

NOTES ON SALMONIDÆ OF THE UPPER COLUMBIA.**By CAPT. CHARLES BENDIRE, U. S. A.**

[NOTE.—The United States National Museum has lately received from Captain Bendire a very fine series of fishes from the neighborhood of Fort Walla Walla, by far the most valuable collection of fishes ever made in the waters of the Upper Columbia. The series is especially valuable, as it throws much light on the life history of the Blue-back Salmon or "Red-fish" (*Oncorhynchus nerka*), and shows, apparently beyond a doubt, what no one had before suspected, so far as I know, that the supposed land-locked little red salmon (*Oncorhynchus kennedyi*) is nothing but the young breeding male or grilse of the *Oncorhynchus nerka*. Accompanying the collection are many valuable field-notes on the different species. Those relating to the Salmon and Trout are here extracted, each paragraph being preceded by my identification of the species to which the remarks refer.—D. S. JORDAN.]

a. *Oncorhynchus nerka* (Walb.) Gill & Jor.

(Adults in spring dress; the ordinary "Blue-back" of the Lower Columbia.)

Species of Salmon, ♀ and ♂, caught in the Columbia River near Wallula, Wash., July 7, 1880. Local name, Silver Salmon. Some 250 miles farther up the Snake River the same fish (at least I have every reason to believe it to be the same fish) are called Blue-backs or Steel-backs. This is undoubtedly the same species which during the spawning stage is known as the Red-fish found in the Wallowa Lake, Oregon, and Payette and Salmon Lakes, Idaho Territory.

b. *Oncorhynchus nerka*.(Young male, exactly like the types of *Salmo kennedyi* Suckley.)

A very interesting specimen. I take this to be a two-year old Red-fish, the only one of this size seen or caught. It was very deep for its size, and resembles, as nearly as I can recollect, the type of *Salmo kennedyi* very much. It was caught on a hook by one of Mr. Messenger's men September 1, 1880, and is the only one of the size ever observed by any of them. Color bluish black above, silvery white on lower parts.

c. *Oncorhynchus nerka*.

(Young, not yet showing hooked jaws.)

Young Red-fish. In some back steel-blue, in others back bluish and greenish bronze; sides lilac-colored, showing almost all the colors of a rainbow; bellies silvery white; iris silvery with black centre. In life one of the handsomest little fish I have ever seen. Some specimens show spots of a bluish-black color like trout on the head and near the tail and caudal fin, a few only along the whole back. Most of these spots disappear shortly after death, but in some I noticed them some

hours after capture. These fish are all about the same size, and, strange to say, they seem to be all males,* and the milt often flows from them while being taken from the hook, through squeezing them.

d. Oncorhynchus nerka.

(Adult in September; "Red-fish.")

Description and color notes taken of several specimens, just as they came out of the water, showing the differences in individuals. All were from Wallowa Lake, Oregon, caught with a seine near the head of the lake August 31 and September 1, 1880.

No. 1, ♂. Upper half of sides and back bright scarlet red, posterior parts shading off to a bright crimson; the two upper fins same color as the back, lower fins bluish on lower parts, the upper ends greenish olive; belly bluish; whole upper part of head light greenish yellow, showing in strong contrast to the body; base of upper jaw steel-blue, lower jaw bluish white.

No. 2, ♂. Upper parts claret-color, slightly brighter about the caudal region, otherwise marked like No. 1. Top of head light yellowish green, the yellow predominating, this color extending to and below the eye, and backwards to end of gills, a deep olive green darker than the upper parts of head, giving this specimen a very peculiar appearance; belly bluish white.

No. 3. Upper parts a very deep purple; lower parts of belly a deep bluish lead-color, otherwise marked like No. 2.

No. 4, ♂. Small. Presumably just arrived at the lake. In this specimen the hooked nose is not as fully developed as in the preceding ones, and the characteristic red of this species is obscured and partly hidden by a bluish tint. The hump is not yet developed on the back, and if it was not for the slightly hooked nose this specimen might readily be taken for a female. Belly silvery white beneath, slightly tinged with blue on the sides. Iris silvery.

The females are much more uniformly colored. The head is considerably tinged with steel-blue and the red tint on the sides is more or less clouded with blue and bronze. Females after spawning show considerable amount of red, only after spawning I noticed that the red coloring matter deposited in the skin appears to be drawn from the flesh, and I find that in proportion to the bright coloring of the skin of the fish the flesh loses this tint. In some instances it is barely pink-colored or almost white. After the spawning of these fish they are brightest outside and palest inside (as far as the flesh is concerned). The average size of a number of males by actual weight is only 5 pounds, and of females only $3\frac{3}{4}$ pounds. After death within half an hour the color of these fish rapidly changes about the head and becomes a dark olive green with bluish reflections, in some instances almost bluish black.

* One female less than a foot long was found in the lot. The eggs were well developed, though few in number.—D. S. J.

Among any number of fish there is an almost endless variation in color, caused, perhaps, by some remaining a longer time in the lake than others. Wallowa Lake is about $4\frac{1}{2}$ miles in length by $1\frac{1}{2}$ to 2 miles wide. It deepens very rapidly out a few feet from the shore, and is said to be 400 feet deep, and more than that in places. Two small streams flow into the lake, and these form the spawning ground proper for these fish; and as there are falls about two miles above the mouth of these streams over which the fish cannot leap, they are restricted to rather limited quarters for spawning. The only place I saw any of these fish was on the bar near the head of the lake, and there most of them are caught. They can be seen in schools of 100 or more at almost any time during the month of August and later. This year the run has been very light, and fishing had to a great extent stopped when I arrived at the lake on the last day of August. Four fisheries had been in operation, and these had put up about 20,000 pounds of fish. I believe two or three years ago it had been the practice to obstruct the entrances to the small streams at the head of the lake to prevent the fish from running up these streams. This year this was not done, and a number of the settlers about the lake seem to be anxious to have the fish properly protected, and it is not at all too soon to do it, either. The placing of obstructions in the above-mentioned streams, and perhaps this year of gill nets on the bar, has no doubt something to do with the scarcity of these fish. But the most abominable things of all which I saw personally in use are several clusters of hooks tied together, so that they form a circle with a radius of about 3 inches. Just above these hooks a lump of Red-fish eggs is laid. These are covered with mosquito-netting, and by this contrivance thousands of young Red-fish (the settlers call them "shiners," others call them "trout," but I am satisfied that it will be found that they are yearling Red-fish*) are caught and salted as well as the full-grown ones. Now, these fish are only about 4 inches long, and for every one caught two are crippled and die. So it can readily be seen that an immense number are destroyed yearly, as some parties make it a business to salt these down as well as mature fish.

I examined all these modes of fishing, and when I hooked with a single hook about one out of three in some other part of the body than the head, it can readily be understood how murderous such a contrivance as the above must be, and how many young fish can be destroyed by a single person in a day. They bait them first, and when they become plenty use their grappling hooks.

The fishermen at the lake complain that the Indians destroy the fish, but from personal observation I can't at all agree with them. It is true that numbers of Indians come from various parts of the country to Wallowa Lake yearly to fish, and they catch a good many. While I was camped at the lake I examined the catch of every Indian that passed

* No doubt of it.—D. S. J.

my camp, and I looked at as many as fifty Indians a day; each one had from six to twelve fish usually tied on his horse, and I found that there was about one female to ten males, and most of these were spent fish which had already spawned. They are not at all particular about this, and a fish which may be all bruised up and skinned is apparently just as well relished by them as a perfectly sound one, and even these Indians appreciated the fact that it would not do to catch too many females; at any rate they told me that as a rule they let the females go, and this is a good deal more than most of our white fishermen are willing to do. Mostly every one out here now concedes that the Red-fish is not a resident of the lakes wherein it is found, and I am perfectly satisfied that they are anadromous and not land-locked. The only thing as yet which I can't understand is, how do they get rid of the hooked nose and the hump after going back to salt water? They surely can't all die after spawning, and sometimes one that weighs as much as ten pounds is caught, and this fish is certainly older than a five-pounder; and it would not be presuming too much to assert that a Salmon of that size must have made more than one trip to sea. While in the lake they do not appear to eat anything, and the stomachs of several which I examined were entirely empty. I cannot understand how they get rid of their long hooked nose and hump.

e. *Oncorhynchus chouicha* (Walb.) Jor. & Gilb.

(Quinnat or Chinook Salmon; a young male corresponding to the "kenneryi" stage of the Red-fish.)

Salmo quinnat ♂. A very small specimen. If not a true Chinook Salmon, it was at least in company with several of this species. The back of this one was olive green, spotted like a trout, with round and also irregularly-shaped black spots; sides greenish white. It was shot with several others in Bear Creek, Oregon, September 4, 1880.

I was very sorry that I had not the means to preserve a pair of large Salmon which I had, but I had no room in the large tank, and these fish were too large to go in if I had the room. A male specimen measured $46\frac{1}{2}$ inches. Back brownish black, merging into a deep olive green on the sides, spotted with well-defined black spots on back, upper part of the sides, and caudal fins; a large bright purple patch, some 8-9 inches long, $2\frac{1}{2}$ to 3 wide, on the lower anal region from the ventral fin back to tail. Belly very pale olive green and whitish. The female measured $37\frac{1}{2}$ inches; colored like the male, but without any trace of red whatever. These fish had not spawned as yet, September 4. The red about the anal region is much more perceptible in large specimens than in small ones. None of the females (three) showed any red on them; all the larger males did, excepting the specimen I put up. The fish were all in good condition, none bruised and skinned up, the way I have seen them on the headwaters of the Salmon River. The Indians catch but few of these Salmon, preferring the Red-fish, which, from its small size,

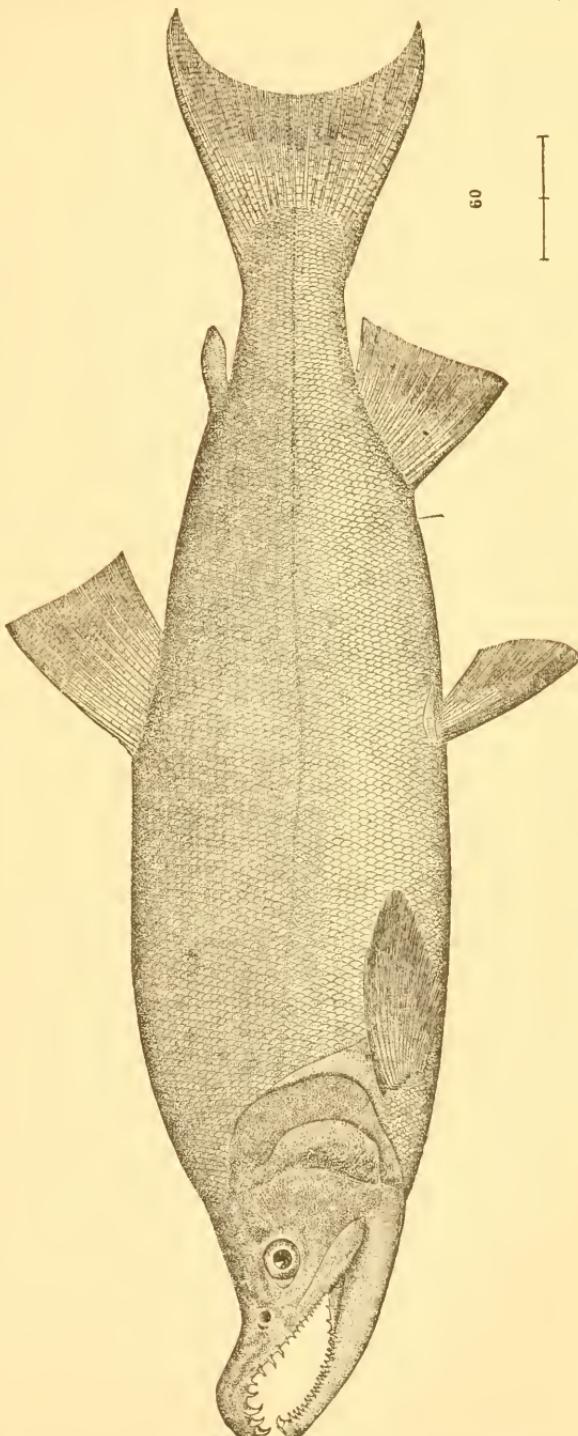
is easier cured; partly smoked and dried. Now and then, I am told, these Salmon run up the Wallowa River to the entrance of the lake, but invariably turn back again as soon as they strike the deep water. I cannot vouch for the truth of this, but every one of the fishermen claims that the principal spawning grounds of the Chinook Salmon, in the vicinity of Lake Wallowa, are near the head of the South Fork of the Wallowa River, and in Bear Creek, Oregon. But these fish arrive in smaller numbers every year, and are diminishing even more rapidly than the Red-fish.

f. Salmo purpuratus Pal-las.

Trout called Salmon-Trout at Fort Cœur d'Alene. Belly silver white, a red stripe along the side, head and back steel-blue, with small black spots scattered over head and back. Small specimens have also a few black spots under the red stripe; these are found mostly towards the head.

g. Salmo purpuratus Pal-las.

Called a Mountain Trout; ♂ weight 7 pounds 2ounces, length 24½ inches. I opened this fish yesterday, September 18, to show him, and see that it has greatly changed. No red



Male Red-fish received from Capt. Bendire, Oct., 1879.

was visible whatever on the sides when caught. The back was bluish horn color with black crescent-shaped spots, sides and belly silvery white. Three larger specimens than this were caught in Wallowa Lake this season by Mr. Messenger; one weighing over 10 pounds. I had another one which weighed $4\frac{1}{2}$ pounds, but had no room for it in the collecting tank, and therefore had it cooked.

h. Salmo purpuratus Pallas. *Tar.* Bouvieri Bendire.

(A variety singularly colored, but not evidently different otherwise.)

Trout from Waha Lake, 14 miles from Fort Lapwai, Idaho Territory. This lake has no visible outlet, is about 3 miles long by $1\frac{1}{2}$ miles wide, and is situated on the northern slope of Craig's Mountain. I frequently fished in this lake in the years 1869 and 1870, when stationed at Fort Lapwai, Idaho Territory, and never heard of any other kind of fish being found in said lake. All the fish caught there are about the same size, from 6 to 10 inches long. I believe it is a new species or variety, as no similar looking Trout are found in the streams or lakes in the neighborhood.

Back bluish green, olive color, sides silvery; in some instances the whole belly is red, in others the sides only; a few show a yellowish tinge; no red on the sides. There are round black spots near the tail, and fainter ones on the flanks. A few have an occasional spot on the head; two vermillion-colored stripes on each side of the under jaw; fins edged with brick red, ranging from this color to an orange.

Caught August 21, 1880.

This lake is very deep, and the water clear and cold. A smaller lake situated only some 400 yards from Lake Waha, and of somewhat lower altitude, contains no fish whatever.

i. Salvelinus malma (Walb.) Jor. & Gilb.

Bull Trout, Cœur d'Alene Lake, August 5. The Bull Trout with one exception were caught by Drum Major Sattors, Second United States Infantry, and I am indebted to Capt. William Mills and First Lieut. John K. Waring, Second Infantry, for several fine specimens of Trout and use of their boats.

According to the general testimony of all the officers, at the time I was at the lake, the fishing there was very poor, at least as far as size is concerned, the largest specimen not weighing over $2\frac{1}{2}$ or 3 pounds, but it seemed to me that fish weighing one pound and upwards were very plenty. The lake, no doubt, contains some large fish, particularly among the Bull Trout, of which specimens have been caught weighing 10 pounds and over. These were, at the time of my visit, very scarce, and were supposed to have gone up some of the numerous streams to spawn.

The Bull Trout seems to bear his name all over this section of country, while for the others there are numerous names, no two parties agreeing.

The more I see of these Trout, the less hopeful I become of adding

new species among this family, and I do not believe that over four* different kinds are to be found in this upper country.

j. Salvelinus malma.

Bull Trout, Cœur d'Alene Lake, August 5. Belly silver white; back and upper parts grayish, spotted with round pink markings; head darker than the back, which seems to be bluish black.

A REVIEW OF THE GENERA AND SPECIES OF THE FAMILY CENTRARCHIDÆ, WITH A DESCRIPTION OF ONE NEW SPECIES.

By CHARLES L. MCKAY.

The object of this paper is to give a catalogue of the genera and species of Centrarchidæ recognized by me, in anticipation of a monographic review of the family which I hope to publish at some future time. The results here obtained are based on a study of all the specimens of Centrarchidæ in the United States National Museum and in the collection of Professor Jordan. Types of nearly all the nominal species thus far described have been examined and compared, and I believe that very few of those here mentioned will prove invalid. The species not examined by me are designated by a star (*).

1. Genus *CENTRARCHUS* C. & V.

1. *Centrarchus macropterus* (Lac.) Jor. = *C. irideus* C. & V.

The characters assumed to distinguish *C. macropterus* and *C. irideus* disappear on examination of a large series.

2. Genus *POMOXYS* Rafinesque.

2. *Pomoxys sparoides* (Lac.) Girard. = *Centrarchus hexcanthus* Cuv. & Val.

3. *Pomoxys annularis* Raf.

3. Genus *ARCHOPLITES* Gill.

4. *Archoplites interruptus* (Grd.) Gill.

4. Genus *AMBLOPLITES* Rafinesque.

5. *Ambloplites rupestris* (Raf.) Gill. = ? *A. carifrons* Cope.

5. Genus *ACANTHARCHUS* Gill.

6. *Acantharchus pomectis* (Baird) Gill.

* *Oncorhynchus chouicha*; *O. nerka*; *Salmo purpuratus*; *Salvelinus malma*. *Salmo irideus* does not range so far to the northward, and *Salmo gairdneri* and the three other species of *Oncorhynchus* (*keta kisutch*, *gorbuscha*), do not ascend so far from the sea.—D. S. J.