



The yield and standing crop of fish in Dailey Lake, Montana  
by Richard L Johnson

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:**

A creel census was conducted on Dailey Lake during the summers of 1960 and 1961, An estimate of the standing crop of fish was made in 1961 by a mark and recovery method. Fishermen harvested 34.3 pounds per acre of rainbow trout, 4.5 pounds per acre of kokanee and 8.4 pounds per acre of yellow perch in 1960. Fishermen harvested 27.8 pounds per acre of rainbow trout, 4.3 pounds per acre of kokanee, and 11.7 pounds per acre of yellow perch in 1961. The total catch per hour was 0.5 in 1960 and 0.81 in 1961. An estimated 4,394 rainbow trout of the 1961 plant were harvested during the 1961 census period giving a return of 23 percent the first year. The standing crop of fish in Dailey Lake was 86.1 pounds per acre in 1961, of which 35 pounds were rainbow trout, 23.6 pounds yellow perch, 19.8 pounds kokanee, and 7.7 pounds longnose suckers. Natural mortality probably accounts for 50 percent of the stocked rainbow trout.

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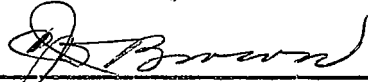
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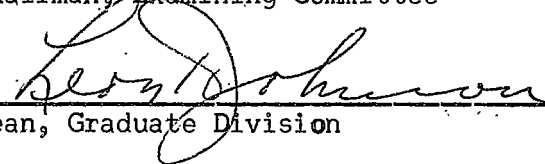
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Table of Contents

	Page
Abstract . . . . .	3
Introduction . . . . .	4
Creel census methods . . . . .	7
Creel census results . . . . .	8
Population estimates methods . . . . .	12
Population estimates results . . . . .	15
Discussion . . . . .	21
Summary . . . . .	22
Literature cited . . . . .	23

ABSTRACT

A creel census was conducted on Dailey Lake during the summers of 1960 and 1961. An estimate of the standing crop of fish was made in 1961 by a mark and recovery method. Fishermen harvested 34.3 pounds per acre of rainbow trout, 4.5 pounds per acre of kokanee and 8.4 pounds per acre of yellow perch in 1960. Fishermen harvested 27.8 pounds per acre of rainbow trout, 4.3 pounds per acre of kokanee, and 11.7 pounds per acre of yellow perch in 1961. The total catch per hour was 0.5 in 1960 and 0.81 in 1961. An estimated 4,394 rainbow trout of the 1961 plant were harvested during the 1961 census period giving a return of 23 percent the first year. The standing crop of fish in Dailey Lake was 86.1 pounds per acre in 1961, of which 35 pounds were rainbow trout, 23.6 pounds yellow perch, 19.8 pounds kokanee, and 7.7 pounds longnose suckers. Natural mortality probably accounts for 50 percent of the stocked rainbow trout.

## INTRODUCTION

A considerable number of population studies have been made on warm-water fish, especially in ponds; however, only a few concern trout populations in lakes. These latter include studies of: Grebe Lake in Yellowstone National Park (Kruse, 1959), four lakes in New York (Hatch and Webster, 1961) and six lakes in Wisconsin and Michigan (Johnson and Hasler, 1954). The present study was conducted on Dailey Lake, in Montana, during June through September of 1960 and 1961. The objectives were to determine the standing crop, species composition and angler harvest of fish.

This lake is located in the Yellowstone River drainage approximately 30 miles north of Yellowstone National Park. It lies in the foothills of the Absaroka Mountain Range at an elevation of 5200 feet mean sea level. Dailey Lake (Figure 1) has a surface area of 204 acres and a maximum depth of 24 feet. During the study period the maximum surface water temperature was 71° F and the minimum 41° F. No marked thermal stratification was observed during the investigation. This was probably due to frequent, strong winds which circulate the water during the ice free period (April-October). The lake is fed by a diversion from a nearby stream which usually flows only during the spring and fall, and also by a small spring and by runoff, largely from melting snow. The outlet is small and flows only during periods of high water. Chemical analysis of the lake water showed the following: methyl orange alkalinity, 320-360 p.p.m.; pH, 8.2-8.6; and total dissolved solids, 403 p.p.m. (one sample).

Aquatic vegetation is abundant in Dailey Lake. Extensive stands of

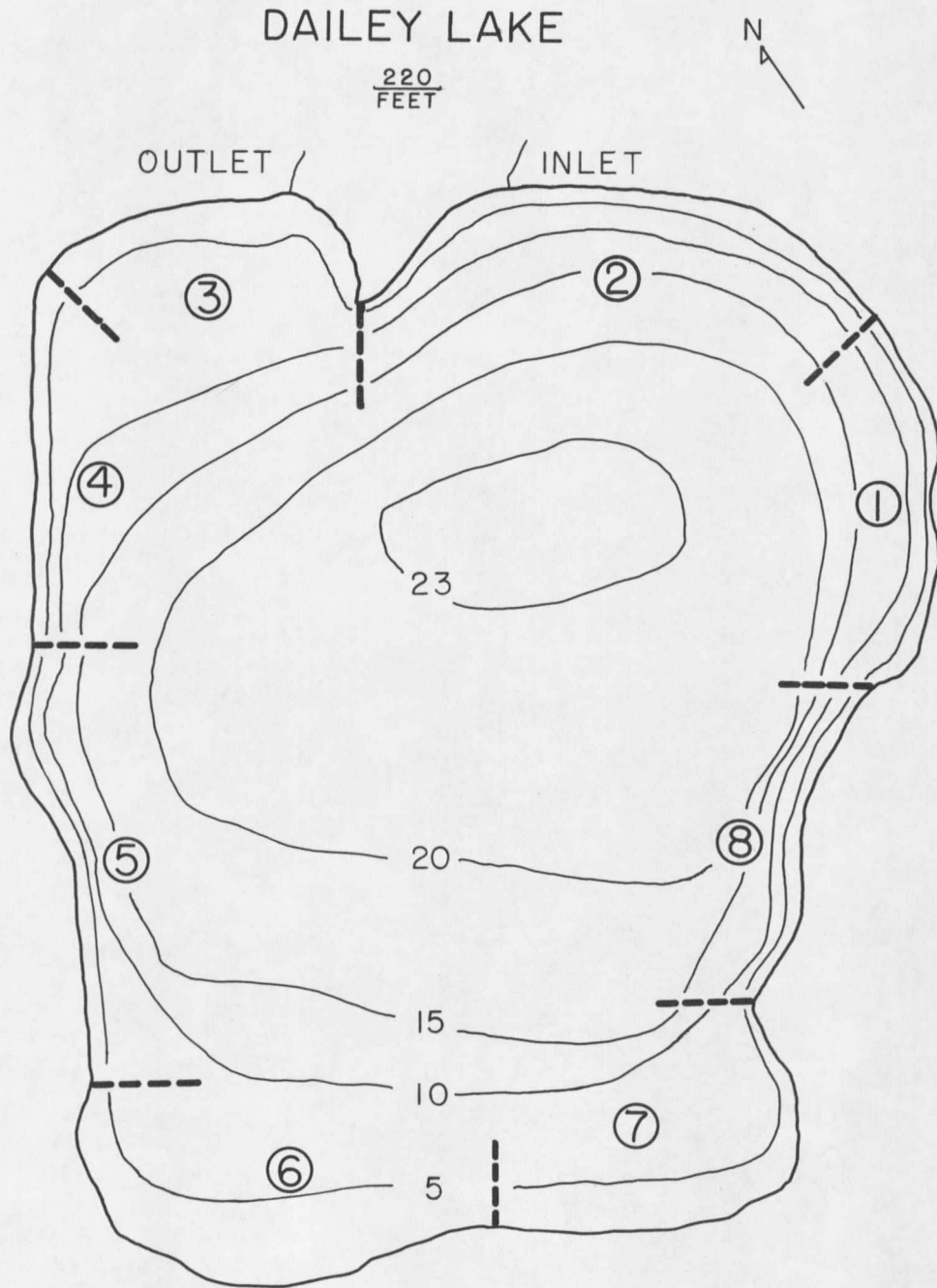


Fig. 1. Dailey Lake, Montana. Circled numbers denote sections used during the marking and recovery study.

bullrush (Scirpus validus) were found in the shallow water along the south end while emergent vegetation was sparse or absent in other parts of the lake. Large Chara beds were found over much of the lake bottom in areas less than 15 feet in depth. Other submerged vegetation was confined to small scattered patches in the shallow areas.

The fish included in the population study in order of decreasing abundance are as follows: yellow perch (Perca flavescens), rainbow trout (Salmo gairdneri), kokanee (Onchorhynchus nerka kennerlyi), and longnose sucker (Catostomus catostomus). Other species present include cutthroat trout (Salmo clarki), brown trout (Salmo trutta), largemouth bass (Micropterus salmoides), black crappie (Pomoxis nigromaculatus), white sucker (Catostomus commersoni), and the lake chub (Hybopsis plumbea). Of these, only the lake chub is abundant.

Yellow perch were probably first introduced in 1944 along with largemouth bass and bluegill (Lepomis macrochirus). Rainbow trout were initially planted in 1947 and since 1951 have been stocked each year. During the study 20,000 of these (total length, 4-12 inches) were planted each year. In 1961 all of the rainbow were marked by removing the right pelvic fin. The longnose sucker was introduced, at an unknown time, probably by bait fishermen. Kokanee have been planted continuously since 1955 at the rate of 50,000 fry annually.

#### ACKNOWLEDGEMENTS

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## CREEL CENSUS

### Methods

During 1960 and 1961 Dailey Lake was open to angling from the last Sunday in May through November 30. Snagging of kokanee was permitted from October 1 through December 31 in both years. A checking station, located on the main access road to the lake, made it possible to interview 85 percent of the summer fishermen in 1960 and 90 percent in 1961. The following information was recorded for each fisherman: Number of hours fished; number of fish caught; species caught; method of fishing (boat or shore). The type of fisherman (perch or trout) and the number of fin-clipped trout in the catch was also recorded in 1961. Approximately 70 percent of the trout in the creel were examined for missing fins. The ratio of clipped to unclipped fish in the creels examined was applied to those creels not examined to obtain the total number of fin-clipped rainbow taken by fishermen during the 1961 census sample.

To obtain a representative sample, the census periods (May 30-September 30, 1960 and May 31 - October 13, 1961) were divided into three-week intervals. A group of seven days, with each day of the week being repre-



sented once, was then randomly selected from each three week interval to make up a sampling period. In 1961 all holidays were also included in the sample.

For estimating the number of fish, fishermen, and hours, the census period was divided into three strata in 1960: stratum I, opening day; stratum II, weekend days and holidays; stratum III, weekdays (Monday - Friday). The 1961 census period was divided into five strata: stratum I, opening day; stratum II, weekend days and holidays through Labor day; stratum III, weekdays through Labor day; stratum IV, weekend days after Labor day; stratum V, weekdays after Labor day.

Estimates with 95 percent confidence limits were determined by the method outlined by Cochran (1953, pp. 72-73). To obtain total harvest and pressure (Table 1) estimates for strata II-III in 1960 and strata II-V in 1961 were computed to supplement the actual counts of stratum I.

Average total length was determined by measuring a random sample of the catch each year. Average weight was found by comparing the average length of creel caught fish to the weights of fish of the same length taken in gill nets during the 1960 and 1961 season. The pounds of fish harvested were computed by multiplying the estimated number of fish caught by their average weight.

## CREEL CENSUS

### Results

The estimated fishing pressure and harvest for both census periods is given in Table 1. Although the 1961 census period was two weeks longer

Table 1. Estimated number of fish, fishermen, and hours of fishing for 1960 and 1961 (95 percent confidence limits).

1960															
Strata	Rainbow trout			Kokanee			Yellow perch			Fishermen			Hours		
I	696	696	696	419	419	419	3	3	3	338	338	338	1716	1716	1716
II-III	7998	9742	10946	348	845	1342	3239	5042	6845	6331	7669	9007	22509	28090	33671
Total	8694	10438	11642	767	1264	1761	3242	5045	6848	6669	8007	9345	24225	29806	35387
1961															
I	876	876	876	510	510	510	229	229	229	442	442	442	2220	2220	2220
II-V	8356	9417	10478	513	701	889	6725	7972	9219	4776	5329	5882	19490	22163	24836
Total	9232	10293	11354	1023	1211	1399	6954	8201	9448	5218	5771	6324	21710	24383	27056

than in 1960, approximately the same number of rainbow and kokanee were harvested each year. The catch of yellow perch increased by about 60 percent in 1961. While the total number of fish caught in 1961 was greater than in 1960, the total weight harvested (Table 2) decreased by 700 pounds.

Table 2. Average length, weight, pounds harvested, and composition of the catch for the 1960 and 1961 census period.

	<u>Average length</u>		<u>Average weight</u>		<u>Pounds harvested</u>		<u>Pounds per surface acre</u>		<u>Percent of catch</u>	
	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
Rainbow trout	12.0	11.6	0.67	0.55	6,994	5,661	34.3	27.8	62.4	52.2
Kokanee	12.6	12.7	0.72	0.72	910	872	4.5	4.3	7.5	6.2
Yellow perch	8.4	8.1	0.34	0.29	1,715	2,378	8.4	11.7	30.1	41.6
Total					9,619	8,911	47.2	43.8		

The average weights (Table 2) of rainbow and yellow perch decreased by 0.12 and 0.05 pounds respectively from 1960 to 1961. This decrease in size is also shown by comparing average total lengths of rainbow taken the opening day for four different fishing seasons. These are as follows: 1955 - 15.9 inches; 1957 - 14.7 inches; 1960 - 13.2 inches; 1961 - 12.2 inches.

The number of fishermen decreased in 1961 while the average number of hours fished, the total catch per hour and number of fish per fisherman increased (Table 3).

Table 3. Fishing intensity and rate of catch for the 1960 and 1961 census period.

	<u>Fishermen per acre</u>	<u>Hours per acre</u>	<u>Total catch per hour</u>	<u>Hours per fisherman</u>	<u>Average number fish per fisherman</u>
1960	39.5	146	0.56	3.7	2.1
1961	28.3	120	0.81	4.2	3.4

The catch of kokanee on opening day (strata I) accounted for 33 percent of the total kokanee catch in 1960 and 42 percent in 1961 (Table 1). Excluding opening day, the catch was highest during the last part of the census period. Kokanee made up 8 percent of the combined rainbow and kokanee harvest during the first three weeks of the census; it averaged 3 percent during July, August and most of September and increased to 20 percent during the last three weeks of the census. A similar pattern was shown by Bjornn (1961) in Idaho. He related the higher catch in the early summer and fall to lower water temperatures during these periods.

The fishing success for all trout fishermen (trout and kokanee) in 1961 was 0.47 fish per hour. Excluding the unsuccessful trout fishermen, the catch per hour was 0.63 fish. Thirteen percent of the trout fishermen caught 47.4 percent of the rainbow and kokanee. Percentage composition of the catch is given in Table 2. The combined harvest of salmonids was 38.8 pounds per surface acre in 1960 and 32.1 pounds in 1961. Georgetown Lake, Montana (2,800 acres) had a catch per hour of 0.50 and a harvest of 14.3 pounds per acre of game fish (salmonids) during the summer season of 1958 (Averett and Whitney, 1959). The total harvest of game fish in this lake for the 1958-59 season (including a partial winter fishery) was 29.4 pounds per surface acre.

Yellow perch fishermen, while making up only 5 percent of the total, had a high rate of success. They averaged 11.3 perch per angler and had a catch per hour of 2.23. The total harvest by all fishermen was 11.7 pounds per surface acre.

An estimated 4,394 rainbow of the 1961 plant were harvested during the 1961 census period giving a return of 23 percent. They made up 46.9 percent of the rainbow harvested during this period.

## POPULATION ESTIMATES

### Methods

Two types of estimates were made. The first was based on fish taken by trap nets, a seine, and sport fishermen from July 26 to September 7. The second was based on fish taken in gill nets from September 11-13.

Two trap nets, similar to the one described by Crowe (1950), were used. These had leads of 125 feet and both the nets and leads were of 0.5 inch bar mesh. They were set facing shore in water ranging from 8 to 12 feet in depth and were fished continuously during the 44 day period. The seine (0.5 inch bar mesh) was 300 feet long, 12 feet deep at the center and tapered to a depth of 7 feet at each end. Seining was usually done on two consecutive nights and then discontinued for three nights depending upon the weather and help available. Only those areas less than 15 feet in depth were fished with the traps and seine. These were divided into eight sections (Figure 1). The north portion, referred to subsequently, includes sections 1 through 4 while the south portion includes sections 5 through 8. An effort was made to mark fish from all sections, however, the greatest amount of effort was applied to sections 2, 3, 6, and 7 where fish were more abundant. Seining was the principal method of capturing fish in the north portion while trapping was the main method in the south. Except for two small areas, seining was practically impossible in

the south portion due to aquatic vegetation and consequently the two available traps were used here.

Fish taken in the traps and the seine were fin clipped with two objectives in mind. The first was to have recognizable fish for population estimates and the second was to determine if there was random mixing of fish between the north and south portions. Rainbow trout stocked in 1961 had the right pelvic fin removed before planting. All fish of this species taken in the traps and seine were marked by removing the left pelvic fin. A hole was punched in the dorsal lobe of the caudal fin for trout taken in the north portion and in the ventral lobe for those taken in the south portion. Kokanee and longnose suckers were marked by removing the right pelvic fin for those captured in the north and the left pelvic for those in the south. The right pectoral fins of perch were removed for those captured in the north and the left pectoral for those in the south. There was no indication that any of the clipped fins had regenerated during the marking and recapturing period. There was evidence of slight regeneration of caudal fin deletions. Fish taken in the traps and seine were taken to the approximate center of the lake, fin clipped and released. The same two persons marked and checked all fish during the estimating period.

Fish were divided into length groups for population estimates. Two groups of trout were recognized; those planted in 1961 (1 year old); and all others (2 years or older). Yellow perch were also separated into two groups; those from 7.2 to 9.2 inches (3 years old), and those over 9.2 inches (4 years old or older). Perch between 5 and 7.1 inches (2 years

old) were too numerous to mark but their numbers were recorded. Only kokanee 11.5 inches or longer and longnose suckers 12.0 inches or longer were included in the population estimate. Very few small kokanee or suckers were taken by traps. No longnose suckers and few small kokanee were known to have been caught by fishermen.

Recruitment into the above classes was considered negligible. Since the rainbow planted in 1961 were all fin clipped before stocking and no successful spawning was observed, there could be no recruitment into either of the trout groups. The two groups of perch could be separated by their length frequency. This was verified by scale reading. Two year old perch were easily distinguished from three year olds but there was some overlap between three and four year old perch. The error in separating these two groups is not considered important. Lengths of the two groups of perch were adjusted every two weeks to allow for recruitment. The lower size limit of three year old perch was 7.2 inches on July 27 and increased to 8.0 inches by September 7. The lower size limit of four year old perch started at 9.3 inches and increased to 10.0 inches by September 7. Longnose suckers taken in traps, gill nets and the seine during the marking and recovery period made up two distinct length groups. The lengths of the two groups were 8.5 inches to 9.5 inches and 12.0 inches to 24 inches. While there was probably some recruitment into the larger group it would not be enough to cause any serious error. Recruitment into the group of kokanee under estimation is thought to be negligible.

Periodic checks were made to determine if there was an increased



























