7 or 8; scales 6-49 or 50-13.

The species ranges from northern China and Japan through the Riukiu Islands to Formosa, ascending streams far beyond tidal influence.

One specimen, Carn. Mus., No. 8313, 140 mm., from the Ara River, Ishigaki.

Family OSPHORONEMIDÆ.

MACROPODUS Lacépède.

(*Polyacanthus* Kuhl and Van Hasselt).

21. *Macropodus opercularis* (Linnæus).

Labrus opercularis LINNÆUS, Syst. Nat., Ed. X, 1758, p. 283, (caudal forked).

?*Chatodon chinensis* BLOCH, Ausl. Fische, 1790, pl. CXVII, fig. 1, China (caudal rounded).

Macropodus filamentosus OSHIMA, Ann. Carnegie Mus. XII, 1919, p. 278, pl. LII, fig. 2, (Kotosho, Formosa) median rays strongly produced.

Native names: *Toyu* (Okinawa) meaning a Chinese fish, not "fighting fish," as stated by most authors.

Several specimens, the longest 85 mm. in length, were taken at Motobo in Okinawa, where it abounds in the ditches of rice-fields.

Snout 3.6 to 6; D. XIII or XIV—6 or 7; A. XVIII or XIX—15; P. II; V. I, 5; C. (branched rays only), 11 or 13, the fin forked; scales 32; no lateral line; first soft ray of ventral produced into a single filament.

The species abounds in China, Cochin-China, Formosa, Korea, and

the Riukiu Islands. Recently the species has been imported to Tosa (Skikoku), Tokyo, Kashiwazaki (Province of Echigo) etc., where it establishes itself very well in stagnant waters. As the species is very hardy in habit, thriving where imported, we conclude that the individuals in the Riukiu Islands and perhaps in Formosa are descended from fishes brought from China. It is questionable whether *Macropodus*, a semi-domesticated form, is not simply a cultivated variant of the native group later called *Polyacanthus*. Mr. George S. Myers regards the form with rounded caudal, known as *chinensis*, as being distinct from the forked-tailed *M. opercularis*.

Carn. Mus., No. 8314, one specimen, 60 mm., from Motobo, Okinawa.

Family POMACENTRIDÆ.

POMACENTRUS Lacépède.

22. *Pomacentrus chrysopæcilus* Kuhl and Van Hasselt.

Pomacentrus chrysopæcilus KÜHL and VAN HASSELT, in Schlegel, Overz. Amphiprion, 1839, p. 21, pl. V, fig. 3.

Pomacentrus notostigmus RICHARDSON, Voy. Sulph., Ichth., 1846, p. 89, pl. XLIV, figs. 1, 2.

Three specimens from 104 to 130 mm. long, from the lower course of Miyara River, Ishigaki, within tidal influence.

Head 3.23 to 3.69 in length without caudal; depth 2.12 to 2.39; eye 3.57 to 3.8 in head; interorbital 2.8 to 3.64; snout 2.8 to 3.57. D. XIII, 16; A. II, 16; scales 28. Color dark, with yellow tints, the fins all black; a white spot below spinous dorsal.

The species is found from the East Indies and the Philippines north to the Riukiu Islands, where it runs a short distance up the streams.

Carn. Mus., No. 8315, one, 108 mm., from Miyara River, Ishigaki.

Family ELEOTRIDÆ.

ELEOTRIS (Gronow) Bloch and Schneider.

23. *Eleotris fusca* (Schneider).

Pæcilia fusca SCHNEIDER, BLOCH, Syst., 1801, p. 653. (After *Cobitis pacifica* Foster MS., *Insulæ orientales*.)

Eleotris oxycephala TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1845, p. 150, pl. LXXVII, figs. 4, 5. Nagasaki (45 scales in typical specimens.)

Native names: *Uba* (Amami-Oshima); *Iibu* (Okinawa); *Gokke* (Ishigaki); *Doro* (Yonakuni).

We have twenty-eight specimens of this species ranging in length from 55 to 170 mm. Five are from the Yamato River, Amami-

Oshima; eleven from the Yabu River, Okinawa; one from Miyako; sixteen from the Ara River in Ishigaki; and one from Yonakuni. On closely comparing these specimens with many others in Stanford University labelled *Eleotris fusca*, from the Philippines, Sumatra, New Caledonia, and Samoa, we are compelled to unite *Eleotris oxycephala* of Japan with *Eleotris fusca*. Four specimens from Okinawa and one from Miyako have 56 to 58 scales in a longitudinal series; the rest all having 50 to 66. In the specimens from the Philippines, Sumatra, and Samoa, the scales range from 60-66, the majority having 50-58. Otherwise no distinct characters can be used to divide the specimens in hand into two or more species.

Head 2.67 to 3.33 in length, without caudal; depth 3.73 to 6.55; eye 5 to 8 in head; interorbital 3.55 to 4.67; snout 3.57 to 5.33; depth of the caudal peduncle 2.18 to 2.73; maxillary 2.67 to 3.25. D. VI—8 to 9; A. 9; P. 16 to 19; C. (branched rays only) 13 to 15; scales 58 to 66; in transverse series 18 to 22.

The species occurs abundantly in brackish waters and the lower reaches of the rivers from the South Seas through the Philippines, Guam, Ceylon, India, Burmah, Siam, Formosa, Southern China, the Riukiu Islands, and the southern part of Japan. Its northern limit is found in the Provinces of Sagami and Boshu. In the Tama River, north of Tokyo, the species never occurs, so far as we know. The representative species in Hawaii is *Eleotris sandwichensis*, which has 70 scales in a longitudinal series, and vertical fins with more or less distinct whitish margins, except the caudal, although the marking is very often obsolete.

Eleven specimens, Carn. Mus., No. 8316, 75 to 170 mm., labeled as from Okinawa.

OPHIOCARA Gill.

24. *Ophiocara aporos* (Bleeker). (Pl. XXII, fig. 1).

Eleotris aporos BLEEKER, Nat. Tydschr. Ned. Ind., VI, 1856, p. 59, Halmaheira (Gilolo); Sindangole and Ternate (in sea).

Native names: *Poo-iibu*, large Goby (Okinawa); *Gokke* (Ishigaki).

Our specimens agree fairly well with the descriptions of Bleeker and of Günther. A broad lateral band, one or two scales wide, runs along the middle of the body, sometimes split into more or less connected spots. There are also several very broad oblique faint bars on the back, directed forward and downward, which meet the band just mentioned. Very narrow lateral bands run parallel to the broad lateral band, two in number above the lateral band, and also two below, these all more or less fading out posteriorly. First dorsal with

two blackish cross-bars, leaving a broad whitish shade between, besides a narrow whitish margin. Second dorsal and anal, each with a sub-marginal brown bar, narrow or broad; in the latter case the basal part of the fins largely brownish, with a narrow whitish band between. Both second dorsal and anal as well as ventral with whitish margin.

D. VI—9 to 10; A. 10 to 11; P. 15 to 16; V. I, 5; C. (branched rays only) 16; scales 28 to 32; in transverse series, 15 to 16.

Our specimens range from 95 mm. to 225 mm. in length, six from the upper stream of Miyara River, Ishigaki, and three from the Yabu River at Naha, Okinawa, where the fishes were seen leaping from holes in the mud, when water was dipped out over them. The fish is very rare in the localities above mentioned. It lives in fresh water, growing to ten inches in length.

The species is reported in the East Indies, the Philippine Islands, Fiji, Gilolo, and Oualan, sometimes occurring on the coast.

Carn. Mus., No. 8317, two specimens, 125–210 mm., from Okinawa.

BOSTRYCHUS Lacépède.

25. *Bostrychus sinensis* Lacépède.

Bostrychus sinensis LACÉPÈDE, Hist. Nat. Poiss., III, 1802, p. 141, pl. XIV, fig. 2, China.

The specimen before us agrees very well with the figure of *Philypnus ocellicauda* Richardson, and with the description of *Eleotris sinensis* by Günther. Very characteristic is a round, black, white-edged ocellus on the upper part of the base of the caudal.

D. VIII—11; A. 11; P. 17; V. I, 5; C. (branched rays only) 15; scales 160; in transverse series 65. A single specimen, 161 mm. long, dark brown in color in life, was taken in a brackish pond connected with the river Miyara. It is rare on Ishigaki, where it lives in holes in the mud close to the river-bank, these holes apparently formed by crabs. It is recorded from both fresh and brackish waters about Canton and Manila, and also in the East Indies and South Seas, whence it ranges northward to the Riukiu Islands.

Carn. Mus., No. 8318, 161 mm., from the Miyara River.

Family GOBIIDÆ.

RHINOGOBIUS Gill.

26. *Rhinogobius similis* Gill.

Rhinogobius similis GILL, Proc. Acad. Nat. Sci. Phila., 1859, p. 165. Near Shimoda, province Sagami, Japan.

Rhinogobius nagoyæ JORDAN and SEALE, Proc. U. S. Nat. Mus., XXX, 1906, p. 167, Nagoya, Japan.

- Ctenogobius bedfordi* REGAN, Proc. Zool. Soc. London, 1908, p. 62, pl. III, fig. 1, Chong-ju, Korea.
- Ctenogobius candidus* REGAN, Ann. Mag. Nat. Hist. (8) I, 1908, p. 153, Lake Candidus, Formosa.
- Ctenogobius kurodai* TANAKA, Ann. Zool. Jap., VII, 1908, Pt. 1, p. 32, in a fresh water pond in the garden of Marquis Kuroda, Tokyo.
- Ctenogobius katonis* TANAKA, Ann. Zool. Jap., VII, 1908, Pt. 1, p. 35, Kanazawa, Province Kaga, Japan.
- Rhinogobius taiwanus* OSHIMA, Ann. Carn. Mus., XII, 1919, p. 295, Shinchiku, Formosa.
- Rhinogobius fluviatilis* TANAKA, Fish Japan, p. 641, pl. CLI, figs. 417, 418, Himeji, Japan.

The specimens before us, fifty-seven in number, are in length about 115 mm. Seventeen were collected in the river Kawauchi, Amami-Oshima; six in the River Hija, Okinawa; and thirty-four on Ishigaki.

The species shows variations according to age, sex, and localities, in relative proportions of the parts of the body, the ground-color and markings, these having been the basis of several nominal species. In the adult the species has the proportion of the eye in snout ranging from 1.75 to 2.17, while in the young the range is from 1.16 to 1.29. Second dorsal, anal, and caudal dusky, with a distinct whitish margin in some specimens; while in others these fins are rather closely spotted, without distinctly pale edgings. In the adult male the dorsals and anal are filamentous, while not so in the female and the young. The scaling on the nape is not constant, some specimens having numerous scales on that region. On comparing many specimens from many places in Japan, the junior writer is led to unite the nominal species cited above under one and the same name.

The species occurs very abundantly in the fresh waters of entire Japan, extending its range to the Riukiu Islands, Formosa, Korea, and perhaps also to China.

Carn. Mus., No. 8319, thirteen specimens, 50 to 65 mm., from Amami-Oshima.

27. *Rhinogobius giurinus* (Rutter).

- Gobius giurinus* RUTTER, Proc. Acad. Nat. Sci. Philad., 1897, p. 89, Swatow, China.
- Gobius giuris* ABBOTT, Proc. U. S. Nat. Mus., XXIII, 1901, p. 491, Tien-Tsin, China. (Not of Buchanan-Hamilton.)
- Ctenogobius hadropterus* JORDAN and SNYDER, Proc. U. S. Nat. Mus., XXIV, 1901, p. 60, fig. 7, Nagasaki.

Native names: *Ubu* (Amami-Oshima); *Gokke* (Ishigaki).

The specimens at hand coincide well with the original description of *Ctenogobius hadropterus* by Jordan and Snyder, and also with the type specimen of *giurinus* in the Stanford Museum. They represent

two forms, distinguished only by the intensity of the markings, as Jordan and Snyder have noted. The one with distinct markings is probably the adult male and the other the female, some of these being very lean and thin. *Ctenogobius nadropterus* is not distinct from *Gobius giurinus* Rutter, from Swatow. Their identity was suggested by Jordan and Richardson in 1909, and by Jordan and Hubbs in 1925.

Head 2.5 to 2.7 in length, without caudal; depth 6.6 to 6.8; D. VI—9; A. 9; scales 26 to 28. The spot at base of the caudal assumes more or less a Y-shape, the two forks directed obliquely backward.

The collection contains seventy-eight specimens, sixteen from Yaku, thirty-four from Amami-Oshima, the rest from Ishigaki and the Yayeyama Islands. The largest measures 105 mm. in length. The species is a common fresh water fish found typically in southern Japan, south of Tokyo and north to Tsuruga and Boshu. Its range extends through Yaku and Amami-Oshima and Yayeyama to Formosa and southern China. It is very abundant in and about the Riukiu Islands.

Carn. Mus., No. 8320, ten specimens, 70 to 105 mm., from Amami-Oshima.

28. *Rhinogobius caninus* Cuvier and Valenciennes.

Rhinogobius caninus CUVIER and VALENCIENNES,

Gobius caninus, Hist. Nat. Poiss., XII, 1837, p. 86.

(*Glossogobius parvus* Oshima, Ann. Carn. Mus., XII, 1919, p. 305).

GLOSSOGOBIUS Gill.

29. *Glossogobius abacopus* Jordan and Richardson.

Glossogobius abacopus JORDAN and RICHARDSON, Mem. Carn. Mus., IV, Aug., 1909, p. 200, pl. LXXIV, Takao, Formosa.

This species and the preceding, both from Udonshiki, are taken from streams to be reared in ponds in the Riukiu Islands.

CHONOPHORUS Poey.

(*Awaous* Steindachner.)

30. *Chonophorus personatus* Bleeker. (Pl. XXII, fig. 2.)

?*Gobius guamensis* CUVIER and VALENCIENNES, Hist. Nat. Poiss., 1837, XII, p. 103, Streams of Guam.

Gobius personatus BLEEKER, Verh. Batav. Genootsch., XXII, 1849, Blenn. en Gob., p. 34, Banjumas, in *flumine Seraiju*.

Gobius grammepomus BLEEKER, Verh. Batav. Genootsch., XXII, 1849, Blenn. en Gob., p. 34, Purworedji, in the river Bogowonto.

Gobius crassilabris GÜNTHER, Cat. Fish., III, 1861, p. 63. Fresh waters of Oualan and Aneiteum.—GÜNTHER, Fische der Südsee, 1877, p. 178, pl. CVIII, fig. B. (same specimens).

Glossogobius grammepomus OSHIMA, Ann. Carn. Mus., XII, 1919, p. 304. Izampo, Giran, Formosa (two specimens).

Native names: *Ubu* (Amami-Oshima); *Iibu* (Okinawa).

The specimens in hand agree very well with those from the Philippines, where it occurs with *Chonophorus ocellaris*, which species sometimes lacks the characteristic spot on the first dorsal.

Head 2.95 to 3.19 in length, without caudal; depth 6.25 to 5.68; eye 5.5 to 6.0 in head; interorbital 6.6 to 8; snout 2.2 to 2.66; depth of caudal peduncle 2.66 to 3.25; maxillary 2.5 to 2.75; scales 50 to 56; in transverse series 16 to 20. D. VI—II; A. 11; P. 15 to 17; C. (branched rays only) 13 or 16.

We have four specimens, ranging from 125 to 150 mm. in length. Three were collected in the River Yabu at Motobu, Okinawa; the other one in the River Yakkachi, Amami-Oshima. The species is a rather rare river-fish in these islands. Besides these, we have examined specimens from the Philippines (Tuguegarao, Cagayan, and Abra, all in the northern part of Luzon); from Amoy, China (*coll.* Prof. Light); and from Giran, Formosa. Mr. Alvin Seale notes specimens from Shortland Island.

Carn. Mus., No. 8321, one specimen, 148 mm., from the River Yabu, Okinawa.

GNATHOLEPIS Bleeker.

31. *Gnatholepis sindonis* Snyder.

Gnatholepis sindonis SNYDER, Proc. U. S. Nat. Mus., XXXV, 1909, p. 101, Nafa Market, Okinawa.—SNYDER, *op. cit.*, XLII, 1912, pl. 68, fig. 1, same specimen.

The two specimens respectively 95 and 160 mm. long were taken from a pond discharging into the River Miyara, where slightly subject to tidal influence. It is inferred that the species lives chiefly in brackish water, extending its range for a short distance up the river. The specimens agree well with the description and figure by Snyder who had a single specimen 110 mm. long.

D. VI—II; A. 10; P. 15 to 17; C. (branched rays only) 13; scales 28 or 29.

A small specimen 45 mm. long from Miyako, differs from the others in the following respects: Six rather large and five smaller brownish spots arranged alternately, forming together a longitudinal series on the middle of the side of body; above the band the back of body is rather profusely scattered with brownish spots; similar spots on head and nape. Two brownish lines emerge from lower margin of eye, of which the anterior across the maxillary reaches the lower

jaw, while the posterior crosses the cheeks, opercles, and nape, these regions being scaleless.

We cannot consider this specimen as distinct from *G. sindonis*, the filaments on the vertical fins being the same as in the original types.

Carn. Mus., No. 8322, one, 95 mm., pond connected with Miyara River.

CHÆNOGOBIUS Gill.

32. *Chænogobius macrognathus* (Bleeker).

Gobius macrognathos BLEEKER, Act. Soc. Sci. Indo-Neerl., VIII, 1860, Japan, p. 83, pl. I, fig. 1, Rivers near Tokyo.

Gobius lævis STEINDACHNER, Ichth. Beitr., VIII, 1879, p. 20, Hakodate.

A single specimen, 85 mm. long, was collected on Amami-Oshima. Head 3.28 in length, without caudal; depth .6; eye 5.25 in head; interorbital 6.2 (between bones 5.25); snout 3; depth of caudal peduncle 2.33; maxillary 2.1; D. VII—II; A. 11; P. 21; C. (counting branched rays only) 15; scales in longitudinal series 75; in transverse series 23.

The dark spot on the posterior part of first dorsal is rather indistinct, much fainter than usual in specimens from Japan. The whitish margin of second dorsal, anal, and caudal, as well as the dark spot at base of caudal, are very distinct, as usual in Japanese specimens.

The species occurs abundantly in the rivers of entire Japan, extending its range south to Amami-Oshima, but it has not as yet been found in Formosa.

Carn. Mus., No. 8313, 85 mm., from Amami-Oshima.

TRIDENTIGER Gill.

33. *Tridentiger kuroiwæ* Jordan and Tanaka, sp. nov. (Pl. XXIII, figs. 1-3).

Native names: *Iibu* (Okinawa); *Ubu* (Amami-Oshima).

Head 6.08 to 6.09 in length, without caudal; depth 3.48 to 4.19; eye 6.5 to 6.4 in head; interorbital 6.83 to 4.2; snout 4.1 to 3.25; depth of caudal peduncle 3.62 to 2.33; maxillary 3.62 to 2.6; scales in longitudinal series 33 to 35; in transverse series 22; D. VI—12; A. 11, sometimes 10; P. 20, sometimes 21; C. (branched rays only) 15.

Body oblong, compressed, the upper contour slightly more curved than the lower; caudal peduncle strongly compressed. Head moderate, rather heavy, depressed, with moderately curved profile and with cheeks a little bulging; eye smallish, entirely in front of middle of head, impinging upon profile; interorbital somewhat wide, slightly

concave; snout short, with steep but evenly curved profile, its length 1.8 to 2 in postorbital part of head; nostrils 2, subequal in size, the anterior a little tubular, somewhat close to the lip; posterior nostril without elevated rim, midway between anterior nostril and eye; maxillary extending to beneath anterior rim of pupil. Mouth moderately wide, with slightly oblique cleft; upper jaw a little the longer; upper lip rather thick; no barbels around the mouth; teeth in jaws in two series, those of the outer series in two closely opposed rows, the teeth alternating in position, each one flat, trilobed; tongue smooth, with rounded free tip. Gill-openings large, lateral; isthmus broad, the width equal to the distance from tip of snout to anterior rim of pupil, and 2.58 in head; pseudobranchiæ well developed; gill-rakers lanceolate in shape, very short; first gill-arch 3 + 7. Dorsals two, well separated; first dorsal inserted a little behind base of pectoral, the spines slender, most of them produced, scarcely reaching last base of second dorsal, when folded backward; second dorsal with evenly rounded outer margin, reaching a little beyond base of upper rays of caudal; anal inserted beneath second ray of second dorsal, with rays similar to second dorsal, scarcely reaching base of caudal when folded backward; pectoral without silky rays above, with broad base, not reaching vertical from vent; ventrals not adnate to belly, inserted beneath base of pectoral, the rays not very fleshy, extending to a little behind middle of pectoral; vent directly in front of anal; anal papilla distinct; caudal broadly rounded. Scales ctenoid, rather large; belly with much smaller scales; nape closely scaled; about fourteen scales in the middle of back in front of dorsal; head otherwise entirely naked. Color in formalin light reddish brown, paler below; a broad brown lateral band covering two scales in width runs backward from the upper end of gill-opening and axil of pectoral along the middle of the side of the body, posteriorly ending at caudal base. Parallel to this band there are several bands much narrower and fainter, the lower ones gradually fading; occipital region with irregular blotches, these fusing and forming vermiculations; a brown band passing the lower edge of eye anteriorly bending downward in a gentle curve, and ending at edge of preorbital; head otherwise nearly immaculate; all the fins brown, with narrow whitish margins excepting first dorsal and caudal; base of pectoral with vertical whitish bar besides a dark brown spot at upper portion.

Description based on the type of the species, the largest of our specimens, 115 mm. long, from Amami-Oshima.

Of our forty-two specimens, two came from Yaku; twenty-eight from Amami-Oshima; nine from Okinawa, and the rest from Ishiga. The species is one of the commonest of these islands.

The species is allied to *Tridentiger bifasciatus* Steindachner from Japan, differing from the latter in having much larger scales and also in having one broad lateral band instead of two. It is also allied

to *Tridentiger obscurus* (Temminck and Schlegel) from Japan, especially in having large scales, but differing from the latter species in having a single distinct lateral band.

Type, Carn. Mus., No. 8324, 115 mm., from Amami-Oshima. Nine paratypes, Carn. Mus., No. 8325, 55–90 mm., from Amami-Oshima.

SICYOPTERUS Gill.

34. *Sicyopterus japonicus* (Tanaka).

Sicydium japonicum TANAKA, Journ. Coll. Sci. Imp. Univ. Tokyo, XXVII, 1909, p. 22, Tosa, Shikoku (Japan).

Native names: *Ubu* (Amami-Oshima); *Iibu* (Okinawa).

The specimens in our collection agree very well with others from Japan and Formosa. The salient characteristics are the snout, overhanging the rather small mouth; the slender body; the cup-formed ventrals, very short and circular in shape, and adnate to belly at their basal part; and the fact that the first dorsal has the third and fourth spines produced, especially in the male. In the female the anal fin has a black submarginal bar, which is a little wider than the marginal bar on the second dorsal, while in the male there are no such bars on these fins.

Head 3.93 to 4.4 in length; depth 6.58 to 6.1; eye 6.67 to 8 in head; interorbital 2.57 to 3.17; snout 2.18 to 2.72; depth of caudal peduncle 1.56 to 1.9; maxillary 2.22 to 3.17; D. VI—11; A. 11; P. 18; C. (branched rays) 13 to 15; scales 52 or 53, in transverse series 16 or 17.

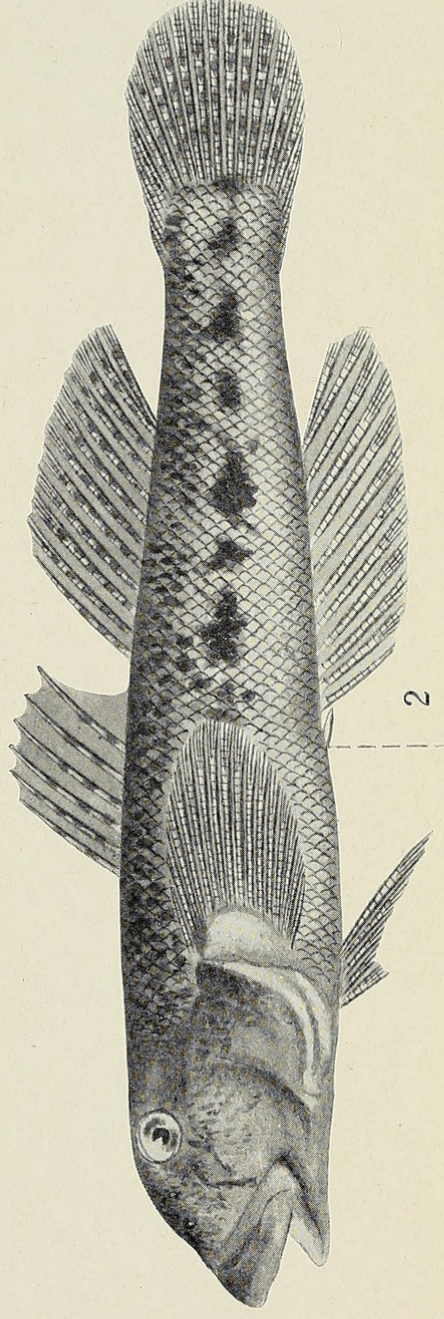
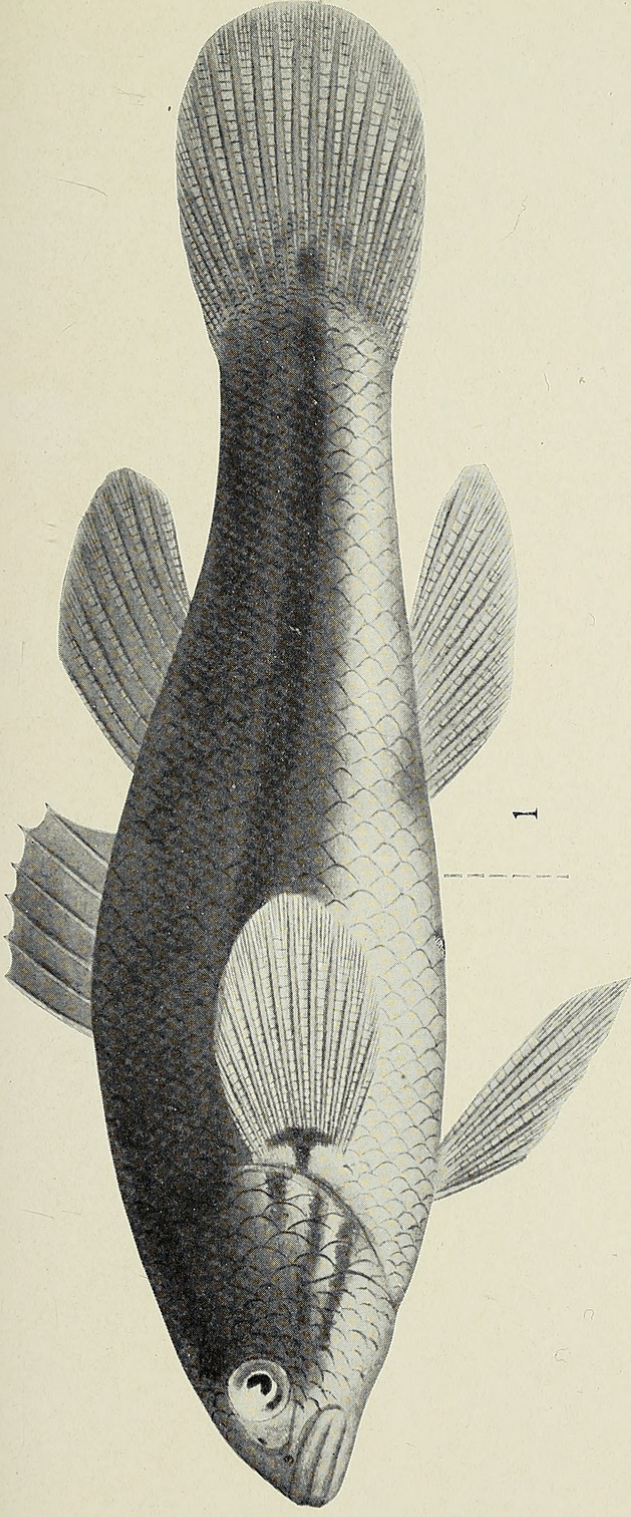
Seventeen specimens were taken in the River Kominato, Amami-Oshima, and one in the River Yabu, Okinawa. The length ranges from 75 to 130 mm.

The species is very common in Formosa and southern Japan south of Tokyo and including Boshu. It also seems to be fairly abundant in Okinawa and Amami-Oshima.

Carn. Mus., No. 8326, two specimens, 87 to 100 mm., from Amami-Oshima.

EXPLANATION OF PLATE XXII.

- FIG. 1. *Ophiocara aporos* (Bleeker). Miyara River at Kawayama, Ishigaki.
Natural size.
- FIG. 2. *Chonophorus personatus* (Bleeker). Streams of the Riukiu Islands,
Natural size.



Ophiocara and Chonophorus.

EXPLANATION OF PLATE XXIII.

- FIG. 1. *Tridentiger kuroiwæ* Jordan and Tanaka, sp. nov. Natural size.
FIG. 2. Ventral view of head of *Tridentiger kuroiwæ*.
FIG. 3. Dorsal view of head of *Tridentiger kuroiwæ*.
FIG. 3. *Apogon amboinensis* Bleeker. Natural size. From Miyara River, Ishigaki.



Jordan, David Starr and Tanaka, Shigeho. 1927. "The fresh-water fishes of the Riukiu Islands, Japan." *Annals of the Carnegie Museum* 17(2), 259–282.

<https://doi.org/10.5962/p.247205>.

View This Item Online: <https://www.biodiversitylibrary.org/item/224537>

DOI: <https://doi.org/10.5962/p.247205>

Permalink: <https://www.biodiversitylibrary.org/partpdf/247205>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder

Rights Holder: Carnegie Museum of Natural History

License: <https://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.