Gallatin River, Montana, where grayling were stocked.
(Pictures courtesy of Mr. Tryon.)

THE MONTANA GRAYLING

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Montana grayling are now found, with few exceptions, only in the headwaters of the Big Hole River, Montana, and in lakes of that region. Despite their restricted distribution, the grayling make spirited spawning runs from these waters into various small inlets. Cultural operations have been successful in maintaining good populations in waters still frequented by grayling. Though apparently suitable spawning grounds are present in the West Gallatin, stocking must be continued to maintain satisfactory fishery under the present fishing pressure.

ALL GRAYLING of the world belong to a single genus, Thymallus, which has a ringlike distribution around the arctic regions, a distribution similar to that of the whitefish and chars although at present much more localized. In the continental United States only one species of grayling occurs. This species, Thymallus signifer, occurs most abundantly in Alaska and northwestern Canada and in historic times has occurred in the United States in Montana and Michigan. Jordan (1905) felt that these two colonies were remnants of a postglacial fauna which had extended further to the south, and that they were tending to extinction. Since then the Michigan stock has disappeared and the Michigan waters have been restocked with grayling from Montana.

When white men first came to Montana,

See also:

Johnson, H. E.
1937. Feeding Montana grayling fry. Prog. Fish-Cult. 30: 35-36.

grayling occupied the headwaters of the Missouri River, chiefly in the Jefferson, Madison, Gallatin, Smith, and Sun Rivers. It will be noticed that all these streams are above Great Falls, the first major barrier as the Missouri is descended. Isolated in this region, the Montana grayling developed differences from the arctic grayling in length of life, age of maturity, and growth rate, as shown by the work of Brown (1943) and Miller (1946).

At present the distribution of Montana grayling is much reduced, and these fish are found, with few exceptions, only in the headwaters of the Big Hole River and in the lakes of that region. About 3 million eggs are taken annually by the State, according to Mr. A. G. Stubblefield, the Superintendent of State Fisheries; by means of these a good population is maintained in the few waters still frequented by grayling. The rapid reduction in the numbers of grayling in the last 60 years is believed by Brown (1943) to be due to competition from introduced species of trout although the grayling is apparently compatible with the cut-throat trout natives to these waters.

The present writer is inclined to feel that, though the grayling is a good game fish, it is by no means so wary a fish as any of the trout. As a result, in streams containing both grayling and trout, the grayling take the brunt of the fishing pressure, which is maintained (owing to the presence of trout) until there are not enough grayling left to continue to propagate themselves.

Spawning Habits

Early accounts of grayling in Montana mention long spawning migrations, some many miles in length. Henshall (1907) believed that they traveled from the Jefferson River far into the headwaters. Brown (1938) does not consider this likely; he believes the grayling is more limited in its runs. Many of the old residents of this region tell of great runs up the Madison River and speak of the river as being carpeted with fish from bank to bank. The present restricted distribution, confined mostly to the lakes, makes such runs a thing of the past.

The grayling does show a spirited spawning run from lakes into various small inlet waters, and its spawning actions excel those of the trout in interest and beauty. Brown (1938) has described these activities as they occurred in the inlet to Agnes Lake in Beaverhead County. In the inlet to Rogers Lake in Lake County their activities were found to be much the same although opportunity for observation was a little greater.

In 1939 grayling were found in the inlet, a small temporary stream made by melting snows, its flow about 1 cubic foot a second. Traps and a small impassable dam were located one or two hundred feet above the lake. When stripped, the fish were thrown upstream above the dam. As they were first observed at 11 a.m. on May 6, the grayling in the stream were drifting back toward the lake as far as possible, those below the dam going on down and out of the stream. The water temperature was constant at 40° F. throughout the time of observation.

At 3 p.m. the fish still left in the stream started to move back up and intermittent spawning acts occurred. The fish were polygamous and apparently made no attempt at nest-building. A male would take up a favored location over a quiet portion of the stream where the bottom was sandy and would maintain his position against other males that attempted to enter. Though they simulated the pugnacity of trout, no great damage was ever done and usually the smaller male was shouldered out of the bed.

When the females came by, the males attempted to spawn with them. The male pressed against a female, erecting the large dorsal fin over the female's back. If the female responded by returning the pressure, their dorsals would be applied tightly, the anterior dorsal portions curving over the female and the caudal portions over the male. The sex products were emitted, apparently simultaneously, while the fish were side by side and quivering violently. The spawning act lasted for 10 seconds, during the latter part of which the tail movements stirred up a cloud of sand so that the eggs could not be seen. The female was usually exhausted and would sink to the bottom with wide-open mouth and lie on her side. The male

Grayling nesting in water so shallow that the dorsal fin and part of the back are out of the water. Inlet to Rogers Lake.

recovered more readily. In the course of 1 minute one male spawned with four different females on their way upstream. The same spot or bed was used many times by the same and different pairs.

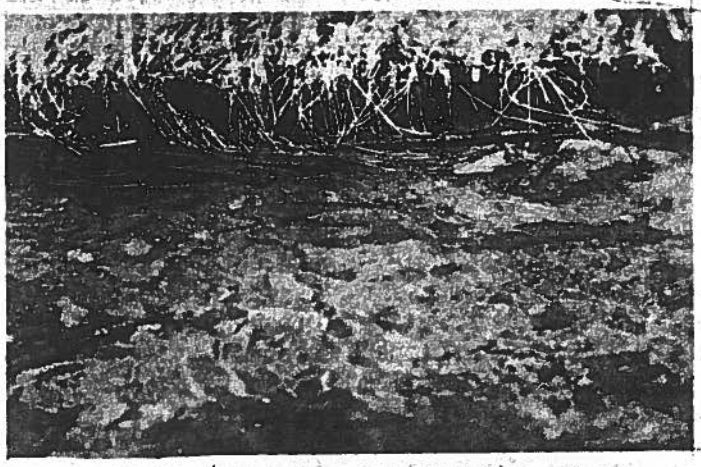
Between 5 and 6 p.m. grayling began to run from the lake into the stream. Schools of grayling could be seen lying about 30 feet out in the lake. The shoal water close to shore apparently acted as a barrier. Small groups of four or five grayling would detach themselves from a school and would come shooting toward the stream, only to turn and dash back as the water shoaled. By 7 p.m., as it began to grow darker, these small groups did not stop but went up the stream in one swift, battering rush. By 8 p.m. there was a constant procession of schools of 15 or 20 making the dash from lake to stream.

The stream at its entrance to the lake was not more than 2 or 3 feet wide, and for 50 feet or more it was one continuous fast riffle. The numbers of grayling were such that the stream was filled with fish packed in side by side from bank to bank. The water was so shallow that the great dorsals and even part of their backs were out of water, yet they contrived to ascend the stream steadily. As they reached the quieter portions, they spawned as opportunity occurred although most of the females were still green. They rested in either the riffles or pools by lying on the bottom. If one fish came by from below while a group rested, they would all start to rush up the stream again.

By 10:30 p.m. the run began to slow down although fish were still coming from the lake, and by 11 p.m. there was a definite slackening. At 6 a.m. the following day the stream was practically empty; all the fish were down as far as they could get.

It is not possible to say what stimulus initiates an individual run or what stops it. Most of the spawning runs occurred in water close to 50° F. although in a few instances, as above, the temperature of the inlet was as low as 40° F.

All the spawning observed was on sandy bottom, where the rush of water was quieter. Other observers have noted grayling spawning on gravel or even along the shore of a lake. The inlets to lakes where grayling have been observed in Montana may or may not be natural spawning grounds; in each case, they were the only spawning streams available. At one time the grayling in Georgetown Lake spawned in Blodget Inlet and traps were set there for spawn-taking. In later years the run shifted to Flint Creek Inlet, where some spawn is still taken although the run has greatly decreased. The reason for this is not known: the only discernible difference is



SPAWNING IN INLET TO ROGERS LAKE

Male, beside female, erects dorsal fin.

Type of bottom ordinarily used in spawning.

Grayling on spawning bed that contains much more gravel than usual.

that Flint Inlet runs about 5° warmer than Blodget.

The only suspicion of a natural run in Montana was one reported by Mr. Park Taylor, a rancher, on the west fork of the Gallatin River. In the first part of April 1941 he reported numerous small grayling running in the lower part of the Buffalo Horn Creek, a tributary of the Gallatin River. This stream is 5 to 12 feet wide and has a rocky bottom and fairly good pools. When the stream was visited on April 19, 1941, most of the grayling were gone. The water of the Buffalo Horn then was 32° while that of the Gallatin River was 46° F. No evidence of actual spawning was obtained. If this represented a run, it was unusually early and was accomplished when the water temperatures were much colder than during the runs from lakes.

Culture

Henshall (1907) gives the earliest accounts of attempts to culture grayling in Montana. Eggs and milt are stripped from grayling in the same fashion as from trout and about as readily although there is some difficulty in obtaining sufficient quantities of milt from the males. When taken, the eggs are amber in color and about 0.095 inches in diameter. They require 2 hours to water-harden and then are 0.15 inches in diameter.

Once impregnated, the eggs, which are adhesive, are placed in jars until eyed, when they may be placed in trays. The development from impregnation of the eggs until advanced fry is given in table 1. These eggs were taken from Grebe Lake in Yellowstone Park on June 11, 1938, and cultured at the Bozeman hatchery.

In hatcheries, as Brown (1939) has demonstrated, the fry start to feed on about the fifth day. Originally considerable difficulty was experienced in feeding the advanced fry, but the work of Laird (1928), Lord (1932), and especially Fuqua (1939) has shown that this may be overcome by providing food of particle size. Fuqua also gives other pertinent information on the raising of grayling.

In table 2 are given growth data on grayling kept for the most part in the Bozeman hatchery. Two lots of eggs are involved, one taken in 1937 and the other in 1939. Both lots of eggs came from Grebe Lake in Yellowstone National Park. The 1939 eggs, which furnished the data for the earlier stages, were kept at a slightly higher temperature as indicated.

Brown (1943) and Miller (1946) have given data on the growth of wild grayling.

Stocking

The West Gallatin is one of the three main headwaters of the Missouri River and is an excellent trout stream throughout. Temperatures are good, and food is abundant. Coincident with the successful culture of grayling at the Bozeman hatchery, the upper waters of the West Gallatin were stocked according to the figures given in table 3. These waters already contained good populations of rainbow and cut-throat trout.

All these fish were stocked in the upper 20 miles of the river. This heavy stocking was very successful: anglers began to catch grayling in 1939, and by 1940 and 1941 good grayling fishing was possible. By 1942, 12- and 14-inch grayling were being caught and dude ranchers reported catches of 2- to 3-pound grayling. Even though the latter reports may be exaggerated, they do indicate that a successful fishery had been established by stocking.

With the advent of the war stocking of grayling in the Gallatin was abandoned. The effects could be noticed the following year, and by 1945 and 1946 grayling were no longer being caught. Many small tributaries, apparently suitable spawning grounds, are available to grayling in the Gallatin watershed.

In the spring of 1938, Squaw Creek, a tributary of the Gallatin, was stocked with 5,000 5-inch grayling. One thousand of these were tagged, but only three tagged fish were recovered--all from below the mouth of the Squaw in the Gallatin River. Attempts to census the Squaw revealed only trout present. Apparently, by the fall after the stocking, all grayling had left Squaw Creek except in some beaver ponds near the mouth. Squaw Creek is a rapidly flowing stream about 10 to

TABLE 1.--Development of grayling eggs and fry

Stage	Number of days	Temperature units	Mean daily temperature	Losses Number	Losses Percent
Impregnation to eyed	10	154.1	47.2° F.	4,800	3.83
To hatching	23	291.9	48.3	7,050	5.64
To advanced fry	1½	27.	50.	1,875	1.5

TABLE 2.--Development of grayling fingerlings

Group	Number of days from hatch	Weight (ounces)	Length (inches)
1939 eggs held at 55 degrees	18	0.0098	
	51	.0152	
	83	.0388	
	113	.0734	
	143	.0995	
	174	.1154	
	205	.1546	
	236	.2026	
1937 eggs held at 50 degrees	223	.0826	2.49
	286	.4165	4.40
	322	.4977	4.45
	334	.5852	4.88
	[1]522	2.1852	7.05
	[1]813	2.7876	9.37

[1]These fish were kept at Ennis hatchery during later stages.

15 feet wide and averages 9 cubic feet of water per second. The bottom is rock and rubble, and pools are shallow and limited. Food is good except for occasional periods of silting during or after high water. Such a stream is evidently not desirable for 5-inch grayling.

The following conclusions could perhaps be drawn from this experience with grayling stocking:

1. Grayling are capable of growing from small to large size in appreciable numbers in the Gallatin.

2. Stocking in such a stream can provide a grayling fishery sufficient to satisfy anglers, but stocking must be maintained or the fishery will fail even though there are apparently suitable spawning grounds.

3. It is possible that grayling, occupying much the same ecological niche as trout, are substituted for trout in the fish population of the stream.

It might be said that there are interesting possibilities in the grayling as an indicator fish in stocking or even as a buffer species in aquatic management.

TABLE 3.--Stocking of grayling in the West Gallatin

Size	Number stocked in year			
	1938	1939	1940	1941
2-inch	19,800			
3-inch		7,000		
4-inch	1,131			10,600
5-inch	5,000	38,800	17,000	13,750
6-inch			14,600	

Acknowledgments

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HAVE YOU NOTICED ANY MALLARD DUCK RAIDS UPON THE FISH POND?

Mallard ducks, it was recalled, had begun coming into the vicinity about January 10. Further, the birds had been most abundant in the neighborhood of the pond in the week from February 3 to February 10. Hatcherymen had paid little attention to these birds, however, because mallard ducks had never previously caused any loss at this station. Apparently, these were first-time offenders.

On January 3, 1947, approximately 40,000 4- to 5-inch Montana grayling were weighed and checked in a 15- by 120-foot dirt pond at the U. S. Fish-Cultural Station, Ennis, Montana. The pond was cleaned each week. No particular shortage of grayling was noticed when the pond was cleaned on February 3, but on February 10 it was found that the pond contained only about 1,000 grayling.