MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION
HELENA, MONTANA

JOB COMPLETION REPORT
INVESTIGATIONS PROJECTS

State of Montana

Project No. F-12-R-8 Name Western Montana Fishery Study

Job No. III Title Georgetown Lake Study

Period Covered May 1, 1961 - April 30, 1962

Abstract:

A partial creel census was conducted on Georgetown Lake during the fishing season of 1961. The total estimated pressure was 132,600 hours and the total harvest was 50,353 game fish. An estimated 30,400 fishing trips were made. The rate of success was just under 0.4 fish per hour. Hatchery rainbow and cutthroat trout, planted as fingerlings, comprised 86.7 per cent of the total catch.

Procedures and formulae for computation of estimates are recorded in detail for future census data analysis on Georgetown and similar Montana waters.

Recommendations:

1. Data to date indicate that rainbow trout provide better fishing than do Yellowstone cutthroat trout in Georgetown Lake. For this reason, it is recommended that rainbow trout fingerlings be substituted for the portion of the plant which is currently composed of cutthroat trout.
2. It is further recommended to continue creel census on Georgetown Lake during the 1962 summer fishing season. Methods and coverage should be identical to those employed in 1961. Days identical to those included in the sample in 1961 should be censused, to provide data for trend

analysis, as a further means of checking the reliability of estimates.

Objectives:

The objective of the Georgetown Lake summer creel census was to obtain data for making estimates of fishing pressure and total game fish harvest. Data obtained from the creel census will be used in formulation of future fishery management plans for the lake.

Techniques Used:

Georgetown Lake has been planted with a variety of trout and salmon species in the past (Averett and Whitney, 1959), and has received annual plants of 150,000 each of three to four-inch cutthroat and rainbow trout since 1958.

Special season opening and closing dates have been in effect on Georgetown Lake for a number of years. In 1961, the fishing season opened on June 25 and closed on October 31. Creel census was initiated on June 25, and continued according to schedule until the fishing season was closed.

Contact information requested from anglers included the following:

1. Fishing license number.
2. Residence (within or outside of 40 mile radius of lake, or non-resident).
3. Length of fishing trip.
4. Total fish caught.
5. Species of fish (with fin clip, if applicable).
6. Boat or shore fisherman.

The schedule for operation of the creel census was patterned after that described by Neuhold and Lu, 1957. This type of creel census employs both through-fishermen contacts and instantaneous boat and shore angler counts. Counts on Georgetown Lake took from 45 to 60 minutes, but were considered instantaneous for census purposes.

In addition to counts of boats made at regularly scheduled times, the census technician was instructed to obtain a count of fishermen per boat

from a number of boats. This was done to prevent delay while making scheduled boat counts and because usually, while boats could be discerned from a distance, the number of anglers in those boats could not be counted. These counts, which were not scheduled, will be termed hereafter as independent boat counts.

Opening day was considered a separate strata and censused accordingly. One census technician conducted instantaneous counts of shore fishermen and the number of fishing boats. Five counts were made throughout the day. The first count was made at 0600 and the last count at 1900. Two crews of two men each were assigned an area of the lake on which to contact angler parties as they left the area.

Approximately 50 per cent of the remaining days in the fishing season were included in the sampling schedule for census. Beginning on June 26, the fishing season was stratified into two-week periods. Seven days were chosen randomly from each strata, with the restriction that no day of the week would be included twice during a two-week period. One census technician conducted two counts of boats and shore anglers each census day, and made completed trip angler contacts during the times that counts were not being made.

Times at which counts were made were selected by stratifying each census day into four, 4-hour periods. Since two counts each day were required, two periods each day were randomly selected giving equal representation to each period throughout the season. The hour of the count was selected at random, initially, from each time period, and then systematically selected.

Because of the length of the sampling schedule, the actual schedule is not presented in this report. Copies of the schedule are on file at district headquarters.

Marked fish:

Portions of the plants of hatchery-reared fish during the years 1958 through 1960 were distinctively marked to establish the contribution by hatchery fish to the Goergetown Lake fishery.

During these years, approximately 300,000, 3-4 inch rainbow and cutthroat trout were planted each year. One-third of the number of each species planted were marked. In 1958, the right premaxillary bone was removed; in 1959, the left premaxillary bone was removed; and in 1960, the adipose fin was removed.

Findings:

The following species of game fish contribute to the Georgetown Lake fishery:

Common name	Abbreviation	Scientific name
Cutthroat trout	Ct	Salmo clarki Richardson
Rainbow trout	Rb	Salmo gairdneri Richardson
Brook trout	Eb	Salvelinus fontinalis Mitchill
Arctic grayling	Gr	Thymallus arcticus (Pallas)
Kokanee	KOK	Oncorhynchus nerka (Walbaum)

Census technicians recorded the species of 1,175 fish caught by Georgetown Lake anglers. Numbers of fish and the per cent of the total recorded catch these fish represented, are presented by species and mark in Table 1.

Table 1. SPECIES COMPOSITION OF RECORDED CATCH, GEORGETOWN LAKE, 1961.

	Species											
	Ct'	Ct*	Ct**	Ct***	Rb'	Rb*	Rb**	Rb***	Eb	Gr	KOK	Total
No.	290	23	64	26	484	44	168	14	44	8	10	1,175
%	24.7	2.0	5.4	2.2	41.2	3.8	14.3	1.2	3.7	.7	.8	100.0

'Trout with no clip
*Trout with 1958 clip
**Trout with 1959 clip
***Trout with 1960 clip

The total per cent of marked fish recorded in the anglers catch is 28.9 per cent. Since one-third of the fish planted were marked, an estimated 86.7

per cent of the total harvest of fish from Georgetown Lake were planted fish.

Marked cutthroat trout comprised 9.6 per cent of the recorded catch, and marked rainbow trout 19.3 per cent, which would indicate that planted rainbow trout provided more fishing than did cutthroat trout.

A total of 471 individual license-holders, who made 642 fishing trips to Georgetown Lake, were contacted by census personnel. Of these 471 anglers, 183, or 38.85 per cent, caught no fish. The distribution of the catch among individual license holders at approximate 5, 10, and 25 per cent levels is presented in Table 2. Per cents expressed are derived by cumulative addition of anglers who caught the most fish to those who caught fewer fish.

Table 2. DISTRIBUTION OF THE CATCH OF LICENSE HOLDERS CONTACTED, AND THE PORTION OF EFFORT EXPENDED BY VARIOUS PER CENT LEVELS OF THE MOST SUCCESSFUL ANGLERS, GEORGETOWN LAKE, 1961.

Per Cent of Total		
Anglers Contacted	Trips made	Fish caught
5.31	12.93	33.33
9.98	17.76	47.45
28.02	37.54	78.18

These findings are similar to the distribution of the catch among anglers who fished Rock Creek in 1960 (Boland, 1961). Georgetown Lake anglers made a smaller per cent of the angling trips to attain identical levels of catch distribution than did Rock Creek anglers.

Statistical procedures for obtaining total estimates of angling pressure and harvest, and the precision of these estimates, were patterned after those described by Neuhold and Lu, 1957. Some modifications of formulae for calculating fiducial limits when standard errors are combined were made. The method of propogation of error is that described by Arkin and Colton, 1953. Tests for independence were made following methods described by Dixon and Massey, 1957.

A detailed description of the statistical analysis of the 1961 Georgetown creel census data is presented to facilitate comprehension of the analysis. Procedures recorded in this report will likely be used for analysis of data from other Montana waters where the mechanical problems of conducting a creel census are similar to those encountered on Georgetown Lake.

As previously stated, the Georgetown Lake fishing season opened on June 25, and was closed on October 31. Opening day was sampled as a separate strata and separate estimates were made. The estimates of harvest and angling pressure for opening day were computed in an identical manner as were estimates for the remainder of the season. For this reason, no formulae or statistical procedures will be described for opening day.

Count data from the entire season are presented in Table 3. All statistics, and their values, are described in Appendix A. Final estimates of angling pressure and harvest are included in Table 4.

Opening day estimates:

Estimates of angling pressure, harvest, and the rate of success obtained for opening day are presented in Table 4. The extremely wide confidence limits for the combined boat and shore angler pressure estimate is a function of the extreme variation in the numbers of boats and shore anglers counted at various count times on opening day.

The basic unit of angling pressure is expressed in terms of hours fished. Contact data from 165 boat and shore anglers on opening day indicate that the average length of fishing trip was 4.42 hours. To obtain an approximate estimate of the number of anglers fishing Georgetown Lake on opening day, the combined boat and shore point estimate was divided by 4.42, resulting in an estimate of 5,352 fishing trips on opening day.

Table 3. SHORE FISHERMAN AND BOAT COUNTS, GEORGETOWN LAKE, 1961.

Date	Boat(X)	Shore(Y)	Date	Boat(X)	Shore(Y)	Date	Boat(X)	Shore(Y)
June 25	904	993	Aug. 11	10	12	Oct. 2	4	14
	426	841		17	21		0	68
	121	348	12	6	12	5	4	11
	42	223		11	28		0	57
	27	146	16	8	9	6	1	16
26	49	42		11	16		0	49
	26	47	17	10	5	10	0	5
28	23	36		14	36		0	17
	14	62	20	13	33	11	0	2
29	17	37		19	62		0	12
	11	72	21	2	5	14	1	15
July 1	14	51		3	11		0	32
	22	73	22	3	9	15	2	65
2	53	112		12	22		0	84
	16	78	23	11	18	17	0	7
4	16	23		4	19		0	22
	21	49	26	17	37	18	0	1
7	8	24		36	81		0	4
	19	46	27	31	46	23	0	3
10	17	20		42	87		0	7
	6	22	31	10	15	26	0	0
11	13	13		4	26		0	2
	8	12	Sept. 1	0	3	27	0	0
14	9	12		3	17		0	9
	10	14	4	14	24	28	0	1
15	20	28		19	35		0	17
	19	31	5	7	16	29	0	8
19	20	56		0	19		0	13
	35	56	6	3	6			
20	8	11		4	11			
	12	38	14	11	15	Opening Day:		
23	15	65		3	81	ΣX = 1,520		
	18	59	15	2	15			
26	15	18		6	22	ΣX^2 = 1,015,826		
	11	18	16	3	6	ΣY = 2,551		
27	6	9		1	104			
	14	46	17	15	77	ΣY^2 = 1,885,479		
29	11	27		12	81			
	17	62	19	4	3	June 26 - Oct. 29:		
31	5	13		5	67	ΣX = 1,181		
	5	23	20	2	12			
Aug. 1	7	24		0	11	ΣX^2 = 24,235		
	32	79	21	2	2	ΣY = 3,657		
4	13	4		2	3			
	17	42	24	3	11	ΣY^2 = 187,713		
6	19	23		3	46			
	18	47	25	0	1			
7	9	3		1	13			
	8	35	29	0	7			
8	13	42		0	38			
	11	56						

June 26 - October 31 estimates:

Beginning on June 26, there were 128 days in the season. The legal angling day began at 0500 and lasted until 2200. There were 17 possible fishing hours each day, or 2,176 possible fishing hours throughout this portion of the season.

Table 4. SHORE AND BOAT FISHING PRESSURE, SUCCESS RATES, AND HARVEST, GEORGETOWN LAKE, 1961.

	Confidence Interval ($t_{.95}$)		
	Lower Limit	Point Estimate	Upper Limit
Opening Day			
Shore fishing pressure	629	8,670	16,711
Boat fishing pressure	7,142	14,987	22,832
Combined shore & boat pressure	12,427	23,657	34,887
Combined shore & boat rate of success	.3652	.3908	.4164
Combined shore & boat total harvest	6,139	9,245	12,351
June 26 - Oct. 31			
Shore fishing pressure	54,400	64,170	73,940
Boat fishing pressure	41,101	44,746	48,391
Combined shore & boat pressure	98,276	108,916	119,556
Combined shore & boat rate of success	.3553	.3774	.3995
Combined shore & boat total harvest	37,093	41,108	45,123
Season Totals			
Hours pressure	110,703	132,573	154,443
Harvest	43,232	50,353	57,474

Creel census was conducted on 62 of the 128 days in the season. Two counts of shore anglers and boats were made each day, totaling 124 counts. During these counts, a total of 3,657 shore anglers and 1,181 boats were counted.

Shore fishing pressure:

The estimate of shore angling pressure was obtained by the following:

$$P_s = (\bar{X}_s)\ (H)$$

$$= (29.49)\ (2{,}176) = 64{,}170 \text{ hours.} \quad (1)$$

To determine the precision of the shore pressure estimate, the variance of shore fishermen per count is calculated by the following:

$$S_s^2 = \frac{\Sigma Y^2 - \frac{(\Sigma Y)^2}{N}}{N-1} = \frac{187{,}713 - \frac{(3{,}657)^2}{124}}{123} = 649, \quad (2)$$

where Y = the number of shore anglers each count.

The standard error of the mean shore anglers per count is derived by,

$$S_{\bar{x}s} = \sqrt{\frac{S_s^2}{N}} = \sqrt{\frac{649}{124}} = 2.29. \quad (3)$$

The standard error of the mean follows a t- distribution with 123 degrees of freedom. The confidence limits to the mean are:

$$C.L._{.95} = \bar{X}_s \pm (t_{.95})\ (S_{\bar{x}s})$$

$$= 29.49 \pm (1.96)\ (2.29)$$

$$= 29.49 \pm 4.49 \text{ anglers per count,} \quad (4)$$

and is expanded to

$$C.L._{.95} = (\bar{X}_s)\ (H) \pm (4.49)\ (H)$$

$$= 64{,}170 \pm 9{,}770 \text{ fisherman hours.} \quad (5)$$

The point estimate of shore fisherman hours is then 64,170 hours, with a lower limit of 54,400 hours and an upper limit of 73,940 hours.

Boat fishing pressure:

During the 124 counts, 1,181 fishing boats were counted. The boat fishing pressure is obtained from the following:

$$P_b = (H)\ (\bar{X}_b)\ (\bar{X}_r) = (2{,}176)\ (9.52)\ (2.16) = 44{,}746 \text{ boat fisherman hours.} \quad (6)$$

To obtain the precision of the boat fishing pressure estimate, the combined standard errors of the means of boats per count and fishermen per boat are used for determining the confidence interval. Since boats per count and the mean number of fishermen per boat can be considered to be independent, the following formula is used to calculate the combined standard error of the two means:

$$S_{\bar{x}_{br}} = \sqrt{\left(S_{\bar{x}_b}\right)^2 + \left(S_{\bar{x}_r}\right)^2} \qquad (7)$$

Values for formula (7) are obtained in the same manner as formulas 2 and 3 from the following, using data from Table 3:

$$S_{\bar{x}_b} = \sqrt{\frac{S_b^2}{N}} = \sqrt{\frac{105.5}{124}} = \sqrt{0.8508} = 0.922 \qquad (8)$$

The standard error of the mean number of fishermen per boat is determined from data obtained from independent boat counts (Table 5.) in an identical manner as was done in formula (8).

Then,

$$S_{\bar{x}_r} = \sqrt{\frac{S_r^2}{N}} = \sqrt{\frac{15.04}{115}} = \sqrt{0.1307} = 0.361 \qquad (9)$$

Table 5. INDEPENDENT COUNTS OF NUMBER OF ANGLERS PER BOAT.

Boats(X)	Anglers(Y)	Boats(X)	Anglers(Y)	Boats(X)	Anglers(Y)	Boats(X)	Anglers(Y)
3	7	1	1	4	11	2	3
3	6	2	7	7	16	2	4
2	3	3	5	3	6	3	8
3	8	3	7	2	4	1	2
7	18	5	9	5	12	4	8
2	5	1	4	6	8	1	2
3	5	4	9	3	5	1	2
5	16	2	3	1	2	2	3
3	10	6	11	4	7		
2	4	2	3	2	4		

$\Sigma X = 115$ $\Sigma Y = 248$ $N = 38$

$\Sigma X^2 = 449$ $\Sigma Y^2 = 2250$ $\Sigma XY = 977$

$\Sigma x^2 = \Sigma X^2 - (\Sigma X)^2/N = 101$ $\Sigma y^2 = \Sigma Y^2 - (\Sigma Y)^2/N = 632$ $\Sigma xy = \Sigma XY - (\Sigma X)(\Sigma Y)/N = 227$

Formula (10) (11) (12)

The formula to obtain the combined standard error is then:

$$S_{\bar{X}_{br}} = \sqrt{.8508 + .1307}$$
$$= 0.9907 \qquad (13)$$

The confidence interval at the 95 per cent confidence level with 36 degrees of freedom is:

$$C.L._{.95} = P_b \pm (t_{.95})(S_{\bar{X}_{br}})(H)$$
$$= 44,746 \pm (1.690)(0.9907)(2,176)$$
$$= 44,746 \pm 3,645 \qquad (14)$$

The point estimate is 44,746 boat fisherman hours with a lower limit of 41,101 hours and an upper estimate of 48,391 hours.

Combined shore and boat angling pressure:

The combined shore and boat angling pressure is obtained by adding estimates obtained above. In this manner:

$$T.P. = P_s + P_b$$
$$= 108,916 \text{ fishermen hours.} \qquad (15)$$

For the purpose of this study the shore and boat fisherman pressures are considered independent. The standard error of the combined estimate is obtained as follows:

$$S_{\bar{X}_{T.P.}} = \sqrt{\left(S_{\bar{X}_{br}}\right)^2 + \left(S_{\bar{X}_s}\right)^2}$$
$$= \sqrt{(.9907)^2 + (2.29)^2} = \sqrt{9.815 + 5.2441} = \sqrt{6.2256} \qquad (16)$$
$$= 2.495$$

The precision of the estimate with 123 degrees of freedom is then:

$$C.L._{.95} = T.P. \pm (t_{.95}) (S_{\bar{x}_{T.P.}}) (H)$$

$$= 108,916 \pm (1.96) (2.495) (2,176)$$

$$= 108,916 \pm 10,640 \qquad (17)$$

The point estimate of total fishing pressure is 108,916 angler hours, with a lower and upper limit of 98,276 and 119,556 angler hours.

Number of fishing trips:

An estimate of the number of angler trips is calculated by dividing the total pressure estimate by the average length of fishing trip, which was 4.35 hours for boat and shore fishermen combined. This calculation resulted in an estimate of 25,038 fishing trips to Georgetown Lake from June 26 to October 31, and by adding the opening day estimate of 5,352 trips, the season total is 30,390 trips. Because the basic unit of pressure is expressed in terms of hours fished, confidence limits were not calculated for the number of fishing trips.

Rate of success:

The rate of angling success is first calculated for shore and boat anglers separately, and then the standard errors are combined to establish a fiducial interval around the combined shore and boat angler rate of success. The rate of success for boat anglers is calculated by:

$$R_b = \frac{F_b}{H_b} = \frac{346}{648} = .5058 \qquad (18)$$

and similarly, for shore anglers is,

$$R_s = \frac{F_s}{H_s} = \frac{535}{1858} = .2879. \qquad (19)$$

To obtain the combined weighted rate of success, it is necessary to compute the estimate of harvest separately for boat and shore fishermen, since the two rates were not identical. This is done as follows:

$$HA_s = (P_s)(R_s) = (64,170)(.2879) = 18,475 \text{ fish, and}$$

$$HA_b = (P_b)(R_b) = (44,746)(.5058) = 22,633 \text{ fish.}$$

The combined weighted rate of success is then:

$$R_{sb} = \frac{HA_s + HA_b}{P_s + P_b} = \frac{41,108}{108,916} = 0.3774.$$

Values used to compute the standard errors of the rates of shore and boat anglers are presented in Table 6. Values for Σ_x^2, Σ_y^2, $\Sigma_{x_1}^2$, and $\Sigma_{y_1}^2$, are corrected values obtained by using formulas (10), (11), and (12), and inserting the appropriate values for computation.

Table 6. STATISTICS USED IN COMPUTING STANDARD ERRORS FOR RATES OF SUCCESS.

Boat				Shore			
Hours fished X		Fish caught Y		Hours fished X_1		Fish caught Y_1	
ΣX	= 684	ΣY	= 346	ΣX_1	= 1,858	ΣY_1	= 535
ΣX^2	= 3,060	ΣY^2	= 1,782	ΣX_1^2	= 10,090	ΣY_1^2	= 2,097
N	= 173	N	= 173	N	= 411	N	= 411
$\bar{X}$	= 3.9537	$\bar{X}$	= 2.00	$\bar{X}$	= 4.5206	$\bar{X}$	= 1.3017
Σ_x^2	= 356	Σ_y^2	= 1,090	$\Sigma_{x_1}^2$	= 1,691	$\Sigma_{y_1}^2$	= 1,401

To determine the combined standard error of the mean number of hours fished and fish caught by boat anglers:

$$S_{\bar{x}_{bhbf}} = \left(\frac{S_{\bar{x}_{bh}}}{\bar{x}_{bh}}\right)^2 + \left(\frac{S_{\bar{x}_{bf}}}{\bar{x}_{bf}}\right)^2 = \left(\frac{.1091}{3.9537}\right)^2 + \left(\frac{.1913}{2}\right)^2$$

$$= (.0275)^2 + (.0956)^2 = .0098. \qquad (20)$$

A similar formula is used to combine the standard errors of hours fished and fish caught by shore fishermen:

$$S_{\bar{x}_{shsf}} = \left(\frac{S_{\bar{x}_{sh}}}{\bar{x}_{sh}}\right)^2 + \left(\frac{S_{\bar{x}_{sf}}}{\bar{x}_{sf}}\right)^2 = \left(\frac{.100}{4.5206}\right)^2 + \left(\frac{.091}{1.3017}\right)^2$$

$$= (.0221)^2 + (.0699)^2 = .0054. \qquad (21)$$

To obtain the combined standard error of hours fished and fish caught by both shore and boat anglers, the standard errors were considered independent and were computed as follows:

$$S_{\bar{x}_{sb}} = \sqrt{\left(S_{\bar{x}_{bhbf}}\right)^2 + \left(S_{\bar{x}_{shsf}}\right)^2} \qquad (22)$$

$$= \sqrt{(.0098)^2 + (.0054)^2} = .01127.$$

The fiducial interval at the .95 level is placed around the point estimate by:

$$C.L. = .3774 \pm (t_{.95})(S_{\bar{x}_{sb}}) \qquad (23)$$

$$= .3774 \pm (1.96)(.01127)$$

$$= .3774 \pm .0221$$

and the lower limit is determined to be .3553 fish, the point estimate .3774 fish and the upper limit .3995 fish per hour.

Harvest

The calculation of the harvest of game fish during the June 26 to October 31 period is based on the combined boat and shore rate of success times the estimate of hours fished, as:

$$HA = (T.P.)(R_{sb}) \qquad (24)$$

$$= (108,916)(.377428) = 41,108 \text{ fish.}$$

To test for dependency, the correlation coefficient for angling pressure and the rate of success was calculated. The correlation was only .088, so these variables were considered independent.

The standard errors for angling pressure and the rate of success are combined to establish fiducial limits by:

$$S_{\overline{x}HA} = \sqrt{\left(S_{\overline{x}T.P.}\right)^2 + \left(S_{\overline{x}sb}\right)^2} \qquad (25)$$

$$= \sqrt{(2.495)^2 + (.01127)^2} = \sqrt{6.2262}$$

$$= 2.495$$

The confidence interval is then:

$$C.L. = 41{,}108 \pm \left[(S_{\overline{x}HA})\ (t_{.95})\right]\left[(H)\ (R_{sb})\right] \qquad (26)$$

$$= 41{,}108 \pm (4.89)\ (821.22)$$

$$= 41{,}108 \pm 4{,}015$$

The point estimate of harvest is then 41,108 game fish, with a lower limit of 37,093 and an upper limit of 45,123 fish.

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Prepared by Boland, R. W. and Leik, T. Approved by George D Holton

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Appendix A

SYMBOL DEFINITIONS AND VALUES OBTAINED FOR PERIOD FROM JUNE 26 TO OCTOBER 31, AND OPENING DAY, GEORGETOWN LAKE, 1961.

		June 26 - Oct. 31	Opening Day
N	= Number of counts	124	5
P_s	= Shore fishing pressure in hours	64,170	8,670
$\bar{X}_s$	= Average number of shore fishermen per count	29.49	510
H	= Possible fishing hours in period	2,176	17
S_s^2	= Variance of shore angler counts	649	145,989
$S_{\bar{x}s}$	= Standard error of mean shore anglers per count	2.29	170.9
P_b	= Boat fishing pressure in hours	44,746	14,987
$\bar{X}_b$	= Mean number of boats per count	9.52	304
$\bar{X}_r$	= Mean number of anglers per boat	2.16	2.9
S_b^2	= Variance of boats per count	105.5	138,436
$S_{\bar{x}b}$	= Standard error of mean number of boats per count	.922	166.4
S_r^2	= Variance of anglers per boat	15.04	.55
$S_{\bar{x}r}$	= Standard error of the mean number of anglers per boat	.361	.235
$S_{\bar{x}br}$	= Combined standard error for boats per count and anglers per boat	0.9907	166.6
T.P.	= Combined shore and boat pressure in hours	108,916	23,657
$S_{\bar{x}T.P.}$	= Standard error combined shore and boat pressure	2.495	238.5
R_b	= Rate of success for boat anglers, expressed as fish per hour	.5058	.4356
F_b	= Total fish caught by boat anglers contacted	346	230
H_b	= Total hours fished by boat anglers contacted	684	528
N_b	= Number boat anglers contacted	173	110
$\bar{X}_{bh}$	= Mean number of hours fished by boat anglers	3.9537	4.80

Appendix A (Continued)

S_{bh}^2 = Variance of hours fished by boat anglers	2.0697	3.4403
$S_{\bar{x}bh}$ = Standard error for hours fished by boat anglers	.1091	.1766
$\bar{X}_{bf}$ = Mean number of fish caught by boat anglers	2.0	2.0909
S_{bf}^2 = Variance of fish caught by boat anglers	6.3372	5.5412
$S_{\bar{x}bf}$ = Standard error fish caught by boat anglers	.1913	.2242
$S_{\bar{x}bhbf}$ = Combined standard error of hours fished and fish caught by boat anglers	.0098	.0128
R_s = Rate of success for shore fishermen, expressed as fish per hour	.2879	.3134
F_s = Total fish caught by shore anglers contacted	535	63
H_s = Total hours fished by shore anglers contacted	1858	201
N_s = Number of shore anglers contacted	411	55
$\bar{X}_{sh}$ = Mean number of hours fished by shore anglers	4.5206	3.6545
$\bar{X}_{sf}$ = Mean number of fish caught by shore anglers	1.3017	1.1454
S_{sh}^2 = Variance of hours fished by shore anglers	4.1243	1.8703
$S_{\bar{x}sh}$ = Standard error of hours fished by shore anglers	.100	.1843
S_{sf}^2 = Variance of fish caught by shore anglers	3.4170	3.277
$S_{\bar{x}sf}$ = Standard error of fish caught by shore anglers	.091	.2439
$S_{\bar{x}shsf}$ = Combined standard error of hours fished and fish caught by shore anglers	.0054	.0029
$S_{\bar{x}sb}$ = Combined standard error of hours fished and fish caught for shore and boat anglers	.01127	.0131
HA_s = Harvest by shore anglers	18,475	2,717
HA_b = Harvest by boat anglers	22,633	6,528
HA = Total harvest of game fish	41,108	9,245
R_{sb} = Combined rate of success for boat and shore anglers	.3774	.3908
$S_{\bar{x}HA}$ = Standard error of harvest	2.495	238.5