MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA **PROJECT TITLE:** STATEWIDE FISHERIES INVESTIGATION

PROJECT NO.: F-46-R-2 **STUDY TITLE:** SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NO.: II-a **JOB TITLE:** NORTHWEST MONTANA COLDWATER LAKES INVESTIGATIONS

PERIOD COVERED: JULY 1, 1988 THROUGH JUNE 30, 1989

ABSTRACT

Ashley Lake water levels were regulated to minimize impacts of seasonal drawdowns on fisheries. Full storage capacity was reached by late May to release adequate fisheries flows into Ashley Creek. Winter fishing pressure and harvest at Lake Mary Ronan increased significantly in 1989 compared to 1988. An estimated 8,132 anglers harvested 71,561 fish (99 percent kokanee) at a rate of 8.8 fish per angler in 1989. Total winter fishing pressure and kokanee harvest was determined for Little Bitterroot Lake. Estimated fishing pressure was 1,699 angler days resulting in a harvest of 16,182 fish. Foy Lake winter harvest and fishing pressure was very low, in part due to critically low dissolved oxygen concentration. An estimated 1,245 anglers harvested 414 rainbow trout at an hourly catch rate of 0.24 fish.

In May, 1989, a summer creel census was initiated at Lake Mary Ronan. Findings will be presented in the FY90 job completion report.

Gill netting data were collected for Lake Mary Ronan and Hungry Horse Reservoir. Kokanee populations were monitored in 10 lakes for size trends and age structure of spawning fish. Mysis monitoring was continued for five lakes in 1988.

BACKGROUND

The lake fisheries resource in Region 1 is comprised of 645 lakes totaling 240,000 acres. Included is a total of 412 coldwater lakes. The total estimated fishing pressure of Region 1 (1985-1986) as determined by a statewide mail questionnaire survey was 515,976 mandays of fishing effort. Approximately 67 percent (345,704 days) of the angling pressure was expended on trout lakes. With the increase of fishing pressure in recent years, large trout regulations have been adopted on several lakes to provide anglers the opportunity to catch larger fish. The monitoring of the fisheries resources is an ongoing effort to update the management programs for maintaining or improving the fisheries.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To manage lake and reservoir water levels to minimize impacts on fish populations. Objective accomplished utilizing state funding.

2. To maintain water quality at present levels as measured by Water Quality Bureau. Objective accomplished utilizing state funding.

3. To maintain aquatic habitat at a level capable of sustaining existing populations. Objective accomplished using state funding.

4. To increase the opportunity to catch larger trout (14" at 0.5 fish/hour) in specified lakes. Objective accomplished.

5. Provide lake fisheries to sustain an increase of 32,600 angler days by 1992 through natural reproduction and hatchery plants. Provide kokanee fisheries for 12"-14" fish at a catch rate of 1 fish per hour. Objective accomplished.

6. To provide a variety of trout sizes and species for angling and prey on stunted salmon. Objective accomplished. Introduced kamloops trout into Lake Koocanusa and Little Bitterroot Lake. Introduced brown trout into Noxon Rapids Reservoir.

7. To manage regulations and stocking to protect or expand species of special concern. Objective accomplished with state funding. A supplemental report on fish genetics of westslope cutthroat trout for several high mountain lakes has been completed (F-46-R-1, I-a, Species of Special Concern Segment).

8. To develop management plans to adapt to the introduction of Mysis and other unwanted species. Objective partially accomplished. Mysis population trends are being monitored annually in several lakes where kokanee and mysids co-exist to determine impacts on fish communities.

9. Coordinate with other agencies to maintain fisheries and water quality at or above present levels. Objective was accomplished using state funding.

10. To encourage public participation in understanding the problems and strategies of resource management. Objective was accomplished. The Swan River drainage plan was prepared and submitted for public review with emphasis directed toward the restoration of adfluvial westslope cutthroat trout in Swan Lake.

11. Attempt to acquire and provide facilities on all lakes and reservoirs capable of sustaining more than 300 man days of fishing per year on a priority basis at the rate of one lake per year. Access acquired on Lower and Upper Thompson lakes in FY1989. Objective was accomplished using state funding.

PROCEDURES

A winter creel census was conducted at Lake Mary Ronan to monitor fishing pressure and kokanee harvest trends. Information derived from fishermen interviews included number of anglers per party, hours fished, fish caught, fish species, and residency of anglers. Traffic counters were installed at two locations to enumerate vehicle traffic by fisherman accessing the lake. Total angling pressure and fish harvest estimates were expanded from traffic counter and angler interview data.

A summer creel census was initiated in May of 1989. Data were collected from angler interviews and expanded using boat counts at 2-hour intervals on weekend days and randomly selected weekdays.

A winter creel census was conducted for Little Bitterroot Lake to determine the utilization of abundant kokanee populations. Data were collected from angler interviews and expanded using angler counts taken on the lake at 3-hour intervals on randomly selected days. The computer program used to estimate total fish harvest and fishing pressure was designed by McFarland and Roche (1987).

Lake fish population surveys were conducted using experimental nylon gill nets measuring 6 feet deep by 125 feet in length with a bar mesh size of 3/4, 1, 1 1/2, 1 3/4, and 2 inches. A monofilament net 100 foot by 16 feet deep with bar mesh size of 1/2 and 3/4 inch was used to fish kokanee in Little Bitterroot and Foy lakes. A 300 foot beach seine was employed to collect mature salmon samples in conjunction with kokanee spawn-taking operations.

Lake gauge elevations were measured with a standard USGS 6.33 foot staff gauge to determine storage capacity measurements of Ashley Lake.

Zooplankton samples were collected using a conical Wisconsin plankton net of 153 micron nitex mesh with a 0.2921 diameter opening. Replicate 30 meter vertical hauls were taken at each station. Samples were preserved in 4 percent formalin mixed with 40 grams per liter sucrose. Samples were then diluted in one milimeter subsamples. Cladocerans and copepods were identified in a Sedgewick-Rafter counting cell under 40 power magnification.

Mysid samples were collected during the dark phase of the moon in early June approximately 2 hours after sunset. Replicate depth hauls were taken through the entire water column using a conical Wisconsin style net one meter in diameter having a mesh size of 500 microns. Samples were preserved in 10 percent formalin, counted under a microscope and categorized as juveniles or adults (<10 mm and >10 mm respectively).

RESULTS AND DISCUSSION

Special Trout Regulation Lakes

Because of time constraints and other priorities, a creel census for special trout regulations to determine fisherman use, catch rates, and average size of angler catch was not initiated in 1989.

Woods Lake was designated as a catch-and-release trout fishery in May of 1984. Gill netting efforts in the summer of 1986 indicated few fish remained in the lake. The catch decreased from 11 fish per net night in 1984 to 3.5 fish in 1986. Growth increments of rainbow trout stocked as 5-inch fish averaged only 3.5 inches per year over a 3-year period. The main food items of these fish included leeches, dragonfly larvae, and snails. Although redside shiners were readily available as forage fish, they did not show up as a significant food source in the diet of trout. It is believed that redside shiners were more in competition with trout for food than providing a forage fish species for trout. Woods Lake was rehabilitated using state funding in the fall of 1988 and stocked with 7-inch Arlee rainbow in the summer of 1989. Follow up gill net surveys will be conducted to assess growth increments of rainbow trout without the presence of redside shiners.

Special trout regulations for Region 1 lakes in 1988 were changed from catch-and-release to 1 fish daily with a maximum size length of 22 inches for Woods, Spencer, Bootjack, and Metcalf lakes. No Tellum Lake regulations remained the same, only 2 fish which must exceed 14 inches.

Lake Mary Ronan Winter Creel Census

A winter creel census was conducted at Lake Mary Ronan for the fifth consecutive year to determine total use and harvest trends of kokanee and trout. The data will be used, in part, to formulate future management strategies for maintaining or improving the fishery.

In 1989, 9 weekdays were randomly selected and were censused during a 70-day period, January 4 through March 15. Creel information was collected about once a week at which time traffic recorders were read. Fisherman interviews were obtained from 94 fishing parties representing 182 anglers. Completed trip information was recorded for 92 percent of the interviews. Anglers caught a total of 1,611 fish of which kokanee comprised 99 percent of the catch (Table 1). Cutthroat trout made up the remaining 1 percent. Seventy-three percent of the anglers caught limits (10 fish daily) of kokanee while 98 percent were successful in catching 1 or more fish. The average catch of all species was 8.85 fish per angler with an average hourly catch of 3.0 fish.

Length frequency measurements were made for 1,403 kokanee. Age analysis was determined by scale readings. The total length of 2-year old kokanee ranged between 8.3 and 10.3 inches. This age group comprised 69 percent of the kokanee catch and averaged 9.5 inches. Three-year old fish ranged between 10.4 and 13.1 inches, averaged 11.0 inches, and comprised 31 percent of the catch. The average weight of 2 and 3-year old kokanee was 0.28 and 0.42 pounds respectively. A length frequency of kokanee measured from the angler harvest is shown in Figure 1.

Table 1. Summary of Lake Mary Ronan winter creel census data, January 4 through March 15, 1989.

Census Day	No. Parties	Anglers	Total Hours Fished	Total Fish Caught	Species Kok	Wct	Rb	CPA	CPH	Limit Catch (Kok)
1/04	4	6	13.0	45	45	0	0	7.5	3.50	1
1/24	8	13	42.5	36	36	0	0	2.8	.93	0
1/27	8	16	30.75	159	159	0	0	9.9	5.2	15
2/13	6	11	27.25	110	110	0	0	10.0	2.50	11
2/21	7	14	28.75	140	139	1	0	10.0	4.9	13
2/27	6	13	51.00	92	92	0	0	7.1	1.8	6
3/08	15	29*	70.25	300	277	23	0	10.3	4.3	25
3/13	12	23	95.75	199	198	1	0	8.7	2.1	15
3/15	12	23**	177.50	530	530	0	0	9.3	3.0	47
Totals/Avg. (9 days)	94	182	536.75	1611	1586	25	0	8.85	3.0	133 (73%)

*Includes Tribal member, caught 18 Wct
**Included 2 anglers 16 over kokanee limit (10 salmon daily and 20 in possession)

Legend: Kok = kokanee Wct = westslope cutthroat trout Rb = rainbow trout
CPA = catch per angler CPH = catch per hour

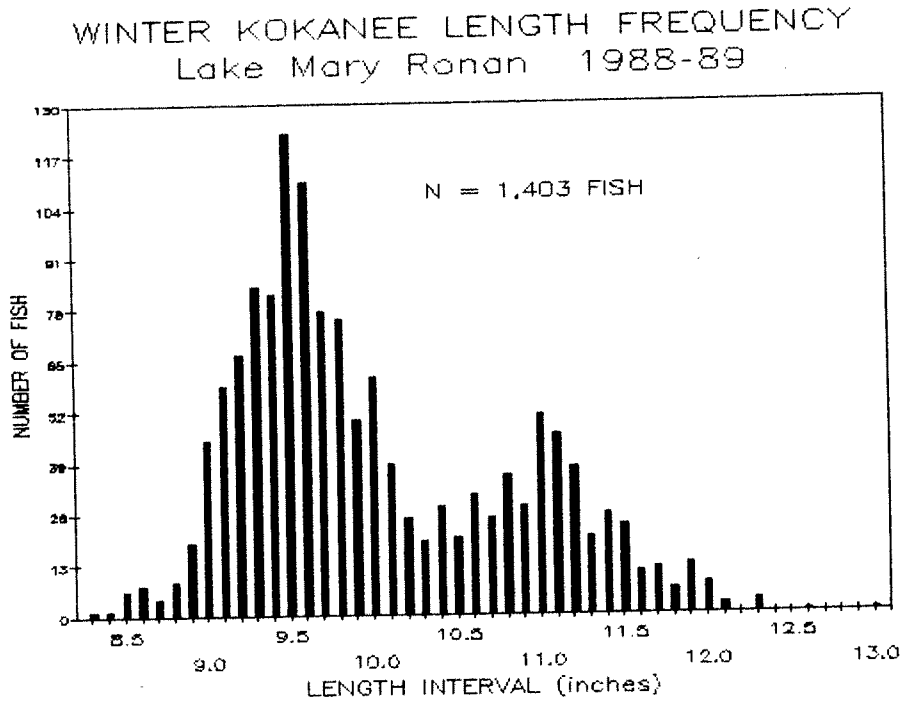

Figure 1. Lake Mary Ronan winter kokanee length frequency, 1987-88.

The total estimated fishing pressure was 8,132 angler days resulting in an estimated harvest of 71,561 fish. Kokanee comprised 99 percent of the harvest, a total of 70,748 fish. Westslope cutthroat trout comprised the remaining 1 percent of the catch, an estimated 813 fish. Total estimated fishing pressure and harvest data are presented in Table 2.

Table 2. Fisherman car counts, fishing pressure, and harvest estimates for State Park and west side access areas of Lake Mary Ronan, winter, 1989.

			State Park		Westside Rd.		Totals	
Month	Interval	Days	No. Cars	No. Anglers	No. Cars	No. Anglers	No.* Anglers	No.** Fish
Jan	04-18	14	608	1180	378	733	1913	16834
	19-24	6	361	700	286	555	1255	11044
	25-27	3	110	213	119	231	444	3907
	28-30	3	249	483	183	355	838	7374
Feb	01-06	7	52	101	8	16	117	1030
	07-13	7	283	249	114	221	770	6776
	14-21	8	253	491	24	47	538	4734
	22-27	6	356	691	83	160	851	7489
Mar	28-08	9	280	543	21	41	584	5139
	09-13	5	273	530	37	72	602	5298
	14-5	2	88	170	26	50	220	1936
TOTALS		70	2913	5651	1279	2481	8132	72561

*Estimated using 1.94, average number of fishermen per party.
**Estimated using 8.8, average catch per angler.

A comparison of winter fishing pressure and harvest estimates from 1985 through 1989 is shown in Table 3. Winter fishing pressure and fish harvest has increased by 41 percent and 68 percent respectively over the season of 1985. In comparison with the 1988 season, the number of anglers and fish harvest exhibited an increase of 55 and 184 percent respectively. This significant increase in fishing pressure and harvest may be related to the collapse of the Flathead Lake kokanee fishery and subsequent closure of its winter salmon season. High catch rates also attracted additional anglers and increased harvest.

Table 3. Comparison of winter fishing pressure and harvest estimates for Lake Mary Ronan. 1985-1989.

Year	No. Anglers	No. Fish	Avg.Catch Per Angler	Avg.Catch Per Hour	Species Composition (Kokanee)	Anglers /Acre	Fish /Acre
1985	5770	42528	6.7	1.7	99	3.8	28.3
1986	3301	19927	6.0	1.6	95	2.2	13.2
1987	5101	25505	4.9	1.2	99	3.4	16.9
1988	5230	25209	4.8	1.2	98	3.5	16.8
1989	8132	71561	8.8	3.0	99	5.4	47.5

Lake Mary Ronan Summer Census

A summer creel census was initiated at Lake Mary Ronan beginning on opening Day (May 20, 1989) and will extend through mid-September. A creel census technician was hired to interview fishermen on all weekend days, holidays, and three weekdays per week. The estimates of year around pressure and harvest will be extremely valuable in updating management strategies to regulate the fishery. As of June 21, 865 angler interviews were recorded resulting in a catch of 2,602 fish. Kokanee comprised 81 percent of the catch, followed by 15 percent westslope cutthroat trout, 3 percent rainbow trout, and 1 percent largemouth bass. The average catch per angler was 3.0 fish and the catch per angler hour was 0.75 fish. a Job Completion Report of both the summer and winter creel census study will be completed in 1990.

Little Bitterroot Lake Winter Creel Census

A winter creel census was conducted at Little Bitterroot Lake for a period of 85 days from January 15 through April 9, 1989. Little bitterroot Lake is lcoated 25 miles west of Kalispell. A total of 276 anglers were interviewed on 14 days during this period. This included information from 115 incomplete and 161 complete trips.

Completed trip information compiled at two-week intervals is presented in Table 4. The total fish harvest from 161 completed trips was 2,805 fish. The average catch per angler was 13.5 fish at a catch rate of 3.6 fish per hour. The average length of trip was 3.8 hours.

Kokanee comprised 99.6 percent of the harvest with rainbow and brook trout comprising the remaining 0.4 percent. Seven of 8 rainbow trout caught were identified as kamloops trout planted in June of 1988. These fish were planted as 8 to 10 inch fish in June of 1988 and averaged 14.1 inches at the time of harvest. Thirteen percent of the kokanee fishermen caught limits of kokanee (50 fish). Daily limits have been liberalized and kamloops introduced in an attempt to reduce densities of kokanee and therefore increase growth rates and average length.

Table 4. Completed angler trip data, collected at two-week intervals for Little Bitterroot Lake, winter 1989.

Two-Week Interval	No. Parties	No. Anglers	No. Hours	Average Length Trip	No. Fish	Catch /Hour	Catch/ Angler Day
1/15-1/28	15	33	114	3.5	109	1.0	3.3
1/29-2/11*	0	0	0	0	0	0	0
2/12-2/25	8	13	36.5	2.8	131	3.6	10.1
2/26-3/11	17	45	153	3.4	717	4.7	15.9
3/12-3/25	20	45	177.5	3.9	754	6.4	16.8
3/26-4/09	10	25	129	5.2	472	3.7	18.9
TOTALS	70	161	610	3.8	2183	3.6	13.6

*Extreme cold weather period - angling pressure very low.

The estimated total harvest in the winter of 1989 was 16,250 fish. Kokanee comprised 16,182, rainbow 54, and brook trout 14 fish in the harvest respectively. Total estimated fishing pressure was 6,861 angler hours representing 1,694 angler days.

The catch per angler day increased significantly as the season progressed. The catch per angler day was 6 times greater during the last two weeks of the season as compared to the first two weeks. A similar trend in catch success through the winter season was experienced for Ashley Lake in 1988. The average catch per angler for Little Bitterroot lake was slightly greater (13.6 fish) than that of Ashley Lake (11.5 fish) in 1988.

Total length measurements were collected from 1,148 kokanee caught by fishermen. These fish ranged from 6.3 to 13.5 inches and averaged 8.6 inches. The average length of II+, III+, and IV+ fish as determined by scale readings was 7.2, 8.7, and 11.3 inches respectively. A length frequency distribution of kokanee harvested in Little Bitterroot Lake during the winter of 1989 is presented in Figure 2.

The fishery is utilized primarily by local fishermen. Flathead County residents comprised 92 percent of the angling pressure followed by Lincoln County (5 percent), and Sanders County (3 percent) residents.

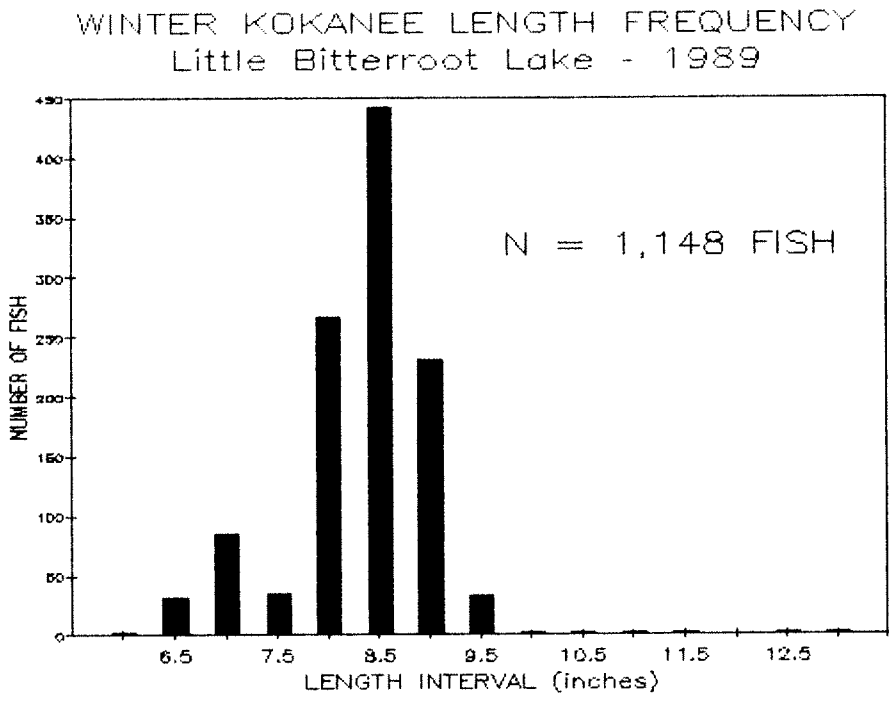

Figure 2. Winter kokanee length frequency, Little Bitterroot Lake, 1988-1989.

Foy Lake Winter Creel Census

A creel census was conducted at Foy Lake during the winter of 1988-89 to determine angling use and fish harvest. Foy Lake is located approximately 5 miles southwest of Kalispell and is utilized almost entirely by local fishermen. The lake is stocked annually with 25,000 4"-6" rainbow (Arlee strain) trout.

The census was initiated on January 7, 1989, and continued through March 25 over a period of 77 days. Angler counts were taken on 35 randomly chosen days at 3-hour intervals on scheduled days, usually 1 weekend day and 2-3 weekdays per week. Angler counts combined with angler interview data (17 days) were used to determine total fishing pressure and angler harvest.

Both winter fishing pressure and fish harvest were extremely low. The estimated total fishing pressure was 1,245 angler days resulting in an estimated harvest of 414 fish. The average catch per angler day was 0.33 fish and the average catch per angler hour was 0.24 fish. The average length of trip was only 1.4 hours. Rainbow trout measurements were taken from 17 fish. The fish averaged 14.5 inches and ranged between 13.0 and 16.1 inches.

The extremely low harvest was probably related to a high winter fish mortality. Low dissolved oxygen readings of less than 3.0 ppm were recorded beneath the ice in late March. It appeared that fish most affected by low oxygen

concentrations were rainbow trout stocked the previous year as 4"-6" fish. Most of the fish recorded in the fisherman's creel were larger fish from previous year's plants.

In 1990 Eagle Lake strain rainbow trout reared in high alkaline waters at the Bluewater State Fish Hatchery will be stocked as 4"-5" fish in September. Barring a repeat of critical oxygen levels experienced in 1989, it is believed this rainbow trout strain will better adapt to high alkalinity (600+ ppm) existing in Foy Lake.

Lake Mary Ronan Gill Net Surveys - Spring and Fall

Annual gill net surveys are conducted in spring and fall to monitor population trends of trout and kokanee. This is an on-going annual monitoring survey conducted since 1965. A total of 6 gill nets (3 floating and 3 sinking nets) are fished overnight for each sampling period. The catch results from fall, 1986 on are presented in Table 5.

The average catch per net night (fall netting) of kokanee (Age I+ and II+) increased from 3.8 in 1987 to 18.7 fish in 1988. Age class I+ fish comprised 78 percent of the catch compared to 21 percent for Age II+ fish. Age I+ fish increased in average length from 8.7 inches in 1987 to 9.0 in 1988 while II+ fish increased from 10.4 to 10.9 inches.

The average catch per net night (spring netting) of kokanee exhibited a decrease from 8.7 fish in 1988 to 5.2 fish in 1989. Age II+ fish comprised 65 percent of the catch, age III+ 22 percent, and age I+ 13 percent. All age groups combined showed slight decreases in growth compared to the spring of 1988. Age I+ fish decreased from 7.1 to 6.6 inches, age II+ 9.8 to 9.5 inches and age III+ 11.7 to 11.1 inches.

The average catch per net night of rainbow trout increased from 1.5 fish in the fall of 1987 to 2.6 fish in 1988. Average spring catch rates increased dramatically from 0.2 fish per net night in 1988 to 2.7 fish in 1989.

The average catch per net night of westslope cutthroat trout in the fall increased from 3.8 fish in 1987 to 5.7 fish in 1988. Eighty-two percent of fish collected in the fall were planted as yearlings (4"-6") in the spring of 1988 and averaged 10.0 inches. Eighteen percent were 1987 plants averaging 12.8 inches. The overall size average of cutthroat trout remained about the same for both spring and fall netting periods. The average catch of cutthroat trout collected in the spring decreased from 3.0 fish per net night in 1988 to 0.8 fish in 1989. The sharp decrease in numbers could have been related to cooler surface water temperatures (56°F) at the time of sampling in 1988.

A comparison of Lake Mary Ronan gill net catch data of kokanee and trout from the fall of 1986 through the spring of 1989 is shown in Table 5.

Table 5. Comparison of Lake Mary Ronan gill net catch data of kokanee and trout for spring and fall netting series, 1986 through 1989. (Mature spawning kokanee not included in fall netting data.)

	Fall 1986				Fall 1987				Fall 1988			
Species	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation
Kokanee (I+)	86	14.3	7.9	0.45	18	3.0	8.7	0.35	88	14.7	9.0	0.39
Kokanee (II+)	53	8.8	10.9	0.66	5	0.8	10.4	0.34	24	4.0	10.9	0.35
Avg. Combined	139	23.2	9.0	---	23	3.8	9.1	---	58	18.7	9.3	
Rainbow Trout	15	2.5	14.7	3.18	9	1.5	15.3	4.99	16	2.6	13.5	3.52
Westslope Cutthroat Trout	16	2.7	12.1	2.08	23	3.8	10.5	0.66	34	5.7	10.5	1.20

	Spring 1987				Spring 1988				Spring 1989			
Species	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation	No.	Avg.Catch Per Net	Avg. Lgth	Standard Deviation
Kokanee (I+)	3	0.5	6.5	0.15	19	3.2	7.1	0.35	4	0.7	6.6	0.32
Kokanee (II+)	9	1.5	9.2	0.33	16	2.7	9.8	0.44	20	3.3	9.5	0.36
Kokanee (III+)	1	.2	12.2	0.00	17	2.8	11.7	0.54	7	1.2	11.1	0.37
Avg. Combined	13	2.2	8.9	---	52	8.7	9.4	---	31	5.2	9.1	
Rainbow Trout	6	1.0	16.5	2.45	1	0.2	16.0	0.00	16	2.7	16.2	3.00
Westslope Cutthroat Trout	8	1.3	11.7	1.33	18	3.0	11.9	0.50	5	0.8	11.8	1.40

Hungry Horse Gill Net Surveys

Fish Abundance and Distribution

Horizontal Gill Nets. - Westslope cutthroat trout have comprised most of the catch in floating nets throughout the study followed by northern squawfish (Table 6). The catch of cutthroat was highest in the spring and fall while squawfish numbers are highest in the summer net sets. Mountain whitefish have predominated the sinking net catches followed by bull trout, northern squawfish and suckers. A substantial catch of pygmy whitefish was recorded for the first time in fall, 1986. The ripe spawning condition of the fish captured indicated that we had set several nets over their spawning beds. The catch composition of sinking and floating nets has been relatively stable through the years.

Catches of westslope cutthroat trout were relatively stable with no discernible trends except in 1988 when a high catch rate of 6.6 fish per net was recorded. This catch was primarily due to record drawdown levels in 1988 which concentrated the cutthroat thus making them more susceptible to nets. Bull trout catch rates also exhibited a large increase in 1988 but there was not a discernible trend in abundance among the years.

Mountain whitefish have comprised 37 to 40 percent of the sinking net catch from 1983-1988. Catches have varied from 6.8 to 22.3 fish per net. The low reservoir levels in 1988 did not appear to influence catch rates as in other species.

Northern squawfish catches were substantial in both sinking and floating gill nets with the highest catch of up to 10.0 fish per net recorded in the summer. The catches in 1988 tended to be higher than in previous years. Overall there did not appear to be any major changes in abundance from 1983-1988.

Suckers comprised an important part of the catch in sinking nets during the summer but were uncommon in floating nets. The catch in 1988 was higher than in other years due to the deep drawdown concentrating the fish.

Table 6. Average catch of fish species in floating and sinking gill nets from Hungry Horse Reservoir, 1983-1988.

Date	Number of nets	Reservoir Elevation[1]	Catch per net night for areas combined from Hungry Horse Reservoir					
			WCT	DV	MWF	NSQ	CSU	LNSU
Floating Gill Nets								
			Spring					
05/84	40	3521	2.4	0.6	0.4	0.7	0.2	0.1
05/85	70	3517	3.5	0.6	0.2	0.7	0.1	0.0
05/86	84	3537	1.9	0.3	0.1	0.3	0.1	0.1
05/87	84	3545	3.2	0.9	0.3	0.8	0.1	0.1
05/88	25	3440	6.6	1.8	0.4	2.2	2.2	0.9
			Summer					
08/83	42	3560	0.4	0.1	0.0	2.0	0.1	0.0
08/84	84	3558	0.2	0.1	0.1	4.1	0.1	0.0
08/85	84	3545	0.6	0.1	0.4	1.5	0.1	0.1
08/86	84	3558	0.3	0.1	0.1	3.1	0.1	0.1
08/88	36	3480	0.9	0.2	0.6	5.9	0.4	0.0
			Fall					
11/83	42	3536	2.4	0.2	0.6	0.1	0.0	0.0
10/84	54	3540	1.1	0.1	0.3	0.5	0.1	0.0
11/85	68	3525	1.3	0.2	0.2	0.1	0.1	0.0
11/86	84	3530	1.9	0.4	0.1	0.8	0.0	0.0
11/88	42	3468	2.8	0.8	1.4	0.1	0.1	0.0

Table 6 continued.

Table 6. Continued.

Sinking Gill Net

				Spring				
05/84	12	3521	0.4	5.3	6.4	3.9	1.1	3.8
05/85	25	3517	0.1	4.7	13.1	2.0	1.7	3.1
05/86	30	3537	0.3	5.8	12.3	2.0	1.8	3.6
05/87	30	3545	0.4	6.3	8.7	4.4	3.6	8.6
05/88	9	3440	0.2	9.4	8.1	6.0	6.2	12.2
				Summer				
08/83	9	3560	0.1	0.8	1.3	8.3	4.1	7.8
08/84	30	3558	0.1	1.4	3.1	9.1	3.7	6.1
08/85	30	3545	0.3	2.7	6.1	10.0	2.9	4.6
08/86	30	3558	0.3	2.2	3.4	7.7	3.4	5.6
08/88	15	3480	0.5	3.5	7.1	10.0	6.1	4.2
				Fall				
11/83	9	3536	0.3	2.2	10.0	2.2	0.9	0.1
10/84	17	3540	0.3	4.4	22.3	4.6	0.8	0.3
11/85	25	3525	0.2	3.8	6.8	2.3	1.0	0.3
11/86[2]	30	3530	0.4	4.8	12.8	2.1	1.2	0.1
11/88	15	3468	0.9	6.9	13.5	3.7	2.5	1.8

[1]full pool elevation = 3,560 ft. msl.
[2]1.2 Pygmy whitefish
Key: WCT = westslope cutthorat DV = Bull trout
MWF = mountain whitefish NSQ = northern squawfish
CSU = coarse scale sucker LNSU = longnose sucker

Lake Monitoring of Kokanee Populations

In 1988, 10 kokanee lakes were sampled to monitor size trends (total length of mature spawning kokanee. The age structure of spawning adults was determined by otolith examination. A summary of the average length and age composition of mature kokanee collected in the fall of 1988 is presented in Table 7.

Table 7. Average length and age structure of spawning kokanee collected from selected lakes in the fall of 1987.

Lake	Surface Acres	Males: No. Fish	Males: Avg. Length Inches	Males: Size-Range Inches	Females: No. Fish	Females: Avg. Length Inches	Females: Size-Range Inches	Age Structure %: II+	III+	IV+
Ashley	3244	15	10.6	(9.9-11.1)	26	10.4	(9.7-11.1)	2.5	95	2.5
Bull	1240	1	12.7	-----	0	---	-----	--	--	--
Crystal	178	33	18.2	(17.7-20.5)	9	17.9	(16.9-19.0)	27	63	10
Glen	340	28	15.5	(14.8-16.9)	69	15.3	(13.2-16.4)	10	45	45
Lake Blaine	372	17	12.1	(11.6-12.6)	5	11.7	(11.0-12.4)	---	---	100
Lake Mary Ronan	1505	25	13.2	(11.5-15.2)	25	13.2	(11.7-14.2)	---	76	24
Middle Thompson	602	11	18.3	(16.6-19.5)	10	17.0	(15.6-17.8)	---	73	27
Spar	392	9	15.5	(14.4-20.2)	6	13.7	(12.3-14.2)	82	9	9
Swan	2680	25	9.4	(9.1-10.2)	25	9.7	(8.8-10.7)	---	80	20
Tally	1326	25	10.1	(9.1-10.7)	10	9.8	(9.5-10.1)	---	93	7

Fish were collected by one of three methods: beach seining, gill nets, and electrofishing. The data collected is used in part to formulate future management strategies, primarily adjustment of stocking numbers and creel limits for individual waters.

Several mature kokanee salmon were observed cruising the shoreline of Foy Lake. These were 2-year old kokanee initially planted as fry in 1986. Attempts to capture fish by electrofishing were unsuccessful. The survival of successive fry plants made in 1987 and 1988 is doubtful because of extremely low dissolved oxygen levels (less than 3.0 ppm) recorded during the winter of 1988-1989.The 1989 kokanee fish plant scheduled for Foy Lake was transferred to Hubbart Reservoir.

Seining and electrofishing efforts to collect kokanee eggs for the statewide hatchery production program were conducted at four lakes. A total of 1,645,000 eggs were taken from Lake Mary Ronan, Swan, Glen, and Ashley lakes. Ninety percent of the total egg take was taken from Lake Mary Ronan and Swan lakes. Continued low water levels at Lake Mary Ronan prevented mature fish from concentrating at traditional spawning areas where beach seining operations are conducted. Consequently, electrofishing gear was utilized to collected scattered schools of fish cruising the shoreline. Egg-take operations at Ashley and Little Bitterroot were relatively unsuccessful.

Mysis Monitoring

In Ashley Lake mysid numbers began to increase substantially from 1985 to 1986 (12.1/m^2 to 37.0/m^2) (Table 8). During 1987 densities more than doubled to a high of 86.3/m for the period 1983-1988. As mysid numbers progressively

Table 8. Average lakewide June Mysis densities (no./m^2) for selected lakes.

Lake	Size	No./m^2 1983*	1984	1985	1986	1987	1988
Ashley	Juveniles (<10mm)	-0-	4.3	3.8	25.8	70.7	57.3
	Adults (≥10mm)	1.3	8.7	83	1.2	15.6	19.1
	Combined	1.3	13.0	12.1	37.0	86.3	76.4
Little Bitterroot	Juveniles	-0-	8.6	12.7	19.4	8.6	6.4
	Adults	7.3	15.9	9.2	7.0	13.1	8.0
	Combined	7.3	24.5	21.9	26.4	21.7	14.4
McGregor	Juveniles	-0-	8.3	0.6	7.0	15.6	34.7
	Adults	6.1	5.4	3.2	4.8	14.7	28.0
	Combined	6.1	13.7	3.8	11.8	30.3	62.7
Swan	Juveniles	-0-	37.9	69.4	108.9	53.2	73.2
	Adults	20.1	33.1	25.5	142.7	169.4	51.6
	Combined	20.1	71.0	94.9	251.6	222.6	124.8
Whitefish	Juveniles	-0-	67.5	207.0	151.9	52.9	80.9
	Adults	18.5	18.8	22.0	23.9	12.1	10.5
	Combined	18.5	86.3	229.0	175.8	65.0	91.4

*30 meter hauls using a larger mesh net were used in 1983.

Little Bitterroot lake mysid densities remained the most constant of all lakes monitored. When mysid numbers decreased from 21.7/m^2 to 14.4/m^2 from 1987 to 1988, cyclops numbers similarily decreased.

Mysid numbers in McGregor Lake have more than doubled each year from 1986 to 1988 (11.8/m^2 to 30.3/m^2 to 62.7/m^2). During the period, daphnia numbers have decreased and cyclops have maintained a constant low level.

Swan lake mysid numbers were initially low in 1983 and steadily increased to a peak in 1986 of 251.6/m^2. Densities dropped slightly in 1987 to 222.6/m^2 and then decreased to 124.8/m^2 in 1988. Zooplankton response to the mysid changes was not substantial.

Mysis in Whtiefish lake peaked during 1985 at 229/m^2 and declined since then to 91.4/m^2 in 1988. Daphnia and Bosmina appeared to increase as mysids declined.

Table 9. Mean lakewide zooplankton densities (no.liter) from regional Mysis monitoring lakes during June, 1985-1988.

		Cladocerans			Copepods			
Lake	Year	Daphnia	Bosmina	Total	Epischura	Diaptomus	Cyclops	Total
Ashley	1985	0.6	0.3	0.9	0.5	-0-	8.0	8.5
	1986	1.4	0.7	2.1	-0-	-0-	14.3	14.3
	1987	-0-	21.6	21.6	-0-	-0-	13.7	13.7
	1988	0.6	15.4	16.0	0.1	-0-	19.2	19.3
L.Bitterroot	1985	0.1	0.6	0.7	0.5	-0-	6.0	6.5
	1986	-0-	1.6	1.6	0.2	-0-	10.3	10.5
	1987	0.8	26.5	27.3	0.1	-0-	13.4	13.5
	1988	-0-	5.4	5.4	0.4	-0-	6.1	6.5
Flathead	1985	2.0	0.8	3.7	0.1	25.8	1.8	27.7
	1986	0.1	0.1	0.2	0.1	13.0	0.8	13.9
	1987	0.1	-0-	0.1	0.9	3.1	0.4	4.4
	1988	----------	----------	----------	N/A	----------	----------	----------
McGregor	1985	4.4	0.1	4.5	0.2	0.2	0.1	0.5
	1986	3.5	-0-	3.5	0.2	-0-	-0-	0.2
	1987	1.7	0.1	1.8	-0-	0.1	-0-	0.1
	1988	1.1	0.1	1.2	-0-	-0-	-0-	-0-
Swan	1985	-0-	-0-	-0-	0.1	5.2	1.0	6.1
	1986	-0-	-0-	-0-	9.3	1.4	0.9	2.6
	1987	-0-	0.4	0.4	2.3	8.2	-0-	10.5
	1988	0.1	0.8	0.9	1.2	4.7	2.8	8.7
Whitefish	1985	0.4	0.3	0.7	0.1	-0-	11.0	11.1
	1986	3.3	1.5	4.9	-0-	-0-	11.4	11.4
	1987	3.6	5.7	9.3	5.9	0.1	-0-	6.0
	1988	3.2	3.5	6.7	-0-	-0-	18.1	18.1

RECOMMENDATIONS

1. Continue monitoring winter fishing pressure at Lake Mary Ronan by monitoring traffic counter data at the state park and west shore access.

2. Discontinue annual Mysis monitoring on the five lakes. Intensify monitoring on Ashley and Little Bitterroot lakes to document mysid/kokanee interactions. Monitoring would include: seasonal kokanee food habits, kokanee age and growth, and seasonal zooplankton and Mysis densities for food availability index.

3. Continue monitoring kokanee populations in 16 kokanee lakes every 1-4 years on a scheduled basis to evaluate changes in fish populations due to changes in fish regulations, stocking rates, and spawning conditions.

4. Special Trout Regulation Lakes: initiate creel census in 1990 during the summer months to determine fisherman use, catch rates, and average size of angler catch. Also included should be an angler attitude survey to measure acceptance of special regulation lakes. These lakes include No Tellum, Spencer, Bootjack, and Woods.

5. Small Lake Surveys:
   a. Renovate Banana Lake with rotenone to remove nongamefish and manage as a stocked lake for rainbow or cutthroat trout using state funding. (Refer to small lake surveys F-46-R-1.)
   b. Renovate Topless Lake with rotenone to eliminate nongame species (pumpkinseed and bull heads) and restock with cutthroat trout using state funding. (Refer to small lake surveys F-46-R-1.)
   c. Survey 5-10 lakes each year to update management recommendations.

LITERATURE CITED

McFarland, Bob and Ric Roche, 1987. Montana Fish Wildlife & Parks User Manual for the Creel Census Program running on an IBM PC Compatible Microcomputer, March 2, 1987.

Rumsey, Scott, 1988. Mysis monitoring in western Montana lakes, 1983-1987, Supplement F-7-R-37, I-a.

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Waters referred to:

Ashley Lake (07-5220-03)
Bootjack Lake (11-7980-03)
Crystal Lake (11-8180-03
Glen lake (11-8380-03)
Hubbart Reservoir (07-6840-95)
Lake Blaine (07-5380-03)
Lindbergh Lake (07-7260-03)
Lower Thompson Lake (05-9152-03)
No Tellum Lake (07-8128-05)
Spar Lake (11-9640-03)
Tally Lake (7-9060-03)
Woods Lake (07-9580-03)
Banana Lake (11-7852-04)
Bull Lake (11-8040-03)
Foy Lake (07-6420-03)
Holland Lake (07-6780-03)
Hungry Horse Resv. (08-8860-05)
Lake Mary Ronan Lake (07-7700-03)
Little Bitterroot Lake (07-7300-05)
Middle Thompson Lake (05-9232-03)
Noxon Rapids Reservoir (05-9328-05)
Swan Lake (07-9000-05)
Topless Lake (11-9830-03)

Key Words: Cyclops, Daphnia, Bosmina, kokanee, rainbow, Mysis

Fish species referred to:
brook trout - Salvelinus fontinalis
bull trout - Salvelinus confluentus
kokanee - Oncorhynchus nerka
largescale sucker - Catostomus macrocheilus
longnose sucker - Catostomus catostomus
mountain whitefish - Prosopium williamsoni
pygmy whitefish - Prosopium coulteri
rainbow trout - Oncorhynchus mykiss
squawfish - Ptychocheilus oregonensis
westslope cutthroat trout - Salmo clarki lewisi