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MYSIS MONITORING IN WESTERN MONTANA LAKES

1983-1984

Prepared by

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Job Title:

Inventory of waters of the project area.

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17 p.

ABSTRACT

In 1968, 1975, and 1976 opossum shrimp (Mysis relicta) were planted into several northwestern lakes of Montana in an attempt to supplement food organisms for trout and salmon. A monitoring program was initiated in June, 1983, to provide information on Mysis populations and their impacts on fisheries and plankton communities. Sampling from six selected lakes during 1983 and 1984 revealed Mysis densities (no./m^3) ranging from 0.0 in Flathead Lake to 3.35 in Whitefish Lake.

OBJECTIVIES

The primary objective of this project is to determine fisheries potential of lakes and streams by obtaining chemical, physical, and biological parameters for management of sport fish species. A secondary objective is to provide baseline data for lakes that contain both Mysis and kokanee salmon.

INTRODUCTION

Numerous lakes in the northwestern United States and Canada have been planted with opossum shrimp (Mysis relicta) as supplement food organisms for trout and salmon. Studies on several lakes indicate that mysid establishment may have significant adverse impacts on kokanee salmon (Oncorphnchus nerka) populations. During 1968, 1975, and 1976 opossum shrimp were planted into several lakes in northwestern Montana (Figure 1). Efforts to assess the planting success have taken place intermittently since 1975 and include some downstream lakes that may have received Mysis through drift (Domrose 1982). During 1983, six Montana lakes containing kokanee and mysid populations were selected for monitoring. Mysis life history investigations are also being conducted by the University of Montana Biological Station at Yellow Bay on Flathead Lake (Bukantis 1984).

METHODS

Six lakes containing both kokanee and Mysis shrimp were selected for monitoring: Ashley, Little Bitterroot, Flathead, McGregor, Swan, and Whitefish Lakes (Figure 2). Two sampling stations were designated in subbasins of greatest depth in each individual lake with the exception of Flathead where three stations were selected (Appendix A).

During 1983, a one-meter diameter by three-meter length conical net, with 1.35 millimeter (1350 micron) mesh was used to determine mysid abundance. A one liter detachable flow-through bucket was mounted on the cod end. The net was lowered with the aid of a 2.27 kilogram weight and retrieved at a rate of approximately 0.35 meters per second. Replicate 30 meter vertical net hauls were made to determine mysid abundance in the water column. Mysis

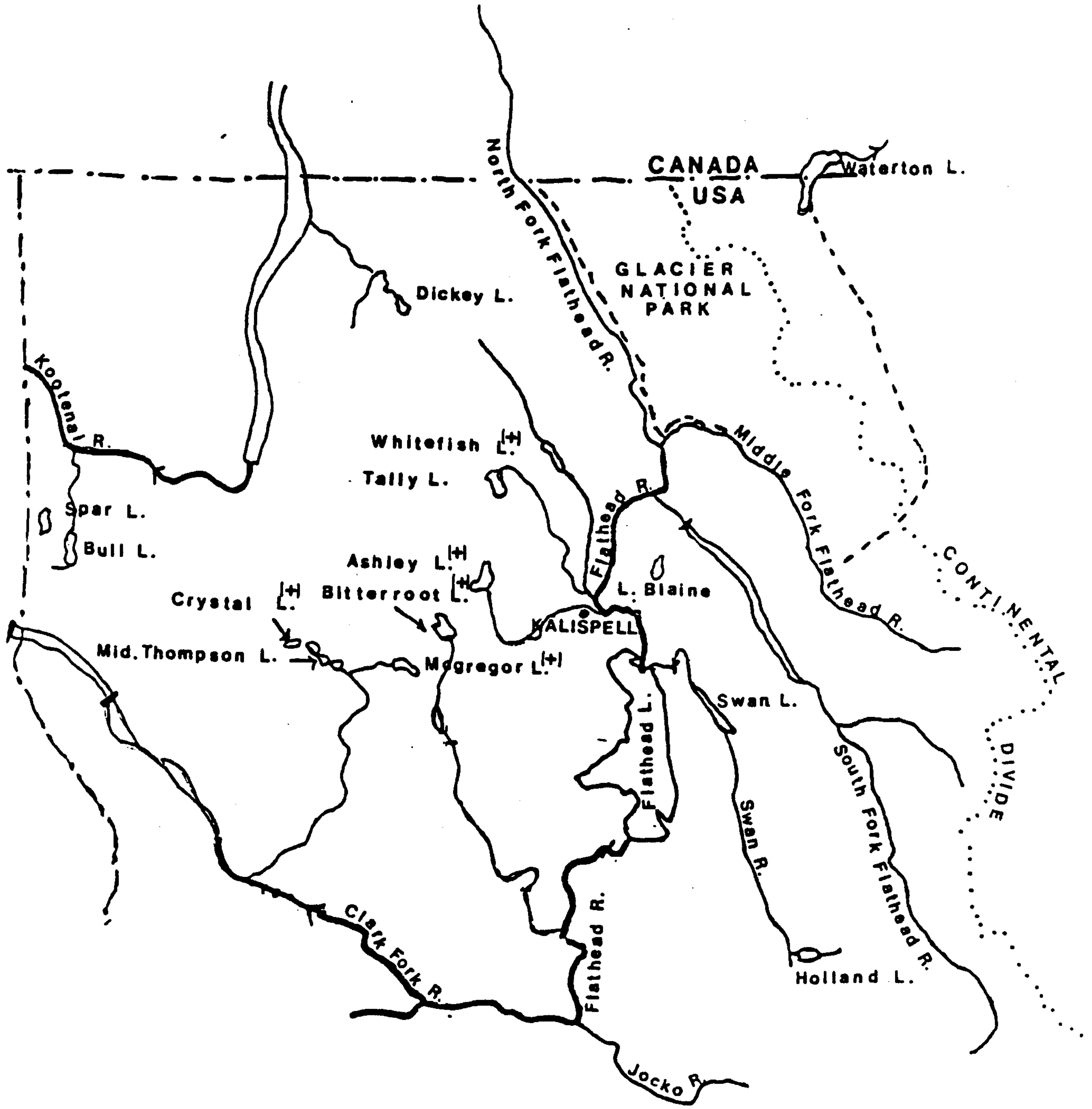


Figure 1. Location of <u>Mysis</u> introductions into Northwestern Montana lakes. (+) denotes initial introductions made in 1968 (Domrose 1982).

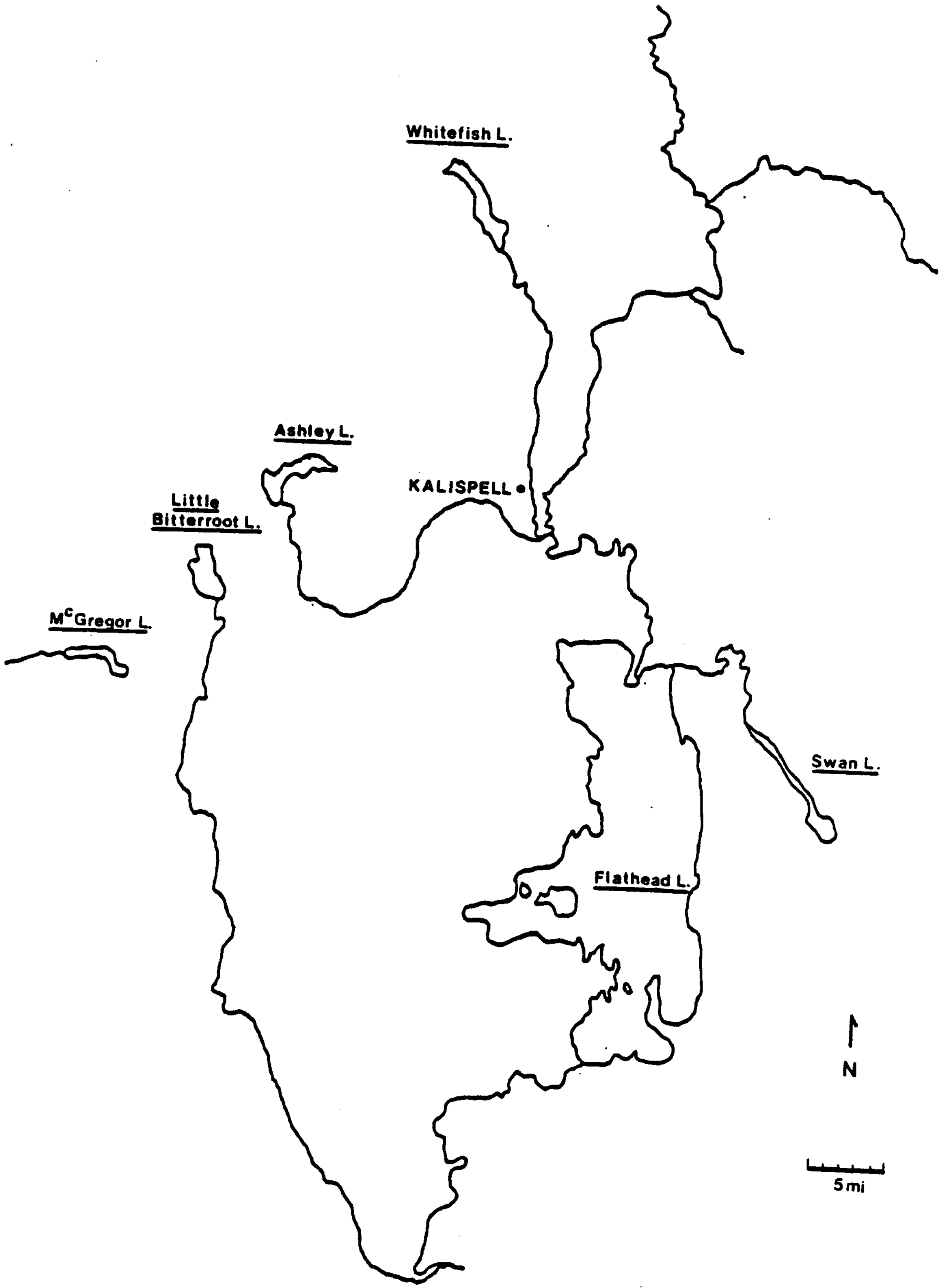


Figure 2. Six lakes selected for *Mysis* monitoring in northwestern Montana.

samples were preserved in 10 percent formalin, counted, and total length of individuals recorded (tip of telson to tip of rostrum).

Samples were collected during the "dark" phases of the moon in early June approximately two hours after sunset. Thermal stratification of the lakes was assumed to be minimal at this time, hence mysids should have been distributed within the upper limits of the water column (Reiman and Falter 1981). Water temperature profiles were recorded with a resistance thermometer at one of the stations on each lake on the same day Mysis hauls were conducted.

During 1984, techniques were modified slightly. In addition to the 30 meter hauls, replicate hauls through the entire water column were made to determine total mysid abundance. These collections were made using a new conical net with a diameter of one meter and length of two meters. Nitex netting was used having a mesh size of 0.05 millimeters (500 micron). A comparison between nets (1.35mm vs 0.05mm) was conducted during June, 1984, on Whitefish Lake to evaluate capture efficiency.

RESULTS

A comparison between the 1.35mm and 0.5mm mesh nets is shown in Table 1. Mysis were categorized into ≤ 10m and > 10mm total length groups to separate juveniles from adults (R.Bukantis, unpublished data). The large mesh net (1.35mm) appeared to be equally effective in capturing adult mysids (> 10mm) as the small mesh net (0.5mm). However, when comparing the nets for juvenile mysids (≤ 10mm), the 0.5mm mesh net was nearly ten times more effective (Table 1).

Table 1. Comparison of Mysis capture efficiency in 30 m vertical hauls using large and small-meshed nets in Whitefish Lake during June, 1984.

Mesh Size (mm)	Number/Tow 1	2	3	Average No. Caught
	Mysis > 10mm			
1.35	16	6	4	8.67
0.5	4	8	13	8.33
	Mysis ≤ 10mm			
1.35	3	2	3	2.67
0.5	19	20	21	20.0

The average densities of all mysids (no./m^3) from the lakes monitored ranged from 0.0 in Flathead Lake to 3.35 in Whitefish Lake during June of 1983 and 1984 respectively (Table 2). A comparison between these two years may not

Table 2. Densities of all Mysis/m³ collected in replicate 30 meter vertical net hauls from northwest Montana lakes during June of 1983-84. The average density represents a mean value for stations sampled on each individual lake.

Lake	Station	1983 Mysis/m³	1983 X/m³	1984 Mysis/m³	1984 X/m³
Ashley	E	0.06	0.11	0.08	0.11
	W	0.15		*0.13	
L.Bitterroot	N	0.38	0.40	0.32	0.22
	S	0.42		0.11	
Flathead	N	-0-	-0-	0.02	0.11
	NE	-0-		0.19	
	S	-0-		0.11	
McGregor	E	0.17	0.41	0.15	0.35
	W	0.65		0.55	
Swan	N	1.49	1.36	*1.34	1.81
	S	1.23		*2.27	
Whitefish	N	2.61	3.35	2.78	2.53
	S	4.08		2.27	

*Indicates total depth haul used.

be valid due to the effectiveness of the two nets used. For this reason, a comparison of the densities of adult mysids only is included from June, 1983 and 1984 in Table 3. Mysis were first documented in Flathead Lake in September of 1981 (Leathe 1982) but were not collected with the smaller nets used in this monitoring program until June, 1984.

Mysids were not limited to the top 30 meters of the water column in lakes sampled during June of 1984 (Table 4). Half of the lakes sampled showed higher densities in hauls through the entire water column when compared to 30 meter hauls. Limited thermal stratification had occurred by the time of sampling and appeared to affect vertical distribution (Figure 3).

Table 3. Densities of adult (> 10mm) *Mysis*/m^3 collected in replicate 30 meter vertical net hauls from northwest Montana lakes during June of 1983-84. The average density represents a mean value for stations sampled on each individual lake.

Lake	Station	1983 Mysis/m^3	1983 $\bar{X}/m^3$	1984 Mysis/m^3	1984 $\bar{X}/m^3$
Ashley	E	0.04	0.04	0.02	0.01
	W	0.04		*-0-	
L.Bitterroot	N	0.11	0.25	-0-	0.03
	S	0.38		0.06	
Flathead	N	-0-	-0-	-0-	-0-
	NE	-0-		-0-	
	S	-0-		-0-	
McGregor	E	0.13	0.21	0.06	0.05
	W	0.28		0.04	
Swan	N	0.82	0.65	*0.92	0.79
	S	0.49		*0.65	
Whitefish	N	0.45	0.62	0.45	0.37
	S	0.79		0.30	

*Indicates total depth haul used.

Table 4. Average densities of all *Mysis* (no./m^3) in 30 meter and total depth vertical net hauls in six lakes during June, 1984.

Lake	Haul 30mm	Haul Total Depth
Ashley	0.11	0.31
L.Bitterroot	0.22	0.39
Flathead	0.11	0.08
McGregor	0.35	0.23
Swan	1.81	1.84
Whitefish	2.53	1.56

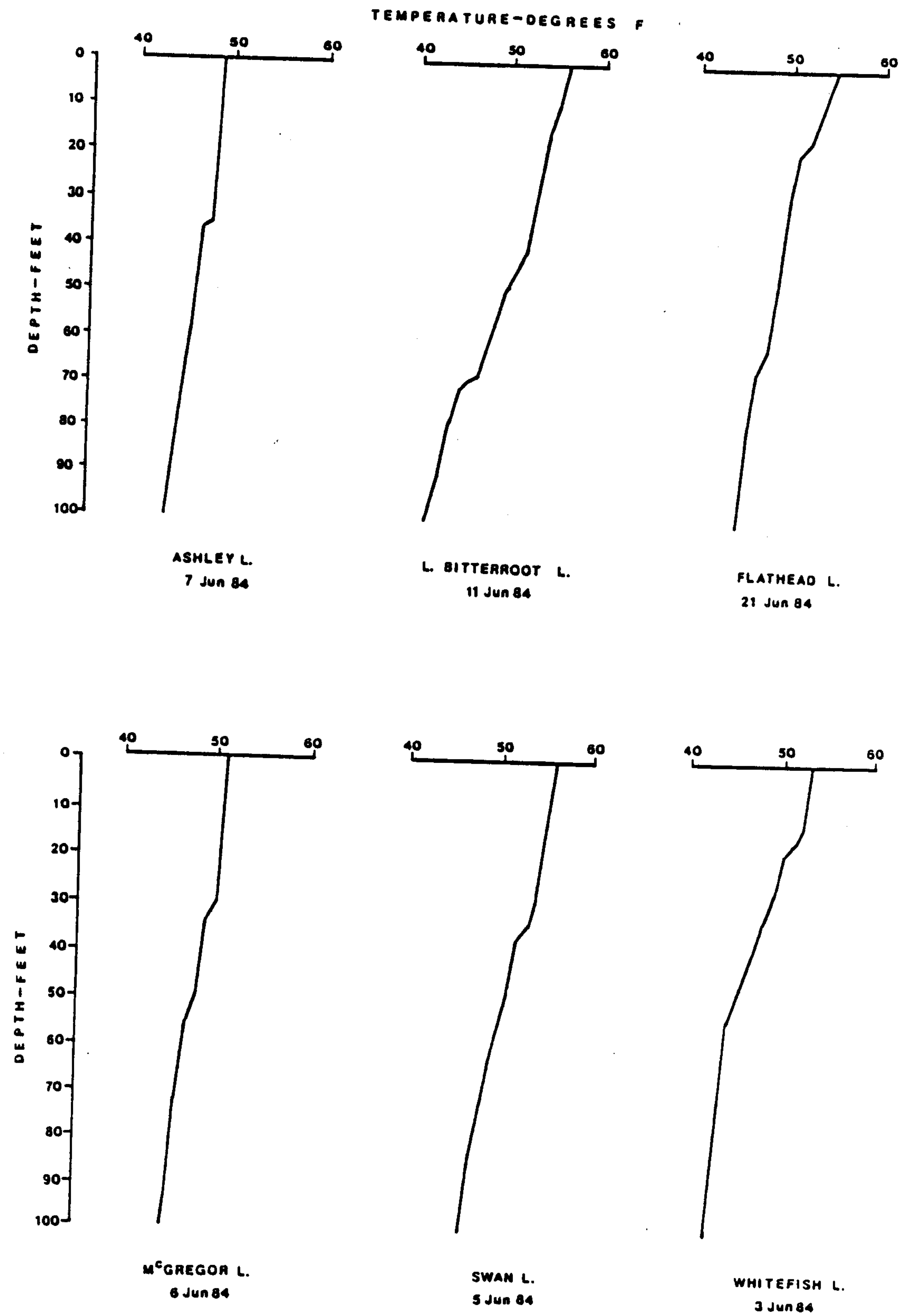


Figure 3. Temperature profiles from six northwestern Montana lakes during *Mysis* monitoring (June 1984).

DISCUSSION

Mysis populations have been well established (contain measurable densities) in Ashley, Little Bitterroot, McGregor, and Whitefish Lakes since 1976 (Domrose 1982). *Mysis* became established in Swan Lake by 1980 while Flathead Lake did not contain measurable densities until 1984.

Following the establishment of *Mysis* in 1976, Whitefish Lake experienced a collapse in the Kokanee fishery. However, kokanee populations in Ashley, Little Bitterroot, and Swan Lakes exhibited no decline in kokanee since mysid establishment. Angler catch limits were increased on these three lakes during 1983 due to their high densities of small-sized kokanee.

Why *Mysis* appear to be affecting kokanee populations in some lakes and not in others is unknown. Through continued monitoring of *Mysis* and kokanee population trends, we hope to define the relationship between *Mysis* and kokanee to develop more effective kokanee management programs.

LITERATURE CITED

Bukantis, R. 1984. Comparative life history studies of Mysis relicta (Loven) in Flathead Basin lakes and effects of Mysis introduction on the zooplankton of those lakes: A preliminary proposal. University of Montana Biological Station. Unpublished Data.

Bukantis, R. Personal Communication. 1984.

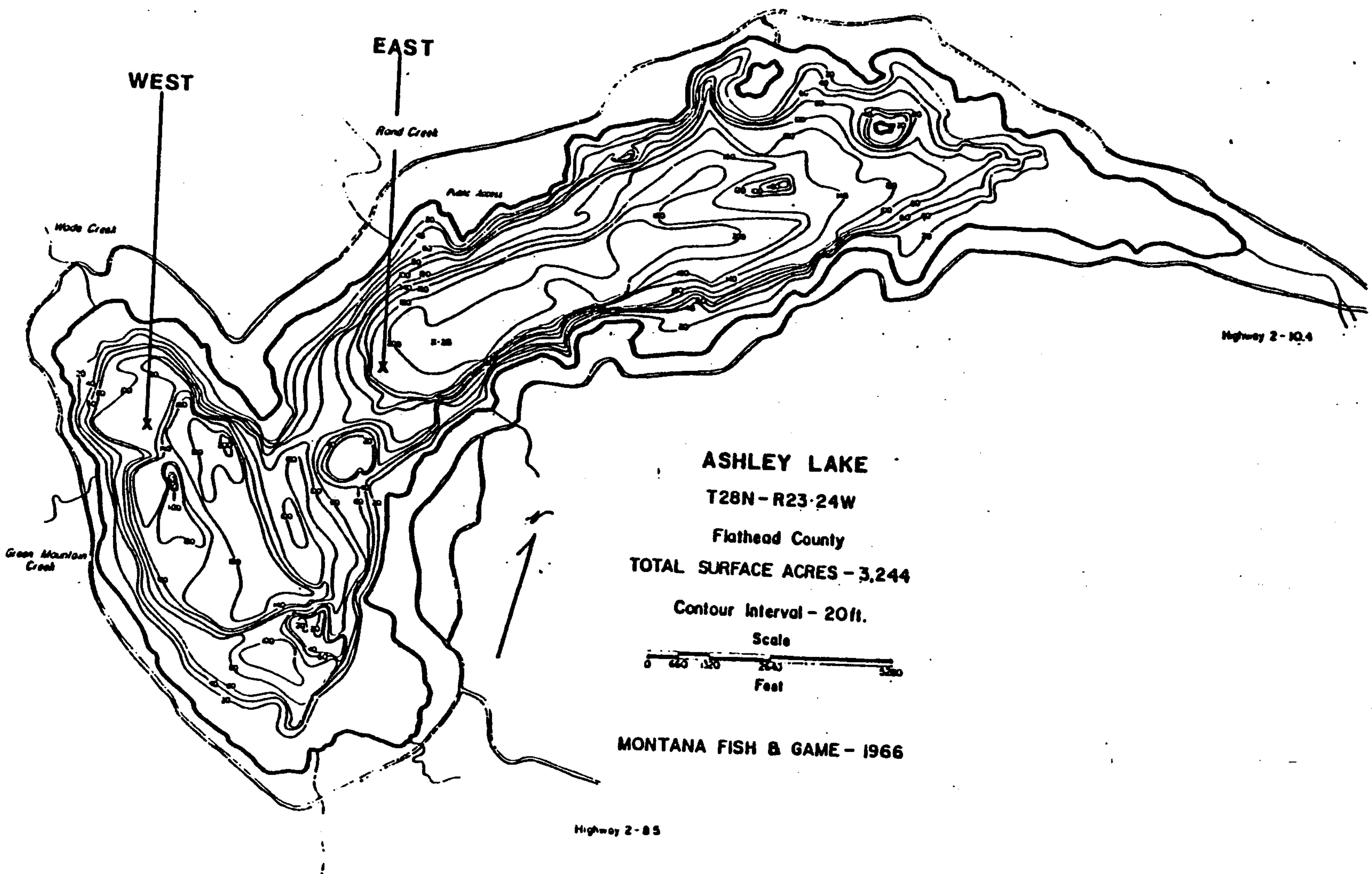
Domrose, R. 1982. Mysis introductions into Western Montana, Dept. of Fish, Wildlife and Parks, Kalispell, MT. 5 p.

Reiman, B. E. and C. M. Falter 1981 Effects of the establishment of Mysis relicta on the macrozooplankton of a large lake. Trans. AM. Fish. Soc. 110:613-620.

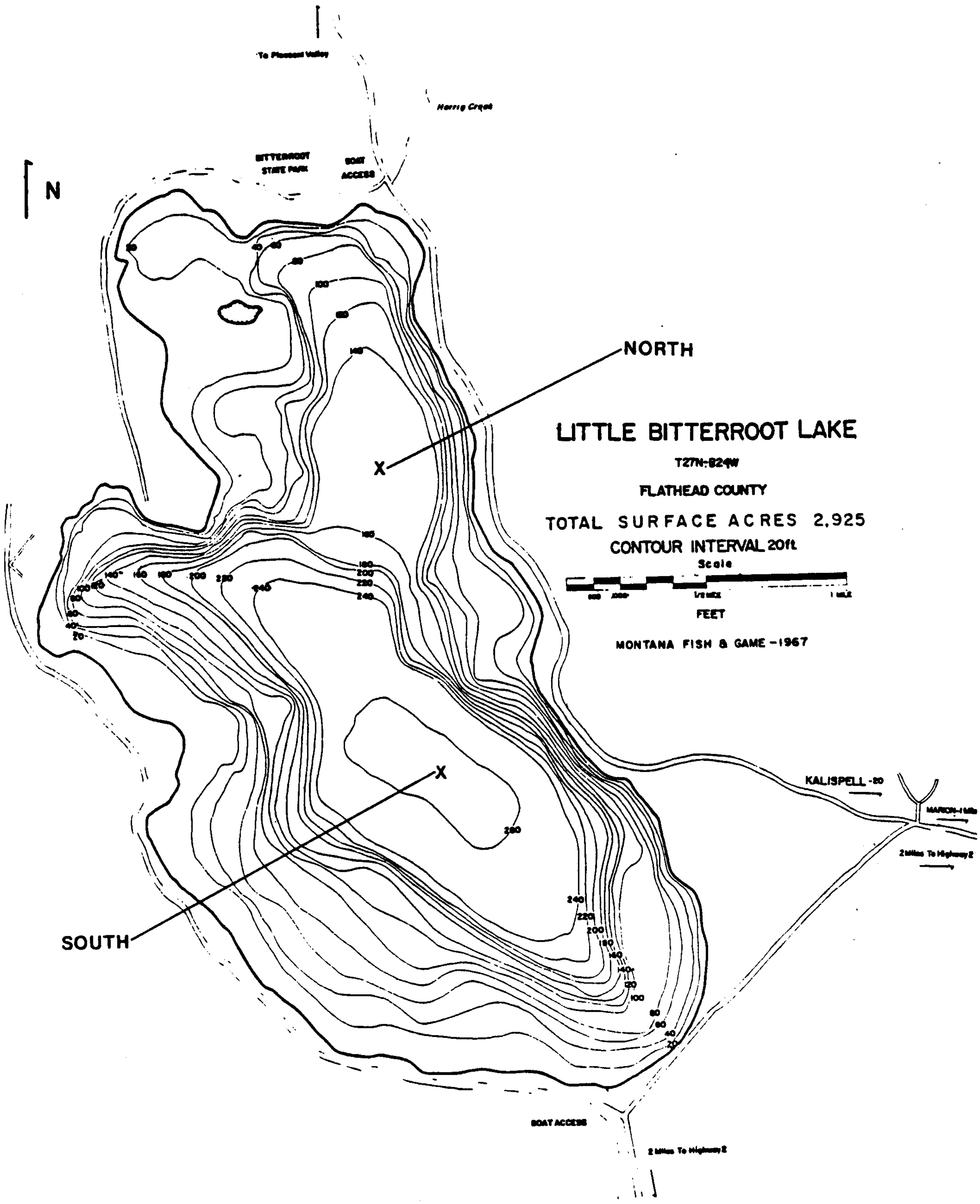
Leathe, S. A. and P. J. Graham 1982. Flathead Lake fish food habits study. Montana Dept. of Fish, Wildlife and parks, Kalispell, MT. Final Report.

APPENDIX A

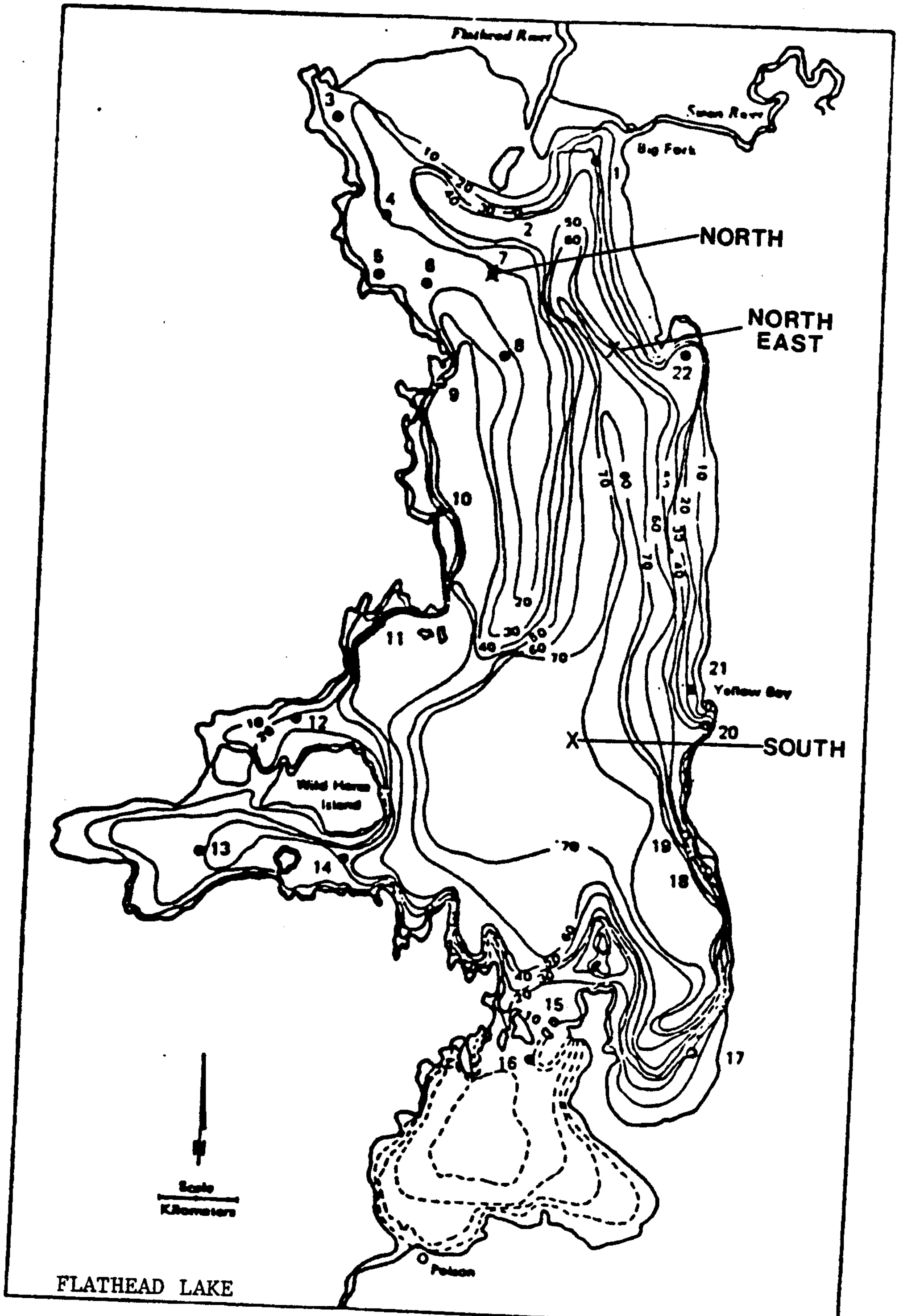
Lakes selected for *Mysis* monitoring in northwest Montana and representative sampling stations.


WEST
EAST
Rand Creek
Public Access
Wade Creek
Green Mountain Creek
Highway 2-10.4
Highway 2-85
ASHLEY LAKE
T28N-R23·24W
Flathead County
TOTAL SURFACE ACRES - 3,244
Contour Interval - 20ft.
Scale
Feet
MONTANA FISH & GAME - 1966

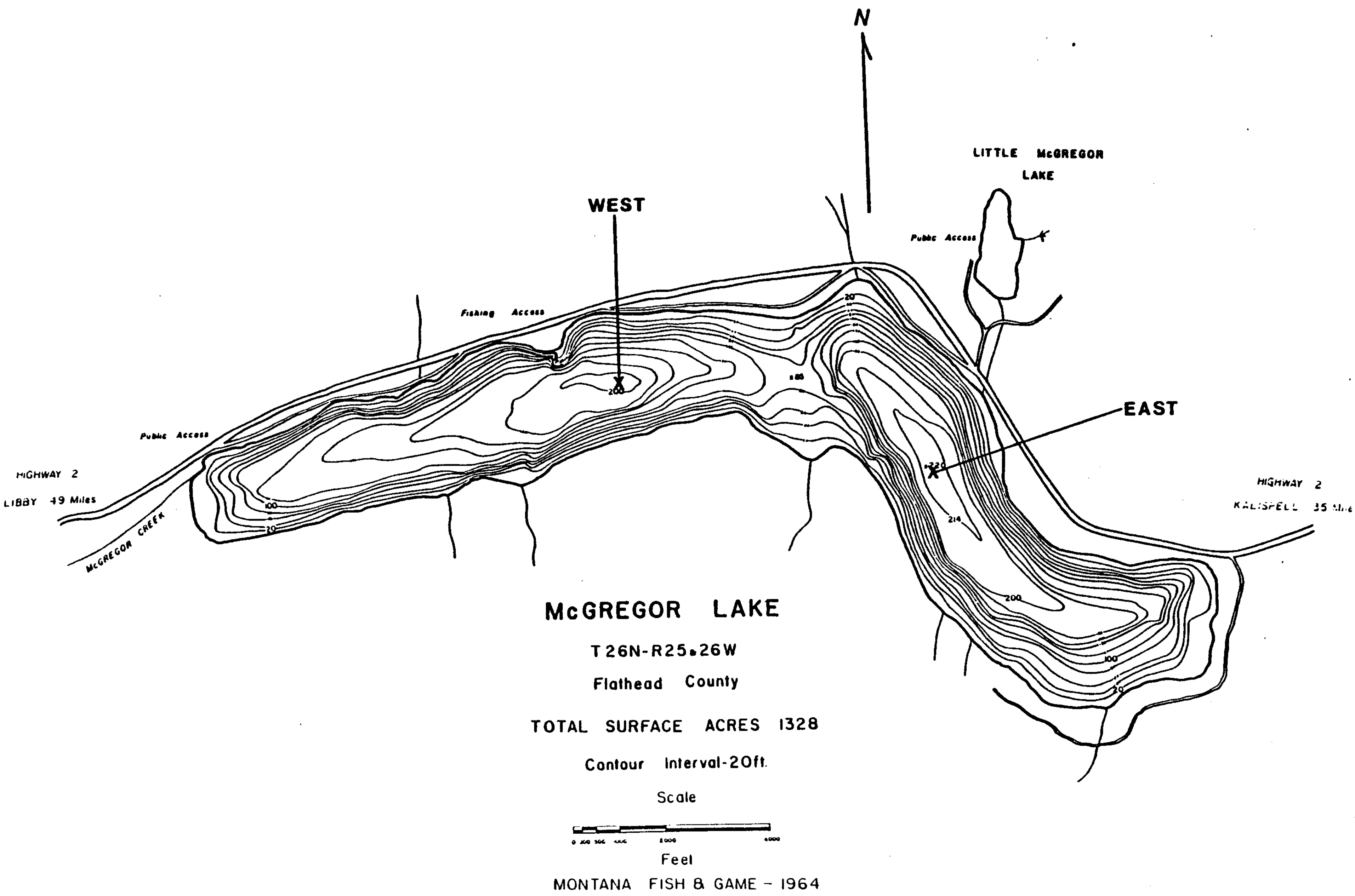
Appendix A1


N
NORTH
LITTLE BITTERROOT LAKE
T27N-R24W
FLATHEAD COUNTY
TOTAL SURFACE ACRES 2,925
CONTOUR INTERVAL 20ft.
Scale
FEET
MONTANA FISH & GAME-1967
SOUTH
KALISPELL-20
BOAT ACCESS

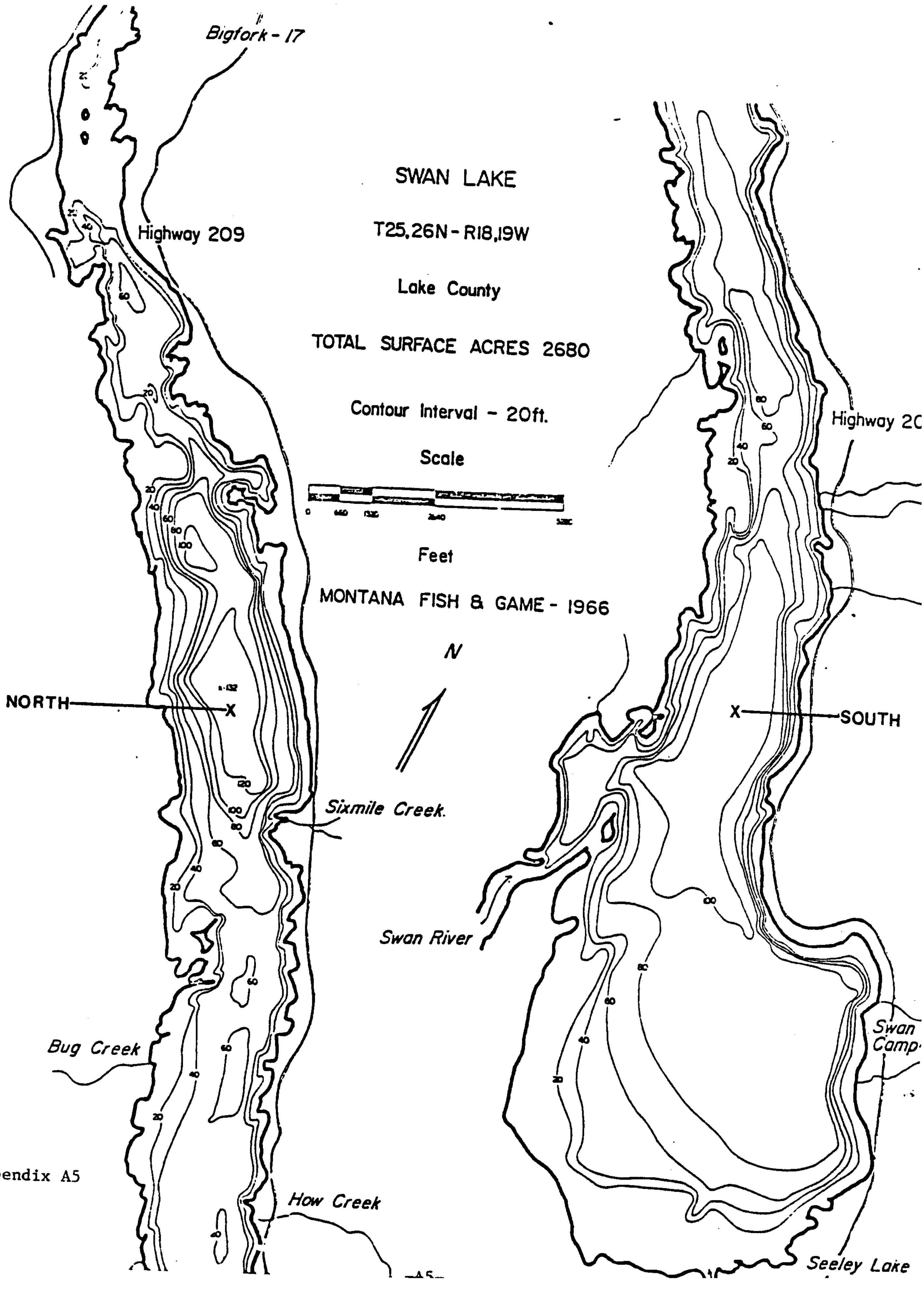
Appendix A2



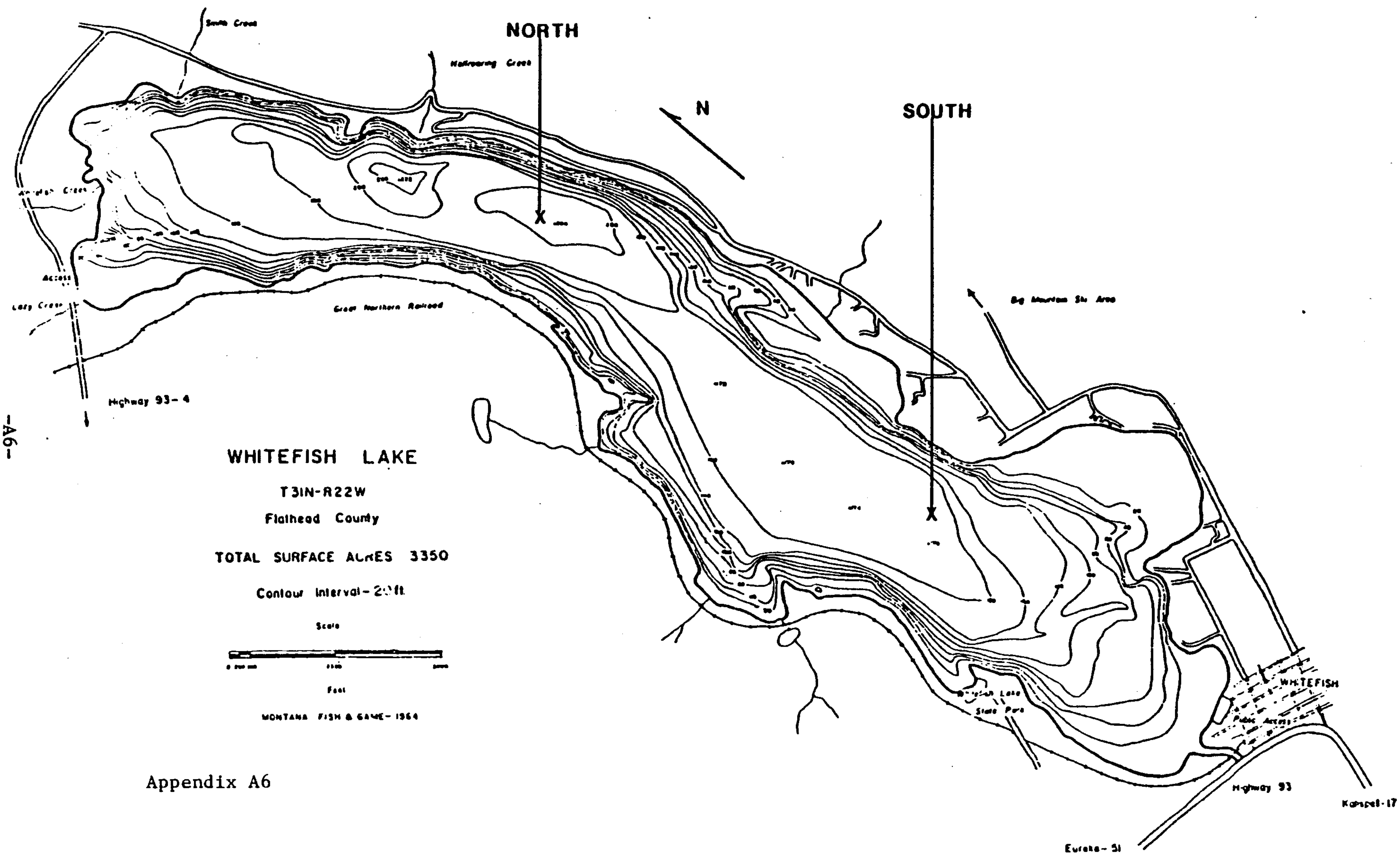
Appendix A3 Flathead Lake, Montana showing bottom contours (meters) and sampling stations.


N
LITTLE McGREGOR
LAKE
Public Access
WEST
EAST
Fishing Access
Public Access
HIGHWAY 2
LIBBY 49 Miles
McGREGOR CREEK
HIGHWAY 2
20
100
200
214
220
McGREGOR LAKE
T26N-R25 & 26W
Flathead County
TOTAL SURFACE ACRES 1328
Contour Interval-20ft.
Scale
Feet
MONTANA FISH & GAME - 1964

Appendix A4


Bigfork - 17
Highway 209
SWAN LAKE
T25,26N - R18,19W
Lake County
TOTAL SURFACE ACRES 2680
Contour Interval - 20ft.
Scale
Feet
MONTANA FISH & GAME - 1966
N
NORTH
SOUTH
Sixmile Creek.
Swan River
Bug Creek
How Creek
Seeley Lake

Appendix A5


NORTH
SOUTH
N
Halfroaring Creek
Big Mountain Ski Area
Great Northern Railroad
Highway 93-4
Lazy Creek
Access
WHITEFISH
Public Access
Whitefish Lake State Park
Highway 93
Kalispell-17
Eureka-51
WHITEFISH LAKE
T31N-R22W
Flathead County
TOTAL SURFACE ACRES 3350
Scale
Feet
MONTANA FISH & GAME-1964

Appendix A6