

RELATIONSHIPS OF THE FISH FAUNA OF THE LAKES OF
SOUTHEASTERN OREGON

By JOHN OTTERBEIN SNYDER

Assistant Professor of Zoology, Leland Stanford Junior University

BUREAU OF FISHERIES DOCUMENT NO. 636

69

RELATIONSHIPS OF THE FISH FAUNA OF THE LAKES OF SOUTHEASTERN OREGON.

By JOHN OTTERBEIN SNYDER,
Assistant Professor of Zoology, Leland Stanford Junior University.

INTRODUCTION.

In the summer of 1897 a party^a sent out by the Commissioner of Fisheries examined a number of the lakes and streams in southern Oregon, leaving Ashland, Oreg., July 15 with camping outfit and remaining in the field until August 15. The region visited is that lying near the southern boundary of Oregon between Ashland on the west and the Warner Lakes on the east. The entire distance traveled by this party exceeded 700 miles, through the lava beds, marshes, and semidesert region of this part of the state.

The following lakes and streams were examined, and collections of their fishes and other aquatic life were made: Spencer Creek, July 16; Lower Klamath Lake, July 17 and 18; Whisky Creek, Spring Creek, and Sprague River, July 19; Drews Creek, at Howard's ranch, July 20; Goose Lake, at Farrington's, and New Pine Creek, near Farrington's, July 21-27; Camass Creek, at Hog Ranch, July 27; Camass Creek, Mud Creek, and Blue Creek, July 28; Honey Creek, near Plush, and Christmas Lake (of the Warner Lakes group), July 29-30; Abert Lake and mouth of Chewaucan River, August 1-2; Chewaucan River, near Paisley, August 3-4; small creek and pond at Harris's ranch, at Summer Lake post-office, August 4-5; large spring which forms Summer Lake River, August 5; Silver Lake, at Duncan's ranch, August 6; Silver Creek, near Silver Lake post-office, August 7; Bear Creek, at Bear Flat, August 8; Yansic Creek, on head of Williamson River, August 8; Klamath Marsh, August 9; Spring Creek, near Klamath Agency, August 10; Pole Creek and Crater Lake, August 12; Union Creek and Rogue River, August 13; Elk Creek and Trail Creek, August 14, and Rogue River, August 15.

In July and August, 1904, another party^b covered a distance of about 1,000 miles with horses and wagon, hastily examining the basins of Malheur, Warner, Abert, Summer, Silver, Alkali, and Goose lakes, together with the upper portion of Pitt River.

In addition to the large series of specimens obtained by these expeditions, collections from the Sacramento, Klamath, and Columbia rivers, belonging to the

^aThis party was in charge of Dr. Barton W. Evermann, of the Bureau of Fisheries, who was assisted by Prof. William P. Hay, Mr. Toxaway B. Evermann, and Mr. Charles M. Rowe, of Washington, D. C., and Mr. William E. Butler, of Ashland, Oreg.

^bComposed of the writer, Prof. E. C. Starks, and Messrs. E. L. Morris and J. D. Snyder.

Bureau of Fisheries, have been used in the preparation of the present paper, as were also the large collections belonging to the Bureau of Fisheries.^a

CHARACTER OF THE LAKES.

The lakes of southeastern Oregon are on a high, semiarid plateau, a portion of which, having interior drainage, may be included in a northwestern arm of the Great Basin. The region has a general elevation of about 4,000 feet. It is mostly a desert, except where the mountains, reaching a sufficient height, form forested areas of considerable humidity. The streams flowing from these mountains are often of large size, and the water, being clear and cool, supports trout in great numbers and of excellent quality. The marshes and lakes attract myriads of water birds, many of which show little fear. The entire region, although in most places desolate and forbidding, is one of particular interest, possessing a scenic beauty entirely its own. On every side are the well-preserved remains of the past activity of geological forces, while the fauna and flora are especially attractive to the naturalist.

Warner Lake lies in a series of shallow depressions in the nearly flat floor of a valley 50 miles long and from 4 to 8 miles wide.^b It receives its water almost entirely through streams flowing from the Warner Mountains lying to the westward. These mountains rise to a height of perhaps 7,000 feet and are well timbered, large pines extending downward to an elevation of about 5,000 feet, where they mingle with the junipers and sagebrush of the table-lands. Late in July large patches of snow are yet to be seen to the west and southwest, where head the principal tributaries of the lake—Honey, Warner, and Twenty-Mile creeks. Tongues from the timber belt extend downward along the upper courses of the creeks, which occasionally flow through mountain meadows often of large size. Warner Creek has cut a magnificent canyon, through which it plunges from the great plateau down into the lake basin beneath. The water passes over a basaltic dyke a short distance from the mouth of the canyon, producing a picturesque fall some 25 feet in height.

The lake is divided into three distinct parts. A transverse ridge of volcanic origin several hundred feet high cuts off a southern third except for a narrow channel, where the water may flow through to the northward. The northern third is completely divided from the central portion by a ridge of sand 10 or 15 feet high and of considerable width. This may at times act as a dam, but it can hardly prevent seepage from one portion of the lake to the other. The water on both sides of the ridge when seen by the writer was fairly fresh, while at the northern end of the lake it was extremely alkaline, nothing growing along its border. All parts of the lake are said to be shallow. The water is very turbid, the bottom being hidden at a depth of a foot.

Immediately north of the volcanic ridge the eastern border of the basin abruptly rises to a great height, the walls being in some places almost sheer cliffs. Seen from the south this elevation resembles a high, circular mesa. In passing to the

^aAcknowledgments are due to Dr. C. H. Gilbert for kindly advice and many valuable suggestions during a study of the distribution of western fishes.

^bThe distances and elevations given here are the results of estimates made in the field, an aneroid barometer being frequently used.

north, however, it soon becomes apparent that what before appeared as a flat-topped mountain is really a great wall which rises some 1,800 feet above the floor of the basin, and with only slightly varying height extends almost to the northern boundary. South of the transverse ridge the basin is bordered by bluffs and ranges of hills which gradually rise perhaps a thousand feet as they recede from the valley. Swinging round to the westward the bordering heights assume greater proportions and are more abrupt. North of Honey Creek they become broken, falling away into rounded hills and low plateaus. In the northern part of the basin a definite and well-preserved shore line extends along nearly the entire face of the eastern escarpment. It appears to be somewhat over 300 feet above the floor of the valley.

Abert Lake occupies part of a basin which is somewhat similar to that of Warner Lake, bordered by a high, precipitous wall on the east and low bluffs and rolling hills on the west. It is about 15 miles long and nearly a third as wide. The water of the lake, said to be not over 18 feet deep, is muddy and intensely alkaline, nothing growing near it.^a It is fed almost entirely by the Chewaucan River, which drains the northeastern part of the Winter Mountains, where they are covered with forests, especially on the slopes exposed to the south and west. Deep snow lying late in the season and an abundance of rain give the river a large volume of clear, cold water. After emerging from the mountains it flows, a deep, sluggish stream, across the great Chewaucan Marsh and finally passes over a fall into the lake.

At the north end of Abert Lake, on the XL Ranch, is a remarkable spring. Its water has a temperature of 61° F., is said to be constant in volume, clear, and fresh. It pours at once into a boggy pool 100 feet in diameter and about 17 feet deep, from whence an outflowing stream spreads over a marsh of tules and rushes. The water of the pool is clouded with algæ and swarms with fishes (*Rutilus*). A handful of crumbs thrown out on the surface attracts great numbers, causing the water fairly to boil, the food disappearing almost instantly. One haul of a seine net inclosed hundreds of specimens measuring from a few inches to nearly a foot in length. Their stomachs were stuffed with vegetation and numbers of a minute gasteropod. Whether the fishes derive their entire support from the pool was not learned. A few were seen in the stream leading from the pool, and it is reported that during wet weather great numbers pass out to the marsh, where they are left to die as the dry season approaches. The fishes are no doubt natives of the spring, the species having been left by the retreat of the desiccating lake.

Summer Lake is somewhat smaller than Abert. It is muddy, alkaline, and very shallow, the greatest depth not exceeding 15 feet, and much of that is soft mud. The bottom slopes very gently from the shore, avocets being able to wade out over a hundred feet. Consequently a slight reduction in the volume of water contracts the area of the lake considerably. It has maintained its present level for at least forty years, as stated by residents of the valley, the shore line occasionally retreating, however, during dry seasons as much as 150 yards. Sometimes a strong wind will drive the water back 200 yards or more, when a long reef of the stumps and fallen

^a Cope (Proceedings Academy Natural Sciences Philadelphia, 1883, p. 138) says: "It abounds in fishes, especially the trout *Salmo purpuratus*." Residents of the region report that fishes may often be found in the lake at the mouth of the Chewaucan River, where many, having passed over the fall, die from contact with the alkaline water.

trunks of gigantic willows are exposed, conclusively showing that for a considerable time during its past history the lake was much smaller than at present. The principal source of water supply is Ana River, a stream unique in many particulars. It rises from a group of several springs which pour out clear, cool water, forming a stream about 15 feet wide and 4 feet deep with a current so swift that it is difficult to stand against it. It is not more than 5 miles long and flows in a deep channel cut in the floor of the lake basin. Sagebrush and other desert plants grow to its very edge and, judging from the landscape alone, no one 200 yards from either the springs or river would suspect their presence. Some of the springs form large pools apparently of great depth, which are held in conical basins, the surface of the water lying 50 or more feet below their rims. The temperature of the water is 60° F., reported to be constant throughout the year.

The Rim Rock Mountains tower perhaps 2,000 feet above the western side of the lake. Their slopes are very steep, in some places dropping off in precipitous cliffs of great height. Their crests are covered with trees, small pines and junipers extending in some places far down their sides. At the base of the mountains along nearly the entire western side of the lake is a narrow belt of meadows and marshes, kept green by springs and small rivulets. The east side of the lake is barren and desolate in the extreme. The water is bordered by extensive mud flats, beyond which are great wastes covered with alkaline dust or shifting sand, the sand piling up against the low hills which skirt the valley. In the distance the hills and bluffs gradually rise to a height approaching a thousand feet.

Summer Lake is separated from the Chewaucan Marsh by only a slight elevation. Between Summer and Silver lakes is a divide apparently not less than 500 feet high.

Silver Lake Valley is bordered on the west by a high basaltic wall, which, though more or less broken by hills and canyons, continues well around the southern end. On the eastern side of the valley this same wall rather abruptly slopes down to a point where the ancient outlet is said to be located, again to rise and extend to the northward with an irregular outline of hills and mesas.

The inlet of the lake comes from the Pauline Marsh, lying to the northward, which in turn receives Bear, Bridge, and Silver creeks, streams of considerable size, draining the northern ranges of the Winter Mountains. The water of the lake, which is turbid and slightly alkaline, was at its maximum height when seen by the writer. It covered nearly the whole floor of the southern part of the valley and no beaches appeared above its level. This condition was said to be only temporary, however, the size of the lake being subject to considerable variation. Not long ago it contracted until nearly dry, remaining so for a year or more. At the time many dead stumps of sagebrush were found standing where they once grew, far within the present shore line.

Alkali Lake is an extensive pond lying in a desolate and forbidding region about 20 miles north of Abert Lake. It is the desiccated remains of a former great lake which was probably over 200 feet deep. On the low land not far from the shore is a spring pool about 50 feet across. Its water is fresh, slightly turbid, and is said to remain at a temperature of about 64° F. It swarms with fish (*Rutilus*), great numbers coming to the surface on the appearance of food. Many

may also be seen swimming about among clumps of algæ in the stream flowing from the spring. They are smaller than those found in the spring at Abert Lake.

Malheur and Harney lakes are extensive bodies of alkaline water. They are in a huge basin with a nearly flat floor, bordered in many places by great walls of basaltic rim rock. Malheur Lake receives the Donner and Blitzen River, flowing from the Stein Mountains on the south, and the Silvies River, which drains a part of the mountainous region to the northward. Harney Lake, the deeper and more salty of the two, often acts as an overflow basin for Malheur Lake. It is also fed by Silver Creek and a group of large, warm springs on the western side which have a constant temperature of 70° F. A stream of considerable size and several pools fed by these springs harbor great numbers of minnows.

Altogether the lakes receive the drainage of a vast territory, the tributary streams increasing the amount of water greatly during the winter and spring. As the dry season progresses the inflow diminishes and the evaporation increases, while the lakes rapidly contract and their salinity grows more pronounced. The constantly widening mud flats, with their glistening surfaces, and the drying up of the marshes add greatly to the general desolation of the valley.

Harney and Malheur lakes are separated from Warner, Abert, Summer, and Silver lakes by a broad, desolate expanse of sage plains and sandy desert, scored by the dry channels of ancient rivers and sparsely dotted with small playa lakes which contain water for only a short time during the year.

The Malheur basin was once drained by the Malheur River, a part of the Columbia system. There is evidence^a to show that it was cut off from that system by volcanic action in comparatively recent geological times. The basins of the other lakes are completely and widely isolated from any system having connection with the ocean. Although little appears to be known of their geological history, they may for the present be regarded as unconnected parts of what may be termed the Oregon lake system. It is to be noted that the lakes of this group receive their water supply from a mountainous region on the southwest. A large portion of this same territory is drained by streams which flow into Klamath and Rhett lakes to the westward, and also by others connected with Goose Lake, lying farther south. It is well known that Klamath and Rhett lakes are integral parts of the Klamath River system.^b Goose Lake belongs with the Sacramento system, although the water seldom rises high enough to flow out through the broad channel leading from the lake to Pitt River. In appearance it is very different from the lakes of the Oregon system. The basaltic rim rock so characteristic of the region to the northward is almost entirely wanting, while in its stead the lake is surrounded by a gently sloping, fertile valley, the northern portion of which is very broad and

^aRussell, Israel C., Notes on geology of southwestern Idaho and southeastern Oregon, Bulletin U. S. Geological Survey No. 217, p. 22.

^bRhett or Tule Lake formerly had an indirect connection with Klamath River through Lost River Slough. The lake served at times as an overflow basin for Klamath River. In a letter on the subject Mr. Elmer I. Applegate, of Klamath Falls, writes: "Until a few years ago Lost and Klamath rivers were connected by what was known as Lost River Slough, which carried a stream of considerable size during high water, offering no obstruction during a large portion of the summer to the passage of all fishes inhabiting the waters of either river. No water passes through this channel now, it having been diked in order to confine the water to Klamath River, and thus lower the level of Tule Lake."

low, a considerable part of it being inundated most of the time and covered with a rank growth of tules. Toward the south the tule belt rapidly narrows and the valley slopes a little more abruptly up to the mountains. On the eastern side the mountains rise about 3,000 feet and are well timbered, large pines in many places extending down almost to the water's edge, while west of the lake they are much lower and support very few trees. The lake is said to be shallow, its greatest depth not exceeding 25 feet. On approaching the water, an old beach of coarse gravel and small boulders may be observed, indicating that the surface has been 6 or 8 feet higher in the recent past. In wading out somewhat over 200 yards, where one's depth is reached, two other well-marked beaches are crossed. During very dry seasons the first of these is laid bare. An elevation of the surface of the water to the height of the outermost beach would cause the lake to overflow, pouring out through the channel leading to the southward. The lake receives numerous streams flowing in from all sides, Drew and Cottonwood creeks, which rise in the Winter Mountains, being the largest. Along the eastern side are many small streams of clear, pure water, the more important of which—Fandango, Lassen, and Davis creeks—are fed late in the summer by banks of snow lying high in the mountains.

LOCAL DISTRIBUTION AND RELATIONSHIPS OF THE FISH FAUNA.

In a discussion of the fish fauna of the lakes of southeastern Oregon it is necessary to keep in mind the relative position of their respective basins, and to simplify this matter an outline map of the region is presented (facing p. 102).

It has been observed that the Malheur basin is closely related, both geographically and geologically, with the Columbia. The first haul of the seine-net in Silvies River, which brought out such forms as *Acrocheilus alutaceus* and *Ptychocheilus oregonensis*, indicated plainly that it also bears a close faunological relation with that system. A careful examination of available material fails to show that the fishes which are isolated in the Malheur basin have visibly differentiated from their congeners in the Columbia. A still closer affinity exists between the fishes of the Klamath and Goose Lake basins and the river systems with which they are each connected by open or temporary waterways.

In an examination of the relationships of the fauna of what has been termed the Oregon lake system, one immediately turns to the species inhabiting the neighboring basins. The close proximity of the Sacramento, Klamath, and Columbia systems has been referred to, and it appears that with certain species found in these rivers the Oregon lake fishes are most intimately related. On a survey of the aggregate fish fauna of these river systems it seems that the various species may be divided for certain reasons into three fairly well defined series or groups. In the first series there may be brought together an assemblage of forms that are anadromous, or at least able to withstand salt water. They are the lampreys, sturgeons, sticklebacks, cottoids, trout, and salmon. Species of this group are generally distributed throughout the three systems or else are represented in each by closely related forms.^a To a second series may be assigned a number of distinctly fresh-

^a Certain cottoids, as *C. princeps*, *C. rhotheus*, and others, whose relationships have not been carefully studied, might be included in this group as having probably descended from marine forms.

water forms, widely differentiated species, many of which constitute peculiar genera characteristic of the basins in which they occur. They are *Orthodon microlepidotus*, *Lavinia exilicauda*, *Mylopharodon conocephalus*, *Pogonichthys macrolepidotus*, *Leuciscus crassicauda*, and *Rutilus symmetricus*, of the Sacramento; *Chasmistes brevirostris*, *Chasmistes stomias*, *Chasmistes copei*, and *Deltistes luxatus*, of the Klamath; *Pantosteus jordani*, *Acrocheilus alutaceus*, *Rhinichthys dulcis*, *Couesius greeni*, *Leuciscus caurinus*, *Columbia transmontana*, and others, of the Columbia. Each species included in this series is limited in its distribution to a single river basin and it is not represented in another by a closely related form. A third series, consisting, like the second, of fresh-water species, differs notably, however, in that each of its members is represented in at least one other than the native basin by a closely related form. To make this statement more clear a single example may be cited. There is in each of the three basins a large-scaled catostomid—*Catostomus occidentalis* in the Sacramento, *C. snyderi* in the Klamath, and *C. macrocheilus* in the Columbia. These resemble one another so closely as to be difficult to distinguish, and their characteristics are such as point directly to the probability of a common origin of the three forms. The species which may be assembled in this series, and which appear to bear out the general observation concerning its members, are here tabulated.

Sacramento.	Klamath.	Columbia.
<i>Catostomus occidentalis</i>	<i>Catostomus snyderi</i>	<i>Catostomus macrochellus</i> .
<i>Catostomus microps</i>	<i>Catostomus rimiculus</i>	<i>Catostomus catostomus</i> .
<i>Rutilus thalassinus</i>	<i>Rutilus bicolor</i>	<i>Rutilus columbianus</i> .
.....	<i>Leuciscus bicolor</i>	<i>Leuciscus balteatus</i> .
<i>Agosia nubila carringtoni</i>	<i>Agosia klamathensis</i>	<i>Agosia nubila carringtoni</i> .
<i>Ptychochellus grandis</i>.....	.....	<i>Ptychochellus oregonensis</i> .

Turning again to the Oregon lake system, it will be found, as is shown in the more detailed part of this paper, that the immediate affinities of its fish fauna are with those species of the Sacramento, Klamath, and Columbia rivers which, except the trout,^a have been assembled in the third series of the above scheme. Moreover, the bond of relationship indicated by a similarity of structure of the representative forms in the different basins is so strong as to leave little doubt of a community of descent.

Cope traced a close affinity between the Oregon lake (including also Goose and Klamath lakes) and the Lahontan systems, and such a relationship no doubt exists. It is only relative, however, as an examination of the representative species will show. *Rutilus oregonensis* differs from *R. olivaceus* in important dental characters which are of at least subgeneric value. Between *Catostomus warnerensis* and *C. tahoensis* the difference is not so great, yet the bond of relationship appears to be no closer than it is between *C. warnerensis* and allied forms in the Columbia and Sacramento rivers. Although the status of the described forms of *Agosia* is not well understood, the examples from the Oregon lake system much more closely resemble the form known as *A. klamathensis* than that found in the Lahontan system.

The present study has not only shown what is believed to be the true relationships of the Oregon lake fishes, but it has also pointed out an affinity existing

^aThe relationship of the trout is in line with the other species, the same form being found in the Sacramento, Klamath, and Columbia rivers.

between certain elements of the aggregate fish fauna of the Sacramento, Klamath, and Columbia rivers not hitherto known. A simple explanation for these interrelationships offers itself when some attention is given to the geography and geology of the region. The close proximity of many tributaries of the three systems, which appears to have been even more pronounced in a past geological period, has probably made possible an intermingling of their waters, thus permitting the passage of individuals of certain species from one basin to another, where their descendants, being able to maintain themselves, have in most cases become sufficiently differentiated to be recognized as distinct species.

TABLE SHOWING DISTRIBUTION OF THE FISH FAUNA.

Sacramento River system.

Species.	Goose Lake Basin.				Sacramento River Basin.					
	Cotton-wood Creek, Oreg.	Drew Creek, Oreg.	Muddy Creek, Oreg.	Goose Lake, Cal.	Joseph Creek, Cal.	Pitt River near Alturas, Cal.	Pitt River near Canby, Cal.	Pitt River, Big Valley, Cal.	Rush Creek near Adin, Cal.	Bur-ney Creek at Bur-ney.
<i>Entosphenus tridentatus</i>				X		X				X
<i>Catostomus occidentalis</i>	X	X	X	X		X				
<i>Mylopharodon conocephalus</i>						X		X		
<i>Ptychocheilus grandis</i>						X		X		
<i>Rutilus symmetricus</i>	X	X	X							
<i>Rutilus thalassinus</i>	X		X	X		X	X	X		
<i>Agosia nubila carringtoni</i> ...	X	X	X	X	X				X	X
<i>Salmo clarki</i>	X			X		X				X
<i>Cottus gulosus</i>		X								

Oregon Lake system.

Species.	Warner Basin.			Chewaucan Basin.			Summer Lake Basin.			Silver Lake Basin.			Alkali Basin.		
	Warner Creek.	Honey Creek.	Warner Lake north of Honey Creek.	Chewaucan River, Paisley.	Chewaucan River near mouth.	XI Spring, Abert Lake.	Spring at Summerlake P. O.	Ana River near mouth.	Springs, source of Ana River.	Silver Lake at Duncan Ranch.	Silver Creek near mouth.	Silver Creek near Silverlake P. O.	Bridge Creek.	Buck Creek.	Spring at Alkali Lake.
<i>Catostomus warnerensis</i> ...	X	X		X	X	X	X	X	X	X	X	X	X		X
<i>Rutilus oregonensis</i>	X	X		X	X	X	X	X	X	X	X	X	X		
<i>Agosia nubila carringtoni</i> ...	X	X	X	X	X	X	X	X	X	X	X	X	X		
<i>Salmo clarki</i>	X	X		X	X	X	X	X	X	X	X	X	X		

Columbia River system.

Species.	Malheur Basin.		
	Silvies River near Burns.	Silver Creek near Riley.	Warm Springs.
<i>Catostomus macrochellus</i>	X		
<i>Catostomus catostomus</i>	X	X	
<i>Acrochellus alutaceus</i>	X		
<i>Ptychocheilus oregonensis</i>	X		
<i>Leuciscus balearicus</i>	X	X	X
<i>Rutilus columbianus</i>	X		X
<i>Agosia nubila carringtoni</i>	X	X	X
<i>Salmo clarki</i>	X	X	X
<i>Cottus punctulatus</i>		X	

SYSTEMATIC DISCUSSION.

EXPLANATION OF MEASUREMENTS.

It is intended that the tables of measurements given in this paper, besides being of use in the identification of the species under consideration, shall express the amount and character of the variation in certain details of structure as well as these can be determined by the study of a small series of specimens. It is presumed that the true relationships of the forms will be more clearly and definitely

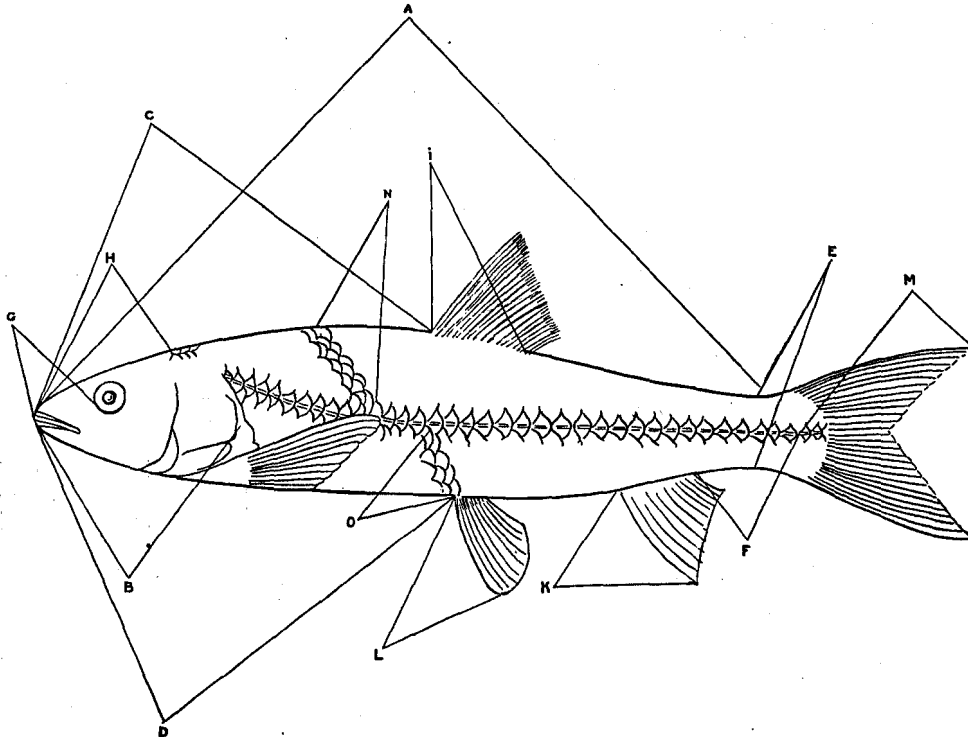


FIG. 1.—Diagram showing method of taking proportional measurements.

Length of body (a) recorded in millimeters. *Length head* (b) measured from tip of snout to posterior edge of opercle, the opercular flap, which is likely to shrink, not being considered. *Depth head*, measured at occiput. *Depth body*, the greatest depth. *Snout to dorsal* (c), *snout to ventral* (d), tip of snout to anterior end of base of fin. *Depth caudal peduncle* (e) measured at the narrowest place. *Length of caudal peduncle* (f), base of posterior anal ray to end of last vertebra; not to base of lowermost caudal ray, as the latter point is often indefinite. *Length snout* (g), tip of snout to anterior border of eye. *Diameter eye*, varies greatly with age. In poorly preserved specimens the tissue surrounding the eye is often shrunken, leaving the opening abnormally large. Only well-preserved examples nearly equal in size ought to be compared. *Interorbital width*, measured on skull, the points of the dividers being closed as nearly as possible between the eyes. *Snout to occiput* (h), tip of snout to the point on occiput where scales of body first appear. *Length base of dorsal* (i), *length base of anal*, from base of anterior to base of posterior ray, the extent of the membrane posteriorly not being taken into account. *Height dorsal*, *height anal* (k), *length pectoral*, *length ventral* (l), the length of longest ray in fin. *Length caudal* (m), measured from end of last vertebra to tip of upper caudal lobe. *Scales lateral line*, counted to end of last vertebra; not on base of caudal, where they frequently become densely crowded and difficult to make out. *Scales above lateral line* (n), from lateral line upward and forward to a point about midway between occiput and insertion of dorsal; not between lateral line and base of dorsal, as in the latter region the scales are sometimes minute, densely crowded, and indistinct. *Scales below lateral line* (o), from upper edge of base of ventral upward and forward to the lateral line. The series in the lateral line is not enumerated in this or the previous count. *Scales before dorsal*, the number of rows or series between occiput and base of dorsal. *Dorsal rays*, *anal rays*, when the posterior ray is cleft to the base it is still counted as a single ray. The anterior ray is often simple and preceded by one or two short, spine-like rays closely united to it. The spine-like rays are not enumerated.

set forth than when such expressions as "closely related," "its affinities are with," and the like are alone used. In many cases the results of comparative measurements of certain parts are merely negative. They are valuable, however, and are generally recorded. Characters which for one reason or another may at once be determined valueless, such as the number of caudal rays, occasionally the depth of the body, etc., are omitted.

The measurements have been made by means of a proportional scale, from carefully prepared specimens. They are expressed in hundredths of the length of the body (which is recorded in millimeters), measured from the tip of the snout to the end of the last caudal vertebra. (See diagram, p. 79.)

CATALOGUE OF SPECIES.

Entosphenus tridentatus (Gairdner).

Goose Lake, Pitt River near Alturas, and Burney Creek.

Catostomus occidentalis Ayres.

Drew Creek, Muddy Creek, and Cottonwood Creek, in Lake County, Oregon; Goose Lake, Pitt River, in California.

MEASUREMENTS OF SPECIMENS OF *CATOSTOMUS OCCIDENTALIS* FROM GOOSE LAKE, CALIFORNIA.

Length of body.....mm..	255	265	235	248	190	236	255	222	222
Length of head.....	.235	.225	.225	.24	.235	.226	.23	.23	.235
Depth of body.....	.205	.20	.205	.215	.195	.21	.19	.20	.225
Snout to dorsal.....	.50	.495	.485	.505	.505	.51	.50	.515	.51
Snout to ventral.....	.59	.585	.555	.565	.575	.57	.585	.575	.545
Depth of caudal peduncle.....	.09	.093	.08	.085	.09	.085	.085	.09	.085
Width of lower lip.....	.05	.055	.045	.05	.045	.05	.045	.05	.05
Length of snout.....	.12	.115	.115	.115	.125	.105	.11	.105	.115
Diameter of eye.....	.035	.035	.04	.04	.04	.04	.037	.04	.04
Depth of head.....	.185	.17	.17	.175	.17	.165	.17	.17	.165
Height of dorsal.....	.155	.165	.165	.18	.165	.155	.175	.165	.175
Height of anal.....	.185	.195	.245	.235	.175	.19	.185	.195	.215
Length of pectoral.....	.21	.205	.22	.21	.20	.21	.19	.215	.215
Length of ventral.....	.15	.155	.165	.17	.145	.15	.145	.155	.16
Length of caudal.....	.23	.23	.23	.23	.245	.23	.225	.23	.23
Dorsal rays.....	12	12	11	12	13	12	12	11	11
Scales of lateral line.....	73	73	72	63	72	72	63	67	70
Scales above lateral line.....	15	16	15	14	15	15	16	17	16
Scales before dorsal.....	35	37	36	34	38	39	36	35	37
Length of body.....mm..	181	130	153	156	141	140	155	133	131
Length of head.....	.24	.24	.235	.25	.24	.24	.233	.24	.245
Depth of body.....	.21	.22	.23	.225	.22	.22	.215	.22	.215
Snout to dorsal.....	.48	.485	.51	.515	.50	.51	.49	.50	.52
Snout to ventral.....	.555	.58	.57	.585	.575	.57	.55	.59	.80
Depth of caudal peduncle.....	.085	.09	.083	.085	.08	.09	.08	.09	.08
Width of lower lip.....	.05	.065	.04	.045	.05	.055	.045	.047	.055
Length of snout.....	.11	.115	.11	.12	.11	.11	.105	.115	.115
Diameter of eye.....	.04	.05	.045	.04	.045	.045	.045	.047	.05
Depth of head.....	.17	.18	.165	.17	.18	.165	.155	.18	.18
Height of dorsal.....	.175	.19	.195	.18	.17	.18	.165	.19	.18
Height of anal.....	.185	.20	.21	.22	.185	.20	.18	.185	.20
Length of pectoral.....	.21	.22	.225	.23	.22	.21	.195	.20	.22
Length of ventral.....	.15	.17	.17	.165	.15	.17	.15	.155	.16
Length of caudal.....	.235	.25	.255	.265	.25	.21	.23	.24	.25
Dorsal rays.....	12	12	11	13	11	12	11	11	11
Scales of lateral line.....	67	65	66	67	65	63	66	70	64
Scales above lateral line.....	16	16	15	16	15	15	17	15	15
Scales before dorsal.....	32	35	36	37	36	33	38	34	32

TABLE SHOWING NUMBER OF RAYS IN DORSAL FIN OF CATOSTOMUS OCCIDENTALIS FROM DIFFERENT LOCALITIES IN THE SACRAMENTO BASIN.

Dorsal rays.	Cotton-wood Creek.	Drew Creek.	Goose Lake.	Cache Creek, Yolo County, Cal.
	<i>Specimens.</i>	<i>Specimens.</i>	<i>Specimens.</i>	<i>Specimens.</i>
11.....	3	1	6	15
12.....	40	9	13	5
13.....	5	2	1	2
14.....	2			

Catostomus macrocheilus Girard.

A few specimens were collected from the deeper parts of the Silvies River, near Burns. They agree in all details with examples from the Columbia.

This species and *C. occidentalis* of the Sacramento appear to be very closely related. They resemble each other perfectly in general appearance except that the Columbia form seems to have a smaller eye and shorter and more rounded pectoral fins. The scales are alike in both cases, and the fin rays are about equal in number.

MEASUREMENTS OF SPECIMENS OF CATOSTOMUS MACROCHEILUS FROM SILVIES RIVER, NEAR BURNS, HARNEY COUNTY, OREG.

Length of body.....mm.	160	167	156	150	152	150	140	124	96	95
Length of head.....	.24	.26	.25	.25	.25	.25	.26	.255	.26	.25
Depth of body.....	.235	.23	.235	.22	.24	.23	.245	.24	.23	.235
Snout to dorsal.....	.525	.525	.52	.52	.525	.52	.54	.525	.53	.525
Snout to ventral.....	.575	.58	.57	.595	.58	.595	.59	.595	.60	.58
Depth of caudal peduncle.....	.075	.08	.08	.075	.075	.075	.077	.08	.08	.075
Width of lower lip.....	.045	.05	.05	.05	.05	.046	.05	.05	.05	.042
Length of snout.....	.125	.13	.125	.125	.12	.115	.13	.125	.12	.11
Diameter of eye.....	.05	.045	.045	.05	.05	.05	.05	.055	.052	.06
Depth of head.....	.18	.19	.175	.17	.185	.175	.185	.18	.18	.18
Height of dorsal.....	.18	.19	.18	.18	.19	.18	.185	.205	.205	.20
Height of anal.....	.18	.185	.18	.18	.18	.18	.18	.185	.17	.18
Length of pectoral.....	.19	.20	.195	.19	.185	.19	.19	.20	.19	.20
Length of ventral.....	.16	.155	.155	.15	.145	.15	.155	.16	.15	.16
Length of caudal.....	.25	.27	.26	.255	.26	.265	.26	.27	.28	.26
Dorsal rays.....	15	15	14	14	14	14	13	14	14	13
Scales of lateral line.....	70	66	66	65	64	64	64	66	64	66
Scales above lateral line.....	13	13	13	14	13	13	13	14	14	14
Scales before dorsal.....	33	32	33	30	31	34	34	37	32	33

Catostomus warnerensis, new species.

The catostomid found in the Warner basin appears to be related to both *C. tahoensis* of the Lahontan system and *C. catostomus* of wide distribution to the north and east. Although resembling each very closely, it can not as we now recognize those species be identified with either. The Warner form has larger scales, there being fewer in the lateral line (73 to 79 compared with 79 to 104), smaller eyes, and a smaller mouth with narrower lower lips. Its affinities are also with the very similar small-scaled species *C. microps*^a of the Sacramento and *C. rimiculus* of the Klamath. It appears, however, to have larger scales than either of these forms. It differs from *C. microps* also in having a larger eye.

Cope^b identified *C. warnerensis* with the species common to the basins of the Lahontan system, but it appears no more closely to resemble that form than it does *C. catostomus*. As here defined the species is found only in the Warner basin. It inhabits the larger streams tributary to the lake, appearing

^a Rutter, Cloudsley, Bulletin U. S. Bureau of Fisheries, vol. xxvii, 1907, p. 120.

^b Cope, E. D., Proceedings Academy Natural Sciences, Philadelphia, 1883, p. 152. The difference in the size of the scales, as shown by examples from the two basins, was noted by this author: "Pyramid Lake; scales, 14-89-14." "Warner Lake; scales, 16-83-15."

in the latter wherever the water is not too strongly impregnated with mineral salts. It has not been found in Warner Creek above the falls.

Description of type no. 55597 U. S. National Museum, from Warner Creek, near Adel, Lake County, Oreg.: Total length, 296 mm. Head, 3.8 in length to base of caudal; depth, 4.5; depth of caudal peduncle, 3.1 in head; snout, 2.1; eye, 8.3; dorsal, 10; anal, 7; scales in lateral line, 79; between occiput and insertion of dorsal, 43; between lateral line and middle of back, 19; between lateral line and insertion of anal, 14. Eye midway between tip of snout and edge of opercle. Inner portion of lip with a scarcely evident horny sheath, much less conspicuous than that of *C. catostomus*; upper lip with 3 or 4 rows of papillæ, the median ones largest; lower lip with 7 or more rows, smaller papillæ frequently being wedged in between the larger ones; cleft of mandibular lobe not complete, a space covered by 2 or more rows of papillæ intervening. Length of base of dorsal equal to height of fin. Anal rather acutely rounded, reaching base of caudal when depressed. Origin of ventrals below base of fourth or fifth dorsal ray; fins when depressed falling considerably short of anal opening. Pectorals rounded, their tips reaching two-

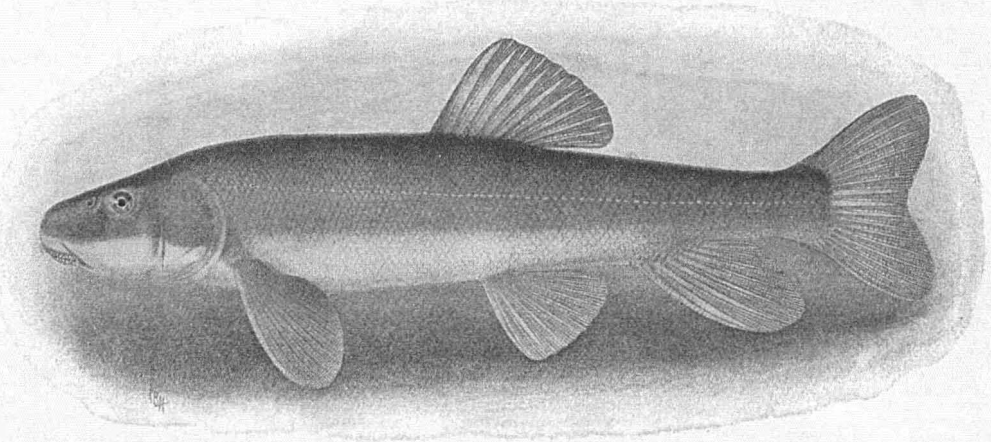


FIG. 2.—*Catostomus warnerensis*, new species. Type.

thirds of distance between their bases and the ventrals. Caudal with a shallow notch, the lobes rounded. Peritoneum dusky. Color dark above, light below; the dark and light areas separated on a lateral line passing just below middle of sides. In life the dusky portion is greenish black, having in places a slight brassy sheen; the light ventral parts creamy white. Fins dusky, the lower ones lighter than the others.

In some examples there are 5 or 6 indefinite rows of papillæ on the upper lip and 8 or more on the lower. Small specimens have the boundaries of the light and dark areas less sharply defined. In individuals 60 or 70 mm. long the color of the darker parts is broken up into spots of irregular shape and size.

The appended table of measurements will indicate other slight individual variations. Similar measurements of examples of *C. tahoensis* are also given.

Represented by specimens from Warner Creek, sloughs south of Warner Creek, and from Honey Creek.

MEASUREMENTS OF SPECIMENS OF CATOSTOMUS WARNERENSIS FROM WARNER CREEK, LAKE COUNTY, OREG.

Length of body.....mm.	245	152	145	140	124	74	71	61	54	57	56	59
Length of head.....	.26	.26	.24	.25	.245	.26	.26	.27	.26	.26	.27	.27
Snout to dorsal.....	.54	.52	.52	.53	.51	.515	.52	.515	.51	.51	.52	.52
Snout to ventral.....	.585	.57	.55	.585	.565	.575	.55	.59	.56	.56	.58	.56
Depth of caudal peduncle.....	.07	.09	.09	.09	.095	.10	.09	.09	.09	.10	.09	.085
Length of snout.....	.12	.12	.11	.105	.11	.115	.11	.105	.11	.105	.105	.10
Width of lower lip.....	.033	.03	.03	.04	.037	.033	.03	.03	.03	.03	.03	.03
Diameter of eye.....	.033	.032	.035	.04	.038	.045	.045	.055	.05	.05	.065	.07
Height of dorsal.....	.16	.18	.17	.18	.185	.185	.20	.22	.20	.21	.20	.20
Height of anal.....	.205	.18	.19	.21	.20	.165	.17	.175	.16	.17	.18	.17
Length of pectoral.....	.20	.19	.185	.20	.19	.18	.18	.22	.20	.20	.205	.19
Length of ventral.....	.16	.14	.14	.14	.15	.14	.145	.16	.15	.15	.16	.15
Length of caudal.....	.20	.22	.21	.23	.21	.22	.23	.25	.24	.24	.25	.25
Dorsal rays.....	10	10	10	11	10	10	11	10	10	10	10	10
Anal rays.....	7	7	7	7	7	7	7	7	7	7	7	7
Scales lateral line.....	79	79	76	77	76	75	75	73	75	74	76	78
Scales above lateral line.....	19	19	17	18	17	17	18	16	17	17	16	16
Scales before dorsal.....	43	38	39	41	38	38	37	37	40	39	37	42

MEASUREMENTS OF SPECIMENS OF CATOSTOMUS TAHOENSIS.

From Warm Springs Creek, Summit, Nev.

Length of body.....mm.	166	152	145	140	136	123	133	116
Length head.....	.27	.24	.245	.24	.25	.24	.23	.25
Snout to dorsal.....	.53	.515	.52	.52	.525	.51	.51	.51
Snout to ventral.....	.60	.59	.58	.57	.59	.59	.58	.585
Depth caudal peduncle.....	.085	.095	.095	.09	.095	.095	.085	.095
Length snout.....	.115	.11	.11	.105	.115	.12	.10	.125
Width lower lip.....	.052	.053	.06	.05	.05	.045	.05	.05
Diameter eye.....	.045	.05	.043	.04	.045	.05	.045	.045
Height dorsal.....	.16	.17	.17	.165	.165	.16	.17	.165
Height anal.....	.215	.20	.19	.185	.21	.19	.195	.195
Length pectoral.....	.195	.18	.18	.18	.195	.19	.17	.20
Length ventral.....	.15	.15	.15	.13	.14	.145	.13	.14
Length caudal.....	.24	.21	.21	.20	.23	.225	.21	.225
Dorsal rays.....	11	11	11	10	11	11	11	11
Anal rays.....	7	7	7	7	7	7	7	7
Scales lateral line.....	79	83	79	79	84	94	93	.....
Scales above lateral line.....	17	18	15	18	19	18	16	17
Scales before dorsal.....	41	41	42	47	44	44	48	44

From Lake Tahoe, Cal.

Length of body.....mm.	215	220	208	Height anal.....	.18	.20	.21
Length head.....	.25	.22	.25	Length pectoral.....	.175	.19	.19
Snout to dorsal.....	.53	.515	.54	Length ventral.....	.14	.14	.14
Snout to ventral.....	.62	.62	.62	Length caudal.....	.195	.215	.22
Depth caudal peduncle.....	.09	.09	.095	Dorsal rays.....	10	11	12
Length snout.....	.12	.11	.12	Anal rays.....	7	7	7
Width lower lip.....	.045	.04	.04	Scales lateral line.....	88	90	90
Diameter eye.....	.045	.04	.04	Scales above lateral line.....	20	19	18
Height dorsal.....	.155	.16	.17	Scales before dorsal.....	44	43	47

Catostomus catostomus (Forster).

Examples from Silvies River at Burns and from Silver River near Riley are very similar to specimens from the Columbia. The Harney specimens appear to have slightly larger scales, however, there being from 83 to 93 rows in the lateral line, while individuals from Little Wood River and Ross Fork, Idaho, have from 88 to 96. Others are recorded as having 90 to 104.^a

^aGilbert & Evermann, Bulletin U. S. Fish Commission, vol. xiv, 1894, p. 189.

MEASUREMENTS OF SPECIMENS OF CATOSTOMUS CATOSTOMUS.

From Silvies River, Burns, Oreg.

Length of body.....mm.	178	229	Height anal.....	.185	.20
Length head.....	.215	.215	Length pectoral.....	.18	.19
Snout to dorsal.....	.51	.51	Length ventral.....	.15	.17
Snout to ventral.....	.575	.555	Length caudal.....	.23	.24
Depth caudal peduncle.....	.075	.075	Dorsal rays.....	11	11
Length snout.....	.11	.105	Anal rays.....	7	7
Width lower lip.....	.053	.05	Scales lateral line.....	93	93
Diameter eye.....	.037	.035	Scales above lateral line.....	19	21
Height dorsal.....	.18	.175	Scales before dorsal.....	49	46

From Silver River, Harney County, Oreg.

Length of body.....mm.	221	121	112	118	.115	52	55
Length head.....	.22	.24	.235	.22	.23	.26	.25
Snout to dorsal.....	.525	.54	.52	.52	.525	.55	.54
Snout to ventral.....	.585	.59	.59	.56	.59	.61	.59
Depth caudal peduncle.....	.085	.085	.08	.08	.08	.085	.085
Length snout.....	.105	.11	.11	.10	.115	.116	.11
Width lower lip.....	.055	.05	.055	.05	.05	.06	.055
Diameter eye.....	.035	.045	.04	.043	.04	.055	.05
Height dorsal.....	.16	.19	.175	.18	.185	.21	.20
Height anal.....	.22	.175	.20	.19	.175	.17	.17
Length pectoral.....	.20	.19	.195	.20	.19	.19	.20
Length ventral.....	.165	.16	.165	.16	.155	.16	.16
Length caudal.....	.23	.23	.22	.24	.23	.26	.27
Dorsal rays.....	11	11	11	12	11	11	11
Anal rays.....	7	7	7	7	7	7	7
Scales lateral line.....	33	86	91	89	84	88	84
Scales above lateral line.....	18	20	18	19	18	19	19
Scales before dorsal.....	45	45	44	52	46	51	45

Acrocheilus alutaceus (Agassiz & Pickering).

Silvies River near Burns; 8 specimens about 100 mm. long.

Mylopharodon conocephalus (Baird & Girard).

Pitt River near Alturas, and near Canby, Big Valley. The former, 3 in number, measure about 350 mm. in length. The fins were bright salmon red. Scales in lateral line 73 to 77, above lateral line 19 to 20, between occiput and dorsal 49 to 54, dorsal 8, anal 8.

Ptychocheilus oregonensis (Richardson).

Specimens of *Ptychocheilus* from the Malheur basin are apparently identical with *P. oregonensis* of the Columbia. A comparison of examples from Silvies River and from the Willamette shows that the former have somewhat longer fins. A few individuals from Hangmans Creek, Washington, and from Boise River, Idaho, are intermediate in this respect between the Silvies and Willamette specimens.

MEASUREMENTS OF SPECIMENS OF PTYCHOCHEILUS OREGONENSIS.

From Silvies River near Burns, Oreg.

Length of body.....mm.	218	203	222	191	219	183	153	158	145	148	99	109	101	98	96
Length head.....	.285	.275	.287	.28	.27	.273	.29	.28	.29	.27	.275	.29	.29	.28	.285
Depth body.....	.24	.22	.245	.235	.225	.245	.245	.225	.22	.22	.245	.21	.22	.21	.22
Snout to dorsal.....	.60	.575	.595	.585	.575	.58	.58	.595	.60	.58	.597	.69	.59	.59	.69
Snout to ventral.....	.56	.565	.555	.56	.553	.54	.57	.56	.58	.57	.57	.54	.565	.56	.55
Length snout.....	.105	.105	.10	.105	.095	.10	.10	.105	.105	.097	.10	.10	.10	.10	.10
Length maxillary.....	.115	.11	.12	.115	.11	.112	.117	.115	.12	.11	.11	.11	.11	.115	.105
Diameter eye.....	.043	.045	.045	.046	.042	.045	.05	.045	.05	.05	.065	.055	.06	.06	.06
Interorbital width.....	.075	.08	.08	.08	.075	.08	.08	.08	.08	.08	.08	.08	.085	.085	.08
Height dorsal.....	.17	.17	.175	.175	.17	.175	.18	.19	.185	.183	.20	.18	.195	.20	.185
Height anal.....	.175	.16	.155	.155	.16	.155	.17	.17	.162	.17	.165	.155	.18	.17	.17
Length pectoral.....	.21	.195	.21	.19	.20	.185	.17	.185	.17	.18	.17	.16	.18	.17	.175
Length ventral.....	.155	.155	.15	.15	.14	.145	.15	.145	.135	.15	.15	.14	.15	.15	.145
Length caudal.....	.26	.27	.255	.255	.25	.25	.27	.26	.28	.285	.285	.27	.28	.28	.28
Dorsal rays.....	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Anal rays.....	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Scales lateral line.....	69	68	69	69	70	74	74	70	73	74	75	68	69	71	70
Scales before dorsal.....	49	46	50	48	50	49	47	50	50	51	54	52	53	53	51
Scales above lateral line.....	19	19	17	19	18	18	18	19	18	20	19	17	20	17	18

MEASUREMENTS OF SPECIMENS OF *PTYCHOCHEILUS OREGONENSIS*—Continued.

From Willamette River, near Corvallis, Oreg.

Length of body.....mm.	255	289	305	234	225	255	241	260	247	238
Length head.....	.28	.29	.285	.29	.27	.295	.275	.28	.285	.285
Depth body.....	.21	.215	.215	.22	.225	.22	.22	.215	.21	.265
Snout to dorsal.....	.555	.58	.59	.60	.56	.59	.58	.58	.58	.575
Snout to ventral.....	.525	.55	.55	.57	.55	.58	.55	.565	.57	.545
Length snout.....	.095	.10	.10	.105	.11	.09	.105	.10	.10	.105
Length maxillary.....	.11	.12	.12	.12	.11	.12	.115	.12	.12	.12
Diameter eye.....	.04	.045	.04	.05	.045	.045	.045	.045	.045	.045
Interorbital width.....	.08	.075	.08	.08	.08	.085	.08	.085	.09	.08
Height dorsal.....	.16	.15	.15	.175	.165	.155	.165	.165	.165	.17
Height anal.....	.15	.15	.135	.16	.15	.14	.16	.145	.15	.155
Length pectoral.....	.16	.175	.15	.19	.175	.16	.18	.16	.175	.185
Length ventral.....	.14	.13	.12	.14	.13	.12	.14	.13	.13	.14
Length caudal.....	.24	.235	.....	.24	.24	.235	.24	.23	.225	.24
Dorsal rays.....	9	9	9	9	9	9	9	9	9	9
Anal rays.....	8	8	8	8	8	8	8	8	8	8
Scales lateral line.....	69	69	68	73	69	69	71	71	75	70
Scales before dorsal.....	53	54	48	49	50	47	53	49	50	48
Scales above lateral line.....	18	18	17	17	18	17	17	17	18	17

Ptychocheilus grandis (Ayres).

Pitt River, near Alturas, and in Big Valley.

Leuciscus balteatus (Richardson).

Warm Springs, Silver Creek, and Silvies River.

Specimens collected at Warm Springs and at Silver Creek were brilliantly colored, especially the former, a description of which follows: Dorsal surface of body deep green; a narrow, diffuse, brassy stripe extending from eye along lateral line, falling below it posteriorly, forming a ventral border to the greenish dorsal area; an indistinct dark greenish stripe extending from eye along the side just below the brassy band; breast and abdomen silvery; sides just below greenish band bright red; snout anterior to eye greenish; cheeks below eye and opercle brassy; fins golden. Immediately after death the greenish dorsal area turns to a steel blue.

In this connection a color description from life made at Cow Creek, a tributary of the Umpqua River, may be of interest: Dorsal surface dark, dull olive; a narrow, sharply defined yellowish orange band, one scale wide, extending from posterior edge of orbit to middle of caudal peduncle, dividing the olive area posteriorly so that a narrow space of the latter color extends below the yellow stripe; breast and abdomen silvery white; sides below yellow stripe orange, the upper edges of the orange area deeply suffused with red; snout, upper part of head, olive; a bright red patch below eye, separated from the latter by a narrow olive area; opercles brassy; fins yellowish.

The following table shows the number of rays in the anal fins of 124 examples.^a Attention is directed to the fact that Warm Springs and Silver Creek are closely connected, while Silvies River is isolated from both.

Anal fin rays.	Warm Springs.	Silver Creek.	Silvies River.
	<i>Specimens.</i>	<i>Specimens.</i>	<i>Specimens.</i>
9.....	7	2	.....
10.....	.....	8	.....
11.....	20	30	.....
12.....	4	18	2
13.....	1	1	7
14.....	.....	.....	8
15.....	.....	.....	13
16.....	.....	.....	3

^aFor a discussion of the variation in the number of anal fin rays of *L. balteatus* see Gilbert and Evermann, Bulletin U. S. Fish Commission, vol. XIV, 1894, p. 196.

Rutilus thalassinus (Cope).

Cottonwood Creek, Oreg.; Muddy Creek and Goose Lake, Lake County, Oreg.; Pitt River near Alturas; Pitt River near Canby and Pitt River in Big Valley, Cal.

Cope^a recognized two closely related species of *Rutilus* (*Myloleucus*) from Goose Lake, both of which are no doubt referable to the same form which he describes under the name *Myloleucus thalassinus*. This species is not to be confused with *Rutilus symmetricus* occurring in the same basin, nor should it be identified with the *Myloleucus parovanus* of Cope^b from Beaver River, Utah.

R. thalassinus may be distinguished from each of the species of *Rutilus* here described by its longer fins. It further differs from *R. bicolor* in having a larger head, a more posterior location of the dorsal fin, and in usually possessing one more dorsal ray; from *R. oregonensis* in having larger scales, there being fewer in the lateral series, in the series before the dorsal fin and in those above the lateral line, and also in having one more dorsal ray; from *R. columbianus* in having a greater number of scales in the lateral series and a lesser number between occiput and dorsal fin. These differences are set forth in greater detail in the tabulated comparisons of the four forms, page 94 et seq.

As at present understood, this species is confined in its distribution to the Sacramento basin, this being the first account of its occurrence beyond the confines of Goose Lake. It is to be searched for in bayous, deep quiet pools, and sluggish streams.

MEASUREMENTS OF SPECIMENS OF RUTILUS THALASSINUS FROM PITT RIVER NEAR CANBY, LASSEN COUNTY, CAL.

Length of body.....mm..	150	139	123	125	100	106	116	103	93	101
Length head.....	.29	.28	.28	.27	.26	.29	.27	.28	.27	.28
Snout to occiput.....	.235	.22	.22	.22	.21	.225	.21	.22	.21	.22
Snout to dorsal.....	.58	.59	.57	.58	.56	.59	.58	.58	.60	.58
Snout to ventral.....	.57	.57	.595	.58	.54	.59	.55	.58	.58	.57
Depth body.....	.29	.30	.31	.30	.28	.31	.28	.30	.28	.30
Depth caudal peduncle.....	.12	.125	.12	.13	.12	.125	.12	.13	.12	.125
Length snout.....	.09	.085	.09	.08	.085	.09	.08	.09	.08	.085
Length maxillary.....	.09	.085	.085	.08	.09	.09	.08	.09	.08	.085
Diameter eye.....	.06	.06	.055	.06	.055	.055	.06	.06	.06	.06
Interorbital width.....	.10	.10	.10	.10	.09	.10	.10	.09	.10	.10
Height dorsal.....	.255	.22	.22	.22	.21	.23	.21	.21	.21	.23
Height anal.....	.20	.18	.18	.16	.185	.19	.18	.18	.17	.19
Length pectoral.....	.21	.20	.19	.19	.20	.21	.18	.20	.18	.20
Length ventral.....	.20	.165	.185	.16	.175	.18	.16	.18	.17	.18
Length caudal.....	.32	.30	.31	.28	.28	.32	.30	.30	.28	.29
Scales lateral line.....	47	49	52	51	50	51	49	51	48	51
Scales above lateral line.....	11	11	12	13	11	11	11	11	11	11
Scales below lateral line.....	6	5	6	6	6	6	6	6	7	5
Scales before dorsal.....	25	27	25	27	26	25	25	26	27	25
Dorsal rays.....	9	9	9	9	9	9	9	9	9	9
Anal rays.....	8	8	8	8	8	9	8	8	8	8

Length of body.....mm..	99	86	86	82	84	78	75	106	137
Length head.....	.28	.29	.28	.29	.28	.29	.28	.28	.28
Snout to occiput.....	.25	.23	.21	.23	.22	.24	.24	.22	.22
Snout to dorsal.....	.59	.59	.57	.58	.57	.59	.59	.58	.57
Snout to ventral.....	.58	.56	.56	.56	.57	.56	.60	.57	.58
Depth body.....	.30	.30	.30	.29	.28	.27	.30	.29	.31
Depth caudal peduncle.....	.13	.13	.13	.13	.115	.12	.13	.13	.135
Length snout.....	.08	.095	.08	.085	.08	.08	.09	.09	.085
Length maxillary.....	.085	.095	.08	.09	.08	.08	.09	.08	.08
Diameter eye.....	.06	.07	.06	.065	.065	.075	.07	.06	.055
Interorbital width.....	.10	.10	.10	.10	.09	.10	.10	.10	.10
Height dorsal.....	.23	.24	.23	.23	.21	.22	.26	.225	.21
Height anal.....	.19	.19	.18	.19	.18	.18	.19	.18	.18
Length pectoral.....	.20	.22	.20	.20	.18	.19	.18	.19	.185
Length ventral.....	.18	.19	.19	.18	.16	.18	.175	.17	.175
Length caudal.....	.33	.33	.32	.33	.31	.32	.33	.31	.31
Scales lateral line.....	47	49	47	50	50	47	46	46	51
Scales above lateral line.....	11	12	12	11	11	11	11	11	11
Scales below lateral line.....	5	6	6	6	5	5	6	6	6
Scales before dorsal.....	24	26	26	25	26	26	23	25	25
Dorsal rays.....	9	9	9	9	9	9	9	9	9
Anal rays.....	9	9	8	8	8	8	8	8	9

^a Cope, E. D., Proceedings Academy Natural Sciences Philadelphia, 1883, p. 143-144. Cope's supposition that he had in hand 2 distinct species was probably due to the poor preservation of his specimens. He says (p. 139): "I fished for a day with hook and line without success, but procured a good collection of fishes by another method. I found numerous specimens both fresh and dry, which had been dropped by fishing birds on or near the shore."

^b Cope, E. D., Proceedings American Philosophical Society, Philadelphia, 1874, p. 136.

Rutilus oregonensis, new species.

This name is here applied to a distinct form found in the isolated lake basins of southeastern Oregon. It is very similar to closely related forms found in the Sacramento, Klamath, and Columbia systems, but differs widely from *R. olivaceus* of the Lahontan system in important dental characters, the latter species having the pharyngeal teeth 5-5.

It differs from the more nearly related forms as follows: From *R. thalassinus* in having shorter fins, a greater number of scales in the lateral line, in the series before dorsal fin, and above lateral line, and also in usually having one less dorsal ray; from *R. bicolor* in having generally a larger head, smaller scales, there being a greater number in the lateral series, between occiput and dorsal fin and above the lateral line; from *R. columbianus* in having smaller scales and in other minor points. These differences are shown in greater detail in the tabulated comparisons of the four forms, page 94 et seq.

Description of type no. 55596, U. S. National Museum, from XL Spring, Abert Lake, Oregon: Total length 202 mm. Head 3.6 in length to base of caudal; depth 3.6; depth caudal peduncle 9; depth head at occiput 5; length snout 3.3 in head; maxillary 3.7; diameter eye 6.1; width space between eyes 3; height dorsal 1.8; anal 2.2; length pectoral 1.6; ventral 2; caudal 1.3; scales lateral line 52; above lateral line 13; between lateral line and origin of ventral 8; between occiput and origin of dorsal 27.

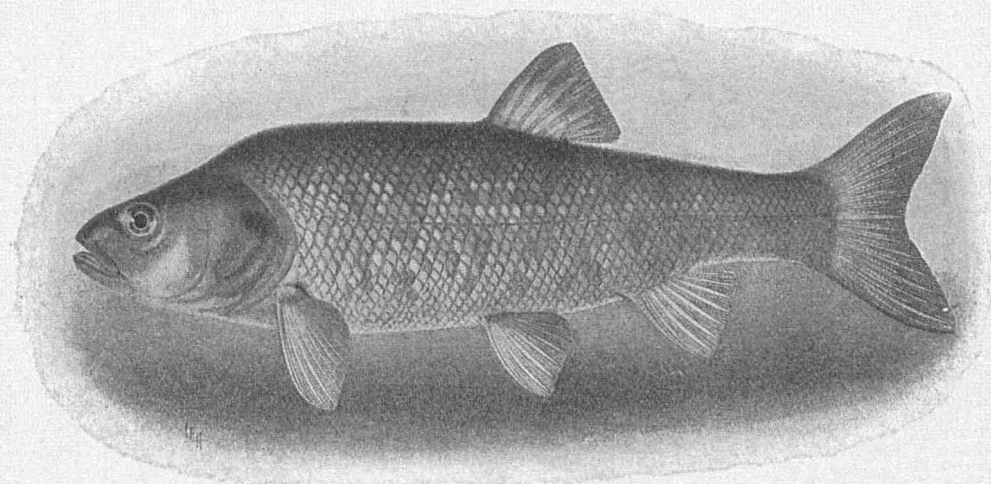


FIG. 3.—*Rutilus oregonensis*, new species. Type.

Body deep and heavy, the dorsal contour with an abrupt elevation at occiput. Mouth very oblique; maxillary extending to a perpendicular through nostril, not nearly reaching anterior border of orbit. Gillrakers on first arch 14, very short, not equal to half the diameter of pupil, acutely pointed. Teeth (from cotypes) 4-5, short and strong, a narrow grinding surface present, tips of smaller ones somewhat hooked. Peritoneum almost black. Intestinal canal very short, its length equal to about $1\frac{1}{4}$ times total length of fish. Lateral line complete, somewhat decurved immediately behind head. Dorsal placed directly above ventrals, the length of its base equal to height of third ray, the free edge straight. Anal shaped like the dorsal, length of base equal to height of fourth ray. Pectorals and ventrals bluntly rounded, the latter not reaching anal opening; notch of caudal broadly rounded. Color in spirits very dark, even the ventral surface being decidedly dusky; edges of scales being much darker than their centers. In life the color is dark olive, some examples having a greener tint, the fins with somewhat darker edges.

Smaller examples do not have a prominent post-occipital hump, the elevation growing more pronounced with age. The young generally have the fins slightly longer and the caudal more acutely notched. In other localities the specimens are often lighter in color, the variation apparently coinciding with the immediate surroundings. In lighter-colored examples the peritoneum is also less dusky. Sexual differences are not striking, the males generally having slightly longer fins. Females appear to be much more abundant than males.

Warner Creek and sloughs south of Warner Creek; Honey Creek; Warner Lake north of Honey Creek; Chewaucan River, Paisley; Chewaucan River, near mouth; XL Spring, Abert Lake; spring, Alkali Lake; spring, Summer Lake Post Office; Ana River; springs at source of Ana River; Silver Lake; Silver Creek near mouth; Bridge Creek; Silver Creek near Silvercreek Post-Office; Buck Creek.

The rather extensive table of comparative measurements which is here inserted shows that while examples from the different lake basins may possibly show slight differences among themselves, they all agree in being differentiated in a measureable way from their representatives in the neighboring systems.

MEASUREMENTS OF SPECIMENS OF RUTILUS OREGONENSIS FROM ISOLATED BASINS OF THE OREGON LAKE SYSTEM.

From XL Spring, Abert Lake.

Length of body.....mm.	106	138	120	125	103	115	97	91	101	112
Length head.....	.28	.26	.285	.285	.28	.28	.29	.28	.29	.28
Snout to occiput.....	.21	.21	.22	.22	.22	.21	.22	.215	.21	.21
Snout to dorsal.....	.56	.56	.58	.58	.57	.56	.58	.54	.55	.55
Snout to ventral.....	.56	.55	.58	.56	.54	.54	.54	.55	.56	.54
Depth body.....	.265	.29	.29	.29	.27	.27	.26	.29	.29	.27
Depth caudal peduncle.....	.11	.12	.12	.125	.125	.12	.12	.13	.13	.13
Length snout.....	.08	.08	.085	.09	.09	.08	.08	.08	.09	.08
Length maxillary.....	.08	.08	.08	.085	.08	.08	.08	.08	.09	.08
Diameter eye.....	.045	.05	.055	.055	.06	.055	.065	.06	.06	.055
Interorbital width.....	.09	.09	.10	.10	.10	.10	.09	.10	.09	.10
Height dorsal.....	.17	.17	.18	.19	.19	.19	.18	.20	.19	.19
Height anal.....	.14	.14	.14	.15	.15	.135	.15	.16	.16	.155
Length pectoral.....	.17	.17	.175	.19	.19	.17	.18	.23	.19	.20
Length ventral.....	.15	.14	.15	.155	.17	.155	.155	.18	.16	.18
Length caudal.....	.25	.24	.24	.25	.25	.26	.26	.28	.25	.26
Scales lateral line.....	59	57	55	55	53	57	56	55	57	55
Scales above lateral line.....	12	13	13	13	14	13	12	13	13	13
Scales below lateral line.....	8	7	8	7	7	7	8	8	7	7
Scales before dorsal.....	31	29	31	30	29	32	31	28	28	31
Dorsal rays.....	8	9	8	8	8	7	8	8	8	9
Anal rays.....	8	8	8	8	8	7	8	8	8	8
Length of body.....mm.	95	104	110	101	107	140	110	106	132	120
Length head.....	.27	.28	.27	.29	.28	.265	.28	.29	.29	.27
Snout to occiput.....	.21	.22	.22	.21	.22	.215	.21	.22	.22	.21
Snout to dorsal.....	.555	.54	.555	.56	.56	.58	.58	.57	.57	.55
Snout to ventral.....	.555	.55	.54	.55	.54	.57	.55	.57	.57	.545
Depth body.....	.25	.28	.29	.29	.27	.265	.28	.30	.27	.26
Depth caudal peduncle.....	.11	.12	.12	.115	.12	.125	.12	.12	.125	.12
Length snout.....	.08	.09	.08	.09	.08	.08	.09	.09	.08	.085
Length maxillary.....	.08	.09	.08	.09	.075	.08	.08	.085	.08	.09
Diameter eye.....	.055	.06	.055	.055	.06	.055	.055	.06	.055	.055
Interorbital width.....	.09	.10	.09	.10	.095	.09	.095	.10	.095	.085
Height dorsal.....	.18	.19	.17	.18	.15	.17	.165	.19	.17	.165
Height anal.....	.15	.16	.135	.15	.135	.145	.14	.15	.135	.13
Length pectoral.....	.18	.20	.18	.18	.16	.17	.17	.195	.19	.17
Length ventral.....	.15	.16	.15	.15	.13	.14	.14	.17	.15	.135
Length caudal.....	.26	.25	.26	.25	.23	.24	.24	.27	.24	.24
Scales lateral line.....	55	56	55	54	56	55	54	51	54	59
Scales above lateral line.....	12	13	13	14	11	12	13	12	14	13
Scales below lateral line.....	9	8	7	7	7	7	8	7	7	7
Scales before dorsal.....	30	30	28	30	30	30	29	30	30	29
Dorsal rays.....	8	8	9	8	8	9	8	8	8	8
Anal rays.....	8	8	8	8	8	8	7	8	8	8

MEASUREMENTS OF SPECIMENS OF RUTILUS OREGONENSIS FROM ISOLATED BASINS OF THE OREGON LAKE SYSTEM—Continued.

From Ana River, Summer Lake—Continued.

Length of body.....mm.	68	76	72	79	77	79	75	73	72	73
Length head.....	.28	.275	.27	.26	.28	.27	.27	.27	.28	.285
Snout to occiput.....	.23	.22	.22	.21	.22	.22	.215	.22	.21	.23
Snout to dorsal.....	.55	.58	.59	.56	.55	.56	.57	.56	.57	.57
Snout to ventral.....	.56	.57	.57	.56	.56	.55	.56	.55	.57	.57
Depth body.....	.27	.28	.28	.26	.27	.28	.26	.27	.28	.27
Depth caudal peduncle.....	.13	.13	.12	.12	.125	.13	.13	.12	.13	.125
Length snout.....	.09	.08	.09	.095	.085	.085	.08	.09	.08	.085
Length maxillary.....	.08	.085	.08	.07	.08	.08	.08	.085	.08	.08
Diameter eye.....	.06	.065	.065	.06	.06	.06	.06	.065	.06	.06
Interorbital width.....	.10	.10	.10	.085	.10	.09	.10	.095	.10	.10
Height dorsal.....	.21	.20	.18	.20	.19	.21	.20	.19	.20	.20
Height anal.....	.16	.14	.14	.13	.13	.16	.14	.15	.15	.14
Length pectoral.....	.20	.17	.18	.18	.17	.21	.17	.21	.16	.17
Length ventral.....	.15	.13	.16	.15	.14	.17	.15	.16	.15	.15
Length caudal.....	.27	.25	.27	.23	.25	.26	.25	.24	.24	.26
Scales lateral line.....	52	56	57	53	55	56	54	52	54	55
Scales above lateral line.....	12	13	13	13	14	13	12	11	12	11
Scales below lateral line.....	6	7	7	7	8	7	7	7	7	6
Scales before dorsal.....	31	32	31	30	33	31	31	28	30	29
Dorsal rays.....	8	8	8	8	8	8	8	8	8	8
Anal rays.....	7	7	8	7	7	7	7	8	7	7

From Bridge Creek, Silver Lake.

Length of body.....mm.	88	66	71	70	75	80	72	93	89	83
Length head.....	.27	.28	.29	.28	.26	.28	.27	.27	.27	.28
Snout to occiput.....	.22	.26	.22	.22	.21	.22	.20	.205	.21	.22
Snout to dorsal.....	.56	.57	.58	.55	.54	.55	.53	.54	.57	.56
Snout to ventral.....	.55	.55	.57	.55	.535	.56	.53	.54	.53	.55
Depth body.....	.26	.27	.28	.26	.27	.27	.245	.27	.26	.27
Depth caudal peduncle.....	.115	.12	.125	.12	.115	.13	.115	.12	.12	.12
Length snout.....	.08	.08	.085	.08	.08	.085	.08	.08	.08	.08
Length maxillary.....	.08	.08	.085	.08	.07	.08	.08	.07	.08	.08
Diameter eye.....	.06	.07	.07	.065	.06	.065	.07	.055	.06	.06
Interorbital width.....	.09	.09	.095	.09	.09	.09	.09	.10	.09	.09
Height dorsal.....	.18	.21	.20	.20	.20	.22	.20	.19	.20	.19
Height anal.....	.14	.16	.14	.16	.15	.17	.17	.14	.15	.14
Length pectoral.....	.17	.18	.185	.21	.17	.20	.19	.15	.17	.16
Length ventral.....	.15	.16	.15	.15	.15	.17	.16	.14	.15	.14
Length caudal.....	.25	.28	.26	.25	.26	.28	.27	.25	.25	.25
Scales lateral line.....	51	49	49	54	55	52	55	51	55	52
Scales above lateral line.....	11	11	11	12	12	11	11	11	12	11
Scales below lateral line.....	6	6	6	6	6	6	6	7	6	6
Scales before dorsal.....	26	27	25	28	29	26	25	25	25	27
Dorsal rays.....	9	8	8	9	8	9	8	9	8	8
Anal rays.....	8	7	7	7	7	7	7	8	7	8

Length of body.....mm.	76	78	70	71	69	68	67	70	65	67
Length head.....	.28	.29	.28	.27	.28	.28	.28	.27	.28	.27
Snout to occiput.....	.22	.215	.22	.21	.215	.22	.22	.22	.22	.20
Snout to dorsal.....	.55	.56	.57	.56	.54	.56	.56	.55	.55	.54
Snout to ventral.....	.56	.57	.57	.54	.56	.55	.55	.55	.55	.54
Depth body.....	.28	.27	.26	.26	.28	.25	.26	.26	.26	.26
Depth caudal peduncle.....	.12	.12	.12	.11	.13	.125	.13	.12	.13	.13
Length snout.....	.08	.08	.08	.08	.08	.08	.08	.085	.09	.075
Length maxillary.....	.085	.08	.08	.075	.08	.075	.08	.085	.08	.08
Diameter eye.....	.06	.06	.07	.06	.06	.07	.08	.07	.075	.065
Interorbital width.....	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09
Height dorsal.....	.22	.20	.20	.19	.20	.21	.23	.22	.21	.23
Height anal.....	.16	.15	.14	.15	.15	.17	.15	.15	.17	.17
Length pectoral.....	.18	.19	.17	.15	.19	.21	.20	.19	.22	.20
Length ventral.....	.15	.15	.14	.14	.15	.18	.17	.15	.17	.13
Length caudal.....	.28	.28	.25	.25	.26	.28	.28	.26	.21	.29
Scales lateral line.....	56	53	54	55	51	54	50	55	53	51
Scales above lateral line.....	12	11	12	12	12	12	11	11	12	12
Scales below lateral line.....	7	6	6	7	6	7	6	6	6	6
Scales before dorsal.....	28	24	28	29	25	27	27	27	25	25
Dorsal rays.....	8	9	9	9	9	8	8	9	8	8
Anal rays.....	7	7	8	8	8	7	7	7	7	7

MEASUREMENTS OF SPECIMENS OF RUTILUS OREGONENSIS FROM ISOLATED BASINS OF THE OREGON LAKE SYSTEM—Continued.

From Spring, Alkali Lake.

Length of body.....mm..	.88	.79	.95	.875	.87	.84	.83	.93	.89	.81
Length head.....	.28	.30	.28	.29	.30	.27	.30	.29	.30	.30
Snout to occiput.....	.21	.22	.20	.225	.23	.20	.23	.22	.23	.21
Snout to dorsal.....	.57	.58	.57	.57	.57	.54	.59	.58	.56	.565
Snout to ventral.....	.58	.575	.56	.56	.57	.53	.57	.58	.56	.565
Depth body.....	.28	.28	.27	.29	.30	.29	.29	.26	.27	.28
Depth caudal peduncle.....	.13	.13	.12	.13	.13	.13	.13	.12	.12	.12
Length snout.....	.08	.08	.075	.08	.08	.07	.08	.08	.08	.08
Length maxillary.....	.08	.08	.075	.08	.08	.07	.09	.08	.075	.08
Diameter eye.....	.07	.07	.055	.06	.065	.06	.07	.065	.06	.07
Interorbital width.....	.09	.10	.09	.10	.09	.09	.095	.09	.10	.09
Height dorsal.....	.20	.195	.19	.19	.18	.18	.19	.18	.19	.18
Height anal.....	.16	.16	.15	.15	.15	.15	.14	.14	.15	.14
Length pectoral.....	.20	.21	.19	.19	.18	.20	.19	.17	.18	.18
Length ventral.....	.17	.18	.155	.16	.16	.16	.16	.15	.15	.16
Length caudal.....	.28	.27	.27	.27	.28	.24	.27	.26	.27	.25
Scales lateral line.....	51	55	52	53	52	50	48	55	55	47
Scales above lateral line.....	12	12	12	12	13	12	12	12	12	12
Scales below lateral line.....	7	6	6	7	6	7	7	6	7	6
Scales before dorsal.....	30	28	30	29	28	28	27	28	28	28
Dorsal rays.....	8	8	9	8	8	8	8	9	8	8
Anal rays.....	7	8	8	8	8	8	8	8	7	8

Length of body.....mm..	.75	.79	.86	.86	.86	.76	.83	.84	.76	.79
Length head.....	.29	.29	.28	.29	.29	.30	.28	.28	.30	.27
Snout to occiput.....	.22	.22	.21	.22	.22	.22	.22	.21	.23	.22
Snout to dorsal.....	.57	.555	.56	.57	.565	.575	.57	.55	.57	.56
Snout to ventral.....	.57	.54	.55	.57	.555	.585	.56	.55	.565	.54
Depth body.....	.30	.27	.27	.28	.27	.30	.27	.28	.30	.30
Depth caudal peduncle.....	.15	.12	.12	.13	.12	.135	.13	.13	.125	.13
Length snout.....	.08	.08	.07	.075	.07	.073	.075	.075	.08	.075
Length maxillary.....	.075	.08	.08	.08	.08	.08	.075	.075	.08	.075
Diameter eye.....	.07	.07	.06	.07	.065	.075	.07	.065	.075	.07
Interorbital width.....	.095	.095	.10	.095	.09	.10	.09	.09	.10	.09
Height dorsal.....	.21	.20	.18	.19	.19	.20	.20	.20	.19	.19
Height anal.....	.17	.16	.15	.14	.15	.17	.16	.16	.15	.16
Length pectoral.....	.22	.20	.19	.19	.20	.20	.20	.21	.20	.21
Length ventral.....	.19	.175	.15	.15	.16	.17	.16	.18	.16	.17
Length caudal.....	.28	.27	.25	.27	.28	.30	.28	.26	.28	.27
Scales lateral line.....	52	48	50	52	48	53	54	51	54	51
Scales above lateral line.....	12	12	13	12	12	12	12	12	12	11
Scales below lateral line.....	7	6	6	6	7	6	7	7	7	6
Scales before dorsal.....	27	28	30	28	28	28	26	27	29	27
Dorsal rays.....	8	8	9	8	8	8	8	8	8	8
Anal rays.....	7	7	10	11	8	7	8	8	8	7

From Warner Creek, Warner Lake.

Length of body.....mm..	123	125	130	129	117	112	92	110	112	111	114	116	112	140
Length head.....	.28	.28	.27	.275	.20	.22	.22	.22	.22	.22	.21	.21	.21	.28
Snout to occiput.....	.21	.205	.20	.22	.22	.22	.22	.22	.21	.22	.21	.21	.22	.215
Snout to dorsal.....	.555	.56	.57	.58	.585	.56	.58	.56	.56	.57	.56	.56	.56	.57
Snout to ventral.....	.55	.56	.57	.58	.585	.565	.58	.575	.55	.565	.57	.57	.57	.57
Depth body.....	.265	.26	.285	.275	.26	.275	.28	.255	.26	.27	.28	.26	.28	.27
Depth caudal peduncle.....	.13	.13	.13	.12	.13	.13	.14	.12	.125	.12	.14	.13	.13	.13
Length snout.....	.085	.08	.08	.08	.085	.085	.085	.09	.08	.08	.08	.08	.085	.08
Length maxillary.....	.085	.085	.08	.08	.085	.085	.085	.08	.08	.085	.08	.08	.085	.085
Diameter eye.....	.055	.06	.05	.05	.055	.06	.06	.05	.055	.06	.06	.055	.06	.05
Interorbital width.....	.095	.095	.09	.09	.10	.095	.095	.095	.095	.095	.09	.10	.10	.09
Height dorsal.....	.18	.18	.18	.19	.19	.21	.22	.205	.195	.195	.23	.20	.195	.18
Height anal.....	.16	.155	.15	.15	.155	.17	.18	.165	.16	.165	.195	.16	.16	.16
Length pectoral.....	.185	.18	.17	.18	.18	.19	.20	.19	.17	.18	.24	.17	.185	.17
Length ventral.....	.15	.15	.16	.155	.155	.17	.18	.18	.15	.15	.19	.155	.16	.155
Length caudal.....	.25	.25	.24	.25	.25	.29	.28	.28	.265	.26	.30	.255	.28	.26
Scales lateral line.....	53	52	55	55	55	54	52	53	51	51	51	52	51	51
Scales above lateral line.....	12	12	13	13	12	12	12	12	12	12	12	12	12	12
Scales below lateral line.....	7	6	8	7	7	7	7	6	6	6	7	7	7	6
Scales before dorsal.....	28	30	30	29	30	30	31	31	28	30	29	27	30	33
Dorsal rays.....	9	9	8	8	9	8	9	8	9	9	9	9	8	8
Anal rays.....	8	8	8	8	8	8	7	8	8	8	8	8	8	7

MEASUREMENTS OF SPECIMENS OF *RUTILUS OREGONENSIS* FROM ISOLATED BASINS OF THE OREGON LAKE SYSTEM—Continued.

From Warner Creek, Warner Lake—Continued.

Length of body.....mm..	64	91	75	75	87	75	81	81	84	85	89	80	89	92
Length head.....	.30	.27	.29	.30	.275	.28	.28	.29	.27	.28	.28	.285	.28	.29
Snout to occiput.....	.23	.21	.22	.235	.21	.21	.22	.22	.22	.225	.225	.225	.215	.22
Snout to dorsal.....	.56	.55	.57	.57	.55	.58	.60	.58	.56	.57	.59	.57	.57	.575
Snout to ventral.....	.27	.27	.30	.28	.27	.275	.265	.27	.28	.27	.29	.285	.255	.27
Depth body.....	.13	.13	.13	.13	.12	.135	.12	.13	.13	.12	.13	.12	.12	.13
Depth caudal peduncle.....	.085	.08	.08	.09	.075	.08	.08	.09	.075	.08	.085	.09	.08	.085
Length snout.....	.085	.08	.08	.08	.075	.085	.08	.09	.08	.08	.09	.08	.08	.08
Length maxillary.....	.07	.06	.07	.07	.06	.06	.06	.07	.06	.06	.06	.07	.06	.06
Diameter eye.....	.10	.09	.10	.09	.085	.085	.08	.095	.085	.09	.095	.095	.095	.095
Interorbital width.....	.22	.22	.22	.20	.19	.19	.185	.19	.22	.19	.20	.20	.19	.20
Height dorsal.....	.18	.17	.17	.155	.145	.14	.15	.15	.18	.145	.155	.15	.15	.15
Height anal.....	.21	.21	.20	.20	.16	.17	.165	.16	.22	.19	.18	.18	.17	.175
Length pectoral.....	.175	.18	.17	.165	.145	.16	.145	.14	.19	.15	.155	.155	.15	.165
Length ventral.....	.29	.29	.28	.25	.25	.26	.255	.25	.27	.25	.27	.28	.25	.26
Length caudal.....	50	52	53	56	54	49	56	55	51	49	49	52	52	52
Scales lateral line.....	12	12	11	13	13	12	12	13	13	13	12	12	12	13
Scales above lateral line.....	6	6	7	8	7	7	7	7	8	7	7	7	7	7
Scales below lateral line.....	27	30	29	30	27	30	28	27	29	29	27	30	29	29
Scales before dorsal.....	8	8	8	8	9	9	9	9	8	8	9	8	8	8
Dorsal rays.....	8	9	8	8	8	8	8	8	8	8	8	8	8	8
Anal rays.....														

Rutilus columbianus, new species.

Closely related to *R. oregonensis*, *R. thalassinus*, and *R. bicolor*, from each of which it differs as follows: From *R. oregonensis* in having larger scales; from *R. thalassinus* in its shorter fins, fewer scales in the lateral series, and a larger number between occiput and dorsal fin; from *R. bicolor* in having a larger

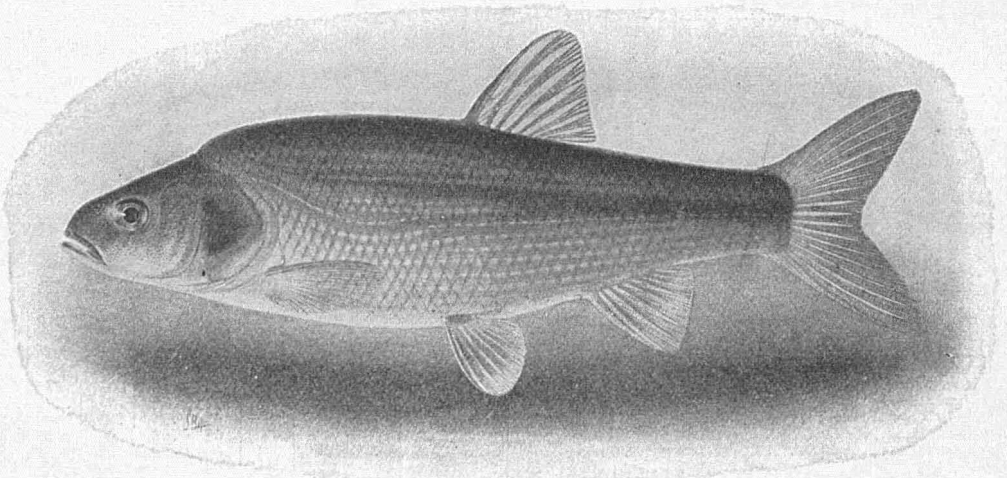


FIG. 4.—*Rutilus columbianus*, new species. Type.

head, higher anal, longer caudal, fewer scales in the lateral line, a larger number between occiput and dorsal fin, and in usually having one more ray in the dorsal fin. The tabulation on page 94 will show some of the distinctive characters of these forms in greater detail.

Description of type no. 55595, U. S. National Museum, from Warm Springs, near Harney Lake, Harney County, Oreg.: Total length, 136 mm. Head, 3.7 in length to base of caudal; depth, 3.6; depth caudal peduncle, 8.4; depth head at occiput, 4.7; length snout, 3.5 in head; maxillary, 3.5; diameter eye, 5.6; width space between eyes, 3.1; height dorsal, 1.6; anal, 2.1; length pectoral, 1.7; ventral, 1.9; caudal, 1.2; scales, 12-49-7; between occiput and origin of dorsal, 27.

Dorsal contour with an abrupt elevation at occiput, which is less prominent in young individuals; mouth very oblique, maxillary extending to a vertical passing midway between nostril and eye; lower

MEASUREMENTS OF SPECIMENS OF RUTILUS COLUMBIANUS—Continued.

From market, Portland, Oreg.

Length of body.....mm.	167	176	185	157	Height anal.....	.155	.17	.165	.18
Length head.....	.27	.275	.26	.27	Length pectoral.....	.15	.18	.17	.18
Snout to occiput.....	.20	.19	.19	.20	Length ventral.....	.16	.16	.16	.185
Snout to dorsal.....	.56	.56	.55	.565	Length caudal.....	.24	.29	.....	.295
Snout to ventral.....	.55	.56	.55	.565	Scales lateral line.....	50	49	46	46
Depth caudal peduncle.....	.125	.13	.13	.135	Scales above lateral line.....	12	12	12	12
Length snout.....	.07	.07	.07	.07	Scales below lateral line.....	7	7	6	7
Diameter eye.....	.055	.05	.045	.05	Scales before dorsal.....	28	28	29	30
Interorbital width.....	.09	.09	.095	.09	Dorsal rays.....	9	9	9	9
Height dorsal.....	.19	.20	.20	.215	Anal rays.....	8	9	9	8

Rutilus bicolor (Girard).

A table of measurements of specimens of this species is introduced for comparison with other forms.

MEASUREMENTS OF SPECIMENS OF RUTILUS BICOLOR FROM SHASTA RIVER, NEAR YREKA, CAL.

Length of body.....mm.	124	121	119	117	114	105	107	103	101	105
Length head.....	.265	.26	.25	.27	.27	.27	.28	.265	.27	.27
Snout to occiput.....	.20	.20	.20	.205	.21	.21	.20	.20	.21	.20
Snout to dorsal.....	.555	.52	.52	.55	.57	.56	.555	.555	.56	.56
Snout to ventral.....	.53	.54	.52	.54	.55	.55	.555	.535	.55	.56
Depth body.....	.28	.29	.28	.27	.28	.28	.29	.28	.27	.28
Depth caudal peduncle.....	.125	.125	.125	.12	.12	.12	.125	.12	.12	.125
Length snout.....	.075	.08	.075	.085	.085	.085	.08	.08	.08	.08
Length maxillary.....	.08	.08	.075	.075	.087	.075	.08	.075	.075	.08
Diameter eye.....	.055	.055	.05	.055	.055	.055	.055	.06	.055	.06
Interorbital width.....	.095	.095	.09	.09	.10	.09	.09	.09	.09	.09
Height dorsal.....	.175	.18	.18	.18	.20	.19	.19	.195	.20	.20
Height anal.....	.14	.14	.13	.14	.15	.14	.15	.13	.14	.15
Length pectoral.....	.17	.16	.17	.15	.175	.18	.17	.17	.16	.20
Length ventral.....	.14	.14	.15	.155	.14	.16	.15	.15	.15	.18
Length caudal.....	.25	.24	.23	.22	.27	.24	.25	.22	.24	.25
Scales lateral line.....	44	49	48	46	45	47	48	48	45	46
Scales above lateral line.....	11	11	10	10	10	11	11	10	11	11
Scales below lateral line.....	6	7	6	6	7	6	7	6	5	7
Scales before dorsal.....	22	27	25	25	25	25	25	25	24	24
Dorsal rays.....	8	9	9	8	8	8	8	8	8	8
Anal rays.....	8	8	7	8	7	8	8	8	8	7

Length of body.....mm.	105	89	97	90	90	76	78	90	85	81
Length head.....	.25	.275	.27	.27	.27	.27	.28	.27	.26	.285
Snout to occiput.....	.20	.205	.21	.20	.20	.21	.21	.21	.21	.21
Snout to dorsal.....	.545	.55	.55	.55	.56	.56	.57	.56	.55	.57
Snout to ventral.....	.545	.55	.55	.54	.56	.56	.56	.56	.54	.57
Depth body.....	.29	.31	.30	.29	.30	.25	.28	.30	.26	.28
Depth caudal peduncle.....	.12	.12	.12	.125	.12	.12	.13	.12	.12	.13
Length snout.....	.075	.085	.08	.08	.08	.08	.085	.08	.08	.085
Length maxillary.....	.075	.08	.075	.08	.075	.075	.08	.08	.075	.075
Diameter eye.....	.055	.06	.06	.06	.06	.06	.065	.06	.06	.065
Interorbital width.....	.08	.10	.09	.09	.09	.09	.10	.095	.085	.095
Height dorsal.....	.18	.20	.19	.19	.20	.19	.20	.20	.185	.20
Height anal.....	.13	.15	.15	.15	.16	.14	.15	.15	.135	.15
Length pectoral.....	.16	.17	.16	.20	.18	.16	.17	.165	.16	.16
Length ventral.....	.14	.16	.15	.17	.16	.15	.15	.15	.14	.15
Length caudal.....	.24	.255	.25	.27	.28	.25	.....	.24	.25	.26
Scales lateral line.....	51	46	40	45	45	47	44	49	46	46
Scales above lateral line.....	11	11	11	10	10	11	12	10	10	10
Scales below lateral line.....	6	6	6	6	7	7	6	5	6	7
Scales before dorsal.....	26	25	21	23	25	25	25	23	26	25
Dorsal rays.....	9	8	8	9	8	8	9	8	8	9
Anal rays.....	8	7	8	8	7	8	8	8	8	8

COMPARISON OF CERTAIN DISTINCTIVE CHARACTERS OF RUTILUS THALASSINUS, R. OREGONENSIS, R. COLUMBIANUS, AND R. BICOLOR.

Length head.

Species.	0.23.	0.25.	0.26.	0.27.	0.28.	0.29.	0.30.	0.31.
R. thalassinus.....	1	.....	2	10	15	18	10	3
R. oregonensis.....	.....	1	13	36	66	57	16	5
R. columbianus.....	.....	.....	.....	3	11	22	6	2
R. bicolor.....	.....	2	2	12	3	1	.....	.....

COMPARISON OF CERTAIN DISTINCTIVE CHARACTERS OF RUTILUS THALASSINUS, R. OREGONENSIS, R. COLUMBIANUS, AND R. BICOLOR—Continued.

Snout to occiput.

Species.	0.18.	0.19.	0.20.	0.21.	0.22.	0.23.	0.24.	0.25.	0.27.	0.29.
R. thalassinus.....			2	10	21	17	7	1		1
R. oregonensis.....	1	1	20	57	85	26	3		1	
R. columbianus.....			1	5	19	16	2	1		
R. bicolor.....			9	11						

Snout to dorsal.

Species.	0.52.	0.53.	0.54.	0.55.	0.56.	0.57.	0.58.	0.59.	0.60.
R. thalassinus.....			1	2	11	15	18	11	1
R. oregonensis.....		2	12	28	55	47	42	7	1
R. columbianus.....			1		8	9	15	6	5
R. bicolor.....	2			6	9	3			

Height dorsal.

Species.	0.15.	0.17.	0.18.	0.19.	0.20.	0.21.	0.22.	0.23.	0.24.	0.25.	0.26.
R. thalassinus.....			2	1	5	16	10	13	7	2	2
R. oregonensis.....	1	11	31	55	64	18	10	3			
R. columbianus.....			3	6	15	14					
R. bicolor.....			5	6	9						

Height anal.

Species.	0.13.	0.14.	0.15.	0.16.	0.17.	0.18.	0.19.	0.20.
R. thalassinus.....			1	15	6	18	12	4
R. oregonensis.....	6	33	72	51	20	6		
R. columbianus.....		1	12	13	11	6	1	
R. bicolor.....	3	7	9	1				

Length ventral.

Species.	0.13.	0.14.	0.15.	0.16.	0.17.	0.18.	0.19.	0.20.
R. thalassinus.....			3	13	8	21	10	4
R. oregonensis.....	6	15	53	67	31	16	5	
R. columbianus.....		2	3	17	9	6	6	1
R. bicolor.....		5	9	4	1	1		

Length caudal.

Species.	0.21.	0.22.	0.23.	0.24.	0.25.	0.26.	0.27.	0.28.	0.29.	0.30.	0.31.	0.32.	0.33.	0.34.
R. thalassinus.....				1	1		7	9	12	8	11	6		4
R. oregonensis.....	1	1	7	25	47	40	21	24	7	2				
R. columbianus.....				2	3	3	12	19	4	3				
R. bicolor.....		2	1	5	6	2	2	1						

COMPARISON OF CERTAIN DISTINCTIVE CHARACTERS OF RUTILUS THALASSINUS, R. OREGONENSIS, R. COLUMBIANUS, AND R. BICOLOR—Continued.

Scales lateral line.

Species.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
R. thalassinus:											
Pit River.....							6	8	5	6	7
Goose Lake.....						2	1	1	1	2	5
Muddy Creek.....					2	4	5	9	7	9	7
Total.....					2	6	12	18	13	17	19
R. oregonensis:											
Chewaucan River.....								1	1	1	1
XL Spring.....										3	2
Ana River.....										1	3
Silver Lake.....								2	4	8	8
Alkali Spring.....						1	3	6	11	11	12
Warner Lake.....						1	2	5	4	10	10
Total.....						2	5	14	21	34	36
R. columbianus:											
Warm Spring.....	1	1	7	9	7	19	11	5	4	1	1
Silvies River.....			1	2	3	3	4	5	5	4	3
Total.....	1	1	8	11	10	22	15	10	9	5	4
R. bicolor:											
Klamath Lake.....						3	1	2	2	3	2
Shasta River.....				1	6	8	10	8	11	13	6
Total.....				1	6	11	11	10	13	16	8

Species.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.
T. thalassinus:										
Pit River.....	12	7	2	2						
Goose Lake.....	1									
Muddy Creek.....	3	2	2							
Total.....	16	9	4	2						
R. oregonensis:										
Chewaucan River.....	2	4	2	5	5	2	2			1
XL Spring.....	5	4	7	11	14	6	5	1	2	
Ana River.....	2	6	8	8	9	9	8	4	1	
Silver Lake.....	8	7	7	8	9	2	2	3	2	
Alkali Spring.....	18	14	10	11	6	3	2		1	
Warner Lake.....	11	21	10	8	14	4	2	1		
Total.....	46	56	44	51	57	26	21	9	6	1
R. columbianus:										
Warm Spring.....										
Silvies River.....	1									
Total.....	1									
R. bicolor:										
Klamath Lake.....	1									
Shasta River.....	6	2	1	1						
Total.....	7	2	1	1						

Scales before dorsal.

Species.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.
R. thalassinus.....		1	8	10	16	13	9	2					
R. oregonensis.....				3	18	9	27	23	34	36	20	10	4
R. columbianus.....				3	8	9	12	5	2				
R. bicolor.....	1	1	2	2	11	2	1						

COMPARISON OF CERTAIN DISTINCTIVE CHARACTERS OF RUTILUS THALASSINUS, R. OREGONENSIS, R. COLUMBIANUS, AND R. BICOLOR—Continued.

Scales above lateral line.

Species.	10.	11.	12.	13.	14.	Species.	10.	11.	12.	13.	14.
R. thalassinus.....	5	47	6	1	.....	R. columbianus.....	.....	17	21	1	.....
R. oregonensis.....	.....	24	109	54	6	R. bicolor.....	9	10	1	.....	.....

Dorsal rays.

Species.	7.	8.	9.	Species.	7.	8.	9.
R. thalassinus.....	.....	.....	59	R. columbianus.....	.....	9	35
R. oregonensis.....	1	130	61	R. bicolor.....	.....	14	6

Anal rays.

Species.	7.	8.	9.	10.	11.	Species.	7.	8.	9.	10.	11.
R. thalassinus.....	1	46	12	.....	.....	R. columbianus.....	.....	43	1	.....	.....
R. oregonensis.....	54	135	3	1	1	R. bicolor.....	5	15	.....	.....	.....

Rutilus symmetricus (Baird & Girard).

Drew Creek, Muddy Creek, and Cottonwood Creek, in Lake County, Oreg.

This species is to be distinguished from *R. thalassinus* by its shorter head, more slender body, and more nearly horizontal lower jaw. The dorsal fin is inserted posterior to the ventral, while in *R. thalassinus* it is almost immediately above it. Individuals of the species are not known to grow so large as those of *R. thalassinus*, and while specimens of the two species may occasionally be taken together, the latter generally prefers deeper and more quiet water.

An examination of specimens from Drew Creek along with others from Putah Creek, in a distant part of the Sacramento Basin, shows that the former usually have fewer dorsal and anal rays and shorter fins. The peculiar character of the Drew Creek examples is further maintained by a comparison with individuals from Napa River and from the streams tributary to San Francisco Bay. Careful measurements^a of many specimens from the latter basin demonstrate that the fins of the males are generally much longer than those of the females, the difference being especially pronounced in the pectorals. The same sexual difference is also to be found in representatives from Drew Creek and other streams.

TABLE SHOWING COMPARATIVE LENGTH OF FINS AND NUMBER OF DORSAL AND ANAL RAYS IN SPECIMENS OF RUTILUS SYMMETRICUS FROM DIFFERENT LOCALITIES.

	Drew Creek.	Putah Creek.	Napa River.		Drew Creek.	Putah Creek.	Napa River.
Height anal:				Length pectoral—Continued.			
0.14.....	6	.....	.....	0.23.....	.....	2	10
0.15.....	6	.....	1	0.24.....	.....	1	5
0.16.....	6	2	3	Length ventral:			
0.17.....	2	3	0	0.12.....	3	.....	.....
0.18.....	.....	5	13	0.13.....	10	.....	3
0.19.....	.....	4	11	0.14.....	3	.....	7
0.20.....	.....	.....	3	0.15.....	4	9	12
0.21.....	.....	1	.....	0.16.....	.....	3	7
Length pectoral:				0.17.....	.....	3	12
0.16.....	8	.....	.....	Dorsal rays:			
0.17.....	6	.....	3	8.....	20	25	.....
0.18.....	3	5	7	9.....	.....	31	68
0.19.....	2	4	10	Anal rays:			
0.20 ^b	1	1	6	7.....	20	1	.....
0.21 ^b.....	.....	1	.....	8.....	.....	52	67
0.22.....	.....	1	2	9.....	.....	3	1

^a Snyder, J. O., Report Bureau of Fisheries 1904, p. 332.

^b The 0.20-0.21 line divides females and males.

MEASUREMENTS OF SPECIMENS OF RUTILUS SYMMETRICUS FROM DREW CREEK, LAKE COUNTY, OREG.

Length of body.....mm.	♀ 72	♀ 69	♀ 44	♀ 71	♀ 61	♂ 65	♀ 62	♀ 64	♀ 62	♂ 58
Length head.....	.255	.26	.27	.255	.26	.245	.255	.26	.26	.26
Depth caudal peduncle.....	.10	.11	.11	.11	.11	.11	.11	.105	.11	.12
Length caudal peduncle.....	.23	.235	.22	.227	.225	.24	.23	.23	.22	.23
Length snout.....	.08	.08	.03	.08	.085	.07	.085	.085	.085	.09
Interorbital width.....	.085	.095	.10	.095	.085	.085	.09	.085	.09	.085
Snout to dorsal.....	.56	.55	.57	.56	.56	.53	.57	.55	.58	.575
Snout to ventral.....	.525	.515	.54	.535	.52	.515	.54	.525	.525	.53
Height dorsal.....	.17	.17	.18	.18	.175	.195	.175	.175	.17	.18
Height anal.....	.14	.135	.15	.15	.14	.16	.14	.15	.14	.155
Length pectoral.....	.17	.16	.18	.16	.17	.185	.165	.16	.155	.17
Length ventral.....	.13	.12	.12	.125	.125	.15	.125	.13	.125	.13
Length caudal.....	.25	.24	.27	.265	.255	.25	.25	.26	.24	.26
Dorsal rays.....	8	8	8	8	8	8	8	8	8	8
Anal rays.....	7	7	7	7	7	7	7	7	7	7
Scales lateral line.....	57	59	56	57	55	61	57	58	54	56
Scales above lateral line.....	13	13	13	12	14	12	13	13	13	12
Scales before dorsal.....	38	36	38	38	34	34	37	34	38	37
Length of body.....mm.	♂ 61	♀ 58	♀ 59	♀ 55	♀ 60	♀ 55	♀ 54	♂ 52	♂ 52	♂ 52
Length head.....	.265	.26	.265	.265	.27	.265	.265	.26	.265	.26
Depth caudal peduncle.....	.12	.11	.11	.11	.105	.11	.105	.12	.11	.105
Length caudal peduncle.....	.23	.22	.24	.225	.24	.25	.24	.24	.23	.24
Length snout.....	.09	.09	.085	.08	.095	.08	.08	.075	.08	.075
Interorbital width.....	.09	.025	.09	.10	.025	.085	.09	.09	.095	.095
Snout to dorsal.....	.58	.57	.55	.575	.575	.57	.57	.55	.56	.565
Snout to ventral.....	.525	.545	.52	.53	.53	.54	.525	.525	.54	.525
Height dorsal.....	.19	.175	.185	.18	.18	.20	.18	.20	.19	.185
Height anal.....	.16	.14	.145	.15	.16	.17	.145	.165	.16	.155
Length pectoral.....	.18	.165	.175	.16	.16	.17	.16	.19	.20	.165
Length ventral.....	.15	.12	.13	.13	.125	.135	.135	.15	.145	.135
Length caudal.....	.275	.26	.27	.27	.26	.265	.25	.265	.27	.27
Dorsal rays.....	8	8	8	8	8	7	8	8	8	8
Anal rays.....	7	7	7	7	7	7	7	7	7	7
Scales lateral line.....	59	60	59	55	60	56	60	61	57	58
Scales above lateral line.....	13	15	14	13	13	14	13	14	13	14
Scales before dorsal.....	35	38	33	35	33	34	33	32	35	31

Agosia nubila carringtoni (Cope).

The examples of *Agosia* taken in the Malheur, Oregon Lake, and Upper Sacramento basins are all provisionally included under the above name. In the recognition of this form, and also of *A. klamathensis*, the size of the scales seems to be the only distinctive character that has been observed.^a The specimens from the Malheur basin have 60 to 79 scales in the lateral line, thus agreeing with examples of *A. nubila carringtoni* from the upper Snake River. Those from the Oregon Lake system have 66 to 81 scales, resembling the Klamath form, *A. klamathensis*, and differing from a recently described Lahontan species which has 56 to 77 scales.^b Examples from Goose Lake and its tributaries have 61 to 74 scales in the lateral series and are apparently indistinguishable from those of the upper Snake River and Malheur basins; but the matter is not simplified when specimens from other parts of the Sacramento basin are found to have as few as 50 scales, thus resembling *A. nubila nubila* of the Columbia River.

The *Agosia* from the Klamath basin is said to have the barbel constantly present. In specimens from the Oregon Lake basin it is usually present, although it may be absent in many cases. It will be noted in the following table that specimens from Silver Creek (Malheur basin) have barbels, while those from Warm Springs have none.

Specimens were taken in the following localities: Cottonwood Creek, Drew Creek, Muddy Creek, and Goose Lake, Oregon; Joseph Creek, Burney Creek, and Rush Creek, California; Warner Creek, Honey Creek, Chewaucan River near Paisley and at mouth, Silver Creek, in Lake County, Bridge Creek, Buck Creek, Silver Creek, in Harney County, and Warm Springs.

^a Gilbert, C. H., & Evermann, B. W., Bulletin U. S. Fish Commission, vol. xiv, 1894, p. 191-193. Evermann, B. W., & Meek, S. E., *ibid.*, vol. xvii, 1897, p. 74. Gilbert, C. H., *ibid.*, vol. xvii, 1897, p. 9.

^b Rutter, Cloudsley, Bulletin U. S. Fish Commission, vol. xxii, 1902, p. 148, *Agosia robusta*.

MEASUREMENTS OF SPECIMENS OF AGOSIA NUBILA CARRINGTONI FROM VARIOUS LOCALITIES—Con.

From Chewaucan River, Lake County, Oreg.

Length of body	74	64	60	59	57	53	54	55	51	46
Length head .....	.25	.25	.24	.26	.26	.25	.25	.27	.27	.26
Depth body .....	.21	.215	.22	.24	.25	.19	.21	.21	.225	.20
Depth caudal peduncle .....	.11	.12	.115	.125	.12	.12	.12	.12	.12	.12
Length caudal peduncle .....	.245	.25	.24	.24	.24	.26	.26	.24	.25	.27
Length snout .....	.10	.09	.08	.09	.09	.08	.08	.09	.10	.09
Diameter eye .....	.045	.05	.05	.05	.05	.055	.05	.055	.06	.06
Snout to dorsal .....	.57	.555	.55	.57	.58	.56	.57	.58	.56	.57
Snout to ventral .....	.52	.495	.53	.52	.52	.50	.50	.51	.52	.51
Height dorsal .....	.17	.175	.17	.17	.18	.18	.19	.19	.18	.19
Height anal .....	.17	.165	.16	.17	.18	.18	.17	.18	.18	.19
Length pectoral .....	.18	.18	.18	.17	.19	.21	.22	.20	.19	.19
Length ventral .....	.13	.13	.125	.13	.15	.13	.13	.14	.14	.13
Length caudal .....	.22	.22	.21	.25	.255	.25	.24	.25	.25	.24
Dorsal rays	8	8	8	8	8	8	8	8	8	8
Anal rays	8	7	7	7	7	7	7	7	7	7

From Honey Creek, Warner Lake, Oreg.

Length of body	58	55	54	54	51	50	50	47	45	43
Length head .....	.25	.255	.26	.26	.25	.26	.26	.26	.28	.27
Depth body .....	.25	.24	.24	.22	.25	.23	.22	.24	.24	.22
Depth caudal peduncle .....	.125	.135	.13	.13	.14	.14	.13	.14	.13	.14
Length caudal peduncle .....	.26	.25	.24	.25	.26	.24	.26	.25	.25	.25
Length snout .....	.085	.09	.09	.09	.08	.09	.085	.09	.09	.09
Diameter eye .....	.05	.05	.06	.05	.05	.045	.06	.055	.06	.06
Snout to dorsal .....	.58	.59	.58	.57	.57	.57	.55	.55	.58	.56
Snout to ventral .....	.52	.54	.54	.53	.51	.54	.53	.53	.54	.52
Height dorsal .....	.17	.16	.16	.18	.17	.18	.17	.18	.18	.19
Height anal .....	.16	.15	.16	.16	.16	.17	.17	.16	.17	.18
Length pectoral .....	.165	.165	.16	.18	.20	.17	.17	.21	.19	.22
Length ventral .....	.12	.12	.13	.13	.13	.13	.12	.13	.13	.15
Length caudal .....	.25	.23	.24	.24	.25	.25	.25	.25	.24	.26
Dorsal rays	8	8	8	8	8	8	8	8	8	8
Anal rays	7	7	7	7	7	7	7	7	7	7

From Burney Creek, Shasta County, Cal.

Length of body	63	62	59	58	62	53	51	58	59	55
Length head .....	.25	.25	.25	.25	.25	.25	.25	.24	.24	.25
Depth body .....	.26	.24	.25	.26	.25	.25	.26	.24	.23	.23
Depth caudal peduncle .....	.115	.11	.115	.12	.11	.12	.12	.12	.11	.12
Length caudal peduncle .....	.23	.23	.23	.225	.23	.24	.23	.25	.23	.23
Length snout .....	.09	.08	.08	.085	.09	.085	.085	.08	.08	.085
Diameter eye .....	.05	.05	.055	.05	.055	.05	.05	.05	.05	.05
Snout to dorsal .....	.58	.56	.57	.59	.59	.58	.59	.57	.57	.59
Snout to ventral .....	.52	.53	.53	.53	.53	.52	.54	.51	.51	.53
Height dorsal .....	.16	.16	.16	.17	.18	.16	.175	.18	.18	.17
Height anal .....	.16	.16	.17	.16	.17	.15	.175	.17	.16	.16
Length pectoral .....	.16	.16	.16	.16	.17	.18	.16	.16	.16	.17
Length ventral .....	.13	.13	.13	.13	.14	.13	.14	.13	.14	.12
Length caudal .....	.23	.22	.22	.22	.20	.23	.24	.24	.22	.22
Dorsal rays	8	8	8	8	8	7	8	8	8	7
Anal rays	7	7	7	7	7	7	7	7	7	7

Salmo clarkii Richardson.

Goose Lake; Pitt River, Alturas; Burney Creek; Cottonwood Creek; Drew Creek; Warner Creek; Honey Creek; Chewaucan River; Paisley; Chewaucan River near mouth; Silver Creek, Buck Creek, Bridge Creek, Silver Creek, Harney County; Silvies River.

The trout of the region under study are generally brightly colored and profusely spotted. Round, sharply outlined spots are present on the head and along the upper parts of the body, growing less regular in outline posteriorly. Along the sides are 2 or 3 rows of large, oval spots underlying the smaller, darker ones. A row along the lateral line is always present except in very large individuals, where sometimes none but the smaller spots persist. The more brightly marked individuals generally have a red dash on the mandible. In the same stream, however, specimens may be found having the red of the mandible scarcely discernible or entirely absent. The dorsal fin has 4 or 5 rows of black spots, the caudal is always spotted, while the other fins and the ventral surface are immaculate.

There are some pronounced variations of a local nature. Examples from the region of Silver Lake have the small black spots usually absent on the head and sparsely scattered along the back, becoming somewhat larger and more plentiful posteriorly, but not extending on the sides. The oval spots along the lateral line are very large, extending upward well toward the back. Specimens from Cottonwood Creek have few spots on the head and anterior parts of body, but are otherwise colored after the usual pattern. The number of scales in the lateral series is as follows: Chewaucan River, 147 to 151; Honey Creek, 154 to 178; Buck Creek, 146 to 160; Cottonwood Creek, 153 to 168; Silver Creek, 156 to 174; the data based on 10 specimens from each locality.

There is some question as to whether the trout of the region is indigenous, testimony on the point being frequently conflicting. For example, the writer was informed by certain old residents of the Warner Lake region that no native trout was found there, the streams having been artificially stocked, while other residents felt just as certain that although fishes were introduced from other localities, native trout had always been plentiful.

***Cottus gulosus* (Girard).**

Drew Creek, Lake County, Oreg. (1 example, dorsal VIII, 19, anal 14); Pitt River, near Canby (1 example, dorsal VII, 19, anal 13). Both have a prickly area beneath pectoral, about as long as the snout; dorsals joined, the membrane extending upward on first ray a distance equal to diameter of pupil; teeth on vomer, none on palatines.

***Cottus punctulatus* (Gill).**

About 30 specimens, measuring from 35 to 90 mm., were collected in Silver Creek, Harney County. The lateral line extends almost as far posteriorly as the base of soft dorsal, in some examples being quite complete. The body is entirely smooth in every case. Of 20 specimens examined 13 have the dorsals separate, the space between them sometimes being nearly as wide as that between two rays; 7 have the fins joined at their bases, the membrane, however, not extending upward on the first ray. Five individuals have 3 preopercular spines, while 15 have 4. In all cases the fourth spine is very minute. In 1 example with 3 spines the lowest is barely visible. The spines are sharper and more prominent on smaller individuals. All have narrow bands of palatine teeth.

In many specimens the fourth ventral ray is small, occasionally being difficult to find. In one individual it is entirely absent. The apparent variability of this character, together with the fact that the specimens agree closely with the description of *Uranidea bendirei* (Bean)^a has led to the supposition that the latter may belong to the genus *Cottus*, being nothing more than an example of *C. punctulatus* in which but 3 of the ventral rays are well developed.^b

This species is very similar to *C. perplexus*, one of a series of 3 closely related forms extending southward in the coastwise rivers, at least to the Sacramento. They are *C. perplexus* of the Columbia, *C. klamathensis* of the Klamath, and *C. gulosus* of the Sacramento. Nothing is known of the distribution of these species in other basins than those mentioned.

TABLE SHOWING NUMBER OF SPINES OR RAYS IN THE FINS OF 20 SPECIMENS OF *COTTUS PUNCTULATUS* FROM SILVER CREEK, HARNEY COUNTY, OREG.

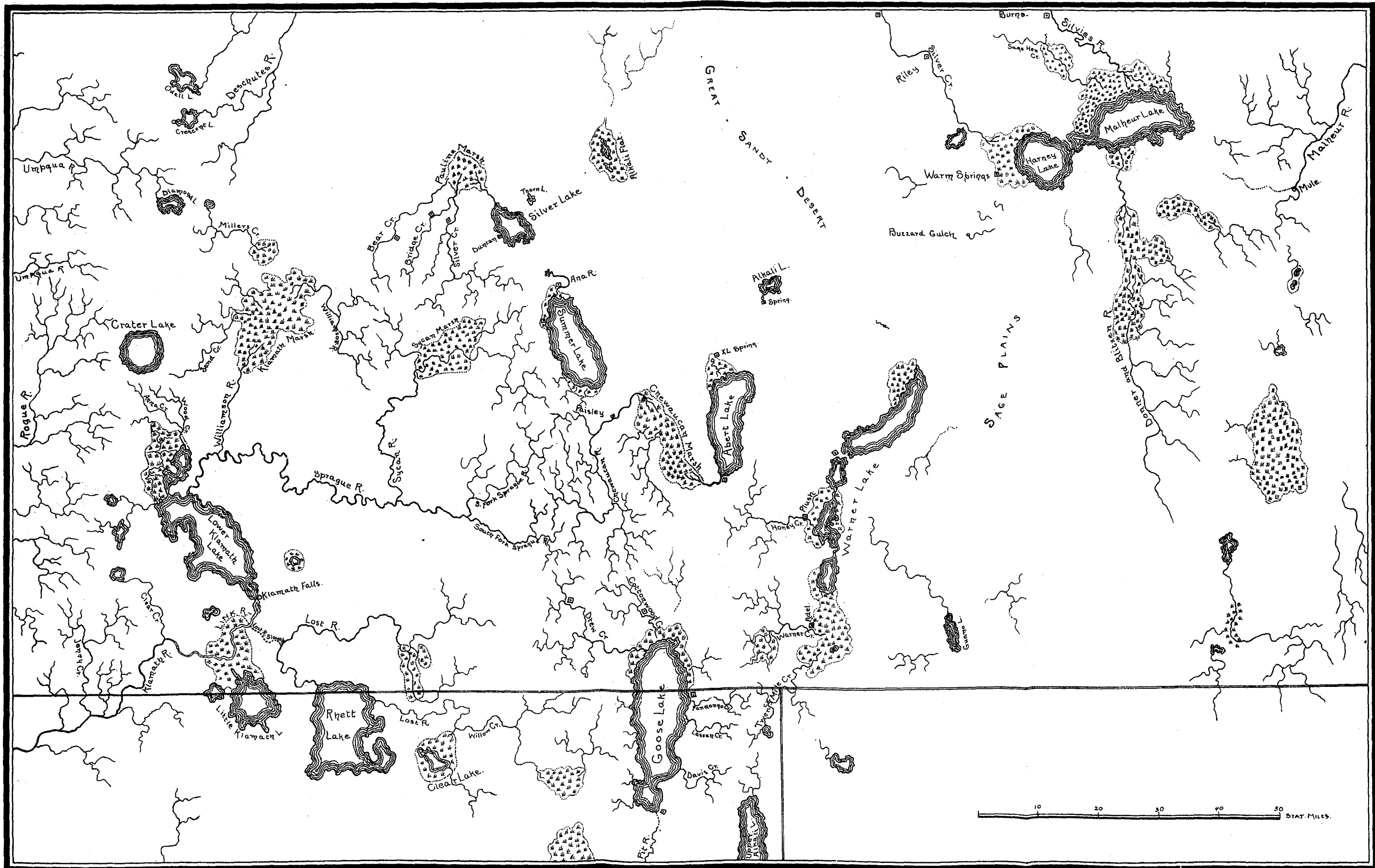
Spines or rays.	Specimens showing character.	Spines or rays.	Specimens showing character.
Spinous dorsal:		Anal—Continued.	
7.....	12	13.....	3
8.....	13	14.....	1
Soft dorsal:		Pectoral:	
15.....	8	13.....	1
16.....	15	14.....	5
17.....	2	15.....	14
Anal:		16.....	5
11.....	4		
12.....	17		

^a Bean, T. H., Proc. U. S. National Museum, 1881, p. 27. *Potamocottus bendirei*, Rattlesnake Creek, near Camp Harney, Oreg.

^b Writing in this connection Mr. B. A. Bean says: "I have examined the type of *Potamocottus bendirei* and find that the ventral of the right side has 1, 3 +. The + is represented by a rudimentary ray showing through the skin, especially at the base. The left ventral has 1, 3. I find no trace of a rudimentary ray."

MEASUREMENTS OF SPECIMENS OF *COTTUS PUNCTULATUS* FROM SILVER CREEK, HARNEY COUNTY,
OREG.

Length body.....mm.	84	73	67	65	57	57	57	56	53	50
Length head.....	.35	.34	.33	.35	.34	.36	.355	.335	.35	.345
Depth body.....	.255	.235	.23	.23	.25	.245	.25	.24	.24	.24
Snout to dorsal.....	.38	.38	.38	.385	.38	.385	.39	.36	.37	.40
Snout to anal.....	.575	.60	.61	.59	.59	.59	.61	.58	.62	.61
Depth caudal peduncle.....	.085	.09	.09	.085	.085	.09	.085	.09	.09	.10
Length caudal peduncle.....	.15	.165	.15	.185	.15	.16	.14	.14	.15	.145
Length snout.....	.12	.095	.105	.11	.11	.105	.11	.12	.11	.11
Length maxillary.....	.175	.17	.165	.165	.15	.145	.15	.15	.15	.15
Diameter eye.....	.06	.075	.075	.075	.08	.085	.085	.08	.10	.08
Interorbital width.....	.06	.07	.05	.06	.06	.05	.05	.055	.05	.05
Depth head.....	.215	.215	.21	.21	.22	.225	.21	.22	.215	.21
Height spinous dorsal.....	.08	.085	.11	.09	.09	.10	.10	.095	.11	.10
Height soft dorsal.....	.13	.15	.15	.15	.14	.14	.15	.15	.14	.155
Height anal.....	.115	.14	.13	.15	.14	.135	.13	.13	.11	.14
Length pectoral.....	.26	.23	.29	.21	.28	.27	.26	.285	.26	.28
Length ventral.....	.16	.17	.14	.20	.19	.21	.15	.17	.16	.20
Length caudal.....	.23	.25	.245	.25	.24	.255	.225	.23	.23	.26
Number dorsal spines.....	8	8	8	7	8	7	7	8	8	7
Number dorsal rays.....	16	16	16	16	16	17	15	15	15	15
Number anal rays.....	12	12	13	11	12	12	12	12	12	11
Number pectoral rays.....	15	14	15	15	15	15	16	15	15	16



MAP OF THE LAKE REGION OF SOUTHEASTERN OREGON.