MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION
HELENA, MONTANA

JOB COMPLETION REPORT

INVESTIGATIONS PROJECT

State of Montana

Project No. F-12-R-7 Name Western Montana Fishery Study

Job No. III Title Georgetown Lake Creel Census

Period Covered March 1, 1960 - April 30, 1961

ABSTRACT

Creel census was conducted on Georgetown Lake during the special winter fishing season to obtain data for making estimates of total angler harvest and pressure. The estimate of total harvest was 49,200 game fish, and total pressure was 68,900 hours. The rate of success was 0.71 fish per hour. An estimated 77 per cent of the total harvest was comprised of cutthroat and rainbow trout planted as fingerlings.

RECOMMENDATIONS

It is recommended that Georgetown Lake be planted with 150,000 each, of rainbow and cutthroat fingerling trout in 1961. One-third of each species planted should be marked with a distinctive fin clip.

Because of the importance of Georgetown Lake to the area, creel census should be conducted during the 1961 summer season to further evaluate the fishery. Census should again be conducted during the special winter fishing season in 1962-63.

OBJECTIVES

The objective of the Georgetown Lake winter creel census was to obtain data for making estimates of total fishing pressure and harvest. This information will be used in an evaluation of the effect of the special winter fishing season on the Georgetown Lake fishery.

TECHNIQUES USED

The winter fishing season on Georgetown Lake opened on December 11, 1960 and continued for 27 Saturdays, Sundays and legal holidays until February 26, 1961. Creel census was conducted on each day of the season.

Two series of data were obtained each day of the season: (1) individual angler contacts, and (2) total counts of angler cars during daylight hours

and counts of lights on the lake during hours of darkness.

To effectively census this 3,000 acre lake, the lake was divided into three areas and each day into six time periods. The area in which contacts were to be made were chosen in a systematic random manner, and the time periods for contacting anglers were sequential following initial random selection of time periods.

Counts of angler cars, both on shore and on the ice, and/or light counts on the ice, were made four times each day, with the exception of Christmas and New Years, when only two counts were made each day. The total number of of counts was 104. The relationship between the number of anglers and the number of lights used was determined by subsampling.

Only completed trip angler contacts were recorded. In addition to standard creel census contact data, the angler's automobile license number, and the fin clip code number of planted fish were included. In 1960, 150,000 each of cutthroat and rainbow trout fingerlings were planted. One-third of each species were marked by removal of the adipose fin. Fish planted in 1958 and 1959 had also been marked by distinctive clips in the same ratio.

FINDINGS

The analysis of data to determine total pressure and harvest involves the following steps: (1) determining the relationship between light and car counts and the number of anglers, (2) computing pressure, rate of success, harvest and the number of anglers, and (3) determing the precision of these estimates.

Pressure and Harvest

Sampling to determine the number of anglers per light was accomplished by making individual counts of the number of anglers per light at various times throughout the season. A check on 183 lights revealed that 382 anglers were using these lights, for an average of 2.09 anglers per light.

A subsample of 100 cars showed a mean number of anglers of 2.23.

To determine the total pressure in terms of hours fished, the average number of fishermen per count is multiplied by the total possible fishing hours in the season (459). The average number of fishermen per count is estimated by adding:

(a) The number of lights counted times the average number of anglers per light, or

$$(1,370)(2.09) = 2,863 \text{ anglers estimated}$$

(b) The number of cars counted on shore or ice, times the average number of anglers per car, or

$$(5,714)(2.23) = 12,742 \text{ anglers estimated}$$

$$\text{TOTAL} = 15,605 \text{ anglers estimated}$$

The above total of 15,605 anglers is an estimate of the total number of anglers present during 104 car and light counts. Since the average time between counts was greater than the average length of fisherman day, it is not an estimate of the total number of fishing trips made during the winter season. It was derived solely for the purpose of determining the average number of anglers per count.

$$\frac{15,605}{104} = 150.05 \text{ anglers per count}$$

Therefore the estimated total pressure is:

$$(150.05)\ (459) = 68,873 \text{ fisherman hours.}$$

Total angler trips for the season are computed by dividing the total fisherman hours by the average length of trip. Average length of trip was 4.494 hours and was derived from angler contacts.

$$\frac{68,873}{4.494} = 15,326 \text{ angler trips}$$

$$R = \frac{F}{H} = \frac{3.209}{4.494} = 0.714 \text{ fish per hour}$$

where R equals rate of success, F equals mean number of fish per fisherman and H equals mean length of trip. A total of 2,813 anglers were contacted. They fished for 12,641 hours and caught 9,027 fish.

The total harvest is calculated by multiplying the rate of success by the total hours fished, or:

$$(0.714)\ (68,873) = 49,175 \text{ fish harvested}$$

Precision of Estimates

The data collected in this study were from parties (lights and cars) and individuals. The precision of estimates based upon subsamples is based upon group and individual variances. This differs from the preceding analysis that was made to give a series of point estimates.

All fiducial intervals were calculated at the 95 per cent confidence level.

Total Hours

The fiducial intervals for total hours of fisherman pressure are computed from the counts of lights and cars as follows:

The interval was calculated using subsample data to determine anglers per light. The standard errors of lights (x) counted and anglers (y) counted

are combined by:

$$S_{\bar{x}} = \left(\frac{S_{\bar{x}}}{\bar{x}}\right)^2 + \left(\frac{S_{\bar{y}}}{\bar{y}}\right)^2 = \left(\frac{3.605}{16.61}\right)^2 + \left(\frac{1.414}{7.96}\right)^2$$

$$= 0.471 + 0.0315$$

$$= 0.0786$$

The fiducial interval for the number of anglers estimated by light counts at the 95 per cent level of confidence is then:

$$C.\ L.\ .95 = (1370)(2.09) + (2.07)(.0786)(1370)$$

$$= 2,863 \pm 223, \text{ or}$$

Lower Limit	Point Estimate	Upper Limit
2,640	2,863	3,086

(b) The interval for the number of anglers from cars counted on shore was calculated from the following angler/car subsample data, where X equals the number of anglers counted:

$$\Sigma X_2 = 223$$

$$\Sigma X_2 = 575$$

$$\Sigma x = 78$$

$$\bar{x} = 2.23$$

$$S_{\bar{x}} = 0.0887$$

$$N = 100$$

Standard errors are not combined in this instance because the variance is in the number of fisherman per single car observed. The fiducial interval at the 95 per cent level of confidence is then:

$$C.\ L.\ .95 = (5714)(2.23) \pm (1.96)(0.0887)(5714)$$

$$= 12,742 \pm 993 \text{ or}$$

Lower Limit	Point Estimate	Upper Limit
11,749	12,742	13,735

To obtain an estimate of total anglers counted with fiducial interval at

the 95 per cent level of confidence, point estimates and limits are added as:

(a)	2,640	2,863	3,086
(b)	11,749	12,742	13,735
	14,389	15,605	16,821

The confidence limits of hours fished and the number of fish harvested were computed by dividing the total point estimate and the associated limits of the number of anglers counted by the number of counts (104), which is 138.36 (lower), 150.05 (point), and 161.74 (upper). Each result is then multiplied by the total possible fishing hours in the season (459) to expand the estimate to the season's hours fished, which are:

Hours Lower Limit	Hours Point Estimate	Hours Upper Limit
63,507	68,873	74,239

Rate of Success

Similarly the rate of success is calculated from the subsample angler parties. The standard error for rate of success for a party is:

$$S_{\bar{x}} = \left(\frac{S_{\bar{x}1}}{\bar{x}_1}\right)^2 + \left(\frac{S_{\bar{x}2}}{\bar{x}_2}\right)^2$$

$$\frac{3.21}{49.77} + \frac{3.14}{37.92}$$

$$.0644 + 0828 = 0.1472 = S_{\bar{x}} \text{ Rate of Success}$$

Confidence intervals then are:

$$0.71 \pm 1.96\ (0.1472)$$

$$= 0.71 \pm 0.29$$

Then:

Lower	Point	Upper
0.42	0.71	1.00

Total Harvest

Total harvest was estimated by the product of the estimated rate of catch and estimated total hours fished. Therefore, the standard error

for total harvest is:

$$S_{\bar{x}} = \frac{S_{\bar{x}}\ (\text{Rate of Success})\ S_{\bar{x}}\ (\text{Total hours})}{\bar{x}\ (\text{Rate of Success})\ \ \bar{x}\ (\text{Total hours})}$$

$$= \frac{(0.1472)(3.21)}{(0.714)(49.77)} = 0.0133$$

Using normal confidence intervals with a t value of 1.96 the following expanded estimate of harvest with 95 per cent confidence limits may be computed:

$$C.\ I. = (68,873)(0.714) \pm (68,873)(0.714)(1.96)(0.0133)$$

$$49,175 \pm 1282$$

Therefore:

Lower Estimate	Total Harvest Point Estimate	Upper Estimate
47,893	49,175	50,457

Species Composition

The species composition of the recorded catch is presented in Table 1.

Table 1. SPECIES COMPOSITION OF RECORDED CATCH, GEORGETOWN LAKE. 1960-61.

		Number	Per cent of Total Fish Caught
Cutthroat trout	1958*	88	1.0
	1959	1,031	11.4
	1960	99	1.1
Total Marked		1,218	
Unmarked		2,695	29.8
Total Cutthroat		3,913	
Rainbow trout	1958*	130	1.4
	1959	1,067	11.8
	1960	4	0.1
Total Marked		1,197	
Unmarked		2,113	23.4
Total Rainbow		3,310	
Eastern brook trout		300	3.3
Grayling		14	0.2
Kokanee salmon		1,486	16.5
Total Fish Caught		9,027	100.0

*Year of Plant

On the basis of one-third of planted trout being marked, an estimated 3,654 (1,218 marked cutthroat X 3 = 3,654) of the cutthroat trout caught were planted fish. This is 93.4 per cent of the 3,913 cutthroat trout recorded. On the same basis, an estimated 3,603 marked rainbow were caught. This number is higher than the number checked, so it is concluded that all rainbow trout were planted fish.

Of the 9,027 fish recorded during the special winter fishing season, 6,968 or 77.2 per cent were hatchery cutthroat and rainbow trout which had been planted as fingerlings.

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