



Observations on the fish population of Willow Creek reservoir, Montana
by James A Posewitz

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

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Abstract:

Observations were made on the spawning, growth, distribution, harvest and movement of trout in Willow Creek Reservoir from March through November, 1960. Successful reproduction was observed only in Willow Creek. Rainbow trout taken in 1960 showed a decline in average size and slower growth rate than the same species taken in previous years. Distribution of trout in the reservoir appeared to be correlated with water temperatures, Rainbow trout were most evenly distributed in the reservoir when water temperatures were warmest, but were concentrated near the surface when water temperatures were cool, Brown trout were always more abundant near the bottom, and at maximum temperatures were restricted to deeper areas. Game fish caught by gill nets included 69.05 percent rainbow trout, 30.04 percent brown trout, 0.68 percent brook trout and 0.23 percent mountain whitefish. Anglers harvested an estimated 14,868 trout during the 1960 (six week) fishing season. The catch was composed of 97.27 percent rainbow trout, 2.47 percent brown trout and 0.26 percent brook trout. Recoveries of marked fish indicated a wide dispersal of fish marked in the tributaries during spawning, and of those planted in 1960.

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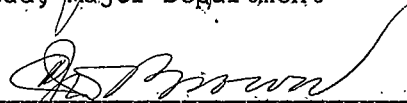
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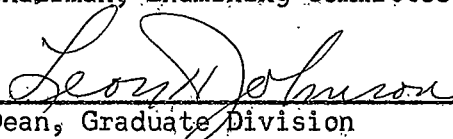
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The Author

I was born in Sheboygan, Wisconsin on March 6, 1935 and completed my elementary and high school education there. In September, 1953 I entered Montana State College where I completed requirements for a Bachelor of Science degree in Fish and Wildlife Management in 1957. For two summers, I was employed by the Montana Fish and Game Department; one as an assistant to a district fish manager, and one as foreman of a fish shocking crew. I was employed for one summer as party leader for a fish collecting crew from Montana State College. In November of 1957 I entered military service and served two years with the United States Army, 15 months of which were spent in Germany. I was married to Helen Vidal in May, 1958 and we now have two sons. In September, 1959 I was accepted as a graduate student in Fish and Wildlife Management at Montana State College. This thesis is submitted as partial fulfillment of the requirements for the Master of Science degree in Fish and Wildlife Management

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Abstract

Observations were made on the spawning, growth, distribution, harvest and movement of trout in Willow Creek Reservoir from March through November, 1960. Successful reproduction was observed only in Willow Creek. Rainbow trout taken in 1960 showed a decline in average size and slower growth rate than the same species taken in previous years. Distribution of trout in the reservoir appeared to be correlated with water temperatures. Rainbow trout were most evenly distributed in the reservoir when water temperatures were warmest, but were concentrated near the surface when water temperatures were cool. Brown trout were always more abundant near the bottom, and at maximum temperatures were restricted to deeper areas. Game fish caught by gill nets included 69.05 percent rainbow trout, 30.04 percent brown trout, 0.68 percent brook trout and 0.23 percent mountain whitefish. Anglers harvested an estimated 14,868 trout during the 1960 (six week) fishing season. The catch was composed of 97.27 percent rainbow trout, 2.47 percent brown trout and 0.26 percent brook trout. Recoveries of marked fish indicated a wide dispersal of fish marked in the tributaries during spawning, and of those planted in 1960.

Introduction

A large number of investigations have been made on fish populations of reservoirs but few concern cold water fish. Studies on cold water fish populations in Colorado were made by Nelson (1955) and Sharpe (1958). The present investigation was conducted from March through November, 1960. It included observations on the life history, distribution and harvest of rainbow trout (Salmo gairdneri) and brown trout (Salmo trutta) in a cold water impoundment.

Acknowledgements. Grateful acknowledgement is due to Dr. C. J. D. Brown who directed the project and aided in the preparation of the manuscript. Thanks are due to several members of the Montana Fish and Game Department for help in the field. John R. Heaton assisted with the age and growth analysis and Tom Leik gave advice regarding the collection and analysis of creel data. Thanks are also due to Charles Quesenbury who suggested and outlined the design for the harvest estimate. The Montana Fish and Game Department provided financial support under the Federal Aid to Fish Restoration Act (Project number F-9-R-9).

Description of Area. Willow Creek Reservoir is formed by an earth filled dam athwart Willow Creek, a tributary of the Jefferson River which in turn is one of three primary headwater tributaries of the Missouri River. This impoundment is located 4 miles east of Harrison, Madison County, Montana. It was filled for the first time in 1938. When full, it has a surface area of 868 acres, a storage capacity of 17,760 acre feet, and a maximum depth of 74 feet. The spillway elevation is 4,736 feet above

sea level. During summer and early autumn of the study period, water levels in the impoundment decreased about 15 feet due to irrigation draw-down. The reservoir is situated in an open rolling grassland and has a drainage area of approximately 160 square miles located on the east slopes of the Tobacco Root Mountains. The tributaries which enter the reservoir are: Willow Creek with a drainage area of 88.4 square miles and an average flow of 43.1 c.f.s.; Norwegian Creek with a drainage area of 34.6 square miles and an average flow of 7.5 c.f.s.; and Dry Hollow Creek which is a very small intermittent stream.

The water in the reservoir is relatively clear, even during run-off. In the study period, water temperatures ranged from 78° (July 22) to 32° F. (ice cover, December through March). The greatest daily variation occurred on July 22 with a maximum of 78° and a minimum of 63° F. No marked thermal stratification was observed.

Chemical analyses of water from the impoundment showed the following: phenolphthalein alkalinity 13 p.p.m.; methyl orange alkalinity 127 p.p.m.; pH 7.3. Chemical analyses of water from the two major tributary streams (Table 1) were made by the Montana State Board of Health.

Rooted aquatic vegetation was present in areas of the reservoir with depths less than 10 feet but much of this area was exposed by draw-down.

Fish observed in the reservoir were rainbow trout, brown trout, brook trout (Salvelinus fontinalis), mountain whitefish (Prosopium williamsoni), white sucker (Catostomus commersoni), longnose sucker (Catostomus catus-
tomus), longnose dace (Rhinichthys cataractae), and mottled sculpin (Cottus

Table 1. Chemical data for Willow and Norwegian Creeks, 1960.

Chemical analyses	Willow Creek p.p.m.	Norwegian Creek p.p.m.
Iron (Fe)	1.0	0.9
Calcium (Ca)	56.0	52.0
Magnesium	27.0	37.0
Sodium and Potassium Calc. (Na-K)	25.0	21.0
Carbonate radical (CO ₃)	0.0	0.0
Bicarbonate radical (HCO ₃)	293.0	317.0
Sulphate radical (SO ₄)	49.0	27.0
Chloride (Cl)	8.0	28.0
Fluorine (F)	0.4	0.5
Nitrates (NO ₃)	0.1	0.0
Hydroxide (OH)	0.0	0.0
Total hardness (as CaCO ₃)	250	281
Total dissolved solids	370	385

bairdi). With the exception of the first three, all are native to the drainage. No records were found regarding the original introduction of trout into the reservoir but stocking records since 1953 are available (Table 2).

Table 2. Willow Creek Reservoir rainbow trout stocking records.

Year	Size in inches	Number	Total weight in pounds
1953	6-9	2,700	360
1954	1	113,175	85
1954	6-9	2,599	769
1955	3	85,966	490
1957	3	46,124	708
1958	3	58,144	705
1959	6-9	29,988	9,630
1959	6-9	25,083	4,810
1960	6-9	29,976	7,847
1960	6-9	25,000	5,000

Rainbow trout have produced spawning runs in the tributary streams and a trap in Willow Creek has been operated since 1950 for the purpose of obtaining eggs of this species (Table 3).

Table 3. Data from the Willow Creek egg taking operation.

Year	Number of females stripped	Number of eggs taken
1950	-----	1,289,680
1951	-----	2,267,136
1952	-----	1,746,810
1953	-----	3,585,600
1954	-----	2,642,164
1955	1830	2,432,960
1956	1139	3,615,744
1957	1771	2,493,102
1958	988	1,773,552
1959*	335	629,748
1960	239	279,800

* In 1959 an additional 443 females and 935,088 eggs were taken from Norwegian Creek.

Observations on Spawning and Fry Production in Tributaries

The tributary streams provide spawning areas for most fishes in the reservoir. Spawning fish in Norwegian and Dry Hollow Creeks were collected by electrofishing, using a 220 volt D.C. generator. A section of 300 feet was established in each stream and practically all adult fish were captured in these areas on each collection date. The spawning fish in Willow Creek were taken in a trap which blocked the entire stream. This trap was installed previous to this study, by the Montana Fish and Game Department for the purpose of obtaining rainbow trout eggs.

The tributaries were first visited on March 27 and at that time adult

rainbow trout, presumably from the reservoir, were observed in Norwegian and Dry Hollow Creeks, no fish were seen in Willow Creek. Seven samples were taken on Norwegian Creek as follows: two on March 30, and one each on April 1, 4, 8, 11, and May 7. A total of 207 male and 124 female rainbow trout was collected (Table 4). Four samples were taken on Dry Hollow Creek; one each on April 1, 8, 11, and May 7. A total of 71 male and 31 female rainbow trout was collected (Table 4).

Table 4. Number, average length, and average weight of rainbow trout taken electrofishing in Norwegian and Dry Hollow Creeks, 1960.

Date	Norwegian Creek		Dry Hollow Creek	
	Males	Females	Males	Females
March 30	22	10	--	--
March 30	25	21	--	--
April 1	33	13	15	4
April 4	37	45	--	--
April 8	29	7	26	13
April 11	16	11	17	7
May 7	45	17	13	7
Total number	207	124	71	31
Average length	13.48	16.80	13.18	14.84
Average weight	0.98	1.62	0.81	1.10

The trap on Willow Creek was put into operation on March 29, and the first rainbow trout was captured along with seven suckers on April 1. The first eggs were taken on April 13, and spawn-taking continued at irregular intervals through May 8. During this period a total of 474 rainbow trout, including 235 males and 239 females, was trapped. A total of 270,800 eggs was taken in this spawn-taking operation (Table 5).

Lengths and weights were taken on rainbow trout in the 1960 spawning run in Willow Creek. Lengths and weights were also available for spawning

