A REVIEW OF THE JAPANESE SPECIES OF SURF-FISHES OR EMBIOTOCIDÆ.

By David Starr Jordan (assisted by Michitaro Sindo),

Of the Leland Stanford Junior University.

In this paper is given an account of the surf-fishes or Embiotocidæ, constituting the suborder of Holconoti, which are known to inhabit the waters of Japan. The family is confined mainly to the shores of California, where 14 genera and 22 species have been described. The few species in Japan are evidently an overflow from this characteristic Californian fauna, and are interesting as completing the series of known species of the group. They are known to fishermen by the name of *Tanago*. The species mentioned are preserved in the United States National Museum.

Suborder HOLCONOTI.

The singular family of Embiotocidæ appears to constitute a distinct group or suborder allied to the Percoidea on the one hand and to the Pharyngognathi on the other, but without very close affinities with either. The structures connected with the viviparous habit, the united pharyngeals, the increased number of vertebræ, the double nostrils, the perfect gills, and the presence of many rays in the soft dorsal and anal, together with the unarmed bones of the head, constitute the chief characters of the Holconoti.

(ὅλκος, groove; νῶτος, back.)

Family EMBIOTOCIDÆ.

THE SURF-FISHES.

Body ovate or oblong, compressed, covered with cycloid scales of moderate size. Cheeks, operculum, and interoperculum scaly; lateral line continuous, running high, without abrupt flexure, not extending on the caudal fin; head rather short; mouth small, terminal; jaws with conical or compressed teeth of moderate or small size, in 1 or 2 series; rarely wanting; no teeth on vomer or palatines; no canines; lower pharyngeals united without suture, their teeth conical or paved; upper

jaw freely protractile; lips full, the lower either forming a free border to the jaw or else attached by a frenum at the symphysis; maxillary short, without supplemental bone, slipping for most or all of its length under the preorbital; opercular bones entire; branchiostegals, 6 (or 5); gill rakers usually slender; gill openings wide, the membranes free from the isthmus or very slightly connected; pseudobranchiæ present; gills 4, a slit behind the fourth; nostrils round; the openings, 2 on each side; dorsal fin single, long, with 8 to 18 usually slender spines, which are depressible in a groove; a sheath of scales along the base of the anterior part of soft dorsal and posterior of spinous dorsal, this sheath separated by a furrow from the scales of the body; anal fin elongate, with 3 moderate or small spines and 15 to 35 slender soft rays, its form and structure differing in the two sexes; ventral fins thoracic, 1, 5; pectorals moderate; caudal forked; oviduct opening behind the vent, the two apertures always distinctly separated; air bladder large, simple; no pyloric cæca; vertebræ 13 to 19, 19 to 23, 32 to 42. Viviparous. The young are hatched within the body, where they remain closely packed in a sac-like enlargement of the oviduct analogous to the uterus until born. These fœtal fishes bear at first little resemblance to the parent, being closely compressed and having the vertical fins exceedingly elevated. At birth they are from 1½ to 2½ inches in length and similar to the adult in appearance, but more compressed and red in color. Since the announcement of their viviparous nature by Prof. Louis Agassiz in 1853 and by Dr. William P. Gibbons in 1854 these fishes have been objects of special interest to zoologists. One species (*Hysterocarpus traski*) inhabits fresh water; one species (*Zalembius rosaceus*) descends to considerable depths. These species reach a length of from 6 to 18 inches and are very abundant where found. They are much used for food, but the flesh is comparatively poor, tasteless, and bony. Most of them feed on crustacea, but one genus (*Abeona*) is partly or wholly herbivorous. The species mostly live in the surf along sandy beaches and are confined to California and Japan, their origin being evidently Californian. The two Japanese species are of separate Californian origin, *Ditrema* being descended from ancestors of *Phanerodon* and *Embiotoca*, while *Neoditrema* must have sprung from ancestors of *Hypocritichthys* and *Hyperprosopon*.

a. EMBIOTOCINÆ. Spinous dorsal shorter than soft dorsal, of 6 to 11 spines; anal spines graduated; marine species.

b. Scales relatively small, 60 to 70 in lateral line.

c. Gill rakers numerous, long and slender, about 25 below angle of arch; lower lip without frenum; profile of head depressed above eye; mouth oblique, short; lower pharyngeals small.

d. Males with one row of teeth in upper jaw, the lower with few or none; females with toothless jaws ..... *Neoditrema*.

cc. Gill rakers few, small, about 15 below angle; lower lip with a frenum; mouth with teeth in one series; sexes similar; lower pharyngeals rather slender, with small teeth ..... *Ditrema*.

NEODITREMA Steindachner.

Neoditrema STEINDACHNER, Beitr. Kenntn. Fische Japans, II, 1883, p. 32 (*ransonneti*).

Body elongate, compressed, with rather long caudal peduncle; frontal region depressed above eyes. Mouth small, the lower jaw projecting; dentition unlike in the two sexes; females without teeth in the jaws; males with one row of bluntish teeth above, these wide set and turned forward in a line with direction of edge of premaxillary bone, the lateral teeth largest; lower lip thin, without frenum; gill rakers close set, long and slender, about 25 below angle of arch; lower pharyngeals small, with small teeth; scales small, deciduous, about 70 in the lateral line; dorsal fin low, rather short; anal low, rather short, much distorted in the male; abdomen shorter than anal fin.

One species known, a small fish closely allied to the American genus, *Hypocritichthys*, from which it differs in the dentition. From *Ditrema*, both genera are separated by the long and slender gill rakers, the depressed frontal region, and the free lower lip.

(*νεός*, new; *Ditrema*.)

NEODITREMA RANSONNETI Steindachner.

NE, OKITANAGO (OFFSHORE SURF-FISH).

Neoditrema ransonneti STEINDACHNER, Fische Japans, II, 1883, p. 32; Yokohama.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1901, p. 752; Tsushima Island, Straits of Korea.

Head, 3½ to 3¾ in length; depth, 3 to 3⅓. D. VI to VIII, 20 to 22. A. III, 26 or 27. Scales, 6—70 to 72—14 to 16. Eye, 3⅕ to 3⅔ in head; interorbital, 3½ to 4; snout, 4; maxillary, 3⅕. Body strongly compressed, the nape and breast especially so; profile above eyes strongly concave; mouth oblique, the chin projecting; lower lip thin, without frenum; eye rather large; gill rakers close set, long and slender, 20 to 25 below angle; spinous dorsal low, the spines slender; soft dorsal low; caudal peduncle moderate, the fin well forked, 1⅕ in head; pectorals, 1⅕ in head; ventrals somewhat shorter; 3½ to 4 rows of scales on cheek. The males have teeth in the upper jaw, sparse, bluntish, wide set, in one row, directed forward in line with edge of the bone, those on sides of mouth largest; lower jaw usually with two or three small teeth in front; females toothless. Color, dark olive brown above, the lower parts coppery or golden, with traces of faint dark streaks along the rows of scales; chin dusky; a dusky spot on upper part of opercle; no spots on preopercle or snout. Males with a jet black spot on the premaxillary, which is wanting in the females; fins dusky yellowish; the anal and dorsal black in front, the ventrals black at tip; a dark streak across base of pectoral.

This little fish is known to us from upward of a hundred examples

of both sexes taken by us in Koajiro Bay, near Misaki, where the species is locally very abundant. It has not been seen elsewhere save on the island of Okishima in the Japan Sea, whence one male example was received from Dr. K. Kishinouye, and from the island of Tsushima in the Korean Straits, where one female example was taken by Mr.

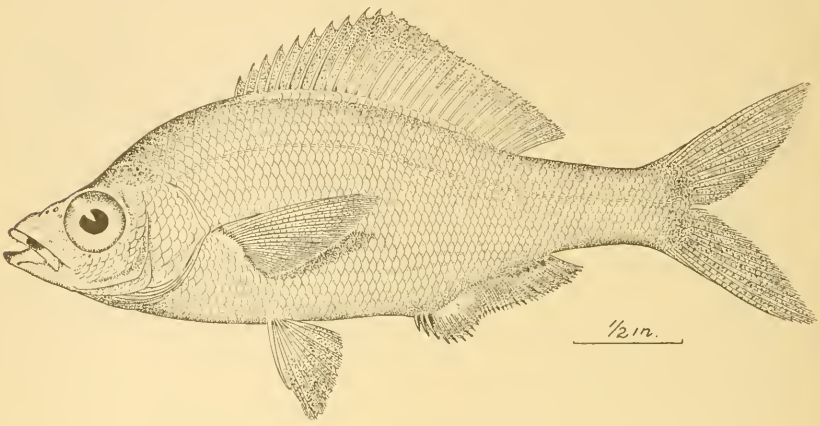

FIG. 1.—NEODITREMA RANSONNETI.

P. L. Jouy. The original types, female, found by Baron Ransonnet in the market of Yokohama, doubtless came from Misaki. The native name at Okishima is *Ne*. At Misaki it is called Okitanago, or offshore surf-fish. The largest example (from Okishima) is but 100 mm. long.

Measurements of Neoditrema ransonneti.

Length in millimeters	100
Head in hundredths of length	28
Depth	31
Snout to dorsal	36
Snout to anal	61
Depth of caudal peduncle	11
Snout	7
Eye	9
Tip of snout to end of maxillary	9
Width of interorbital space	7⅛
Length of dorsal fin	41
Length of anal fin	22
Height of longest dorsal spine	11
Height of longest dorsal ray	16½
Height of longest anal spine	6
Height of longest anal ray	7
Length of pectoral fin	25
Length of caudal fin	28
Length of ventral fin	19½
Number of scales	6-72-16
Number of dorsal rays	VII, 20
Number of anal rays	III, 20
Number of pectoral rays	I, 19
Locality	Oki Island

DITREMA Schlegel.

Ditrema SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 77, pl. XL, fig. 2 (*temminckii*).

Body oblong, more or less elevated, somewhat compressed, the caudal peduncle robust. Head moderate, the jaw included. Lips moderate, the lower attached by a frenum at the chin. Maxillary short,

its whole length slipping under the preorbital. Teeth few, conical, bluntish, in one series. Gill rakers weak, rather short and slender. Pharyngeals normal, the anterior and lateral teeth small, conic, none of them especially enlarged; males with a gland on some of the anterior anal rays, but none of them modified to form a definite plate. Vertebræ 14+18 or 19, the base of anal below 9 caudal vertebræ; first hæmal spine small, applied to the second. Caudal fin lunate; anal fin rather long, much longer than abdomen, its spines small. Scales small, 60 to 80 in the lateral line. This genus is close to the American genus *Embiotoca*, the most generalized and perhaps the most primitive genus of the family. The only difference of importance is the slight one of the coarser and blunter teeth of *Embiotoca*.

(*δίς*, two; *τρῆμα*, aperture, the generative organs in all *Embiotocidæ* having a distinct opening from the intestines.)

DITREMA TEMMINCKI Bleeker.

UMI-TANAGO (SEA SURF-FISH); AKATANAGO (RED SURF-FISH).

Ditrema Schlegel, Fauna Japonica, 1846, p. 77, pl. xl, fig. 2; Nagasaki.

Ditrema temminckii Bleeker, Verh. Bat. Gen., XXV, Japan, p. 33; Nagasaki.—Günther, Cat. Fish., IV, 1862, p. 246.—Steindachner and Döderlein, Fische Japans, II, 1883, p. 31; Tokyo, Yokohama.—Ishikawa, Prel. Cat., 1897, p. 27; Hokkaido, Tokyo, Fukushima.—Jordan and Evermann, Fish. N. and M. Amer., II, 1898, p. 1510; Tokyo.

Ditrema lævc Günther, Cat. Fish., II, 1860, p. 392; Japan.—Nystrom, Kong. Svensk. Vet. Akad., 1887, p. 32; Nagasaki.

Ditrema smitti[1] Nystrom, Kong. Svensk. Vet. Akad., 1887, p. 32; Nagasaki (adult example).

Embiotoca smitti Jordan and Snyder, Proc. U. S. Nat. Mus., 1900, p. 358; Yokohama, Coll. *Albatross*.

D. X, 21; A. III, 26. Scales, 11—75—19. Head measured, exclusive of opercular flap, $3\frac{1}{2}$ in length, exclusive of caudal fin; depth, $2\frac{4}{5}$. Snout, $3\frac{1}{5}$ in head; eye equal to snout; interorbital space, 3; caudal fin, 1 in head; pectoral, $1\frac{1}{10}$; ventral, $1\frac{2}{3}$; the longest dorsal spine, 3; longest dorsal ray, the fifth, $1\frac{2}{3}$; third anal spine, $5\frac{1}{4}$; the longest anal ray, the ninth from the last, equal to the pectoral; depth of caudal peduncle, 2.

Body ovate, compressed, the nape somewhat prominent; nasal bone slightly prominent; ventral outline from throat to vent almost straight. Mouth small, maxillary nearly equal to snout; lower jaw slightly included; teeth conical, blunt, in a single series, on the front of lower

[1] *Ditrema smitti* is described as having the head 4 in total length with caudal, the depth nearly 3, D. XI, 21, A. III, 27. Scales, 11–78–18; spinous dorsal black with a narrow line of the same color at the base of the soft rays. Pectorals yellowish, and with black tips, the first ray with a black spot at base. Preopercle with a blackish spot on the lower limb and a larger one behind it. Length, 180 mm. This is certainly the adult of the species, of which a rather faded young specimen was first described as *Ditrema*.

jaw only, those on upper jaw pointing more outward than downward. Nostrils small, posterior ones slightly larger. Gill rakers short and slender, anteriorly inclined, about 15 on lower limb of arch; 5 rows of scales on cheek. Mandibles and edge of opercle naked. Scales below lateral line on middle of body largest, their depth being greater than the length. Fins naked, the dorsal with a scaly sheath. Pectoral fins pointed behind, the upper rays longest, graduated, the tip reaching to vent. Ventral fins inserted below the second dorsal spine, their tips not reaching to that of the pectorals. Dorsal spines shorter than the soft rays, the last the longest; soft dorsal highest in front; anal spines small, the third the longest, much shorter than the soft rays, in male seventh to tenth soft anal rays from the last prolonged almost equal to the length of pectoral fin, graduated posteriorly; males with the anal considerably depressed in front with a glandular appendage, the soft rays sometimes considerably produced; caudal widely forked.

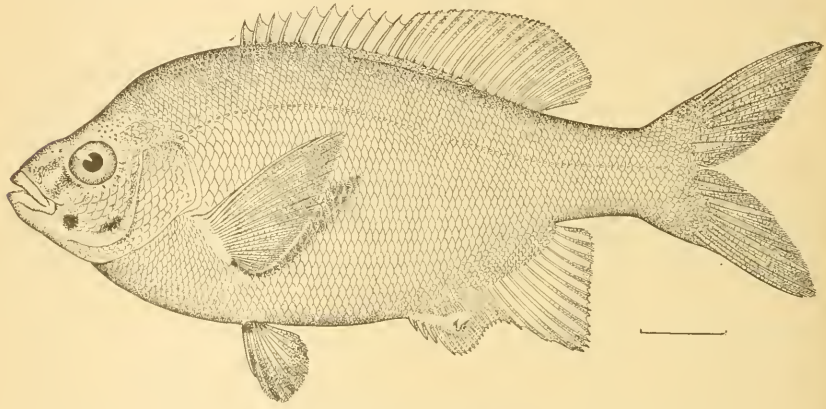

FIG. 2.—DITREMA TEMMINCKI.

Color silvery, steel blue on back; lower limb of preopercle with a black spot in front and another at the angle, these very rarely obsolete; two black bars from eye toward maxillary, a dark blotch on upper end of opercle; upper half of spinous dorsal black; soft fin uncolored, or with a dark edge; anal and caudal fins dusky; pectorals uncolored, axil slightly dusky; tips of ventrals dark, with the first rays and the membrane between the fourth and fifth rays chalky white. The ground coloration is subject to considerable variation, but the two spots below the eye and the two stripes on snout are rarely absent.

Here described from a specimen 8½ inches long from Tokyo. Our numerous specimens were collected by Jordan and Snyder at Nagasaki, Hakata, Onomichi, Kobe, Wakanoura, Misaki, Tokyo, Same, Aomori, and Hakodate. The specimen from Hakata is the type of the accompanying figure.

Those from Misaki, obtained in rather deeper water than the others, were distinctly of a coppery red in life, with a redder line running laterally forming the chord to the arc of the curved lateral line. These were locally called *Aka-tanago* (red surf-fish). The majority of these red specimens have their dorsal spines reduced to 7 or 8, but some have 9; the body is rather more roundish than in those from other localities, the fins duskier with a slender black bar running at the base of the dorsal and anal fins; the lips are dusky. We do not, however, regard them as forming a distinct species. One specimen from Hakata has the body and fins except the pectorals blackish dusky, with the spinous dorsal uncolored, and the body considerably thicker than in the others. Many specimens have a black spot at the pectoral axil, and the ventral fins are often black from root to end; a black bar running along the root of dorsal and anal fins; the vertical fins higher, the eyes larger and the head longer in young specimens than in the adult. All these peculiarities seem to depend upon the character of the water or of the bottom and are within the range of specific variation.

(Named for Prof. C. J. Temminck, the associate of Professor Schlegel.)

Measurements of Ditrema temminckii.

Locality.	Nagasaki.	Misaki.	Tokyo.	Hakodate.
Length in millimeters	149	105	172	191
Head in body	28	31	29	29½
Depth	45½	45	45	47
Snout to dorsal	39	42	40	41
Snout to anal	59	59	62	64
Depth of caudal peduncle	13	13	14	14
Snout	9	9½	9	10
Eye	9	9½	8	8½
Tip of snout to end of maxillary	8	7½	8½	8½
Width of interorbital space	9	8½	9½	9½
Length of dorsal fin	51	45	49½	50½
Length of anal fin	27	28	27	25
Height of longest dorsal spine	8½	10½	9½	8
Height of longest dorsal ray	14½	13	17	17
Height of longest anal spine	4½	6	6	5
Height of longest anal ray	22½	12	15	22½
Length of pectoral fin	25	25	25	26
Length of caudal fin	29	27	30	30
Length of ventral fin	16	17	16½	15
Number of dorsal rays	X, 20	IX, 21	X, 20	X, 21
Number of anal rays	III, 26	III, 26	III, 26	III, 25
Number of pectoral rays	1, 19	1, 19	1, 19	1, 19
Scales above lateral line	10	11	10	10
Scales on lateral line	75	71 to 74	76	77
Scales below lateral line	19–20	21	19–20	19–20