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Region 4

MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

State: Montana Project No. F-78-R-5
Project Title: Statewide Fisheries Investigations
Job Title: Northcentral Montana Warm and Coolwater Ecosystems

1998 Annual Report

ABSTRACT

A total of thirteen warm/coolwater fishery ecosystems in Region Four were investigated during 1998. Harvest of walleye populations was monitored in Bynum Reservoir, Lake Frances and Tiber Reservoir along with northern pike populations in Lake Frances and Tiber Reservoir. First-year exploitation rates vary from a low of 7 percent for walleye in Lake Frances to a high of 11 percent for northern pike in Tiber Reservoir. Walleye populations remain stable in Bynum Reservoir, are up slightly in Lake Frances and down slightly in Tiber. Younger walleye are recruiting in the fishery in Bynum and Frances. Year-class strength of walleye was determined for Bynum, Frances and Tiber. The forage base at Bynum has good yellow perch numbers and spottail shiner are increasing. At Frances, yellow perch have decreased while spottail shiner have increased. Yellow perch and spottail shiner have decreased at Tiber. Cisco were stocked into Tiber for the second year and data is presented on survival as well as probable spawning of this species. Hydroacoustic surveys and vertical gill nets were used to monitor cisco numbers. The Portage Coulee section of the Missouri River was electrofished to monitor trends. Spottail shiners, introduced into Petrolia Reservoir in June 1996, 1997, and 1998, were seined in higher numbers in 1998 than in 1997. Capture rates of all species of forage fish in Petrolia increased in 1998. Numbers of walleye gill netted increased from 1997, but yellow perch decreased from record high abundance in 1997. In East Fork Reservoir, traps caught 148 northern pike and 38 yellow perch. Record numbers of juvenile yellow perch were seined, but gill net catch of adult yellow perch declined substantially in East Fork Reservoir.

OBJECTIVES

1. To identify and monitor the characteristics and trends of fish populations, angler harvest and preferences, and habitat conditions in northcentral Montana warm and coolwater ecosystems.

2. Use survey and inventory information to identify management problems and opportunities, then develop and implement management actions to maintain fish populations at levels consistent with habitat conditions or other limiting factors.

3. Review projects proposed by state, federal, and local agencies and private parties which have the potential to affect fisheries resources and aquatic habitats. Provide technical advice or decisions to reduce or mitigate resource damage.

4. Provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources and aquatic habitat.

5. Enhance public understanding and awareness of fishery and aquatic habitat resources and issues in northcentral Montana through oral and written communication.

6. Maintain and enhance public access to fishery resources in northcentral Montana.

PROCEDURES

Fish populations were sampled with a boat mounted electrofish shocker; standard 125 x 6 foot multi-filament experimental gill nets (fished sinking or floating) with 25 foot sections of 0.75, 1.00, 1.25, 1.50, and 2.00 inch square mesh; 100 deep x 10 foot wide vertical gill nets (six nets of differing square mesh: 0.50, 0.75, 1.00, 1.25, 1.50 and 2.00 inch); 3 x 4 foot frame trap nets (0.25 inch square mesh); 4 x 6 foot frame trap nets (1.00 inch square mesh); a 50 x 4 foot beach seine (1/8 inch square mesh); and a 100 x 10 foot seine (0.25 inch square mesh). Stomach samples were collected from some fish for food habits. Scale and fin ray/spine samples were taken for age and growth studies. Vertical plankton tows were made using a 30 cm conical net with a 15 cm radius (0.153 mm mesh). Walleye dorsal spines were mounted and sectioned according to methods described by Mackay et al. (1990). A computer program designed by Liknes (1993) was used to generate age composition and estimate the number of walleye caught by age. An index of year-class strength of walleye was calculate using parameters developed by Goeman (1993). Age composition of a gill net catch was re-constructed according to Ketchen's stratified subsampling method described in Ricker (1975). Relative weights (Wr) of walleye, northern pike and yellow perch were determined using MDFWP computer programs which utilized data in Murphy el al. 1990, Willis 1989, and Willis et al. 1991. Floy T-tags were used on northern pike; Floy T-tags, Cinch-up tags and metal jaw tags were used on walleye; and white sucker were fin clipped during spring trapping. Abbreviations for fish species appearing in tables and figures throughout this report are as follows: WE=walleye; NP=northern pike; LMB=largemouth bass; Ling=burbot; YP=yellow perch; Rb=rainbow trout; Cis=cisco; SS=spottail shiner; ES=emerald shiner; LND=longnose dace; LC=lake chub; FHC=flathead chub; SB=brook stickleback; MSc=mottled sculpin; WSu=white sucker and LnSu=longnose sucker.

FINDINGS

CHOTEAU AREA WATERS

Bynum Reservoir

Trap nets were fished in Bynum Reservoir from April 21 to 25, 1998, for a total of 45 trap net nights Total catch includes 255 walleye, 22 yellow perch, 1 brook trout, 1 cutthroat trout and 7,280 white sucker. Water temperatures varied from 47-53°F throughout the surveys. Lengths and weights of miscellaneous species are on file in the Choteau, field office.

To assist in monitoring exploitation, green Floy T-tags and metal jaw tags were placed on 206 walleye greater than 14 inches. These fish averaged 19.2 inches and 2.63 pounds (range 14.3-24.9 inches and 0.90-6.50 pounds). Anglers returned 14 tags from this group of fish for nearly a 7 percent first-year return (Table 1). Anglers also returned 32 additional tags from earlier tagging years, with the 1995 cumulative return now totaling 15 percent.

Small mesh trap nets (0.25 inch) were fished overnight in late July. Three trap nets caught a total of 265 young-of-the-year (YOY) walleye, 2,185 YOY and 82 yearling yellow perch, 32 YOY white sucker, 1 spottail shiner and 59 crayfish. Shoreline seining in August indicates a fairly good forage base composed of yellow perch, spottail shiner and crayfish. Natural reproduction of walleye was also documented during seining surveys. These results are found in Appendix I. When compared to the previous year, the 1998 findings exhibit fewer yellow perch and white sucker but slightly increased spottail shiner numbers (Figure 1).

Nine sinking gill nets in September caught a total of 84 walleye, 43 yellow perch, 416 white sucker and 2,370 crayfish. Examination of Table 2 indicates a healthy walleye population with good recruitment of smaller fish. Overall walleye numbers continue to be stable as shown in Figure 2, while yellow perch numbers have moderately increased. Crayfish averaged 160 per net, down from a high of 263 per net in 1997.

Of 23 walleye stomachs examined in the field for food content, approximately one-half were empty but nearly all were extended indicating recent feeding activity. Nearly one-half contained yellow perch or unidentified fish remains. It is interesting to note that only one stomach contained crayfish, even though crayfish are very abundant.

For the second consecutive year, yellow perch spawning structures were placed in Bynum Reservoir in early May. In cooperation with the Great Falls Chapter of Walleye Unlimited, approximately 550 scotch pine trees with a concrete base were sunk in an area of about 2 acres. In mid-May, three scuba divers checked on three different types of structures placed in 1997. They observed numerous eggs, most of which were on scotch pine, with few on fir trees and essentially none on the Berkley "Fish-Hab" structures.

Table 1. Angler exploitation of walleye and northern pike in Region Four reservoirs as indicated by voluntary tag returns (1994-1998).

Lake	Species	Year tagged	Number tagged	Number of returns (%)					
				1994	1995	1996	1997	1998	Cumulative
Bynum Res.	WE	1994	483	23(4.8)	13(2.7)	0(0.0)	1(0.2)	1(0.2)	38(7.9)
		1995	347		26(7.5)	10(2.9)	9(2.6)	7(2.0)	52(15.o)
		1996	250			5(2.0)	12(4.8)	11(4.4)	28(11.2)
		1997	250				17(6.8)	14(5.6)	31(12.4)
		1998	206					15(7.3)	15(7.3)
Lake Frances	WE	1994	242	12(4.9)	10(4.1)	3(1.2)	4(1.7)	1(0.4)	30(12.4)
		1995	289		17(5.9)	6(2.1)	11(3.8)	6(2.1)	40(13.8)
		1996	73			1(1.4)	2(2.7)	2(2.7)	5(6.8)
		1997	226				7(3.1)	10(4.4)	17(7.5)
		1998	78					5(6.4)	5(6.4)
	NP	1994	310	17(5.4)	9(2.9)	4(1.3)	1(0.3)	0(0.0)	31(10.8)
		1995	325		26(8.0)	13(4.0)	2(0.6)	0(0.0)	41(12.6)
		1996	46			6(13.0)	2(4.3)	0(0.0)	8(17.4)
		1997	155				7(4.5)	8(5.2)	15(9.7)
		1998	55					5(9.1)	5(9.1)
Tiber Res.	WE	1994	461	48(10.2)	14(3.0)	7(1.5)	1(0.2)	1(0.2)	71(15.4)
		1995	500		63(12.6)	18(3.6)	13(2.6)	2(0.4)	96(19.2)
		1996	499			40(8.0)	26(5.2)	5(1.0)	71(14.2)
		1997	499				39(7.8)	22(4.4)	61(12.2)
		1998	475					46(9.7)	46(9.7)
	NP	1994	153	25(16.3)	0(0.0)	1(0.7)	1(0.7)	0(0.0)	27(17.6)
		1995	182		14(7.7)	7(3.8)	1(0.5)	0(0.0)	22(12.1)
		1996	250			26(10.4)	8(3.2)	3(1.2)	37(14.8)
		1997	79				13(16.5)	1(1.3)	14(17.7)
		1998	127					15(11.8)	15(11.8)

Table 2. Overnight gill netting results in warm and cool water reservoirs in the western portion of Region Four, 1998.

Water (date sampled)	Surface acres 1/	No. of nets 2/	Mean hrs per net	Species	No. of fish	Length range (avg)	Weight range (avg)
Bynum Reservoir (9/22-23/98)	2,700	9 S	17.0	WE	32	9.3-12.8 (10.6)	0.23- 0.72 (0.40)
					13	13.2-15.6 (14.2)	0.74- 1.37 (0.96)
					27	16.0-19.8 (18.4)	1.14- 3.40 (2.32)
					12	20.0-24.2 (21.1)	2.88- 4.88 (3.47)
				YP	43	--	--
				WSu	53	8.5-12.7 (11.5)	0.27- 1.12 (0.79)
					383	13.0-19.4 (15.4)	1.08- 3.26 (1.75)
Lake Frances (9/15-16/98)	4,000	17 S	17.7	WE	32	7.6-12.5 (9.8)	0.10- 0.62 (0.30)
					45	13.0-15.9 (14.8)	0.66- 1.37 (1.01)
					28	16.2-19.9 (17.8)	1.25- 2.88 (1.89)
					4	20.6-23.7 (22.4)	2.74- 5.03 (3.62)
				NP	31	10.1-15.8 (13.9)	0.18- 0.90 (0.57)
					37	16.0-19.9 (18.2)	0.79- 1.67 (1.29)
					18	20.0-27.7 (22.9)	1.70- 4.48 (2.83)
				YP	98	5.0- 8.9 (7.7)	0.05- 0.95 (0.25)
					131	9.0-10.9 (10.1)	0.41- 0.79 (0.59)
					79	11.0-13.4 (11.5)	0.74- 1.30 (0.92)
				WSu	7	15.2-19.8 (17.9)	1.90- 4.16 (2.97)
Tiber Reservoir (9/9-11/98)	16,400	29 S	17.6	WE	33	7.3-12.8 (11.1)	0.12- 0.67 (0.41)
					27	13.1-15.8 (14.3)	0.63- 1.30 (0.89)
					17	16.0-19.9 (17.8)	1.20- 2.60 (1.79)
					1	(20.1)	(2.44)
				NP	2	14.5-15.5 (15.0)	0.56- 0.76 (0.66)
					15	17.0-19.9 (18.5)	1.06- 1.77 (1.34)
					23	20.5-27.8 (23.0)	1.70- 4.75 (2.87)
				YP	119	5.2- 8.9 (6.5)	0.05- 0.35 (0.13)
					29	9.0-10.8 (9.7)	0.31- 0.68 (0.46)
				Rb	4	11.8-14.0 (12.8)	0.60- 1.00 (0.77)
					10	16.7-21.4 (19.0)	1.22- 2.55 (1.95)
				Cis	23	9.6-11.4 (10.4)	0.30- 0.67 (0.45)
				WSu	28	6.6-12.9 (10.6)	0.13- 1.42 (0.60)
					46	13.0-19.8 (16.9)	0.41- 3.62 (2.16)
				LnSu	8	9.3-12.9 (10.7)	0.23- 0.74 (0.44)
				Carp	8	23.1-29.8 (27.5)	5.90-14.00 (10.90)

1/ Approximate surface acres at time of survey.
2/ S = Sinking gill nets.

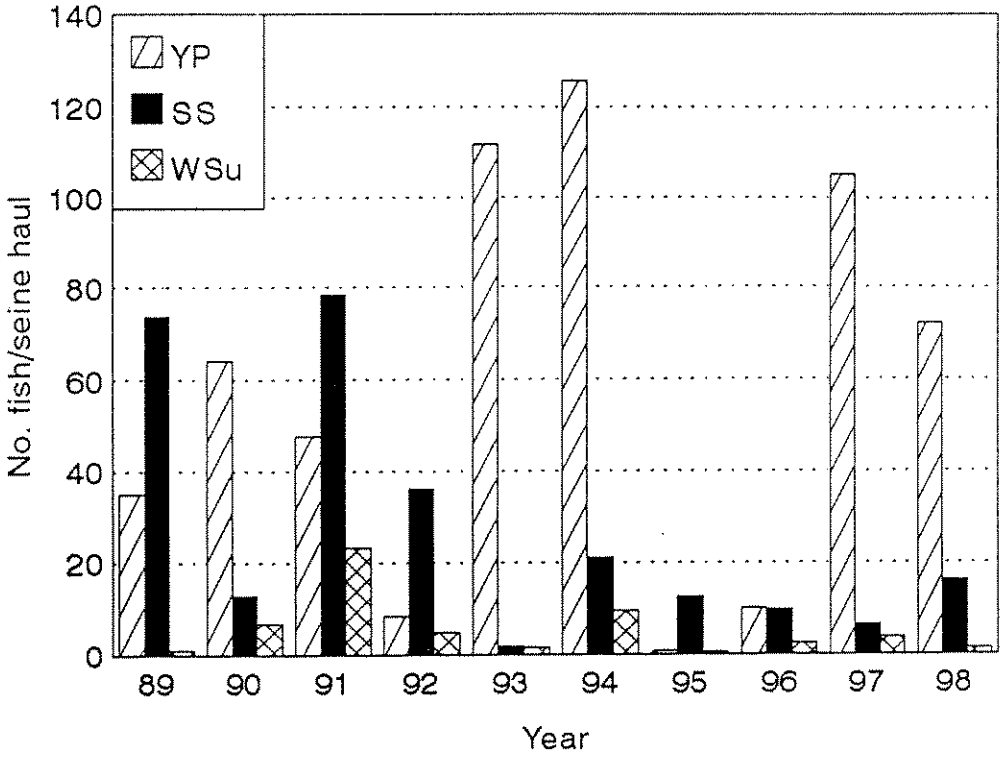

Figure 1. Forage fish trends in Bynum Reservoir, 1989-98.

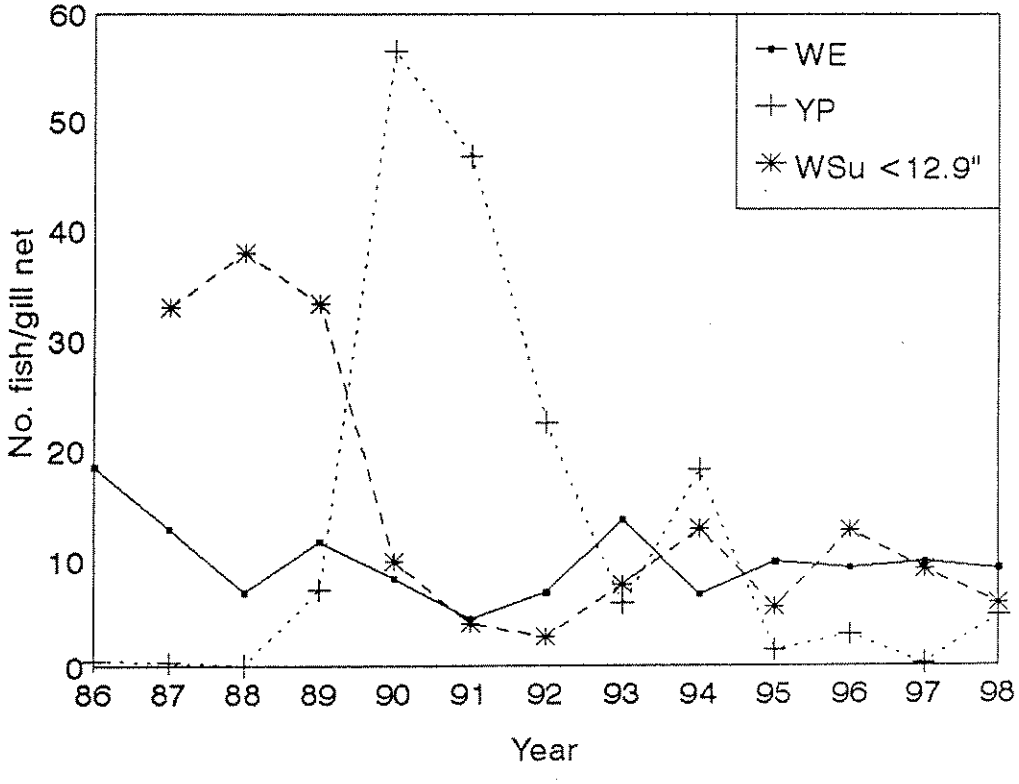

Figure 2. Trends in the fish populations in Bynum Res. (fall gill nets 1986-98).

Lake Frances

A total of 24 trap net nights on Lake Frances captured 69 walleye, 76 northern pike, 6 burbot and 5 white sucker. Surveys were conducted from April 22 to 25, 1998. In addition, 42 short-term gill nets caught 33 walleye and 2 northern pike. Water temperature ranged from 46-49°F during spring trapping. Data collected on miscellaneous species are on file in the Choteau field office.

Combining fish taken with both types of sampling gear, a total of 78 walleye over 14 inches in length were tagged with metal jaw tags. Walleye averaged 17.3 inches (range 13.8-26.0) and 1.68 pounds (range 0.73-5.44). Likewise, 55 northern pike over 16 inches were tagged with orange Floy T-tags. They averaged 18.8 inches (range 16.1-26.9) and 1.56 pounds (range 0.92-3.96).

Anglers returned four tags from walleye tagged in 1998 for a 5.1 percent harvest (Table 1). They also returned 19 tags from fish tagged in earlier years, with a cumulative exploitation rate of nearly 14 percent for the 1995 tagging year. Anglers also returned 12 northern pike tags, with 5 of these accounting for a first-year return of over 9 percent and the remaining 7 tags bringing the cumulative harvest to 9 percent for the 1997 tagging year.

Sampling of forage fish was conducted in August with 16 seine hauls made at previously established shoreline locations. Spottail shiner were most abundant with nearly 100 fish/pull (Appendix I). Four other species were taken, along with crayfish. Examination of Figure 3 shows that yellow perch YOY have declined for the second straight year following a peak experienced in 1996, while spottail shiner have more than tripled since last year. Few YOY walleye were collected during the surveys, either as those produced naturally in the lake or as those surviving from a stocking of 99,340 fingerlings made on June 22, 1998.

A total of 17 sinking gill nets were fished in Lake Frances in mid-September. Species caught in decreasing order of abundance were: 308 yellow perch, 109 walleye, 86 northern pike and 7 white sucker (Table 2). Yellow perch continue to increase from a low experienced in 1992 (Figure 4) while northern pike are somewhat stable. Walleye numbers taken in gill nets in 1998 are highest since 1990. Gill nets also captured 546 crayfish or 32/net catch, down from 39/net in 1997.

Forty-two walleye stomachs were examined in the field for food content. Approximately 38 percent were empty, unidentified fish remains occurred in approximately 28 percent, and crayfish in about 21 percent of the stomachs. Other items include freshwater shrimp, vegetation and tapeworms. A total of 33 northern pike stomachs had the following occurrence of food items: crayfish at 42 percent and fish remains at 12 percent. Also occurring in one stomach each, were a yellow perch, a walleye and a northern pike. Approximately 39 percent of the pike stomachs were empty.

Pishkun Reservoir

Forage surveys were conducted on August 19, 1998, in which 16 seine pulls were made along the

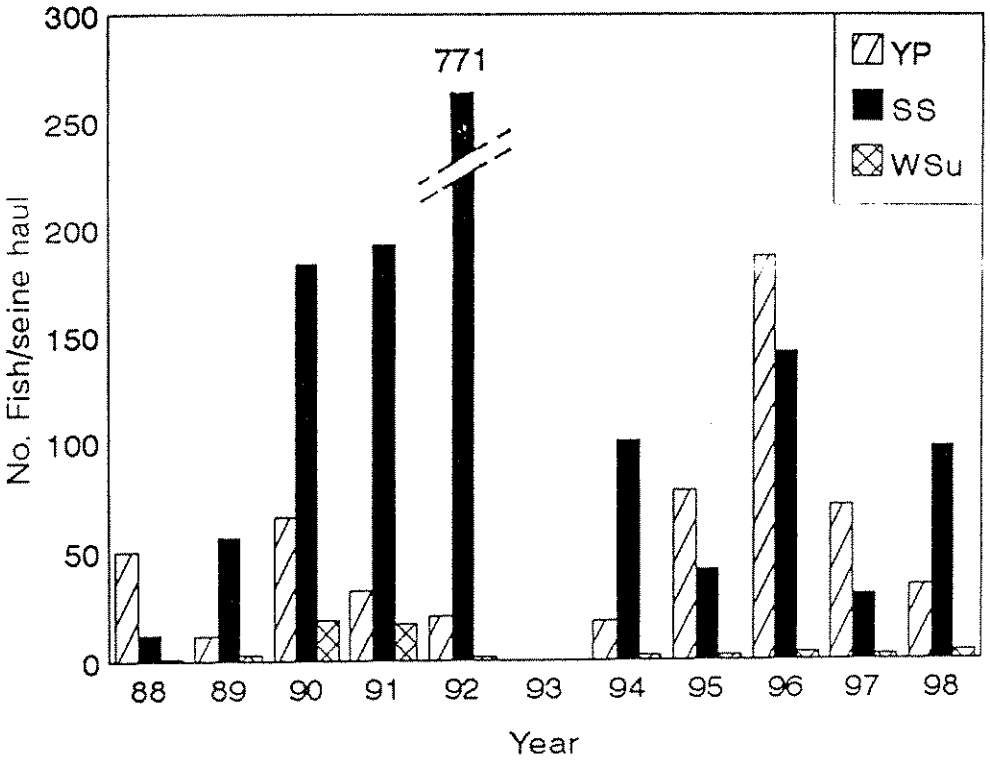

Figure 3. Forage fish trends in Lake Frances, 1988-98.

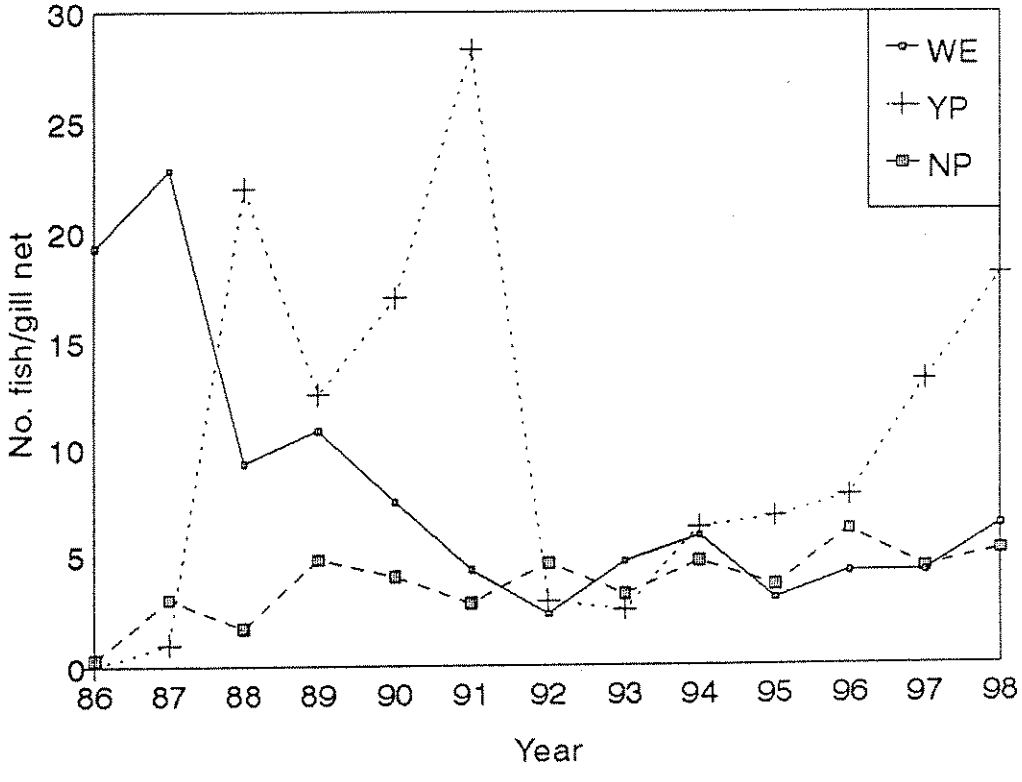

Figure 4. Trends in the fish populations in Lake Frances (fall gill nets, 1986-98).

shoreline. Young-of-the-year yellow perch were most abundant followed by YOY white sucker (Appendix I). Forage numbers appear to closely resemble the 1997 results. Gill netting results for Pishkun Reservoir appear in the annual coldwater lakes report (Tews, et al. 1999).

Tiber Reservoir

Trap nets were employed in two areas of Tiber Reservoir during early April to monitor trends in walleye and northern pike populations. Forty trap net nights in the Devon area caught 138 walleye, 69 northern pike, 39 rainbow trout, 9 burbot, 18 yellow perch, 10 white sucker, 9 longnose sucker, 12 carp, 1 flathead chub and 1 cisco. In the Willow Creek Arm (WCA), 78 trap net nights captured 135 walleye, 92 northern pike, 8 rainbow trout, 24 burbot, 555 yellow perch, 35 white sucker, 2 longnose sucker and 1 carp. Water temperatures ranged from 45-48°F in the Devon area from April 8-11, 1998, and from 45-46°F in the WCA from April 13-20, 1998. Lake levels were stable at 2981.3 feet M.S.L. throughout the surveys.

The Marias River and the upper portion of the WCA were electrofished to obtain additional information on species composition. In the Marias River, a total of 292 walleye were taken along with 7 northern pike and 38 rainbow trout. In the WCA, 96 walleye, 4 northern pike and 1 rainbow trout were captured. Inflows in the Marias River varied from 400-630 cfs from April 8-11, 1998, and water temperatures ranged from 41-46°F. Flows were absent in the WCA during the April 13-20 surveys.

A total of 475 walleye caught with both types of gear from both areas of the reservoir were tagged and released. In addition, 127 northern pike and 102 rainbow trout were also tagged. In the Devon/Marias River area, 275 walleye averaged 15.9 inches (range 13.8-25.7) and 1.35 pounds (0.73-6.60), while 200 walleye in the WCA averaged 17.6 inches (range 13.9-25.2) and 2.00 pounds (range 0.85-6.40). Forty-five northern pike in the Devon area averaged 21.2 inches (range 16.1-34.1) and 2.67 pounds (range 0.93-16.3). In the WCA, 82 northern pike averaged 23.3 inches (range 19.2-31.0) and 3.37 pounds (range 1.79-9.10). Ninety-four rainbow trout in the Devon/Marias River area averaged 19.5 inches (range 14.2-22.4) and 2.50 pounds (range 1.02-3.70). Eight rainbow trout in the WCA averaged 19.6 inches (range 17.0-21.1) and 2.42 pounds (range 1.74-3.07). The average size of fish when combined from both areas is as follows: walleye- 16.6 inches and 1.62 pounds; northern pike- 22.5 inches and 3.12 pounds; and rainbow trout- 19.5 inches and 2.19 pounds. Lengths and weights of miscellaneous species are on file in the Choteau field office.

Throughout the report period, anglers voluntarily returned tags from 63 walleye and 13 northern pike (Table 1). Of fish tagged in 1998, approximately 8 percent of both species were harvested in the first year. Highest first-year returns for walleye in previous years was over 12 percent while northern pike was over 16 percent. Cumulative returns range from 12-19 percent for walleye and 12-18 percent for northern pike. Anglers also returned 3 tags from rainbow trout, 2 from 1998 and 1from 1997. Movement patterns of walleye and northern pike resemble those reported in an earlier report (Hill, et al. 1998).

Small mesh trap nets were fished in the WCA on June 16-17, 1998. Approximately 3400 spottail shiner were captured and transferred to Petrolia Reservoir near Lewistown.

Forage surveys were conducted in late August at established shoreline seining locations. A total of 68 seine hauls captured 12 species (Appendix I), with spottail shiner most abundant followed by yellow perch. Examination of Figure 5 shows that when compared to previous years, both spottail and perch numbers have declined. Carp and emerald shiner numbers are similar to 1997. YOY walleye averaged 0.3 fish/seine haul, the lowest recorded since 1990. During the surveys, reservoir elevations were approximately 2989 feet M. S. L. and water temperatures ranged from 71-72°F.

A total of 29 sinking gill nets were fished throughout the reservoir from September 9-11, 1998, with eight species captured (Table 2). Yellow perch were most abundant followed by walleye and white sucker. A new species, cisco, were taken for the first time during the netting surveys. Cisco were introduced in 1997 for additional forage for walleye and northern pike (Hill, et al, 1997). Figure 6 shows trends for the four most common species in Tiber Reservoir. Slight increases were noticed for northern pike and white sucker while walleye and yellow perch both decreased from 1997 levels. It should be noted that walleye populations were lowest in 1985 as reported in an earlier document (Hill, et al, 1997). Netting results for four individual areas of the reservoir are found in Appendix II.

Cisco were also sampled monthly using overnight vertical gill nets set at the Bootlegger Trail station. Table 3 demonstrates cisco distribution by depth and temperature. In May, cisco were most common in the 0-25' and 26-50' depth ranges, with temperatures ranging from 55°F at the surface to 47°F at 50 feet. From June through September, few fish were taken in the 0-25' depth range as temperatures warmed to 73°F at the surface in July and 76°F in August. Most of the cisco appeared to seek depths of 26-75' throughout this time period. Temperatures ranging from 52-73°F were recorded at these depths. Relatively fast growth was experienced for this year class, attaining 4.5 inches in September of 1997, increasing to 9.4 inches by June, 1998. Growth stabilized from June through September (9.4-9.8 inches). The October sample shows average length increased to 10.1 inches (range 8.9-11.0). Sexual differentiation was possible as early as June. Approximately one-fourth of the males and females checked from July through October were sexually mature and would likely spawn as age I+ fish.

In conjunction with regular gill netting surveys in September, a series of six vertical gill nets were fished overnight to obtain cisco trend information. Cisco were most abundant in the Bootlegger Trail area followed by WCA and the Dam area (Table 4). All of the cisco taken were age I+ fish (1997 year class) with the exception of six YOY, including one from WCA, one from the Dam area, and four from the Bootlegger Trail area. The only other species taken include a total of three spottail shiner from the WCA and Dam area. Depths at the netting stations were: 94 feet at WCA; 113 feet at the Dam; and 101 feet at the Bootlegger. Afternoon surface temperatures varied from 70-72°F at the three sites.

To determine whether or not cisco were going to spawn in 1998, additional sampling efforts were undertaken near the upper end of the reservoir in late October and early December. Two sinking

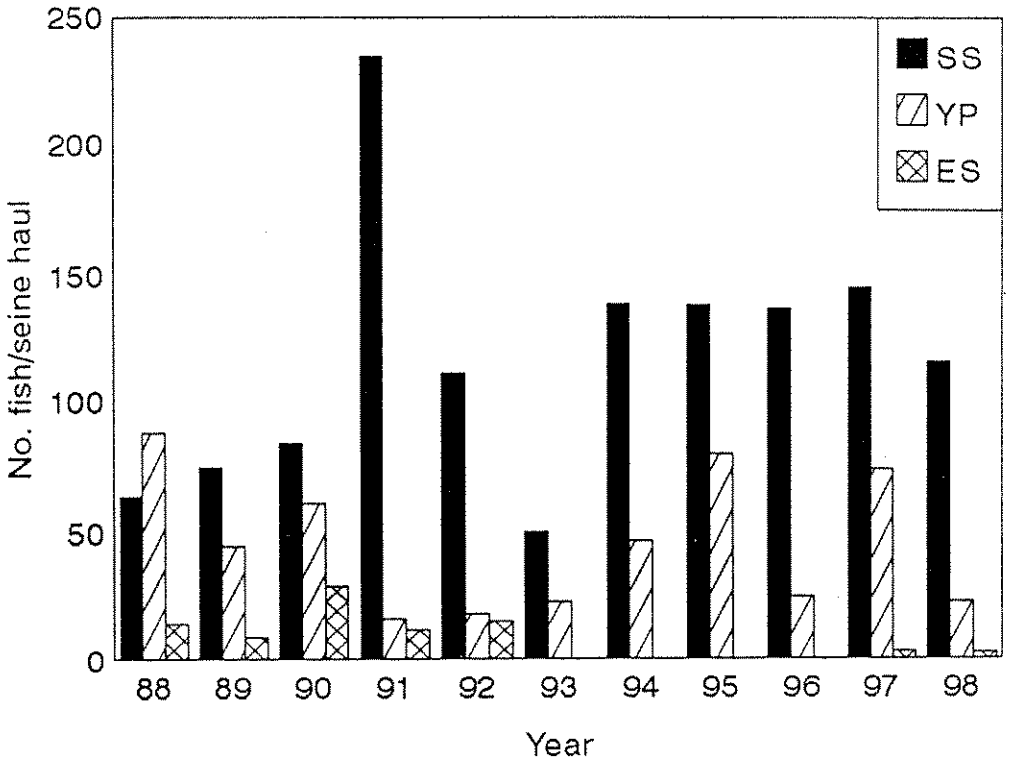

Figure 5. Forage fish trends in Tiber Reservoir, 1988-98.

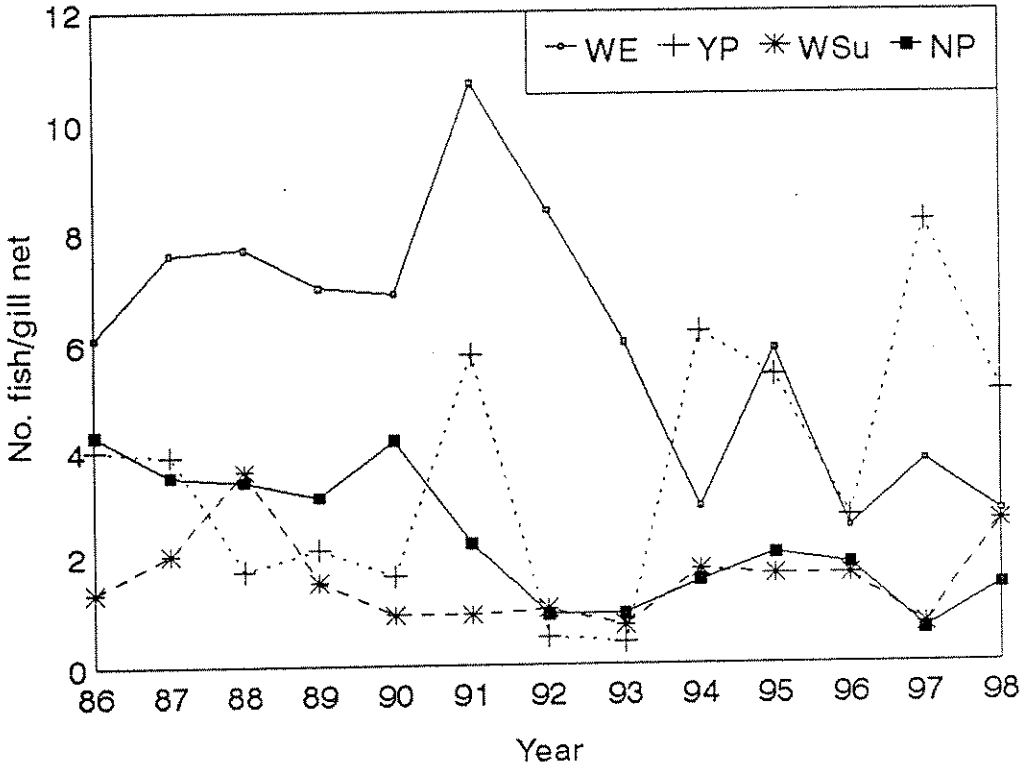

Figure 6. Trends in the fish populations in Tiber Res. (fall gill nets, 1986-98).

Table 3. Monthly distribution of cisco: % of catch by depth (and temperature range) of the 1997 year class at the Bootlegger Station, Tiber Reservoir.

Depth range	Sep 97	May 98	Jun 98	Jul 98	Aug 98	Sep 98	Oct 98
0 - 25'	9 (66°)	44 (51-55°)	0 (61°)	2 (70°)	1 (73-76°)	1 (69-70°)	16 (-)
26 - 50'	24 (66°)	35 (47-50°)	14 (60°)	14 (64-69°)	29 (67-73°)	13 (68-69°)	25 (-)
51 - 75'	51 (66°)	18 (45-46°)	57 (52-60°)	62 (57-63°)	48 (59-66°)	53 (61-68°)	39 (-)
76 - 100'	16 (65°)	4 (44°)	29 (51°)	22 (57°)	21 (58°)	33 (61°)	20 (-)
Avg. length (inches)	4.5	7.8	9.4	9.2	9.8	9.7	10.1

Table 4. Vertical gill net catch of cisco from three areas of Tiber Reservoir, 1998.

Area (date)	Depth range	No. of fish by net size						Length range (avg)
		1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	
WCA	0- 25'	0	0	8	3	0	0	
(9/9/98)	26- 50'	1	0	18	14	0	0	9.2-10.8 (9.8)
	51- 75'	0	2	86	64	1	1	
	76-100'	0	1	30	43	1	0	
		1	3	142	124	2	1	
Dam	0- 25'	0	0	4	2	0	0	
(9/10/98)	26- 50	0	0	15	6	0	0	8.8-10.6 (9.8)
	51- 75	0	0	68	31	1	0	
	76-100'	1	1	35	32	0	0	
		1	1	122	71	1	0	
Bootlegger	0- 25'	0	0	3	1	0	0	
(9/11/98)	26- 50'	0	0	28	13	1	0	8.8-10.4 (9.7)
	51- 75'	0	4	102	60	3	1	
	76-100'	4	1	47	53	5	0	
		4	5	180	127	9	1	

experimental gill nets set overnight (October 26) caught 23 cisco. Ripe fish were not observed, however, one-fourth of the females and three-fourths of the males were mature and would probably spawn in the near future. On December 1, two sinking gill nets, each set for two hours, and two floating gill nets (set for three hours) , caught 46 cisco. Of these, 75 percent of the females were running eggs and all the males were expending milt. On December 3, approximately three miles of the Marias River above Tiber was electrofished to determine whether or not any cisco were running upstream. (Cisco are not known to inhabit running water for any length of time). Flows in the river were 213 c.f.s. and only one cisco, a ripe male, was taken.

Ovaries from 10 female cisco were collected in mid-October to determine fecundity. Subsample counts were made using methods described by DuBios et al. 1989. Approximately 15 percent of the eggs by weight of each ovary were removed and counted. Actual counts ranged from 1,110-2,158 eggs (Table 5). By simple ratio, estimated total counts of eggs per female ranged from 7,403-14,387. Mullins, (1991), reported the mean number of eggs in spawning cisco (ages I-IV+) in Fort Peck Reservoir ranged from 1,119-13,956.

Information was obtained on hydroacoustics, walleye stomach analysis, plankton counts and cisco stomach analysis. These results will appear in a future report.

Creel Census

Weekend creel censuses were again conducted at Lake Frances and Tiber Reservoir from Memorial Day to Labor Day. This is the sixth consecutive year for the census and the data are presented in a separate document (Hill, 1999).

Tag Loss

Various types of tags used on walleye and the loss associated with each was reported in previous documents (Hill, et.al, 1998, and Hill, et.al, 1997). The most recent data obtained in 1998 is included in the latest document. As new information is acquired, it will be added to a similar report.

Age and Growth

A total of 71 walleye spines collected from Bynum Reservoir in 1998 were analyzed and represent age groups two through nine (Appendix III). Good numbers of two year old fish are beginning to recruit into the fishery. The aging technique is supported with the evidence that a strong year class developed in 1996 (as two year olds) and this data is presented in Table 6.

At Lake Frances, 90 walleye spines were examined and represent age groups one through twenty. Appendix IV contains this information but fish beyond age 12 are grouped together. Walleye numbers are fairly well represented in age groups one through four, an indication that overall numbers may be on the increase when compared to previous years. An especially strong year class of walleye was established in 1994 (Table 6), having an index of 202. Near average year classes appear to have

Table 5. Fecundity of age 1+ cisco in Tiber Reservoir, 1998.

Date	Length	Weight	Total egg weight (g)	15% egg weight (g)	15% egg count	Estimated total eggs
Oct 13	10.5	0.46	15.74	2.36	1,710	11,405
	9.6	0.37	14.94	2.24	1,110	7,403
	10.7	0.45	18.27	2.74	1,612	10,749
	10.4	0.46	14.18	2.13	1,649	10,978
	10.4	0.48	19.97	3.00	1,716	11,423
	10.8	0.54	24.20	3.63	2,158	14,387
	10.2	0.43	18.97	2.85	1,283	8,540
	10.5	0.43	15.44	2.32	1,261	8,392
	10.6	0.48	18.25	2.73	1,572	10,509
	10.6	0.45	16.98	2.55	1,294	8,617

Table 6. Walleye year-class strength from three Region Four reservoirs (1991-1998 fall gill nets).

Year class	Year-class strength index*		
	Bynum Reservoir	Lake Frances	Tiber Reservoir
1983	-	114	-
1984	-	37	91
1985	81	138	162
1986	28	153	154
1987	63	83	128
1988	39	117	112
1989	71	120	173
1990	312	189	132
1991	164	65	102
1992	18	37	74
1993	10	21	35
1994	103	202	47
1995	95	95	69

* Index based on values averaging near 100.

Table 7. Relative weights of walleye from Region Four reservoirs.

Year	Relative Weights		
	Bynum Reservoir	Lake Frances	Tiber Reservoir
1991	87	86	92
1992	86	87	88
1993	94	89	86
1994	93	89	84
1995	95	87	87
1996	97	92	83
1997	91	87	90
1998	84	84	82

established in 1995 and 1996. Additional support is given to the year class information when the 1998 creel age data is analyzed (Hill, 1999). The 1998 harvest was composed of 19 percent three year old and 47 percent four year old fish. This data is comparable to 1993 but much better than 1994, 1995 and 1996 where the harvest was composed of 1-12 percent three year old fish and 13-25 percent four year old fish. All of these fish are from natural reproduction.

Seventy-four walleye spines were analyzed from Tiber Reservoir (Appendix V). Age groups two through nine were represented. Below average year classes are evident for the years 1992 through 1996. Contrary to this information, the 1998 summer creel survey referenced above indicates an excellent walleye fishery with catch rates averaging 0.57 fish per hour throughout the summer.

Relative Weight

Average relative weights of walleye from Bynum Reservoir, Lake Frances and Tiber Reservoir are presented in Table 7. According to Murphy, et.al (1990), average relative weights (Wr) should range from 95-105. Walleye collected in 1998 fall gill nets at the three reservoirs have average Wr ranging from 82-93, all below the suggested range.

GREAT FALLS AREA WATERS

Missouri River between Morony Dam and Marias River

Standardization of the Portage Coulee area electrofishing survey began in 1998. The section will start at Portage Coulee and end at Huntley Coulee, reducing the section length to 5.2 miles. One electrofishing pass will be made along each bank (one day per bank) and electrofishing time recorded in minutes that equipment was turned on and in use. Shocking will be conducted in late August to early September to meet a water temperature range of low-mid 60°F. Surveys will be accomplished utilizing a boom mounted aluminum jet boat equipped with a 240 volt generator, and a Coeffelt rectifying unit capable of delivering 10-15 amps of straight DC. Crew size will consist of one dip netter and one boat operator. All fish will be netted except for big carp, buffalo and fish species too small to capture. Large carp and buffalo (i.e., those over 5 pounds) deemed catchable will be tallied but not netted or placed in live well. When available, measurements will be taken on 25 randomly selected individuals of each species on each of the two survey days. All unmeasured fish will be counted for catch-per-unit-effort (CPUE) computation. All game species will be weighed and measured. When necessary, the more numerous non-game species will be taken to mid-river, counted and released.

The Portage Coulee section was electrofished on September 1-2, 1998, for a total of 5.5 hours. Water temperatures ranged from 69-73°F. Sixteen species were collected for length and weight measurements (Table 8). Fifty-four carp were counted as being capturable by dip net but not placed in the live well. Smallmouth buffalo, long nose dace, emerald shiners and mottled sculpins were

Table 8. Catch statistics from electrofishing surveys of the Portage Coulee Section on the Missouri River, Montana, 1-2 September 1998.

Species	Number of fish	Length (inches) Mean	Range	Weight (pounds) Mean	Range	Mean condition factor
Freshwater drum	47	13.2	10.8-23.2	1.23	0.57- 6.50	46.57
Goldeye	50	13.1	11.4-15.1	0.78	0.49- 1.12	34.14
Rainbow trout	12	5.9	3.8-11.5	0.12	0.03- 0.60	44.12
Brown trout	2	11.2	9.0-13.5	0.62	0.30- 0.95	39.88
Mountain whitefish	12	6.3	4.5-16.0	0.20	0.03- 1.74	34.55
Walleye	6	14.1	12.0-15.8	1.09	0.60- 1.53	36.65
Sauger	10	14.9	11.8-18.5	1.12	0.44- 2.18	31.42
Smallmouth bass	115	7.5	3.7-14.9	0.39	0.02- 2.01	57.92
Mountain sucker	12	5.0	4.2- 6.5	0.06	0.03- 0.11	41.54
Shorthead redhorse	51	14.6	4.0-20.8	1.76	0.02- 4.50	44.83
Longnose sucker	49	7.8	3.7-18.3	0.27	0.04- 2.37	42.15
White sucker	19	9.2	5.5-16.8	0.59	0.06- 2.25	44.04
Stonecat	10	6.7	5.2- 8.9	0.10	0.04- 0.21	30.53
Northern pike	5	27.5	21.0-30.0	5.05	2.16- 6.70	23.38
Channel catfish	12	18.7	16.4-20.5	2.41	1.64- 3.45	36.90
River carpsucker	24	17.7	15.3-22.6	2.88	1.65- 7.50	49.88

observed but not captured. Relative abundance and catch statistics for all species captured are presented in Table 8.

Sauger CPUE increased to 1.8 fish per hour in 1998 but remains low compared to the high CPUE of 13.8 recorded in 1988 (Table 9). Six walleye were captured for a CPUE of 1.1, a decline from the previous consistent catches of 3.5-3.9 fish per hour recorded from 1995-1997. Catch rates for smallmouth bass increased to 20.9 fish per hour, the highest since surveys were initiated in 1988. Twenty thousand smallmouth fingerling were stocked between Morony Dam and Carter Ferry in late July of 1998. Thirty-one percent of the 115 bass sampled were young-of-the-year, similar to catch statistics from 1997 (et al, 1996). Anglers have returned two tags from a total of 65 bass tagged over 9.0 inches since the fall of 1997. This represents a 3 percent harvest to date.

Rainbow and brown trout catch rates again declined in 1998 to 2.2 and 0.4 fish per hour, respectively (Table 9). Mountain whitefish catch rates increased in 1998 to 2.2 fish per hour. Catch rates for trout species may have been affected due to higher water temperatures than the desired target of low-mid 60°F. Other game species collected include 5 northern pike and 12 channel catfish.

LEWISTOWN AREA WATERS

East Fork Reservoir

Trap nets were set in mid-April within one week of ice-off. During 25 trap nights, 148 northern pike, 38 yellow perch and 930 white suckers were captured. Eleven northern pike and 96 white suckers were recaptured. Northern pike averaged 3.08 lbs, yellow perch 0.33 lbs and white suckers 1.28 lbs (Table 10). A Schnabel estimate (Van Den Avyle 1993) of 622 northern pike was computed from 1998 recaptures. The 95% confidence interval on this estimate is 347 - 1266 northern pike. Due to the small number of total recaptures this confidence interval is based on a Poisson distribution (Ricker 1975). A Schnabel estimate of 4223 white suckers was also computed from 1998 recaptures. The 95% confidence interval on this estimate is 3519 to 5279 white suckers based on a normal distribution. Angler tag returns have been sparse from this water. Four tags of fish tagged in April 1998 were returned by December 1998. However, 1 of the 17 northern pike tagged in 1995 and 9 fish tagged in 1997 were recaptured during 1998 trapping. The northern pike tagged in 1995 had grown from 30.0 to 36.5 inches and from 6.1 to 14.5 pounds. The northern pike tagged in 1997 grew an average of 1.9 inches and 0.39 pounds.

Shoreline seining surveys captured record numbers of yellow perch averaging 500 per haul that were less than 5 inches long (Figure 7, Table 11). Small numbers of white suckers and northern pike were also captured (Table 11).

Fall gill netting results were different from those seen in 1997. Yellow perch were captured at very low levels and northern pike capture rate was higher than seen in 1997 (Figure 8). Relative weights of northern pike and yellow perch increased from 1997 and were very good for both species (Table

Table 9. Comparison of catch per unit (CPUE) of game species from electrofishing surveys of the Portage Coulee section on the Missouri River, 1988-1998.

	Date								
	9/8-9/88	8/23-24/89	8/24&28/91	9/14/93	9/1-2/94	9/7-8/95	9/10&13/96	9/8-9/97	9/1-2/98
Species	CPUE - number of fish/hour (total number captured)								
Sauger	13.8 (94)	2.3 (15)	0.4 (3)	4.2 (11)	0.1 (1)	3.5 (19)	2.2 (15)	1.1 (9)	1.8 (10)
Walleye	2.1 (14)	0.2 (1)	0.1 (1)	2.3 (6)	0.4 (3)	3.5 (19)	3.5 (24)	3.9 (32)	1.1 (6)
Rainbow trout	1.2 (8)	0.5 (3)	0.3 (2)	2.7 (7)	4.8 (34)	3.3 (18)	8.7 (60)	3.8 (31)	2.2 (12)
Brown trout	2.4 (16)	0.5 (3)	0.1 (1)	3.8 (10)	2.9 (20)	1.9 (10)	5.9 (41)	2.2 (18)	0.4 (2)
Mountain whitefish	0.3 (2)	0.2 (1)	- (0)	0.4 (1)	3.4 (24)	6.9 (37)	3.9 (27)	0.7 (6)	2.2 (12)
Smallmouth bass	- (0)	- (0)	- (0)	0.4 (1)	0.3 (2)	2.0 (22)	13.0 (90)	8.8 (72)	20.9 (115)
Total effort (hours)	6.8	6.5	7.2	2.6	7.0	5.4	6.9	8.2	5.5

Table 10. Overnight trap net results in large lakes and reservoirs in the Lewistown area during 1998.

Water Name Date Surveyed	# of trap nights	Species *1*	Total # of fish	Length (in) Range (Mean)	Weight (lbs) Range (Mean)	Relative Weight Range (Mean)
East Fork Res. 4/14/98	25	LNSU	3	14.8-16.2 (15.5)	1.28-1.55 (1.42)	
4/15/98, 4/21/98		NP	148	10.6-36.5 (22.0)	0.25-14.5 (3.08)	64.4-151.5 (95.7)
4/22/98, 4/23/98		WSU *2*	1026	11.6-16.3 (14.4)	0.66-1.96 (1.28)	
		YP	38	6.3-10.4 (8.5)	0.10-0.91 (0.33)	64.7-179.2 (97.7)
Petrolia Res. 4/29/98	10	CARP	77	10.0-24.2 (13.6)	0.60-1.94 (0.99)	
4/30/98		NP	15	19.7-24.5 (22.1)	1.65-2.86 (2.14)	68.5-90.3 (81.2)
		WE	3	18.5-22.0 (19.9)	2.29-3.55 (2.72)	83.8-93.8 (87.8)
		WSU	4	17.5-18.5 (18.1)	2.11-2.83 (2.45)	
		YP	2	9.8-10.0 (9.9)	0.41-0.48 (0.45)	82.6-90.6 (86.6)

1 LNSU = longnose sucker; NP = northern pike; WSU = white sucker; YP = yellow perch; WE = walleye; *2* sub-sample of lengths and weights taken.

Table 11. Number of forage fish captured per pull during 1998 beach seining of large Lewistown area reservoirs.

Water Name	Date	Water Temp	# of Hauls	Species Count *1* Average Length (in)						
				YP	WE	NP	FHMN	WSU	SPSH	CARP
East Fork Res. *2*	8/11/98	76 F	5	2494 (3.1)		5 (11.6)		3 (14.3)		
Petrolia Res.	8/13/98	79 F	8	134 (2.8)	6 (6.6)	1 (10.8)	1 (2.5)		48 (1.8)	68 (3.4)

1 YP = yellow perch; WE = walleye; NP = northern pike; FHMN = fathead minnow; WSU = white sucker; SPSH = spottail shiner. *2* Lengths subsampled in East Fork Reservoir.

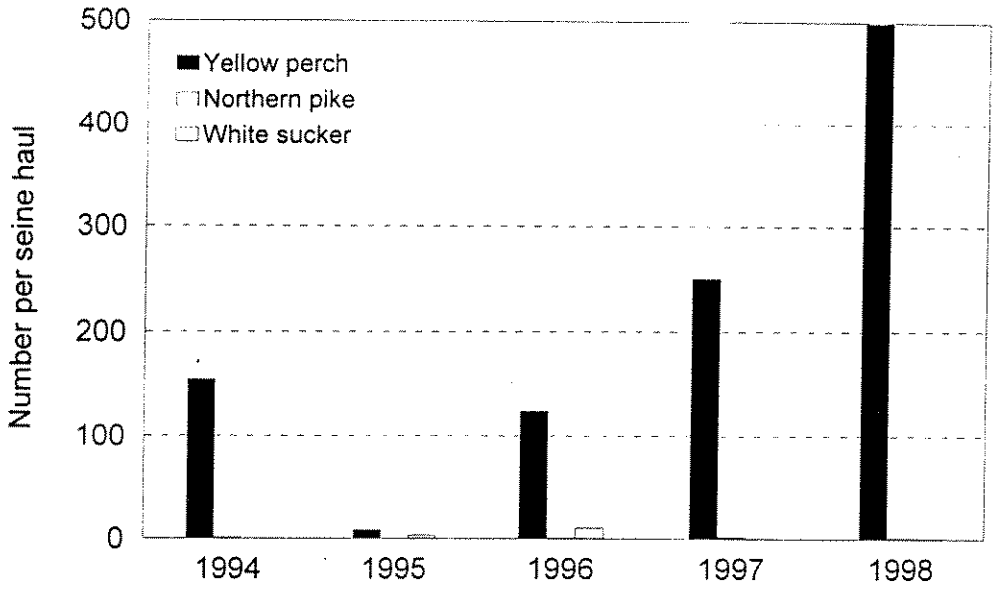

Figure 7. Forage fish trends from shoreline seining hauls taken in East Fork Reservoir 1994 - 1998.

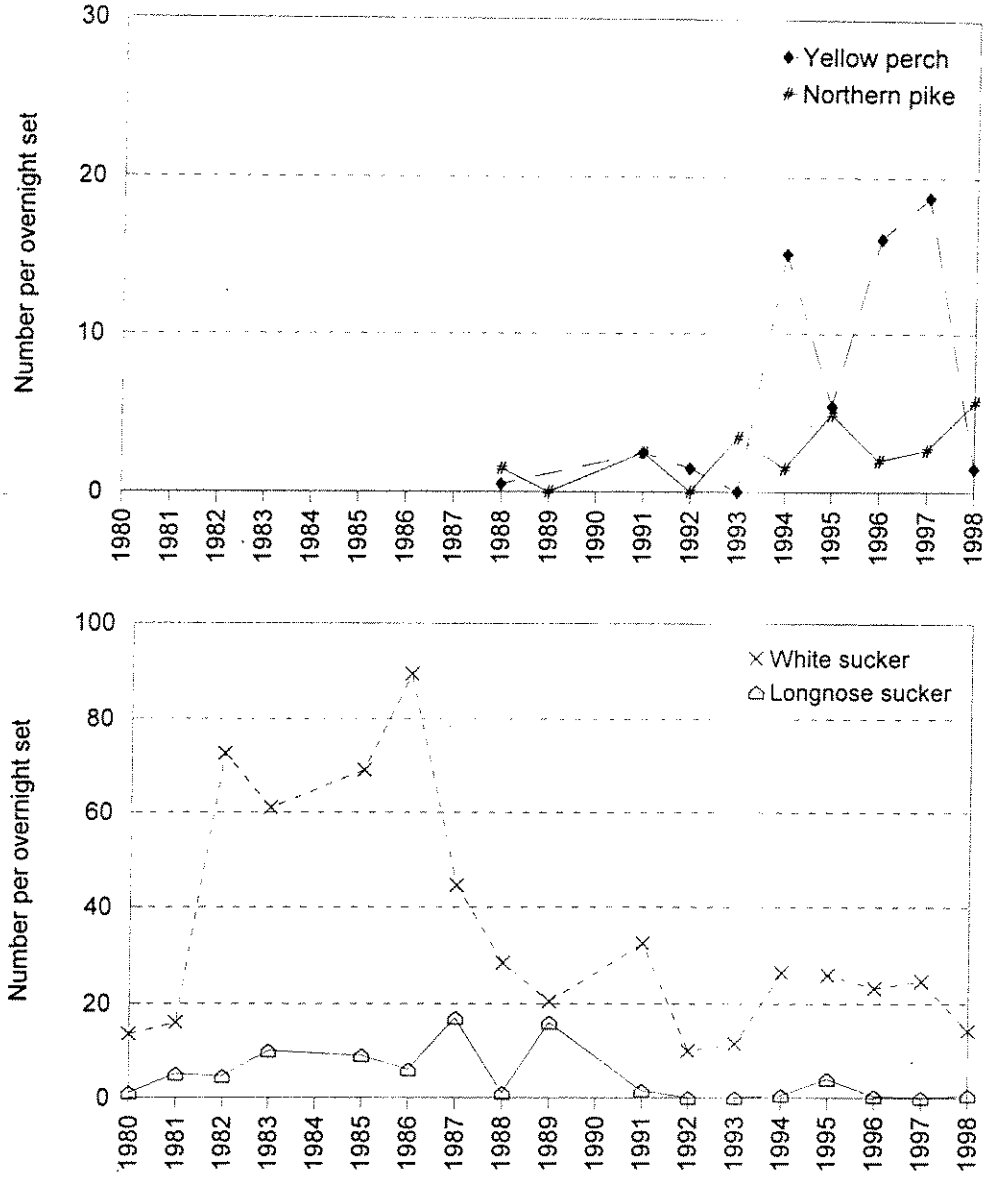

Figure 8. Trends in fish populations from East Fork Reservoir from fall gill nets (1980-1998).

12 and Hill et al. 1998). Average northern pike total length decreased by about 3.5 inches while yellow perch total length increased by 0.4 inches. White sucker size continued to increase from 1997. Zooplankton community composition in East Fork Reservoir was analyzed in 1998. Results are reported in Zollweg et al. 1999.

Petrolia Reservoir

In ten trap nights, three walleye and two yellow perch were caught (Table 10). Trapping was probably initiated too late to capture many fish. Thirty-four hundred spottail shiners were transferred to Petrolia Reservoir on 6/16/98 and 6/17/98. Forty-eight spottails were captured during shoreline seining in 1998; however, all were probably from the 1998 transfer, none from the 1997 transfer. Catch rates of yellow perch increased and walleye catch rates were the same as 1997 (Table 11, Figure 9).

Gill netting captured 57 walleye from 7.0 - 19.0 inches (Table 12). This was an increase in catch rate from 1997 (Figure 10). Average relative weight of walleye decreased from 94.0 to 87.5 and is less than a suggested target range of 95 - 105 (Murphy et al. 1990). Catch rates of yellow perch were down from the highest ever documented in 1997. Average yellow perch total length decreased from 8.6 to 6.8 inches and relative weight decreased from 106.8 to 90.4. Northern pike numbers were down from 1996 and 1997 levels, and average size increased from 21.5 to 25.1 inches. White sucker numbers declined slightly. (Table 12, Hill et al. 1998, and Hill et al. 1997).

Other Lewistown Reservoirs

Surveys in 1997 found three reservoirs that have the potential to provide warmwater fisheries. All three are located on BLM land near the Musselshell Trail and include Bub's, Whisker and Wolf Coulee Reservoirs. Bub's and Whisker Reservoirs have not been stocked by MFWP. Wolf Coulee was stocked before the dam washed out several years ago. EA's were prepared in 1998 for planting black crappie and largemouth bass in Whisker and black crappie and bluegill in Wolf Coulee. An EA was also written for introducing bluegill and yellow perch into Drag Creek Reservoir after the outflow is raised and largemouth bass are restocked.

Dry Blood Reservoir- During the 1998 survey, largemouth bass up to 12 inches long were observed. Hundreds of YOY largemouth bass were also observed. The large numbers of largemouth bass from 2 - 8 inches indicate reproduction and recruitment continue to be very good in this reservoir.

Payola Reservoir- During a short electrofishing survey, 11 yellow perch numbers were captured, no bullheads, and two largemouth bass (Table 13). Average total length of yellow perch decreased from 8.6 to 4.6 inches. The largemouth bass taken were 12.1 and 12.6 inches, similar in size to the largemouth bass taken in 1997 (Table 13 and Hill et al. 1998).

South Fork Blood Reservoir- About 1000 2-11 inch largemouth bass were transferred from Dry Blood to South Fork Blood Reservoir in August 1997 (Hill et al. 1998). During a short electrofishing survey in 1998, twelve largemouth bass ranging from 4.9 to 7.3 inches were captured (Table 13).

Table 12. Overnight gill netting results in large lakes and reservoirs in Lewistown area during 1998.

Water Name	Date Surveyed	# of Nets 1	Mean hrs/net	Species 2	Total # of fish	Length (in) Range (Mean)	Weight (lbs) Range (Mean)	Relative Weight Range (Mean)
East Fork Res.	9/28/98	2 F, 2 S	20.2	LNSU	2	16.5-16.6 (16.6)	1.43-1.78 (1.61)	
				NP	23	10.7-35.6 (19.4)	0.31-12.2 (2.73)	80.3-119.1 (95.3)
				WSU	57	13.1-16.0 (14.6)	0.94-1.69 (1.31)	
				YP	6	6.4-8.8 (7.9)	0.14-0.35 (0.25)	87.0-125.4 (99.2)
Petrolia Res.	9/30/98	2 F, 2 S	23.0	CARP	7	11.1-24.5 (15.6)	0.68-7.4 (2.39)	
				NP	6	9.9-30.8 (25.1)	0.16-6.0 (3.8)	72.8-87.3 (77.9)
				WE	57	7.0-19.0 (13.7)	0.08-2.25 (0.96)	72.1-100.2 (87.5)
				WSU	6	12.8-16.1 (15.1)	0.69-1.78 (1.21)	
				YP	19	5.4-11.5 (6.8)	0.06-0.74 (0.16)	68.3-130.2 (90.4)

1 F = Floater; S = Sinker. 2 LNSU = longnose sucker; NP = northern pike; WSU = white sucker; YP = yellow perch; WE = walleye.

Table 13. Electrofishing results from small reservoirs in northcentral Montana during 1998. One lap of the shoreline was completed in one hour.

Water Name	Date Surveyed	Species 1	# of fish	Length (in) Range (Mean)	Weight (lbs) Range (Mean)	Relative Weight Range (Mean)
Payola Res.	6/25/98	LMB	2	12.1-12.6 (12.4)	0.94-1.2 (1.1)	101.8-114.3 (108.1)
		YP	11	3.9-6.6 (4.6)	0.02-0.12 (0.04)	67.3-166.2 (84.6)
South Fork Blood Res.	6/25/98	LMB	12	4.9-7.3 (6.4)	0.02-0.24 (0.17)	109.0-156.1 (134.2)

1 LMB = largemouth bass; YP = yellow perch.

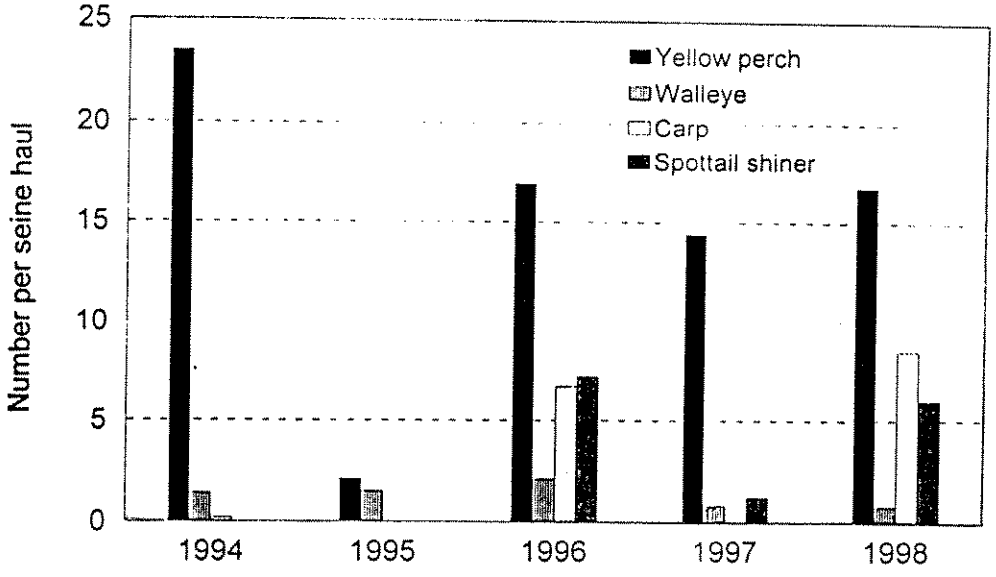

Figure 9. Forage fish trends from shoreline seining hauls taken in Petrolia Reservoir 1994 - 1998.

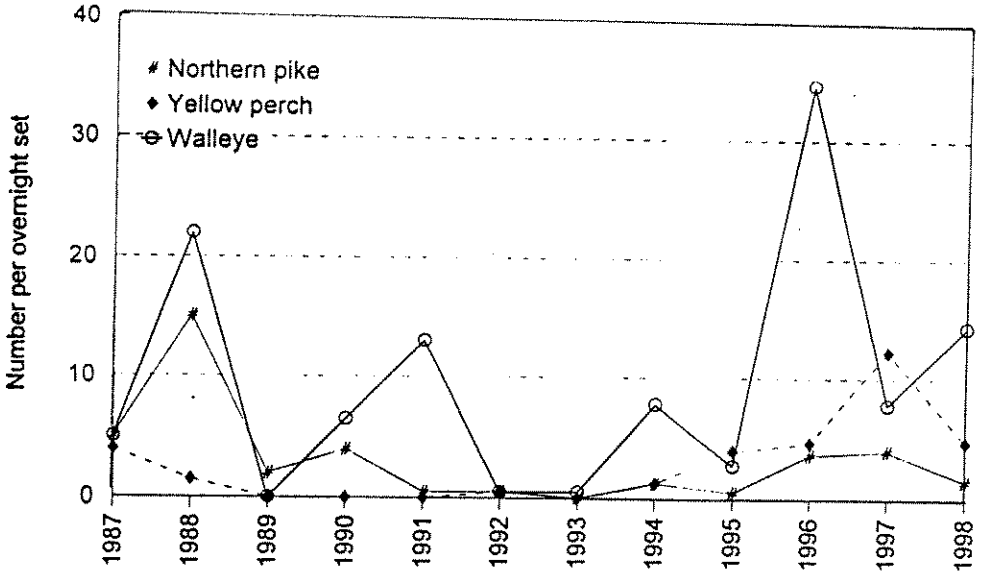

Figure 10. Trends in fish populations from Petrolia Reservoir from fall gill nets (1987-1998).

HABITAT PROTECTION

Private individuals or government entities that wish to construct projects that may alter streambeds or banks are required to obtain a permit. The 1975 Natural Streambed and Land Preservation Act (310) involves the private sector while the Stream Protection Act of 1963 (SPA) covers government agencies. Projects received during 1997 are documented in the Choteau, Lewistown and Great Falls offices. Site inspections were held on most of the projects received and recommendations were made or permits issued.

No significant water discharge permit applications or renewals were received and no significant pollution complaints were received during the report period.

DISCUSSION AND RECOMMENDATIONS

The walleye population of Bynum Reservoir remains fairly stable and younger fish, particularly two year olds, are beginning to recruit into the fishery. Walleye recruitment should be closely monitored. At this time, it is recommended to not stock walleye fry or fingerlings into Bynum unless recruitment failure occurs. Scuba divers have observed that scotch pine trees serve as spawning structures for yellow perch in Bynum and additional scotch pine should be placed as time permits.

In recent years, northern pike populations in Lake Frances have been quite abundant and thought to be limiting walleye recruitment. Walleye fingerlings were stocked in 1997 (very poor condition) and 1998 in an attempt to improve walleye numbers. It is questionable whether or not stocked fish would have any better chance at recruiting than those produced naturally. Data obtained from creel census and netting surveys during 1998 indicates that fairly good numbers of two, three and four year old walleye are now coming into the fishery. It is recommended to continue monitoring surveys directed at determining walleye recruitment and whether they were produced naturally or are the result of stocked fish.

Cisco were introduced into Tiber Reservoir in 1997 and 1998 to improve the forage base for walleye and northern pike. The 1997 year class had excellent survival and approximately one fourth of the cisco are thought to have spawned in the fall of 1998. Few cisco from the 1998 plant were sampled in netting surveys and appear to have had poor survival. The cisco population should continue to be monitored to determine their contribution to the overall forage base as well as whether or not they have reproduced naturally. Based on gill netting surveys, walleye numbers appear at fairly low levels. However, 1998 creel surveys demonstrated that anglers enjoyed very good walleye fishing with catch rates of 0.57 fish per hour.

There appears to be discrepancies between sampling gear results (particularly walleye populations) and what shows up in the anglers creel. However, until better methods can be developed, walleye and northern pike populations should continue to be monitored in Region Four waters using traps,

seines, gill nets, and creel surveys (where possible).

We should continue monitoring fish populations in East Fork Reservoir by trapping, tagging, seining and gill netting. This information will help determine if the fishery is being over harvested and to better understand the size structure of the northern pike and yellow perch populations.

Potential access conflicts on Petrolia have not been resolved; public access will continue in the near future but nothing has been decided regarding site maintenance responsibilities. Spottail shiners need to be planted again in Petrolia Reservoir. Walleye should continue to be stocked at rates seen during the past few years. The trapping operation should be intensified to get a better understanding of the yellow perch, walleye and northern pike size structure in Petrolia Reservoir.

Once Wolf Coulee fills, depth should be surveyed to determine fishery potential. Bub's, Wolf Coulee and Whisker Reservoirs need to be evaluated for stocking options and for access.

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PREPARED BY: William J. Hill, Emily C. Zollweg, Anne E. Tews, and Paul D. Hamlin

DATE: December 1999

PRINCIPAL FISH SPECIES INVOLVED: Walleye, northern pike, yellow perch, spottail shiner, cisco, largemouth bass, white sucker, longnose sucker, carp.

CODE NUMBERS OF WATERS REFERRED TO IN REPORT:

14-7080 Bynum Reservoir
14-7440 Lake Frances
14-9240 Tiber Reservoir
16-4950 East Fork Spring Creek Reservoir
17-4864 Missouri River Sec. 07
18-2475 Whisker Reservoir
18-9480 Wolf Coulee Reservoir
18-7560 Drag Creek Reservoir
18-7565 Dry Blood Reservoir
18-8700 Payola Reservoir
18-8720 Petrolia Reservoir
18-9150 South Fork Blood Reservoir
20-7950 Pishkun Reservoir

Appendix I. Forage fish/reproduction survey results for several Region Four reservoirs during August, 1998 (beach seining).

Water	Date	Water temp (°F.)	No. of pull	Number of fish/pull											
				YP	SS	WSu	Cray	WE	NP	Carp	MSc	LC	ES	SB	FHC
Bynum Res.	8-21-98	70°	14	72.1	16.0	1.2	4.2	1.0							
Lake Frances	8-20-98	70°	16	33.6	97.1	4.0	1.1	0.1	0.6						
Pishkun Res.	8-19-98	69°	16	26.1	0.5	9.3	0.3		0.1						
Tiber Res.															
Dam	8-24-98	71°	17	19.6	117.4	6.0	1.1			6.2	0.2		1.0		
WCA	8-25-98	71°	18	33.3	57.3	1.8	1.7	0.1		33.4	0.1	0.2	0.4	0.1	
BT	8-26-98	70°	17	33.4	134.0	4.1	4.2	0.1	0.1	2.8		1.0	1.6		0.2
Devon	8-27-98	70°	16	4.3	157.8	0.4	0.4	1.0			0.1	7.4	8.3		0.8
Tiber combined			68	23.1	115.2	3.1	1.9	0.3	Tr.	11.1	0.1	2.0	2.7	Tr.	Tr.

Appendix II. Gill net summaries by area of Tiber Reservoir, 1998.

Area (date)	No. of nets	Hours fished	Species	No.of fish	Length range (avg)	Weight range (avg)
WCA area (9/9/98)	10	18.0	WE	13	9.2-12.8 (11.6)	0.24- 0.61 (0.46)
				19	13.1-15.5 (14.1)	0.63- 1.15 (0.84)
				12	16.0-19.7 (17.7)	1.23- 2.60 (1.77)
				1	(20.1)	(2.44)
			NP	10	17.3-19.9 (18.6)	1.06- 1.77 (1.39)
				8	20.5-26.2 (22.3)	1.70- 4.40 (2.56)
			YP	70	5.5- 8.9 (6.4)	0.07- 0.35 (0.12)
				17	9.2-10.8 (9.9)	0.37- 0.68 (0.49)
			WSu	23	6.8-12.7 (10.7)	0.14- 1.42 (0.62)
				31	13.0-19.5 (16.6)	0.41- 3.61 (2.10)
			Carp	3	28.6-29.8 (29.2)	10.70-13.40 (12.20)
			Rb	2	19.0-20.5 (19.8)	2.32- 2.33 (2.33)
			Cis	2	10.0-10.7 (10.3)	0.42- 0.47 (0.45)
Dam area (9/10/98)	6	15.5	WE	3	12.2-12.8 (12.4)	0.52- 0.67 (0.58)
				6	13.5-15.8 (14.7)	0.78- 1.30 (1.04)
				2	18.9-19.9 (19.4)	2.11- 2.49 (2.30)
			NP	1	(15.5)	(0.76)
				3	17.5-19.5 (18.3)	1.06- 1.40 (1.29)
				9	21.0-27.8 (23.4)	1.76- 4.75 (3.06)
			YP	28	5.2- 8.7 (6.3)	0.05- 0.31 (0.11)
				3	9.0-10.4 (9.6)	0.31- 0.53 (0.41)
			WSu	2	12.0-12.9 (12.5)	0.74- 1.02 (0.88)
				7	15.1-19.8 (17.6)	1.40- 2.87 (2.20)
			LnSu	2	9.3-10.7 (10.0)	0.23- 0.42 (0.33)
			Rb	3	17.2-18.4 (17.9)	1.22- 1.75 (1.49)
			Carp	2	26.2-29.5 (27.9)	10.80-14.00 (12.40)
BT area (9/10-11/98)	7	16.5	WE	9	7.3-12.3 (9.7)	0.12- 0.60 (0.30)
				2	17.1-17.5 (17.3)	1.52- 1.85 (1.69)
			NP	1	(14.5)	(0.56)
				2	17.0-19.1 (18.1)	1.06- 1.24 (1.15)
				3	20.9-23.7 (22.7)	1.74- 3.50 (2.74)
			YP	18	5.6- 8.8 (7.3)	0.09- 0.33 (0.20)
				6	9.0- 9.7 (9.3)	0.34- 0.44 (0.40)
			Carp	1	(28.2)	(11.90)
			WSu	1	(17.9)	(2.78)
			Rb	5	16.7-21.4 (19.4)	1.60- 2.55 (2.07)
Devon area (9/11/98)	6	18.0	WE	8	9.8-12.5 (11.2)	0.25- 0.50 (0.40)
				2	(14.3)	0.85- 0.87 (0.86)
				1	(16.2)	(1.20)
			NP	3	23.1-24.9 (23.7)	2.77- 4.00 (3.26)
			YP	3	5.7- 8.9 (6.8)	0.10- 0.32 (0.17)
				3	9.2-10.4 (9.9)	0.44- 0.58 (0.52)
			Carp	2	23.1-25.2 (24.2)	5.90- 7.80 (6.85)
			WSu	3	6.6-10.2 (8.5)	0.13- 0.46 (0.28)
				7	14.1-18.2 (17.1)	1.28- 3.00 (2.27)
			LnSu	6	9.5-12.9 (10.9)	0.33- 0.74 (0.48)
			Rb	4	11.8-14.0 (12.8)	0.60- 1.00 (0.77)
			Cis	21	9.6-11.4 (10.4)	0.30- 0.67 (0.45)

Appendix III. Age composition of walleye captured in fall gill nets on Bynum Reservoir, 1991-1998.

Year	No. of spines	No. of nets	Number of fish per age per gill net set										
			1	2	3	4	5	6	7	8	9	10	Totals
1991	14	4	1.00	-	0.50	1.75	-	1.25					4.50
1992	23	4		1.50	3.50	0.50	0.50	0.50					6.50
1993	45	4		4.00	7.50	0.50	1.18	-	0.33	0.25			13.76
1994	26	4		0.50	1.38	4.13	0.25	0.25	-	-	0.25		6.76
1995	94	10	3.10	0.10	0.31	3.69	1.97	0.53	-	0.10			9.80
1996	60	10	0.80	1.10	0.30	0.30	1.60	5.00	-	-	0.30		9.40
1997	71	10	0.70	1.90	1.00	-	-	1.58	3.96	0.46	0.10	0.20	9.90
1998	71	9	-	3.44	1.33	0.67	0.22	0.23	1.30	1.68	0.46		9.33
Mean catch for each age class			0.70	1.56	1.98	1.44	0.72	1.17	0.69	0.31	0.14	0.03	8.74
Average % contribution by each age class			.080	.178	.227	.165	.082	.134	.079	.035	.016	.003	.999

Appendix IV. Age composition of walleye captured in fall gill nets in Lake Frances, 1991-1998.

Year	No. of spines	No.of nets	Number of fish per age per gill net set												
			1	2	3	4	5	6	7	8	9	10	11	12+	Totals
1991	41	6	0.67	0.83	2.00	1.50	0.83	0.50		0.33	0.17				6.83
1992	24	12		0.33	0.94	0.39	-	0.42	0.08						2.16
1993	45	10		0.70	1.30	0.70	0.80	0.10	0.30	0.30	0.20	0.30			5.40
1994	54	10		0.20	0.68	1.44	1.09	0.41	0.30	0.61	0.78	-	0.10	0.20	5.81
1995	57	20	0.65	0.05	0.40	0.40	0.25	0.45	0.20	-	0.25	0.10	0.05	0.05	2.85
1996	73	20	0.35	0.90	0.25	0.25	0.42	0.60	0.60	0.26	0.06	0.43	0.06	0.10	4.28
1997	58	20	0.10	0.45	2.25	0.21	0.31	0.18	0.37	0.18	0.10	-	0.15		4.12
1998	90	17	1.12	0.82	1.11	2.04	0.19	0.24	0.24	0.06	0.06	0.06	0.18	0.29	6.41
Mean catch for each age class			0.36	0.54	1.12	0.87	0.49	0.36	0.26	0.22	0.20	0.11	0.07	0.08	4.68
Average % contribution by each age class			.077	.115	.239	.186	.105	.077	.056	.047	.043	.024	.015	.017	100.1

Appendix V. Age composition of walleye captured in fall gill nets on Tiber Reservoir, 1991-1998.

Year	No.of spines	No.of nets	Number of fish per age per gill net set													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1991	109	24	0.91	4.18	2.12	1.44	1.05	0.42	0.36	0.15	0.05	0.04	-	-	-	0.04	10.76
1992	102	25		1.70	3.22	1.14	0.93	0.69	0.60	-	0.04						8.32
1993	92	25	0.28	0.59	2.80	0.72	0.68	0.44	0.33	0.13							5.97
1994	66	25		0.38	1.65	0.37	0.12	0.13	-	0.09	0.05	0.04	0.04	0.04			2.91
1995	97	28	0.18	0.48	1.58	2.13	0.92	0.23	0.26	0.08	0.04						5.90
1996	65	27	0.22	0.15	0.51	0.61	0.66	0.11	0.15	0.11	-	-	-	-	-	0.04	2.56
1997	86	29	0.46	0.75	0.99	0.56	0.57	0.18	0.16	0.07	-	0.03					3.77
1998	74	29	-	0.24	1.15	0.56	0.29	0.25	0.07	0.03	0.10						2.69
Mean catch for each age class			0.26	1.06	1.75	0.94	0.65	0.31	0.24	0.08	0.04	0.01	0.01	0.01	-	0.01	5.37
Average % contribution by each age class			.048	.197	.326	.175	.121	.058	.045	.015	.007	.002	.002	.002	-	.002	100.0