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MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana PROJECT TITLE: Northwest Montana Fisheries Investigations

PROJECT NO: F-7-R-34-35 JOB TITLE: Inventory of waters: Whitefish, Little Bitterroot and McGregor Lakes

JOB NO: 1-a Supplement

PERIOD COVERED: April 1984 through March 1986

ABSTRACT

Efforts to improve or redirect management of sport fisheries in Whitefish, McGregor, and Little Bitterroot Lakes are examined and discussed in this report.

In 1976, the kokanee fishery in Whitefish Lake declined dramatically apparently in response to competition with Mysis. An attempt to re-establish the fishery by planting advanced fry in late spring has so far been unsuccessful. Imprint fry plants in three tributaries and along old shoreline spawning areas in the spring of 1985 cannot be assessed until 1988. Annual stocking of sub-catchable size westslope cutthroat trout initiated in 1975 has yielded poor results. Fewer westslope cutthroat were captured in 1984 than in 1979 gillnetting in spite of increased annual stocking. The cause is unknown but may be downstream losses by outmigration and/or predation by northern pike. Lake whitefish and lake trout populations appear to have increased between sampling periods. The peamouth net catch declined considerably, but catches of other fish species were similar during both sampling periods.

Efforts to re-establish a kokanee fishery in McGregor Lake through 10 years of annual fry stocking were unsuccessful. The reason is believed to be the result of biological interactions caused from the introduction of *Mysis relicta*. Present management is to supplement the existing lake trout fishery with annual plants of sub-catchable sized rainbow trout. The success of this effort may be improved by stocking increased numbers annually. The lake trout population is comprised of numerous small palatable fish. Forage fish are scarce so aquatic invertebrates, Mysis and plankton, are the main food item components. Consideration could be given to a forage fish introduction in the future.

Little Bitterroot Lake has a population of small kokanee which have been occasionally supplemented with fry plants.

Recent management direction has been to discontinue stocking kokanee fry and encourage increased angling harvest with larger bag limits to reduce densities and increase average lengths. Beginning in 1983, increased numbers of sub-catchable size rainbow trout were added to the annual stocking program to supplement the sport fishery. Results of these efforts appear unsatisfactory. Few kokanee are harvested by anglers, and the best trout fishing is from wild stocks of rainbow reaching weights from 5 to greater than 15 pounds. Improvement in the salmonid fishery may be attempted by switching the annual plant to a piscivorous strain of rainbow trout. If needed, kokanee plants should be continued to maintain the forage base.

Data presented from Whitefish, McGregor, and Little Bitterroot Lakes include information about growth rates, size, food habits and distribution of game fish species, zooplankton densities, and temperature profiles. Although a separate job progress report covers the Whitefish Lake data for 1979 (Anderson and Domrose 1981), some of it is included in this report for comparison with the 1984 and 1985 sampling data.

OBJECTIVE

This investigation applies to paragraphs three and four of the job objectives for the Job Description of Project Number F-7-R-34and 35, Job I-a: to establish relative abundance indices of kokanee and other associated game fish species in large regional lakes (over 3,000 surface acres); this segment will emphasize initial work on Whitefish and Ashley lakes. And, to determine fisheries potential of lakes and streams by obtaining chemical, physical, and biological parameters for management of sport fish species.

INTRODUCTION

Whitefish, McGregor and Little Bitterroot Lakes are large oligotrophic lakes located in northwest Montana within 40 miles of the City of Kalispell. Whitefish Lake has a surface area of 3,350 acres and drains into the Flathead River above Flathead Lake; Little Bitterroot lake has a surface area of 2,925 acres and drains into the Flathead river below Flathead Lake; McGregor Lake has a surface area of 1,328 acres and drains through Thompson River into the Clark Fork River near the town of Thompson Falls, Montana (Figure 1). Maximum depths of the lakes are over 200 feet with approximately 80 percent of their surface areas over depths greater than 100 feet.

Emphasis in this report is on the management of Whitefish, McGregor, and Little Bitterroot lakes fisheries potential. Relative abundance indicies of kokanee was not established because of poor sampling success from spot creel census and gill netting.

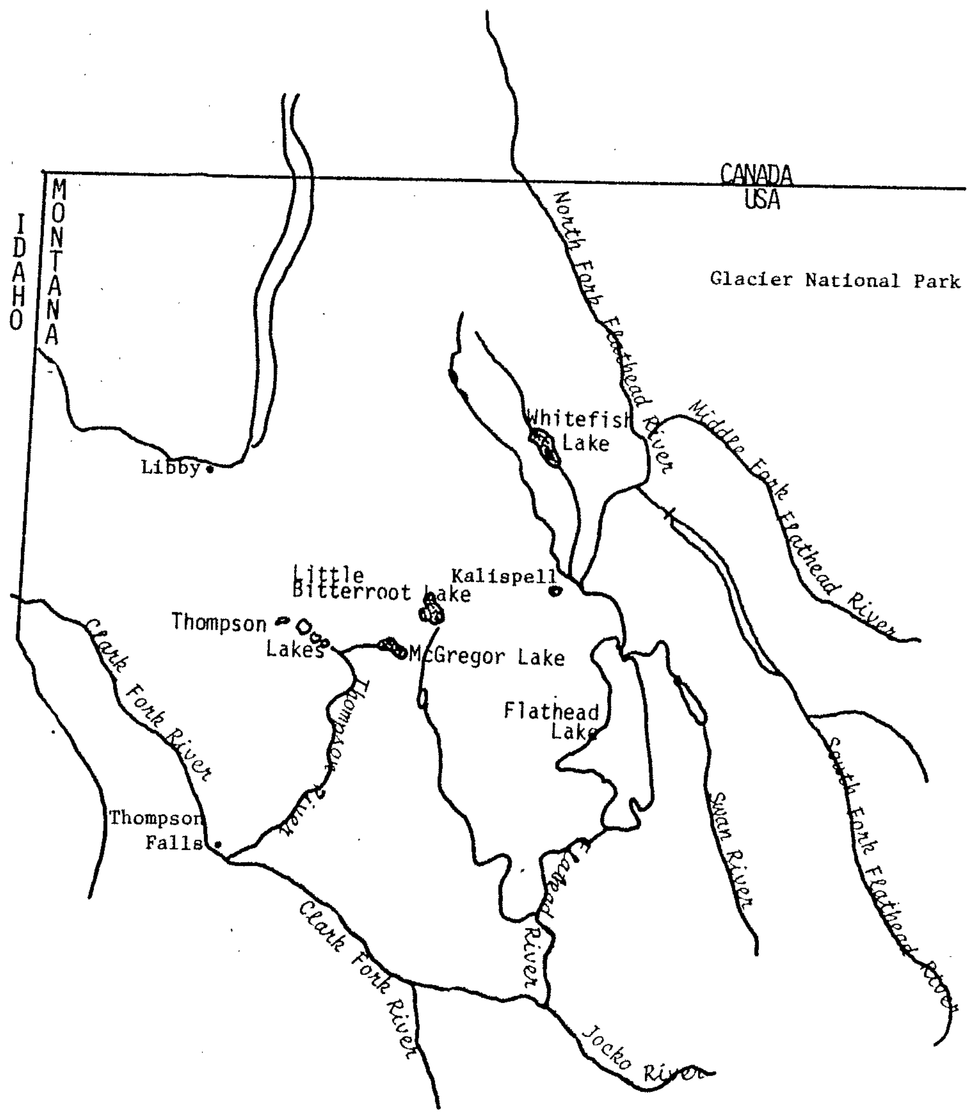


Figure 1. Northwest Montana Region One area map depicting Flathead River and Clark Fork River drainages.

Outlet dams regulate the water levels of McGregor Lake for lakeshore stabilization and Little Bitterroot Lake for downstream irrigation purposes. Little Bitterroot Lake has an average annual vertical fluctuation of 1.2 feet, whereas the estimated annual vertical fluctuation is about 2 feet in McGregor Lake. Whitefish Lake has a natural outlet constriction that contributes to an average annual fluctuation of 3.5 feet.

Fish species found in the lakes are listed in Table 1. A brief history of introduced fish species is presented by lake.

Table 1. Occurrence and abundance of fish in Whitefish Lake (WF), McGregor Lake (McG), and Little Bitterroot Lake (LB).

Common Name	Abbreviation	Scientific Name	Occurrence[1] WF	McG	LB
Arctic Grayling	Gr	Thymallus arcticus	Iu	–	–
Rainbow trout	Rb	Salmo gairdneri	Ir	Ic	Ic
Lake trout	Lt	Salvelinus namaycush	Ia	Ia	–
Mountain Whitefish*	MWf	Prosopium williamsoni	Nc	Nc	–
Bull trout*	DV	Salvelinus confluentis	Nc	–	–
Brook trout	EB	Salvelinus fontinalis	Ir	Ir	Ir
Yellowstone cutthroat	Yct	Salmo clarki bouvieri	Iu	Iu	Iu
Westslope cutthroat*	Wct	Salmo clarki lewisi	Nc	Nr	Ir
Kokanee	Kok	Onchorhynchus nerka	Ir	Ir	Ia
Largemouth bass	LmB	Micropterus salmoides	Iu	–	–
Pumpkinseed	Pmk	Lepomis gibbosus	Ic	–	–
Yellow perch	Yp	Perca flavescens	Ic	Ic	Ic
Largescale sucker*	Csu	Catostomus macrocheilus	Nc	–	–
Longnose sucker*	Fsu	Catostomus catostomus	Na	Na	Na
Northern squawfish*	Sq	Ptychocheilus oregonensis	Na	Nu	–
Peamouth*	Crc	Mylocheilus caurinus	Na	Nu	–
Redside shiner*	Rss	Richardsonius balteatus	Nr	Nr	–
Black bullhead	Bul	Ictalurus melas	Iu	–	–
Sculpins*	Cot	Cottus spp.	Nr	Nc	Nc
Northern Pike	Np	Esox lucius	Ic	–	–
Lake whitefish	LWf	Coregonus clupeaformis	Ia	–	–
Pygmy whitefish*	PWf	Prosopium coulteri	Nc	–	Nc

[1]Occurrence: I = introduced; N = native; a = abundant, c = common r = rare; u = unknown
*Indigenous species.

Historical Background

Over two million undesignated cutthroat trout were stocked in each of the three lakes in various years from 1924 until 1971. This undesignated cutthroat trout had a genetic makeup predominated by yellowstone cutthroat with some rainbow and westslope cutthroat in unknown proportions.

Whitefish Lake

MDFWP planted 80,000 rainbow fry in Whitefish Lake in 1924. This species is very rare in the lake, but is commonly found in the Whitefish and the Flathead rivers above Flathead Lake. Kokanee were introduced in 1945 and because of successful spawning supplemented with annual stocking, became a major fish species through the mid-1970's. Kokanee numbers declined dramatically in 1976 probably as a result of competition with Mysis (opossum shrimp) and on-going efforts to re-establish it, though not completed, are presently unsuccessful. Northern pike were first reported in Whitefish Lake in the mid-1970-'s. The origin of these fish was from illegal introductions by either direct stocking or upstream movement from downstream sources. Any fish species inhabiting the Flathead River drainage above Kerr Dam have access to Whitefish Lake.

The lake whitefish was introduced into Whitefish Lake around 1910, and a viable population became established. This species was considered an exceptional food fish, and it was hoped they would do as well in Flathead area lakes as in the Great Lakes (Alvord 1964). Lake trout were introduced into the lake by MDFWP in 1941. Starting in 1975 MDFWP initiated annual plants of sub-catchable size westslope cutthroat trout in Whitefish Lake to enhance the native population of this species.

McGregor Lake

In McGregor Lake two introduced game fish species make up the majority of its salmonid population. Those are lake trout introduced by the MDFWP in 1942 and rainbow trout which are currently being stocked on an annual basis. A self-sustaining population of lake trout exists in the lake, but the rainbow trout cannot sustain themselves by natural reproduction.

Stocking of other game fish species has been attempted in past years with varying degrees of success. Westslope cutthroat trout plants were initiated in the spring of 1975 and continued through 1981. A diminishing population of westslope cutthroat trout from these stocking efforts remains in the lake. This fish species probably occurred naturally in McGregor Lake before impoundment since no natural barriers exist between it and the lower drainage where westslope cutthroat are indigenous. Kokanee were introduced in 1944 and annual spring fry plants were continued through 1985. Self-sustaining populations have never been established as there is no suitable spawning habitat. Almost 3.8 million kokanee fry were planted from 1966 through 1985. In recent years the survival of kokanee to maturity was very poor apprarently due to competition with introduced Mysis (opossum shrimp). Past introductions of other sport fish have been of little consequence to the recent lake fishery.

Little Bitterroot Lake

Little Bitterroot Lake has a population of small kokanee, averaging 11 inches or less, which are sustained by periodic stocking and some natural reproduction. Introduction of this salmon occurred in 1968 when 50,000 fry were stocked. Although *Mysis* were introduced to this lake, their added competition has not decimated kokanee as it may have in Whitefish and McGregor lakes. Supplemental planting may be required in future years to sustain an acceptable kokanee population. One contributing factor is limited spawning habitat reduced further by low fall lake elevation. Rainbow trout were first planted into Little Bitterroot Lake by the MDFWP in 1927. A successful spawning population was established in the lake inlet (Herrig Creek) and eggs were collected on an annual basis for several years. Heavy planting of undesignated cutthroat and rainbow trout in combination for many years resulted in a population of rainbow/cutthroat hybrids. Electrophoresis tests conducted by the University of Montana genetics laboratory established that some of the trout population is westslope cutthroat/rainbow hybrids and some a rainbow strain with both coastal and inland genetic characteristics. The stocking of westslope cutthroat trout during the years 1975 through 1981 was not considered successful since low numbers of predominately small fish were returned to the angler's creel. Other fish species introductions have contributed little to the recent lake sport fishery (Table 2).

Table 2. Numbers of fish stocked in Whitefish, McGregor, and Little Bitterroot lakes since 1924.

	LAKES		
Species	Whitefish	McGregor	Little Bitterroot
Rainbow trout	389,000	1,224,871	5,931,952
Brook trout	44,000	4,000	17,152
Bull trout	1,950	--	--
Lake trout	162,100	125,136	--
Kokanee salmon	8,062,932*	3,770,082*	2,415,817*
Coho salmon	20,000	190,000	110,300
Artic grayling	500,000	2,113,300	911,088
Cutthroat trout (undesignated)	2,472,585*	2,143,270*	2,286,891*
Westslope cutthroat trout	823,075	271,826	785,212
Yellowstone cutthroat trout	--	67,340	177,705

*Size less than 3" fry.

Present Region One management direction is to protect, enhance, establish, or re-establish westslope cutthroat populations in selected Montana waters of the Flathead River drainage above Kerr Dam. This species is indigenous to many western Montana waters and stocking on a scheduled basis was initiated in 1975 after establishment of a hatchery broodstock. The recent history of salmonid stocking efforts, including westslope cutthroat trout in Whitefish, McGregor, and Little Bitterroot lakes, are shown in Table 3.

Table 3. Number and size of salmonids planted in Whitefish, McGregor, and Little Bitterroot lakes, 1975-1985. Numbers shown in thousands.

Rainbow

	Whitefish			McGregor			Little Bitterroot		
Year	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->
1982					40			50	
1983					96			101	
1984				69	27		72	85	
1985					76			73	

Yellowstone

	Whitefish			McGregor			Little Bitterroot		
Year	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->
1976								30	
1977								35	

Westslope Cutthroat Trout

	Whitefish			McGregor			Little Bitterroot		
Year	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->
1975		35			31			11	38
1976		42			30			51	
1977	40	30		10	33		20	40	
1978	68	48		38			55	38	
1979		102			40		216	72	
1980		69			40			50	
1981		50			38			51	
1982		50							
1983		50							
1984	98	137							
1985		159							

Kokanee

	Whitefish			McGregor			Little Bitterroot		
Year	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->	0"-3"	4"-6"	7"->
1975	350			350			200		
1976	200			150					
1977	200			100					
1978	350			300			100		
1979	399			100			50		
1980	300			100			50		
1981	282								
1982				85					
1983	286			100					
1984	269			100					
1985	500			75					

METHODS

Plankton and fish collection methods were similar for all three lakes and are discussed below.

Zooplankton Methods

The plankton sampling was done on a monthly basis from May through September at two stations on each lake during 1984. Plankton sampling was continued in 1985 on a monthly basis from May through December in Whitefish Lake. Plankton samples were collected using a 0.2921 meter diameter opening by 1 meter long conical net with an 80 micron mesh size. Each sample was collected from a 30 meter vertical tow. The field samples were preserved in a mixture of 4 percent formalin with 40 g/liter of sucrose. Laboratory procedures were to count five 1 milliliter sub-samples collected from the dilutions of each sample. The amount of dilution was determined by plankton densities and the counting was done with a 40X dissecting microscope. The zooplankters are presented in the following manner: Copepods were counted to the sub-orders Cyclopoid and Calanoid in Whitefish and Little Bitterroot lakes. Cladocera were counted to the genera *Daphnia* and *Bosmina* in all of the lakes; and Calanoids were counted to the genera *Epischura* and *Diaptomus* in McGregor Lake as they were both well represented in the samples. The zooplankton densities are presented in numbers per liter.

Fish Collection Methods

To determine fish population abundance, three gill net monitoring stations were selected at each lake in 1984 (Figures 2, 3, and 4). The areas chosen on each lake were considered representative of the entire lake. At each of the stations, one sinking gill net was set near the shoreline in depths of approximately 6 feet and extending out 125 feet to depths ranging from 25 to 75 feet. Two surface gill nets were ganged together establishing a length of 250 feet and set in the immediate vicinity of the sinking nets. Standard experimental gill nets 125 feet long by 6 feet deep were used for all of the sampling. They had 25 foot long sections of bar mesh of 3/4 inch, 1 inch, 1 1/2 inch, 1 3/4 inch, and 2 inch sizes. The nets were set overnight for approximately 12 hours during the months of May, July, and September. Lengths and weights were measured for all collected fish by species; scale samples were taken from all game fish and stomach samples were collected from a representative number of all game fish species from the lakes. Age and growth were determined from the total fork length and scale sample analysis; food habits were determined from the stomach samples; and fish species distribution was determined from the gill net sampling.

Temperature Profiles

Water temperature profiles were measured at one station on each lake from May to September. They were at station one on Little Bitterroot and McGregor lakes and station two on Whitefish Lake (Figures 2, 3, and 4). Temperatures were measured using a hydro thermometer with a one-hundred foot cable. Depths were recorded for every one degree fahrenheit change.

Age and Growth

Ages were determined by readings of magnified acetate scale impressions and distances to annulus were measured along a standard scale radius in millimeters. Total body length-scale radius relationships were log-log nomograph plots reflected as back-calculated lengths at annulus.

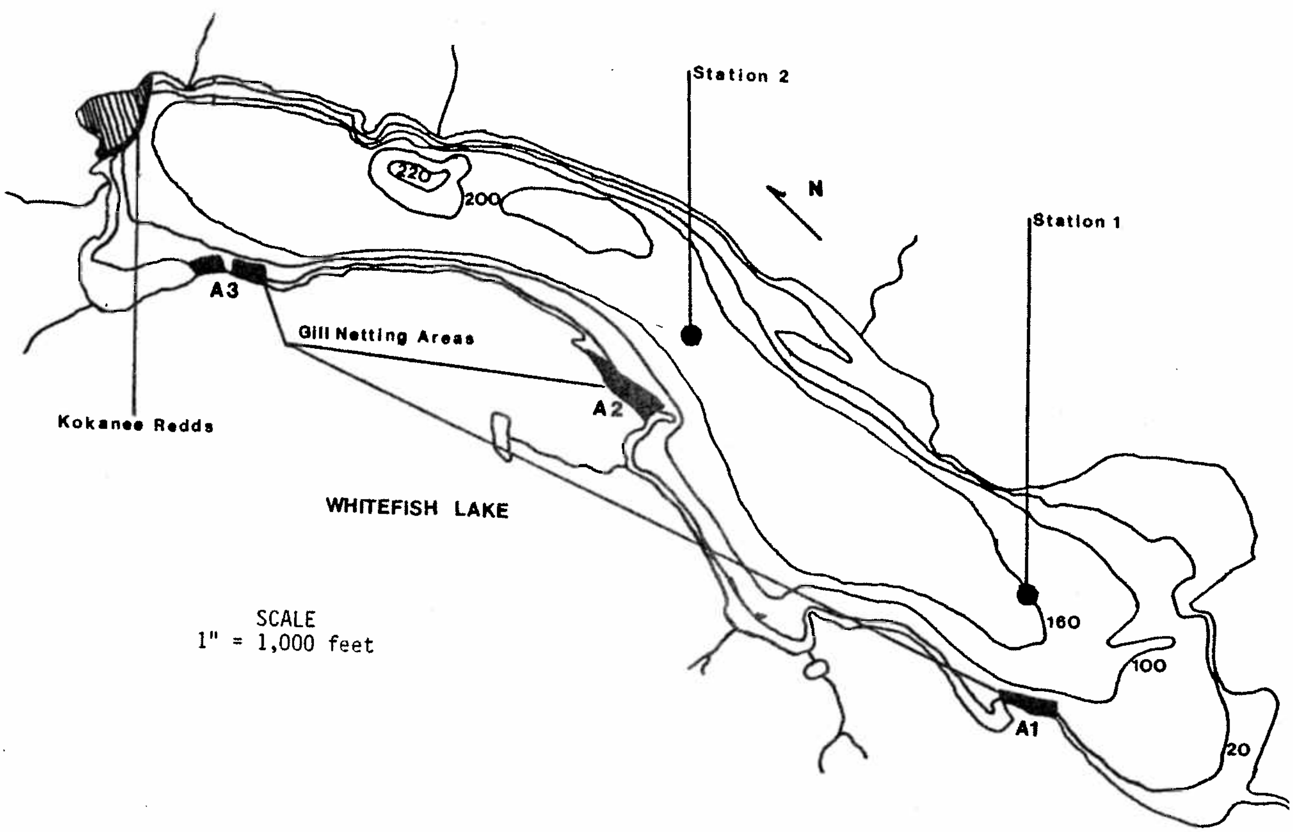


Figure 2. Whitefish Lake water quality, plankton and gillnet sampling stations.

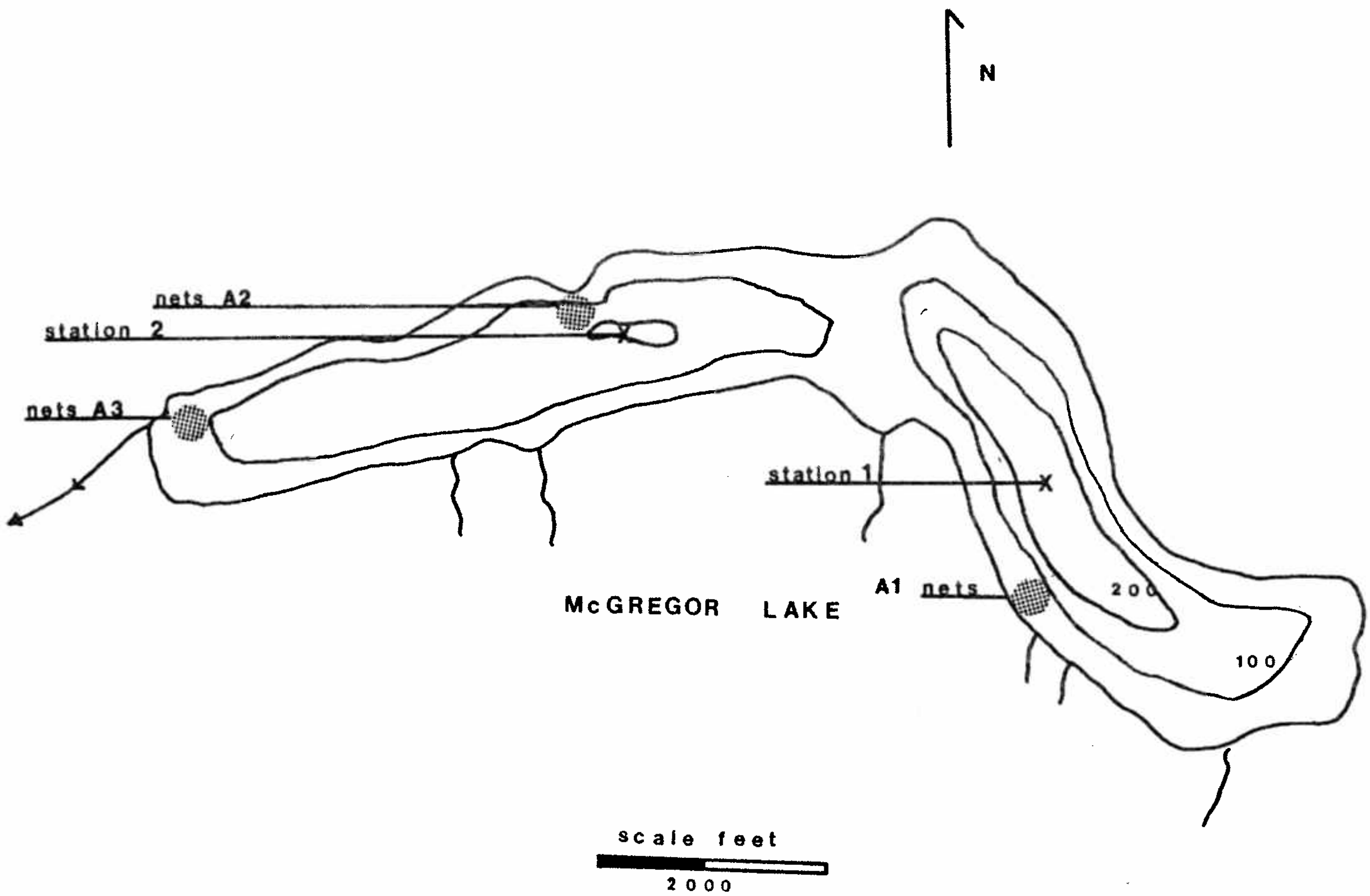


Figure 3. McGregor Lake water quality, plankton and gillnet sampling stations.

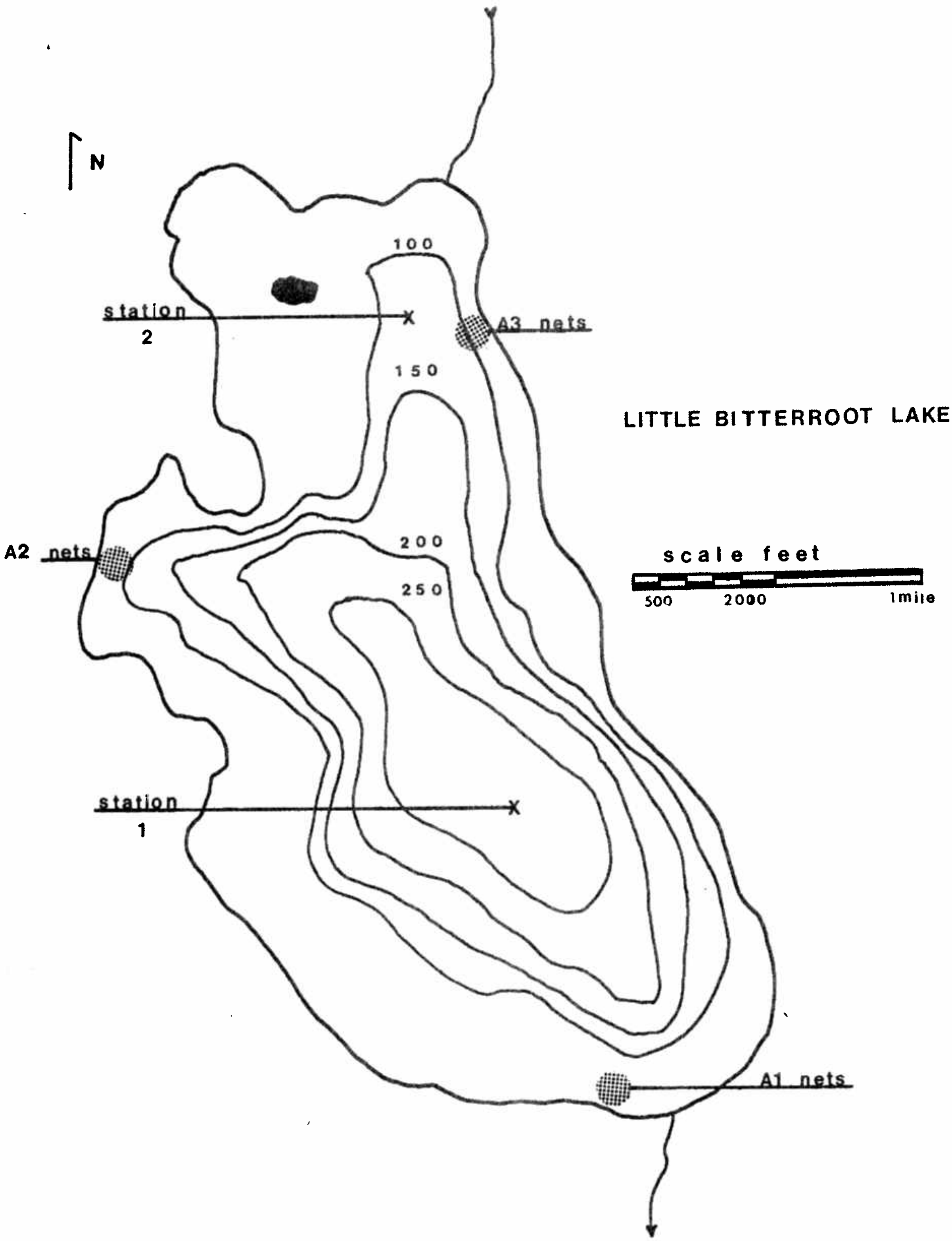


Figure 4. Little Bitterroot Lake water quality, plankton and gillnet sampling stations.

RESULTS AND DISCUSSION

Temperatures

Whitefish Lake

Profiles relating temperature with depth by month during 1979, 1984, and 1985 are presented in Figure 5. The thermoclines were established by July of 1979 and 1985, but cooler water temperatures in the early summer contributed to a delay until August, 1984. The thermocline was well defined until October 1979, but they were deeper and poorly defined by September in 1984 and 1985.

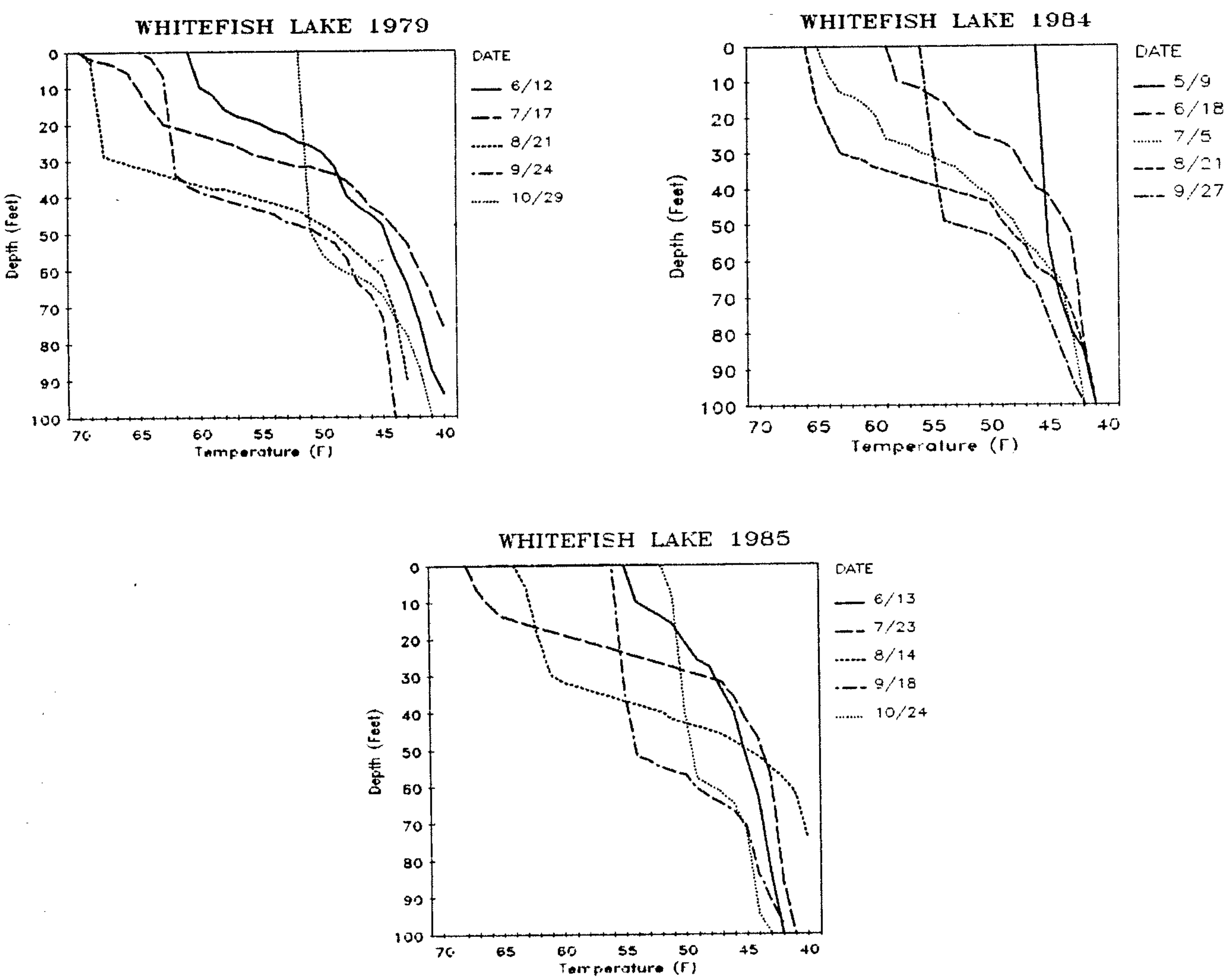
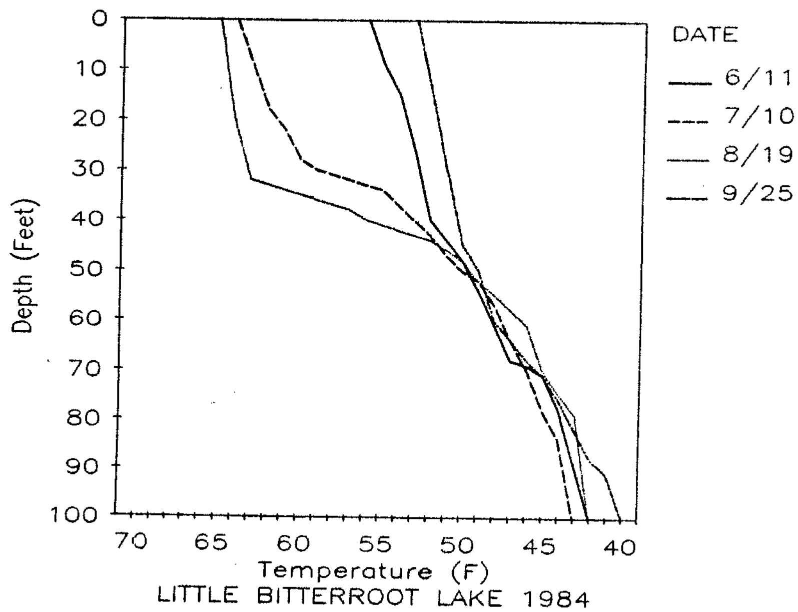


Figure 5. Monthly temperature profiles, Whitefish Lake, 1979, 1984, 1985. Depth feet; degrees Fahrenheit.

Little Bitterroot and McGregor Lakes

Figure 6 shows temperature profiles on a monthly basis in Little Bitterroot and McGregor lakes during 1984. Their maximum surface temperature measured during August were 65°F. Weak thermoclines developed by July in both lakes and became more defined thermobarriers in August.



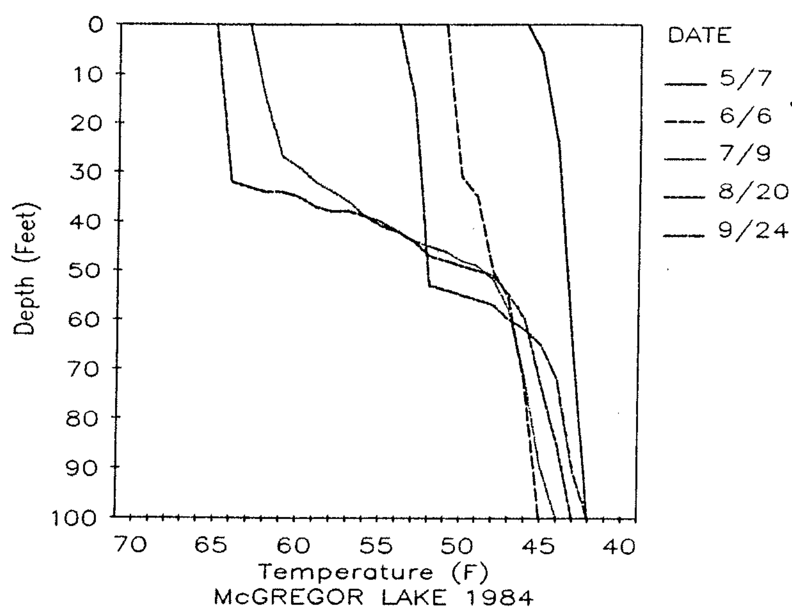


Figure 6. Monthly temperature profiles in Little Bitterroot and McGregor Lakes in 1984. Depth feet; degrees Fahrenheit.

Zooplankton

Whitefish Lake

Zooplankton samples were collected in Whitefish Lake during 1979, 1984, and 1985. Cyclopoid copepods were the most abundant zooplankton organisms every month sampled during the three years. The low numbers of Calanoid copepods were mostly comprised of the genus Epischura with infrequent occurrence of Diaptomus. Cladocerans were comprised of the species Bosmina longirostris, Daphnia thorata, Daphnia longiremus, and rare occurance of Leptodora (Table 4).

The Daphnia and Bosmina populations peaked in July, 1984 and 1985 and during August, 1979. An investigation conducted in 1981 also found the peak Cladoceran populations developing in July (Leathe 1982). The reason for this later Cladoceran population peak in 1979 was not related to cooler spring and summer water temperatures. A comparison between the three years shows that average surface and epilimnion water temperatures were warmer during the spring and early summer of 1979 (Figure 5).

Little Bitterroot Lake

Zooplankters from Little Bitterroot Lake were collected in 1984. Cyclops was the most abundant copepod. Calanoid copepods were comprised of the larger genus Epischura with infrequent occurrence of smaller Diaptomus. Cladocerans were comprised of the species Bosmina longirostris and Daphnia thorata with an infrequent occurance of an unidentified Daphnia.

The peak populations of the most numerically abundant organism, Bosmina, occurred during the months of June and July. Daphnia population densities were much lower and peaked during August and September (Table 5).

Table 4. Number of adult zooplankton and percent composition of the total of Cyclopoid, <u>Daphnia</u>, <u>Bosmina</u>, and Calanoid at two stations on Whitefish Lake from 100 foot depth vertical tows in 1979 and 30 meter depth vertical tows during 1984 and 1985.

Years	Month	Sampling Area	No/Liter(%) Cyclopoid	No/Liter(%) Daphnia	No/Liter(%) Bosmina	No/Liter(%) Calanoid	No/Liter Total
1979	June	1	15.4(99)	0.0(0)	0.0(0)	0.2(1)	15.6
		2	14.7(97)	0.3(2)	0.2(1)	0.0(0)	15.2
	July	1[a]	4.9(70)	1.4(20)	0.5(7)	0.2(3)	7.0
		2	9.3(85)	1.0(9)	0.3(3)	0.3(3)	10.9
	August	1[b]	16.8(55)	8.1(27)	4.5(15)	1.0(3)	30.4
		2	12.5(68)	1.8(10)	3.3(18)	0.8(4)	18.4
	September	1[c]	12.0(61)	5.8(30)	1.5(8)	0.3(1)	19.6
		2	8.2(84)	1.3(13)	0.3(3)	0.0(0)	9.8
	October	1[d]	19.7(93)	1.2(6)	0.2(1)	0.0(0)	21.1
		2	10.7(93)	0.8(7)	0.0(0)	0.0(0)	11.5
1984	March	1	5.8(94)	<0.1(0.5)	0.3(5.2)	<0.1(0.3)	6.15
	May	1	19.0(91.8)	0.1(0.5)	1.6(7.7)	0.0(0)	20.70
		2	19.9(90)	2.0(9)	0.2(1)	0.0(0)	22.10
	June	1	no samples				
		2	no samples				
	July	1	20.5(63)	5.9(18)	6.1(19)	0.0(0)	32.50
		2	23.2(61)	8.2(21.5)	6.6(17.4)	<0.1(0.1)	38.04
	August	1	8.5(64)	4.0(30)	0.7(5.0)	0.1(1.0)	13.30
		2	7.8(65)	3.4(29)	0.6(5.0)	0.1(1.0)	11.90
	September	1	8.4(84.5)	1.5(15.1)	0.0(0)	<0.1(0.4)	9.94
		2	7.0(63)	3.9(35)	0.2(2.0)	0.0(0)	11.10
1985	May	1	13.2(96)	0.5(3)	0.1(1)	0.0(0)	13.80
		2	8.4(98.6)	0.1(1.1)	0.1(1.1)	<0.1(0.2)	8.52
	June	1	10.9(92)	0.4(3)	0.3(3)	0.2(2)	11.80
		2	11.1(94)	0.5(4)	0.2(2)	0.0(0)	11.80
	July	1	6.2(55)	3.9(35)	1.0(9)	0.1(1)	11.20
		2	7.2(55)	4.1(32)	1.5(12)	0.2(1)	13.00
	August	1	8.7(75)	1.8(16)	0.9(8)	0.2(1)	11.60
		2	7.4(76)	1.9(20)	0.3(3)	0.1(1)	9.70
	September	1	13.4(82)	1.1(7)	1.6(10)	0.2(1)	16.30
		2	10.7(83)	1.2(9)	1.0(8)	0.0(0)	12.90
	December	1	7.3(86)	0.2(2)	1.0(12)	0.0(0)	8.50
		2	7.0(85.0)	0.1(1.2)	1.1(13.4)	<0.1(0.4)	8.23

[a]Sampling depth 90 feet
[b]Sampling depth 85 feet
[c]Sampling depth 75 feet
[d]Sampling depth 80 feet

Table 5. Number of adult zooplankters and percent composition of total of Cyclopoid, Daphnia, Bosmina, and Calanoid at two stations on Little Bitterroot Lake from 30 meter depth vertical tows in 1984.

Month	Sampling Area	No/Liter(%) Cyclopoid	No/Liter(%) Daphnia	No/Liter(%) Bosmina	No/Liter(%) Calanoid	No/Liter Total
March	1	0.7(37)	<0.1(2)	1.1(58)	<0.1(3)	1.9
May	1	4.8(41)	0.0(0)	6.4(55)	0.4(4)	11.6
	2	No sample				
June	1	5.9(35)	0.0(0)	10.7(62)	0.5(3)	17.1
	2	3.4(22)	0.1(1)	11.3(74)	0.4(3)	15.2
July	1	8.7(39)	0.4(2)	12.9(58)	0.2(1)	22.2
	2	4.8(33)	0.2(1)	9.6(65)	0.1(1)	14.7
August	1	3.1(37)	0.8(10)	4.3(52)	0.1(1)	8.3
	2	3.5(47)	0.8(11)	3.1(42)	0.0(0)	7.4
September	1	5.4(40)	0.5(8)	0.5(8)	0.0(0)	6.4
	2	4.2(75)	0.6(11)	0.6(11)	0.2(3)	5.6

McGregor Lake

The cladoceran genera and copepod suborders were collected in McGregor Lake during 1984. Relatively good numbers of the large cladoceran (Daphnia pulex), were collected in the monthly samples from May through September, 1984. Much lower numbers of Bosmina longirostris occurred during August and September, 1984. Copepod suborders were exclusively calanoid with two genera, Epischura and Diaptomus, represented. Epischura were more numerous in May and June while the Diaptomus population peaked in August and September (Table 6). The average length of this unusually large Diaptomus (for northwestern Montana lakes) was 1.4 mm with a range of 0.8 mm to 1.9 mm.

Table 6. Number of adult zooplankton and percent composition of total of Cyclopoid, Daphnia, Bosmina, and Calanoid genera (Epischura and Diaptomus) at two stations on McGregor Lake from 30 meter depth vertical tows in 1984.

Month	Sampling Area	No/Liter(%) Cyclopoid	No/Liter(%) Daphnia	No/Liter(%) Bosmina	No/Liter(%) Calanoid		No/Liter Total
					Epischura	Diaptomus	
March	1	0.0(0)	0.3(50)	0.0(0)	0.2(33)	0.1(17)	0.6
May	1	0.0	5.6(79)	0.0(0)	1.4(20)	0.1(1)	7.1
	2	0.0(0)	4.7(87)	0.0(0)	0.5(9)	0.2(4)	5.4
June	1	0.0	5.1(88)	0.1(2)	0.5(9)	0.1(1)	5.8
	2	0.0(0)	7.5(88)	0.0(0)	0.9(10)	0.1(2)	8.5
July	1	0.0(0)	7.6(95)	0.0(0)	0.3(4)	0.1(1)	8.0
	2	0.0(0)	2.1(84)	0.0(0)	0.3(12)	0.1(4)	2.5
August	1	0.0(0)	7.0(79)	0.1(1)	0.8(09)	1.0(11)	8.9
	2	0.0(0)	6.3(75)	0.2(2)	0.7(08)	1.2(15)	8.4
September	1*	0.0(0)	2.0(64)	0.5(16)	0.1(04)	0.5(16)	3.1
	2	0.0	3.7(66)	0.8(14)	0.1(02)	1.0(18)	5.6

*Sampling depth 25 meters.

Food Habits

Whitefish Lake

Lake Trout. - A total of 30 lake trout stomachs were examined from the 1984 sampling period. The sizes ranged from 11.9 to 27.0 inches in length with an average of 17.9 inches. The largest weighed 7.75 pounds. Aquatic invertebrates and fish were the most abundant food items found in their diets during all seasons. Fish remains were found in 33 percent of the stomach samples and were a more significant portion of the biomass in the diets of lake trout greater than 17 inches long. Mountain whitefish remains were found in stomachs from three individuals. Stomach contents from smaller lake trout were primarily invertebrates. Terrestrial insects were found in one lake trout stomach collected during spring sampling and a single lake trout collected in March had fed on Mysis.

Lake Whitefish. - The stomach contents of 112 lake whitefish were examined during the sampling period. Their most frequent food items during all sampling seasons excluding winter, were zooplankton (mostly Daphnia) and aquatic invertebrates. In March, the two lake whitefish captured had empty stomachs.

In 1984 frequency of occurrence of zooplankton in their diet were highest in the spring, 63 percent, but remained high throughout the summer and fall. Examination of lake whitefish stomachs in the spring and fall of 1979 sampling yielded a somewhat similar high frequency of occurrence for zooplankton. It was 43 percent in June and 75 percent in July. No lake whitefish stomachs were examined from the fall 1979 sampling for comparison with 1984.

Flathead Lake food habit investigations found that zooplankton were an important food item in the diet of lake whitefish from April through November (Leathe 1982). During that study, zooplankton comprised almost 50 percent of the total biomass ingested by lake whitefish. The importance of zooplankton in their diet increased during June and July and remained high throughout the summer and fall.

Westslope Cutthroat Trout. - Only nine westslope cutthroat trout stomachs were examined during the sampling period. They were all captured in the fall gillnetting. Their stomach contents indicated that opportunistic selection of food items occurred in September, 1984. Both terrestrial and aquatic invertebrates were found in combination with zooplankton in most of their stomachs. Terrestrial insects comprised the greatest biomass of those selected food items.

In the 1979 lake sampling, terrestrial insects were the most important food item for westslope cutthroat in August and declined to almost equal importance with aquatic invertebrates and zooplankton during October. Zooplankton were found in 80 percent of the stomachs collected in October, 1979.

Westslope cutthroat trout stomach contents collected during the fall of 1981 from Flathead lake had a dominant biomass of winged insects (Leathe 1982); zooplankton were never found to be an important food item component of their diet during that study. In Lake Koocanusa, Daphnia were an important food item for westslope cutthroat trout during the fall and winter months (McMullin 1979); in less fertile Hungry Horse Reservoir they were also found to be an important food item during the late fall and winter seasons (May 1985).

Table 7. Composition by numbers (#) and percent frequency (%) of food items from lake trout, lake whitefish, and westslope cutthroat trout collected seasonally in 1984 from Whitefish Lake.

	Season																							
	Spring						Summer						Fall						Winter					
Species	Lt		Lwf		Wct		Lt		Lwf		Wct		Lt		Lwf		Wct		Lt		Lwf		Wct	
(No. Samples)	(14)		(97)		(0)		(7)		(7)		(0)		(8)		(6)		(9)		(1)		(2)		(0)	
Food Item	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Coleoptera	1	7											6	67										
Hemiptera							1	14					7	78										
Hymenoptera	1	7											1	11										
Arachnidi													2	22										
Plecoptera			4	4	1	14																		
Ephemeroptera	2	14	1	1	5	71	3	43			1	17	1	11										
Tricoptera	1	7			3	43					1	17	4	44										
Diptera	1	7	1	1			1	14					6	67										
Chironomidi	2	14	14	14	5	71	3	43	3	38	1	17	8	89										
Gastropodi			2	2					1	13	1	17												
Crayfish	1	7																						
Gammarus			1	1	1	14																		
Mysis			1	1			1	14							1	100								
Zooplankton			61	63			4	57			3	50	6	67										
Fish Remains	5	36			1	14			4	50														
Empty Stomach	4		27				0		0				2		2		0		0		2	100		

Little Bitterroot Lake

Rainbow. - The size of rainbow trout captured in Little Bitterroot Lake ranged from 7.1 to 26.3 inches with a maximum weight of 8 pounds. A total of 16 stomachs from these fish were examined.

The most frequent food item found in rainbow stomachs in the spring of 1984 was terrestrial insects, comprised mostly of beetles (Coleoptera), true bugs (Hemipteras), and winged flies Diptera. One of the stomachs from an individual weighing 4 pounds contained crayfish remains.

Rainbow trout were also collected in September, 1984, and October, 1985. Results of examination of their stomachs indicate a greater variation of food items selected during this season. Two of the stomachs from rainbow captured in September, 1984, measuring 7.3 and 16.9 inches, contained crayfish. The three remaining stomachs contained the following: one had beetles (Coleoptera), one had winged fly larve (Chironomids), and one had *Mysis*.

Three of four stomachs from rainbow trout collected in October, 1985, were full of Mysis; the other contained pygmy whitefish. The sizes of rainbow trout which fed on Mysis ranged from 10.0 to 26.3 inches with the largest weighing 8 pounds.

Kokanee. – Only nine kokanee stomachs were examined during the sampling period. Five were collected during spring and four during the fall season. Their size ranged from 7.6 to 9.7 inches in spring collections and 9.3 to 10.3 inches in fall collections.

Cyclopoids were the only zooplankton found in their stomachs during both seasons. Chironomids were also found in two stomachs from fall captured kokanee.

Table 8. Composition by numbers (3) and percent frequency (%) of food items from rainbow trout, cutthroat trout, and kokanee collected seasonally in 1984 and 1985 from Little Bitterroot Lake.

	Season																							
	Spring						Summer						Fall						Winter					
Species	Rb		Kok		Wct		Rb		Kok		Wct		Rb		Kok		Wct		Rb		Kok		Wct	
(No. Samples)	(8)		(5)		(3)		(0)		(0)		(0)		(8)		(4)		(0)		(1)		(0)		(0)	
Food Item	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Coleoptera	7	88	0		2	66							1	12	0				0					
Hemiptera	2	25	0										0		0								0	
Hymenoptera	0		0		1	33							0		0								0	
Diptera	1	13											0		0								0	
Chironomidae					1	33							2	25	2	50							0	
Crayfish	1	13											2	25	0								0	
Mysis	0												4	50	0								0	
Zooplankton	0		2	40									0		3	75							0	
Fish Remains	1	13											1	12	0								1	100
Empty Stomach	0		3	60									0		1	25			0					

McGregor Lake

Rainbow Trout. – A total of 13 rainbow trout stomachs were examined from the sampling period. Their sizes ranged from 10.8 to 20.7 inches in length with the largest weighing 2.55 pounds. Rainbow trout captured from the spring and summer season were feeding selectively and in combination on Daphnia pulex and aquatic insects. One larger individual collected from this sampling period (length 17.6 inches, weight 2.55 pounds) had stomach contents of unidentified fish remains and Daphnia. Stomach contents of rainbow trout captured during the fall were comprised of snails (Gastropods) and one also contained *Mysis*.

Lake Trout. – A total of 69 lake trout stomachs were examined from all sampling seasons in McGregor Lake. They ranged in size from 12.2 to 25.4 inches in length with an average of 16.1 inches. The largest weighed only 4.44 pounds. Zooplankton and aquatic invertebrates were the most frequent food items of their diet during all seasons. Terrestrial insects were found in stomachs from 10 individuals captured in the spring netting. *Mysis* were utilized by individual lake trout during all seasons and 50 percent of the winter stomach samples contained them. Only 12 percent of their stomachs contained fish remains. Three individuals collected during the summer sampling contained tiny unidentified fry. A small rainbow trout was found in the stomach from one of the larger individuals collected during fall sampling.

Table 9. Composition by numbers (#) and percent frequency (%) of food items from lake trout and rainbow trout collected seasonally in 1984 from McGregor Lake.

	Season															
	Spring				Summer				Fall				Winter			
Species	Rb		Lt		Rb		Lt		Rb		Lt		Rb		Lt	
(No. Samples)	(5)		(25)		(3)		(6)		(5)		(22)		(0)		(16)	
Food Item	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Coleoptera			3	12												
Hemiptera	1	20	1	4												
Hymenoptera			1	4												
Ephemeroptera					1	33										
Trichoptera	2	40	4	16									2	12		
Diptera			7	28	1	33										
Chironomidal	1	20	10	40	1	33	5	83	1	20	16	73	2	12		
Gastropodal					1	33			3	60						
Gamaerus			1	4	1	33					1	4	3	19		
Mysis			1	4			2	33	1	20	1	4	8	50		
Zooplankton	4	80	22	88	1	33	3	50			20	91	9	56		
Fish Remains					1	33	3	50			4	18				
Empty Stomach	0		0		0		0		2		0				1	

*Number of stomach samples.

Age and Growth

Whitefish Lake

Lake whitefish growth in 1984 was similar to 1979 (Table 10). Average calculated total lengths at annulus were slightly less than the mean of over 10,000 lake whitefish collected from various North American lakes (Carlander 1969).

Table 10. Average back-calculated lengths and mean growth increments in inches (and millimeters) at annulus for lake whitefish in Whitefish Lake, 1984.

		Average	Average Length at Annulus						
Age	No.	Length	I	II	III	IV	V	VI	VII
I	9	8.1(207)	4.6(116)	0	0	0		0	0
II	26	10.9(276)	5.0(126)	8.4(212)	0	0	0	0	0
III	83	12.7(321)	5.0(126)	8.0(204)	10.5(267)	0	0	0	0
IV	58	14.0(356)	5.1(128)	8.0(204)	10.6(269)	13.0(331)	0	0	0
V	36	15.5(394)	5.1(127)	7.8(198)	10.6(268)	12.9(327)	14.1(359)	0	0
VI	31	17.0(433)	4.3(109)	8.2(208)	11.1(281)	13.3(337)	15.2(386)	16.2(414)	0
VII	7	17.6(448)	4.2(106)	7.3(186)	10.4(265)	12.7(322)	14.4(367)	16.1(410)	16.9(429)
Total	250		4.9(124)	8.0(204)	10.6(270)	13.0(330)	14.6(371)	16.3(413)	16.9(429)
Growth Increments			4.9(124)	3.1(80)	2.6(66)	2.4(60)	1.6(41)	1.7(42)	0.6(16)

Average calculated total length at each annulus of lake trout to age VII is greater than many North American lakes including Lake Michigan, Lake Taho, California, and the mean of over 12,000 fish collected from 29 Ontario lakes (Carlander 1969). Few larger fish are represented in this data as they were seldom captured by gillnetting (Table 11).

Table 11. Average back-calculated lengths and mean growth increments in inches (and millimeters) at annulus for lake trout in Whitefish Lake, 1984.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV	V	VI	VII
II	2	14.3(363)	7.1(181)	11.0(280)	0	0	0	0	0
III	13	15.2(385)	6.3(159)	9.6(243)	13.4(343)	0	0	0	0
IV	17	15.5(394)	5.7(146)	9.0(229)	12.0(304)	14.5(368)	0	0	0
V	24	20.6(522)	6.1(155)	9.3(236)	12.7(323)	15.9(403)	18.5(471)	0	0
VI	6	24.5(622)	6.9(174)	10.8(274)	14.2(362)	17.6(446)	20.6(527	23.0(585)	0
VII	5	27.0(686)	5.4(137)	8.7(220)	11.9(302)	15.2(387)	18.1(460)	21.3(541)	24.6(626)
Total	67		6.1(155)	9.4(239)	12.8(324)	15.6(395)	18.9(479)	22.3(565)	24.6(626
Growth Increments			6.1(155)	3.3(84)	3.3(85)	2.9(71)	3.3(84)	3.4(86)	2.4(61)

Cautious conclusions should be made from the limited northern pike data (Table 12). The growth rates are similar to many Northwest Territory lakes in northern Canada and considerably less than most eastern U. S. lakes listed by Carlander (1969).

Table 12. Average back-calculated lengths and mean growth increments in inches (and millimeters) at annulus for northern pike collected in 1984 and mean growth increments from 1979 in Whitefish Lake.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV
I	1	(391)	8.9(225)	0	0	0
II	5	(440)	8.9(225)	14.2(361)	0	0
III	4	(483)	8.1(206)	13.0(330)	16.9(428)	0
IV	2	(570)	6.2(158)	10.3(261)	16.0(361)	19.1(486)
Total	12		8.1(207)	13.0(332)	16.0(406)	19.1(486)
Growth Increments			8.1(207)	4.9(127)	3.0(74)	3.1(80)
1979			No.43	No.20	No.1	
Total	64		8.6(218)	13.7(348)	19.1(486)	
Growth Increments			8.6(218)	5.1(130)	5.4(138)	

Age and growth data on westslope cutthroat trout is limited by low incidence of capture during the sampling. A total of 14 fish from 1978 and 15 from 1984 and 1985 together were analyzed

(Table 13). Few conclusions should be made from the samples. Average condition factor (k) for age 2 fish was 0.91 in 1978 and 1.15 for 1984 and 1985.

Table 13. Average back-calculated length and mean growth increments in inches (and millimeters) at annulus for westslope cutthroat collected in 1978, 1984, and 1985 in Whitefish Lake.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV
1978						
II	10	10.6(268)	2.6(67)	5.0(127)	0	0
III	2	11.2(287)	2.5(64)	4.8(122)	8.0(204)	0
IV	2	14.1(358)	2.5(64)	5.3(134)	10.0(253)	12.4(314)
Total	14		2.6(66)	5.0(128)	9.0(228)	12.4(314)
Growth Increments			2.6(66)	2.4(62)	4.0(100)	3.4(85)
1984 and 1985						
II	4	8.7(220)	2.6(65)	4.9(124)	0	0
III	6	9.9(252)	2.6(65)	4.7(119)	7.0(178)	0
IV	4	12.6(321)	2.6(65)	4.5(115)	7.6(192)	10.3(262)
Total	14		2.6(65)	4.7(119)	7.2(184)	10.3(262)
Growth Increments			2.6(65)	2.1(53)	2.5(65)	3.1(78)

Little Bitterroot Lake

Sixteen rainbow trout ranging from age I to V were aged (Table 14). Their average length of 12 inches at age III compared favorably with many northwestern Montana lakes.

Table 14. Average back-calculated lengths and mean growth increments in inches (and millimeters) at annulus for rainbow trout in Little Bitterroot Lake, 1984.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV	V
I	4	8.7(220)	5.8(148)	0	0	0	0
II	3	15.4(390)	5.4(136)	10.4(266)	0	0	0
III	4	15.5(394)	4.8(122)	8.2(208)	12.0(305)	0	0
IV	4	18.4(467)	4.5(115)	7.4(187)	11.3(288)	15.2(386)	0
V	1	26.3(668)	4.7(119)	6.9(176)	14.3(365)	20.4(517)	23.9(607)
Total	16		5.1(129)	8.4(213)	12.0(304)	16.2(412)	23.9(607)
Growth Increments			5.1(129)	3.3(84)	3.6(91)	3.2(82)	

First year growth of kokanee was excellent, but subsequent years of growth were poor, as reflected by average lengths of spawners under 11 inches (Table 15). This is typical of many western Montana lakes with heavy competition for available food items, usually because of dense kokanee populations and in some lakes, *Mysis* competition.

Table 15. Average back-calculated lengths and mean growth increments in inches and (millimeters) at annulus for kokanee in Little Bitterroot Lake, 1984.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV	V
II	3	8.7(222)	4.4(113)	7.0(178)	0		
III	56	10.2(259)	4.5(114)	7.4(188)	9.2(231)		
Total	59		4.5(114)	7.4(187)	9.1(231)		
Growth Increments			4.5(114)	2.9(73)	1.7(44)		

McGregor Lake

Average back-calculated length at each annulus is greater than for lake trout from many lakes listed by Carlander (1969). Early growth to age IV is probably enhanced by heavy consumption of an aquatic food base combination of *Mysis*, large zooplankton, and terrestrial insects. The result is good average lengths at each annulus of lake trout to age IV (Table 16). Larger fish are seldom captured by anglers because of suspected slower growth for older year classes. There are few forage fish available for consumption.

Table 16. Average back-calculated lengths and mean growth increments in inches (and millimeters) at annulus for lake trout in McGregor Lake, 1984.

Age	No.	Average Length	Average Length at Annulus I	II	III	IV	V
III	11	14.1(357)	5.9(151)	9.0(228)	11.8(299)	0	0
IV	24	16.2(412)	5.5(140)	8.6(219)	11.7(297)	14.3(364)	0
V	5	19.5(496)	5.3(135)	8.0(204)	11.4(289)	14.3(363)	17.2(438)
Total	40		5.6(142)	8.6(219)	11.7(297)	14.3(363)	17.2(438)
Growth Increments			5.6(172)	3.0(77)	3.1(78)	2.6(66)	3.0(75)

Fish Species Distribution

Whitefish Lake

Westslope cutthroat trout were distributed throughout the 3 gill netting areas during both sampling years, but most of the catch occurred in the spring and fall sampling seasons (Table 17).

Table 17. Percent abundance and average catch per net night by species and net type of gamefish from combined spring, summer, and fall gill netting on Whitefish Lake in 1979 and 1984.

	Net Type (Number of Sets)			
	Bottom(16)		Surface(19)	
Species	Percent Abundance(#)	Catch/ Net Night	Percent Abundance(#)	Catch/ Net Night
1979				
Westslope cutthroat	4.7(8)	0.5	82.1(32)	1.7
Lake whitefish	57.1(97)	6.1	2.6(1)	<0.1
Northern pike	23.5(40)	1.8	10.3(4)	0.2
Bull trout	7.6(13)	0.8	5.0(2)	0.1
Lake trout	7.1(12)	0.7	0.0	0.0
1984	Bottom(9)		Surface(18)	
Westslope cutthroat	1.3(2)	0.3	81.8(9)	0.5
Lake whitefish	71.8(115)	12.8	9.1(1)	0.1
Northern pike	8.7(14)	1.6	0.0	0.0
Bull trout	1.3(2)	0.2	0.0	0.0
Lake trout	16.9(27)	3.0	9.1(1)	0.1

Surface nets caught most of the cutthroat in both 1979 and 1984. Age composition of the species was over 80 percent I+ and II+ years old during both sampling years. The percent age composition was similar in 1979 and 1984, but there was over a 200 percent decline in average catch per net night from 1979 to 1984.

A comparison of the years just preceding each sampling period establishes that a change in westslope cutthroat stocking patterns wasn't a reason for the decline (Table 3). The combined number of this species planted during the years 1977 through 1979 was 288,000. This is 47,000 fewer fish than were stocked in the year 1982 through 1984. A comparison of the subcatchable sized fish stocked during each sampling period was also less in 1979 (180,000 for 1979 period, 237,000 for 1984 period). Because the data from only two sampling years are limited, further investigation of Whitefish Lake is needed to confirm if any measurable change is occurring in the westslope cutthroat trout population.

Most of the northern pike caught in both 1979 and 1984 were captured in bottom sets located in gillnetting area 3 at the northwest end of Whitefish Lake near Beaver Bay (Figure 2). The bay is relatively shallow with abundant aquatic vegetation so most of the yellow perch and pumpkinseed are found in this area. The average catch per net night was slightly less in 1984 than 1979 but the change wasn't enough to indicate a difference in the population between sampling periods.

The average bull trout catches in 1984 declined considerably from 1979. Since species abundance was low in both years, trend analysis is not justifiable.

In both 1979 and 1984 most of the lake trout in Whitefish Lake were caught in bottom nets during the fall sampling season. A 300 percent increase in the catch occurred in 1984 over 1979 and the percent composition more than doubled over the same period. This big difference in the catch between sampling periods indicate that a population increase of this species occurred in Whitefish Lake.

Lake whitefish were the most numerous gamefish species caught during both the 1979 and 1984 sampling years in Whitefish Lake. The percent abundance of this species (compared to other gamefish species) was over 50 percent in both years and increased between 1979 and 1984 (Table 17). The average catch per net night doubled from 1979 to 1984 indicating that an increase in population of this species may have occurred between sampling periods.

In 1984 a total of 160 gamefish (53 percent of the catch) and 140 nongame fish (47 percent of the catch) were collected from gillnet sampling. The 1979 gillnet sampling showed a difference in the ratio of 46 percent gamefish to 54 percent nongamefish (Table 18).

Table 18. Total number and percent composition of two fish groups (nongamefish-gamefish) and peamouth from combined spring, summer, and fall gillnetting in Whitefish Lake in 1979 and 1984.

Year	Gamefish		Nongamefish		Peamouths	
	Number	Percent	Number	Percent	Number	Percent
1979	333	46	391	54	60	8
1984	160	53	140	47	1	<0.00

A sharp decline in the catch of peamouth in the 1984 gillnet sampling contributed to the reversal in the composition between game and nongamefish species. From the total of 391 nongame fish collected in 1979, 60 were peamouth, 15 percent of all nongame fish. The peamouth catches were well dispersed throughout the seasons and in surface and bottom net sets. In contrast, only 1 peamouth out of 140 nongamefish was caught during 1984. The cause of this decline in the catch of peamouth is unknown. It raises further questions about the unknown interactions occurring in the fisheries of Whitefish Lake since the establishment of northern pike and *Mysis relicta* by 1976 (Anderson and Domrose 1981).

Little Bitterroot Lake

From a total of 210 fish collected in Little Bitterroot Lake during 1984 gillnet sampling, 16 fish were collected in 24 surface nets and 194 fish were collected from 12 sinking nets (Table 19). Gamefish composition was 30 percent (62) and non-gamefish composition was 70 percent (148) of the total catch.

Table 19. Percent abundance and catch per net night by species and net type of gamefish from combined spring, summer, and fall gill netting on Little Bitterroot and McGregor lakes in 1984. Percents were calculated from the combined total of game and nongame fish collected by net types.

LITTLE BITTERROOT LAKE

	Net Type (Number of Sets)			
	Bottom(12)		Surface(24)	
Species	Percent Abundance(#)	Catch/ Net Night	Percent Abundance(#)	Catch/ Net Night
Rainbow trout	5.2(11)	0.8	6.3(1)	<0.1
Westslope cutthroat	1.0(2)	0.2	12.5(2)	0.1
Kokanee	12.5924)	2.0	81.2(13)	0.5

MCGREGOR LAKE

	Net Type (Number of Sets)			
	Bottom(9)		Surface(18)	
Species	Percent Abundance(#)	Catch/ Net Night	Percent Abundance(#)	Catch/ Net Night
Lake trout	61.4	10.8	84.6(11)	0.6
Rainbow trout	8.9(14)	1.6	15.4(2)	0.1
Mountain whitefish	12.6(20)	2.2	0.0	0.0

Rainbow trout were collected mostly in bottom sets during June and September. The fewest numbers were collected in the netting area located at the south end of the lake near the outlet (Figure 4). Distribution of the catch was nearly equal in the remaining two netting areas. The distribution of rainbow trout in Little Bitterroot Lake was similar to Lake Koocanusa (Huston, et al. 1984). Investigations on Lake Koocanusa found that most rainbow were bottom oriented and evenly dispersed throughout the reservoir in near shore areas.

Only 4 westslope cutthroat trout were collected in the net sampling. They were probably older fish remaining from the last cutthroat plant made in 1981.

Most of the kokanee were caught in surface nets during the September sampling. These maturing fish were still dispersed throughout the lake, but the netting area located near their spawning grounds at the north end of the lake caught 61 percent of the total during September.

The remaining kokanee were caught in the spring sampling period. Their numbers were almost evenly distributed over the three sampling areas and between surface and bottom nets. These fish were shoreline oriented at some point during the 12-hour sampling period since many were caught in shoreline bottom sets.

Other fish species collected in the 1984 sampling were peamouth (67), longnose sucker (72), yellow perch (17), and pygmy whitefish (1).

Independent of the scheduled seasonal sampling one each bottom and surface gill nets were set under the ice at net area 3 in March. No fish were caught in the surface net, but 1 rainbow was collected in the bottom set.

McGregor Lake

From a total of 272 fish collected in McGregor Lake during the 1984 gillnet sampling, 13 fish were collected in 18 surface nets and 259 fish were collected in 9 bottom nets. A total of 60 percent (164) were gamefish and 40 percent (108) were nongamefish species.

Nongamefish species collected were longnose suckers (81) and yellow perch (27); all were caught in bottom nets.

Lake trout were the most abundant fish collected in McGregor Lake gillnet sampling during 1984 (Table 19). A total of 108 were caught, 97 in bottom nets and 11 in surface nets. Their catch per net night for the combined season is much higher than the 1979-1984 gillnet sampling of Whitefish Lake and the 1980-

1981 sampling of Flathead Lake (Leathe 1982). They were numerous in the samples during all seasons and dispersed throughout the netting areas (Figure 3).

Of the 16 total rainbow caught in McGregor Lake, 11 were collected at net area 2 located in the middle section of the lake. A total of 14 were caught in surface nets and 2 were caught in bottom nets, all near the shoreline (Figure 3).

All mountain whitefish were caught in bottom nets and 19 of a total of 21 were collected from net area 2 (Figure 3). Their seasonal collection numbers at this station were 7 in the spring, 6 in the summer, 5 in the fall, and 1 in the winter. Two were caught in net area 3 during the fall.

Most of the rainbow, mountain whitefish, and yellow perch were caught in net area 2 (Figure 3). More sites should be sampled in future years to see if other areas have comparable use by these fish species.

Independent of the scheduled sampling, two bottom and one surface gillnets were set under the ice in March, 1984, at net areas 2 and 3 (Figure 3). A surface net, set exclusively at area 2, caught no fish, but the bottom nets set at both areas collected fish. The net at area 2 caught 12 lake trout and 1 mountain whitefish and the net area 3 caught 5 lake trout and 2 longnose suckers (Figure 3).

CONCLUSIONS

Whitefish Lake

The lake has four abundant year classes of catchable size lake whitefish beginning at age III. Their development into a sport fishery has been slow, though they are considered tasty by many people. Their availability and the best angling methods are unknown to many local anglers. Most fishing pressure along with a very successful catch rate occurs during a four to eight week period in December, January, and February when the mature fish are concentrated in shallow areas near shorelines for spawning and the lake is usually frozen, so easy access is available.

Indications are that catch and growth rates of northern pike have slowed in the lake since 1979. Information from anglers is that fewer large fish are being harvested since 1979. This lake is not considered a good candidate for an intensive northern pike fishery because of low numbers of suitable forage fish and lack of good spawning and rearing habitat. It has produced several larger pike however with the largest weighing 33 pounds.

Although the annual stocking rate of westslope cutthroat trout has increased since 1979, no increase in the population has been measured. Loss to predation by northern pike is one possible cause. It could often occur during the spring, summer, and fall when the trout frequently feed on surface insects near shoreline areas. Another reason could be their loss from the lake by out-migration.

Lake trout abundance in Whitefish Lake appears high. The growth rates during their early years compare favorably with many lakes in the U. S. and Canada, though complaints from anglers indicate that harvest of larger fish may be declining.

Recommendations

Information regarding methods to improve local angling success for lake whitefish should be solicited from other states and shared with interested anglers through the local communications media and personal contacts.

An effort to improve the westslope cutthroat trout fishery should be attempted in the near future in Whitefish Lake. A survey of the spawning and rearing habitat should be made to determine the feasibility of rehabilitation by chemical supression of the resident inlet fish populations followed with imprint plants of adfluvial westslope cutthroat. Annual stocking numbers should be increased to 300,000 or more subcatchable sized fish with monitoring of the outlet to assess downstream losses. Northern pike stomach samples should be analyzed to assess predation losses.

Investigation of the lake trout population should be conducted with emphasis on the capture of larger fish for examination of growth rates and food habits. Of particular interest is the utilization of lake whitefish as a food item by the larger lake trout. This could be critical to the maintenance of a trophy lake trout fishery since the decline of kokanee salmon. This information could also be used as a management aid for other regional lakes where establishment of a forage fish base for lake trout is being considered.

Monitoring of the *Mysis* and plankton communities should continue in conjunction with other lakes impacted by *Mysis* introductions, to record and learn the effects on various plankton and fish communities in different types of lake habitat.

The introductions of other exotic organisms, including new fish species, is not recommended at this time as structural changes in some biological communities may be on-going.

Little Bitterroot Lake

The status of the kokanee population in Little Bitterroot lake is unknown. The average length of fall spawners has remained 11.0 inches or less over many years and to date has not responded with increased average size since planting was discontinued in 1980. This may be the result of competition on a plankton food base too limited to support improved growth at current population densities. The current fishing pressure for this species remains very low during all seasons.

Low densities of the cladoceran (Daphnia) found in the 1984 sampling is of some concern. The importance of this organism as a kokanee food source has been well established by many food habit studies. If low densities of Daphnia continues in future years, it may result in dependence on small Bosmina as a food source. This could reduce survival and growth and limit kokanee harvest potential to low total numbers or at best just one-year class of small three-year old fish. Morgan (1981) investigated the impacts of Mysis relicta introduction on four subalpine lakes. The Daphnia populations were eliminated and healthy Bosmina populations continued to survive. A similar effect on the plankton community may be occuring in this lake.

The wild trout in Little Bitterroot Lake produce a trophy fishery with some individuals greater than 5 pounds and a few greater than 15 pounds reported. Electrophoretic analysis of 30 juvenile rainbow collected in the spring of 1985 from the spawning inlet (Herrig Creek) was conducted by the University of Montana genetics laboratory. Individuals of pure rainbow trout (Salmo gairdneri) and hybrids with various proportions of westslope cutthroat trout (Salmo clarki lewisi) were found in the sample. This indicates that populations of both species may spawn together in Herrig Creek and produce individual offspring with one or both of the above genetic characteristics. Producing an acceptable broodstock from these wild trout populations would be extremely difficult or impossible.

Subcatchable rainbow trout have been stocked since 1983 to supplement this wild trout fishery with poor results. The possibility of losses by outmigration downstream should be considered. Spot creel census checks have yielded poor results. Angler contacts were rare and may be indicative of an overall poor quality lake fishery. Most fishing pressure seems to occur during the winter months with anglers concentrated near the mouth of Herrig Creek and selecting for larger size trout.

In October 1984, 85,000 Eagle Lake rainbow trout were introduced. This strain was used in an attempt to establish a piscivorous trout which lives longer and grows larger than the present Arlee strain. Apparent severe downstream losses from outmigration thwarted this effort.

Recommendations

Assess the extent of natural reproduction of wild rainbow by trapping Herrig Creek during May and June to monitor the spawning run. Make redd counts after their spawning is completed, to compare with numbers of spawners counted and also learn the distance of their migration.

Spawning success in Herrig Creek may be limited by few spawning areas, high levels of sediments in the gravels, and high water temperatures and low flows in late summer. Consideration could be given to the possibility of supplementing the wild trout reproduction by collecting wild trout eggs, raising them in the hatchery to fingerling size and restocking. This could increase production without further genetic contamination of wild stocks.

If use of hatchery fish is continued, consideration should be given to the use of other rainbow strains or species to overcome the apparent poor success of Arlee rainbow plants. Selection of the strain of rainbow should consider the possibility of increasing the trophy fishery. Kamloops rainbow is a good candidate since it grows to a large size when feeding on kokanee which is probably the most abundant forage fish found in this lake. Future consideration could also be given to the introduction of smallmouth bass, Micropterus dolomieui to utilize the abundant crayfish in the lake and provide a better summer fishery. This probably should be delayed, however, until attempts at improving the salmonid fishery are made and assessed.

Kokanee densities should be measured, their food habits investigated along with monthly plankton and Mysis monitoring to determine the effects of Mysis competition on their growth and survival.

McGregor Lake

Numerous small lake trout inhabit McGregor Lake. They are harvested throughout the year, in summer predominately by trolling and in winter by jigging. The creels are comprised of fish sizes ranging from one to three pounds with rare occurrence of larger specimens ranging up to twenty plus pounds. Their flesh is pinkish colored and many anglers have expressed satisfaction regarding their taste.

Plankton, Mysis, terrestrial insects and other aquatic organisms are the prevalent food items for all age classes. Extremely low availability of forage fish results in few lake trout growing to a size greater than five pounds.

Reports from other lakes are that lake trout spawn as early as age IV, exhibit slow growth, and have shorter life spans when they feed predominately on plankton at all ages (Carlander 1969). More evidence is needed to confirm or refute this possibility in McGregor Lake. No fish older than age V were found in the 1984 sampling and determining the earliest age of spawning year classes was not considered. In future investigations of lake trout, their at spawning and life spans should be considered.

The survival of stocked rainbow trout to catchable size is unknown. Reports from anglers are spotty, though occasional good catches are reported. One concern is predation on the younger hatchery fish by lake trout. It is believed that subcatchable size 4 to 6 inch rainbow are less vulnerable to lake trout predation than the smaller kokanee fingerling and fry plants of previous years.

The mountain whitefish population seems low for unknown reasons. The food base should be adequate to support a larger population of this species. Their low numbers may be caused by inadequate spawning habitat and some combination of lake trout competition and predation.

Recommendations

Continue annual spring stocking of subcatchable size rainbow trout. Conduct spot creel census checks during the winter and summer seasons along with a spring and fall gill netting series to determine angler and stocking success. If needed, increase the plants by increments of 100,000 annually to see if improved returns may be obtained.

Consideration should be given to the introduction of a forage fish for lake trout. It should be investigated thoroughly and proceed with caution however, as introductions of a new fish species may upset the present balance and cause undesirable effects within the existing fish communities (Mosher 1984).

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Waters referred to:

Lake--water code	Rivers/Streams--water code
Flathead Lake 07-6400	Flathead River 07-1560
Little Bitterroot Lake 07-7300	Herrig Creek 07-2060
McGregor Lake 05-9216	Whitefish River 07-4980
Whitefish Lake 07-9540	

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