

FIG. 3.—REDTHROAT TROUT; CUTTHROAT TROUT; BLACKSPOTTED TROUT.

FISHES OF THE YELLOWSTONE NATIONAL PARK.¹

With Description of the Park Waters and Notes on Fishing.

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INTRODUCTION.

The fishes of the Yellowstone National Park constitute one of the most interesting and noteworthy attractions of that wonderland. The special appeal which the fishes make to the park visitors comes partly from the beauty, gameness, and variety of the fishes, and partly from the inspiring environment in which fishing may be done. Among the wild, backboned animals in the park the fishes are the only ones whose killing is allowed and encouraged by the park authorities. The greatly increased number of visitors to the park in recent years has brought the fishes into unusual prominence and necessitates renewed efforts to maintain the supply by means of artificial propagation and protection.

It is hoped that this little document relating to fishes and fishing may serve a useful purpose beyond merely furnishing information for anglers. Increased knowledge of the park fishes should have the effect of increasing the public appreciation of the extraordinary opportunity for healthful recreation that the park affords, and at

¹ Appendix III to the Report of the U. S. Commissioner of Fisheries for 1921. B. F. Doc. 904.

the same time should discourage unnecessary destruction of fish life and develop a spirit of cooperation with the Government agencies that are striving to maintain the fish supply.

The present report is a revised and amplified edition of the one published by the Bureau of Fisheries in 1915.² The exhaustion of the supply of that document and the continued public demand for information on this subject, together with the availability of new data on the fishes, make this publication desirable.

INDIGENOUS FISHES.

The native fish life of the park was profoundly affected by the great lava flow which occurred over a large part of the park in Pliocene times. Whatever fishes were then present were necessarily killed, and, with the reestablishment of the watercourses after the cooling of the surface of the lava, fishes in outside waters were to a great extent prevented from reaching the lofty plateau, which comprises most of the area of the park, by the high and steep falls over which the streams leave the lava beds.

It thus follows that the native fish fauna of the park is very limited. Except in Yellowstone River and its tributaries practically no fishes occur naturally above the falls, and in the extensive basin of that river the few species that do exist gained access to the region above the falls because of the imperfect watershed separating the Yellowstone and the Snake River basins.

The original comparative barrenness of the park in fish life was due entirely to topographical conditions. The physical character of the waters is, in general, highly favorable for fishes, and an examination of the streams and lakes of the park by Prof. Forbes in 1890³ disclosed the presence in certain barren waters of an abundant insect and crustacean food well suited for sustaining certain kinds of fishes. The theory that would account for the original absence of fishes in particular park waters as due to the high temperature and chemical constituents of the great volumes of water flowing from the geysers and hot springs is entirely untenable for several reasons: First, native trout abound and flourish in various streams and lakes in close proximity to the outpourings of geysers and hot springs, and, secondly, both native and exotic trouts have been successfully planted in barren waters receiving the discharge of geysers and hot springs.

The fishes of natural occurrence in the park represent 10 species, as follows: Longnose sucker, rosieside sucker, chub, silverside minnow, longnose dace, dusky dace, Rocky Mountain whitefish, red-throat trout, Montana grayling, and blob. Of these only the trout and the grayling have generally been recognized as game fishes, although the whitefish might properly be so considered. While these were very abundant in certain waters, the annually increasing numbers of angler-tourists in the park made it desirable to augment the natural supply of game fishes by the introduction into barren waters of selected species of other game fishes.

² The fishes of the Yellowstone National Park. By William C. Kendall. Bureau of Fisheries Document No. 818. 1915.

³ A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyo., and the Flathead region of Montana. By S. A. Forbes. Bulletin U. S. Fish Commission, vol. XI, for 1891, p. 207-253, pl. XXXVII-XLII. 1893.

INTRODUCED FISHES.

In immediate response to the outcome of investigations to determine the suitability of fishless park waters for game fishes, the Bureau of Fisheries in 1889 inaugurated the planting of selected species in predetermined waters, and this work has been continued to the present time. The one species of native trout was soon supplemented by the very successful introduction of five other trouts, and in a short time the park became an angler's paradise, affording better and more varied trout fishing than could be found anywhere else in the country, if not in the world.

The nonindigenous trouts that have been introduced into park waters are the rainbow, Loch Leven, brown, lake, and eastern brook trouts, all of which have become firmly established. The distribution of the native redbthroat trout has been greatly extended into previously barren waters. The introduction of two other game fishes has been attempted, but apparently without positive results. One of these is the landlocked salmon (*Salmo sebago*), of which 7,000 fry were planted in Yellowstone Lake and 2,000 in Duck Lake in 1908, but not a vestige of these plants has ever been seen. The other species is the largemouth black bass (*Micropterus salmoides*), of which 500 fingerlings were planted in "lakes in Yellowstone National Park," according to the indefinite official record. These lakes are thought to have been Feather Lake and Goose Lake, in the Lower Geyser Basin. An earlier plant of 250 black bass was made in the Gibbon River, in 1893, but it is not known which of the two species of black bass composed this plant. There is no evidence of the survival of black bass anywhere in the park, and this may be regarded as a fortunate circumstance. In our opinion, there should be no further attempts to establish black bass in the park, as they do not harmonize with the trouts, and their predatory habits make them unsafe species to introduce among the soft-finned fishes which, with two minor exceptions, constitute the local fauna. The only other species of fish that has been introduced into park waters is the yellow perch, whose planting was unofficial and is apparently to be ascribed to the unauthorized act of a private individual. This fish now abounds in certain lakes in the Lower Geyser Basin.

FISH CULTURE IN THE PARK.

The hundreds of thousands of visitors who have already been in the park and the millions of others who are destined to visit it owe to fish culture and fish acclimatization a debt whose value can hardly be estimated. Within a few years after experienced fish-culturists began to give attention to needs of the park the hitherto fishless waters began to produce desirable game fish in abundance, and this has continued up to the present time. The early work, as well as the efforts of the fish-culturists of late, has been directed mostly to maintaining the supply of fishes already established.

For many years the Bureau of Fisheries has conducted fish-hatching operations in the park. The first hatchery was located at the Thumb of Yellowstone Lake; the principal hatchery now is on the lake shore near the Lake Hotel. In 1921 a permanent hatchery was erected on Soda Butte Creek, which had been the site of a field

hatchery for a number of years. The hatcheries are maintained, primarily, for the purpose of keeping up the supply of redbthroat trout.

The redbthroat trout is the only local trout which spawns during the season when the park is easily accessible and when it is possible without unwarranted effort and expense to obtain a supply of running water for hatching purposes. The adult fish begin to ascend the streams that are put into flood by the melting snows and they continue to run until the latter part of July. Some fish, however, doubtless spawn also in Yellowstone Lake and other large lakes.

The principal supply of eggs for hatching purposes comes from creeks on the eastern side of Yellowstone Lake. Into these creeks the trout run at spawning time and across them the fish-culturists erect intercepting barricades or racks. These racks are provided with narrow passageways that lead into traps in which the fish congregate. The trout are transferred to live cars, where they are held pending the ripening of their eggs. At the proper time the eggs are stripped from the fish and held at improvised field hatcheries pending shipment to the central station. The adult fish are released alive.

The questions naturally arise, Why not let the trout run up the creeks and spawn naturally? Why not permit the eggs to hatch in the manner intended by nature and let the young remain for awhile in the water where they were born and then run back to the lake at the proper time? These questions, which will, no doubt, be asked by many thoughtful park visitors, afford an opportunity to indicate one way in which it is possible to improve on nature and to point out why in the Yellowstone National Park, as elsewhere, it is desirable or necessary for the fish-culturist to go to nature's assistance.

The streams in which the redbthroat trout spawn are usually much swollen at the time of the run. Pushing upstream energetically, the fish often go far from the lake and deposit their spawn during high water in places which later, with the complete melting of the snow, may become exposed to the air. Heavy losses of eggs occur in this way. If conditions are favorable for the laying and hatching of the eggs in streams that may be raging torrents in spring and early summer, it frequently happens that by July and August such streams become almost dry, are cut off from the lake and reduced to disconnected pools, and the young fish necessarily perish sooner or later.

The adverse conditions occurring in nature make it probable that at best only 5 or 10 per cent of the eggs produce fry that reach the feeding stage at which the hatchery turns the fish loose. On the other hand, fully 90 per cent of the eggs taken by artificial methods are safely incubated and yield fry that are liberated in selected places—along the lake shore or near the mouths of open creeks where there is a good prospect of survival.

There are still a few fishless waters in the park, but each season additional lakes and streams are stocked and ultimately all waters suitable for fish will have received attention. In 1919 Mallard Lake, a beautiful mountain gem not far from Old Faithful Inn, was found to be fishless and was planted with eastern brook trout. This seems destined to become a favorite angler's resort. Other waters

recently stocked with redthroat trout for the first time are various lakes in the southwest section of the park.

PRINCIPAL FISHING WATERS.

The fishing season in the park does not ordinarily begin before July, by which time, according to one of the angling writers hereafter cited, "the plethora of water has disappeared and the streams flow swift, clear, and cold. At this season of the year trout fishing is at its best."

Information regarding the fishing in various localities may be found in the annual reports of the superintendent of the park, particularly the report for 1897, and in the annual circulars of information issued by the National Park Service. The following publications pertaining wholly or partly to fishing in the park may be consulted for detailed or special data:

Fish in the National Park and tributaries of Snake River. By J. E. Curtis. Bulletin U. S. Fish Commission, vol. iv, for 1884, p. 335-336.

A reconnaissance of the streams and lakes of the Yellowstone National Park, Wyo., in the interest of the United States Fish Commission. By David Starr Jordan. Bulletin U. S. Fish Commission, vol. ix, for 1899, p. 41-63, with map and many plates.

A reconnaissance of the streams and lakes of western Montana and northwestern Wyoming. By Barton W. Evermann. Bulletin U. S. Fish Commission, vol. xi, for 1891, p. 3-60, with plates and maps.

A woman's trout fishing in Yellowstone Park. By Mary Trowbridge Townsend. *Outing*, vol. xxx, no. 2, May, 1897, p. 163-164.

A list of the fishes of Montana, with notes on the game fishes. By James A. Henshall. Bulletin of the University of Montana, No. 34, Biological series no. 11. 1906.

Wyoming summer fishing and the Yellowstone Park. By Ralph E. Clark. *Outing*, vol. lii, no. 4, July, 1908, p. 508-511.

Fly fishing in wonderland. By Klahowya (O. P. Barnes). 56 p. 1910.

The Yellowstone National Park. By Hiram Martin Chittenden. *Fishes*, p. 210-212. 1915.

The following annotated list of park fishing waters is based partly on information kindly furnished by Col. L. M. Brett, United States Army, formerly acting superintendent of the park; partly on notes taken from the works before cited; partly on observations by A. H. Dinsmore, of the Bureau of Fisheries, in 1919 and 1920; and partly on the senior author's observations in 1914 and 1919.

YELLOWSTONE LAKE.

Yellowstone Lake is one of the most beautiful lakes in the world. It and some of the tributary creeks abound with the native or redthroat trout. There appear to be no other game species in the lake. Landlocked salmon planted in 1908 and 1909 have not been seen since. The rainbow trout, planted at the same time in some of the affluents, have shown no evidence of establishment, excepting on the statement of Mr. Croley, a hotel fisherman for 12 years, to the effect that he had seen only one fish other than the blackspotted trout. This fish "looked different and had a broad side band" and was thought to be a rainbow.

In 1919 the senior author found the water of Flat Mountain Arm, though shallow, distinctly colder than in the lake, evidently owing to the inflow of springs and the creek at its head. Near the head of

this arm he found the largest redthroat trout met with in the park, fine, clean, trim, vigorous fellows, not like those observed elsewhere.

All suitable tributary creeks contain redthroat trout. The most notable creeks on the east side of the lake, enumerated from north to south, are: Pelican, Cub, Clear, Columbine, and Beaverdam Creeks. All contain native trout. Sylvan Lake, which discharges through Clear Creek in times of high water, contains a few trout. It is a beautiful mountain lake, clear and moderately cold. Ralph E. Clark said of Pelican Creek:

One mile east of Yellowstone River outlet is Pelican stream, which rises in the cold snows of the mountains and empties its waters into the lake. Here you catch quantities of uncontaminated trout, large, beautiful, fat, and gamy, as free from worms as the fresh cold waters they swim in are free from pollution.

On the west side of the lake, named in the same order, are Bridge Creek, entering Bridge Bay; Arnica Creek, an affluent of the northwest side of the Thumb; Solution Creek, a small, narrow stream, with lava bottom and grassy banks bordered with willows, the outlet of Riddle Lake, sometimes going dry. Riddle Lake, so called because of the former mystery of its outlet, is a clear pond of roundish outline, about $1\frac{1}{2}$ miles in diameter, about whose outlet are numerous lily pads and other plants. Its shores are shallow, and its bottom is chiefly of lava gravel. The temperature is about 50° F. Trout are numerous.

Near West Thumb is another small, deep-set lake, named Duck Lake, which has no outlet. It formerly contained no trout, but redthroat trout and landlocked salmon were planted in it. Redthroat trout now appear to be abundant, but landlocked salmon have never been observed. However, the senior author found good-sized Loch Leven trout common in 1919.

Grouse and Chipmunk Creeks enter opposite sides of the southern end of the South Arm. Besides these there are numerous unnamed creeks, some of which go dry in summer. One, however, flowing into Flat Mountain Arm, was found by the senior author on July 17, 1919, to contain more water than many of the other creeks around the lake, probably never going dry. A creek that will flow as did this one during a period of drought, with the lake level one-third lower than ever before known, must be permanent. The creek, unnamed on the available maps, clear and cold, with beautiful green, grassy banks with trees here and there, meanders to an extraordinary degree through a broad, open valley, flowing over a gravelly bed, now with riffles, now with deep holes, making a charming trout brook. At its mouth is a flat much frequented by elk. This creek was found to contain numerous trout of season's hatch; some 3 to 5 inches long of the previous season; and older fish up to 12 inches in length.

YELLOWSTONE RIVER ABOVE THE LAKE.

Above the lake the Yellowstone River winds through marshy meadows, between wooded hills, behind which are the rugged peaks of high volcanic mountains. The current is sluggish, and, according to Mr. Dinsmore, the fall is so slight that it would be a comparatively easy matter in times of ordinary flow to travel by canoe the entire distance from the lake to the southern boundary of the park.

The principal tributaries of this portion of the river from the lake southward on the left are Cabin, Trappers, Mountain, Cliff, Escarpment, and Thoroughfare Creeks. On the other side in the same direction are Badger, Phlox, and Lynx Creeks. Good fishing is found in the river and in the creeks high up where they meander from the mountains.

YELLOWSTONE RIVER BELOW THE LAKE.

Below the lake to the upper falls there is no great descent, and the river flows for about 15 miles with a quiet current. Here its banks are bordered with low hills, some of them wooded, others forming open pastures. On the right side going northward the principal creeks are Cotton Grass and Sour Creeks, which unite to discharge their waters into the Yellowstone not far from Alum Creek on the opposite side of the river. On the west side of the river is Trout Creek, which is a clear stream, with grassy banks and gravelly bottom. It has a summer temperature of about 58° F. and is a good trout stream.

Alum Creek is a clear stream about 8 feet wide and 1 or 2 feet deep, rising in the Continental Divide opposite the head of Nez Perce Creek and flowing eastward through the grassy fields of Hayden Valley. Its bed contains much white alkali from the hot springs above, and there is a perceptible alkaline taste to the water, which has a temperature of about 60° F. in summer. In its upper course it has some hot tributaries. One of these is Violet Creek, with a number of hot springs and mudholes. Still another fork is charged with alum, but a third branch is said to be one of the best redthroat trout streams in the park.

YELLOWSTONE RIVER AND BRANCHES BELOW THE FALLS.

About 15 miles below the lake the river plunges into a deep canyon over two vertical falls 109 feet and 308 feet in height. This remarkable canyon is more than 20 miles long, with nearly perpendicular walls 800 to 1,100 feet in height. The current below the falls is swift until the river leaves the park.

The most important eastern tributary of the Yellowstone River is Lamar River. It is a large stream, sometimes referred to as the East Fork of the Yellowstone. It joins the Yellowstone not far below Butte Junction. There are many tributary creeks of various sizes, particularly on the north and northeast side. The principal of these are: Miller, Calfee, Cache, Soda Butte, joined by Amphitheater and Pebble Creeks; Slough Creek, the largest branch of which is Buffalo Creek. On the west side the creeks are smaller than most of those of the other side, the principal ones being Cold, Willow, and Timothy, near the upper course. Chalcedony Creek is farther down, and all but Cold Creek are in rather deep ravines near the river. Cascade Creek is a clear brook a few feet wide which enters the Yellowstone between the falls. The high, nearly vertical "Crystal Falls" (129 feet) is near the mouth of the stream and, of course, prevents the ascent of fishes. Redthroat trout were once planted above the falls.

Lamar River and most of its tributaries are inhabited by native trout. The junction of Yellowstone and Lamar Rivers is noted for fine fishing. Soda Butte is well stocked up to near its head, where a waterfall keeps the fish back. According to Mr. Dinsmore, Fish Lake, where the Bureau of Fisheries has for a number of years collected native trout eggs and where in 1921 a small hatchery was established, is a very remarkable water, with an area of only 75 acres. It contains a dense growth of vegetation, which in the late summer blossoms near the surface. After sundown the fish, which average about 2 pounds each, will come up out of the weeds and take gray-hackle flies almost as fast as they can be placed upon the water.

Slough Creek is said to be well stocked with trout up to the lakes at its head, only one of which, Lake Abundance, in Montana, contains trout.

Hellroaring Creek, which joins the Yellowstone from the north below the mouth of Lamar River, is abundantly supplied with native trout in its lower part.

The tributaries of the west side of the Yellowstone worthy of mention all enter this river below the Grand Canyon. The uppermost is Antelope Creek, which joins the river not far from the mouth of Tower Creek. It contains native trout. Tower Creek, for almost its whole length, is hidden in dense forests. Its current is swift, and it is perhaps the coldest stream in the park, the summer temperature being about 45° F. Carnelian Creek is one of its upper branches. About one-fourth mile from its mouth the creek forms a singularly picturesque, quite vertical fall of 132 feet, which is surrounded by lofty towers of volcanic conglomerate. Below the falls is a deep canyon, where the stream is about 10 feet wide and shallow. The waters above the falls were barren previous to the introduction of eastern brook, rainbow, and redbthroat trouts.

The lower tributaries of the Yellowstone in the park are Geode Creek, Blacktail Deer Creek, and Gardiner River. Geode Creek is small. Rainbow trout planted in it in 1909 have not since been observed. Blacktail Deer Creek is a clear, rather cold (55° F.) stream running largely through open pastures, with willows along its course. It has no canyons or falls. Its bottom is of laval gravel and rocks, with some water weeds. In summer it is usually 5 or 6 feet wide by 1 or 2 feet deep and is well stocked with native redbthroat trout and rainbow trout. Eastern brook trout were planted in 1912, 1913, and 1914.

GARDINER RIVER AND ITS BRANCHES.

In the park Gardiner River may be said to be formed by two branches, designated on the maps as Lava Creek and Gardiner River, but the latter is sometimes referred to as the "Middle Fork."

Lava Creek is a clear, mountain stream in its upper course, flowing through evergreen forests on the north side of the mountain range. The stream is normally about 10 feet wide and 1 or 2 feet deep. Toward its mouth it cuts its way into a broad, flat shelf of lava, forming two falls about one-tenth of a mile apart. The upper falls, called Undine Falls, are vertical for about 30 feet, with two additional leaps of about 20 and 10 feet. The lower falls are vertical and about 50

feet high. Below these falls the stream flows through a highly picturesque canyon, joining Gardiner River above Mammoth Hot Springs.

Lupine Creek is a small tributary of Lava Creek, entering it above the falls. Near its junction with Lava Creek this creek has a cascade about 100 feet high called Wraith Falls. Notwithstanding the barrier offered by the falls, Dr. Jordan said that it was reported on good authority that small trout had been taken in Lava Creek above the falls. His attention was called to a possible means of access from Blacktail Deer Creek to Lava Creek in times of high water. In Lava and Lupine Creeks the only trout is the native redthroat. Below the falls native redthroat and Loch Leven trouts occur in Lava Creek.

Gardiner River, or Middle Fork, rises on the east slope of the Gallatin Mountains in the northwestern part of the park. It flows eastward, southward, then abruptly northward, bending around Bunsen Peak and forming a deep canyon, toward the head of which are Osprey Falls. Gardiner Canyon is some 800 to 1,000 feet deep, with vertical walls of lava, basalt, etc., and in grandeur is surpassed only by the Grand Canyon of the Yellowstone. Osprey Falls are about 150 feet high and nearly vertical. The principal headwaters of the Gardiner are Fawn, Panther, and Indian Creeks, which, with their branches, unite near Seven-mile Bridge. Winter and Straight Creeks unite into one stream and join Obsidian Creek to form Willow Park Creek, which also joins the Middle Fork near Seven-mile Bridge. Obsidian Creek originates in or near Twin Lakes, according to Jordan, and some of its branches in other small lakes, notably Lake of the Woods, which flows into Beaver Lake. At first the creek is very small, and its course for 2 or 3 miles is full of hot springs, solfataras, boiling mudholes, and various similar heated areas. Lower down cold springs enter the stream, and at Beaver Lake the water is clear and cold. Beaver Lake is a shallow, grassy pond, about a mile long, formed in the stream by the beavers. Eastern brook trout are reported as plentiful, but the rainbow trout, also planted there, have never been heard of. Below this lake the creek receives the clear, cold waters of Winter Creek and Straight Creek.

Winter Creek is a large stream which heads in Christmas Tree Park at the foot of Mount Holmes. Straight Creek flows through dense woods, open grass-grown meadows, and narrow canyons. It is a very pretty stream, with many riffles and deep holes behind prostrate logs, and wide, shallow, gravelly reaches. In the course of Straight Creek is Grizzly Lake. It is a gem, with steep, wooded banks, clear, cold water, with shelving bottom and quite deep center. After their junction the waters of these creeks, under the name of Willow Park Creek, flow through Willow Park, a large mountain meadow, at the foot of which it meets the waters of Indian Creek and the others which have been mentioned, forming the Middle Fork of Gardiner River. Indian Creek is a clear, cold stream similar to the Gardiner.

All of the aforementioned creeks, previously barren, now teem with eastern brook trout, the only trout occurring in them. Jordan reported that Obsidian Creek with Winter Creek was one of the best eastern brook trout streams in the park. Its summer temperature is about 50° F. Its bottom is composed of laval gravel, lined with

grass, algæ, and other water plants in which small crustaceans abound. The senior author observed that Straight Creek teemed with brook trout of all sizes up to 12 inches long. Hundreds, mostly about 6 or 7 inches long, were observed. The fish were the most beautifully colored seen in the park. Males only 3 or 4 inches long showed the brilliant coloration of the fully developed fish in breeding season. Females 6 inches in length and upward had well-developed eggs. Grizzly Lake contains very large brook trout.

Above Osprey Falls the Gardiner is a clear, cold stream, having a temperature of about 50° F. The bottom is composed of numerous stones and bowlders, and there are many deep holes. This previously barren stretch of water now contains the introduced eastern brook, Loch Leven, brown, and rainbow trouts. About halfway down from the falls to the junction with the East Fork Glen Creek joins the river on the left side. Glen Creek has been called the West Fork of the Gardiner. It rises in the Sepulcher Mountain region and flows southeast to Swan Lake outlet, thence northeast, joining the Gardiner at the foot of the canyon. It is a small stream, only 5 or 6 feet wide and 1 or 2 deep, which runs mostly through open meadows, with gravelly and grassy bottom. Its waters are very cold, about 48° F. in summer. Glen Creek has a waterfall some 70 feet high, known as Rustic Falls, at the Golden Gate near the base of Bunsen Peak. A small lake in the vicinity of Sepulcher Mountain was stocked with eastern brook trout in 1912, but the results are as yet uncertain. Below the falls the deep canyon is so choked with bowlders and talus that fish can not ascend it.

Swan Lake is a small, roundish pond about a half mile long, with a bottom of crumbled lava. While the water near shore is very shallow, the depth at the center seems considerable. The water is clear and cold and abounds with insects and crustaceans.

Eastern brook trout abound in the creek above the falls, but those planted in Swan Lake, it is said, seem to have left the lake for the small streams, as they have not been found in the lake. Near the junction of the Gardiner with the East Branch the stream is rough and boulder-strewn, but of a good volume, much like the Gibbon in character. The lower course of the Gardiner below the falls is well stocked with native redbthroat trout and introduced eastern, rainbow, and Loch Leven trouts. Indigenous whitefish, suckers, and minnows also occur.

Below Mammoth Hot Springs the scalding waters of those springs discharge through "Hot River" into the Gardiner. It is said that in winter native trout are especially abundant at the mouth of the stream.

GIBBON RIVER ABOVE FALLS, GREBE AND RAINBOW LAKES.

Gibbon River issues from Grebe Lake, which is located in a marshy area in the highlands. Grebe Lake is about a mile long and is one of the most attractive small lakes in the park. It was stocked with redbthroat trout in 1912, but the results are not definitely known.

Approximately a mile or a mile and a half below Grebe Lake is another small lake visited by the senior author and Mr. Dinsmore in 1919. They proposed to name it Rainbow Lake. The lake drains a very extensive marshy area whose arms extend far into the hills, with greatly meandering, clear, cold streams. The lake has a gravelly

bottom, gently sloping shores, and a deep center. At several points are extensive beds of yellow water lilies, and the mouth of the large main affluent is covered by the same plants. Large rainbows frequent the lake and the effluent, and smaller fish abound in all the minor streams.

Gibbon River emerges from the southeast corner of Rainbow Lake. About a mile below the lake are hot mineral springs which discharge into the river, and for a mile or more the water is warm, distinctly impregnated, and fishless. Then cold springs entering the river from the hillsides render the stream again inhabitable by trout, which occur all the way to the Upper Falls of the Gibbon. These falls are too high to permit of the passage of fish upward.

From Virginia Cascade to Norris Station the river, with Solfatarata Creek, affords fine fishing for eastern brook trout. Mr. Dinsmore reports that on July 26, 1919, he had wonderful fishing for this species and no other species was observed in this section of the river, although rainbows occur above Virginia Cascade and in the Gibbon below Norris Station.

Below the falls Canyon Creek, entering the river from the eastward, contains redthroat trout. From the falls to the junction of the Gibbon with the Madison the fish are the same as those occurring in the Madison and below the cascades of the Firehole.

MADISON RIVER AND ITS BRANCHES, FIREHOLE RIVER, NEZ PERCE CREEK, LITTLE FIREHOLE RIVER, ETC.

Native redthroat trout, whitefish, and grayling are abundant, as are also the introduced Loch Leven and brown trouts in the upper Madison.

The Firehole River, about twice the size of the Gibbon River, joins it from the south. This stream heads just west of Shoshone Lake, separated from it and from the head of Bechler River by a relatively low divide, according to Gannett. It flows through Madison Lake, which is nearly dry in summer, but below it is reinforced by the fine, clear Spring Creek from the east. In its upper course the Firehole, like Spring Creek, is a clear and very cold stream, flowing through dense woods, with narrow marshy valleys alternating with small canyons. Keppler's Cascades, above the Upper Geyser Basin, is a series of very picturesque falls probably impassable to trout. Along the Firehole are the most noteworthy of the geyser basins, and a great volume of hot water is poured into it without, however, rendering its waters at any point really warm or unfit for trout. The principal tributaries are Iron Creek and Little Firehole River, in the Upper Geyser Basin. At the lower basin the Firehole receives the waters of Sentinel Creek, Fairy Creek, and the larger and more important Nez Perce Creek.

Nez Perce Creek comes in from the east, is nearly half as large as the Firehole, and is similar in character and temperature of the water. It is fed by numerous short streams, none of them hot and most of them confined to a narrow canyon.

Madison River.—The name Madison is used only for the river below the junction of its chief tributaries, the Firehole and Gibbon Rivers. The principal tributaries of the Madison as thus defined join the river

beyond the park boundary. Named in order from the south to north they are Cougar, Gneiss, and Grayling Creeks. Within the park Cougar Creek receives the waters of Maple Creek, the principal tributary of which is Duck Creek. These upper waters are inhabited by native redthroat trout. Campanula Creek joins Gneiss Creek beyond the park boundary. It also contains redthroat trout, as do the upper waters of all three of the main creeks mentioned, and in their lower courses they have whitefish and grayling besides native trout. The main Madison appears to contain a mixture of all the trouts that occur in the park, as well as whitefish and grayling.

SNAKE RIVER DRAINAGE.

Above its junction with Heart River the Snake pursues a north-west course, receiving numerous small tributaries, the most important of which is, perhaps, a branch which heads in Mariposa Lake. Two relatively large tributaries come in from the northeastward—Crooked and Sickle Creeks.

Mariposa Lake is a small body of water in the southeast corner of the park about a mile north of the park boundary. It is said to be alive with native redthroat trout and to afford wonderful fishing for large trout. About a mile beyond the boundary Bridger Lake is another remarkable native trout water.

Heart Lake, about $3\frac{1}{2}$ miles long and not quite 2 miles in width, lies in a deep depression at the eastern foot of Mount Sheridan. Near the head of the lake and in the lake are numerous geysers and hot springs. Its bottom is of laval gravel, rather shallow near the shore but becoming deep in the middle. It receives some small tributaries, principal of which are Witch and Beaver Creeks. Heart River, its outlet, just below the lake receives a comparatively large tributary known as Surprise Creek.

Witch Creek has its rise 2 or 3 miles above the lake, in the singular collection of geysers, hot springs, and steam holes known as Factory Hill. Its water is at first scalding hot, but it gradually cools, receiving the waters of one cold tributary as large as itself. The lower course of Witch Creek winds through grassy meadows, with a bottom of fine laval gravel and sand. The creek at its mouth has a temperature of about 75° F. Native redthroat trout are numerous, occurring most commonly about the mouth of the creek. Besides the trout are suckers, chubs, and shiners, and the blob, or fresh-water sculpin, also occurs. There is plenty of fish food in the lake. The temperature varies according to the nearness to hot springs and geysers. Trout are said not to ascend Witch Creek, although the other species do, the chubs ascending until the water is fairly to be called hot.

Beyond the mouth of Heart River the Snake bends to the southward, thence later to the westward, receiving a number of tributaries, the largest being Basin Creek, Red Creek, and Forest Creek from the north. All the tributaries flowing directly into the Snake contain native redthroat trout.

Lewis River, which joins the Snake just within the park boundary, is the outlet for the waters of Shoshone and Lewis Lakes.

SHOSHONE LAKE AND TRIBUTARIES.

This lake has a length of about $6\frac{1}{2}$ miles and a width of one-half to $4\frac{1}{2}$ miles, being dumb-bell shaped or constricted in the middle. Its area is about 12 square miles. Its shores are mostly bold, rocky, and densely wooded, the eastern shore being especially abrupt, and the bottom is there made by large lava boulders. On the other side somewhat different conditions obtain, there being a considerable growth of aquatic vegetation. The lake is clearer and colder than either Yellowstone Lake or Heart Lake. The principal tributaries are Shoshone Creek at the northwest corner and De Lacy Creek at the northeast corner. Moose Creek from the southward enters the southern side of the eastern expansion of the lake. Shoshone Lake is connected with Lewis Lake at the southward by a stream of still water known as the "Canal," about 3 miles long.

Lewis Lake occupies a rounded basin with rather low banks. It is pear-shaped, about 3 miles long by 2 miles broad, very clear and cold, and apparently in every way suited for trout. Its bold shores are heavily wooded and without any large tributary streams. A few hot springs enter it on the western side.

Below Lewis Lake Lewis River enters a deep and narrow canyon. At the head of this canyon is a cascade of about 80 feet, of which 20 feet at the top is perpendicular. Toward the end of the canyon and not far above the junction with the Snake is another cascade some 50 feet in height. Owing to the falls in Lewis River no fish were able to ascend to Lewis and Shoshone Lakes, which were therefore uninhabited by any trouts until they were introduced.

Loch Leven and lake trouts are numerous, and eastern brook trout abound in Shoshone Creek. Mr. Clark wrote that the Shoshone and Lewis Lake region was probably the best fishing in the park:

These two lakes and their outlet, Lewis River, are full of native trout and have been stocked with Mackinaw and Loch Leven trout, which are increasing in number and size most successfully. These fish will not rise to the surface and take the fly as do the regular native trout, and it is necessary to go down into the water for them. In the lakes you can catch them by trolling if you can find the particular cove where they happen to be running. However, in spite of the uncertainty of the lake trolling, there is one place where you can troll with assurance of success, and that is the canal between Shoshone and Lewis Lakes. This is a natural body of water with little or no current and not very wide. In Lewis River just below Lewis Falls, in the deep pools where the eddies are covered with foam, you are sure to find good fishing.

Rainbow trout said to have been planted in De Lacy Creek in 1895 have never been observed, but eastern brook trout of small size are numerous.

FALLS RIVER AND BECHLER RIVER.

Falls River pursues a sinuous course near the boundary in the southwestern corner of the park. It rises by two branches, one originating in a marshy area, the other in Beula Lake, near which are Herring Lake and another smaller one, both mere ponds, and flows to the eastward. In the Birch Hills it passes through a short ravine, flowing over two falls, Terraced and Rainbow Falls, the latter being the most westerly. Before joining Bechler River it receives a considerable creek, Mountain Ash by name, which flows down from the south side of Pitchstone Plateau.

Bechler River rises on the northwest side of Pitchstone Plateau and winds to the southward to its junction with Falls River just north of the boundary. It passes through a deep gorge in which are several falls, notably Iris Falls, and a short distance below Colonnade Falls. Below these falls it receives several tributaries, the most important of which is Boundary Creek, which rises across the border and flows southeastward to its junction with Bechler River.

In 1920 A. H. Dinsmore visited this region and reported it as one of the most beautiful, if not the most beautiful, of the valleys in all the park—flat as a floor, abounding in wild and domesticated grasses, meandered by fine, clear streams in which native trout of good size may be taken in large numbers. At the head of the valley, within an area of not more than 3 miles, not less than eight streams fall from the timbered plateau over falls and cascades which rival any in the park excepting the Great Falls of the Yellowstone. So close to the valley are these waterfalls that many of them are in plain view as one rides through it.

Native trout are abundant in Falls River, probably up as far as Rainbow Falls, and in Mountain Ash Creek to Union Falls; also in all the waters below the falls.

FISHING REGULATIONS.

In order to prevent undue destruction of fish and depletion of the park waters, certain restrictions have become necessary, and it is believed that anglers generally will be in full sympathy with the protective measures that the park authorities find it desirable to adopt from time to time. The general policy is to curtail fishing as little as may be compatible with the maintenance of the supply and to depend largely on increased fish-cultural operations to prevent the depletion of park waters.

Following are the fishing regulations now in force:

1. Fishing with nets, seines, traps, or by the use of drugs or explosives, or in any other way than with hook and lines, or for merchandise or profit, is prohibited.
2. Fishing in particular waters may be suspended by the superintendent.
3. All fish hooked less than 8 inches long shall be carefully handled with moist hands and returned at once to the water, if not seriously injured. Fish retained should be killed.
4. Ten fish shall constitute the limit for a day's catch per person from all waters within 2 miles of the main belt-line road system. In the case of other waters the superintendent of the park may authorize a limit of not exceeding 20 fish for a day's catch per person.

LIST OF FISHES.

1. MONTANA GRAYLING (*Thymallus montanus*).

The Montana grayling, which originally existed only in tributaries of the Missouri River above Great Falls, in the park occurs naturally in the Madison and Gallatin Rivers and their branches, Grayling Creek and Fan Creek, and in the Firehole River below the falls. It is reported as sometimes abundant at the junction of the Gibbon and Firehole Rivers and is said to ascend in summer as far as Firehole Falls. It is the principal fish in the south fork of the Madison and occurs also in the backwater of the Madison at the dam. This is a most graceful and attractive fish, of shapely proportions and ex-

quisite coloration. The adult averages about 1 pound, but may attain a weight of 4 pounds.

The grayling prefers swift, clear, pure streams, with gravelly or sandy bottom. It is quite gregarious, lying in schools in the deeper pools, in plain sight, and not, like the trout, concealed under bushes and overhanging banks. In search of food, which consists principally of insects and their larvæ, it occasionally extends its range to streams strewn with boulders and broken rocks.

Unlike the native trout, the grayling will go long distances, if necessary, to find suitable spawning grounds. It spawns in April and May on gravelly shallows. In the north fork of the Madison River, where the water is comparatively warm, coming from the Firehole River in the park, the grayling spawns a month earlier than in any other waters in Montana.

In point of activity it even excels the native trout, when hooked breaking the water repeatedly in its effort to escape, which the trout seldom does. It takes the artificial fly eagerly, and if missed at the first cast will rise again and again from the depths of the pool, whereas

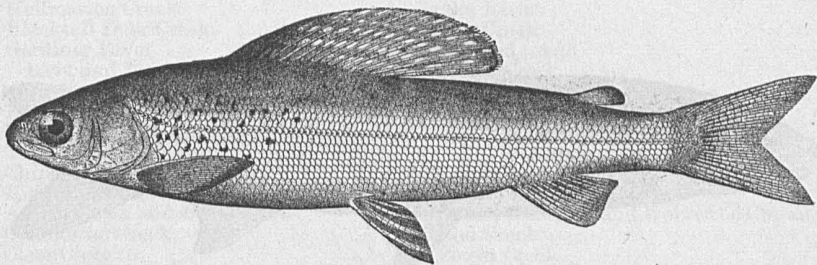


FIG. 1.—Montana grayling.

the trout will seldom rise a second time without a rest. It will also take various baits, such as caddis-fly larvæ, grasshoppers, and worms. Among the recommended flies are professor, Lord Baltimore, queen of the water, grizzly king, Henshall, coachman, and various gauze-winged flies, with No. 10 and 12 hooks. As a food fish it is even better than the trout, its flesh being firm and flaky, very white, and of delicate flavor. The grayling is artificially propagated in Montana by the United States Bureau of Fisheries and the State fish commission.

2. ROCKY MOUNTAIN WHITEFISH (*Coregonus williamsoni*).

The Rocky Mountain whitefish occurs in all suitable waters on the west slope of the Rockies from Utah to British Columbia. A scarcely, if at all, distinguishable variety or subspecies bearing the name of *Coregonus williamsoni cismontanus* is found in certain waters of the upper Missouri Basin. In some localities this fish is miscalled grayling,⁴ with which it should not be confused, as it is a very different species, and there seems to be a local Yellowstone River name, the phonetic spelling of which is "sterlet" or "steret."

⁴ Referring to the fishing in the canyon of Sunlight Creek, Clark Fork, Ralph E. Clark probably made this mistake in writing the following: "You will probably first catch a scaly fish which looks like a long sucker. It is the Montana grayling, and there are many down there."

In the park it naturally occurs in the Yellowstone River below the falls as far up as Crevice Gulch, beyond which it is seldom found, in Madison and Gallatin Rivers below the falls, and has been reported also from the junction of Firehole and Gibbon Rivers. At the junction of Lewis and Snake Rivers "grayling," or "mountain herring," are reported as taken by anglers; these are doubtless whitefish.

Young whitefish 2 to 5 inches long from Montana were planted in park waters, as follows: In 1889, 2,000 were placed in Twin Lakes and 980 in Yellowstone River above the falls, and 10,000 more were planted in the latter place in 1890. It is considered doubtful if any of these have survived, owing to the number and size of voracious trout in the Yellowstone River and the mineral character and high temperature of Twin Lakes.

This fish prefers clear, cold lakes and streams, where the usual length of adults is about a foot, although it is known to have attained a weight of 4 pounds. The *cismontanus* form is essentially a river fish rather than an inhabitant of lakes and is most abundant in the

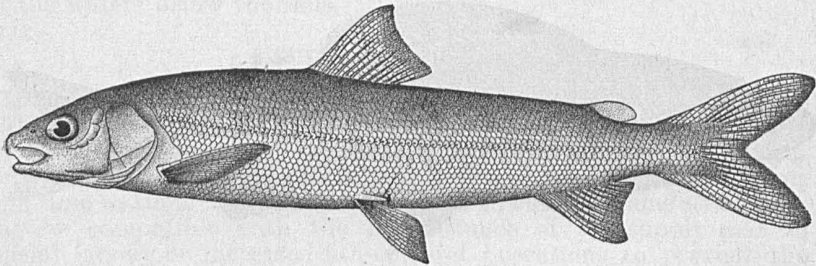


FIG. 2.—Rocky Mountain whitefish.

eddies or deeper places of swift streams. It spawns in late fall or early winter. This is a slender, graceful fish, readily taking the artificial fly like a grayling or trout, as well as natural baits, such as worms and insects and even fresh meat. However, owing to the smallness of its mouth, the hook should be no larger than No. 10 or 12, and when hooked the fish requires careful "playing" owing to the tenderness of the mouth parts. It is a game fighter. It ranks high as a panfish, for, when in condition, it is of surpassing sweetness and delicacy of flavor.

3. REDTHROAT TROUT; CUTTHROAT TROUT; BLACKSPOTTED TROUT (*Salmo lewisi*).

(See frontispiece.)

In its numerous varietal, subspecific, or specific forms the redthroat, cutthroat, or blackspotted trout is of extensive distribution on the Pacific slope. In the park a form designated as *Salmo lewisi* is found naturally in both upper Snake and upper Missouri waters, having doubtless gained access to the latter from the Snake River by the way of Two Ocean Pass, and it is not unlikely that an interchange of individuals still takes place.

Yellowstone Lake and Yellowstone River from its source to many miles beyond the park are inhabited by it. The abundance of trout above the falls is remarkable. At almost any time as one passes along fish are seen breaking water.

Trout are known to naturally occur in the following park waters:

Lower Yellowstone River.	Upper Yellowstone River.—Continued.
Sour Creek.	Bridger Lake and Creek.
Trout Creek.	Falcon Creek.
Alum Creek.	Thoroughfare Creek.
Antelope Creek.	Escarpment Creek.
Lamar River.	Cliff Creek.
Cold Creek.	Lynx Creek.
Willow Creek.	Phlox Creek.
Timothy Creek.	Mountain Creek.
Miller Creek.	Badger Creek.
Calfee Creek.	Trappers Creek.
Cache Creek.	Madison River.
Soda Butte, Pebble, and Amphitheater Creeks.	Canyon Creek.
Slough and Buffalo Creeks, Lake Abundance, etc.	Cougar Creek.
Hellroaring Creek.	Maple Creek.
Blacktail Deer Creek.	Gneiss Creek.
Gardiner River.	Snake River.
Lava and Lupine Creeks.	Fox Creek.
Yellowstone Lake.	Crooked Creek.
Beaverdam Creek.	Sickle Creek.
Rocky Creek.	Pacific Creek.
Trail Creek.	Heart Lake and Heart River.
Chipmunk Creek.	Witch Creek.
Riddle Lake and Solution Creek.	Beaver Creek.
Arnica Creek and Beach Lake.	Surprise Creek.
Columbine Creek.	Basin Creek.
Clear Creek.	Colter, Harebell, and Wolverine Creeks.
Bear Creek.	Red Creek.
Pelican Creek.	Forest Creek.
Upper Yellowstone River.	Falls River.
Atlantic Creek.	Mountain Ash Creek.
Jay Creek.	Bechler River and tributaries to the canyon.
	Boundary Creek to the falls.

Gibbon River has no trout above the falls. In the Firehole River trout occur naturally below the falls. At times near the junction with the Madison there is very good fishing.

In the Gardiner River trout are abundant from the foot of the falls to its junction with the Yellowstone. Trout have not been seen above Osprey Falls.

In Soda Butte Creek trout are numerous until obstructed by falls in the upper part.

Hellroaring Creek is well stocked in the lower part.

In Canyon Creek trout abound below the falls.

It is stated on good authority that, notwithstanding the barrier offered by Undine Falls, trout occur above in Lupine and Lava Creeks. It appears that in 1889 trout obtained from Howard Creek, Idaho, were planted in Lava Creek. However, it was subsequently ascertained that trout had possible access to this locality from Blacktail Deer Creek, which has no falls and was abundantly supplied with trout.

Trout are numerous in Heart Lake and, according to A. H. Dinsmore, in Lewis River below the falls.

The size attained by trout in the park waters, as elsewhere, varies much with locality and conditions. Fish of over 4 pounds have been reported.

This trout in some waters is a highly esteemed game fish and can be taken in all sorts of ways—spoon, phantom, natural bait, artificial fly, etc. Mary Trowbridge Townsend (l. c.) writes of it in the Fire-hole River:

The father of the Pacific trout, the blackspotted "cutthroat" with the scarlet splotch on his lower jaw, was most in evidence, with long symmetrical body, graduated black spots on his burnished sides. He is a brave, dashing fighter, often leaping salmon-like many times from the water before he can be brought to creel. We found him feeding on the open riff or rising on the clear surface of some sunlit pool.

Ralph E. Clark wrote (l. c.) that "the dark, silvergray trout of the West seem to favor flies more in harmony with their own coloring," and mentioned the gray hackle, brown hackle, coachman, grizzly king, Seth Green, black gnat, and white moth:

The junction of Yellowstone and Lamar Rivers is noted for fine fishing. If you find the waters high, swift, and roily, you will probably try your flies in vain. Put on a spinner or a little spoon and watch the fish rise to it, almost touch it, and then go away. They are after live bait and won't touch anything else. The grasshoppers are abundant. Catch a few, bait your hook carefully, and let it float down with the current. A large trout will rise to it, and if you are not very careful he will steal it from you.

This is an excellent food fish when fresh from cool waters, but the trout from some parts of the Yellowstone Lake, Upper Yellowstone River, and Heart Lake are generally reputed to be infested with a parasitic worm. In his book previously cited in the list of publications pertaining to the fish of the park, Gen. Chittenden says:

The trout of Yellowstone Lake are to a slight degree infected with a parasitic disease that renders them unfit for eating. Many efforts have been made to discover the cause of this condition and a suitable remedy for it, but so far without success. An explanation sometimes advanced is that the excessive number of these fish and the absence of sufficient food reduce the vitality and they become an easy prey to parasites which a more vigorous constitution would throw off. Later investigations have shown that reports of the prevalence of this condition were much exaggerated.

The parasite referred to is a tapeworm, of which only the larval or intermediate form occurs in the trout, the host of the adult being an entirely different animal, as is the case with all tapeworms of this kind. Briefly, its life cycle has been found to be as follows: Starting with the egg in the water, it develops into a ciliated embryo. This passes into the fish, probably by way of the mouth; and becomes established and assumes the form usually observed. The fish is eaten by the pelican, and in the intestinal tract of that bird the parasite attains its adult and reproductive stage, and its round of life is there completed. The eggs pass into the water and a new generation is begun.

Gen. Chittenden's statement that the parasite renders the fish unfit for food involves a matter of prejudice rather than actual unfitness for food or danger to the consumer. Cooking destroys the vitality of the worm, and it may be said that this particular worm is not harmful to man. Probably no one would knowingly eat an infected fish, but if he should there would be absolutely no danger in doing so. Beyond doubt the presence of this parasite is greatly exaggerated, as Gen. Chittenden says, and lean, cadaverous, un-

sightly trout, the condition of which is commonly attributed to parasitism, are often fish which are run down from breeding, although they may carry some parasites. There is scarcely a fish that swims that is not more or less infected by some sort of parasitic worm, and in this respect the Yellowstone fish do not appear to be worse than fish of many other lakes in the country.

It has been said that there are two varieties of native trout in the park, the larger ones of the Yellowstone, with bright yellow bellies, and the smaller kind more silvery in appearance and exhibiting much greater activity and game qualities, of which Tower Creek fish are examples. Also trout of Yellowstone Lake seem to differ from those of Heart and Henry Lakes in having more distinct and rather less numerous black spots. However, in this respect very much individual variation is shown.

This is the principal fish artificially propagated by the United States Bureau of Fisheries at the hatcheries on Yellowstone Lake and Soda Butte Creek. From three to twenty million eggs are taken annually. After the local park waters are liberally stocked the remaining young are supplied to suitable waters in the adjoining States. The park, however, should and does have the first and major claim on the hatchery output.

4. RAINBOW TROUT (*Salmo shasta*).

The rainbow trout has its geographical range in the mountain streams of the Coast Range and the western slopes of the Sierra Nevada Mountains, but the natural abode of the rainbow trout of fish-cultural fame is the McCloud River, Calif. This form, now recognized as a species distinct from *Salmo irideus*, bears the name of *Salmo shasta*. It has been successfully introduced into many streams in different parts of the United States where it was not previously found.

The rainbow, first introduced into the park in the Gibbon River in 1880 and subsequently planted in various waters and on numerous occasions, has become one of the most abundant, most widely distributed, and most popular of the park fishes. The waters stocked, in addition to the Gibbon River above and below the falls, have included the Gardiner River, tributaries of Yellowstone Lake, and various small lakes.

The size attained by the rainbow trout varies greatly and is dependent upon volume of water, temperature, food supply, etc. Under certain conditions it reaches an extraordinary size, but in the ordinary environment 6-pound or 8-pound fish are to be regarded as large. In general, it may be said that the fish does not overrun 2 pounds. Its food is composed largely of insects.

This fish now abounds in the Gibbon River both above and below Virginia Cascades, and good fishing is found at times at the junction with the Madison. Regarding this stream the park superintendent's report for 1897 shows that the fish planted above the cascades seemed to have come down over the falls, as but few were found above, while below the stream was well stocked to its junction with the Firehole. In the Gibbon River above the falls it appears that the supply has been greatly depleted, in fact, nearly fished out, owing to the cir-

cumstance that the road follows the stream for many miles, and there must have been thousands of anglers fishing there in 1919, according to the senior author's notes of July, 1919. Grebe Lake, Blacktail Deer Creek, Madison, Firehole, and Little Firehole Rivers all contain rainbow trout. Referring to the last-named stream in 1897, the superintendent of the park wrote that several good specimens had been taken near its source, for which he could not account, as it seemed impossible for any fish to ascend the lower falls of the Little Firehole. A. H. Dinsmore reports the fish from Tower Creek above the falls.

Many persons who have had experience in angling for rainbow trout say it is one of the best, and some pronounce it the very best, of the trouts. It often dashes from the water to meet the descending fly and leaps repeatedly and madly when hooked. It has been said that it takes the fly so readily that there is no reason for resorting to other lures. However, its activity and habits, as in the case of most fishes, are modified more or less by its surrounding conditions. The same is true of its food qualities, which ordinarily are very good.

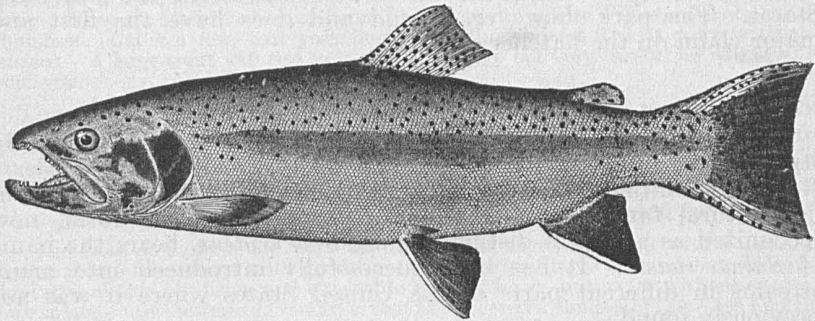


FIG. 4.—Rainbow trout.

Mary Trowbridge Townsend (l. c.) had the following to say relative to her experience with the rainbow trout in Firehole River:

The California rainbow trout proved true to his reputation as absolutely eccentric and uncertain, sometimes greedily taking a fly and again refusing to be tempted by the most brilliant array of a carefully stocked book. During several days' fishing we landed some small ones, none weighing over 2 pounds, although they are said to have outstripped the other varieties in rapidity of growth, and tales were told of 4-pounders landed by more favored anglers.

5. SCOTCH LAKE TROUT; LOCH LEVEN TROUT (*Salmo levenensis*).

This trout originated in Loch Leven, the lake made famous by Scott's poem, "The Lady of the Lake." Typically it was peculiar to this loch, where it seldom if ever attained much over 1 pound in weight. The claim has been made that it is merely an ontogenetic development of the common brown trout, and that when transferred to other waters its progeny can not always be distinguished from the common brown trout. On the other hand, information derived from persons familiar with Loch Leven indicates that both this trout and the brown trout exist in the same lake, and that in that body of water they can always be distinguished.

It is not impossible that confusion has arisen by brown trout from that lake having been propagated under the supposition that they were Loch Leven trout. There are parallel instances of such mistaken identity in this country in respect to other species, and so-called Loch Leven trout have been propagated for a long time in this country. In the early years the progeny of Loch Leven eggs could easily be distinguished from brown trout hatched at the same time, especially when they had attained a few inches in length. Recently, however, there is reason to suspect that many of the so-called Loch Leven plants have been brown trout. Be that as it may, trout under each name have been introduced into Yellowstone Park waters, and there are records of both having been subsequently taken. The first plants of this trout in the park were made in the upper part of the Firehole River in 1889. The next year Lewis Lake and Shoshone Lake were stocked, and in 1903 further plants were made in tributaries of the Firehole.

The Loch Leven trout has been taken in the following park waters, in some of which it is abundant: Firehole River above and below the cascades, Madison, Gibbon, and Gardiner Rivers, Shoshone and Lewis

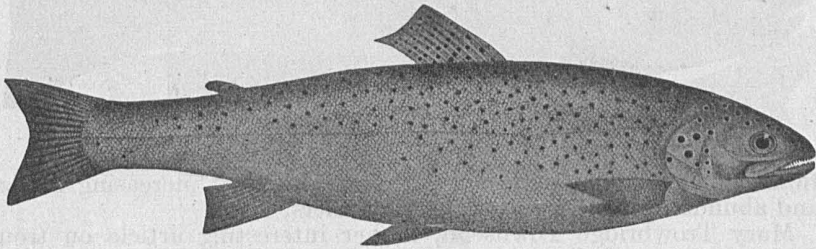


FIG. 5.—Scotch lake trout; Loch Leven trout.

Lakes and the "canal" connecting those lakes, upper Snake River waters, Heron Creek, and Duck Lake, near the Thumb of Yellowstone Lake.

Fish of large size and in great abundance were found in Duck Lake in 1919. Landlocked salmon had been planted in this lake in 1908 and were reported to have survived and flourished, but none have ever been authentically identified, and it seems likely that the Loch Leven trout, the history of whose introduction into this lake is quite obscure, have been mistaken for landlocked salmon. Hundreds of fish were observed jumping at times, and a number of specimens up to 4 pounds in weight were taken in the summer of 1919 after a game fight.

6. EUROPEAN BROWN TROUT; VON BEHR TROUT (*Salmo fario*).

The brown trout is widely distributed in continental Europe and the British Isles, inhabiting lakes as well as streams, but it is the "brook trout" of the continental European countries. Under favorable conditions it is known to grow to over 20 pounds, but as a true brook trout it seldom registers over 1 pound in weight.

The brown trout thrives in clear, cold, rapid streams and at the mouth of streams tributary to lakes, having much the same habits

as our eastern brook trout. It is by some regarded highly as a game fish, taking either bait or artificial fly. The best fly fishing is usually toward night. As a game and food fish it is in its prime from May to September. Its flesh is very agreeable in flavor. Spawning begins in October.

The brown trout has a rather extensive distribution in the park, although only a single plant of 9,300 fish was made in Nez Perce Creek in 1890. The fish now inhabits the Madison, Gibbon, and Firehole Rivers. In the last named it is found from its junction with the Gibbon to Keppler Cascades and is particularly numerous in Nez Perce Creek, Little Firehole River below Mystic Falls, and Iron Creek. In the main streams fish have been taken weighing up to 8 pounds. In the park, as elsewhere, the brown trout has the reputa-

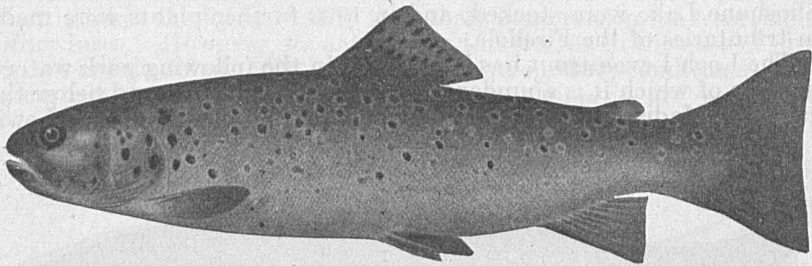


FIG. 6.—European brown trout; Von Behr trout.

tion of being antagonistic to other trouts and of increasing in size and abundance at the expense of the others.

Mary Trowbridge Townsend, in her interesting article on trout fishing in the park (l. c.), mentioned a brown trout from the Firehole River:

A good 4-pounder, and unusual marking, large yellow spots encircled by black, with great brilliancy of iridescent color. * * * I took afterwards several of the same variety, known in the park as the Von Behr trout, and which I have since found to be the same *Salmo fario*, the veritable trout of Izaak Walton.

7. LAKE TROUT; MACKINAW TROUT (*Cristivomer namaycush*).

The lake trout, otherwise known as laker, lunge, togue, Mackinaw trout, etc., is of wide northern distribution. In British America it ranges from the Atlantic to the Pacific coasts and northward to the Arctic Ocean. In the United States it is found in many of the larger and deeper lakes in New England and New York, in the Great Lakes Basin, and in a few localities in the Western States, as Montana and Idaho. It occurs also in Alaska. It has also been spread by fish-cultural operations into waters where it did not previously exist.

The lake trout owes its presence in the park to two plants of 30,000 and 12,000 fingerlings in Shoshone Lake and Lewis Lake, respectively, in 1890. The fish is now common in those waters, especially around the shores, and was formerly taken in large quantities to supply the park hotels. It is found also in the "canal" connecting the two large lakes. In some waters it attains a very large size. Examples weighing over 100 pounds have been reported from the Great Lakes,

and in former years the average weight of the fish in the commercial fisheries of those waters was stated at 20 to 30 pounds. At this time, however, 10 to 15 pounds can be considered large.

Park Ranger Dewing reports that in 1915 he saw a lake trout that weighed 32 pounds caught in Shoshone Lake by a soldier. Mounted specimens of two large lake trout from Shoshone Lake are in the lobby at Old Faithful Inn. One taken July 13, 1912, by Pete Bergendorf, hotel fisherman, weighed 12 pounds, the other, 39 inches long, weighed 21 pounds. In the summer of 1911 Howard Eaton with a party fished in Lewis Lake and in one day caught 200 pounds of lake trout. The largest fish was 39½ inches long and weighed 20 pounds; another was 34 inches long.

According to A. H. Dinsmore, as early as 1901 the lake trout had spread from Lewis Lake and become abundant in Lewis River below the upper falls. The fish has been reported also below Idaho Falls and has passed up through the tributary coming from Jenny Lake, in which water it occurs in numbers about equal to the native trout,

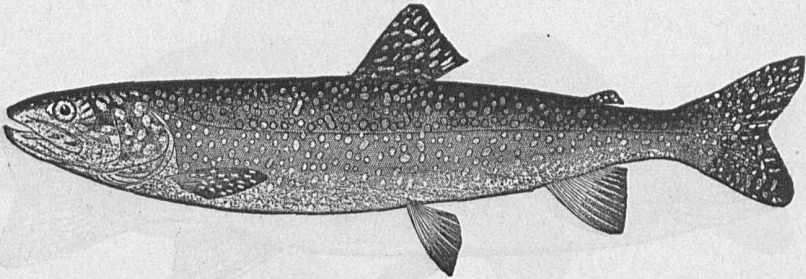


FIG. 7.—Lake trout; Mackinaw trout.

and specimens are recorded from the Buffalo Fork of the Snake River.

The large size of the lake trout affords its chief attraction as a game fish, for it is not ordinarily a very active fighter, although a powerful antagonist. It is usually caught by deep trolling, but is sometimes found at the surface and is occasionally taken on an artificial fly. The fish may be caught by trolling or casting with artificial or natural baits.

Opinions differ regarding its table qualities, and, as with most fishes, much depends upon how it is prepared and cooked. It is a very oily fish and often has an unpleasant, strong, oily flavor. This may be obviated, however, by removing the skin before the fish is cooked. The best method of cooking it is by boiling, serving with mayonnaise dressing or egg sauce.

Mr. Clark (l. c.) wrote in 1908 that the lake trout were plentiful in Shoshone Lake and Lewis Lake and River, and that they could be caught in the canal between Shoshone and Lewis Lakes as fast as one could throw in a trolling spoon, and he remarked that they were large and fat. On August 6, 1919, Mr. Dinsmore caught a 4-pound fish on a feathered spinner, in the canal off Point of Rocks.

8. EASTERN BROOK TROUT; SPECKLED TROUT (*Salvelinus fontinalis*).

The natural western limit of this brook trout in the United States is northeastern Minnesota. It inhabits lakes as well as streams and varies in size according to locality. It does not flourish in water temperature over 68° F., and about 50° F. is preferable. The largest trout of this species authentically recorded weighed somewhat over 12½ pounds. In some lakes trout of 5 or 6 pounds are not uncommon, but such large fish are seldom found in streams unless the streams are tributary to fairly large lakes. In streams of moderate size trout of 1 or 2 pounds' weight are to be considered large, and in most brooks a trout of one-half or three-fourths pound is an exception, at least in recent years. Its spawning season is in fall.

Plants of eastern brook trout have been made by the Bureau of Fisheries in various park waters, and the fish is now abundant and widely distributed. It is known to occur in Gardiner River and its tributaries with their branches, particularly those of the west side: Glen, Fawn, Panther, Indian, Willow, Winter, Straight, and Obsidian

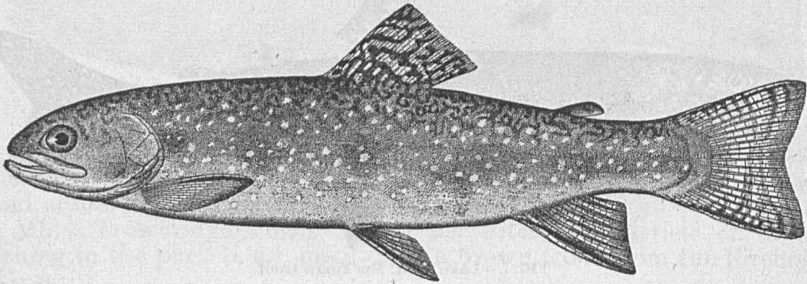


FIG. 8.—Eastern brook trout; speckled trout.

Creeks; Swan, Grizzly, and Beaver Lakes; Gibbon and Madison Rivers; Solfatar Creek; Virginia Meadows; Firehole River, above Kepler Cascades, where, according to the 1897 report of the superintendent of the park, this trout was very abundant, and between its junction with the Gibbon and the lower falls; Upper Little Firehole; Upper Nez Perce Creek, but, according to Park Ranger Dewing, not in lower Nez Perce. According to Mr. Dinsmore it is found in Juniper Creek, a tributary of the Upper Nez Perce, and it occurs in Lone Star Creek and Spring Creek. Tower and Carnelian Creeks above the falls contain it, according to Mr. Dinsmore. It is abundant in Shoshone Creek, and according to the park superintendent's 1897 report that creek was alive with brook trout up to 1½ pounds in weight. Small fish are found in lower De Lacy Creek.

The brook trout is one of the most noted and esteemed of American game fishes, but there must be something besides activity that makes it such a general favorite, as in that respect it is surpassed by several others. One appealing attribute is its beauty of coloration, and another its delicacy of flavor, which is hardly surpassed by any other fish.

The brook trout may be taken by almost any method known to anglers. In open streams fly fishing is the method par excellence.

In streams where overgrowth prevents fly casting, angleworms, grasshoppers, or almost any bait will be taken when the trout is feeding. Everything will be disregarded when it is not feeding. The best flies to use in any body of water must be learned by experience, but the brown hackle is seldom a failure anywhere. Professor, queen of the water, Montreal, coachman, and many others are usually quite successful. Gauze-winged flies will sometimes succeed when others fail. The best time to fish for this trout is in the morning and early evening. It lurks in eddies and pools and at the foot of rapids or under overhanging banks, old stumps, or rocks.

9. YELLOW PERCH (*Perca flavescens*).

The yellow perch has a wide eastern distribution. It is common in the Great Lakes and the tributaries of the upper Mississippi River

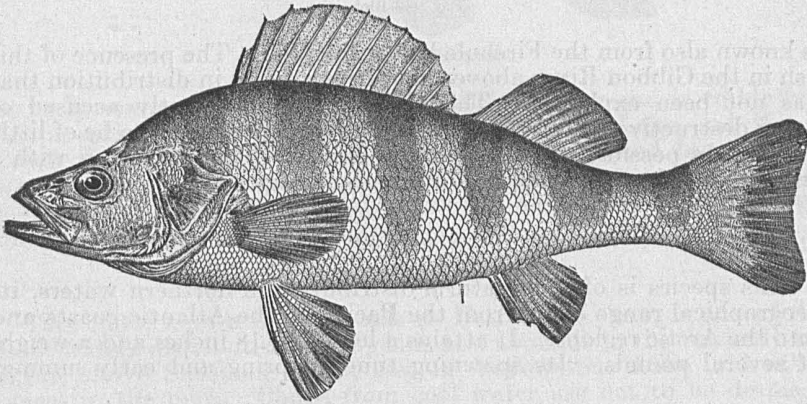


FIG. 9.—Yellow perch.

and in coastwise streams and lakes from Nova Scotia to North Carolina.

In 1919 this fish was found by the senior author to abound in Goose and Feather Lakes in the park. Its presence there is apparently traceable to an unofficial, unauthorized plant made many years ago by a Montana citizen, who is said to have obtained a consignment of yellow perch from the State of Washington, into which State the species had been introduced some years before.

In the park lakes the yellow perch attains a length of a foot and is most readily caught by the use of small spinners cast from shore and rapidly drawn in. Only a few of the park authorities have been aware of the occurrence of this fish in local waters. It can not be regarded as a desirable addition to the fish life of the park, and its spread to other waters than those now inhabited should be prevented. It is not usually reputed to be a game fish, and its voracious habits make it a menace to young trout. When fresh from cold water, it is one of the best of pan fishes, being firm-meated and of delicious flavor.

10. BLOB (*Cottus punctulatus*).

This little sculpin belongs in the Missouri Basin and abounds in some of the waters of the park. It has been reported to swarm in the grassy-bottom portions of the Madison and Gibbon Rivers and in Canyon Creek and to be numerous in the Gibbon above the falls. It

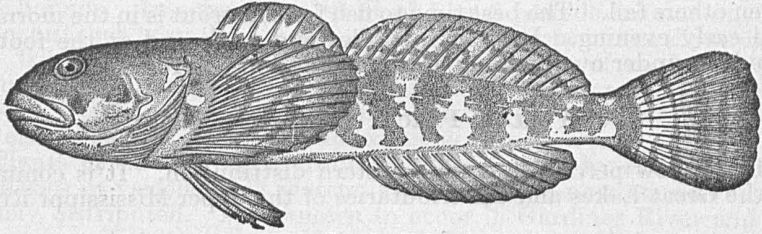


FIG. 10.—Blob.

is known also from the Firehole below the falls. The presence of this fish in the Gibbon River above the falls is a freak in distribution that has not been explained. The blob is probably justly accused of being destructive to the eggs of other fishes and appears to be of little use, unless possibly as bait for large trout. It can be taken with a small baited hook. It attains a length of 5 inches.

11. LONGNOSE SUCKER (*Catostomus catostomus*).

This species is of wide natural distribution in northern waters, its geographical range being from the Pacific to the Atlantic coasts and into the Arctic regions. It attains a length of 18 inches and a weight of several pounds. Its spawning time is spring and early summer

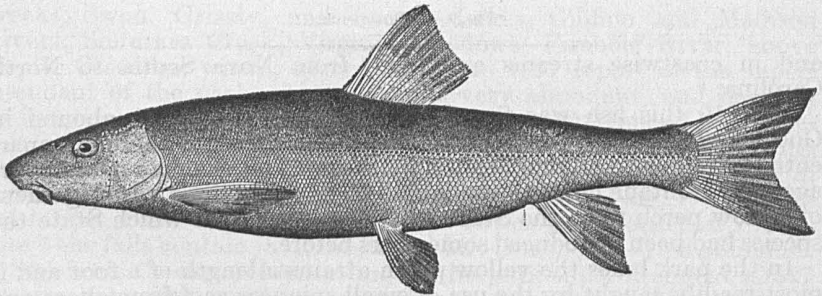


FIG. 11.—Longnose sucker.

when the males have their anal fin profusely covered with tubercles and the side of the body with a broad red stripe more or less diffuse on the edges. It is not sought as a game fish, but sometimes takes a baited hook and fights fairly well. When taken from cool water and cooked at once it is a good-flavored pan fish, although somewhat bony. It is abundant in Yellowstone and Gardiner Rivers below the Osprey, Undine, and Rustic Falls.

12. ROSYSIDE SUCKER (*Catostomus ardens*).

This sucker is abundant in the Snake River Basin above Shoshone Falls. It is reported from Heart Lake and Witch Creek and is said to ascend the latter into very warm water flowing from Heart Lake Geyser Basin. Like the longnose sucker, it spawns in spring

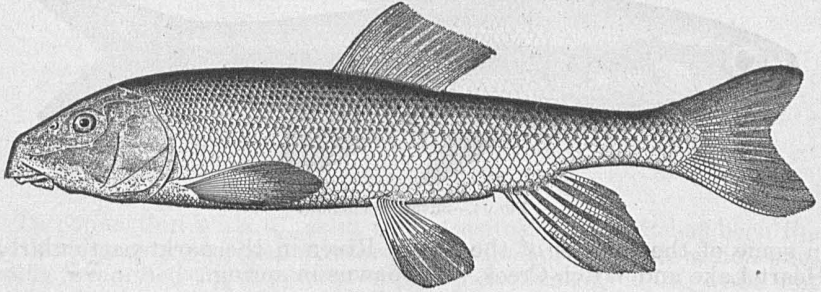


FIG. 12.—Rosyside sucker.

or early summer. It will also take a baited hook and is edible but not as palatable as the other sucker. In Heart Lake and Witch Creek the alimentary tract of this sucker is infested by parasitic worms, which, although offensive to the eye, do not render the fish harmful as food. Affected fish, however, are likely to be lean and unpalatable.

13. CHUB (*Leuciscus lineatus*).

This chub, known in the books as Utah Lake chub, is one of the most widely distributed of the genus and abounds in the Snake River Basin above Shoshone Falls; also in Yellowstone Lake and other places in the park. Chubs from cool water are not to be despised

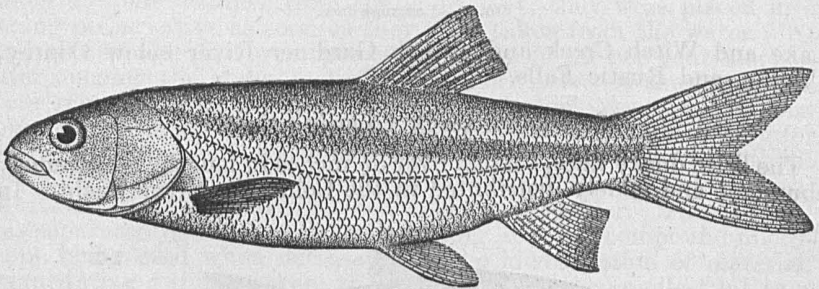


FIG. 13.—Chub.

in game and food qualities. The species reaches a length of 12 or 15 inches or more and is said to be destructive to the eggs and young of trout. No worms have been found in its alimentary canal. It spawns in spring and early summer.

Dr. Jordan says: "Chubs ascend Witch Creek until they reach water fairly to be called hot, and the sucker is not far behind," enduring a temperature of 88° F.

14. SILVERSIDE, MINNOW (*Leuciscus hydrophlox*).

This little fish is too small to be of much use for other than food or bait for trout, attaining a length of only 3 to 5 inches. It occurs

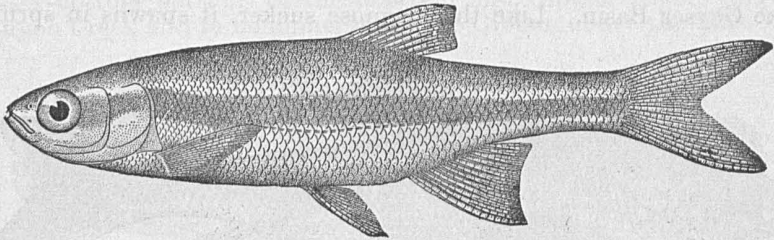


FIG. 14.—Silverside minnow.

in some of the sources of the Snake River in the park, particularly Heart Lake and Witch Creek. It spawns in spring.

15. LONGNOSE DACE (*Rhinichthys dulcis*).

This little minnow, attaining a maximum length of only about 5 inches, is food for trout and useful as bait. It is found in Heart

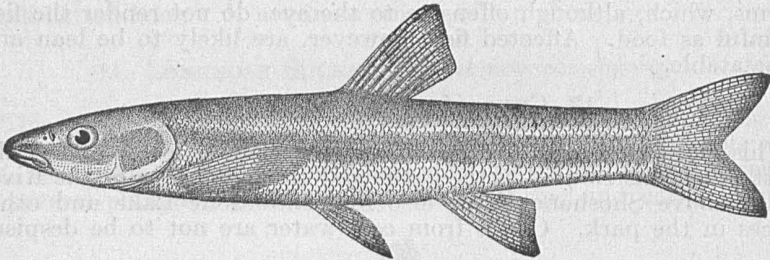


FIG. 15.—Longnose dace.

Lake and Witch Creek and also in Gardiner River below Osprey, Undine, and Rustic Falls.

16. DUSKY DACE (*Agosia nubila*).

The little dusky dace, seldom over 3½ inches in length, is extremely abundant and widely distributed in the Columbia River Basin. In

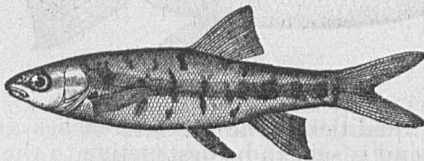


FIG. 16.—Dusky dace.

the park it has been recorded from Heart Lake and Witch Creek. It is useful as food for larger fishes and as bait for trout.