MONTANA FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

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Project Title:	STATEWIDE FISHERIES MANAGEMENT PROGRAM	Job Title:	SOUTH CENTRAL MONTANA WARMWATER FISHERIES INVESTIGATIONS

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ABSTRACT

Water levels dropped to record lows in Bighorn Lake in 1994 following a warm dry spring that caused peak inflows to occur more than a month early. These conditions did not change until the spring of 1995 when above normal spring precipitation and runoff pushed the lake into the flood pool.

Walleye sampling data and movement information are summarized for 1994 and the spring of 1995. Poor weather conditions in 1994 contributed to a poor walleye egg take in the spring from Bighorn Lake. Walleye egg collection activities at Bighorn were totally suspended in 1995.

Fifteen ponds were stocked with largemouth bass and four with channel catfish in 1994. Sampling and stocking data are summarized for many of the warmwater fisheries in the region.

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PROCEDURES

Water level data for Bighorn Lake was obtained from the Montana Projects Office of the Bureau of Reclamation (USBR) in Billings and from summaries in their annual operating plan (USBR 1994). All data were collected and summarized using the USBR Hydromet system.

Electrofishing was conducted using a fixed-boom electrofishing boat powered by an outboard jet motor. Electrofishing equipment included a 6,500 watt generator and Coffelt VVP-15 shocking box. Direct current at 250 to 300 volts and 10-12 amps was used on most waters. Pulse AC current was utilized on some night electrofishing for largemouth bass. Walleye and largemouth bass shocking were conducted at night. Rivers were electrofished during the day.

All walleye collected during spring egg-taking operations were separated by sex and held in live cages suspended from the government dock in Box Canyon. Eggs were stripped from the females into a large, flat, dry pan and fertilized using milt from two or three males. Milt was expressed into a quart of water, mixed and poured over the eggs for fertilization. Once fertilized, eggs were treated with a solution of Fullers earth to prevent clumping, water hardened in screen trays in the lake for 3-4 hours, placed in plastic bags of water, and shipped to the Miles City Fish Hatchery. All walleye were weighed, measured and tagged with a numbered Carland tag before release. Scales from walleye under 8 inches long and pectoral spines from larger walleye were collected for age analysis.

Standard 125 foot floating and sinking experimental gill nets along with various combinations of seines, trap nets, and angling were used to sample the various warmwater fisheries throughout the region.

RESULTS AND DISCUSSION

Bighorn Lake

Water Levels

A dry winter in 1992 followed by above average precipitation during the spring and summer of 1993 resulted in normal water levels in Bighorn Lake during 1993. The lake reached the top of the conservation pool on June 17 and remained near full the rest of the year. The reservoir started the 1994 water year at 103% of normal, about 1.3 feet above the top of the conservation pool. Winter precipitation was near normal, but a warm dry spring in 1994 resulted in a very early runoff. Peak spring inflows into Bighorn Lake occurred on May 14, 1994, compared to a normal year when peak runoff usually occurs in late June or early July. Precipitation remained below normal for the spring and summer, and the June-July

inflow dropped to 27% of normal. River releases were reduced to 1,550 cfs on July 13 and 1,450 cfs on August 1, but lake levels in Bighorn Lake continued to decline. By the end of August, Bighorn Lake was at a record low elevation of 3604.14 for that time of year. Low water levels resulted in the closing of the boat launch at Horseshoe Bend on June 10 for the remainder of the season. Bighorn Lake ended the 1994 water year at 78% of normal. Snowpack remained near or slightly below normal during the winter of 1994. Heavy spring precipitation in 1995 increased the mountain snowpack to well above normal before spring runoff started. These conditions brought the lake level up into the flood pool by early summer and resulted in above normal discharges into the Bighorn River during the spring and early summer.

Spring Electrofishing and Walleye Egg Take

Major electrofishing efforts on Bighorn Lake in the spring have revolved around attempts to collect walleye as part of an annual egg-taking operation which continued through 1994. No attempt was made to collect walleye eggs from Bighorn Lake in 1995, however, spring electrofishing was continued to monitor walleye populations.

Six nights of electrofishing between April 18 and May 9, 1994 produced 271 walleye including 25 mature females and 77 mature males. This total was the lowest number of mature fish collected since the egg-taking program was started in 1988. Only 21 females were successfully spawned, resulting in the poorest egg take since the program began (Table 1).

Table 1. Summary of walleye egg-taking results on Bighorn Lake, 1988-1994.

YEAR	NO. FEMALES SPAWNED	AVERAGE EGGS/FEMALE	TOTAL EGGS COLLECTED
1988	46	154,000	7.1 million
1989	82	130,000	10.7 million
1990	47	130,000	6.3 million
1991	46	172,782	8.04 million
1992	41	82,927	3.4 million
1993	53	124,528	6.6 million
1994	21	128,571	2.7 million

The walleye egg-taking program was discontinued at Bighorn Lake in 1995. Annual egg takes at Bighorn Lake have run between 2.7 and 10.7 million eggs with a total take of 44.8 million eggs over a 7 year period (Table 1). In contrast, Fort Peck Reservoir produced over 140 million walleye eggs in 1994 and 175 million eggs in 1995. In 1995, walleye egg collecting emphasis in Region 5 shifted from Bighorn Lake to assisting with the egg-taking program at Fort Peck as needed.

A cold wet spring and major cold front that dropped 8" of snow on the dock at Ok-A-Beh appeared to have a major effect on walleye spawning in 1994. Spring water temperatures warmed slowly then and shortly after reaching levels necessary to start walleye spawning activity, the cold front hit causing a 5° drop in water temperature. This drop seemed to end spawning activities for the year. The average size of mature females collected in 1994 was larger than average sizes observed in recent years (Table 2). In the past the larger, older female walleyes seemed to be the first ones to spawn. The cold front may have ended spawning in 1994 before the smaller females became very active. Also in 1994, the average length of mature females was over 8 inches longer than the average length of males, which again reflects the lack of smaller females in the sample. Average sizes of male and immature walleye were comparable to previous years (Table 2). The largest walleye captured in 1994 was a spent female 30.7 inches long and weighing 13.3 lbs. She probably would have weighed close to 15 lbs when full of eggs.

Three nights of survey shocking between April 18 and May 5, 1995 produced 122 walleye, most of which were immature fish (Table 2). No concentration of mature walleye were found during sampling, however, sampling dates were spread far enough apart to have missed a short duration spawning peak.

The average size of immature walleye collected in 1995 was down significantly from previous years due to a large increase in the number of yearling walleye collected. Thirty seven walleye between 4.3 and 7.0 inches were collected during three nights of electrofishing in 1995. In contrast, only seven walleye 7.0 inches or smaller were collected during all spring shocking conducted as part of the egg-take operation between 1988 and 1994. Based on these data, there was a very strong 1994 year class of walleye in Bighorn Lake.

Table 2. **Average size and condition factor of walleye collected during spring electrofishing in Bighorn Lake from 1992 through 1995.**

	NUMBER	AVG. LENGTH (inches)	LENGTH RANGE (inches)	AVG. WEIGHT (lbs)	AVG. CONDITION FACTOR (k)
			1992		
Immature	5	12.8	11.0 - 13.7	0.78	37.09
Males	99	16.1	10.5 - 24.5	1.67	33.84
Females	100	21.3	18.0 - 29.9	4.00	40.25
Combined	204	18.5	10.5 - 29.9	2.79	37.06
			1993		
Immature	137	10.5	7.4 - 16.6	0.36	26.77
Males	78	18.5	14.3 - 24.5	2.10	30.86
Females	99	23.6	18.5 - 30.9	4.83	34.23
Combined	314	16.6	7.4 - 30.9	2.20	30.14
			1994		
Immature	169	12.3	9.5 - 15.1	0.56	29.33
Males	77	17.9	11.8 - 25.1	1.98	31.27
Females	25	26.0	21.5 - 31.1	6.80	36.63
Combined	271	15.2	9.5 - 31.1	1.54	30.55
			1995		
Immature	86	9.0	4.3 - 16.7	0.32	28.28
Males	26	17.0	12.7 - 28.0	1.78	29.93
Females	10	24.0	16.1 - 29.1	5.14	33.07
Combined	122	12.0	4.3 - 29.1	1.02	29.02

Walleye Stocking

Fingerling walleye were first stocked into Bighorn Lake in 1990, and since then fingerling plants have ranged between 44,000 and 200,000 fish annually except for 1994 (Table 3). A surplus of

walleye fingerlings in 1994, resulting from an excellent egg take at Fort Peck Reservoir, provided an extra 234,000 fingerlings over the normal request of 200,000 fingerlings for Bighorn Lake. This large increase in fingerling plants in 1994 could help account for the significant increase in yearling walleye seen in 1995. It remains to be seen if this strong year class will carry over into the future fishery.

The normal walleye planting request for Bighorn Lake is currently 4 million fry and 200,000 fingerlings per year. Four million fry were planted in 1994 along with the 434,000 fingerlings discussed above. In 1995, 4 million fry and 200,000 fingerlings were planted by Montana. 1995 was the first year Wyoming Game and Fish stocked walleye fingerlings in Bighorn Lake instead of fry (Table 3). Wyoming's request since they began annual walleye stocking in 1987 has been 3 million fry, and they have come close to this request most years. In 1995 they planted 100,000 walleye fingerlings instead of fry, and they hope to continue fingerling plants in the future. Based on the apparent contribution of the larger 1994 fingerling plants, this could be a significant change in the stocking program for Bighorn Lake.

Table 3. Historical summary of Montana and Wyoming walleye stocking into Bighorn Lake.

	MONTANA		WYOMING		TOTAL	
YEAR	Fry	Fingerlings	Fry	Fingerlings	Fry	Fingerlings
1966	3,900,000	123,876			3,900,000	
1967	576,300				576,300	
1968	1,233,000				1,233,000	
1969						
70						
71						
72						
73						
74						
75						
1976			13,161,000		13,161,000	
1977			6,000,000		6,000,000	
1978			1,177,784		1,177,784	
1979			5,000,000		5,000,000	
80						
81						
82						
1983			5,500,000		5,500,000	
1984			9,263,112		9,263,112	
85						
86						
1987			2,250,000		2,250,000	
1988	4,700,000		2,260,072		6,960,072	
1989	5,000,000		1,999,049		6,999,049	
*1990	4,300,000	123,876	2,460,000		6,760,000	123,876
1991	3,900,000	136,956	2,996,000		6,896,000	136,956
1992	4,700,000	44,000	2,520,000		7,220,000	44,000
1993	5,000,000	196,000	528,000		5,528,000	196,000
1994	4,000,000	434,000	3,000,000		7,000,000	434,000
1995	4,000,000	200,000		100,000	4,000,000	300,000

* An additional 2.2 million fry from South Dakota were planted, but survival was very poor.

Walleye Tagging and Movement

A total of 118 walleye were tagged with Carland tags during the 1994 egg-taking operation. To date, 17 of these tags have been returned by anglers for an exploitation rate of 14.4%. Sixteen older tags were also returned in 1994 including two, one, four, and nine from 1990 through 1993 respectively. Four of the 1994 tagged walleye had not moved significantly between tagging and recapture; one had moved 4 miles; six had moved between 5 and 20 miles; one had moved 25 miles; and three had moved over 40 miles. The three walleye showing the greatest movement were all tagged in April and recaptured in mid-June, so it appears they started moving immediately up reservoir after spawning. All walleye that had moved over five miles were mature fish, indicating that much of the walleye movement in the Bighorn Lake is probably spawning related. This same pattern has been noted in the past.

Other Fish Species

Other gamefish species were captured in 1994 and 1995 incidental to spring electrofishing for walleye (Table 4). Burbot or ling were the most common game species captured, other than walleye. Apparently, 1994 was a good year for ling production, because a majority of the ling collected in 1995 were 5.5 to 7.0 inches long and probably one-year-old fish. Most of the ling captured in the spring of 1994 were 15 inches or longer with only a couple of fish in the 10 inch size range. No yearling ling were captured during the more intense spring shocking in 1994. Most sauger are found in the Wyoming end of the reservoir during the spring when mature fish are running up the Big Horn River to spawn. Largemouth bass are also more common from about mid-reservoir upstream. Brown trout seem to be spread throughout the lake, and the large difference in the brown trout catch observed between 1994 and 1995 may have been due to a difference in weather patterns or water temperatures that affected brown trout distribution.

Table 4. Summary of game species other than walleye collected during spring electrofishing in Bighorn Lake in 1994 and 1995.

SPECIES	NUMBER	MEAN LENGTH (inches)	LENGTH RANGE (inches)
		1994	
Sauger	2	-	15.0, 19.5
Brown trout	32	14.4	5.7 - 19.3
Rainbow trout	1	-	18.8
Ling	14	17.5	10.3 - 24.7
Largemouth bass	3	14.4	13.9 - 14.7
Black crappie	1	-	9.1
Stonecat	1	-	6.3
		1995	
Sauger	1	-	15.6
Brown trout	3	13.0	7.0 - 18.1
Ling	33	9.9	5.5 - 25.3
Channel catfish	1	-	5.0

Fall Gill Netting

A series of six experimental gill nets set overnight in October 1994 at standard locations between the dam and Bull Elk Creek caught 21 walleye and four sauger. The walleye averaged 14.5 inches while the sauger averaged 14.9 inches. The average catch rate of 3.5 walleye per net was up from a catch rate of 2.2 walleye per net for this same series in 1993, but well below the record catch of 13.2 walleye per net in the same series in 1991. The 1994 walleye catch rates were on the low side when compared with long term gill netting trends summarized in past reports (Frazer et al. 1992).

Because of the limited number of sites where gill nets can be set in Bighorn Lake, and the steepness of even the good sites, the value of these fall net series in providing walleye population trends on Bighorn Lake is questionable. Netting results are probably as much a factor of the depth and activity of the walleye

on the night the nets are set as they are of the actual number of fish present.

Warmwater Ponds and Reservoirs

Water conditions in 1994 were much better for the smaller ponds in southeastern Montana than they had been for several years due to a wetter than normal spring and summer. Efforts continued to reestablish fisheries in ponds that died out during recent low water years, and additional ponds were located and stocked for the first time in 1994. Much of the management effort in 1994 concentrated on ponds and reservoirs with open public access.

Fifteen ponds and lakes were stocked with 67,729 largemouth bass fingerlings in 1994. A majority of these bass (44,000) were planted into four waters with good public access. The remaining bass were spread between 11 privately owned ponds where the owners allow some public access. Five of these were newly located ponds being stocked for the first time. Plants into the other ponds were to supplement existing fisheries or to reestablish bass fisheries that had been lost due to low water conditions.

Channel catfish were also planted in 1994 to increase the diversity of warm- and cool-water fisheries available in Region 5. Four ponds received a total of 14,520 channel catfish. All four ponds had received channel catfish plants in the past. Catfish were planted in early September at about 3.8 inches in length.

A list of stocked warmwater ponds was developed for Region 5 in the spring of 1995. This list included both private ponds and ponds open to public access. Region 5 has resisted printing a list in the past that included private warmwater ponds because of the limited number of ponds available and large population base in the Billings area. Many private pond owners are afraid of being overrun by anglers if they put their name on a list. However, there has been enough outside pressure to provide a list of stocked ponds that it could no longer be avoided. As a result, some of the pond owners who had been allowing access in the past have withdrawn from the private pond program.

Public Waters

Anita Reservoir. Anita Reservoir is a 30 acre irrigation reservoir located on the Huntley Project irrigation system. It is connected directly to the Yellowstone River by an irrigation canal, so any fish species found in the Yellowstone River can potentially get into Anita Reservoir. Because this is an irrigation reservoir, water levels can be drawn way down to meet irrigation demands which can result in fish kills during the irrigation season or the following winter. A bass fishery established in 1981 was lost when the lake was pulled down for dam repair in 1984. Attempts to

secure a formal agreement for minimum water levels for fisheries have been unsuccessful, so no attempt was made to manage the fishery in Anita between 1984 and 1989. According to irrigation district personnel, the normal operating plan for the reservoir calls for refilling the reservoir in the fall before shutting down the ditch.

Based on this operating plan, largemouth bass were again stocked into Anita Reservoir in 1989, and have been planted each year since. Anita received 10,000 1.8 inch largemouth in 1994.

A boom electrofishing boat was used to sample Anita in 1994. Approximately 2 hours of night shocking in late July produced 10 species of fish (Table 5). Three size groups of largemouth bass were collected. Six bass between 1.9 and 2.4 inches were probably from the 1994 plant. A second group ranged between 4.9 and 6.3 inches. One 13.5 inch bass was also captured.

Black crappie was the only other game species collected. Nine crappie between 2.0 and 4.0 inches long were collected. The remaining 17 crappie averaged 7.1 inches long with the largest one being 7.9 inches long and weighing 0.24 lbs.

Two trap nets, two sinking and one floating gill net were set overnight on April 22, 1995 and caught 10 species of fish (Table 5). Largemouth bass are rarely captured in nets, and this proved to be the case in this sample. Crappie were the most common species collected. Of the 108 crappie that were measured, 11 ranged between 4.5 and 4.9 inches with and average length of 4.6 inches. The remaining crappie were all greater than 6 inches long and averaged 6.8 inches. Three channel catfish were collected including a 26.3 inch fish that weighed 7.22 lbs. Channel catfish have not been planted in Anita Reservoir so these fish probably came from the Yellowstone River via the Huntley Ditch. A single burbot collected also probably came from the Yellowstone River via the ditch system.

Table 5. Summary of fish sampled from Anita Reservoir during electrofishing 7/28/94 and netting 5/23/95.

SPECIES	NUMBER	LENGTH RANGE (inches)
	1994	
Largemouth bass	16	1.9 - 13.5
Black crappie	26	3.6 - 7.9
Pumpkinseed sunfish	4	4.0 - 5.2
Yellow perch	1	2.0
Shorthead redhorse sucker	2	10.6 - 12.5
White sucker	1	8.0
Carp	8	13.5 - 21.8
Goldeye	1	11.2
Emerald shiner	1	2.5
Hybonathus sp.	1	4.1
	1995	
Black crappie	359	4.4 - 8.5
Yellow perch	10	6.1 - 7.0
Channel catfish	3	9.5 - 26.3
Burbot	1	14.4
Shorthead redhorse sucker	116	11.1 - 15.3
White sucker	75	8.9 - 15.9
Longnose sucker	52	7.4 - 14.2
River carpsucker	10	13.7 - 19.0
Carp	4	13.9 - 15.4
Goldeye	27	11.1 - 13.1

Arapooish Pond. Arapooish Pond is a flooded gravel pit located on a fishing access site in Big Horn County, near Hardin. The pond covers about 30 acres with a maximum depth of 8 to 10 feet. It was rehabilitated in 1985 to get rid of rough fish, and has been managed, with limited success, as a largemouth bass pond since then. In 1990, Big Horn County, in cooperation with FWP,

installed an aeration system in Arapooish to try and combat a persistent winterkill problem.

By 1993, Arapooish was receiving heavy use and was the most popular bass fishery in Region 5. Bass from 1990 and 1991 plants survived the winter with the help of the aeration system and the future was looking good for this fishery. During the winter of 1994 power to the aerators was lost for about 10 days, and Arapooish experienced another extensive winter kill. No live bass were observed in the pond in the spring of 1994. Yet several reports of anglers catching bass during the summer in 1994 and bass spawning in the spring of 1995 indicate there was limited survival. A large number of fathead minnows were observed in Arapooish during the spring and summer of 1994, and in late July, 10,000 2-inch largemouth bass were stocked into the pond. Hook and line sampling in mid-October captured four 7.5 to 8 inch largemouth, and several others were observed. Despite the large number of fathead minnows available in Arapooish, these bass appeared to be in fairly poor condition going into winter. The aeration system ran all winter, and in June, 1995 hook and line sampling captured 10 largemouth bass around 9 inches long. Many other bass of the same size were observed, and all fish appeared to be in very good condition. If these fish make it thorough another winter, Arapooish will again become a very important fishery.

Sudden changes in water clarity have been observed in the past at Arapooish and both algae and water chemistry samples have been analyzed (Frazer et al. 1992). On September 12, 1994 two dissolved oxygen (D.O.) samples were taken at Arapooish Pond. At the time, the water was very clear with a temperature of 69°F. The D.O. levels were 8.4 and 7.2 mg/l. One month later on October 13th, the water at Arapooish was pea soup green with only a couple of inches of visibility, the water temperature was 60°F, and one D.O. sample produced a reading of 7.4 mg/l. After ice-off in the spring of 1995, the water in Arapooish Pond was again clear enough to see to the bottom in 8 to 10 feet of water. Arapooish is too shallow to develop much stratification or go through fall turnover, making these sudden changes in water conditions hard to explain. More research is needed on this pond.

Broadview Reservoir. Broadview Reservoir is a 7 to 8 acre pond that was first developed by the Great Northern Railroad as a water stop for their steam engines. It was first stocked by the state in 1944 and has since received more or less annual plants of fish. In the 1950's-1970's it provided an excellent mixed trout-crappie fishery. Carp were introduced from an unknown source in the late 1970's and immediately overpopulated the pond, causing high turbidity and seriously reducing the quality of the fishery. An attempt was made to rehabilitate the pond in 1983 with rotenone, but this was only partially successful and the carp have repopulated the pond. After the rehab efforts, Broadview was restocked with a combination of trout, crappie and largemouth bass.

The fishery has remained marginal. The trout plants have provided some recreation on a more or less put-and-take basis. Crappie have successfully reproduced in the pond, but are generally stunted. Bass appear to be surviving with an occasional report of a nice bass being caught. The ability to sample bass in Broadview is limited because of the high conductivity which makes electrofishing difficult, and because bass are very good at avoiding most nets.

Recent management efforts on Broadview Reservoir have included occasional plants of catchable trout to try and provide some recreation, and heavy plants of largemouth bass to encourage some survival with all the small crappie in the pond. Tiger muskie were planted into Broadview Reservoir in 1991, 1992 and 1993 in hopes of reducing the carp population in the pond, and increasing predation on crappie to reduce numbers and increase size on the remaining fish. The tiger muskie should also provide a limited trophy fishery close to Billings.

Broadview Reservoir was sampled in the spring and fall of 1994 and again in the spring of 1995 to evaluate the success of the tiger muskie plants and to monitor changes in the existing fish populations. A trap net and one floating gill net were set in the narrow deep trench east of the railroad tracks in the spring and fall of 1994. One seine haul with a 100 foot X 1/4 inch seine was made in the spring. Sampling efforts were expanded into the shallow pond west of the dike in the spring of 1995. Besides the normal trap net, gill net and seine haul in the deep trench, two additional trap nets were set on the shallow side.

The tiger muskie population appeared to be doing very well in Broadview. Tiger muskie are known to be difficult to sample, yet eight tiger muskie were captured in a single gill net set during both the spring and fall of 1994 (Table 6) indicating tiger muskie numbers must be quite high in the pond. Two of the three tiger muskie captured in the spring of 1995 were also caught in a single gill net set. The third and largest tiger muskie was captured in a frame trap set in the shallow part of Broadview Reservoir.

Between 500 and 600 tiger muskie were stocked annually into Broadview between 1991 and 1993. The average size at planting ranged between 6.3 and 6.7 inches. These tiger muskie had generally grown to around 14 inches by the following spring, 23 inches the second year and 27 to 30 inches by the fall of the third year. The fall of 1994 was the first time tiger muskie over the minimum legal size of 30 inches were collected from Broadview Reservoir. The longest fish was 31.1 inches and weighed 7.0 pounds. A second fish was 31.0 inches and weighed 7.1 pounds. Both of these fish were probably from the 1991 plant. The largest tiger muskie captured in the spring of 1995 was 27.5 inches long, weighed 4.82 pounds, and was probably a three-year-old fish from the 1992 plant.

Table 6. Summary of catch from gill nets, trap nets and seine hauls made in Broadview Reservoir 6/14/94, 9/13/94 and 5/17/95.

SPECIES	NUMBER	MEAN LENGTH (inches)	LENGTH RANGE (inches)
	Spring 1994		
Tiger muskie	8	20.7	13.5 - 27.0
Black crappie	44	6.2	5.2 - 6.8
Carp	72	6.6	3.4 - 15.0
	Fall 1994		
Tiger muskie	8	26.1	14.9 - 31.1
Black crappie	7	7.5	6.6 - 7.9
Carp	9	8.9	6.5 - 11.3
	Spring 1995		
Tiger muskie	3	22.7	20.2 - 27.5
Black crappie	84	7.2	6.5 - 9.0
Carp	60	9.8	4.6 - 14.6
Largemouth bass	1	-	8.0
Fathead minnow	2	-	2.2
Lake chub	1	-	3.3

The primary reason for stocking tiger muskie into Broadview Reservoir was to provide biological control of carp and crappie. Netting results indicated this may be occurring. The average size of black crappie collected from Broadview increased from 6.2 to 7.2 inches between the spring of 1994 and spring of 1995 (Table 6). Sampling efforts at Broadview were intensified in the spring of 1995, so Table 6 does not provide a standardized comparison of catch rates between the 1994 and 1995. However, comparison of data from the normal gill net, trap net and seine samples for 1994 and 1995 provide a different picture. The number of crappie captured in these nets remained about the same, 41 in 1995 and 44 in 1994 while the average size increased by an inch. The number of carp captured in this standard net series declined significantly from 72 carp in 1994 to only 14 carp in 1995 while the average size of carp

increased over 3 inches. This evidence indicates that the tiger muskie may be having desirable impacts on the crappie and carp populations. The largest tiger muskie captured in the spring of 1995 was collected in a trap net set on the shallow west side of the dike. This net contained a large number of crappie and carp along with the tiger muskie, indicating the muskie may have been in the area because of the abundant prey base. If the tiger muskie are the cause of these observed changes, the average size of the carp in Broadview Reservoir should continue to increase as the average tiger muskie size increases.

Only one largemouth bass was captured in the spring of 1995. This was an 8.0 inch fish captured in a trap net on the shallow west side of Broadview. Four thousand and twenty 2" largemouth bass were stocked into Broadview in 1994, and 4,000 more are requested for 1995. Broadview reservoir also received a plant of 1,000 4" rainbow trout in the spring of 1995. These fish were surplus from a canceled plant and were planted to provide some additional angling opportunity at Broadview.

Chief Joseph Pond. Chief Joseph Pond, a small pond located in a city park in Harlowton, provides fishing for local residents and visitors staying in the park. It has been managed as a put-and-take trout fishery and normally receives three plants of 500 catchable rainbow during the summer. Attempts to establish a largemouth bass fishery have been unsuccessful in the past. Channel catfish were planted for the first time in 1990 in hopes of diversifying the angling opportunities in the pond.

Chief Joseph Pond received approximately 1,500 catchable rainbow trout and 600 channel catfish in 1994. One night of electrofishing was conducted on Chief Joseph Pond in June, 1994. Eight rainbow ranging from 7.3 to 9.6 inches in length were captured along with 23 white suckers that averaged 7.8 inches long. No channel catfish or largemouth bass were observed, but water clarity was very poor during this sampling.

Cooney Reservoir. Warmwater fisheries data for Cooney Reservoir are summarized in Poore (1995) as part of the overall discussion of the Cooney Reservoir trout/walleye fishery.

Lake Elmo. Lake Elmo is a 64 acre irrigation reservoir located in Lake Elmo State Park on the northeastern outskirts of Billings. The lake is filled from the Billings Bench Water Association Canal originating from the Yellowstone River at Laurel. Water from the lake is released as needed resulting in water level fluctuations of up to 3 feet on a weekly basis. Maximum depth of the lake is 16 feet when full.

Lake Elmo is heavily used by swimmers and sailboarders in the warmer months. Angler use has increased greatly since a handicapped accessible fishing pier was completed on the lake in

1994. The pier has become a great gathering place for young anglers fishing for yellow perch and anglers of all ages fishing for channel catfish.

Fish populations were sampled in the spring and fall of 1994 and again in the spring of 1995 (Table 7). Largemouth bass, yellow perch, crappie, and sunfish were stocked into Lake Elmo in the 1930's and still inhabited the lake in 1983 when management of the fishery was begun by the FWP. Stocking was resumed by FWP in 1984. Largemouth bass and channel catfish have been planted on a yearly basis with occasional transplants of adult black crappie. A number of other fish species inhabit the lake including rainbow trout, brown trout, carp, goldfish, flathead chub, lake chub, emerald shiner, Hybognathus sp., fathead minnow, shorthead redhorse, longnose sucker, white sucker, mountain sucker, stonecat, burbot, and pumpkinseed sunfish.

Most of these species probably entered the lake from the Yellowstone River through the irrigation canal that feeds the lake. Others have been illegally released into the lake. Walleye, first captured in Lake Elmo in 1992, were probably from an illegal introduction. In July, 1994 a young angler fishing with a worm caught a piranha from Lake Elmo. A second piranha was also reported caught, but was never confirmed.

Lake Elmo received plants of largemouth bass and channel catfish in 1994. Twenty thousand 1.9 inch largemouth bass were stocked in July, and 7,520 3.8 inch channel catfish in September.

There has been an ongoing effort to improve fish habitat in Lake Elmo since 1984 (Frazer et al. 1992). Efforts continued in the spring of 1995 with the placement of 13 Christmas tree tepee structures off the end of the fishing pier on the south side of the lake. This project was organized and coordinated by the Billings Fishing Club with some assistance from the Billings Chapter of Walleye Unlimited.

Table 7. Summary of catch from Lake Elmo using gill nets, trap nets and electrofishing during spring and fall of 1994; gill nets and trap nets during spring 1995.

SPECIES	NUMBER	MEAN LENGTH (inches)	LENGTH RANGE (inches)
	Spring 1994		
Yellow perch	53	4.2	2.8 - 9.2
Largemouth bass	3	6.0	3.0 - 11.5
Channel catfish	48	8.8	7.0 - 16.8
Black crappie	9	11.6	2.7 - 12.9
White sucker	65	14.8	10.6 - 17.5
Longnose sucker	13	14.1	8.5 - 17.4
Shorthead redhorse sucker	22	15.2	10.6 - 18.1
Pumpkinseed sunfish	102	4.5	2.9 - 6.4
River carpsucker	1	-	21.6
Carp	2	14.6	10.8, 18.3
	Fall 1994		
Yellow perch	162	6.1	5.2 - 9.6
Largemouth bass	38	4.3	2.9 - 7.9
Channel catfish	14	10.2	6.0 - 19.4
Black crappie	24	3.9	2.7 - 6.4
White sucker	16	10.2	7.7 - 13.8
Longnose sucker	17	9.0	6.0 - 11.2
Shorthead redhorse sucker	3	16.6	15.3 - 17.5
Pumpkinseed sunfish	3	4.7	4.6 - 4.9
Brown trout	1	-	13.4
Flathead chub	2	6.5	6.4, 6.6

Table 7. Summary of catch from Lake Elmo using gill nets, trap nets and electrofishing during spring and fall of 1994; gill nets and trap nets during spring 1995.

SPECIES	NUMBER	MEAN LENGTH (inches)	LENGTH RANGE (inches)
	Spring 1995		
Yellow perch	33	6.5	4.5 - 8.3
Channel catfish	17	11.3	6.7 - 18.5
Black crappie	21	7.0	4.5 - 12.1
White sucker	142	13.2	8.3 - 17.2
Longnose sucker	11	9.3	3.6 - 12.5
Shorthead redhorse sucker	16	15.5	11.1 - 19.6
Pumpkinseed sunfish	3	3.4	2.3 - 5.1
Lake chub	6	3.3	3.0 - 3.6

Largemouth Bass. Largemouth bass have been stocked into Lake Elmo every year except one since 1984, yet a good bass fishery has never developed. It is very difficult to monitor this fishery, because bass are so hard to sample. Few bass are collected in nets, so night electrofishing is the main method used to sample bass in Lake Elmo.

One night of electrofishing in the spring of 1994 only produced three largemouth bass (Table 7). The largest one was an 11.5 inch fish weighing 1.03 pounds. The other two were small bass, probably from the 1993 plant. Fall shocking in 1994 produced numerous small bass from the summer plant with many more observed but not netted. Only four bass over 6 inches long were captured. The largest one (7.9 inches) was aged at two years old. This same pattern has been observed in the past where large numbers of planted bass are present in the fall, but very few seem to make it through the winter. Lake Elmo has produced a few nice bass in the past, but bass fishing has never been good on the lake.

Black Crappie. Lake Elmo continues to produce a few nice black crappie. Crappie over 12 inches long were collected during both 1994 and 1995, but total crappie numbers remained low in the lake. Small crappie collected during the spring and fall of 1994

showed there was some successful reproduction occurring, but recruitment to the fishery appeared to be low. Intense predation from perch and other predatory fish species appears to keep crappie numbers at a low level. Habitat improvement projects like the one completed in the spring of 1995 should be beneficial to the crappie fishery by improving survival of young fish.

Channel Catfish. The channel catfish population is doing well in Lake Elmo, and a popular catfish fishery has developed on the lake. Two gill nets set in late May, 1994 captured 46 channel catfish ranging from 7.0 to 16.8 inches in length. Most of these fish were in the 7 to 10 inch size range and were probably two year old fish. There were a few fish in the 10 to 12 inch range and three fish over 12 inches long. These larger fish averaged 16 inches long with the largest one being 16.8 inches and weighing 1.70 pounds. Two gill nets in the spring of 1995 collected 17 channel catfish. One 6.7 inch fish may have been from the 1994 plant. A majority of these fish were in the 10.5 to 12.5 inch range and were probably from the same strong year class seen in 1994 as 7 to 10 inch fish. The largest channel catfish captured in the spring of 1995 was 18.5 inches long and weighed 2.2 pounds.

Anglers began catching channel catfish off the fishing pier at Lake Elmo during early summer in 1994. As word got out the pier became a very popular fishing site, with many 1.5 to 2 pound catfish taken home by happy anglers. Several catfish in the 4 pound range have also been caught, and one catfish caught off the pier in 1995 weighed 9.5 pounds.

Due to a moratorium on importing any live fish into Montana following an outbreak of whirling disease, no channel catfish were available for stocking into Lake Elmo in 1995. This may provide an opportunity to evaluate if any natural reproduction is occurring in the lake. Lake Elmo contains a good population of mature catfish, and a number of artificial nesting cavities have been placed in the lake in recent years. It is likely some natural reproduction is occurring, but survival of small catfish may be limited due to the large number of perch present in Lake Elmo.

Yellow Perch. Yellow perch were the most numerous fish species sampled or observed in Lake Elmo in 1994 and 1995. Sample numbers in Table 7 represent the subsample of perch that were actually collected and measured. Many additional perch were observed during electrofishing but not collected. Large numbers of 2.5 to 4 inch perch observed in the spring of 1994 indicated there was a strong year class of perch produced in 1993, which accounts for the small average size reported in the spring of 1994. The average size of the yellow perch collected in the fall of 1994 and spring of 1995 is more representative of the mature perch population in Lake Elmo.

Past reports have discussed the apparent lack of larger perch in the Lake Elmo population and some possible explanations for this (Frazer et al. 1992). This trend continued through the 1994, 1995 sampling period with only five perch greater than 8.5 inches in length and two perch greater than 9 inches being collected.

Despite the lack of larger perch in Lake Elmo, the perch have been providing a very popular kid's fishery at the fishing pier. During most summer days there are several kids on the dock at any time fishing for perch. Many small perch are caught, and most of them are released; however, some nice stringers of perch are taken home.

Other common species in Lake Elmo include white and longnose suckers and pumpkinseed sunfish. The pumpkinseed sunfish provide a limited kid's fishery along with the perch. No walleye were collected from Lake Elmo during sampling in 1994 or 1995, but an angler was observed during the summer of 1994 with a 3 to 4 pound walleye he had caught off the fishing pier.

Lake Josephine. Lake Josephine is a 20 acre lake formed from an old gravel pit on the southern edge of Billings. It was originally purchased by FWP and has since been leased to the City of Billings. The lake is now part of Riverfront City Park, and gets considerable use, especially by young anglers.

The lake is located on the floodplain of the Yellowstone River, and is also connected to the river by an irrigation canal, so it can potentially contain any fish species found in the Yellowstone River. For many years no attempt was made to manage this fishery, and it was entirely dependent on fish from the Yellowstone River and unauthorized introductions.

In 1987, the FWP made an experimental plant of 40,000 largemouth bass fry into Lake Josephine to supplement a bass population already present in the pond. Although some natural bass reproduction was occurring, survival and recruitment was thought to be limited due to the large number of small predators (crappie, sunfish and yellow perch) present in the pond. A second plant of 10,000 1.5 inch largemouth was made in 1989, and 10,000 more were planted in 1991. Current management calls for supplemental bass plants on an every-other-year basis. In recent years, Lake Josephine has become one of the most consistent largemouth bass fisheries in the region with a few bass over 5 pounds being caught.

Channel catfish were stocked into Lake Josephine in 1991 to provide an additional fishery and to increase predation on stunted sunfish and crappie in the lake. Catfish are now being stocked on an annual basis when available.

Trap nets and gill nets set during August, 1994 captured a wide diversity of fish species from Lake Josephine (Table 8). Black crappie were the most numerous fish collected followed by

pumpkinseed sunfish, yellow perch and white suckers. The average size of the different warmwater species was small, yet several of these species provide considerable recreational opportunity, especially for the younger anglers who are the main user group at Lake Josephine. For the past several years the YMCA in cooperation with the Billings Fishing Club have been conducting an annual kids fishing day at Lake Josephine. This program has been very successful and has introduced many new anglers to the sport. Sunfish are the most common fish caught during these kids days.

Table 8. Summary of fish sampled from Lake Josephine using gill nets and trap nets (August 9-10, 1994).

SPECIES	NUMBER	MEAN LENGTH (inches)	LENGTH RANGE (inches)
Yellow perch	30	5.2	4.1 - 5.9
Walleye	1		16.3
Largemouth bass	1		5.6
Channel catfish	21	8.7	6.6 - 13.3
Black crappie	211	6.7	3.5 - 7.5
Green sunfish	7	4.0	3.2 - 5.0
Pumpkinseed sunfish	54	3.9	2.3 - 5.7
White sucker	35	11.5	8.0 - 13.9
Longnose sucker	6	9.2	7.6 - 10.2
Shorthead redhorse sucker	2		14.2, 15.1
Carp	6	15.1	14.3 - 16.0
Black bullhead	2		6.2, 8.7

The channel catfish fishery seems to be developing quit well in Lake Josephine. Based on size distribution, there appeared to be three age groups of catfish in the 1994 sample. A majority of the catfish collected were in the 6.5 to 7.5 inch size range. These were probably fish from the 1993 plant. A second group of fish ranged from 10.4 to 11.5 inches with the largest catfish measuring 13.3 inches. The largest catfish collected from Lake Josephine to date is a 15.1 inch channel catfish caught in 1993. A plant of 2,400 3.8 inch fish in early September, 1994 represents the fourth year catfish were stocked into Lake Josephine.

One 16.3 inch walleye was collected in a gill net in 1994. This was the third walleye netted from Lake Josephine, with a 17.3 and

an 18.8 inch walleye being netted in 1993. Walleye have never been legally planted in Lake Josephine so these walleye were all from illegal introductions. It remains to be seen what impacts they may have on the fish populations in the lake.

A boom electrofishing boat was used to sample largemouth bass in the section of Lake Josephine east of the foot bridge in August, 1994. One pass was made around this section of the lake after dark using pulsed AC current. Only largemouth bass were netted during this shocking run. Forty-six minutes of electrofishing produced 132 largemouth bass ranging from 2.1 to 16.2 inches in length. The largest bass weighed 2.50 pounds.

No largemouth bass were planted in Lake Josephine in 1994, so the presence of the small bass indicated natural reproduction was occurring. There was a good size distribution of bass 9 inches and under present in the lake, but the number of larger bass appeared to be quite limited indicating that exploitation rates are quite high. Future management planning for Lake Josephine should consider possible regulation changes to protect some of the larger bass.

Two seine hauls made with a 100 foot X 1/4 inch seine in June, 1995 as part of a kids school program captured pumpkinseed and green sunfish, largemouth bass, white suckers, yellow perch, black crappie and a channel catfish. The catfish was 6.2 inches long and was probably from the 1994 plant. Nine largemouth bass ranged from 2.5 to 6.7 inches long. Size ranges of the other fish were comparable to those seen in previous data.

Other Waters

Lebo Lake. Lebo Lake is a large, privately-owned lake located near Two Dot, Montana. It covers about 314 surface acres with a maximum depth of about 14 feet. Lebo Lake is used primarily for irrigation storage. The State first stocked trout in Lebo in 1936, and continued to plant most years through 1957. Most plants were rainbow trout although some brown trout, cutthroat trout and even some bullheads were legally introduced. Bluegill and crappie were also introduced from unknown sources. Lebo Lake was predominantly a trout fishery with some very nice trout being produced.

In 1963 Lebo Lake was rehabilitated to eliminate a large population of suckers, stunted bluegill, and crappie. Between 1964 and 1982, Lebo received annual plants of 30,000 to 40,000 4 to 6 inch rainbow and provided a good trout fishery. Changes in the early 1980's increased turbidity in the lake, and a tremendous sucker population again took over the lake. A small plant of white crappie was made in 1984, but a viable crappie fishery never developed. In 1988, approximately 1,200 1.7 to 2.3 inch tiger muskie were stocked into Lebo Lake. Another 1,900 1.5 inch tiger muskie were planted in 1989 and 1,500 6.5 inch tiger muskie in 1991. Tiger muskie were

stocked into Lebo Lake to help control the tremendous white sucker population present in the lake. Growth rates have been very good and a substantial tiger muskie fishery has developed in Lebo (Frazer et al. 1992).

Two trap nets and six gill nets set overnight in Lebo Lake in October, 1994 caught eight tiger muskies. These fish averaged 32.9 inches long and 8.94 pounds, and ranged from 32.9 to 40.0 inches in length. The largest tiger muskie was 40.0 inches long and weighed 17.5 pounds. This fish was probably from the second tiger muskie plant made in 1989. The remaining tiger muskies ranged from 7 to 9 pounds and were probably from the 1991 plant. A new state record tiger muskie weighing 27.0 pounds was caught by and angler in 1994. Other unconfirmed reports of fish in this same size range have been received. These fish would be from the first tiger muskie plant in 1988.

The two trap nets and six gill nets set in 1994 only caught 50 suckers, and only three of these were less than 12 inches long. The average length of the white suckers collected was 16.4 inches. In the early to mid-80s, before tiger muskies were introduced into Lebo, it was common to catch between 40 and 80 suckers per net with a similar set. Tiger muskies have had a major impact on the sucker population in Lebo, and as a result, water clarity has improved significantly in the lake.

On July 20, 1993 one of the landowners at Lebo Lake arranged to have 8,000 Arlee rainbow stocked into the lake. Half of these fish averaged 5.5 inches long with the others averaging 8.8 inches. Three months later, during fall sampling, three of these rainbow were captured. These fish averaged 12.7 inches long and 0.81 pounds. Four rainbow netted during fall sampling in 1994 averaged 20.4 inches long and 4.81 pounds; all were in fantastic condition. Now that the sucker population has been significantly reduced by tiger muskie, Lebo Lake will likely produce some tremendous trout as it did in the past. At the same time we should continue to see new record tiger muskie produced for years to come.

Warmwater Sections of Streams

Lower Bighorn River. The lower Bighorn River was not sampled in 1994 due to low flow conditions. Releases from Yellowtail Dam declined to less than 1,500 cfs by mid-July and remained at these low levels through the rest of the summer and fall.

Lower Yellowstone River. A seven-mile section of the lower Yellowstone River near Worden was electrofished in the fall of 1994 in an attempt to obtain a mark/recapture estimate on channel catfish. Three days of electrofishing in late September collected a total of 89 channel catfish. This total was not enough for a good mark/recapture estimate so the effort was discontinued for the

year. One additional day of electrofishing was conducted in the same area in late November to look at changes in catfish distribution. A pass through the whole electrofishing section produced no catfish until a backwater area near the lower end of the section was shocked. This one hole yielded 48 channel catfish. Apparently most of the catfish in the river had moved into a few limited areas in preparation for winter conditions.

The average size of the catfish collected from the Yellowstone River was over 20 inches, with the largest catfish being 29.7 inches long and weighing 14.25 pounds (Table 9). Other game fish collected during this fall sampling included brown trout, rainbow trout, smallmouth bass, ling, sauger, whitefish and one 12.3 pound northern pike. Non-game species were also collected during one day of this shocking.

Table 9. Summary of fish collected from the lower Yellowstone River near Worden during 4 days of electrofishing in the fall of 1994 (9/26,27,28 and 11/27).

SPECIES*	NUMBER (inches)	MEAN LENGTH (inches)	LENGTH RANGE (inches)
Channel catfish	137	20.8	12.3 - 29.7
Smallmouth bass	3	12.7	11.2 - 14.7
Ling	15	17.3	9.5 - 24.7
Rainbow trout	6	9.9	7.3 - 17.4
Brown trout	12	12.7	10.2 - 16.7
Mountain whitefish	6	13.1	9.8 - 16.1
Sauger	5	19.9	16.6 - 23.9
Walleye	1	-	18.5
Yellow perch	2	-	7.2, 7.3
Northern pike	1	-	36.5
Shorthead redhorse sucker	52	16.1	1.4 - 20.4
Longnose sucker	32	5.1	3.2 - 12.6
White sucker	37	9.8	4.8 - 18.0
Mountain sucker	20	5.5	2.4 - 7.6
River carpsucker	5	16.1	15.4 - 16.8
Carp	16	23.1	19.7 - 26.1
Largemouth buffalo	1	-	24.1
Goldeye	90	12.9	12.2 - 14.1
Flathead chub	105	4.5	2.1 - 5.4
Longnose dace	52	2.4	1.6 - 3.2

* Nongame species were only sampled during one day of shocking.

MANAGEMENT RECOMMENDATIONS

Bighorn Lake

1. Discontinue walleye egg taking efforts at Bighorn Lake. Shift efforts to assisting with egg collection at Fort Peck Reservoir.

2. Continue to stock a combination of walleye fry and fingerlings into Bighorn Lake each year. Coordinate efforts with Wyoming Game and Fish to maximize fingerling plants.

3. Continue to monitor the walleye population through spring electrofishing and fall gill netting.

4. Continue annual spring meeting with Wyoming Game and Fish, the Bureau of Reclamation, and the National Park Service to discuss water levels and management options. Obtain the best water levels possible for the fishery that can still meet the requirements of the Bighorn River downstream from the dam and of the other agencies involved.

Warmwater Ponds and Reservoirs

1. Continue efforts to locate additional ponds suitable for planting and obtain permission to stock them for public use.

2. Continue to monitor existing bass fisheries and stock additional largemouth bass where needed to supplement natural reproduction or to reestablish fisheries lost due to low water.

3. Discontinue largemouth bass plants into Lake Elmo unless larger bass become available, at which time, experimental plants could be attempted to see if a largemouth bass fishery could be developed using larger fish.

4. Continue efforts to increase fishing opportunities in warm- and cool-water lakes and ponds open to general public access.

    a) Work with local sportsmen's groups on habitat enhancement projects for these waters.

    b) Monitor developing catfish fisheries in Lake Elmo, Lake Josephine, and Chief Joseph Pond. Evaluate other waters, such as Anita Reservoir, for potential catfish plants.

    c) Evaluate the need for additional regulations to protect heavily used fisheries such as the largemouth bass fishery in Lake Josephine.

d) Continue to monitor the tiger muskie fisheries in Broadview Reservoir and Lebo Lake.

e) Continue efforts to obtain public access to Lower Glaston Lake.

Warmwater Sections of Streams

1. Continue to monitor fish populations on the lower yellowstone River with emphasis on channel catfish, sauger and smallmouth bass. Attempt to obtain population estimate on catfish.

2. Work with Region 7 on efforts to improve fish passage over barriers in the lower Yellowstone River.

3. Increase efforts to sample warmwater fish populations in the Musselshell River downstream of Lavina.

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