The distribution of the cutthroat trout (Salmo clarki) in Montana
by Delano A Hanzel

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

Abstract:
The distribution of cutthroat trout (Salmo clarki) and the factors affecting it were investigated during the summers of 1957 and 1958. Distribution records were obtained from the following sources: 100 streams surveyed, east of the Continental Divide; 219 records from fisheries biologists and 769 from creel census returns (Montana Fish and Game Department); 35 records from the Montana State College collection. Fifty-five (75 percent) of the streams surveyed had only cutthroat trout above barriers. The important barriers were natural falls, high gradient areas, and beaver dams. "Wherever rainbow and/or-eastern brook trout were present in association with cutthroat trout they were predominant. Cutthroat trout are presently restricted to the headwaters of streams which originally were entirely inhabited by them. Taxonomic determinations, were based upon the examination of 345 cutthroat trout (126 from streams that had never been stocked with rainbow trout), 54 rainbow; trout and 88 rainbow X cutthroat trout. Satisfactory separation for fish over 4.0 inches , in total length was achieved. Individual distribution records of cutthroat trout from 699 streams and 244 lakes were listed. They were predominant (only game fish present or ranked first in relation to other game fish) in 253 (38 percent) streams and l42 (58 percent) lakes.

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THE AUTHOR

Delano A. Hanzel was born on March 20, 1935 in Belt, Montana and graduated from Belt Valley High School in 1953. He entered Montana State College in 1953 and received a Bachelor of Science degree in Fish and Wildlife Management in June, 1957. During the summer months of 1952 - 1956, he was employed by the Montana Fish and Game Department as a student assistant. He was married to the former Betty L. Hill in 1958.

He began graduate studies at Montana State College in September 1957. This thesis fulfills part of the requirements for his Master of Science degree in Fish and Wildlife Management at Montana State College, Bozeman, Montana.

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ABSTRACT

The distribution of cutthroat trout (Salmo clarki) and the factors affecting it were investigated during the summers of 1957 and 1958. Distribution records were obtained from the following sources: 100 streams surveyed, east of the Continental Divide; 219 records from fisheries biologists and 769 from creel census returns (Montana Fish and Game Department); 35 records from the Montana State College collection. Fifty-five (75 percent) of the streams surveyed had only cutthroat trout above barriers. The important barriers were natural falls, high gradient areas, and beaver dams. Wherever rainbow and/or eastern brook trout were present in association with cutthroat trout they were predominant. Cutthroat trout are presently restricted to the headwaters of streams which originally were entirely inhabited by them. Taxonomic determinations were based upon the examination of 345 cutthroat trout (126 from streams that had never been stocked with rainbow trout), 54 rainbow trout and 88 rainbow X cutthroat trout. Satisfactory separation for fish over 4.0 inches in total length was achieved. Individual distribution records of cutthroat trout from 699 streams and 244 lakes were listed. They were predominant (only game fish present or ranked first in relation to other game fish) in 253 (38 percent) streams and 142 (58 percent) lakes.

INTRODUCTION

The cutthroat trout (Salmo clarki) originally inhabited all the waters of Montana in and adjacent to the mountains except for a considerable number of small isolated virgin lakes. Other native game species which shared this range were the grayling (Thymallus arcticus) and the mountain whitefish (Prosopium williamsoni) on the eastern slopes of the Continental Divide with the dolly varden (Salvelinus alpinus) and the mountain whitefish on the western slopes. Other native fishes were also present (Table 1).

Jordan (1889) reported that cutthroat trout were abundant in the upper Yellowstone River drainage. Evermann and Cox (1894) stated that the cutthroat trout attracted a large number of anglers in the upper waters of the Missouri River Basin and although the supply was large it had begun to diminish. This decline was attributed to fishing pressure and increased water and land use. Evermann (1893) reported an abundance of cutthroat trout on the western slopes of the Rocky Mountains. There is evidence to show that cutthroat trout were abundant in the mountainous areas of Montana, however, this species was probably no more abundant than grayling and mountain whitefish in many streams.

While exotic trout have been introduced into all the major drainages originally occupied by cutthroat trout, a few small tributaries still remain unmolested. Rainbow trout (Salmo gairdneri) was first introduced in 1891 and has been most extensively stocked since that time. Brown trout (Salmo trutta) was originally introduced in 1891 and has become the pre-

Table 1. List of the fishes associated with cutthroat trout (Salmo clarki) in Montana.

Species		Distribution 1/	Origin 2/
Game			
Grayling	Thymallus arcticus	E	N
Kokanee salmon	Onchorhynchus nerka	EW	I
Brown trout	Salmo trutta	EW	I
Rainbow trout	Salmo gairdneri	EW	I
Eastern brook trout	Salvelinus fontinalis	EW	I
Dolly varden trout	Salvelinus alpinus	W 3/	N
Pygmy whitefish	Prosopium coulteri	W	N
Mountain whitefish	Prosopium williamsoni	EW	N
Others			
Common white sucker	Catostomus commersoni	E	N
Eastern longnose sucker	Catostomus catostomus	E	N
Columbia largescaled sucker	Catostomus macrocheilus	W	N
Mountain sucker	Pantosteus platyrhynchus	E	N
Carp	Cyprinus carpio	EW	I
Longnose dace	Rhinichthys cataractae	EW	N
Columbia River chub	Mylocheilus caurinus	W	N
Squawfish	Ptychocheilus oregonense	W	N
Redside shiner	Gila balteata	W	N
Black bullhead	Ictalurus melas	E	I
Burbot	Lota lota	EW	N
Pumpkinseed	Lepomis gibbosus	W	I
Yellow perch	Perca flavescens	EW	I
Northern sculpin	Cottus bairdi	EW	N
Slimy sculpin	Cottus cognatus	W	N
Torrent sculpin	Cottus rhotheus	W	N

1/ E - east Continental Divide; W - west Continental Divide; EW - both sides of Divide.

2/ N - native; I - introduced.

3/ St. Mary's Drainage, east Continental Divide.

dominant species in the valley streams of the cutthroat trout range. Eastern brook trout (Salvelinus fontinalis) was introduced in 1894 and now occupies many of the small valley brooks and mountain headwater creeks as well as a considerable number of mountain lakes. These exotic species have gradually replaced the cutthroat trout in the lower parts of its original range. The native strains of cutthroat trout are now limited to a few remote areas of the State.

Hybrids between rainbow and cutthroat trout have appeared in practically all drainages where rainbow trout were introduced. These hybrids are numerous in most places which makes identification of the cutthroat trout and the determination of its present range extremely difficult. The effects of hybridization on the future of the cutthroat trout are not known.

This study of cutthroat trout has two primary objectives: to determine the distribution and abundance of pure cutthroat trout stocks; and to secure information on influencing factors. In addition, observations were made on taxonomic differences between the various native strains of cutthroat trout and on the prevalence of hybrids. This study may prove useful in future management of these species.

Time did not permit the writer to determine the complete range of the cutthroat trout for the whole State. Investigations were concentrated east of the Continental Divide. However, all the available information on this species in Montana has been reviewed and included. Field collections were made and surveys conducted during the summers of 1957 and 1958 (June to September).

The writer extends thanks to the following persons and organizations for their assistance during the study. Dr. C. J. D. Brown gave technical supervision and aided in the preparation of this manuscript. Nels A. Thoreson suggested the problem and rendered valuable field assistance; other Montana Fish and Game Department personnel aided in collecting specimens and furnished distribution data. Edward Nevala, Quenton Stober and James Calkins assisted in the stream surveys. The U. S. Forest Service supplied maps. The Montana Fish and Game Department financed the field work under Federal Aid to Fisheries Restoration Project F-5-R.

DESCRIPTION OF THE STUDY AREA

The present distribution of the cutthroat trout, east of the Continental Divide in Montana, is confined to parts of most major primary tributary drainages; in the Missouri River from Three Forks to the mouth of the Musselshell River, and in the Yellowstone River from the Wyoming boundary to the mouth of the Big Horn River. This species is rarely found in the main stem of the Missouri River, however, it does occur frequently in the Yellowstone River for a distance of about 90 miles down stream from Yellowstone National Park.

The major primary streams of these two large rivers have vast networks of secondary and tertiary tributaries draining the east slope of the Rocky Mountains in Montana. Remnants of pure cutthroat trout are mostly confined to the small headwater streams. These drain: steep mountain slopes, which are generally covered by coniferous forests; mountain valleys where grasses, sedges and willows predominate; valleys at low elevations characterized by sagebrush and bunchgrass.

These streams are 5 - 20 feet in width (av. approx. 9 feet) and have depths usually less than two feet. They originate at elevations from 6,000 to 8,000 feet above sea level. The lowest elevation at which cutthroat trout were collected in streams was 4,500 feet, however, a few specimens were taken in ponds and reservoirs at lower elevations. Estimated gradients of streams presently occupied by cutthroat trout were usually from 50 to 250 feet per mile, but there were extensive stretches of cascades and falls where gradients were higher. Summer stream velocities of 1 - 3 feet per second were characteristic of riffle areas. Velocities taken during early spring run-off in the more precipitous areas were approximately double those of summer. Beaver dams occur frequently on the streams and have a tempering effect on the velocities. In general, bottom materials (based on visual estimates) were composed of about 10 percent boulders, 15 percent rubble, 60 percent gravel and 15 percent sand and detritus. Exceptions to the general composition were in areas of beaver activity and mining dumps where silt became a major component.

Summer water temperatures (June 20 to Sept. 24) varied from 45 to 65° F. and the total alkalinity (methyl orange) range was 13.5 - 227 ppm. The principal stream bottom organisms were stoneflies (Plecoptera), caddisflies (Trichoptera) and mayflies (Ephemeroptera). Algae were common but vascular water plants were rare.

Mining, logging, and livestock are the major industries found in the area of cutthroat trout distribution. U. S. Forest Service and other access roads are present in some forest areas, however, about 75 percent of the cutthroat trout streams are still inaccessible by road.

FIELD SURVEY METHODS

The lack of roads along mountain streams made the use of an electric fish shocker impractical. Most collections were made by angling or by using cresol, however, other fish toxicants and dynamite were employed to a limited extent.

An attempt was made to test the effectiveness of sampling by angling. Six miles of a stream were selected which had an approximate average width of nine feet, a depth of eight inches and a velocity of two feet per second. The stream was then divided into six 1-mile sections. A 300 foot portion of each mile section, selected in favorable trout habitat, was shocked (110 volt A.C.). The fish recovered were counted and returned to the area in which they were taken. Each one mile section was then fished using flies (wet and dry). A distance of one mile was covered in approximately two hours of fishing. While the number of fish taken by angling was considerably less than by shocking, angling appeared adequate to show the range and relative abundance of trout (Table 2).

In actual practice the length of streams fished ranged from 3 - 8 miles. Usually two fishermen sampled alternate parts of a stream from lower to higher elevations. Success was generally good, possibly because of low fishing pressures in these areas. Angling was considered sufficently successful to determine the range and relative abundance of trout in 80 of the 100 streams surveyed. Relative abundance estimates were probably more accurate on small streams where fishing was more intense.

Table 2. Angling and shocking success on test stream.

Sections	Species of trout	Shocking (per 300')	Angling (per mile)
		No. Fish	No. Fish
1	Cutthroat trout	48	22
2	Cutthroat trout	36	14
3 1/	Eastern brook trout	98	24
	Cutthroat trout	36	6
	Rainbow trout	1	0
4	Eastern brook trout	53	17
	Cutthroat trout	4	2
	Rainbow trout	2	0
5	Rainbow trout	26	11
	Eastern brook trout	6	8
6	Eastern brook trout	44 2/	18
	Rainbow trout	8	5
	Cutthroat trout	1	0

1/ Rainbow x cutthroat hybrids were present, but at this early date of the investigation no definite identification was made.

2/ Twenty-nine of these were less than 3 inches in length.

Cresol was used where angling success was low. An estimate of the stream volume was made by using a velocity head rod. Cresol was applied at the rate of one gallon per four cfs for each 100 yards of the stream (Wilkins, 1955). Cresol was spread over the upper half of the sample area when velocities were less than one foot per second. When velocities were greater, it was applied in a narrow band across the stream, usually at the head of a pool. Incapacitation of trout and sculpins in the faster streams was almost immediate after application and the effect was only momentary. In the slower streams the incapacitation time varied from 5 - 8 minutes and recovery from 5 - 20 minutes. All sizes of fishes were affected by the treatment. A small amount of mortality occurred as a result of fish thrashing about and becoming beached.

FIELD SURVEY RESULTS

Field surveys were made on 100 streams east of the Continental Divide, 73 of which contained cutthroat trout. Fifty-five (75 percent) of these had only populations of cutthroat trout above barriers; nine had exotic trout planted above fish barriers; two had cutthroat trout planted into existing exotic trout populations; five had cutthroat populations which were seriously effected by pollution or dewatering; two had populations of cutthroat and exotic trout with no barriers separating them.

Forty-six (84 percent) of the barriers which had only cutthroat trout above them were either natural falls, high gradient areas or beaver dams. Natural falls (Fig. 1) varied in height from 4 - 30 feet and no exotic trout were found above them in most instances. High gradient areas (gradient 500 - 1,500 feet per mile) varied in length from 330 - 1,320 feet (Fig. 2). The bottom materials in these areas were predominantly large boulders and rubble with numerous dead falls and other debris. Beaver dams formed barriers either singly or in series. Single dams were usually old and ranged from 6 - 12 feet in height. Even low beaver dams were barriers if a large enough number occurred in a series

Fig. 1. Natural falls fish barrier (Hellroaring Creek, Beaverhead River Drainage).

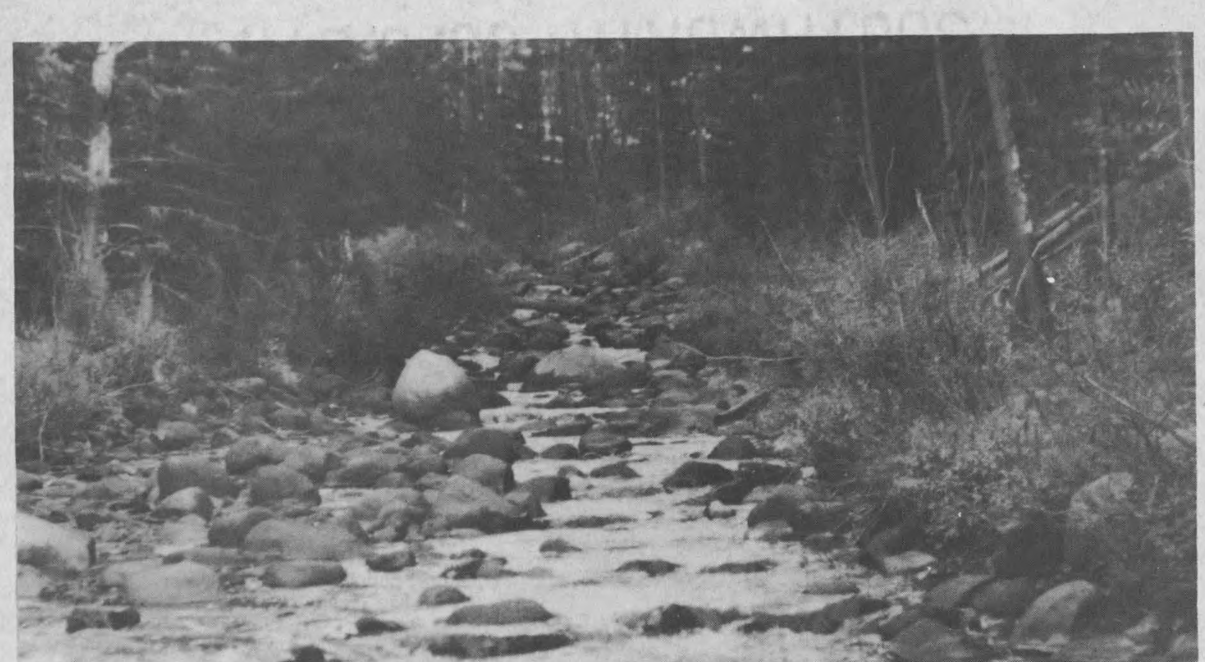

Fig. 2. High gradient area fish barrier (David Creek, Big Hole River Drainage).