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STATE OF ALASKA

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ANNUAL REPORT OF PROGRESS, 1960-1961

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-2

SPORT FISH INVESTIGATIONS OF ALASKA

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Introduction

This report of progress consists of the Job Completion Reports from the State of Alaska's Federal Aid in Fish Restoration Project F-5-R-2, "Sport Fish Investigations of Alaska".

The current Project is composed of eighteen separate studies and were designed to evaluate the various aspects of the State's recreational fisheries resources. The information gathered will provide the necessary background data for the development of future programs. During the current segment continued emphasis was placed on overall inventorying of accessible waters and the evaluation of general catch data.

Several problems of immediate concern appeared sufficiently defined to warrant independent studies. As a result, two independent creel censuses, one experimental silver salmon egg take and a Resurrection Bay area silver salmon population study were instigated. Data accumulated from prior jobs dealing with the Arctic grayling has resulted in the formulation of three separate investigations during the current segment.

The rapid expansion of Alaska's population is being reflected in the ever increasing numbers of "No Trespassing" signs encountered in the vicinity of population centers. Fortunately, much of Alaska's fishing waters are still in the public domain. An aggressive program of acquiring access to fishing waters, instigated in 1959, was continued during the present segment. Increased emphasis is being placed on this job and the successful continuation of this activity, now and in the immediate future, will forestall many of the serious recreational use problems currently facing other states.

The enclosed progress reports are fragmentary in many respects and the interpretations contained therein are subject to re-evaluation as the work progresses.

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECTS
COMPLETION OF 1960 - 1961 SEGMENT

State: ALASKA

Project No.: F-5-R-2 Name: Sport Fish Investigations
of Alaska

Job No.: 2-C Title: Creel Census and Popula-
tion Sampling of the Sport
Fishes in the Cook Inlet
and Bristol Bay Drainages

Sub-Job No: (b) Sub-Title: Bonney Lake Creel Census

Period Covered: May 28, 1960 to September 2, 1960

Abstract:

A creel census investigation was formulated and carried out on Lower Bonney Lake, Matanuska Valley, during the effective fishing season from May 28 to September 2, 1960.

Fishermen were contacted during regular, daily sampling periods and interviewed for total catch, number of hours fished, gear used and residence.

It is estimated that 1,223 anglers fished 2,599 hours to catch 944 rainbow trout; a seasonal rate of success of 0.38 fish per hour.

The following pertinent biological data were collected and recorded during the investigation: size classes entering the sport fish catch, the age composition of the catch, and annual growth rates.

Analysis of scale samples from the catch showed five age classes present. Age groups I and II comprised 81.3 percent of the sample. The mean, annual increment was found to be 0.39 pounds and 3.2 inches.

A discussion of the creel census sampling design is given

with suggestions for designing creel census investigations in Alaskan waters.

Recommendations are presented for future management and investigations pertaining to managed, stocked lakes and annual fry plants.

Introduction:

Basic information required for the proper management of a cold water trout fishery includes a knowledge of the fishing mortality. Such information gains additional emphasis in those areas where the fishery is being maintained by artificial recruitment.

The water selected for the creel census study was a 120 acre lake (Lower Bonney) located 2 1/2 miles north of milepost 83 1/2, Glenn Highway. It has a maximum depth of 35 feet with a mean depth of 10 feet. There is but one inlet, and one outlet with an estimated summer flow of 4 cfs. The inlet is a short, meandering stream 1 1/4 miles in length flowing from Upper Bonney Lake. The outlet flows into Sawmill Creek and thence into the Matanuska River. An impassable falls in the lake's outlet prevents upstream movement of fish. Some spawning is known to take place in both the inlet and outlet of this lake, but the extent of natural recruitment is not known. A diagrammatic outline of the study area is presented in Figure 1.

History of the Trout Population: Lower Bonney Lake was a virgin lake prior to 1953. The initial stocking of rainbow trout by the Alaska Department of Fish and Game occurred in August of 1953 with a plant of 4,000 rainbow fry from the Fairbanks Hatchery. Since 1953, the lake has been stocked annually, Table 1. Spot checks of the angling pressure and angling success by Department personnel each year indicates that the fry plants have been successful and in the initial years produced exceptional catches. However, there have been indications since 1958, from fishermen reports and the lone resident on the lake, that the catch per unit of effort, and the size of the fish being caught, has declined.

Investigation of the Fishing Mortality: The present study was concerned with collecting data on the fishing mortality, fishing success, age composition of the catch, and annual growth rates. This was the initial study of the rainbow trout population in

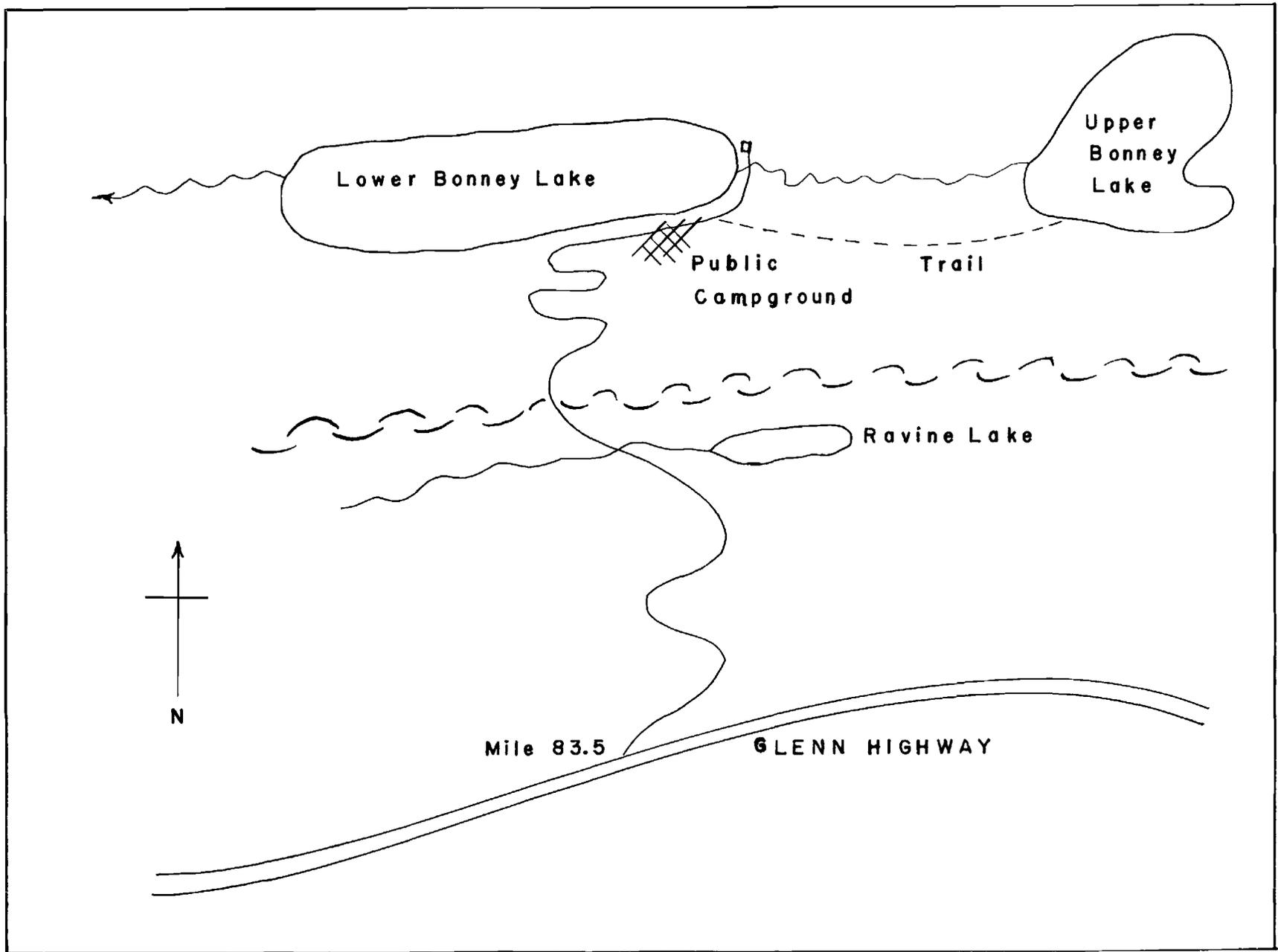


Figure 1. Diagrammatic Outline of the Lower Bonney Lake Study Area.

Table 1. Rainbow Trout Planted in Lower Bonney Lake from 1953 to 1959.

Year	Number	Number of Trout/Pound
1953	4,000	1,000
1954	4,490	1,000
1955	38,000	2,000
1956	32,580	2,800
1957	33,000	1,018
1958	35,000 and 3,000	2,000 and 220
1959	40,000	2,200

Lower Bonney Lake and will be part of the long term investigation concerned with formulating a management program for lakes in the Matanuska Valley-Anchorage areas.

The creel census design was arranged to sample the daily fishing interval throughout the effective fishing season. The daily fishing interval was 24 hours per day due to the long period of daylight found at high latitudes. The effective sport fishing season in the Matanuska Valley begins on opening day, May 28, and terminates for all practical purposes on August 20, the first day of hunting season. The present investigation covered the period of time from May 28 through September 2, 1960.

Sampling Design: The sampling period was comprised of a total of 98 days. From these, 84 days were selected at random with the following conditions: all week days, but one, and all weekends were sampled.

Each 24 hour fishing period was divided into four, 6-hour sampling periods. One 6-hour sample period was chosen at random for each of the census days, Table 2; 28 of these were weekends and 56 were on week days.

Fishermen Interview: Fishermen interviews were made by boat and by foot. The entire area was patrolled each period and all anglers fishing during the sample period were contacted.

Data from each angler interviewed was immediately recorded on IBM Port-A-Punch cards. The interview provided the following data: the class of the angler, (resident/non-resident); type of gear used; and whether the interview was complete or incomplete; (e.g., if the angler was still fishing when contacted, it was recorded as an incomplete interview). Gear was recorded as lures, bait, or flies. Scale samples for age composition analysis were collected throughout the season from the fishermen's catch. Fish were measured and weighed. The weights and lengths were recorded as pounds and tenths of pounds, and inches and tenths of inches respectively

The census taker recorded daily surface water temperatures and weather conditions during each 24 hour period.

Table 3 is offered to show the IBM Port-A-Punch coding arrangement, which worked out very well and may have definite advantages over handwritten data.

Table 2. Creel Census Sampling Design, Lower Bonney Lake, 1960

Week Number	Weekly Period	Sat.	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.
1	May 28 - June 3	A	B	A	B	C	D	E
2	June 4 - June 10	C	D	B	C	D	E	A
3	June 11 - June 17	A	C	C	D	E	A	B
4	June 18 - June 24	B	D	D	E	A	B	C
5	June 25 - July 1	D	C	E	A	B	C	D
6	July 2 - July 8	B	A	E	A	B	C	D
7	July 9 - July 15	B	C	A	B	C	D	E
8	July 16 - July 22	A	D	B	C	D	E	A
9	July 23 - July 29	C	D	C	D	E	A	B
10	July 30 - Aug. 5	A	B	D	E	A	B	C
11	Aug. 6 - Aug. 12	B	A	D	E	A	B	C
12	Aug. 13 - Aug 19	D	C	E	A	B	C	D
13	Aug. 20 - Aug. 26	D	B	A	B	C	D	E
14	Aug. 27 - Sept. 2	A	C	B	C	D	E	A

WHERE: A = 2400 hrs. - 0600 hrs.
 B = 0600 " - 1200 "
 C = 1200 " - 1800 "
 D = 1800 " - 2400 "
 E = Day not sampled

Table 3. Arrangement of IBM Port-A-Punch Card Coding. Lower Bonney Lake, 1960.

Column Number	Information	Code
1 - 2	Day of month	Punch directly
3	Month	1 = May 2 = June 3 = July 4 = August 5 = September
4	Year	1 = 1960
5 - 6	Weekly period	Punch directly
7	Daily sample period that angler is contacted in.	1 = 2400 - 0600 2 = 0600 - 1200 3 = 1200 - 1800 4 = 1800 - 2400
8	Number of anglers	Punch directly
9 - 10	Total number of hours	Punch directly
11 - 12	Number of rainbow trout	Punch directly
14	Angler	1 = resident 2 = non-resident 3 = resident military 4 = non-resident military
15	Gear used	1 = Lures 2 = Bait 3 = Flies
16	Type of interview	1 = Complete 2 = Incomplete

Findings:

Estimate of Total Number of Anglers: Because of the design of the experiment, it would appear that the number of anglers interviewed in each sampling period is an accurate representation of the number of people who fished during this time interval. Thus under this basic assumption, the method used for the estimation of the total anglers for the season was mean per sampling unit estimate.

These data were treated as a simple random sample drawn from the possible sampling periods; i.e., the 84 sampling periods were treated as random draws from the population of 336 possible sampling periods. Through this treatment, an estimate of the total number of fishermen and the corresponding confidence limits were obtained as follows:

$$\hat{Y} = N\bar{y} \pm Nt \sqrt{\frac{s^2}{n}}$$

Where:

\hat{Y} = estimate of total anglers

N = 336

\bar{y} = average number of anglers for each sampling period

t = normal deviate for .05 level of significance which is 1.96

$$s^2 = \frac{\sum (y_i - \bar{y})^2}{n - 1}$$

n = 84

The estimate of total number of fishermen, by this method, is 1223. The 95% confidence limits for this estimate are:

$$742 < \hat{Y} < 1704$$

Estimate of Total Hours Fished: To obtain this estimate, it was necessary to use only the completed trips. With the small sample of completed-trip anglers, perhaps this is rather biased, but with the data obtained, this would seem to be the only approach. From this category of anglers, a mean hours fished, per angler, was obtained. This is derived by $\frac{\sum x_i}{\sum Y_i}$ using only the completed-trip anglers.

From the data presented, this is $\frac{51}{24} = 2.125$ hours per angler.

Total hours fished then would be: (2.125) (1,223 number of anglers) or 2,599 = \hat{X} = Angler Hours.

Estimate of Total Catch or Fishing Mortality: This estimate is perhaps the most important and, with incomplete angler trip data, perhaps the most difficult to obtain. As yet, there does not exist an efficient method to deal with incomplete trip data. However, the method employed will give a fair idea of the total catch.

The method used to obtain an estimate of the total catch utilizes the mean number of fish caught per sampling period. The main assumption to this method is that during the 6 hour sampling period, all the fish caught during this period of time were recorded. Experience showed this assumption to be realistic, and thus, the same method was employed to get an estimate of total catch as was previously employed in obtaining an estimate of total anglers. The 84 sampling periods were treated as random draws from the 336 possible sampling periods. Again, the estimate of total catch and the corresponding confidence limits are given by:

$$\hat{Z} = N\bar{z} \pm Nt\sqrt{\frac{s^2}{n}}$$

Where:

\hat{Z} = estimate of total catch

N = 336

\bar{z} = average catch for each sampling period

t = normal deviate for .05 level of significance which is 1.96

$$s^2 = \frac{\sum (z_i - \bar{z})^2}{n - 1}$$

n = 84

The estimate of total catch by this method is 944. The 95% confidence limits are:

$$452 < \hat{Z} < 1436$$

Age Composition of the Catch: Scale samples were collected from 245 rainbow trout caught by anglers throughout the fishing season. The scales were dry mounted on glass micro slides and analyzed for age by projection against a screen with a magnification of 100 diameters.

The results of the age analysis are shown in Table 4. The heaviest fishing mortality, percentage wise, occurred on the I and II year age groups; these two classes comprised 81.3 per

Table 4. Age Composition of the Catch of Lower Bonney Lake
Rainbow Trout, 1960.

Age*	Number	Per Cent	Accumulated Per Cent
I	69	28.2	
II	130	53.1	81.3
III	41	16.7	98.0
IV	4	1.6	99.6
V	1	.04	99.94
Total	245		

Note: * Fish are actually 4 to 6 months older.

cent of the total sample.

A total of five age classes were determined from the sample. The relatively small percentages of the older age classes may be due to previous heavy angler cropping of the younger age classes and a higher natural mortality.

Size Classes Entering the Catch: The rate of exploitation can be shown in a slightly different manner as illustrated in Figure 2. The average size of the fish entering a catch is related to the annual harvest rate; the greater the harvest, the smaller the average size. The majority of the fish that were caught fell in the range between 9.1 and 11.0 inches for the 1960 season. This size group was comprised almost solely of age II fish, indicating a high angling harvest on this group.

Growth Rate of Rainbow Trout: For the calculation of the growth rates in the rainbow trout of Lower Bonney Lake, the average weights and lengths of a sample of 245 fish were obtained from the angler catch.

From the 245 fish sample, 100 fish were chosen and their respective weights were plotted against lengths as shown in Figure 3. The line was fitted by inspection. Interpreting the greatest proportion of fish from the area of greatest growth prior to the peak of the curve, which is the point of diminishing returns in fish flesh production

The means, standard deviations and standard error of the means, of the fork lengths and weights of three age classes of rainbow trout from Lower Bonney Lake are shown in Table 5. Plotting weight and length against age class resulted in the linear regression curves of Figure 4, where the annual increment in weight and length from the slopes of the lines indicate .39 pounds and 3.2 inches respectively.

Weather and Water Temperatures: Daily weather conditions and surface water temperatures were recorded throughout the study period. Surface water temperatures were logged each day at noon. Table 6 presents the daily weather conditions as clear, cloudy and rain, and cloudy and wind, (wind speed over 10 mph). The weekly mean temperatures and weekly range are shown in Table 7.

FIGURE 2.

FISHING HARVEST - SIZE CLASSES
LOWER BONNEY LAKE, 1960

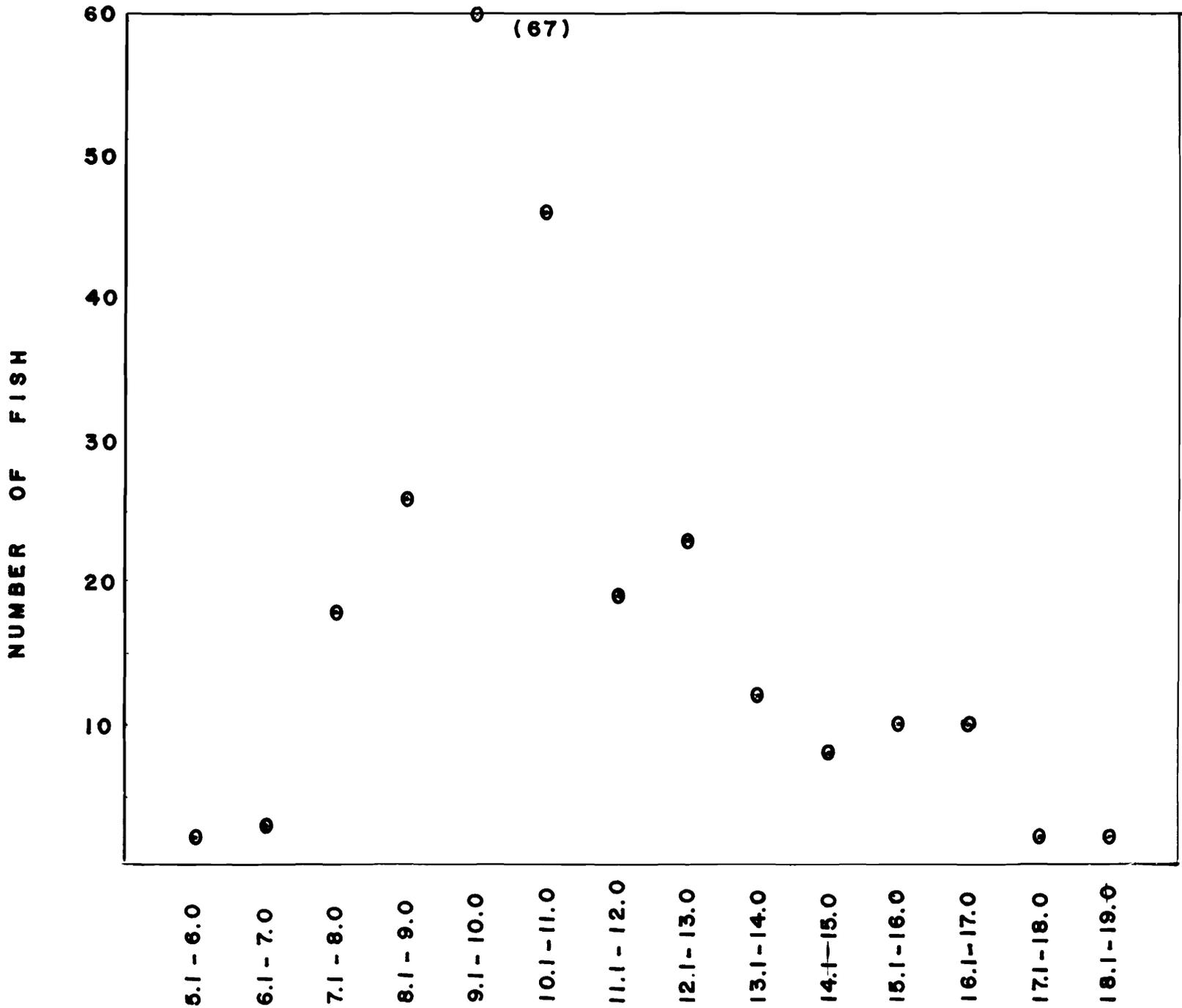


Figure 3.

Weight-Length --- Rainbow Trout
Lower Bonney Lake 1960
N = 100

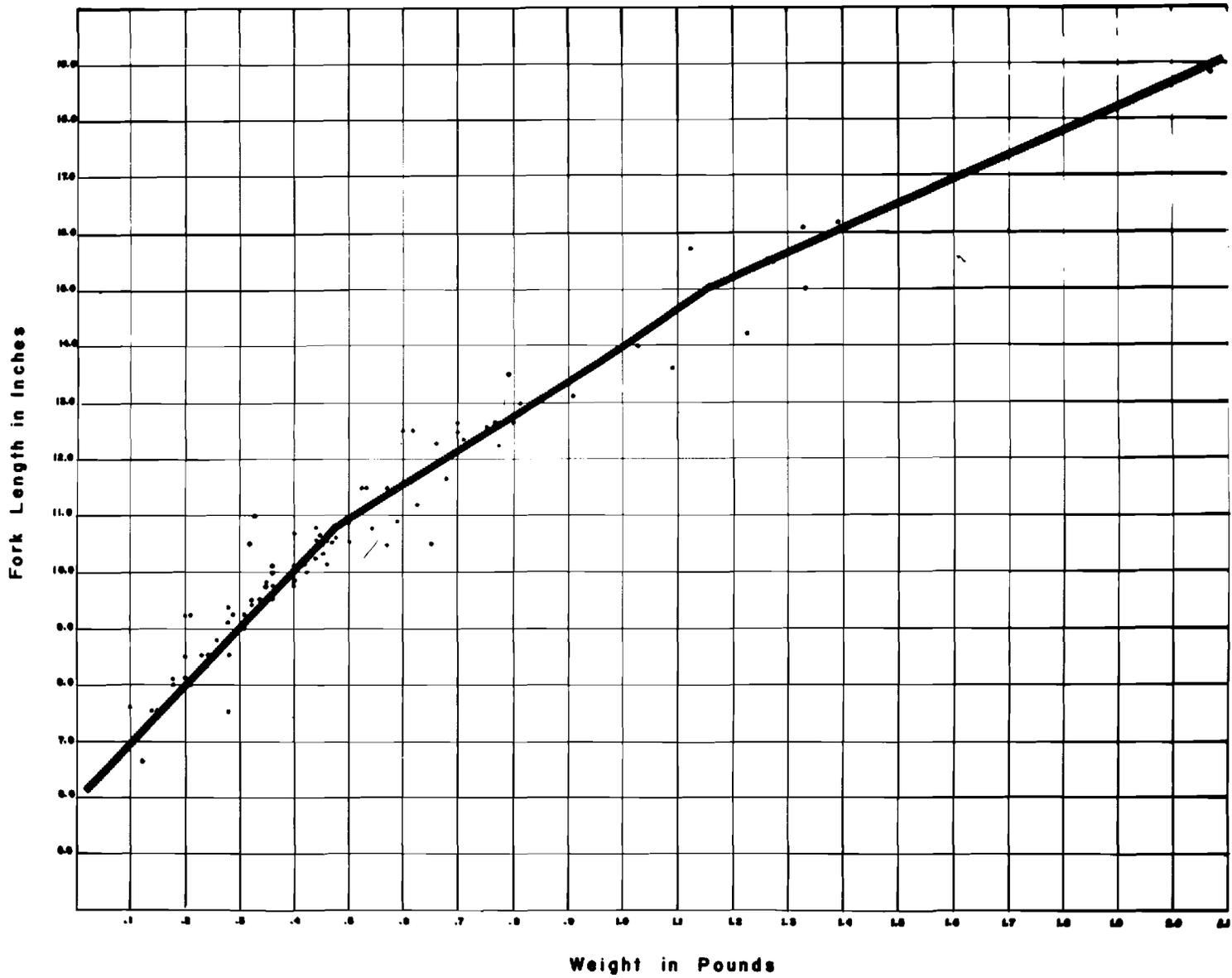


Table 5. Means, Standard Deviations and Standard Error of the Means of the Fork Lengths (inches) and Weights (pounds) of Three Age Classes of Rainbow Trout in the Anglers' Catch, Lower Bonney Lake, 1960.

	Age - Class					
	I		II		III	
	Length	Weight	Length	Weight	Length	Weight
Means	8.9	0.28	10.7	.49	14.3	1.06
Standard Deviation	1.0	0.09	1.66	.23	1.95	.295
Standard Error	.12	0.01	.145	.019	.30	.045

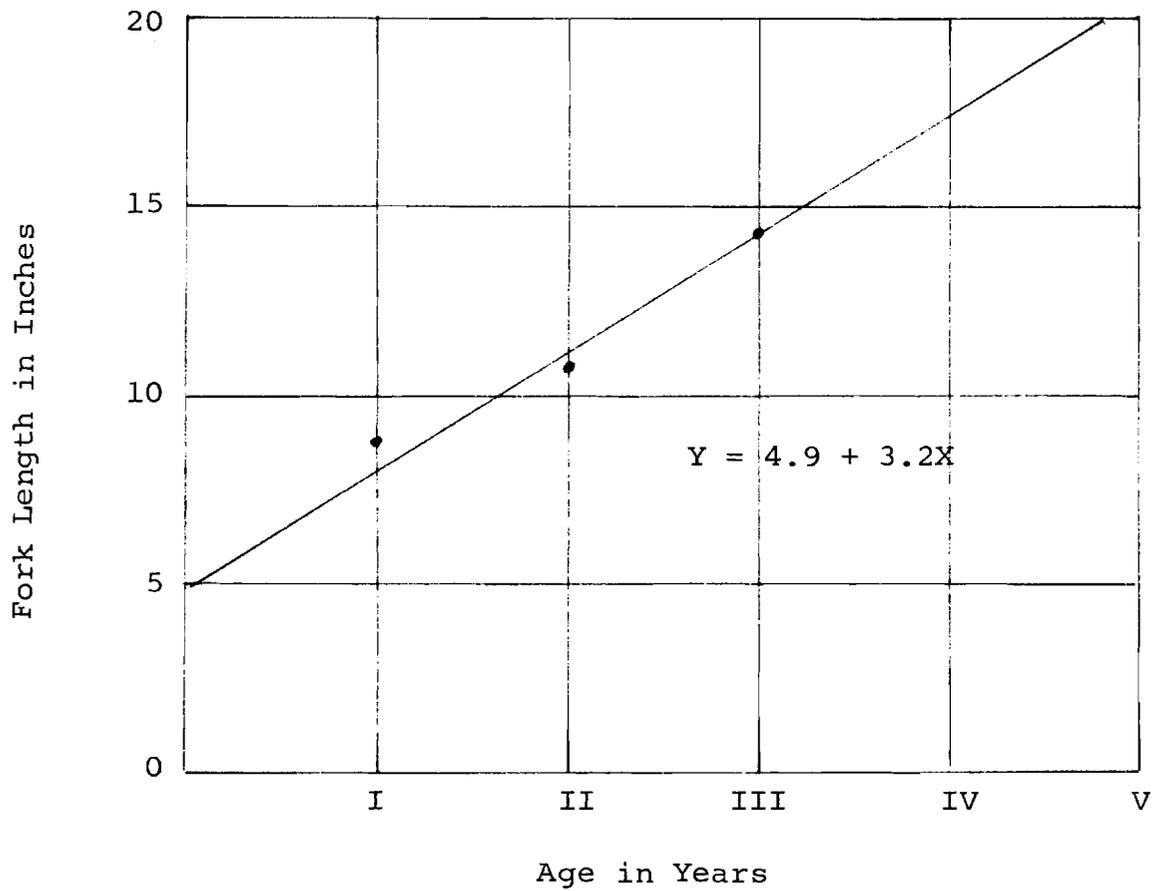
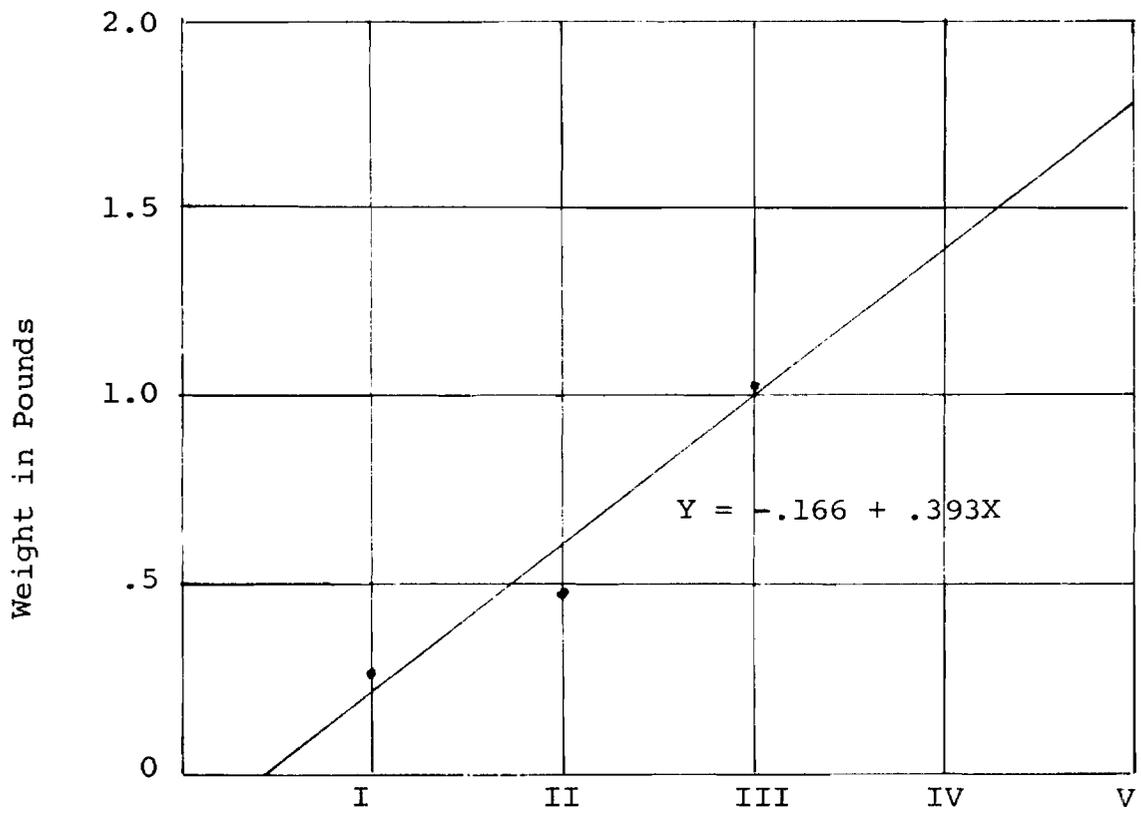


Figure 4. Linear Regression Curves, Length and Weight of Rainbow Trout, Lower Bonney Lake, 1960.

Table 6. Daily car counts (based on 6 day/week observations)
and weather conditions
Lower Bonney Lake, 1960

Weekly Period	Sat.	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Total Car Count	# CL+R	# CL+W
1	CL+R 34	CL+R 9	CL+W 13	CL+W 0	Clear 4	CL+W 5		65	2	3
2	CL+R 46	CL+R 11	CL+W 2	CL+R 3	CL+W 6		CL+R 10	78	4	2
3	CL+W 19	CL+W 12	CL+W 4	Clear 2		CL+W 39	CL+W 10	86	0	5
4	Clear 42	CL+R 24	CL+R 0		CL+R 17	Clear 15	CL+W 16	114	3	1
5	Clear 17	CL+W 15		CL+R 4	CL+R 9	CL+R 6	CL+R 4	55	4	1
6	Clear 39	Clear 21		Clear 42	CL+W 3	Clear 3	Clear 11	119	0	1
7	Clear 20	Clear 19	Clear 5	Clear 7	Clear 8	CL+R 1		60	1	0
8	CL+R 28	CL+R 5	CL+R 1	CL+W 5	Clear 3		CL+W 7	49	3	2
9	CL+R 18	CL+W 11	CL+R 3	CL+R 4		CL+R 8	CL+W 1	45	4	2
10	CL+W 5	CL+W 11	CL+R 5		CL+W 26	CL+R 3	Clear 3	53	2	3
11	Clear 6	Clear 15	Clear 5		Clear 15	Clear 14	Clear 5	60	0	0
12	CL+R 19	CL+R 23		CL+R 15	CL+W 2	CL+R 3	CL+R 7	69	5	1
13	CL+R 9	CL+W 15	Clear 5	Clear 12	Clear 2	CL+W 2		45	1	2
14	CL+R 4	CL+R 2	CL+R 6	Clear 2	Clear 1		CL+R 6	21	4	0
15	CL+R 5	CL+R 7	Clear 1	CL+R 7		Clear 6	Clear 4	30	3	0
Totals	311	200	50	103	96	105	89	949	36	23
Tot. CL+R	2	7	5	5	2	5	4	36		
Tot. CL+W	2	5	3	2	4	3	4	23		
Tot. Clear	5	3	4	5	6	4	4	31		

Note: Clear = Sunny - no overcast
CL+R = Cloudy & Rain
CL+W = Cloudy & Windy (over 10 mph)

Table 7. Mean Weekly Surface Water Temperatures and Weekly Range, in Fahrenheit, Lower Bonney Lake, 1960.

Weekly Period	Mean	Range	Weekly Period	Mean	Range	Weekly Period	Mean	Range
1	53.3	51 - 56	6	52.5	49 - 55	11	53.7	51 - 59
2	51.8	50 - 54	7	65.2	56 - 74	12	51.8	51 - 53
3	52.8	52 - 54	8	58.3	57 - 60	13	49.7	49 - 51
4	53.5	52 - 55	9	56.2	52 - 62	14	48.2	47 - 49
5	52.6	51 - 56	10	52.2	51 - 53			

Over one-third of the days in the sample period were characterized by cloudy and rainy conditions. It is with some certainty that the adverse weather conditions present in the upper Matanuska River valley during the summer discouraged many anglers from fishing Lower Bonney Lake.

Residence of Anglers: A total of 215 anglers were contacted at Lower Bonney Lake and interviewed as to their legal residence. Of this number, 114 were residents, 5 were non-residents, and 96 were military residents.

Lures Used: Included in the angler interview was a query concerning the type of lure used. Three classifications were established: (1) Lures (hardware type); (2) Bait (salmon eggs, canned corn, live insects) and (3) Artificial flies. From the sample of 215 anglers contacted, 61 were using lures, 149 bait and 5 used flies. Field observations confirmed that bait, salmon eggs and canned corn, were the most effective at all times in the taking of fish.

Discussion and Recommendations:

Sampling Design: The sampling design formulated for Lower Bonney Lake obtained estimates of the total rainbow trout harvest, the seasonal rate of angler success and the age and growth of the available stock. The design was not adequate in providing the unit of angler effort from week to week needed for an estimate of the population available to the angler by the DeLury method.

Weekends and holidays were observed to be important in the angler sampling. The greatest angling intensity was normally found on weekends and holidays. Also, the fishing intensity fluctuated considerably in the daily fishing interval due to the long daylight period characteristic of southcentral Alaska summers. The majority of anglers started fishing between midnight and 6:00 a.m. and between 6:00 p.m. and midnight.

To cope with the many variables affecting angling pressures in southcentral Alaska waters, it is recommended that a future creel census study be based on a 100% angler contact, or on a sampling design where completed-trip anglers could be contacted. Complete angler contact studies would provide the needed information to estimate probable errors in formulating creel census designs.

Recommendations: The initial study of the rainbow trout population and the angling mortality in Lower Bonney Lake provided only part of the data for stocked waters in the area. Of utmost concern in the long range planning is the proper programming of the annual fry plants. Growth rates are slow in Lower Bonney Lake, as is true of most waters in the area. Practical economical means of increasing survival of stocked fish are needed. Only in this way, can the best use of the local hatchery and rearing station be obtained.

Angler harvest is adequate to prevent overpopulation and increased fishing pressure is anticipated. Lower Bonney Lake lends itself geographically and biologically to an intensive study of the results of management practices. It is recommended that a plant of 10,000 marked rainbow trout fry be instigated in 1961. It is further recommended that an intensive creel census study be made in 1962 to follow up the results of this experimental plant and to continue the work of the present investigation.

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15, May 1961

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