

A REVIEW OF THE SALMONOID FISHES OF JAPAN.

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In the present paper is given a descriptive catalogue of the Salmonidæ, Argentinidæ, and Salangidæ known to inhabit the waters of Japan. It is based on material obtained by the writers in 1900, series of the specimens being in the museum of Leland Stanford Junior University and in the United States National Museum.

Family I. SALMONIDÆ.

SALMON FAMILY.

Body oblong or elongate, covered with cycloid scales. Head naked. Mouth terminal, large or small, varying much in the different genera; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone; premaxillaries not protractile. Teeth various, sometimes wanting. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill rakers various; gill membranes not connected, free from the isthmus; branchiostegals 10 to 20. No barbels. Dorsal usually nearly median, not greatly elongate, its rays 9 to 15, only one or two of the anterior simple or rudimentary, the others branched; adipose fin present; caudal fin forked; anal fin moderate or rather long; ventrals moderate, nearly median; pectorals placed low. Lateral line present. Abdomen rounded in outline. Parietals not in contact, separated at middle by the intervention of the supraoccipital, which connects with the frontals; epipleural appendages not developed. Air bladder large, stomach siphonal; pyloric cæca very numerous. Ova large, falling into the cavity of the abdomen before exclusion. As now restricted, this is no longer one of the large families of fishes, but in beauty, activity, gameness, and quality as food, and even in size of individuals, different members of the group stand easily with the first among fishes. The Salmonidæ are confined to the northern regions, and north of about 40° N., everywhere abundant where suitable waters occur. Some of the species, especially the larger ones, are

marine and anadromous, living and growing in the sea, and entering fresh waters to spawn. Still others live in running brooks, entering lakes or the sea as the occasion serves, but not habitually doing so. Others again are lake fishes, approaching the shore, or entering brooks in the spawning season, at other times retiring to waters of considerable depth. Some of them are active, voracious, and gamy, while others are comparatively defenseless and will not take the hook. The large size of the eggs and their lack of adhesiveness, with the ease by which the eggs may be impregnated, render the Salmon and Trout especially adapted for artificial culture. The Salmonidae are of comparatively recent evolution, few of them occurring as fossils, except in the most recent deposits. The instability of the specific forms and the lack of sharply defined specific characters may be in part attributed to their recent origin, as Dr. Günther has suggested.

- a. Mouth deeply cleft, the long lower jaw articulating with the quadrate bone behind the eye, the maxillaries rather narrow.
- b. *Salmoninae*. Dentition strong and complete; conical teeth on jaws, vomer, and palatines; tongue with two series of strong teeth (sometimes deciduous in very old specimens); scales small.
- c. Anal fin elongate, of 14 to 17 developed rays; gill rakers 20 to 40; branchiostegals 12 to 16; vomer narrow, long, flat, with weak teeth; species spotted with black, if at all. *Oncorhynchus*, 1.
- cc. Anal fin shorter, of 9 to 13 developed rays; gill rakers 10 to 15; branchiostegals 10 to 14.
- d. Vomer flat, its toothed surface plane; teeth on the shaft of the vomer in alternating rows or in one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest; posterior vomerine teeth sometimes deciduous; species black spotted *Salmo*, 2.
- dd. Vomer boat-shaped, the shaft strongly depressed, without teeth; hyoid bone with very weak teeth or none; species not anadromous.
- e. Scales moderate, silvery; body covered with small, black spots; head flattened above, the jaws long. *Hucho*, 3.
- ee. Scales small (about 200); body with round, red, whitish or yellowish spots; head not depressed *Salvelinus*, 4.
- aa. *Plecoglossinae*. Dentition feeble; premaxillaries with a few pointed teeth; teeth of maxillaries and of lower jaw broad, truncated, serrate lamellæ, movable, each in a fold of skin; inside of mouth behind lower jaw with folds of skin; tongue with minute teeth; vomer with few or none; scales very small.

Plecoglossus, 5.

1. ONCORHYNCHUS Suckley.

QUINNAT SALMON.

Oncorhynchus Suckley, Ann. Lyc. Nat. Hist. N. Y., 1861, p. 312 (*scooteri*).

Hypisifario Gill, Proc. Ac. Nat. Sci. Phila., 1862, p. 330 (*kennerlyi*).

Body elongate, subfusiform, or compressed. Mouth wide, the maxillary long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front. Vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak;

palatines with a series of teeth; tongue with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone. Branchiostegals more or less increased in number. Scales moderate or small. Dorsal fin moderate; anal fin comparatively elongate, of 14 to 20 rays. Pyloric appendages in increased number. Gill rakers rather numerous. Ova large. Sexual peculiarities very strongly developed; the snout in the adult males in summer and fall greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly elongate and somewhat hooked at tip; the teeth on these bones also greatly enlarged. The body becomes deep and compressed; a fleshy hump is developed before the dorsal fin, and the scales of the back become embedded in the flesh; the flesh, which is red and rich in spring, becomes dry and poor. Salmon, mostly of large size, ascending the rivers tributary to the North Pacific in North America and Asia, spawning in the autumn. The genus is very close to *Salmo*, differing only in the increased number of certain organs. The species never feed in the rivers and die after spawning. (*ὄγκος*, hook; *ρύχος*, snout.)

- a. *Oncorhynchus*. Gill rakers comparatively short and few (20 to 30 in number).
- b. Scales very small, more than 160 (160 to 210) in a longitudinal series above the lateral line.
- c. Caudal fin large, with oblong black spots; branchiostegals 11 or 12; anal rays 15 (*gorbuscha*.¹)

¹ONCORHYNCHUS GORBUSCHA (Walbaum).

HUMPBACK SALMON OF ALASKA.

Salmo gorbuscha WALBAUM, *Arledi Piscium*, 1792, p. 69; Kamchatka, after the Gorbuscha of Pennant and Krascheninnikow.

Oncorhynchus gorbuscha JORDAN and GILBERT, *Synopsis*, 1883, p. 305.—JORDAN and EVERMANN *Fishes N. and M. Amer.*, I, 1896, p. 478.

Salmo gibber BLOCH and SCHNEIDER, *Syst. Ichth.* 1801, p. 409; Kamchatka, after Krascheninnikow.

Salmo proteus PALLAS, *Zoogr. Russo-Asiatica*, III, 1811, p. 376; Bering Sea.—SUCKLEY *Monogr. Salmo*, 1861 (1874), p. 97.

Oncorhynchus scouleri GÜNTHER, *Cat.*, VI, 1866, p. 158.

Salmo scouleri RICHARDSON, *Fauna Bor.-Amer.*, III, 1836, p. 158; Observatory Inlet.

Oncorhynchus proteus GÜNTHER, *Cat.*, VI, 1866, p. 157.

Salmo tschaweytschiformis SMITT, I *Riksmuseum Befintliga Salmonider*, 1886, p. 161; Port Clarence.

B. 11 or 12. Gill rakers 13+15. A. (developed rays) 15; D. 11; scales 215 (210-240), those of the lateral line larger, 170. Pyloric cæca very slender, about 180. Body rather slender, in the female plump and symmetrical, in the autumn males very thin and compressed, with the fleshy dorsal hump much developed and the jaws much elongated, strongly hooked, and with extravagant canines in front. Ventral appendage half the length of the fin. Color bluish; sides silvery; back posteriorly, adipose fin, and tail with numerous black spots; those on the caudal fin particularly large and oblong in form; autumn males red, more or less blotched with brownish; weight 3 to 6 pounds; Pacific coast and rivers of North America and Asia from Oregon northward, and southward to Kamtchatka, not yet known from Japan; occasionally taken in the Sacramento. Known at once by the very small size of the scales, and by the coarse oblong spots on the tail. The flesh is much inferior to that of *tschawytscha* and *nerka*.

(*gorbuscha*, the Russian vernacular name in Alaska.)

- cc. Caudal fin small; unspotted; branchiostegals 14 or 15; anal rays about 14..... *masou*, 1.
- bb. Scales medium, about 145 (138 to 155) in a longitudinal series; pyloric cæca about 150.
- d. Anal rays 13 or 14; black spots small or obsolete; branchiostegals 13 or 14; caudal broad; body mottled blackish and silvery..... *keta*, 2.
- dd. Anal rays about 16; back and upper fins with round black spots; B. 15 to 19..... (*tshawytscha*)¹
- bbb. Scales comparatively large, about 130 (125 to 135) in a longitudinal series; pyloric cæca 50 to 80; tip of dorsal black; black spots few..... *kisutch*, 3
- aa. *Hypsifario*: Gill rakers comparatively long and numerous (33 to 40 in number); scales large, about 130; back in adults unspotted, clear blue in spring, red in fall; young more or less spotted in front of dorsal; landlocked examples small and more closely spotted..... *nerka*, 4

1 ONCORHYNCHUS TSCHAWTSCHA (Walbaum).

QUINNAT SALMON; TCHAVICHE; KING SALMON OR CHINNOOK SALMON.

Salmo tshawytscha WALBAUM, *Artedi Piscium*, 1792, p. 71; rivers of Kamchatka; after the *Tschawytscha* of Krascheninnikow, *Desc. Kamchatka*, 1768, p. 178, and the *Tschawytscha* of Pennant, 1792.—BLOCH and SCHNEIDER, *Syst. Ichth.*, 1801, p. 407.

Oncorhynchus tshawytscha JORDAN and EVERMANN, *Fishes N. and M. Amer.*, I, 1896, p. 479.

Salmo orientalis PALLAS, *Zoogr. Ross.-Asiat.*, III, 1811, p. 367; Kamchatka.

Oncorhynchus orientalis GÜNTHER, *Cat.*, VI, 1866, p. 159.

Salmo quinnat RICHARDSON, *Fauna Bor.-Amer.*, III, 1836, p. 219; Columbia River, and of many writers.

Salmo argyreus SUCKLEY, *Pacific R. R. Surv.*, XII, 1860, Pt. 2, p. 326, and *Monogr. Salmo*, 1861 (1874), p. 110.

Fario argyreus GIRARD, *Proc. Ac. Nat. Sci. Phila.*, 1856, p. 218; Cape Flattery, Fort Steilacoom.

Oncorhynchus quinnat GÜNTHER, *Cat.*, VI, 1866, p. 158.—JORDAN, *Proc. U. S. Nat. Mus.*, 1878, p. 69.

Salmo confluentus SUCKLEY, *Ann. Lyc. Nat. Hist. N. Y.*, December, 1858, and *Pacific R. R. Surv.*, XII, 1860, Pt. 2, p. 334; Puyallup River, near Fort Steilacoom (Coll. Suckley); and *Monogr. Salmo*, 1861 (1874), p. 109.

Oncorhynchus chouicha JORDAN and GILBERT, *Synopsis*, 1883, p. 306.

Head 4; depth 4. B. 15 or 16 to 18 or 19, the number on the two sides always unlike. D. 11; A. 16. Gill rakers usually 9 + 14 (i. e., 9 above the angle and 14 below). Pyloric cæca 140 to 185; scales usually 27-146-29; the number in a longitudinal series varying from 140 to 155, and in California specimens occasionally as low as 135. Vertebrae 66. Head conic, rather pointed in the females and spring males. Maxillary rather slender, the small eye behind its middle. Teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males. In the males in late summer and fall the jaws become elongated and distorted, and the anterior teeth much enlarged, as in the related species. The body then becomes deeper, more compressed, and arched at the shoulders, and the color often nearly black. Preopercle and opercle strongly convex. Body comparatively robust, its depths greatest in its middle. Ventrals inserted behind middle of dorsal, ventral appendage half the length of the fin; caudal, as usual in this genus, strongly forked, on a rather slender caudal peduncle. Color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots (these are sometimes few, but very rarely altogether wanting); sides of head and caudal fin with a peculiar metallic tin-colored luster; male, about the spawning season (October), blackish, more or less tinged or blotched with dull red. Flesh red and rich in spring, becoming paler in the fall as the spawning season approaches. Length 2 to 5 feet. Usual weight in the Columbia River 22 pounds, in the Sacramento 16 to 18 pounds; in smaller rivers still less, but individuals of 70 to 100 pounds have been taken. Alaska, Oregon, and California, southward to Ventura River, and to northern China, ascending all

1. ONCORHYNCHUS MASOU (Brevoort).

MASU; YEZOMASU.

Salmo masou BREVOORT, Exped. Japan, 1856, p. 275, pl. ix, fig. 2; Hakodate; (description from a very bad drawing;

Oncorhynchus yessoensis HILGENDORF, Monatsber. Ges. Ostasien, XI, 1876, p. 25; Hokkaido.

Head 4 in length; depth 4; depth of caudal peduncle $3\frac{1}{2}$ in head; snout $4\frac{2}{3}$; eye 7; maxillary $2\frac{1}{3}$; D. 13; A. 15; scales in lateral series about 190; between lateral line and insertion of dorsal about 29.

Interorbital space convex, $3\frac{1}{4}$ in length of head; maxillary extending considerably beyond eye; gill rakers 12+17 on first arch, long and slender; branchiostegals 13. Teeth on jaws weak, a few very small ones on palatines and vomer. Opercle and preopercle strongly convex behind; caudal fin forked, strong and short, contained about 5 times in the length; pectoral $1\frac{2}{3}$ in head; ventral $2\frac{1}{5}$; the ventral appendage almost two-thirds the length of fin.

Coloration rather dark; sides silvery; no distinct black spots on body or fins; tip of dorsal and inside of pectorals and ventrals blackish. Here described from an immature female specimen in alcohol, 360 millimeters long, from Aomori. The accompanying figure is taken from this specimen.

This species resembles the Humpback salmon of Alaska and British Columbia (*Oncorhynchus gorbuscha* Walbaum). It seems to differ, however, in the larger scales (about 190) and the larger number of branchiostegals, 13 to 16 instead of 11 or 12 as in *O. gorbuscha*. The caudal fin lacks the large oblong black spots seen in *O. gorbuscha*. The species also resembles *O. keta*, but can be usually distinguished by the smaller size, smaller scales, darker fins, and narrower caudal. The tip of the dorsal and the inside of the pectorals and ventrals are very

large streams; especially abundant in the Columbia and Sacramento rivers, where it is the principal salmon. The usual order of salmon running in the streams of Oregon and Washington is *nerka*, *tshawytscha*, *kisutch*, *gorbuscha*, and *keta*. Those which start first go farthest. This species ascends the large streams in spring and summer, moving up, without feeding, until the spawning season, by which time many of those which started first may have traveled more than 1,000 miles. It ascends the Snake River to the neighborhood of Upper Salmon Falls, where it spawns in October and November. In the Salmon River of Idaho it ascends to the headwaters, more than 1,000 miles from the sea, where it spawns in August and early September when the water has reached a temperature of about 54° F. After spawning, most or all of those which have reached the upper waters perish from exhaustion. It is by far the most valuable of the species of salmon. It has lately been introduced into streams of eastern North America, and should be introduced into the streams of Japan, where as yet it is unknown.

(*tshawytscha*, better spelled by earlier writers *Tchaviche*, the vernacular name in Alaska and Kamchatka.)

dark. A third specimen, obtained in salt at Aomori, came from the Ishikari River at Sapporo in Hokkaido. We have also young examples said to have been taken in the Daiya River at Nikko. The species is thus far known only from the island of Hokkaido, from the neighboring shores of the province of Aomori, and from the Daiya River.

The Japanese fishermen fail to distinguish the smaller salmon (*masu*, *kisutch*) from the adult of the Japanese trout (*Salmo perryi*), calling them all alike *Masu*, in opposition to the large salmon *O. keta*,

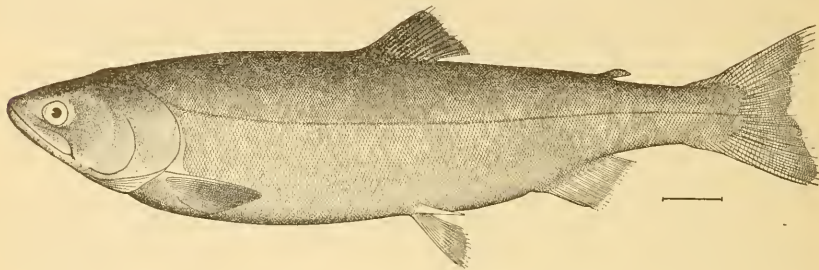


FIG. 1.—ONCORHYNCHUS MASOU.

called *Sake*, and the young trout, which are called Yamabe. This confusion extends to some of the published writings. The different species are, however, correctly distinguished by Hilgendorf. In his account of *O. yessoensis* Hilgendorf, however, counts 133 to 137 scales in the lateral line. This leaves some doubt as to the specimen he had in hand. He finds also 16 dorsal rays, doubtless including the rudiments.

(*masu* the Japanese name of small salmon; *yesso* is the old name of the great island now called Hokkaido, or "North Shore.")

2. ONCORHYNCHUS KETA (Walbaum).

SAKE; DOG SALMON; CALICO SALMON.

Salmo keta vel *kayko* WALBAUM, *Artedi Piscium*, 1792, p. 72; Rivers of Kamchatka; after the *Keta* or *Kayko* of Pennant and Krascheninnikow.

Oncorhynchus keta JORDAN and GILBERT, *Synopsis*, 1883, p. 305.

Salmo lagocephalus PALLAS, *Zoogr. Ross.-Asiatica*, III, 1811, p. 372; Bering Sea.

Oncorhynchus lagocephalus GÜNTHER, *Cat.*, VI, 1866, p. 161.

Salmo japonensis PALLAS, *Zoogr. Ross.-Asiatica*, III, 1811, p. 382; Kurile Islands; Amur River.

Salmo dermatinus RICHARDSON, *Voyage Herald, Zoöl.*, 1854, p. 167; Yukon River.

Salmo consuetus RICHARDSON, *Voyage Herald, Zoöl.*, 1854, p. 168; Yukon River.

Salmo camis SUCKLEY, *Ann. Lyc. Nat. Hist. N. Y.*, 1858, p. 9; and *Monogr. Salmo*, 1861, p. 101 (1874); Puget Sound.—JORDAN and EVERMANN, *Fish. N. and M. Amer.*, I, 1896, p. 478; San Francisco; Kamchatka; Bering Straits.

Oncorhynchus haberi HILGENDORF, *Monatsber., Ges. Ost-Asien*, XI, 1876, p. 25; Hokkaido.—ISHIKAWA, *Prel. Cat.*, 1897, p. 20; Nishibetsu R., Yehigo, Matsushiro, Shinshin.

Head 4; depth 4; D. 9; A. 13 or 14; scales about 28–150–30; B. 13 or 14, rather broad; gill rakers 9+15; pyloric caeca 140–185. General

form of *O. tshawytscha*, but the head proportionately longer, more depressed and pike-like; the preopercle more broadly convex behind, and the maxillary extending considerably beyond eye; gill rakers few, coarse, and stout as in the Quinnet; accessory pectoral scale short, not half the length of fin; caudal fin broad. Dusky above; sides paler, little lustrous; back and sides with no defined spots, but only fine specklings, which are often entirely obsolete; head dusky, scarcely any metallic luster on head or tail; caudal dusky, plain, or very finely maculate, its edge usually distinctly blackish; fins all mostly blackish, especially in males; breeding males generally blackish above, with sides brick red, often barred or mottled. Weight 8 to 12 pounds. Hokkaido to Kamchatka, and south to northern California, ascending all streams in the autumn, and spawning at no great distance from the sea. At the time of its run the males of this species are much distorted and the flesh has little value. It is the common large salmon of northern Japan swarming in its rivers in the fall. It is known to all fishermen

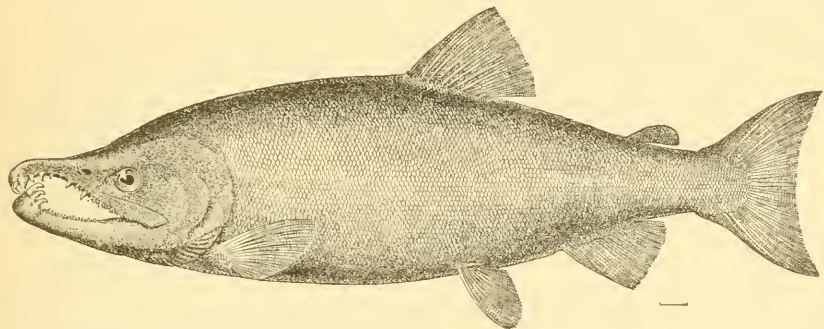


FIG. 2.—*ONCORHYNCHUS KETA*.

as *Sake*. It ranges southward to Same and Noto, and the annual value of the product is given by Matsubara at \$400,000. Salted salmon is valued as a New Year's present in Japanese homes.

This description is from specimens from Puget Sound. The figure is taken from an old male from Hakodate, much distorted and entirely black. The extreme lankness of this individual is not well shown in the figure. Our specimens are from Ishikari River, Hokkaido, in the markets of Aomori and Hakodate. One of these weighing 9 pounds showed the following characters: Scales 160; B. 14 to 16; anal fin high, with concave edge, less falcate than in *O. masou*; its rays III, 14; (II, 15; III, 13 in other specimens); first anal ray 2 in head; head $4\frac{1}{2}$ in length; depth 4. Coloration dirty silvery, blotched with darker, no black spots; pectorals, ventrals, and dorsals blackish, the paired fins darker on the inner edge, the dorsals on its anterior half. Old males are still darker, almost black, and extravagantly distorted. The flesh in this species is pale and pasty, unfit for canning purposes, and

in all respects less valuable than in any of the other species of *Oncorhynchus*. The introduction of better species to the Japanese rivers is a matter of great economic importance.

(*Keta*, a vernacular name in Kamchatka.)

3. ONCORHYNCHUS KISUTCH (Walbaum.)

GINMASU, SILVER SALMON, KISUTCH.

? *Salmo milktschutch* WALBAUM, *Artedi Piscium*, 1792, p. 70; Bering Sea; after *Milktschutsch* or *Milktschitsch* of Pennant and Krascheninnikow; probably the young of *kisutch*.

Salmo kisutch WALBAUM, *Artedi Piscium*, 1792, p. 70; rivers and lakes of Kamchatka; after the *Kisutch* of Pennant.

? *Salmo striatus* BLOCH and SCHNEIDER, *Syst. Ichth.*, 1801, p. 407; Kamchatka; after *Milktschitsch* of Krascheninnikow.

Salmo kysutch BLOCH and SCHNEIDER, *Syst. Ichth.*, 1801, p. 407; Kamchatka; after Pennant.

Salmo sanguinolentus PALLAS, *Zoogr. Ross.-Asiat.*, III, 1811, p. 379; Bering Sea.

Salmo tsuppitch RICHARDSON, *Fauna Bor.-Amer.*, III, 1836, p. 224; Columbia River.—GÜNTHER, *Cat.*, VI, 1866, p. 118.

Oncorhynchus lyaodon GÜNTHER, *Cat.*, VI, 1866, p. 155; in part.

Salmo scouleri SUCKLEY, *Monogr. Salmo*, 1861 (1874), p. 94.

Oncorhynchus sanguinolentus GÜNTHER, *Cat.*, VI, 1866, p. 160.

Oncorhynchus tsuppitch JORDAN, *Forest and Stream*, Sept. 16, 1880, p. 130.

Oncorhynchus kisutch JORDAN and GILBERT, *Synopsis*, 1883, p. 307.—JORDAN and EVERMANN, *Fish N. and M. Amer.*, 1896, p. 480.

Oncorhynchus perryi HILGENDORF, *Monatsb. Ges. Ostasien*, 1876, p. 25 (not *Salmo perryi* Brevoort).—ISHIKAWA, *Prel. Cat.*, 1897, p. 20; Arikawa, Toshima, Hakodate, Matsushiro, Shinshin.

Head 4; depth 4; B. 13 or 14; pyloric cæca very few and large, 63 (45 to 80); gill rakers 10 + 13, rather long and slender, nearly as long as eye, toothed; scales 25–127–29; D. 10; A. 13 or 14 (developed rays). Body rather elongate, compressed. Head short, exactly conical, terminating in a bluntly pointed snout, which is longer and broader than the lower jaw; head shorter than in a young quinnat (*tscharwytscha*) of the same size. Interorbital space broad and strongly convex; opercle and preopercle strongly convex behind; the preopercle very broad, with the lower limb little developed; cheeks broad. Eye quite small, much smaller than in young quinnat of the same size. Suborbital very narrow, with a row of mucous pores along its surface; maxillary slender and narrow, but extending somewhat beyond the eye. Teeth very few and small, only 2 or 3 on the vomer; those on tongue very feeble; fins small; pectorals and ventrals short, the ventral appendage three-fifths the length of the fin; caudal strongly forked, on a slender peduncle. Bluish green, sides silvery, with dark punctulations; dorsal always tipped with black; this color usually conspicuous both in the adult and the young; no spots, except a few rather obscure on top of head, back, dorsal fin, adipose fin, and the rudimentary upper rays of the caudal; rest of the caudal fin unspotted; pectorals dusky

tinged; anal with dusky edging; sides of head without the dark coloration seen in the quinnat; males mostly red in autumn, and with the usual changes of form. Length 15 inches; weight 3 to 8 pounds. A small salmon, ascending streams in the autumn to no great distance. Abundant from San Francisco northward, especially in Puget Sound and the Alaskan fjords; south on the Asiatic coasts to Japan. Here described from Puget Sound specimens. A specimen from Otaru in the museum at Hakodate seems to be typical of the species, the tip of the dorsal black, as usual. Three others from the Otaru, two from Ura River, and several from Osatsubo, sent by the museum at Sapporo, seem to be the young of this species. Four adult examples (325, 331, 332, 337) were secured by us in the market at Aomori.

(*Kisutch*, the vernacular name in Alaska and Kamchatka; called by the Russians *Bielaya Ryba*, or whitefish).

4. ONCORHYNCHUS NERKA (Walbaum).

BENIMASU (RED SALMON), BLUE BACK.

Salmo nerka WALBAUM, *Artedi Piscium*, 1792, p. 71; after the *Nerka* of Pennant, the *Narka* of Kraschininnikow, rivers and seas of Kamchatka.—BLOCH and SCHNEIDER, *Syst. Ichth.*, 1801, p. 417; after Pennant and Kraschininnikow.

Salmo lyaodon PALLAS, *Zoogr. Rosso-Asiat.*, III, 1811, p. 370; Ochotsk Sea, Kamchatka.

Salmo paucidens RICHARDSON, *Fauna Bor.-Amer.*, III, 1836, p. 222; Columbia River.

Salmo tapdisma CUVIER and VALENCIENNES, *Hist. Nat. Poiss.*, XXI, 1848, p. 365; Kamchatka; on a drawing.

Salmo arabatsch CUVIER and VALENCIENNES, *Hist. Nat. Poiss.*, XXI, 1848, p. 365; Kamchatka; on a drawing.

Salmo melampterus CUVIER and VALENCIENNES, *Hist. Nat. Poiss.*, XXI, 1848, p. 365; Kamchatka; on a drawing.

Salmo kennerlyi SUCKLEY, *Ann. Lyc. Nat. Hist. N. Y.*, VII, 1861, p. 307; Chiloweyuck Lake (dwarf and landlocked); (Type, No. 2092. Coll. Kennerly).—SUCKLEY, *Monogr. Salmo*, 1861 (1874), p. 145.—GÜNTHER, *Cat.*, VI, 1866, p. 120.

Salmo cooperi SUCKLEY, *Notices New Species N. A. Salmon*, New York, June, 1861, and *Monogr. Salmo*, 1861 (1874), p. 99; Okanogan River. (Coll. Geo. Gibbs.)

Salmo warreni SUCKLEY, *Notices New Species N. A. Salmon*, June, 1861, and *Monogr. Salmo*, 1861 (1874), p. 147; Fraser River, British Columbia. (Type, Nos. 2070 and 2073. Coll. Kennerly.)

Salmo richardi SUCKLEY, *Notices New Species N. A. Salmon*, June, 1861, and *Monogr. Salmo*, 1861 (1874), p. 117; Fraser and Skagit rivers. (Type, No. 2005.)

Hypsiario kennerlyi GILL, *Proc. Ac. Nat. Sci. Phila.*, 1862, p. 330.

Oncorhynchus lyaodon GÜNTHER, *Cat.*, VII, 1866, p. 155.

Oncorhynchus paucidens GÜNTHER, *Cat.*, VII, 1866, p. 158.

Oncorhynchus nerka JORDAN and GILBERT, *Synopsis*, 1883, p. 308.—JORDAN and EVERMANN, *Fish N. and M. Amer.*, I, 1896, p. 481.

Oncorhynchus nerka kennerlyi BEAN, *Forest and Stream*, July 9, 1891.

Head 4; depth 4. B. 13 to 15; D. 11; A. 14 to 16; scales 20–133–20; pyloric cæca 75 to 95; vertebrae 64. Gill rakers about 32 to 40, usually

14 or 15 + 22 or 23, as long as eye. Body elliptical, rather slender. Head short, sharply conic, pointed, the lower jaw included. Maxillary rather thin and small, extending beyond eye. Teeth all quite small, most of them freely movable; vomer with about 6 weak teeth, which grow larger in fall males, instead of disappearing. Preopercle very wide and convex; opercle very short, not strongly convex. Preopercle largely free behind. Ventral scale about half the length of the fin. Caudal fin narrow, widely forked; anal fin long and low; dorsal low. Flesh deep red. Males becoming extravagantly hook-jawed in the fall, the snout being then prolonged and much raised above the level of rest of head, the lower jaw produced to meet it; mandible $1\frac{1}{3}$ in head in fall males, $1\frac{3}{4}$ in females; snout $2\frac{1}{4}$ in head in fall males, $3\frac{1}{2}$ in females. Color clear bright blue above; sides silvery, this hue overlying the blue of the back; lower fins pale, upper dusky; no spots anywhere in adults in spring; the young with obscure black spots above.

Color of breeding male, back blood red, with dark edges to some of the scales; middle of side darker red, but unevenly so, usually darkest at middle of body; under parts dirty white, with numerous fine dark dustings; head above and on sides pale olivaceous, some darker mottling on sides; tip of nose and side of jaws dark, under part of lower jaw white; dorsal pale red, anal darker red; adipose fin red; ventrals and pectorals smoky, some red at base. Color of breeding female essentially the same, rather darker on the sides. Length 2 feet; weight $3\frac{1}{2}$ to 8 pounds. (Description from Columbia River specimens.)

Two specimens, measuring about 270 millimeters, from Lake Akan in Hokkaido, show the following characters:

Head 4 in length; depth $4\frac{1}{2}$; depth of caudal peduncle $2\frac{2}{3}$ in head, eye $4\frac{2}{3}$; snout $4\frac{1}{2}$; maxillary 2; interorbital space $3\frac{1}{4}$; scales in lateral series 130; in transverse series 19+22; D. 11; A. 15. Teeth on jaws small, immovable; those on palatines and vomer equal in size to those of jaws; interorbital space convex; preopercles and opercles decidedly convex posteriorly; branchiostegals 14, gill rakers on first arch long and slender 13+20. Caudal very broad, not deeply forked; ventral appendage short, contained about $2\frac{1}{2}$ times in length of fin. Fins all dark, the pectorals and ventrals darker above than below; upper parts of body, caudal fin and base of dorsal with round of oblong dark brown spots.

Another specimen has but one or two indistinct spots on base of dorsal and on upper part of caudal; the caudal fin is more forked.

The species ranges from Hokkaido to Kamchatka, Alaska, and southward to Oregon. It is abundant in Alaska, ascending streams in spring to great distances, and often frequenting mountain lakes in fall, spawning in their small tributaries. It is one of the most graceful of the Salmonidæ, scarcely inferior to the quinnat when fresh, but

the flesh more watery and less valuable when canned. It is the principal salmon of Alaska, and one which merits introduction into the lakes of Japan. This species is very rare in Japan. In the museum at Hakodate is a third specimen from Akan Lake in the Province of Kushiro, in northern Hokkaido. This specimen, about a foot long, is blue above, with a few faint dark spots, silvery below. D. 11, 10; A. 11, 14; scales 135; gill rakers 15+22=37; B. 13. A specimen without spots in the same museum, labeled *Benimasu* or *Red Salmon*, also apparently belongs to this species. It is from Urup Island (Kuriles). The two described above from Lake Akan, a little larger and darker in color have been received from Professor Nozawa of the museum at Sapporo. It is said that the species occurs in no other locality in Japan proper except about Kushiro Bay, into which Akan Lake flows, and that it never reaches a larger size. Similar dwarfish varieties, known as subsp. *kennerlyi*, occur in lakes of Idaho and Washington.

2. SALMO¹ (Artesi) Linnæus.

Salmo (Artesi, Genera Piscium) LINNÆUS, Syst. Nat., 10th ed., 1758, p. 308, (*salar*, etc.).

Trutta LINNÆUS, Syst. Nat., 10th ed., 1758, p. 308 (*trutta*, etc.: "*Trutta corpore variegato*").

Fario CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXI. 1848, p. 277 (*argenteus* =*trutta*).

Salar CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXI, 1848, p. 314 (*ausonii* =*fario*).

Trutta SIEBOLD, Süßwasserfische Mittel Europa, 1863, p. 280 (*trutta*).

Body elongate, somewhat compressed. Mouth large: jaws, palatines, and tongue toothed, as in related genera: vomer flat, its shaft not depressed, a few teeth on the chevron of the vomer, behind which is a somewhat irregular single or double series of teeth, which in the migratory forms are usually deciduous with age. Scales large or small, 110 to 200 in a longitudinal series. Dorsal and anal fins short,

¹SALMO FARIO Linnæus.

ANEMASU (FOREIGN TROUT); EUROPEAN BROOK TROUT.

Salmo fario LINNÆUS, Syst. Nat., 12th ed., I, p 509, and of authors generally.

This European species has been introduced into Japan. A specimen taken in Lake Chuzenji seems to belong to this species. It is said to have been introduced from America. Length 14 inches; head $4\frac{1}{2}$; depth $4\frac{1}{3}$; D. II, 11; A. I, 13; B. 13; snout $3\frac{3}{4}$; eye $4\frac{1}{2}$; P. $1\frac{3}{4}$ in head; maxillary 2. Scales 120 in lateral line, not counting small ones at base of caudal; 130 oblique series. Anal low, short, white, its margin concave, its longest ray $2\frac{3}{4}$ in head, $1\frac{1}{4}$ in base of fin. Color olive above, sides very silvery; no dark specks or edgings to the scales; dorsal, caudal, and pectoral slightly dusky; anal all white; no parr marks, upper parts with scattered round black spots; spots on dorsal, adipose, and base of caudal. Caudal well forked, the middle caudal ray from scales $3\frac{1}{4}$ in the longest ray. Nine pairs vomerine teeth, weak in a shorter row. The species is said to reach a length of 3 feet. It is slenderer and paler than the Japanese trout, with the tail more deeply forked and the parr marks obsolete.

usually of 10 to 12 rays each; caudal fin truncate, emarginate or forked, its peduncle comparatively stout. Branchiostegals 11 to 13; gill rakers about 20. Sexual peculiarities variously developed; the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw being hooked upward at the end and the upper jaw emarginate or perforate. In the larger or migratory species these peculiarities are most marked. Species of moderate or large size, black-spotted, abounding in the rivers and lakes of North America, Asia, and Europe; no fresh-water species occurring in America east of the Mississippi Valley; a few species, marine and anadromous. The nonmigratory species are in both continents extremely closely related and difficult to distinguish. The excessive variations in color and form have given rise to a host of nominal species. Those which ascend the rivers from the sea feed in the streams, and it is probable that not all die after spawning.

(*salmo*, the Latin name of *Salmo salar*, originally from *salire*, to leap).

5. SALMO PERRYI Brevoort.

KAWA-MASU (RIVER SALMON) (ADULT); YAMABE (MOUNTAIN SIDE); YAMAME (MOUNTAIN THING); YAMABAI (MOUNTAIN MINNOW).

Salmo perryi BREVOORT, Exped. Japan, 1856, p. 273, pl. ix, fig. 1; Hakodate.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 349; Lake Biwa (Karasaki).

Salmo macrostoma GÜNTHER, Shore Fishes, Challenger, 1880, p. 71, pl. xxxi, fig. A; Yokohama.—ISHIKAWA, Prel. Cat., 1897, p. 21; Tokadzu, Kushiro, Chichibu, Ojiro River, Kai, Ise, Tosa.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1890, p. 743; Lake Chuzeiji.

Head $4\frac{1}{5}$ in length; depth $3\frac{2}{3}$; D. III, 12; A. I, 14; eye 5 in head; snout $3\frac{1}{2}$; B. 14; P. $1\frac{3}{4}$ in head; scales 140 (oblique rows). Anal rather low, straight edged, the longest ray $2\frac{1}{2}$ in head, $1\frac{1}{2}$ in base of fin; caudal moderately forked, the longest ray $2\frac{1}{2}$ times length of middle one measured from scales.

Body rather deep with firm scales, the black spots much the same, small, round, sparse, confined to the back, some on dorsal, adipose, and base of caudal; 3 to 5 distinct roundish dark spots along base of dorsal always present; none distinct on head; otherwise just as plain anteriorly as posteriorly; sides with 9 large parr marks or blackish bars under the scales; below these, numerous round dark spots of the same nature, each scale above with an edging of dark spots, making the fish dusky; 6 pairs of teeth forming a short line on vomer.

This description from a specimen 14 inches long from Lake Chuzeiji, having been introduced there from the River Kinu, near Utsonomiya, below the impassable fall of Kegon-no-taki. A smaller specimen taken at the same place, about $7\frac{1}{2}$ inches long, shows the following characters: D. III, 11; A. I, 12; B. 14; scales about 130.

Longest ray of anal longer than base, $2\frac{1}{2}$ in head; the fin straight-edged, high and short. Vomerine teeth in a longish row. Color as above; parr marks 9; sides reddish; pectorals yellowish; ventrals blackish, with a little white at tip; anal blackish, with whitish tip; caudal dusky, flushed with red, scales dark-edged; dorsal spotted at base; caudal unspotted.

This black-spotted trout is common in clear waters throughout the islands of Hondo and Hokkaido. As ordinarily seen in the streams it is less than a pound in weight, with the parr marks or dark cross bars distinct. These brook trout are known as Yamabe or Yanomi. In the large rivers, as the Kitakami, they reach a weight of 8 or 10 pounds. The parr marks are lost and the coloration is more silvery. In the waters of Hokkaido they descend to the sea. In the small fish the teeth on the shaft of the vomer are about 12 in number in a long double series. As the fish grows larger, the vomerine teeth are lost, until in the adult only about 4 teeth are present. These large fishes are called "Masu" or salmon by the fishermen. The dark spots vary much with individuals, but apparently not with age, some being profusely spotted, others taken at the same time almost immaculate. Both extremes in this regard are shown in our specimens from Lake Biwa, one of which is as profusely spotted as is shown in Brevoort's figure of *Salmo perryi*. Most specimens agree in this, as in other respects, with Günther's figure of *S. macrostoma*. The black blotches along base of dorsal, 3 to 5 in number, are almost always present and are diagnostic.

Of the Yamabe, or young trout, we have specimens from Aomori, Niigata, Lake Chuzenji, Kinu River at Utsonomiya, Daiya River at Nikko, Otani River near Nikko, Kamihana in Omi, Maebara on Lake Biwa, Karasaki on Lake Biwa, and Kawagiri in southwestern Rikuchu, on a tributary of the Kitakami.

Of the adult trout, Kawamasu, we have specimens from the Kitakami River at Morioka, from Aomori and Hakodate, and from the Tokyo market. The largest specimens from Hakodate reach a weight of about 12 pounds, and much resemble the salmon of the Atlantic.

From *Salmo mykiss*, of Kamchatka, which the species resembles, it is distinguished by the longer anal (12 or 13 developed rays) and by the posterior insertion of the ventrals, which are rather behind the middle of the dorsal and reach more than halfway to the vent. *Salmo mykiss* shows no trace of the distinctive spots at base of dorsal.

The species is almost intermediate between the typical group of *Salmo* and the group called *Oncorhynchus*. It indicates the transition from the former to the latter, and might with almost as much propriety be called a salmon as a trout.

From our field notes at Morioka I take the following:

Kitakami River at Morioka; a large, very plump trout with few spots; large scales; very high falcate anal of 12 rays; small head; no

red on sides or under throat; the lower fins yellowish in spawning female. Abundant in the Kitakami at this season, also sent in from Aomori. It has no teeth on the shaft of the vomer, or almost none, as in *Salmo salar*. Its flesh is firm and red, as in the Atlantic salmon, and the flavor is the same.

One small spawning female taken at Morioka. Spent males seen in Hakodate; two taken are blackish, very thin, with a red bar on side interrupted by black bars.

(Named for Commodore Perry.)

3. HUCHO Günther.

Hucho GÜNTHER, Cat. Fish., VI, 1866, p. 125 (*hucho*).

Body slender, elongate, the head pike-like, with vertical sides, and flattened snout and frontal region; mouth large; vomer as in *Salvelinus*, the shaft depressed below the head and without teeth; palatine teeth strong; strong teeth on the tongue, none on the hyoid region; scales silvery, large or small, the body marked with small black dots; anal fin short; branchiostegals 12; gill rakers few.

Old World fishes, large pike-like trout, intermediate between the charrs and the salmon.

(*hucho*, an old name of *Hucho hucho*, from the German *Huch* or *Huchen*.)

6. HUCHO BLACKISTONI (Hilgendorf).

ITO-UWO (STRING-FISH.)

Salmo blackistoni HILGENDORF, Monatsber, Gesellschaft Ostasien, 1876, p. 25; Hokkaido.—ISHIKAWA, Prel. Cat., 1897, p. 21; Hokkaido.

Head $3\frac{1}{2}$ in length; depth 5; depth of caudal peduncle $3\frac{1}{4}$ in head; eye 5; interorbital space $4\frac{1}{2}$; snout 4; maxillary $2\frac{1}{6}$; D. 10; A. 9; scales in lateral series 109, in transverse series 18 + 17; pores in lateral line

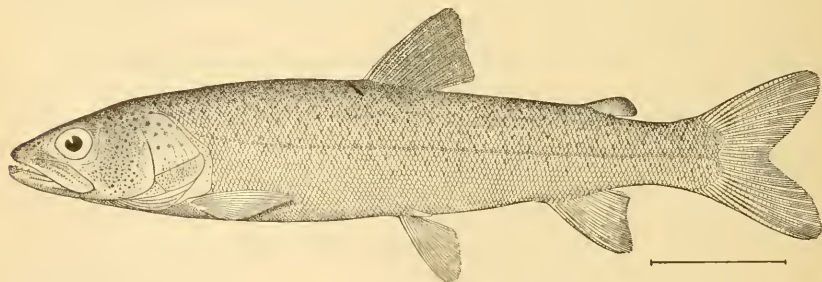


FIG. 3.—HUCHO BLACKISTONI.

97. Head long, low, broad, pike-like, quadrangular in section; interorbital area broad, slightly convex; maxillary extending a little beyond eye. Teeth small, those on lower jaw longest; no teeth on shaft of vomer, even in the young; tongue with a row of sharp teeth on each

edge; branchiostegals 12; gill-rakers on first arch 6 + 11, long and slender. Height of dorsal $1\frac{9}{10}$ in head, anal $2\frac{1}{10}$, caudal deeply forked, $1\frac{2}{3}$ in head, ventral appendage about one-third as long as the fin, pectoral 2 in head.

Color silvery, dark above, the head and body usually profusely covered with small, brownish spots; dorsal fin with a few at its base.

Streams of northern Japan, rather common in Hokkaido, reaching a length of $2\frac{1}{2}$ to 3 feet. Our description and figure are taken from a specimen from Kushiro, presented by the Sapporo Museum. We have compared this with a larger example from Nemuro in the museum of Hakodate. Others were examined in the same museum from Nemuro, Chishima, Settsu and Shifto River, in Hokkaido, and from Heigun River, in the province of Rikuchu, near Morioka.

This singular trout seems to be closely related to *Hucho hucho* of the Danube, differing from that species in its larger scales. The common name "Ito" (string) is suggested by its slender form.

(Named for Captain Blackiston, author of a treatise on the birds of Japan, whose interest in natural history was largely responsible for the growth of the museum of Hakodate.)

4. SALVELINUS (Nilsson) Richardson.

CHARRS.

Salvelini NILSSON, Prodr. Ichth. Scand., 1832, p. 7 (*alpinus*); group name.

Salvelinus RICHARDSON, Fauna Bor.-Amer., III, 1836, p. 169 (*alpinus*); after NILSSON.

Baione DE KAY, N. Y. Fauna; Fishes, 1842, p. 244 (*fontinalis*).

Umbra RAPP, Fische Bodensee, 1854, p. 32 (*umbra = alpinus*).

Body moderately elongate. Mouth large or small. Teeth of jaws, palatines, and tongue essentially as in *Salmo*, the hyoid patch present or not. Vomer boat-shaped, the shaft much depressed, without raised crest, with teeth on the head of the bone and none on shaft. Scales very small, 200 to 250 in a lengthwise series. Fins moderate, the caudal forked in the young, truncate in some species in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round crimson spots, the lower fins sometimes with marginal bands of black, reddish, and pale. Species numerous in the clear streams and lakes of the northern parts of both continents, sometimes descending to the sea, where they lose their variegated colors and become nearly plain and silvery. The members of this genus are by far the most active and handsome of the trout, and live in the coldest, clearest, and most secluded waters. "No higher praise can be given to a Salmonoid than to say it is a charr."

(*salvelinus*, an old name of the charr; from the same root as *Sälbling* or *Saibling*.)

7. SALVELINUS KUNDSCHA (Pallas).

AMEMASU (RAIN SALMON); KUNDSCHA.

Salmo kundscha PALLAS, Zoogr. Rosso. Asiat., III, 1811, p. 250; Kamchatka.—JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898, p. 438, pl. XLV; Petropaulsky.

Salvelinus kundscha JORDAN and EVERMANN, Fish. N. and M. Amer., III, 1898, p. 2823; Petropaulsky, Tareinsky.

Salmo leucomanis PALLAS, Zoogr. Rosso. Asiat., III, 1811, p. 250; Kamchatka.—BREVOORT, Exped. Japan, p. 276, pl. x, fig. 3; Hakodate.—STEINDACHNER, Sitzber, Ak. Wiss. Wien, 1870, p. 15; Decastris Bay.—ISHIKAWA, Prel. Cat., 1897, p. 21; Shiribeshi, Hokkaido.

Salmo curilus PALLAS, Zoogr. Rosso. Asiat., III, 1811, p. 251; Kurile Islands.

Head $4\frac{1}{2}$ in length; depth $4\frac{1}{2}$; depth of caudal peduncle $2\frac{2}{3}$ in head; eye 5; interorbital space $2\frac{1}{2}$; snout $3\frac{1}{2}$; maxillary 2; D. 11; A. 10; scales in lateral series 210, in transverse series 35 + 40. Maxillary projecting beyond eye, opercles very convex posteriorly; teeth on jaws and palatines weak, those of vomer restricted to a small anterior patch; branchiostegals 13; gill-rakers on first arch 5 + 10, rather long, compressed. Height of dorsal $1\frac{1}{2}$ in head; caudal rather deeply forked, its length $1\frac{1}{10}$ in head; highest anal ray $1\frac{2}{3}$ in head; ventral appendage small, about one-third the length of fin. Body dark above, the spots on sides somewhat larger than pupil, arranged in 3 more or less distinct rows; dorsal and caudal dusky, without spots, the latter narrowly tipped with black; anal, ventrals, and pectorals white, the paired fins dusky above.

This species, common in the streams of Kamchatka, is occasionally taken in northern Japan. We have one fine specimen about 300 millimeters long, from Nemuro, the northernmost point in Hokkaido, presented by the museum of Sapporo. Another from Iturup Island was examined in the museum of Hakodate. A specimen from Shinbeshi is in the Imperial Museum.

8. SALVELINUS PLUVIUS Hilgendorf.

AMENOUWO (RAIN FISH); IWANA (ROCKLING); OSOROKOMA; TOKOSISU.

Salmo pluvius HILGENDORF, Monatsber, Ges. Ostasien, 1876, p. 25; Nikko.—ISHIKAWA, Prel. Cat., 1897, p. 21; Iturup, Tokazu, Aomori, Kodzuke, Kiso, Chichibu, Kaga, Kamo R.

Head 4 in length; depth $4\frac{1}{4}$; depth of caudal peduncle $2\frac{1}{2}$ in head; eye $5\frac{1}{5}$; snout $3\frac{3}{4}$; interorbital space $3\frac{1}{4}$; maxillary $1\frac{1}{5}$; D. 10; A. 9; scales in lateral series 200, in transverse series 41 + 41; pores in lateral line 124. Head rather short, blunt, the interorbital space broad and convex; mouth large, the maxillary extending past eye a distance equal to diameter of pupil. Teeth on jaws weak, a single row on the palatines, a small cluster on anterior part of vomer, none on the shaft; teeth on the tongue in 2 rows, somewhat stronger than those of the

jaws, curved backward. Pseudobranchiæ small; gill rakers on first arch 6+9, rather long and slender. Dorsal and anal of equal height, the longest rays contained $1\frac{1}{2}$ times in head; caudal rather deeply notched, its length $1\frac{1}{2}$ in head; pectorals $1\frac{2}{3}$ in head; ventrals $1\frac{8}{9}$. Supplemental appendage of ventral slender, its length $2\frac{2}{3}$ in the fin.

Color in alcohol, body with numerous light spots about as large as pupil, ventral and anal fins edged anteriorly with bright yellow, upper surfaces of pectorals and ventrals dusky.

Described from an individual about 200 millimeters long from Lake Chuzenji. Specimens in Lake Chuzenji are pale gray in life, the spots on the sides crimson, those on the back grayish white; lower fins scarlet, dusky, shaded with whitish edge; in streams the colors are darker.

This beautiful little charr is abundant in the mountain streams and lakes of Hondo and Hokkaido. It reaches but a small size, the largest specimens seen by us not exceeding 2 pounds. Our specimens are from Lake Chuzenji, near Nikko (introduced), Chishima, Nemuro, Ohata River at Aomori and Kawagiri in Rikuchu. Numerous others from localities in Hokkaido are preserved in museums.

The species is very close to *Salvelinus malma* of Kamchatka and the Aleutian region, differing in the longer mouth and larger spots, traits which are constant in the material at our disposal.

(*pluvius*, rainy, the Latin equivalent of Amenouwo.)

9. SALVELINUS MALMA (Walbaum.)

MALMA.

Goltra KRASCHEINNIKOW, Descr. Kamch., 1768, p. 183; Kamchatka.

Malma PENNANT, Arctic Zoöl., Introd., 1792, p. 126; Bering Sea; after Steller, etc.

Salmo malma WALBAUM, Artedi Piscium, 1792, p. 66; Kamchatka; based on *Malma* of Pennant.

Salmo callaris PALLAS, Zoogr. Rosso-Asiat., III, 1811, p. 353; Bering Sea.—GÜNTHER, Cat., VI, 1866, p. 143.

Salmo levigatus PALLAS, Zoogr. Rosso-Asiat., III, 1811, p. 385; Kurile Islands.

Salmo nummifer CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXI, 1848, p. 365; Kamchatka; on a drawing by Mertens.

Salmo erythrorhynchus CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXI, 1848, p. 367; Kamchatka.

Salmo tudes COPE, Proc. Amer. Phil. Soc. Phila., 1873, p. 24; Captains Harbor, Unalaska. (Coll. Prof. George Davidson.)

Salvelinus malma JORDAN and GILBERT, Synopsis, 1883, p. 319.—EVERMAN, Bull. U. S. Fish. Comm., XI, 1891, p. 50, pl. xxv, fig. 1.—JORDAN and EVERMAN, Fish. N. and M. Amer., I, 1896, p. 508; III, 1898, p. 2823.—JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898.

Salmo jariopsis (KNER MS.) STEINDACHNER, Sitz. Ak. Wiss. Wied., 1870, p. 17, pl. 1, fig. 3; Decastris Bay, Manchuria.

Head $4\frac{1}{4}$ to $4\frac{1}{2}$; depth $4\frac{1}{4}$ to $4\frac{3}{8}$; D. 11; A. 9; scales about 40-240-36; pyloric cæca large, 40 to 50; gill-rakers about 8+12. Body rather elongate, the head comparatively small, the mouth small, the maxillary usually not reaching beyond line of eye. Caudal fin well forked;

lower fins short, the ventral reaching halfway to vent. Olivaceous or grayish, the sides with small, round red spots, much smaller than pupil; back with small whitish spots; lower fins dusky with a pale stripe in front followed by a dark one. Sea-run specimens silvery, with the spots faint or obsolete.

Length varying with the waters from 5 to 20 inches or more. Large specimens in the sea reaching 12 pounds.

Streams of Alaska and Kamchatka descending to the sea, very abundant throughout the Aleutian region and extending its range through the Kuriles to Okhotsk Sea. Probably *S. pluvius* is a southern variety of the species as is also the Dolly Varden trout, *Salvelinus parkii*, Washington, Oregon, and northern California.

The fish from the Japan Sea described and figured by Steindachner under the name of *Salmo fariopsis* agrees perfectly with the young of *Salvelinus malma*, and differs from the Japanese *Salvelinus pluvius* in the smaller size of the mouth and in the coloration. The northern species, *Salvelinus malma*, has been already recorded from the Kurile Islands.

(*malma*, a vernacular name in Kamchatka.)

3. PLECOGLOSSUS Schlegel.

Plecoglossus SCHLEGEL, Fauna Japonicus, Poiss., 1846, p. 229 (*altivelis*).

Body moderately elongate, covered with very small scales. Mouth wide, the premaxillaries with a few, small, conical, pointed teeth. Maxillaries and lower jaw with teeth of a peculiar form, lamelliform, broad, truncate, serrate, movable, seated in folds of skin; mandibles each ending in a small knob, not joined at the symphysis. Mucous membrane of interior of mouth between terminal halves of the mandible forming a peculiar organ, being raised in folds with two pouches in front and one behind. Tongue very small, with minute teeth, its top toothless; no teeth on vomer, palatines with teeth. Pyloric cæca very numerous. Eggs small. Small fishes inhabiting the clear streams of Japan and Formosa, migratory like the salmon, and among the very finest of food fishes. One species is known.

(πλέκος, anything folded or plaited; γλῶσσα, tongue).

10. PLECOGLOSSUS ALTIVELIS Schlegel.

AYU; HIUWO (RED-FISH); KOAYU (YOUNG AYU); NENGIO (ANNUAL FISH); KOGIO (FRAGRANT FISH).

Plecoglossus altivelis SCHLEGEL, Fauna Japonica, Poiss., p. 229, pl. cv, fig. 1; no locality.—GÜNTHER, Cat. Fish., VI, 1866, p. 165.—ISHIKAWA, Zool. Mag., Tokyo, VII, 1895, p. 129; Matsubara, Maebara; Prel. Cat., 1897, p. 19; Musashi, Tama, Yechigo, Kaga, Hasa R., Katsusa R., Mino, Uji R., Yamashiro, Kamo R., Tanba, Osaka, Tosa, Fukuoka, Higo, Maebara, Lake Biwa.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 349, Lake Biwa; Proc. U. S. Nat. Mus., 1900, p. 744; Numata, Tsushima.

Head $4\frac{3}{8}$ in length; depth $4\frac{1}{2}$; depth of caudal peduncle $2\frac{1}{2}$ in head; eye 5; snout $2\frac{5}{8}$; maxillary $1\frac{3}{4}$; D. 10; A. 15; scales in lateral series 156, between lateral line and insertion of dorsal 18.

Head small, the snout pointed. Mouth oblique, maxillary extending past eye a distance a little greater than diameter of pupil; the sheath of the upper jaw longer than that of the lower. Gill-rakers on first arch 16+19, short and very slender. Palatine teeth are present, though very small. Height of dorsal contained $6\frac{1}{2}$ times in length; anal $8\frac{1}{2}$; length of caudal $5\frac{3}{4}$; pectorals 7; ventrals 8. The above characters are shown by a specimen about 180 millimeters long. Larger individuals, measuring 225 millimeters, have deeper bodies, shorter heads, and higher dorsal fins. A specimen from the market at Hiroshima measures: Depth $3\frac{4}{5}$ in length; head $4\frac{3}{4}$; height of dorsal $5\frac{3}{4}$; anal $8\frac{1}{3}$; length of pectorals $6\frac{2}{3}$; ventrals $7\frac{1}{2}$; caudal $5\frac{1}{4}$. Occasionally the dorsal when depressed reaches the base of adipose fin. The dorsal

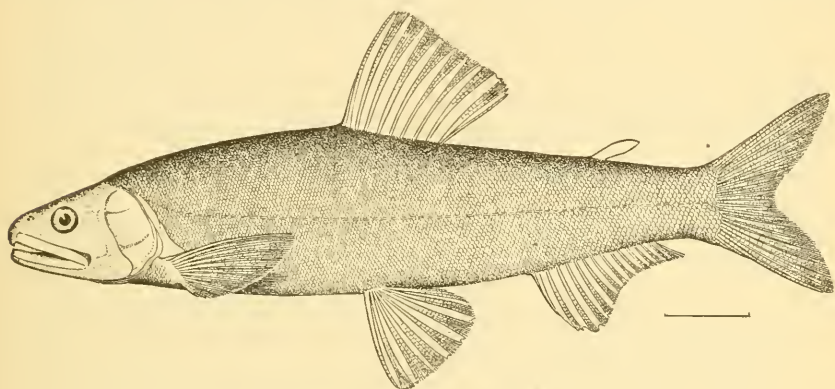


FIG. 4.—PLECOGLOSSUS ALTIVELIS (FROM FORMOSA).

rays number 10, occasionally 11, the anal 14 to 16. Color olivaceous, silvery below; always a light yellow bar or blotch above the middle of the pectoral on side; adipose fin edged with scarlet, dorsal somewhat shaded with dusky, anal with reddish. The young, to at least the length of 100 millimeters, have a broad silvery lateral band. The body is very elongate, the depth contained about $7\frac{1}{2}$ times in the length.

Our specimens are from Ishikari River, Niigata, Aomori. Same, Matsushima, Sendai, Morioka, Tokyo, Tanagawa River at Tachikawa, Daiya River at Nikko, Gifu, Lake Biwa, Osaka, Wakanoura, Kobe, Hiroshima, Kurume, Nagasaki, and Tan Sin River at Taihoku, the capital of Formosa. Specimens from Formosa are a little larger than any from Japan, and with the anal possibly a little longer as compared with the head. This form is apparently not different specifically. At Gifu and Tachikawa, tame cormorants are largely in the capture of the Ayu, which is the most delicious of all Japanese food-fishes.

(*altus*, high; *velum*, sail.)

Family II. ARGENTINIDÆ.

THE SMELTS.

Body elongate, covered with moderate or small scales, which are usually cycloid. Head naked. Mouth terminal, small or large, formed as in the *Salmonidæ*, the maxillary forming the margin of the upper jaw. Teeth various, sharp-pointed. Gills 4, a slit behind the fourth. Gill membranes separate, free from the isthmus, with 6 to 10 branchiostegals. No barbels. Stomach a blind sac, with the pyloric caeca few or none. Dorsal fin short, nearly median; adipose fin always present; caudal forked; anal moderate; pectorals placed low; ventrals moderate, nearly median; no spines in the fins. Lateral line present. No phosphorescent spots. Abdomen rounded. Air bladder large, single. Ova large, falling into the cavity of the abdomen before extrusion. Small fishes, marine or anadromous, some of them inhabiting deep water; all but one genus confined to the waters of the Northern Hemisphere. There are about ten genera and perhaps a dozen species; reduced *Salmonidæ*, smaller and in every way feebler than the trout, but similar to them in all respects except the form of the stomach. Most of them are very delicate food-fishes.

- a.* Branchiostegals 6 to 10; body not cylindrical, the sides more or less compressed; gill membranes separate.
- b.* Mouth large, with strong teeth in the jaws and on tongue.
- c.* Scales large, smooth, similar in both sexes; pectoral fin moderate, its rays 10 to 12; ventrals inserted under front of dorsal; teeth strong, those on tongue enlarged, canine-like; scales moderate, loosely attached. . . *Osmerus*, 6.
- bb.* Mouth rather small, with weak teeth or none; scales large, smooth; ventrals below middle or front of dorsal.
- d.* Jaws with minute teeth; similar teeth on tongue and palate; maxillary reaching past front of eye. *Mesopus*, 7.
- dd.* Jaws toothless, or very nearly so; vomer and palatines with small teeth; mouth very small, the maxillary not reaching past front of eye; tongue with a curved row of small teeth on each side; scales usually more or less spinescent. *Argentina*, 8.

6. OSMERUS (Linnæus) Lacépède.

SMELTS.

Osmeris LINNÆUS, Syst. Nat., 10th ed., 1758, p. 310 (*eperlanus*).

Osmerus LACÉPÈDE, Hist. Nat. Poissons, V, 1803, p. 229.

Eperlanus GAIMARD, Voy. Island and Grœnland, 1851 (*eperlanus*).

Spirinchus JORDAN and EVERMANN, Fish. N. and M. Amer., 1896, I, p. 522 (*thaleichthys*).

Body elongate, compressed. Head long, pointed. Mouth wide, the slender maxillary extending to past the middle of the eye; lower jaw projecting; preorbital and suborbital bones narrow. Maxillaries and premaxillaries with fine teeth; lower jaw with small teeth, which are larger posteriorly; tongue with a few strong, fang-like teeth, largest

at the tip; hyoid bone, vomer, palatines, and pterygoids with wide-set teeth. Gill-rakers long and slender. Branchiostegals 8. Scales large, loose, 60 to 70 in the course of the lateral line. Dorsal small, about midway of the body, over the ventrals; anal rather long. Vertebrae about 40. Pyloric caeca small, few. Small fishes of the coasts of Europe and northern America, sometimes ascending rivers; delicate in flesh and considerably valued as food.

(ὄσμηρὸς, odorous: the name is equivalent to the English "smelt.")

11. OSMERUS DENTEX Steindachner.

KUORI-UWO (CUCUMBER-FISH).

Osmerus dentex STEINDACHNER, Sitzungsber. Kais. Akad. Wiss. Wien, LXI, 1870, p. 429; Decastris Bay, northern China.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 349; Tokyo Market, Hakodate.—JORDAN and GILBERT, Synopsis, 1883, p. 293.—TURNER, Contr. Nat. Hist. Alaska, 1886, p. 102, pl. x.—NELSON, Rept. Nat. Hist. Coll. Alaska, 1887, p. 313.

Osmerus eperlanus ISHIKAWA, Prel. Cat., 1897, p. 19; Nemuro; Tokadzu. (not of Linnæus).

Head 4 in length; depth 6; depth of caudal peduncle $4\frac{1}{2}$ in head; eye 5; snout $3\frac{1}{2}$; interorbital space $4\frac{1}{4}$; D. 10; A. 15; scales in lateral series 70; between lateral line and dorsal 8. Body long, slender, compressed, caudal peduncle narrow; head long, sharp, pike-like. Snout long, pointed, the lower jaw slightly projecting, maxillary extending to posterior edge of orbit, its length contained about 2 times in head. Teeth on maxillaries and premaxillaries minute: 2 to 4 large sharp teeth on anterior edge of vomer, a row of smaller teeth on the palatines, and a similar row opposite the latter and extending farther back on the pterygoids; lower jaw with a row of rather large teeth; tongue with fang-like teeth, the anterior ones largest. Pseudobranchiae present; gill-rakers on first arch 9 + 18, very long and slender. Scales large, cycloid, loosely attached. Lateral line straight, extending along middle of body. Dorsal inserted near middle of body, its longest rays contained $1\frac{2}{3}$ in the head; height of anal $2\frac{2}{3}$; caudal deeply forked, $1\frac{1}{3}$ in head; pectoral rays 12, the longest $1\frac{2}{3}$ in head; ventral rays 8, 2 in head.

Color in alcohol, brownish above, white below, the sides silvery; scales narrowly edged with brown except on the ventral surface of body. In life back pale olive, the scales edged with darker; sides above lateral line purple, changing to blue, violet, and gold; belly satin white; fins slightly golden. The above description is from a specimen 250 millimeters long, collected at Kushiro. A somewhat smaller specimen from Tokyo measures as follows: Head $3\frac{5}{8}$ in length; depth $4\frac{2}{3}$; depth of caudal peduncle $3\frac{2}{3}$ in head; eye 5; snout $3\frac{1}{3}$; interorbital space $4\frac{1}{3}$; D. 10; A. 15; P. 12.

A fish brilliantly colored in life, the flesh of firmer texture than in

the rest of the genus. Coast of Alaska south to Manchuria and northern Japan, abundant northward; our specimens are from Kushiro, Hakodate, and the market of Tokyo, whither they may have been brought from the north.

(*Denter*, toothed.)

7. MESOPUS Gill.

(SURF SMELTS.)

Mesopus GILL, Proc. Ac. Nat. Sci. Phila., 1862, p. 14 (*pretiosa*).¹

Hypomesus GILL, Proc. Ac. Nat. Sci. Phila., 1862, p. 15 (same definition, no type named).

Body rather elongate, moderately compressed, covered with thin scales of moderate size. Head rather pointed. Mouth moderate, the shortish maxillary not extending quite to middle of eye; its outline below broadly convex; lower jaw projecting. Teeth minute, on jaws, vomer, palatines, pterygoids, and tongue. Ventrals inserted under middle of dorsal or rather before it. Branchiostegals 6 to 7. North Pacific.

(μέσος, middle; πούς, foot; in allusion to the rather backward position of the ventrals.)

a. Ventrals inserted immediately below or anterior to first ray of dorsal; anal rays 16; dorsal 8 or 9.....*olidus*, 12.

aa, Ventrals inserted below second or third dorsal ray; anal rays 12 or 13, dorsal 10
japonicus, 13.

12. MESOPUS OLIDUS (Pallas).

CHIKA; AMASAGI (SWEET SAGI OR SMELT).

Salmo (*Osmerus*) *olidus* PALLAS, Zoogr. Ross.-Asiat., III, 1811, p. 391; lakes and rivers of Kamchatka.

Mesopus olidus GÜNTHER, Cat., VI, 1866, p. 169, in part.

Hypomesus olidus, ISHIKAWA, Prel. Cat., 1897, p. 19; Hitaka, Nemuro, Kaga, Tsuchiura.—JORDAN and EVERMANN, Fishes N. and M. Amer., I, 1896, p. 525.

Head $4\frac{1}{2}$ in length; depth $5\frac{1}{4}$; depth of caudal peduncle $2\frac{5}{8}$ in head; eye $3\frac{1}{2}$; interorbital space 5; snout $3\frac{1}{2}$; D. 9; A. 16; scales in lateral series 57; in transverse series 13.

This species closely resembles *M. japonicus*, differing from it noticeably in the longer anal fin, which has 15 or 16 rays, the shorter dorsal of 8 or 9 rays, and the more anterior position of the ventrals, which are inserted below or anterior to first dorsal ray. The maxillary is usually longer in this species, extending to middle of pupil or as far as the posterior border. A careful study of more material may prove this and the next species to be the same. Many specimens from Aomori have the dorsal rays 9, sometimes 8, the anal 16, the scales in

¹ By inadvertence these two synonymous names were applied to this genus by Gill. *Mesopus* has priority of a page and has also a type indicated.

lateral series 57 to 62; two specimens from Same have the dorsal rays 9, anal 14 and 15, scales 57; one from Matsushima has dorsal 9, anal 15, scales 56. Two specimens from Grantley Harbor and two from Port Clarence, which we identify with this species, have the dorsal rays 8 or 9, anal 14, scales 57 to 60.

Common in northern Japan, inhabiting the bays in large numbers. Our specimens are from Aomori, Same, and Matsushima. It ranges northward to Kamchatka and eastward to Alaska.

(*Olidus*, oily.)

13. MESOPUS JAPONICUS Brevoort.

CHIKA; WAKASAGI (YOUNG SAGI).

Osmerus olidus (called *Osmerus japonicus* on plate) BREVOORT, Exped. Japan, 1856, p. 278, pl. x, fig. 2; Hakodate.

Osmerus oligodon KNER, Fische. Naturh. Museum, Godeffroy, 1865, p. 9, pl. xiv, fig. 1; Decastris Bay, Manchuria.

Mesopus olidus GÜNTHER, Cat., VI, 1866, p. 169; in part.

Head 5 in length; depth $5\frac{1}{2}$; depth of caudal peduncle 3 in head; eye 4; interorbital space $3\frac{3}{4}$; snout 4; D. 9; A. 13; scales in lateral series 65, in transverse series between ventral and dorsal 14.

Body long, somewhat compressed, the head short and pointed. Interorbital space broad, flat, or slightly convex. Snout about equal in length to diameter of orbit, pointed, the lower jaw slightly projecting; mouth small, the maxillary extending to a vertical through anterior edge of pupil, lower outline of maxillary convex, rounded posteriorly. Teeth minute, on jaws, vomer, palatines, pterygoids, and tongue, those on the tongue largest. Pseudobranchiæ present. Gill-rakers on first arch 9 + 21, very long and slender. Scales large, smooth, easily displaced. Lateral line not very conspicuous, passing along the eighth series of scales below dorsal. Dorsal inserted near middle of body, half way between tip of snout and base of caudal fin, the anterior rays highest, $1\frac{2}{3}$ in head. Anal low, the highest rays $2\frac{2}{3}$ in head. Caudal deeply forked, about equal to length of head. Ventrals inserted below second or third dorsal ray, $1\frac{1}{2}$ in head. Pectoral rays 13; length $1\frac{2}{3}$ in head.

Alcoholic specimens show a broad, silvery lateral band alongside of body, the scales on upper half of body edged with dusky dots, the top of head dark.

The figure named *Osmerus japonicus* by Brevoort, though crude, serves well to distinguish this species from *Mesopus olidus*. The posterior position of the ventrals and the short anal base are distinctly shown. In *Mesopus olidus* the ventrals are inserted immediately below or anterior to the first ray of the dorsal, and the anal base is longer, the fin having 16 rays.

We have two specimens of *Mesopus japonicus* about 170 millimeters

long, the one from Kushiro, presented by Mr. Nozawa, naturalist of the Hokkaido Museum at Sapporo, the other from Aomori. The specimen from Kushiro has 67 scales in the lateral series and 12 anal rays. The species is probably less abundant in Japan than *Mesopus olidus*.

8. ARGENTINA (Artedi) Linnæus.

Argentina (ARTEDI) LINNÆUS, Syst. Nat., 10 ed., 1758, p. 315 (*sphyræna*).

Silus REINHARDT, Bemærkinger Skandinavisk Ichthyol., 1833, p. 11 (*silus*).

Acantholepis KRÖYER, Danmarks Fiske, III, 1846-49, p. 98 (*silus*).

Body oblong, covered with rather large cycloid scales, which are more or less rough with spinous points. Mouth small, the maxillaries very short, not reaching to the eye; eye very large. Jaws toothless; an arched series of minute teeth on the head of the vomer and on the forepart of the palatine; tongue with a series of small curved teeth on each side. Dorsal fin short, in advance of the ventrals; caudal fin deeply forked. Eggs small. Pyloric cæca present. Branchiostegals 6. Fishes of deep or cold waters, never entering fresh streams. (Latin *argentum*, silver.)

14. ARGENTINA KAGOSHIMÆ Jordan and Snyder, new species.

Head $3\frac{1}{2}$ in length; depth $7\frac{1}{2}$; depth of caudal peduncle $4\frac{1}{5}$ in head; eye $3\frac{1}{8}$; snout 3; interorbital space 4; maxillary $5\frac{2}{3}$; D. 9; A. 10; P. 15. Body elongate, somewhat compressed, the caudal peduncle short. Head very long, as wide and deep as body, flat above. Snout

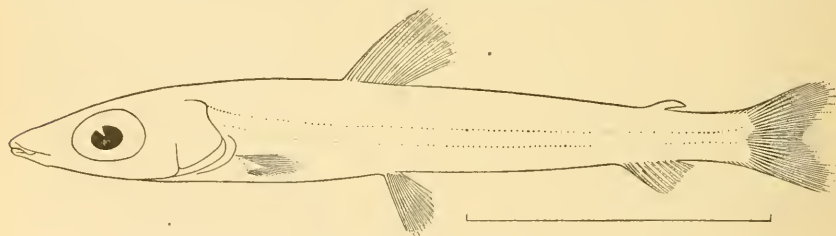


FIG. 5.—ARGENTINA KAGOSHIMÆ.

pointed, jaws equal, maxillary not reaching over halfway to eye, mouth small. No teeth on jaws, a small patch of minute teeth on anterior end of vomer, a few large curved teeth near tip of tongue. Eye very large, the diameter about equal to length of snout, interorbital space broad, slightly concave in the middle. Pseudobranchiæ well developed; gill-rakers on first arch reduced to a few mere elevations. Body covered with large, loosely imbedded, smooth scales. The two specimens at hand are so poorly preserved that the number of scales can not be told, nor can the shape or measurements of the fins be given. Dorsal inserted anterior to ventrals, the latter immediately below the last ray of the former. Anal inserted a distance from base

of caudal equal to space between tip of snout and posterior border of orbit. Adipose fin rather high, the base short. A silvery band about as wide as the pupil extending along middle of sides, opercle silvery, upper part of eyes black, the iris silvery. Two specimens about 70 millimeters long, from Kagoshima in Kiusiu, presented by Professor Mitsukuri. Type No. 6854. Leland Stanford Junior University Museum, the cotype presented to the U. S. National Museum.

Family III. SALANGIDÆ.

ICE-FISHES.

Body slender, translucent, elongate, compressed, naked or with a few exceedingly thin, large, deciduous scales. Head elongate, much depressed, with long, flat, pointed snout. Eye small. Cleft of mouth wide; jaws and palatines with pointed teeth, some of those in front being enlarged; no teeth on vomer; tongue with teeth; branchiostegals 4. Dorsal fin inserted before anal far behind ventrals; anal many rayed; adipose fin present, small; caudal forked; pseudobranchiæ well developed; alimentary canal straight, without bend; no pyloric cæca; no air bladder; eggs small.

Small translucent fishes somewhat resembling very young salmon, running in the rivers of Japan, Korea, and China.

9. SALANX Cuvier.

Salanx CUVIER, Règne Animal, 1st ed., 1817, p. 185; (*cuvieri*, "une espèce encore nouvelle").

Leucosoma GRAY, Zoological Miscellany, 1831, p. 4 (*reversi*).

Salangichthys BLEEKER, Act. Soc. Sci. Nederl., VII, Japan, VI, p. 100, (*microdon*).

The characters of the single genus are included above. Two subgenera may be recognized, *Salanx*, the "Chinese Whitebait," in China and Korea, with two species (*chinensis* and *hyalocranius*), and *Salangichthys* in Japan, with two species (*microdon* and *ariakensis*). The latter subgenus is distinguished mainly by its feeble dentition, the canines being small. The head is shorter and less depressed in *Salangichthys*.

(σαλλάγζ, name of some unknown fish; from σαλάσσω, to crowd or cram.)

a. SALANGICHTHYS. Canines small; head short, relatively narrow.

ab. Anal rays 23 *microdon*, 15

bb. Anal rays 26 *kriakensis*, 16

15. SALANX MICRODON Bleeker.

SHIRA-UWO (WHITE-FISH); HIRAO (FLAT-TAIL); HIAGIO (ICE-FISH).

Salanx (*Salangichthys*) *microdon* BLEEKER, Act. Soc. Sci., Indo. Nederl., VII, Japan, VI, p. 100; Jeddo (Tokyo).

Salanx microdon GÜNTHER, Cat. Fish., VI, 1866, p. 206; Jeddo.—ISHIKAWA, Prel. Cat. 1897, p. 19; Tokyo, Tsuchiura.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 350; Tokyo.

Head 6 in length; depth at insertion of anal $8\frac{1}{2}$; depth of caudal peduncle $\frac{1}{4}$ in head; eye $4\frac{5}{6}$; interorbital space $5\frac{1}{2}$; snout $3\frac{1}{10}$; D. 11; A. 23; P. 15. Body very elongate, cylindrical anteriorly, compressed posteriorly, especially in male specimens, where, in the region of insertion of anal, the depth is double that of the body immediately behind the head; the females are more slender; caudal peduncle rather narrow and compressed. Head greatly depressed, flat or slightly rounded on top, snout spatulate; pointed when seen from the side. Maxillary extending to anterior edge of orbit; lower jaw projecting slightly beyond the upper; teeth in a single row on jaws and palatines, none on vomer, those on the premaxillaries enlarged; tongue with a few small teeth. Gill-rakers on first arch 3+12, long and slender. Head and body naked, a single large, thin scale extending along body at base of anal fin in the male, the width of the anterior part of the scale equal to distance between the eyes. Dorsal inserted on posterior third of body, the highest rays contained two times in head. Adipose fin low, the length of its base about equal to depth of caudal peduncle. Caudal fin deeply forked, the lower rays slightly longer than the upper, equal to length of head. Anal inserted below middle of dorsal, the length of its base equal to length of head, the longest rays $1\frac{2}{3}$ in head. Ventrals inserted near middle of body, of 7 rays, the outer one longest, $1\frac{1}{3}$ in head, its tip somewhat filamentous. Pectorals falcate, $1\frac{1}{2}$ in head.

Color translucent, except for the eyes, the fish being almost invisible in the water; two rows of black dots along the ventral surface.

The straight alimentary canal, the distinct muscle segmentation, the very thin ventral wall of the abdominal cavity, and other characters suggest a larval stage of development. Specimens about 100 millimeters long are apparently mature, having large eggs in the ovaries.

This little fish is found at certain seasons in the bays of northern Japan in great abundance, probably ascending the streams to spawn. It reaches a smaller size than its allies *Salanx chinensis* of southern China and *Salanx hyalocranius* of Korea and northern China. Our many specimens are from Mororan, Aomori, Same, and Tokyo.

It is reported in Japan that the fish is annual, ascending the streams in summer, and all individuals dying in the autumn after the deposition of the eggs. This alleged fact needs verification.

(μικρός, small; ὀδόντις, tooth.)

16. SALANX ARIAKENSIS Kishinouye, MS.

"B. 3. D. 13. A. 26. P. 10. V. 7.

"Length of the head $5\frac{1}{2}$ times contained in the total; head nearly twice as broad as high; the diameter of the eye is about one-seventh of the length of the head. Teeth subequal. Tongue toothless. Root of the ventral fin in the middle of the total length. Dorsal fin opposite to the anal. Adipose fin originates from the base of the anal. Body scaleless and nearly colorless, except a few black spots in two rows along the ventral median line and the caudal fin, which is light brown.

"This description is based upon two specimens about 16 cm. in length. They were collected from a weir in the Ariake Sea (Kiu-shiu) by Mr. Kamesaburo Toyama, on July 19, 1901. I can not tell the sex of these specimens, as the sexual gland is not yet ripe". (Kishinouye.)

The above account is from advance manuscript, kindly furnished to us by Dr. Kamekichi Kishinouye, chief of the Imperial Fisheries Bureau in Tokyo. This description will also be published in Tokyo.

RECAPITULATION.

Family I. SALMONIDÆ.

1. *Oncorhynchus* Suckley.
 1. *masou* (Brevoort); Aomori, Ishikari R. at Sapporo, Daiya R. at Nikko.
 2. *keta* (Walbaum); Ishikari River, Aomori, Hakodate.
 3. *kisutch* (Walbaum); Otaru, Ura R., Osatsubo, Aomori.
 4. *nerka* (Walbaum); Akan Lake in Kushiro, Urup I.
2. *Salmo* Linnaeus.
 5. *perryi* Brevoort; Aomori, Niigata, Lake Chuzenji, Kinu R., Daiya R., Otani R., Kamelani, Maebara, Karasaki, Kawagiri, Kitakani R., Hakodate, Tokyo market.
3. *Hucho* Günther.
 6. *blackstoni* (Hilgendorf); Nemuro, Chishima, Settsu, Shifto R., Heigun R.
4. *Salvelinus* Richardson.
 7. *kundscha* (Pallas); Nemuro, Iturup I., Shinbeshi.
 8. *pluvius* Hilgendorf; Lake Chuzenji, Chishima, Nemuro, Ohata R., Kawagiri.
 9. *malma* (Walbaum).
5. *Plecoglossus* Schlegel.
 10. *atlirelis* Schlegel; Ishikari R., Niigata, Aomori, Same, Matsushima, Morioka, Sendai, Tokyo, Tana R., Nikko, Gifu, Lake Biwa, Osaka, Wakanoura, Kobe, Hiroshima, Kurume, Nagasaki, Tan Sin R., Taihoku, Formosa.

Family II. ARGENTINIDÆ.

6. *Osmerus* Lacépède.
 11. *denter* Steindachner; Kushiro, Hakodate, Tokyo market.
7. *Mesopus* Gill.
 12. *alidus* (Pallas); Aomori, Same, Matsushima.
 13. *japonicus* Brevoort; Kushiro, Aomori.
8. *Argentina* Linnaeus.
 14. *kagoshimæ* Jordan and Snyder; Kagoshima.

Family III. SALANGIDÆ.

9. *Salangr* Cuvier.
 15. *microdon* Bleeker; Mororan, Aomori, Same, Tokyo.
 16. *ariakensis* Kishinouye; Ariake.