MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Northwest Montana Fisheries Study

Project No. F-7-R-21 Title Fish Management Surveys

Job No. I-b

Period Covered April 1, 1971 through March 31, 1972

ABSTRACT

Opening day creel census data were collected for Kilbrennan Lake and Lake Mary Ronan. The 1971 brook trout harvest at Kilbrennen Lake increased by 23 percent over 1970. Fishing pressure remained about the same. The average catch per hour of game fish for Lake Mary Ronan increased for the third consecutive year from .18 fish in 1969 to .57 fish in 1971. Kokanee comprised 96 percent of the catch.

Stream population sampling was conducted for 16 tributary streams to the Swan River above Swan Lake to determine relative abundance, species composition and size distribution of fish. Brook trout, Dolly Varden and westslope cutthroat were found to be most abundant in the catch. Flow measurements, water temperatures and water chemistry data were also collected.

Monthly water quality data were collected from stations in the Prospect Creek, Lake Creek and Bull River Drainages to establish base line water quality data of streams subjected to present and future mining development.

Partial control of rough fish species in Bull Lake was repeated to remove spawning populations of northern squawfish, longnose and largescale suckers and peamouth by trap netting and partial poisoning with rotenone. Trapping success and the feasibility of rough fish removal are discussed.

BACKGROUND

Basic data other than fish populations inventories are pertinent to the needs of fisheries management. This is a continuing project designed to accumulate and update information on various other aspects of fisheries management procedures.

PROCEDURES

Procedures are discussed along with findings for each segment of the project.

FINDINGS

Opening Day Creel Census

Kilbrennan Lake

An opening day creel census was conducted at Kilbrennan Lake for the sixth consecutive year to determine the effect of a statewide ten-pound, no number limit for brook trout on total opening day harvest. This liberalized limit has been in effect since 1966. Kilbrennan Lake has a surface area of 58.5 acres and is considered one of the better producing brook trout lakes in the state. The brook trout population is self-sustaining and is not supplemented by hatchery fish. Kilbrennan Lake is fed by several small springs and a small tributary stream (Feeder Creek). This lake is unique in that it is the only self-sustaining brook trout lake that has a closure during the spawning period. The lake is open to fishing from the third Sunday of May through September 30th.

In 1971, a total of 275 fishermen were interviewed on opening day. Fishermen were successful in catching 1,623 fish for 823 hours of fishing effort. The catch per hour was 1.97 fish and the catch per angler 5.9 fish. The average length of trip was 2.99 hours. Brook trout comprised 98.6 percent of the catch and rainbow trout 1.4 percent. Length and weight measurements taken from 80 brook trout averaged 11.1 inches and 0.49 pounds. Local resident anglers (mostly from Libby and Troy) comprised 97 percent of the angling pressure while non-residents (Idaho and Washington) comprised three percent of the anglers. Since 1966, resident fishermen made up between 86 and 97 percent of the angling pressure.

Angling pressure in 1971 was similar to that of 1970, although the average time spent fishing about 1.5 hours less than in 1971. Adverse weather conditions, wind and blowing rain and snow, probably accounted for the decrease in time spent fishing. Despite the low number of angler hours, the total opening day catch increased by 23 percent over 1970.

A comparison of data (contact and expanded) for the years 1966 through 1971 is shown in Table 1. Estimated fishing pressure and harvest data were derived from contacting all boat and shore fishermen during the census day. These were expanded by adding fishermen still on the lake at the termination of the census and an estimate of their catches.

Since the opening day census was initiated in 1966, fishing pressure estimates have fluctuated between a low of 243 anglers in 1966 to a high of 407 anglers in 1967. This increase in angling pressure was concurrent with the influx of Libby Dam construction work force. Since then, the angling pressure in terms of total angling hours was lowest in 1971 with a total expended effort of 925 hours, a reduction of 46 percent over the 1967 estimate.

Total harvest estimates ranged from a high of 2,808 fish in 1968, following a low of 1,106 fish in 1969. Through the six-year period, the opening day angling harvest averaged 1,834 fish with an average catch per angler of 5.6 fish. The average total length of brook trout caught during this period ranged between 10.1 and 11.7 inches.

The increase in the opening day brook trout harvest attributed to the ten pound, no number limit varied between 4.1 and 9.7 percent (1966-1971). The smallest increase of 4.1 percent in 1966 was probably due to fishermen not being aware of the regulation change. The 9.7 percent increase in harvest occurred in 1968 when 17 percent of the total anglers (61) caught more than ten fish per angler. Over the past three years the annual harvest due to the liberalized brook trout limit varied between 5.3 and 6.5 percent. This increase was accounted for by less than six percent of the anglers in 1969 and 1970 and ten percent of the anglers in 1971.

Based on creel information collected over the past six years on opening day, the liberalized brook trout limit has not reduced the quality and quantity of brook trout fishing in Kilbrennan Lake. Total harvest and catch rates of brook trout showed variation from year to year, but it would appear that this was a result of a strong year classes of older age fish rather than over-harvest resulting from a change in the brook trout bag limit.

Lake Mary Ronan

A partial creel census was conducted at Lake Mary Ronan on opening day of fishing season (1971) to compare harvest rates with those of previous years. A total of 52 fishermen caught 76 fish at a rate of 1.5 fish per angler and 0.57 fish per hour. Kokanee comprised 96 percent of the catch, with rainbow comprising the remaining 4 percent. Sixty-five of the anglers were successful in catching one or more fish.

Angling success in terms of fish per angler and fish per hour showed improvement for the second consecutive year. A comparison of opening day creel census data for the years 1966 through 1971 is shown in Table 2.

Swan River Drainage Inventory

Stream population sampling of 16 tributary streams to the Swan River above Swan Lake was conducted in August of 1971. The headwaters of these streams flow from steep slopes of the Swan and Mission Mountains through heavily forested areas emptying into the Swan River. Typical stream gradients vary from high velocity, steep boulder types of greater than 25 feet per mile near the headwaters to meander types with a moderate gradient. These streams vary in length from 1.5 to 20.0 miles.

Electrofishing gear was used to sample fish populations to determine relative abundance, species composition and size distribution of fish. Sampling sections were 600 feet in length and were located near the mouths of most streams. The location of fish sampling stations is shown in Figure 1. Data collected included total length, weights and scale samples. An effort was made to jaw tag mature Dolly Varden trout.

Table 1. Summary of opening day creel census data collected at Kilbrennan Lake, 1966 through 1971

	CONTACT DATA			EXPANDED DATA				
Year	Anglers	Fish	Catch per Angler	Anglers	Fish	Anglers Hours	Total (pounds)	Catch (fish per surface acre)
1966	177	1042	5.9	243	1328	1070	611	22.7
1967	335	2077	6.1	407	2460	1702	900	42.0
1968	357	2597	7.3	386	2808	940	1053	48.0
1969	335	1055	3.2	384	1106	1484	677	18.9
1970	262	1328	5.1	301	1478	1260	872	24.6
1971	275	1623	5.9	309	1824	925	894	31.0

Table 2. Summary of opening day creel census collected from Lake Mary Ronan, 1966 through 1971

Year	Fishermen contacted	Number fish caught	Average catch per angler	Average catch per hour
1966	65	248	1.2	0.32
1967	98	118	1.2	0.25
1968	215	348	1.6	0.25
1969	62	58	0.9	0.18
1970	100	127	1.3	0.35
1971	52	76	1.5	0.57

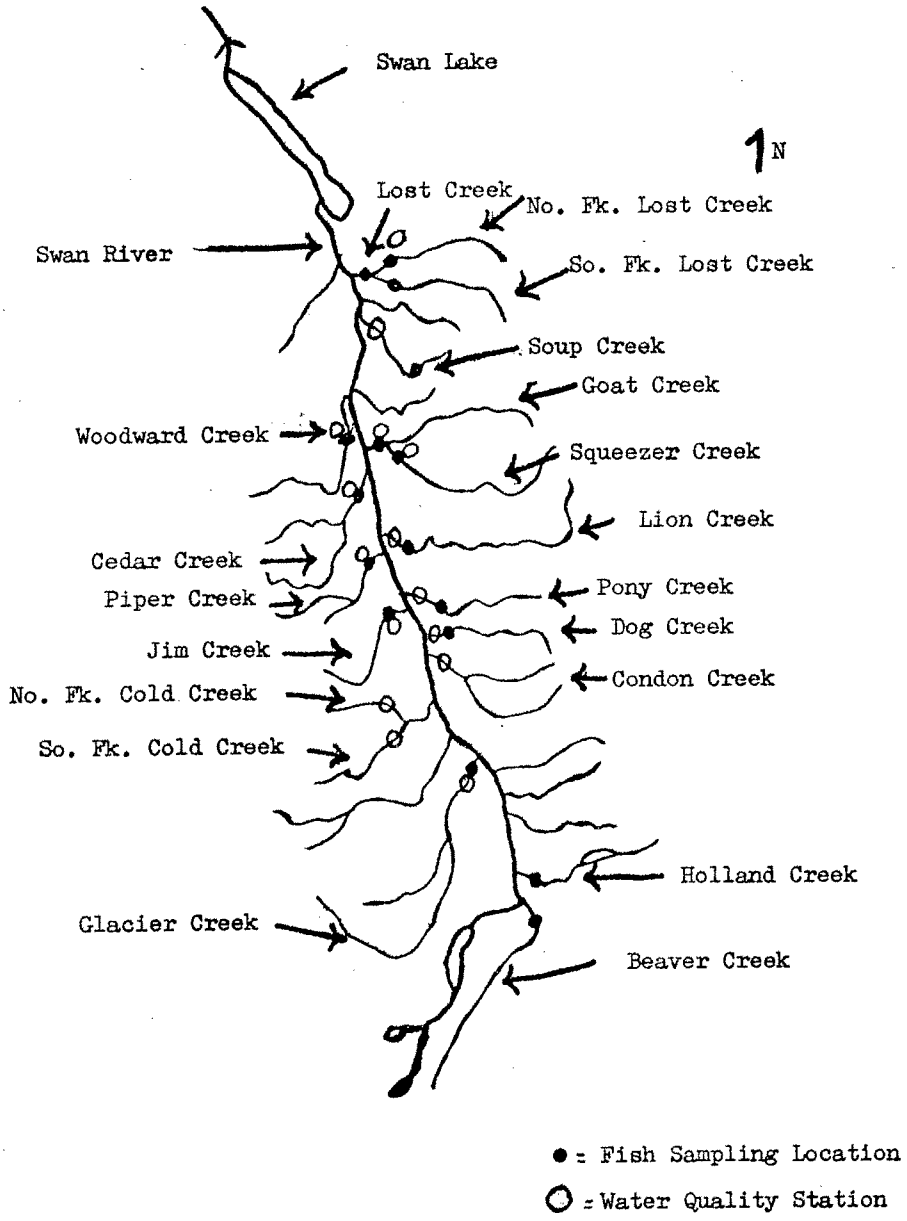

Figure 1. Location of 1971 fish population sample sections and water quality stations

A total of 817 fish were collected from the 16 streams sampled, 21 percent of the fish were larger than six inches. Brook trout were the most numerous comprising 64 percent of the catch, followed by Dolly Varden 17 percent; westslope cutthroat 12 percent; rainbow 2 percent; and other (whitefish, longnose sucker, squawfish and redside shiner), 5 percent. Brook trout were dominant in the catch in eight streams, Dolly Varden in four streams and westslope cutthroat in three streams. The species compositions of fish populations from the 16 Swan River tributary streams sampled are shown in Figure 2.

Maximum-minimum thermometers were installed near the mouths of major tributary streams to record seasonal streams temperature variations. Temperatures were monitored for the period of mid-June through mid-November. Thermometers were serviced weekly during June, July and August and periodically thereafter. The high (maximum) summer temperatures recorded for all streams ranged between 72° and 49° F. while low (minimum) temperatures recorded ranged between 63° and 45° F. Maximum stream temperatures for most streams were recorded during the first two weeks in August. The locations of water quality sampling sites are shown in Figure 1.

Staff gauges were installed to record seasonal water flow as determined by cross sectional area and velocity measurement. Velocity measurements were recorded with a Price current meter and volume flows were recorded periodically when time allowed. When sufficient cross-sectional measurements are completed, flow curves will be established and volume flow measurements can be interpreted from gauge height readings. In 1971, the peak spring flow period occurred the week of June 7 - 11, while seasonal low flows were recorded in mid-October.

Water chemistry data collected include alkalinity, conductivity, pH, and turbidity. Water quality data were collected periodically during the spring, summer and fall of 1971. With the exception of turbidity, these parameters increased with a decrease in stream flow in late summer. In most instances the basic fertility of streams draining the Mission Mountains on the west is lower than those streams draining the Swan Range on the east. The upper and lower limits of water quality parameters for major Swan River tributaries are shown in Table 3.

Further sampling of fish populations and water quality collections of Swan River tributaries will continue in 1972. Population sampling will be conducted higher up in the drainages to determine species composition and distribution at higher elevations. An attempt will be made to determine stream habitat type associated with various fish species. Water quality collections and volume flow measurement at various flow stages will be continued.

Water Quality Base Data

Water quality data were collected from Prospect Creek, Lake Creek, and Bull River Drainage to establish base line data of streams subject to present and future mining development which may be chemically altered.

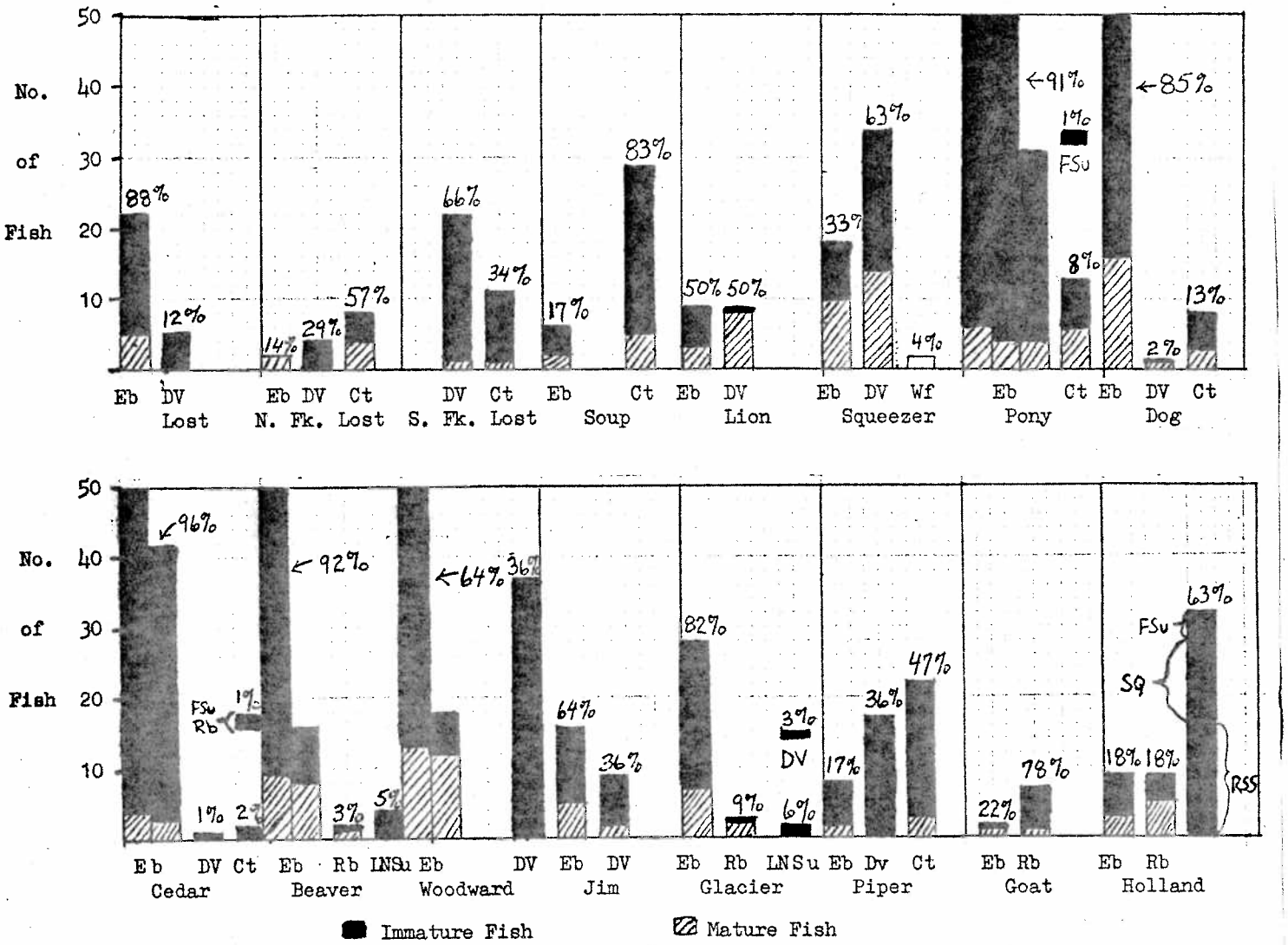

Figure 2. Species composition of fish populations from Swan River tributary streams, 1971

Table 3. Upper and lower limits of physical and chemical measurements collected from Swan River tributary streams. (June-September, 1971)

Stream	Maximum Temperature (F°)	Conductance (Micro Mhos/cm.)	pH (Units)	Total Alkalinity (ppm)	Turbidity (J.T.U.)
Soup	43°-61°	230-355	8.0-8.2	146-205	0- 7
Goat	41°-57°	219-301	7.9-8.2	121-161	2-10
Squeezer	41°-54°	195-261	7.8-8.1	109-147	0- 7
Lion	40°-55°	154-225	7.8-8.0	85-128	0- 9
Pony	44°-71°	128-210	7.4-7.7	91-112	0-10
Dog	40°-59°	90-203	7.6-7.9	71-109	0-11
Condon	44°-72°	133-222	7.5-7.7	79-128	0-10
Lost	44°-60°	115-165	7.8-8.2	203-298	0- 4
Cedar	44°-63°	105-164	7.4-8.1	66-125	0- 9
Woodward	41°-54°	153-192	7.7-8.0	87-106	0- 9
Piper	41°-56°	70-141	7.4-7.9	70-148	0- 8
North Fork Cold	38°-63°	114-236	7.6-7.9	63-144	0- 5
South Fork Cold	42°-64°	124-240	7.7-7.9	75-138	0- 5
Jim	42°-52°	117-185	7.7-7.8	117-188	0- 7
Glacier	39°-68°	48- 75	7.2-7.4	30- 50	0-10

Water quality monitoring began in January 1970 and was conducted on a monthly basis for a year's duration through December 1971. Sampling stations were established for the Bull River (3), Ross Creek (1), Stanley Creek (1), Lake Creek (2), Prospect Creek (3), and Cox Creek (1). A contract was entered into with the Montana Bureau of Mines and Geology for water quality analyses. All water quality data were coded on IBM cards, summarized and are kept on file at the Regional and Helena office. The parameters analyzed include dissolved heavy metals cadmium (Cd), zinc (Zn), copper (Cu), nickel (Ni), and iron (Fe), plus calcium (Ca) magnesium (Mg) manganese (Mn), potassium (K), and sodium (Na). Numerous other water quality parameters including total dissolved solids, alkalinity and pH were analyzed.

Streams in the Prospect Creek Drainage, Prospect Creek and Cox Creek, are low in chemical fertility with total dissolved solids ranging from 12 to 59 ppm, pH values were also low ranging from 6.4 to 7.1 units. Dissolved heavy metals were present in only minute amounts throughout the entire sampling period.

The fertility of the Bull River was somewhat higher than the Prospect Creek Drainage with total dissolved solids ranging from 36 to 92 ppm. pH values were accordingly higher with a range of 7.0 to 8.0 units. Dissolved heavy metal concentrations were present in minute amounts. Concentrations of dissolved copper, zinc, nickel and manganese did not exceed .04 ppm. The highest concentration of iron recorded was 1.3 ppm.

Streams in the Lake Creek Drainage, Stanley, Ross and Lake Creeks, are considered low in chemical fertility with total dissolved solid readings ranging from 33 to 74 ppm. The pH range was from 6.7 to 7.9 units. Concentrations of dissolved heavy metals other than iron did not exceed .04 ppm. The highest concentration of iron recorded was .10 ppm.

It would appear that present water quality parameters of streams measured in the proposed mining influence zones are within the range for supporting trout populations. Because these streams are low in pH and dissolved solids, they have little buffering affects. Therefore, a small amount of modifying substances, such as mine effluents, could alter the pH considerably and cause significant damage to the aquatic environment.

Efforts will be continued to monitor various aspects of the aquatic habitat. Aquatic invertebrate sampling was initiated in the spring of 1972 to measure relative abundance and species composition of aquatic insect populations. Seasonal measurements (spring, summer, fall and winter) will be taken with three square feet samples collected at each sampling station. Samples will be collected above and below mining influence areas. A summary of the collection data will be presented and discussed in completion report F-7-R-22, Job I-b.

The U.S. Forest Service has expressed interest in continuing water quality measurements of the Bull River and Lake Creek Drainages. They will sample on a quarterly rather than monthly basis.

Experimental Removal of Rough Fish Species from Bull Lake

Experimental control of rough fish species in Bull Lake with the use of trap nets and rotenone was repeated for the third consecutive year. The large abundance of rough fish species is believed to be responsible in part for the poor sport fishery. The key target species to be controlled are northern squawfish, longnose sucker, largescale sucker and peamouth.

A series of five trap nets was set overnight on June 1, 1971 to determine inshore movement of mature spawning fish. Daytime and nightlight observations along shoal areas were made in conjunction with netting operations. A total of 16 fish were collected of which nine were non-game fish. The non-game fish consisted of seven squawfish, ranging from 9.3 to 22.3 inches and two longnose suckers, 17.1 and 16.6 inches. All mature fish were classified as "green". Few suckers and squawfish were sighted during shoal area observations. Shoal area water temperature (surface) on June 2 was 52° F. Because of the poor catch and green condition of the fish, intensive netting was postponed until inshore concentrations of fish appeared.

Night-light observations and trap netting was resumed on June 15 and continued through June 25. Night-light observations were made to determine areas of greatest fish concentrations. Individual fish caught were weighed, measured and examined internally for sexual maturity and the degree of ripeness. Females were classified as green, ripe or spent and males classified as ripe or spent. Scale samples were taken from a number of individuals for age analysis.

In 1971, a total of 1,737 fish were caught with trap nets of which 98.8 percent were non-game and 1.2 percent game fish. Game fish caught and released included largemouth bass, mountain whitefish, rainbow trout and cutthroat trout. The species composition of rough fish species removed included 31.7 percent northern squawfish, 33.7 percent longnose sucker, 27.3 percent largescale sucker and 6.1 percent peamouth. A summary of fish captured in trap nets is presented in Table 4.

In 1970, 1,050 non-game fish were removed from Bull Lake by trap netting. The overall catch per net night was 35.0 fish, similar to that achieved in 1971. In 1970, largescale suckers comprised almost 50 percent of the fish caught.

At the onset of netting operations (June 15), the catch averaged 15 fish per net-night. First large concentrations of fish on the gravel bars were ripe male longnose suckers. This species comprised 63 percent of initial catch. No mature female rough-fish species were caught with the exception of peamouth. The mature peamouth collected were either green or spent females, which may indicate that the peak spawning period for this species was in progress or had already occurred. The water temperature was 52° F.

As air temperatures warmed, surface water temperatures in the shoal areas warmed considerably, and inshore schooling of rough fish species intensified. A gradual increase in the number of ripe females was noted, and squawfish became increasingly abundant in the catch.

Table 4. Summary of non-game fish caught in trap nets from Bull Lake, 1971

Date	Number of net sets	Sq	LNSu	CSu	Pm	Total	Catch per net night
6/16-17	5	9	44	7	7	67	13.4
6/17-18	5	41	73	11	10	135	27.0
6/18-19	5	43	131	105	8	287	57.4
6/19-20	5	19	53	25	13	110	22.0
6/21-22	5	23	59	31	0	113	22.6
6/22-23	5	145	87	108	15	355	71.0
6/23-24	5	59	35	37	27	158	31.6
6/24-25	5	124	58	103	17	302	60.4
6/25-26	5	88	45	47	9	189	37.8
Total or average	45	551	585	474	106	1,716	38.1

Sq= Squawfish, CSu= Largescale suckers, LNSu= Longnose Suckers, Pm= Peamouth

Trapping success reached a peak on June 22. Maximum surface water temperature rose sharply from 57° F. on June 21 to 67° F. on June 22 triggering a mass inshore movement of spawning individuals. Most noted increase was that of squawfish and largescale suckers. At this time, 100 percent of the largescale suckers were ripe as compared to only 15 percent of the squawfish. On June 23, water surface temperatures dropped to 60° F. and the catch dropped accordingly. Thirty-three percent of the largescale suckers captured on June 23 were spent. At the termination of trap netting operation, squawfish had not spawned in Bull Lake although they were fast approaching the ripe stage.

During the time trap netting was conducted, peamouth were found to be in varying stages of spawning condition. Individuals examined ranged from the green stage to the spent stage. Spawning for this species apparently occurs over a long span of time with the peak period occurring prior to trapping efforts (June 15). Ninety-four percent of females collected from Placid Lake, Montana, were spent by June 9 (Hill, 1962). The range in size of mature females was 9.4 to 12.5 inches and mature males ranged in size from 8.9 to 10.9 inches. The ratio of males to females was 6 to 4.

The longnose sucker spawning population was comprised of a preponderance of males. Males outnumbered females by a ratio of 20 to one. Mature males ranged in size from 13.1 to 17.3 inches and the range of females was from 14.5 to 18. inches. Like the peamouth, the longnose sucker was found to spawn over a wide span of time. The low ratio of females to males and the large percent of spawned out females observed may indicate peak spawning for this species might have occurred before netting began.

The movement of largescale suckers into spawning areas was much more conspicuous and probably triggered by a sharp rise in water temperature. Female largescale suckers found to be 100 percent green on June 16 were 81 percent ripe and 19 percent spent on June 18. The majority (90 percent) of the females captured at the end of the netting period were classified as ripe. Mature male largescale suckers ranged from 12.8 to 19.1 inches while females ranged between 12.4 to 22.5 inches. The sex ratio of males to females was 5.2 to 4.8.

Squawfish inshore movement seemed to be stimulated by the rapid temperature rise of surface waters to 67° F. on June 22. On this date, 85 percent of this species captured were classified as green and 15 percent ripe. The same ratio of green to ripe females was found at the termination of the netting operations. None of the squawfish examined were spent. Hill (1962) found that 47 percent of squawfish collected June 16, 1957, in Seeley Lake, Montana were spent. Mature males ranged in size from 10.0 to 18.8 inches and females from 10.6 to 22.6 inches. The sex ratio of males to females was 6.4 to 3.6.

Partial-poisoning efforts to remove rough fish species were conducted the nights of June 22 to June 25. Direct application of rotenone to individual schools of fish was initiated when fish appeared in the shoal areas. Approximately 55 gallons of rotenone was applied with a pressure pump at an estimated concentration of 2 ppm. Post treatment observations indicated a relatively light kill. An estimate of 100 fish were killed on June 15 and 500 fish, June 25.

Age and growth determinations of squawfish and largescale suckers were made in an effort to determine whether population reduction had occurred for these species. Theoretically, if population control is effective, the average age and size of mature individuals removed should diminish each successive year trapping operations are carried out until only individuals spawning for the first time become dominant in the catch.

Scale samples were collected from 57 squawfish and 54 largescale suckers in 1970 and 98 squawfish and 99 largescale suckers in 1971 to determine the age and size of sexually mature fish.

It was determined that male squawfish in Bull Lake begin to mature at age 5 and are all mature by age 6. At age 6, male squawfish average 10.5 inches. Female squawfish begin to mature at age 6 and nearly all mature by age 7. At age 7, female squawfish average 11.7 inches. Therefore, it is assumed that age groups 5 through 7 should become dominant year classes in succeeding years as older age groups are removed.

In 1970, the range in size of mature squawfish sampled was 11.5 to 23.1 inches, representing age groups from 5 to 11. Approximately 5 percent of the fish sampled comprised age groups 5 to 7. In 1971, mature fish of both sexes sampled range in size from 11.5 to 22.6 inches. The 5 to 7 year old age class represented approximately 10 percent of the number sampled.

Male largescale suckers first mature at age 4 with the smallest individual collected measuring 12.2 inches. By age 6 all males collected were mature fish. Six year old males averaged 15.9" in total length. Females began to mature at age 6 with the smallest individual captured measured 13.4 inches. Nearly all females were mature at age 6. Six year old females averaged 16.2 inches in total length.

In 1970, the range in size of mature largescale suckers sampled ranged between 13.6 and 21.5 inches, representing age groups 5 through 9. Approximately 24 percent of the mature fish sampled comprised age groups 5 and 6 in 1970. In 1971, the range in size of mature largescale suckers was 12.8 to 22.5 inches representing age groups 5 through 10. Approximately 27 percent of the 5 to 6 year age group was represented in the sample collected.

Squawfish and largescale suckers maturing for the first time showed a percentage gain in 1971 as compared to 1970. This could indicate that older age fish of these species are being removed. However, this percentage increase is small amounting to 5 percent for squawfish and 3 percent for largescale sucker.

Night-lite observations along the shoreline at the termination of netting operations indicated the presence of adult rough fish species to be widespread throughout the lake. Because of the widespread expanse of suitable shoal spawning areas, the overlap of spawning periodicity of various rough fish species, and the apparent low harvest of older age fish trap netting and partial poisoning does not appear feasible to harvest these species to the benefit an increasing the survival of game fish yields.

Other management alternatives to improve the Bull Lake Fishery are (1) species manipulation by introductions of game fish species that occupy the pelagic area of the lake having infrequent contact with non-game species or (2) complete lake renovation of the Bull Lake Drainage System with a fish toxicant and restocking with westslope cutthroat trout.

RECOMMENDATIONS

It is recommended that the project be continued to obtain information needed for evaluation of the success of various management procedures not covered by routine inventory-type surveys.

LITERATURE CITED

Hill, Clifford, "Observations on the life histories of the peamouth (Mylocheilus caurinus) and the northern squawfish (Ptychocheilus oregonensis) in Montana, Proceedings of the Montana Academy of Sciences, No 22:27-44, 1962.

Prepared by Robert Domrose

Date June 15, 1973

Waters referred to:

11-8640-03	7-4020-01	7-9740-01	7-3440-10	11-6480-01
7-7700-03	7-2420-01	7-0240-01	7-1720-01	11-3540-01
7-2540-10	7-4340-01	7-5100-01	7-2120-01	5-5648-01
7-3200-01	7-3500-01	7-2240-01	5-0864-01	5-1712-10
7-4200-01	7-1200-01	7-1700-01	11-5640-01	7-5540-03