Georgetown Lake
Kokanee salmon
Cutthroat
Rainbow trout

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Study Title Investigation of More Important Waters

Project No. F-12-R-25 Job Title Georgetown Lake Management Survey

Job No. II-b

Period Covered July 1, 1978 - June 30, 1979

ABSTRACT

Summer anglers caught 0.61 fish per hour while ice-fishermen creeled 2.4 fish per hour during the 1978-79 fishing season. Winter anglers fished 4237 man-days to creel 33,739 game fish. Severe weather conditions reduced fishing pressure by more than 60 percent. Kokanee now dominate in the winter harvest but have decreased in size, apparently due to increasing population numbers.

Spawning kokanee have decreased in size, also apparently due to increasing population densities. Methods will be explored to reduce kokanee densities to improve salmon growth rates yet maintain a reasonable catch rate. Spawning brook trout also decreased in size but the decrease may be due to a sampling problem.

Only a moderate decline in oxygen was measured during the winter although combined snow and ice levels exceeded three feet.

Rainbow trout in the creel were smaller this year than in past years. This was attributed to a heavy angler harvest taking the trout from the lake before they grew to the desired size. Three management strategies were identified and will be presented to anglers in a preference survey.

BACKGROUND

Georgetown Lake is a shallow, 2,768 acre lake located at an elevation of 6,400 feet, approximately 18 miles west of Anaconda. Georgetown probably receives more fishing pressure per acre than any other lake in the state. Sub-catchable rainbows are planted each spring while the kokanee and brook trout are self-sustaining. Rainbows are the dominant gamefish but kokanee have steadily increased in the catch in recent years.

OBJECTIVES AND DEGREE OF ATTAINMENT

The objectives of the study were:

1. To measure the characteristics of the angler harvest from the lake and the age and growth of fish in the lake.

2. To measure the size of spawning kokanee and brook trout.

3. To monitor dissolved oxygen concentrations in the lake during periods of ice-cover.

4. To initiate efforts to sample angler preference toward management alternatives for the fishery.

All of the objectives were attained.

PROCEDURES

Individual anglers were contacted during the summer fishing season to obtain an estimate of angler success. An intensive creel census was conducted during the winter fishing season to obtain estimates of total pressure and harvest. Census days were chosen at random during the season and fishermen counts were scheduled randomly for the morning (0600-1300 hrs) or afternoon (1200-1900 hrs) at hourly intervals. Several changes were made from past census procedures. Fishermen were counted directly rather than by counting cars and estimating fisherman densities. The presence of cars owned by snowmobilers and other non-fishing recreationists made the old method inaccurate. Fishermen hidden in shelters were difficult to count, however, the use of shelters is nominal and attempts were made to contact fishermen in shelters directly to obtain accurate numbers. Increased road maintenance has improved vehicle travel around most of the lake so the lake was censused as a whole rather than divided into segments as in the past. Although fishing is legal 24 hours per day, night-time fishing is negligible so the angling day was assumed to last the 14 hours from 0600-2000 hours. Anglers were interviewed at the completion of their trip and scales were collected from gamefish along with corresponding length data.

Gamefish were also captured in 125 foot graduated mesh gillnets set overnight at various stations on the lake in the summer. Scales from the fish were aged with the aid of a Bausch and Lomb scale projector (70x).

Length information on spawning kokanee and brook trout was collected by electrofishing Stuart Mill Creek and the North Fork of Flint Creek respectively during November. A Smith-Root D.C. backpack shocker was used to collect the fish.

Dissolved oxygen was measured during periods of ice-cover at standardized sites on the lake. A Yellow Springs Instruments (YSI) Model 57 dissolved oxygen meter was calibrated by the Winkler method and used to measure dissolved oxygen at one-meter intervals.

FINDINGS

1978 Summer Creel Census

Fourteen days of creel census were conducted during the 1978 summer fishing season. The 522 anglers interviewed fished 1584.5 hours to creel 974 gamefish for an average of 0.61 fish per hour (Table 1), identical to the 1977 summer season. On the average, boat fishermen had nearly doubled the catch rate of shore fishermen. Of the 53 anglers interviewed at the end of their trip, the shore anglers enjoyed a higher hourly catch rate (1.4) than boat fishermen (1.0) but boaters took home more fish since they fished longer (Table 1). The total average trip length is comparable to past years. A majority of the anglers (64.6%) came from the Butte-Anaconda area while 15.5% were state residents from more than 40 miles away and 19.9% were nonresidents. These percentages are very close to the distribution for the 1977 summer season.

Table 1. Angler effort and success during the 1978 summer fishing season on Georgetown Lake.

Angler type	No. interviewed	Fish/hour	Fish/day[1/]	Trip length[1/] (hours)
Shore	488	0.57	3.1 (37)	2.2 (37)
Boat	34	1.10	5.7 (16)	5.6 (16)
All	522	0.61	3.9 (53)	3.2 (53)

[1/] Based on anglers completing their trip. The sample size is in parentheses.

Rainbow trout made up 90.6% of the catch while brook trout and kokanee accounted for 6.4% and 3.0% respectively (Table 2). The percentage of kokanee was much lower in the census this year than in the past. This was due to a lack of sampling during the hours of heaviest kokanee fishing. The partial census is not conducted on a purely random basis and some variation can be expected from year to year. Rainbow trout averaged 0.9 inches shorter than in 1977, however, the kokanee averaged 1.8 inches shorter than in 1977, indicating salmon lengths may be declining (Table 2).

Table 2. Composition of the 1978 summer angling catch in Georgetown Lake (sample size in parentheses).

Species	Mean length (inches)	Mean weight (pounds)	Percent of catch
Rainbow	10.2 (664)	0.42 (20)	90.6 (883)
Kokanee	9.8 (20)		3.0 (29)
Brook trout	10.2 (49)		6.4 (62)

1978-79 Winter Creel Census

An intensive creel census was conducted during the 1978-79 winter fishing season to obtain estimates of total fishing pressure and harvest. Twenty-nine of the 75 days in the season were censused on a randomly assigned basis (Table 3). The creel census technician conducted 315 angler interviews and 230 fishermen counts. Counts averaged 15.3 fishermen per hourly count but pressure was nearly double that on the weekends (Table 3).

Table 3. Sampling parameters for the 1978-79 Georgetown Lake winter creel census.

	Strata I (Weekends & holidays)	Strata II (weekdays)	Entire season
No. days in season	26	49	75
Hours in season [1/]	364	658	1050
No. days sampled	11	18	29
No. fishermen interviewed	219	96	315
No. fishermen counts	86	144	230
Avg. fishermen/count	28.3	7.6	15.3

[1/] Based on a 14-hour fishing day, 0600-2000 hours.

During the 1978-79 winter season, 4,237 anglers fished 15,568 hours to catch 33,739 gamefish (Table 4). Although catch rates were the highest ever recorded for Georgetown, extremely cold temperatures (-30 to -50°F) and deep, drifting snow combined to reduce pressure more than 60% and harvest about 30% from the 1962-74 average (Table 5). Anglers took home nearly eight fish per day.

Table 4. Estimates of angler effort and success during the 1977-78 winter season, Georgetown Lake.

	Strata I (weekends & holidays)	Strata II (weekdays)	Entire season
Total fishermen	2,764	1,474	4,237
Hours fished	10,319	5,250	15,568
Fish creeled			
Rainbow	9,982	6,125	16,107
Kokanee	12,784	6,017	18,801
Brook trout	1,300	384	1,684
Total	21,213	12,526	33,739
Fish/hour	2.1	2.4	2.3
Fish/angler	7.7	8.5	7.9

Table 5. A comparison of winter fishing seasons on Georgetown Lake, 1962-1979

Year	Season length (days)	Total fishermen	Total harvest	Catch per hour
1962-63	27	11,774	34,969	0.75
1963-64	71	10,041	22,561	0.55
1966-67	73	12,329	58,675	1.38
1969-70	70	14,642	80,252	1.42
1971-72	73	10,169	54,954	1.66
1972-73	74	12,645	63,048	1.41
1973-74	76	10,368	76,245	2.18
1978-79	75	4,237	33,739	2.30

Kokanee now account for more than half the catch in the winter (Table 6). Kokanee are more available to the average fisherman in winter than in the summer when the salmon are taken primarily by boaters. Liberalized limits and increasing fishermen expertise have also increased the salmon catch and a growing number of fishermen now prefer to catch salmon over trout. Kokanee also appear to have increased greatly in number in recent years as evidenced by increasing catch rates but decreasing size (Table 8).

Table 6. Species composition of harvest in the Georgetown Lake winter fishing seasons, 1963-1979. Sample size in parentheses.

Year	Rainbow trout	Kokanee salmon	Brook trout	Cutthroat trout	Arctic grayling
1963-64	80.9 (3103)	8.7 (333)	6.9 (266)	3.5 (135)	-
1966-67	89.4 (9663)	7.0 (753)	3.6 (386)	0.1 (7)	
1967-68	87.4 (2703)	8.9 (274)	2.1 (64)	0.1 (2)	1.5 (48)
1969-70	82.8 (4870)	14.4 (849)	1.8 (105)	0.1 (2)	0.9 (52)
1970-71[2/]	76.4 (581)	20.4 (155)	2.2 (17)	-	0.1 (7)
1971-72	59.1 (4402)	36.5 (2721)	4.2 (308)	0.1 (1)	0.2 (17)
1972-73	66.5 (3392)	28.5 (1452)	4.8 (246)	0.1 (6)	0.1 (2)
1973-74	56.7 (2416)	39.3 (1675)	4.0 (171)	-	0.1 (1)
1975-76[2/]	64.7 (44)	32.4 (22)	2.9 (2)	-	-
1976-77[2/]	35.2 (700)	62.4 (1242)	2.5 (49)	-	-
1977-78[2/]	38.7 (851)	58.1 (1276)	3.2 (71)	-	-
1978-79	41.5 (995)	55.0 (1317)	3.5 (83)	-	-

2/ Partial census

A majority of the anglers (72.8 percent) came from the Butte-Anaconda area while 26.2 percent lived elsewhere in the state and 1.1 percent were nonresidents.

Kokanee and Brook Trout Spawning Surveys

Spawning kokanee were captured by electro-fishing in Stuart Mill Creek on November 14, 1978. Forty-seven males and 26 females were measured with males averaging 10.1 inches in total length and females averaging 10.5 inches. Males and females had decreased 2.0 and 1.4 inches in length respectively from the average for 1975-77. The salmon are uniform in size and quite numerous and it appears that growth may be negatively related to density.

Brook trout were captured in the North Fork of Flint Creek on November 14, 1978. Ice-cover made sampling difficult, especially in pools where the larger fish appeared to be holding. The sample is probably not truly representative of the spawning run and it is recommended that sampling be done at mid-October in the future to avoid this problem. Fifty males and 27 females were captured, averaging 10.2 and 9.4 inches in total length respectively. Numbers of fish appeared adequate for available substrate.

1978-79 Winter Dissolved Oxygen Sampling

Dissolved oxygen was measured at five stations (Figure 1) on the lake from December 20, 1978 to March 2, 1979. Coordinates for the stations are on file in Region Two Fisheries files.

Moderate declines in oxygen were measured into March (Table 7). The April sampling was delayed and unsafe ice conditions finally precluded further sampling. Ice thickness increased to more than 24 inches and snow levels often exceeded 12 inches. Station 1 shows the effect of inputs of oxygenated spring water but the effect is limited in relation to the entire lake. A fish kill involving 5-10,000 salmonids was documented in early June, 1979. A heavy bacterial and parasitic infestation was identified as the cause of mortality but stress and crowding due to oxygen depletions may have contributed to the outbreak.

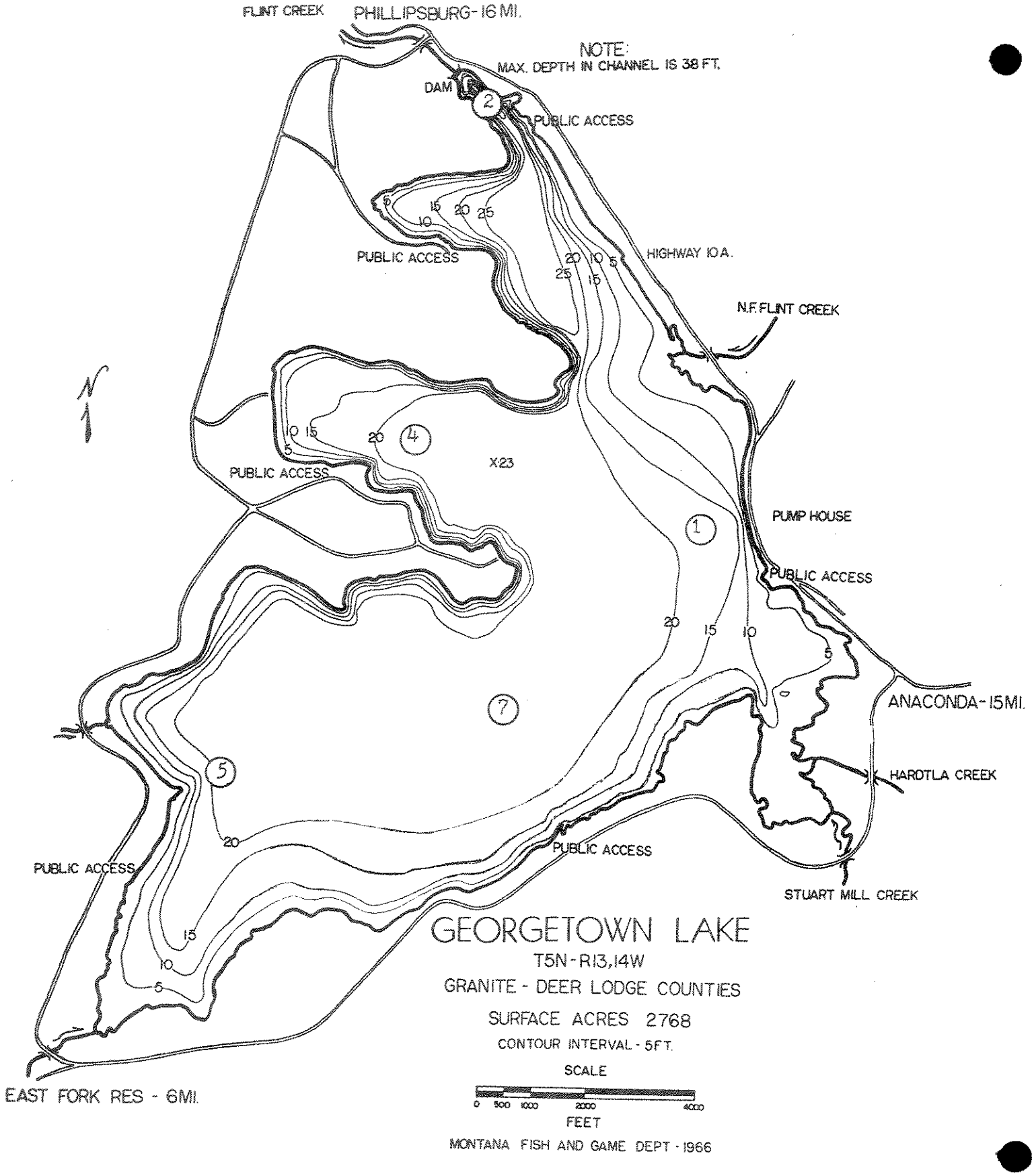

Figure 1. Dissolved oxygen sampling sites on Georgetown Lake, winter 1978-79

Table 7. Dissolved oxygen (mg/l) at five stations on Georgetown Lake during winter, 1978-79.

Date	Depth[1/] (meters)	Station 1	2	4	5	7
12-20-78	0		10.1	11.7		11.1
	1		10.1	10.4		10.8
	2		10.0	9.7		8.9
	3		9.6	8.8		7.0
	4		8.2	5.0		4.7
	5		5.7	1.2		0.06
	6		3.8			
	7		0.1			
	8		0.05			
1-26-79	0	10.0	8.7	10.0	10.7	10.4
	1	9.9	8.1	9.4	8.6	9.9
	2	6.6	6.6	7.2	2.6	7.4
	3	7.4	4.2	7.0	2.4	4.8
	4	1.8	1.3	1.8	0.6	3.2
	5		0.7	0.6		0.8
	6		0.2			
	7		0.2			
3-2-79	0	8.4	8.1	8.6		10.2
	1	6.0	5.3	7.6		8.9
	2	5.8	2.6	5.2		4.2
	3	4.2	0.8	2.7		3.2
	4		1.1	0.8		0.9
	5		1.3			0.6
	6		0.7			
	7		0.7			
	8		0.6			

[1/] Depths measured from the bottom of the ice. Maximum depth at a station may vary due to changes in water levels and irregularities of the bottom.

Angler Preference Survey

Georgetown Lake was once known for its trophy trout but anglers have increasingly complained about the decreasing size of fish in recent years (Table 8). In 1978, efforts were initiated to identify the cause of the problem, identify management alternatives available, and to survey angler preferences for different management strategies for the lake.

Table 8. A comparison of the average length of creeled fish in the Georgetown Lake winter seasons, 1966-1979. Sample size in parentheses.

Year	Rainbow trout	Kokanee salmon	Brook trout
1966-67	11.7 (214)	12.3 (34)	11.4 (22)
1967-68	11.3 (306)	10.7 (55)	11.0 (17)
1969-70	11.1 (247)	11.4 (20)	10.1 (10)
1970-71	10.1 (555)	10.9 (149)	9.9 (12)
1971-72	10.6 (1407)	10.9 (717)	10.5 (133)
1972-73	10.7 (888)	9.9 (302)	10.0 (86)
1973-74	10.4 (544)	9.8 (301)	9.6 (50)
1975-76	10.4 (45)	11.5 (14)	10.3 (2)
1976-77	10.6 (247)	10.8 (346)	11.1 (9)
1977-78	10.0 (171)	9.3 (194)	10.5 (12)
1978-79	9.9 (165)	7.9 (119)	9.8 (17)

Age-growth studies on rainbow trout indicated that rainbows average about five inches when planted in late May and grow to about eight inches by early July when they are recruited into the fishery. The trout average about 9 inches in January and measure about 10 inches by the following June, one year after planting (Table 9). The trout then grow about two inches in each of the following two years. Although this is not fast growth, it should be remembered that the lake sits at a high altitude (6400 ft.) and has a short growing season. Georgetown also sustains more fishing pressure per acre than any other lake in Montana according to the Department's 1975-76 fishing pressure mail survey. This heavy pressure may crop the faster growing individuals out of the lake, thus stunting the general population growth. At any rate, it appears that rainbow trout will have to survive in the lake 24-36 months after planting to reach the 12-14 inch size range most anglers seem to prefer.

Table 9. Seasonal growth of Rainbow trout year classes in mean total length (inches) in Georgetown Lake. Sample size in parentheses.

		Year Class						
Year	Month	1979	1978	1977	1976	1975	1974	1973
1976	D				9.6 (22)	12.1 (4)	14.2 (1)	
1977	J				9.8 (9)	11.7 (18)	14.1 (4)	17.4 (1)
	F				9.9 (7)	12.2 (13)	14.0 (2)	17.2 (1)
	M			5.1[1/] (52)				
	A							
	M							
	J				10.8 (43)	13.1 (24)	14.9 (1)	
	J			8.0 (4)	11.1 (46)	13.8 (10)	14.9 (5)	
	A			8.3 (14)	11.6 (15)	13.1 (4)		
	S							
	O							
	N							
	D							
1978	J			9.0 (18)	11.4 (9)	13.2 (1)		
	F			9.1 (31)	11.5 (12)	12.8 (11)		
	M							
	A							
	M		5.9[1/] (75)					
	J		6.5 (1)	10.7 (76)	12.8 (14)			
	J		7.8 (20)	10.2 (66)	13.0 (15)	15.0 (1)	16.1 (1)	

Table 9. Cont'd.

Year	Month	Year Class 1979	1978	1977	1976	1975	1974	1973
1978	A		8.3 (69)	10.8 (73)	13.4 (10)	15.1 (3)		
	S							
	O							
	N							
	D							
1979	J		9.0 (83)	11.6 (31)	13.3 (6)	14.7 (3)		
	F							
	M							
	A							
	M							
	J	8.2 (12)	10.4 (45)	12.4 (16)	14.2 (1)			
	J							
	A							
	S							
	O	8.5 (31)	11.1 (23)	13.1 (8)				
	N							
	D	9.1 (65)	11.2 (53)	13.0 (13)				

1/ Size at planting.

A study of the age-class composition of the angler catch revealed that age I rainbows predominate in the catch in the spring (Table 10). Newly-planted trout (age 0) are recruited into the fishery in early July and make up about 16-34 percent of the catch by late summer. The age 0 fish predominate in the catch (46-67 percent) by winter and continue to dominate the catch into the spring as age I fish. The contribution of an age class to the catch dwindles rapidly after this point and only about 10-20 percent of the catch consists of age II fish and very few age III fish are caught (Table 10). Since rainbows don't reach the desired size range until age II of III, it appears clear that most of the trout do not survive to the size that anglers want. A 1974 creel census showed that anglers can creel as much as 60 percent of a trout plant, indicating that angling is a major mortality factor. If trout are to survive to the desired size mortality, and therefore angling harvest, will have to be reduced.

Table 10. Percent composition of the Georgetown Lake angler harvest by age-class and season.

Year	Season 1/	Age-class 2/ 0+	I+	II+	III+	IV+
1977	W	46	43	9	2	
	Sp		68	32		
	Su	18	62	14	5	
	F					
1978	W	60	26	15		
	Sp		85	15		
	Su	34	54	10	2	>1
	F					
1979	W	67	25	5	2	
	Sp					
	Su	16	61	22	1	
	F	50	37	13		

Table 10. Cont'd.

Year	Season[1/]	Age-class[2/] 0+	I+	II+	III+	IV+
1980	W	50	40	10		

1/ Seasons: W- Winter, December-February
Sp- Spring, May-June
Su- Summer, July-August
F- Fall, September-October

2/ All age-classes are advanced one year on May 1.

These facts were presented to several sportsmen's groups in 1978 in an attempt to identify management alternatives that were biologically sound and acceptable to anglers. A minimum size limit was rejeected since more than 90 percent of Georgetown anglers use bait and this method would cause heavy mortality in small fish that were released. Restricting the season length was also rejected since the lake is now closed nearly four months of the year. Further closures would restrict angling opportunities and probably only concentrate fishing pressure in a shorter period of time. It was finally agreed that a year-round reduction in the daily limit was the most equatable means of reducing harvest.

A study of 1247 anglers contacted in creel censuses between 1974 and 1977 showed that while most anglers catch a few fish, very few fishermen catch the current limit of 10 trout (Figure 2). The average catch per angler was 2.9 rainbows. In studying the effect of limit reductions on this group of anglers it was assumed that if an angler caught from six to 10 trout under the old regulations, he would still catch five trout if the daily limit were reduced to five. Using this assumption, the effect of a reduction of the daily limit on the annual harvest was calculated for daily limits from 0 to 9 (Figure 3). Daily limits of 6-9 trout had little effect on the annual harvest. Daily limits of five, four, and three rainbows reduced the harvest by 13.1, 21.2, and 33.1 percent respectively (Figure 3). Since a reduced limit would probably encourage anglers to release more small fish with a corresponding increase in post-mortality, and taking into account fluctuations in the annual harvest, it was felt that daily limits of four or five trout might not have the desired effect. A daily limit of three rainbows was chosen as the most likely to increase trout survival and therefore average length.

A survey form was designed to sample angler preferences toward three management alternatives: 1) maintain the present fishery, 2) manage for larger trout by reducing the daily limit, or 3) manage for trophy trout. Since Georgetown sustains 80,000 man-days of angling annually, a daily limit of even one trout could result in a significant harvest. It appears that catch-and-release fishing with artificial lures would be necessary to manage for trophy trout.

As noted previously, kokanee have also decreased in size recently. It is felt that this is due to over population. The kokanee are self-sustaining and are controlled only by environmental factors and angler harvest. Methods should be explored for increasing angler harvest of the salmon and for decreasing initial year class production. Salmon do not enter the fishery until age two but do compete for food during those years. Therefore, reduction in initial year class size would

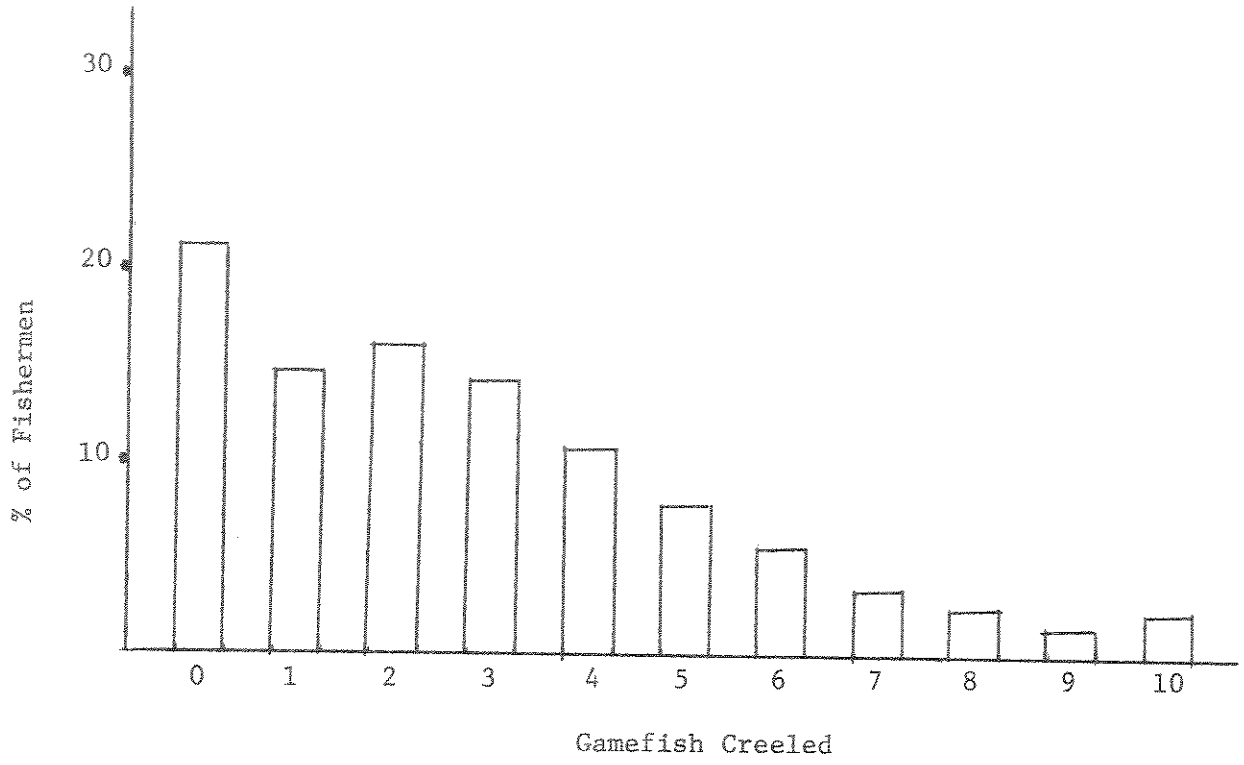

Figure 2. Percent distribution of 1,247 anglers by daily catch on Georgetown Lake, 1974-78.

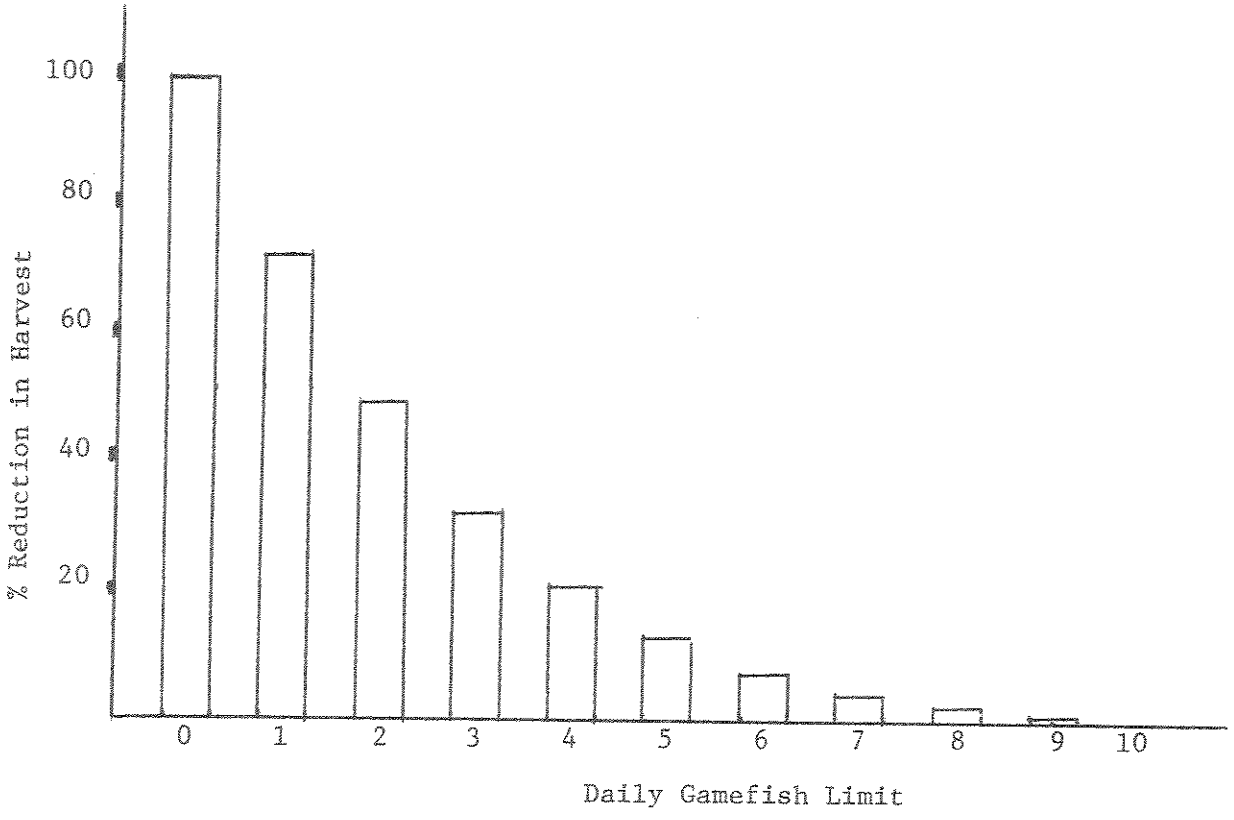

Figure 3. Effect of reduced limits on harvest for 1,247 anglers on Georgetown Lake, 1974-78.

be the most effective means of controlling population size to increase growth. The increasing popularity of the salmon makes it undesirable to reduce numbers to the point where catch rates drop severely, however. An adult in the 10-12 inch size range appears to produce a size and catch rate that satisfies most anglers.

RECOMMENDATIONS

A preference survey should be presented to as many anglers as possible to sample their preference toward different management strategies for rainbows.

Partial creel censuses should be conducted during the summer and winter angling seasons to monitor angler catch rates and the average size of creeled game fish. It is recommended that a complete summer creel census be conducted as soon as possible since total summer angling harvest has not been estimated since 1974. New harvest estimates are needed to determine current angling trends and to aid in future management decisions.

Methods should be explored to reduce the number of salmon in the lake to increase average size while maintaining a reasonable catch rate.

The brook trout spawning run should continue to be monitored to determine the effect of heavy angling pressure at the mouth of Flint Creek.

Dissolved oxygen should be measured during periods of ice-cover to monitor oxygen depletions.

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Date: March, 1980

Water referred to: 2-06-7961-5 Georgetown Lake