Middle Missouri River fisheries monitoring, mitigation and enhancement studies.

- 2004 field season -

Annual Progress Report

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ABSTRACT

A comprehensive fisheries monitoring and evaluation program for the middle Missouri River was initiated in 2001 and evaluations continued during 2004. A total of 16,401 fish were sampled in the five sections representing 35 of the 49 species known to occur in this reach. Shorthead redhorse, emerald shiner, goldeye, Hybognathus spp. and longnose sucker were the five most commonly sampled species by electrofishing consisting of 30, 21, 13, 9 and 4 percent of the 2004-catch. A total of 759 game fish, representing 10 species were sampled; sauger, smallmouth bass, channel catfish, walleye and rainbow trout were the four most common species consisting of 33, 22, 17, 12 and 6% of the 2004 game fish total. Shovelnose sturgeon was the most abundant game fish species sampled by drifting trammel nets and catch rates were greatest (4.6/drift) at the Coal Banks Section. Eleven pallid sturgeon were captured with trammel nets, one at Judith Landing area and the remaining 10 at the Robinson Bridge area. Six species, Flathead chub, *Hybognathus*, emerald shiner, shorthead redhorse and fathead minnow were the most abundant species seined during 2004, all with an overall average catch rate greater than 12.7 fish/haul. Shorthead redhorse now dominate the electrofishing catches throughout the study area and have increased 409% from the 1977-79 survey abundance measure. There has also been a substantial change in sauger abundance. Present sauger catch rates at Morony were only 9% of the 1977-79 survey catch rates, however, the present catch rates farther downstream were considerably greater, where at Robinson Bridge catch rates were 345% greater than the 1977-79 survey record.

INTRODUCTION

The middle Missouri River (MMR) supports a diverse warm water fishery. All of the native fish species that historically occurred here are still found in this reach because of the relatively unaltered state of the river. Berg (1981) conducted a planning and inventory study of the MMR 20 years ago and concluded that this reach supports a fishery with exceptional aesthetic and recreational values. He also established some baseline biological measurements of the fish populations for future comparisons. General fisheries monitoring in the MMR has been lacking since 1982 and it wasn't until 1998 that Montana Fish Wildlife and Parks (FWP) resumed fisheries monitoring. Recently, PPL Montana (PPL) was re-issued a 50-year operating license for the company's Great Falls hydro dams located on the Missouri River. PPL Montana was required by the Federal Energy Regulatory Commission (FERC) to develop and implement a comprehensive fisheries monitoring and evaluation program for the protection, mitigation and enhancement of the fisheries resources in the MMR. PPL contracted with FWP to conduct this work beginning with the 2001 field season. Specifically the fisheries work deals with FERC order 2188, Article 417, implementation of the fisheries plan for specific mitigation and enhancement measures and post-licensing evaluation and monitoring for the five Great Falls reservoirs and their tailwaters. The second article pertaining to the FERC order is Article 421, the endangered species protection plan, with regards to pallid sturgeon recovery in the study area.

OBJECTIVES

1. Monitor the relative abundance of the most abundant fish species in the Missouri River downstream of Morony Dam.

2. Implement adaptive management practices to mitigate fisheries impacts associated with dewatering, reservoir fluctuations and peaking operations at the Great Falls hydro dams.

3. Create new fishing opportunities in the Great Falls area by improving/creating fishing ponds.

4. Protect and provide for the recovery of threatened, endangered, and species of concern.

PROCEDURES

An electrofishing system was used to sample fish in the river. The system was a dual boom-type and mounted to a 17 or 19-foot aluminum boat powered by an 80 or 140 hp jet drive outboard motor. Power was supplied to the system with a 5,000-watt AC generator. The alternating current was delivered to a Coffelt Model VVP-15 rectifying unit, which changes the alternating current to pulsed-DC. The positive electrode setup consisted of two fiberglass booms with four, 18-inch pieces of stainless steel cable attached to each boom that extended from the end of the boom and into the water. The boat hull served as the negative. The unit was typically operated at 4-8 amps, 100-215 volts. Catch per unit effort for electrofishing was expressed as number of fish caught per hour. Electrofishing was not used for capturing pallid sturgeon, nor was this method used in areas of known pallid sturgeon concentrations.

Trammel nets were also used to capture fish. Trammel nets used for sampling were 150 ft. long and 6 ft. deep. Two mesh sizes were used: 1 inch inner walls with 10 inch outer walls, and 2 inch inner walls with 10 inch outer walls. Mesh material for both inner and outer walls were light-weight for better fish tangle characteristics and to insure that the net could be retrieved off submerged objects in the event that net material had to be torn free. The trammel nets were set in snag-free areas of the river and allowed to drift with the current along the bottom typically for 7 minutes. Distances of the drift varied from 50 to 400 yds. Catch per unit effort for drift netting was expressed as number of fish caught per drift.

A 50 x 4 ft, 1/4-inch mesh beach seine with a bag was used to sample shallow peripheral habitats. The seine was dragged in a variety of shoreline habitats, typically for a distance of about 30 yds in areas with water depths generally less than 2 1/2 ft. All captured fish were identified and counted, and associated habitat type was recorded. Catch per unit effort was expressed as number of fish caught per haul.

Trawling was used to sample small fish in the deep water zones of the study area. The benthic rock hopper trawl consisted of a 6 ft wide by 1 1/2 ft high rectangular metal frame with skids and an 18 ft long outer chafing net with an 11 ft long, 1/8-inch mesh inner liner, attached to the frame. The trawl was towed downstream off the bow of the boat usually for a distance of 150-200 yds. A 50 ft rope was attached to each side of the trawl and at the end of the tow the trawl was hand-retrieved by a person at the end of each rope.

All fish were measured to the nearest 0.1 inch (fork length for sturgeon and total length for all other fish), and weighed to the nearest 0.01 pound. A spiny dorsal fin ray was extracted from sauger, walleye and smallmouth bass for aging purposes.

DESCRIPTION OF STUDY AREA

The middle Missouri River study area consists of a 239-mile reach in north central Montana between Great Falls and the headwaters of Fort Peck Reservoir near the confluence with the Musselshell River. One hundred forty-eight miles of the study area lies within the Upper Missouri National Wild and Scenic River (UMNWSR) administered by the U.S. Bureau of Land Management. Downstream of the UMNWSR, 54 miles of the study area is bordered by the western portion of the Charles M. Russell National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service. There are three major tributaries entering the Missouri in the study area; the Marias River from the north and the Judith and Musselshell rivers from the south. The present flow regimen of the Missouri River in the study area is not entirely natural because of regulation and storage at several upriver dams. For study purposes, the river was divided into five study sections with the locations and boundaries shown in Figure 1 and Appendix A.

The MMR throughout most of the 239-mile reach is entrenched within the Missouri River Breaks topography being contained in a moderate to narrow valley depending on location.

A sandstone/shale canyon borders the river in the Morony section. Here the river current is fast and the channel is shallow and armored mostly with large cobble and boulders. Downstream, the river within the Fort Benton and Coal Banks sections meanders throughout a moderately wide valley. The river channel depth and velocity in these sections average 6.1 feet and 3.0 ft/s (Gardner 1994). Cobble and gravel substrates are the predominant substrate types here. The river below the Coal Banks section, for the most part, is confined in a narrow sandstone canyon and because of this, the river channel is shallower, with faster river current and larger substrates. The average depth and velocity measured by Gardner (1994) was 5.4 feet and 3.8 ft/sec, with the majority of substrates comprised of small to large cobble. Robinson Bridge, the lowest section, exhibits a more meandering channel pattern within the wider valley. Here channel depths are greater and velocities slower averaging 7.6 feet and 3.0 ft/sec. (Gardner 1994). Channel substrate size also decreases with sand being the predominant type.

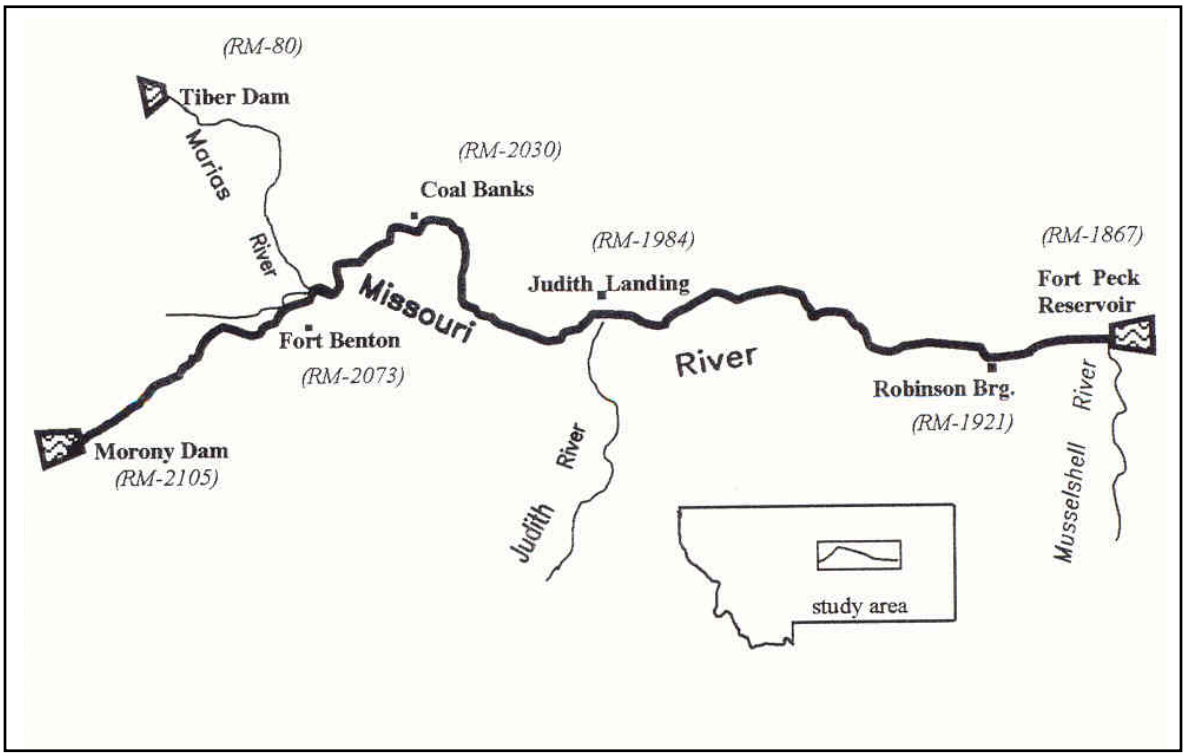

Figure 1. Map of the study area.

RESULTS

Most of the objectives were addressed during the 2004 field season. The study area continued to be influenced by drought conditions, consequently, river flows in the MMR were near record lows and fish habitat conditions were probably sub-optimal. Four sampling methods were used to evaluate the fish communities. The first method was fall electrofish sampling in established 6-mile trend areas located at Morony (RM 2105), Fort Benton (RM 2073), Coal Banks Landing (RM 2030), Judith Landing (RM 1983) and Robinson Bridge area (RM 1930). This method worked best for evaluating the adult fish populations in shallow water habitats. Number of fish sampled per hour was the measure used for evaluating abundance. Trammel drift netting was used to sample adult fish in deepwater habitats. Catch rates and size statistics were used to evaluate the population condition. The third method used was summer seining in the shallow river habitats throughout the study area. This method worked best for evaluating the juvenile fish and the cyprinid portion of the fish communities. Catch rates and presence/absence were used to measure the population condition. Finally, small and young fish species in deepwater habitats were sampled with a small benthic trawl. Catch rates and presence/absence were used to measure the population condition.

To facilitate data analysis, only information from target species was analyzed in detail. These target species were divided into five types of groups based on guilds and sampling method. These groups were: shallow water game fish, shallow water non game fish, deepwater large fish, deep water small fish and shallow water small fish (minnows and age-0 fish). The groups consisted of species that were generally more common and representatives from a variety of habitat and trophic guilds. Table 1 is a list of these19 fish species along with life history status and group affiliation. These groups of target species from the general fish communities were used as biological indicators as part of the comprehensive fisheries monitoring and evaluation program for the protection, mitigation and enhancement of the fisheries resources in the MMR.
The approach used to evaluate the fish communities over time and location was to monitor abundance and size statistics of the more common game fish and non-game fish species from a variety of trophic and habitat guilds. Differences in abundance or sizes of target species (if any) would be examined to determine if any environmental changes could be correlated to these observations.

Adult fish monitoring

Electrofishing (shallow water large fish group)

A total of 8,021 fish were sampled by electrofishing in the middle Missouri River during fall, 2004. Average 2004 catch rates for each section are given in Table 2. Twenty-nine species were sampled in the five trend areas combined, with the greatest number (24) recorded at the Morony trend area. Shorthead redhorse, emerald shiner, goldeye, Hybognathus spp. and longnose sucker were the five most commonly sampled species consisting of 30, 21, 13, 9 and 4 percent of the fish captured in the MMR. A total of 759 game fish, representing 10 species were sampled; sauger, smallmouth bass, channel catfish, walleye and rainbow trout were the four most common species consisting of 33, 22, 17, 12 and 6% of the game fish total.

Trend information for the game fish group depicted sauger as the most abundant game fish species sampled. The sauger overall average catch rate was 6.2/h followed by channel catfish (2.7/h) and smallmouth bass (2.2/h) (Table 3). Catch rates for channel catfish were the highest at Fort Benton and Judith Landing averaging 3.0/h at both sections. Mountain whitefish (avg. 2.0/h) and smallmouth bass (avg. 8.2/h) exhibited the highest average catch rates in the Morony Section. The highest average catch rates for sauger occurred at Judith (avg. 9.0/h) and Robinson (avg. 10.0/h) sections. Walleye were sampled at the greatest abundance in the Judith (avg. 2.7 /h) and Coal Banks (avg. 2.3 /h) sections. There appeared to be differences in average annual catch rates for game fish species between years. Annual catch rates for four of the five game species were above average in 2001, whereas, annual catch rates were all below average in 2002. Annual catch rates were more mixed in 2003 and 2004.

Present distribution and abundance of these game fish in the MMR seemed to have changed substantially compared to that reported for the period 1977-79 (Berg 1981). Channel catfish, smallmouth bass and walleye were either sampled at low levels or absent in the 1977-79 electrofish surveys but present sampling indicate these species are now well represented (Table 4). There have also been substantial changes in sauger abundance. Present sauger catch rates at Morony were very low and only 9% of the 1977-79 survey catch rates, however, the present catch rates farther downstream were considerably higher, where at Robinson Bridge catch rates were 345% higher than that reported for the 1977-79 survey catch rates. The present mountain whitefish distribution and abundance appears to be similar to that reported for the 1976-79 survey.

Table 1. A list of the 18 monitored species and their life history status and sampling method used. (Taken after Galat et al. 2004 and Bergsted et al. 2004).

	Habitat use Guild	Trophic Status	Life stage	Monitoring Method	Group
Blue sucker	Fluvial Specialist	Invertivore	Adult	Electrofish/ Trammel net	
Carp	Macrohabitat generalist	Invertivore/ Detritivore	Adult	Electrofish	Non game shallow
Channel catfish	Macrohabitat generalist	Invertivore/ Carnivore	Age-0/ Adult	Electrofish/ Trawl	-Game fish shallow -Shallow water spp.
Emerald shiner	Macrohabitat generalist	Planktivore	Age-0/ Adult	Seine	-Shallow water spp.
Flathead chub	Fluvial Specialist	Invertivore	Age-0/ Adult	Seine	-Shallow water spp.
Goldeye	Fluvial Dependent	Invertivore	Age-0/ Adult	Electrofish/ Seine	-Shallow water spp. -Non game shallow
Hybognathus spp.	Fluvial Dependent	Detritivore	Age-0/ Adult	Seine	-Shallow water spp.
Longnose sucker	Fluvial Dependent	Invertivore	Adult	Electrofish	-Non game shallow
Mountain whitefish	Fluvial Specialist	Invertivore	Adult	Electrofish	Game fish shallow
River carpsucker	Fluvial Dependent	Planktivore/ Detritivore	Adult	Trammel net	Deep water
Sauger	Macrohabitat generalist	Carnivore	Age-0/ Adult	Electrofish/ Seine	-Game fish shallow -Shallow water spp.
Shovelnose sturgeon	Fluvial Specialist	Invertivore	Adult	Trammel net	Deep water
Shorthead redhorse	Fluvial generalist	Invertivore	Adult	Electrofish	Non game shallow
Sicklefin chub	Fluvial Specialist	Invertivore	Age-0/ Adult	Seine	-Shallow water spp
Smallmouth bass	Macrohabitat generalist	Carnivore	Age-0/ Adult	Electrofish/ Seine	-Shallow water spp. Game fish shallow
Smallmouth buffalo	Macrohabitat generalist	Invertivore/ Herbivore	Adult	Trammel net	Deep water
Sturgeon chub	Fluvial Specialist	Invertivore	Age-0/ Adult	Seine	Shallow water spp
Walleye	Macrohabitat generalist	Carnivore	Adult	Electrofish	Game fish shallow
White sucker	Fluvial Dependent	Invertivore/ Detritivore	Adult	Electrofish	Non game shallow

Table 2. Average catch rates (no./hour) and number of fish sampled by electrofishing at trend areas in the middle Missouri River, MT, fall 2004. (Only fish ≥ 6.0 inches were counted unless otherwise denoted).

	Morony	Fort Benton	Coal Banks	Judith Landing	Robinson Bridge	Total Number
Blue sucker	0.3		0.9	0.4		16
Brown trout	0.7	0.1	0.1			9
Burbot	0.1	0.3	0.4		1.1	19
Carp	5.0	3.8	1.6	3.3	2.3	164
Channel catfish	3.7	1.1	1.0	4.5	2.1	129
Emerald shiner *	74.0	66.2	0.3	9.6	20.1	1715
Flathead chub *	0.5	0.1	1.0	11.0	15.5	288
Freshwater drum	4.6	1.8	1.6	2.4	2.2	129
Goldeye	30.8	12.3	29.2	14.2	15.2	1033
Hybognathus spp. *	8.2	0.7	12.3	25.8	25.9	745
Longnose dace *		0.2				2
Longnose sucker	17.6	6.2	3.8	3.8	0.6	326
Mottled sculpin *	0.2	0.2				5
Mountain sucker *			0.1			1
Mountain whitefish	0.9	0.3	0.6	0.4		23
Northern pike	0.2			0.1		3
Pallid sturgeon			0.1			1
Pumpkinseed *	0.1					1
Rainbow trout	3.6	0.2			0.4	43
River carpsucker	0.7	1.2	2.9	3.8	2.4	104
Sauger	0.3	1.9	4.6	7.9	9.9	252
Shorthead redhorse	45.3	86.8	56.1	26.0	24.1	2400
Shovelnose sturgeon			0.7	0.4	1.1	19
Smallmouth bass	8.9	0.6	1.0	0.6		170
Smallmouth buffalo	0.7	0.2	1.0	0.9	0.7	34
Stonecat *	1.2			0.4	0.1	17
Sturgeon chub *					0.4	4
Walleye	0.3	0.8	3.0	3.1	1.6	92
White sucker	13.9	12.7	1.0	t		279
Total no. fish	2266	1961	1262	1297	1235	8021
Total no. hours	10.2	9.9	10.2	10.9	9.8	

* Denotes species where all sizes were counted

Sauger was the only member of the game fish group that average sizes could be compared with past size statistics because there was an adequate sample size for the past surveys. Sauger average total lengths are much greater now (14.0 inches) than that reported in the 1977-79 survey (12.9 inches).

Monitoring of the game fish group for 2004 followed the previously mentioned longitudinal abundance pattern for past years (2001-03) with the exception of a higher catch rate of channel catfish at Morony and a lower catch rate at Fort Benton (Table 3). The 2004 annual catch rates for channel catfish, mountain whitefish and sauger were below the four year average. The 2004 average total lengths for 3 of 5 species were similar to past years (2001-03) with the exceptions of smallmouth bass that averaged about 1 inch longer (avg. 10.7 v 9.8 inches) and walleye that averaged about 1 inch shorter (avg. 15.9 v 16.7 inches) in 2004 (Tables 4 and 5).

Non game fish

Trend information for the non game fish group depicted shorthead redhorse and goldeye as the most abundant game fish species sampled (Table 6). Overall average electrofishing catch rates were highest for shorthead redhorse (59.2/h) and goldeye (24.0/h). Four of the five species in the non game fish group were most abundant at the Morony Section. Here average catch rates for carp, goldeye, longnose sucker and shorthead redhorse were 7.1, 41.2, 25.5 and 86.9 fish/hr. White sucker was the only species from this group that was most abundant at another section, where at the Fort Benton it averaged 15.3/hr. Present distribution and abundance for carp, goldeye and longnose sucker have not changed appreciably from that reported for the 1977-79 survey (Table 7). However, there has been a 409% increase in shorthead redhorse abundance for all sections combined (avg catch rates of 56.9/hr v 13.9/hr) which has overwhelmed the species composition in the MMR. White sucker also show a similar abundance trend, although to a far lesser magnitude.

A comparison of present size statistics with that reported for the past found that carp, shorthead redhorse and white sucker differed between these periods; goldeye and longnose average lengths were similar (Tables 7 and 8). Overall average total lengths for the present average sizes for carp were 2.8 inches longer and that both shorthead redhorse and white sucker were shorter (1.0 and 2.4 inches, respectively) than in 1977-79.

The 2004 monitoring of non game fish group generally followed the previously mentioned longitudinal abundance pattern. The 2004 overall average total lengths for 4 of 5 species were similar, however, longnose sucker was 1.5 inches shorter than average (11.3 v 12.8 inches) for the 2004 sampling period (Table 8). The greatest catches of combined non game fish occurred during the 2003, when longnose sucker and shorthead redhorse catches were 258, and 143 percent of average (Table 6).

Table 3. Current abundance trends, average catch rates (no./hour), for five game fish species sampled by electrofishing during fall, middle Missouri River, MT.

		Morony	Ft.Benton	Coal Bnks	Judith L	Robinson	Average
Channel catfish							
	2001	0	3.0	1.7	0.6	4.7	2.0
	2002	1.6	3.0	0.6	3.9	1.2	2.1
	2003	1.9	5.1	8.0	3.2	2.7	4.2
	2004	3.7	1.1	1.0	4.5	2.1	2.5
	Average	1.8	3.0	2.8	3.0	2.7	2.7
Mountain whitefish							
	2001	5.5	0	0.1	0	0	1.1
	2002	0.6	0.3	0.1	0.4	0.2	0.5
	2003	0.8	0.8	0.5	0.3	0	0.5
	2004	0.9	0.3	0.6	0.4	0	0.4
	Average	2.0	0.4	0.3	0.3	0.1	0.6
Sauger							
	2001	1.8	6.2	6.5	11.5	7.0	6.6
	2002	1.9	4.4	5.3	6.0	9.4	5.4
	2003	3.5	4.1	7.1	10.4	13.8	7.8
	2004	0.3	1.9	4.6	7.9	9.9	4.9
	Average	1.9	4.2	5.9	9.0	10.0	6.2
Smallmouth bass							
	2001	6.9	3.8	0.9	0.2	0.1	2.4
	2002	3.7	1.2	0.4	0.3	0	1.1
	2003	13.3	2.2	0.9	0.2	0	3.3
	2004	8.9	0.6	1.0	0.6	0	2.2
	Average	8.2	2.0	0.8	0.3	T	2.2
Walleye							
	2001	1.0	2.8	1.7	3.7	1.4	2.1
	2002	0.2	1.9	2.5	2.4	0.6	1.5
	2003	0.2	0.7	2.1	1.5	0.7	1.0
	2004	0.3	0.8	3.0	3.1	1.6	1.8
	Average	0.4	1.6	2.3	2.7	1.1	1.6

Table 4. Past (1977-79) abundance trends, average catch rates (no./hour), and size statistics for five game fish species sampled by electrofishing, middle Missouri River, MT (Berg 1981).

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson
Channel catfish						
	Avg. CPUE	0	0	T	0.2	T
	Avg. TL (in.)	--	--	--	23.6	--
	Avg. WT (#)	--	--	--	5.79	--
Mountain whitefish						
	Avg. CPUE	1.0	1.2	0.2	0	T
	Avg. TL (in.)	12.1	14.5	9.0	--	--
	Avg. WT (#)	0.90	1.50	0.29	--	--
Sauger						
	Avg. CPUE	20.1	6.7	4.2	3.6	2.9
	Avg. TL (in.)	14.0	13.3	13.5	11.9	11.7
	Avg. WT (#)	0.84	0.73	0.77	0.59	0.55
Smallmouth bass						
	Avg. CPUE	0	0	0	0	0
	Avg. TL (in.)	--	--	--	--	--
	Avg. WT (#)	--	--	--	--	--
Walleye						
	Avg. CPUE	0.3	0.1	0.1	T	T
	Avg. TL (in.)	15.4	23.0	12.0	--	--
	Avg. WT (#)	1.89	5.59	0.57	--	--

Table 5. Average (2001-03) and 2004 size statistics for five game fish species sampled by electrofishing during fall, middle Missouri River, MT.

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
Channel catfish							
	Avg. TL (in.)	22.9	23.8	23.6	23.4	21.1	23.0
	Avg. WT (#)	5.12	5.83	5.44	5.63	4.03	5.21
	2004 TL (in.)	22.2	22.2	22.2	25.1	22.1	22.8
	2004 WT (#)	4.59	4.59	4.82	4.13	4.15	4.46
Mountain whitefish							
	Avg. TL (in.)	12.6	9.3	10.3	9.0	--	10.3
	Avg. WT (#)	1.17	0.39	0.41	0.24	--	0.55
	2004 TL (in.)	13.8	--	9.8	8.6	--	10.7
	2004 WT (#)	1.51	--	0.33	0.47	--	0.77
Sauger							
	Avg. TL (in.)	11.3	15.8	14.9	14.2	13.8	14.0
	Avg. WT (#)	0.61	1.27	0.97	0.95	0.91	0.94
	2004 TL (in.)	14.9	15.7	14.5	14.2	13.9	14.6
	2004 WT (#)	0.99	1.31	0.93	0.90	0.97	1.02
Smallmouth bass							
	Avg. TL (in.)	9.5	9.2	10.3	10.2	--	9.8
	Avg. WT (#)	0.74	0.80	0.96	0.94	--	0.86
	2004 TL (in.)	10.5	12.9	10.0	--	9.5	10.7
	2004 WT (#)	0.89	1.49	0.86	--	0.75	1.00
Walleye							
	Avg. TL (in.)	20.0	16.7	15.3	14.9	16.7	16.7
	Avg. WT (#)	3.49	1.77	1.49	1.23	2.16	2.03
	2004 TL (in.)	16.9	15.5	15.8	15.1	16.2	15.9
	2004 WT (#)	1.86	1.30	1.45	1.38	1.97	1.59

-- no sample collected

Table 6. Current abundance trends, average catch rates (no./hour), for five non game fish species sampled by electrofishing during fall, middle Missouri River, MT.

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
Carp							
	2001	12.3	6.9	5.6	--	3.5	7.1
	2002	3.9	7.3	2.5	3.1	1.7	3.7
	2003	7.5	7.4	5.5	3.4	--	6.0
	2004	5.0	3.8	1.6	3.3	2.3	3.2
	Average	7.1	6.4	3.8	3.3	2.5	5.0
Goldeye							
	2001	27.0	36.3	29.2	--	20.7	28.3
	2002	50.0	39.2	43.9	17.3	15.0	33.1
	2003	56.9	17.1	12.3	12.8	--	24.8
	2004	30.8	12.3	29.2	14.2	15.2	20.3
	Average	41.2	18.4	28.6	14.8	17.0	26.6
Longnose sucker							
	2001	20.2	9.4	5.9	--	1.0	9.1
	2002	7.6	2.7	2.7	2.7	0.5	3.2
	2003	56.5	2.2	3.3	2.6	--	16.2
	2004	17.6	6.2	3.8	3.8	0.5	6.4
	Average	25.5	5.1	3.9	3.0	0.7	8.7
Shorthead redhorse							
	2001	70.0	74.4	50.4	--	24.0	54.7
	2002	73.4	87.5	57.2	24.2	17.4	51.9
	2003	159.0	65.1	42.6	26.9	--	73.4
	2004	45.3	86.8	56.1	26.0	24.1	47.7
	Average	86.9	78.4	51.6	25.7	21.8	56.9
White sucker							
	2001	7.4	18.6	8.3	---	0	8.6
	2002	4.1	14.4	3.5	0.2	0	4.4
	2003	6.4	15.6	1.5	0.2	--	5.9
	2004	13.9	12.7	1.0	T	0	5.5
	Average	8.0	15.3	3.6	0.1	0	6.1

-- indicates not sampled

Table 7. Past (1977-79) abundance trends, average catch rates (no./hour), and size statistics for five non game fish species sampled by electrofishing, middle Missouri River, MT (Berg 1981).

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson
Carp						
	Avg. CPUE	1.5	3.7	6.5	3.2	2.2
	Avg. TL (in.)	21.8	19.5	18.6	18.6	18.4
	Avg. WT (#)	5.08	3.50	3.08	3.26	2.84
Goldeye						
	Avg. CPUE	22.7	13.2	29.3	13.9	19.5
	Avg. TL (in.)	12.5	12.4	12.2	12.2	11.5
	Avg. WT (#)	0.57	0.59	0.59	0.62	0.55
Longnose sucker						
	Avg. CPUE	17.9	11.9	8.0	4.3	0.1
	Avg. TL (in.)	15.0	14.8	14.0	12.9	9.3
	Avg. WT (#)	1.50	1.45	1.19	1.06	0.40
Shorthead redhorse						
	Avg. CPUE	7.3	22.0	21.4	16.5	2.1
	Avg. TL (in.)	18.1	16.8	15.1	14.3	13.4
	Avg. WT (#)	2.49	2.00	1.58	1.50	0.99
White sucker						
	Avg. CPUE	1.8	1.0	0.3	0.5	T
	Avg. TL (in.)	12.1	13.0	14.5	10.6	--
	Avg. WT (#)	0.90	1.10	1.28	0.66	--

-- indicates no sample collected

Table 8. Average (2001-03) and 2004 size statistics for five non game fish species sampled by electrofishing during fall, middle Missouri River, MT.

	Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
Carp						
Avg. TL (in.)	22.9	24.3	22.3	21.0	20.4	22.2
Avg. WT (#)	7.83	8.00	5.33	4.46	4.02	5.93
2004 TL (in.)	26.3	24.9	23.0	20.7	19.9	22.9
2004 WT (#)	9.94	7.72	5.91	3.86	3.43	6.17
Goldeye						
Avg. TL (in.)	12.3	12.3	12.1	11.5	11.4	11.9
Avg. WT (#)	0.62	0.63	0.59	0.54	0.48	0.57
2004 TL (in.)	12.6	11.9	12.2	11.9	11.9	12.1
2004 WT (#)	0.70	0.59	0.66	0.60	0.59	0.63
Longnose sucker						
Avg. TL (in.)	12.2	14.2	13.5	13.0	11.2	12.8
Avg. WT (#)	0.98	1.35	1.11	0.95	0.60	1.00
2004 TL (in.)	12.0	13.8	10.1	11.0	9.5	11.3
2004 WT (#)	1.01	1.34	0.54	0.64	0.48	0.80
Shorthead redhorse						
Avg. TL (in.)	16.2	17.0	12.8	13.6	13.0	14.5
Avg. WT (#)	2.14	2.29	1.70	1.36	1.04	1.71
2004 TL (in.)	16.5	15.2	14.3	15.9	11.5	14.7
2004 WT (#)	2.24	1.70	1.41	1.74	1.14	1.65
White sucker						
Avg. TL (in.)	10.5	11.8	10.0	--	--	10.8
Avg. WT (#)	0.73	0.98	0.57	--	--	0.76
2004 TL (in.)	12.5	11.0	11.1	--	--	11.5
2004 WT (#)	1.16	0.82	0.76	--	--	0.91

-- no sample collected

Trammel net drifting (deep water large fish group).

Trammel net drift sampling provides information about the fish populations in the deeper areas of the river. A total 1,094 fish was netted representing 18 different species during 2004 field season. Average 2004 catch rates for each section are given in Table 9. Shovelnose sturgeon, goldeye, shorthead redhorse, longnose sucker and river carpsucker were the five most abundant

species sampled. Shovelnose sturgeon was the most abundant game fish species sampled and catch rates were greatest (4.6/drift) at the Coal Banks Section. Eleven pallid sturgeon were captured, one at Judith Landing area and the remaining 10 at the Robinson Bridge area.

Deep water large fish group trend sampling indicated that shovelnose sturgeon was the most abundant species captured in trammel nets over the years (Table 10). Shovelnose overall catch rates had averaged 4.9/drift compared to 0.5/drift and 0.2/drift for river carpsucker and smallmouth buffalo, respectively. Shovelnose sturgeon was most abundant at Coal Banks (avg. 9.6/drift) and river carpsucker (avg. 0.8/drift) and smallmouth buffalo (avg. 0.4/drift) were most abundant at Fort Benton. The Morony section was netted only during 2004, therefore, little can be said about the abundance of these 3 species here. The 2004 MMR monitoring of the deep water large fish group followed the 3-year average longitudinal distribution and abundance pattern, however, the 2004 shovelnose catch rate was only 48% of average. Sizes of river carpsucker were fairly uniform at most sections except at Coal Banks, where the average total length was at least 1.3 inches shorter than at the other three sections (Table 11). Shovelnose sturgeon sizes displayed a downstream gradation in average fork length with the larger sturgeon found in the upper sections and smaller at Robinson Bridge, the lowest section. The 2004 sturgeon sizes were very comparable to the average sizes reported at all sections.

Table 9. Average catch rates (no./drift) and number of fish sampled by drifting trammel nets in the middle Missouri River, MT, July - October, 2004.

	Morony	Fort Benton	Coal Banks	Judith Landing	Robinson Bridge	Total Number
Blue sucker		0.1	0.1	0.1	*T* [1]	8
Burbot					T	2
Carp			0.1	0.3	0.3	25
Channel catfish				0.1	0.1	11
Flathead chub		0.2	0.4	0.4	0.5	61
Freshwater drum		0.1			T	4
Goldeye	5.3	3.7	0.4	0.4	0.2	227
Longnose sucker	1.2	1.5	1.5	0.3		87
Pallid sturgeon				0.1	0.1	11
Rainbow trout					T	1
River carpsucker		0.9	0.3	0.3	0.4	67
Sauger		0.1	0.2	0.5		13
Shorthead redhorse	1.8	1.7	0.3	0.3	0.1	95
Shovelnose sturgeon		1.5	4.6	2.5	2.9	423
Smallmouth bass			0.1			1
Smallmouth buffalo	0.1	0.5		0.1	0.2	29
Walleye		0.1			0.1	7
White sucker	0.1	1.0	0.1			22
Total no. fish	188	218	144	93	451	1094
Total drifts	22	20	18	19	91	170
Average depth (ft)	5.5	5.7	4.3	6.0	6.0	5.5
Average distance (yd)	255	266	203	292	280	259
Average drift time (min)	5.5	5.8	5.8	6.3	7.2	6.0

[1] Denotes catch rates <0.1 fish/hr.

Table 10. Average catch rates (no./drift) sampled by trammel netting for three trend species in the middle Missouri River, MT.

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
River carpsucker							
	2001	--	0.6	0.1	1.0	0.3	0.7
	2002	--	--	0.4	0	0.4	0.3
	2003	--	--	0.2	0.4	1.0	0.5
	2004	0	0.9	0.3	0.3	0.4	0.4
	Average	--	0.8	0.2	0.4	0.5	0.5
Shovelnose sturgeon							
	2001	--	3.6	7.8	5.2	7.0	5.9
	2002	--	--	17.2	2.1	2.2	7.2
	2003	--	--	8.8	3.2	0.9	4.3
	2004	0	1.5	4.6	2.5	2.9	2.3
	Average	--	2.6	9.6	3.2	3.5	4.9
Smallmouth buffalo							
	2001	--	0.3	0.2	0.1	T	0.2
	2002	--	--	0	0.1	0.2	0.1
	2003	--	--	0.2	0.1	0.6	0.3
	2004	0.1	0.5	0	0.1	0.2	0.2
	Average	--	0.4	0.1	0.1	0.3	0.2

-- indicates not sampled

Table 11. Average (2001-03) size statistics and 2004 size statistics for three fish species sampled by drifting trammel nets, middle Missouri River, MT.

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
River carpsucker							
	Avg. TL (in.)	0	19.8	18.1	19.8	19.4	19.3
	Avg. WT (#)	0	3.80	2.72	3.76	3.93	3.55
	2004 TL (in.)	0	20.3	18.8	20.4	21.1	20.2
	2004 WT (#)	0	3.81	2.98	3.87	4.84	3.88
Shovelnose sturgeon							
	Avg FL(in.)*	0	32.1	30.8	30.1	27.0	30.0
	Avg. WT (#)	0	6.20	5.28	4.82	3.47	4.94
	2004 FL(in)*	0	32.4	31.4	30.1	26.4	30.1
	2004 WT (#)	0	6.05	5.40	4.66	3.33	4.86
Smallmouth buffalo							
	Avg. TL (in.)	0	0	23.8	25.6	23.9	24.4
	Avg. WT (#)	0	0	8.97	9.18	7.98	8.71
	2004 TL (in.)	0		0	--	--	
	2004 WT (#)	0		0	--	--	

* denotes fork length measurement

-- no sample collected

Resident cyprinids and age-0 fish monitoring

Seining (Shallow water small fish group)

Seining surveys were conducted in the MMR for assessing the cyprinid populations and evaluating game fish reproduction. A total of 6,022 fish representing 20 species was sampled (Table 12). Sampling was directed at a variety of shallow water habitats in main channel borders, main channel pools, side channel borders, side channel pools and backwater. Six species, Flathead chub, *Hybognathus*, emerald shiner, shorthead redhorse and fathead minnow were the most commonly sampled species, all with an overall average catch rate greater than 12.7 fish/haul (Table 12). Age-0 channel catfish, smallmouth bass walleye and yellow perch were the game fish species that were seined. No age-0 sauger were sampled this year, which was unusual for this important game fish species.

Trend information for three target cyprinid species indicated that *Hybognathus spp.* was the most abundant species captured by seining having a overall average catch rate of 24.0/haul Table 13). Emerald shiner and flathead chub both were next in abundance and nearly equal in overall representation. Emerald shiner were seined in greatest abundance in the Fort Benton Section, flathead chub at Robinson Section and *Hybognathus spp* at Coal Banks. The three age-0 species were sampled in far less abundance with goldeye found chiefly at Robinson Section, smallmouth bass in the upper three sections and sauger at Morony and Robinson sections. All the age-0 sauger sampled at Morony were believed to be hatchery sauger stocked in the early summer while the ones sampled at the Robinson section were probably from both hatchery and wild origin (Gardner 2005a). Little can be said with certainty about spatial and temporal differences in small fish abundance at this time. There appears to be considerable variability in catch rates, but, probably after a couple more years of data and a more detailed analysis, comparisons between years and among sections can then be better evaluated.

Trawling (Deep water small fish group).

Sampling with a trawl is an effective method for capturing smaller fish species in deep water habitats such as sicklefin and sturgeon chubs, two species of special concern. A total of 1,264 fish represented by 17 species were sampled with the trawl in 2004 and results are presented in Table 14. Channel catfish (age-0), longnose dace, sicklefin chub, stonecat and sturgeon chub were the five most common species sampling a total of at least 100 for the 170 tows. Only one age 0 shovelnose sturgeon was sampled this year.

Trend information depicted longnose dace as the most abundant species captured by trawling with an average overall catch rate of 2.2/tow (Table 15). Age-0 channel catfish and stonecat were the next most abundant each having average overall catch rate of about 1.0/tow. Age-0 channel catfish, sicklefin chub and sturgeon chub were sampled in greatest abundance at the Robinson Section. Longnose dace and stonecat were sampled in greatest abundance at the Coal Banks Section. Age-0 shovelnose sturgeon are rarely sampled with only a couple individuals per year sampled in the Robinson Section. Little can be said with certainty about spatial and temporal differences in small fish abundance at this time. There appears to be considerable variability in catch rates, but, probably after a couple more years of data and a more detailed analysis, comparisons between years and among sections can then be better evaluated.

Table 12. Average catch per seine haul of fish sampled in the middle Missouri River, 2004.

	Morony	Fort Benton	Coal Banks [3]	Judith Landing	Robinson Bridge	Total # Fish
Carp y	3.8	1.5	6.2	1.2	0.1	128
Channel catfish y [1/]					0.1	1
Emerald shiner	25.7	7.8	20.1	5.7	13.4	862
Flathead chub		0.6	11.6	45.3	23.0	1033
Fathead minnow	14.2	5.6	43.5	0.8		641
Hybognathus spp. [2/]	0.6	0.4	28.5	36.3	14.1	941
Longnose dace	9.6	13.4	0.9	1.1		255
Longnose sucker y		1.3	1.0	1.6	0.4	47
Mottled sculpin		0.1				1
River carpsucker		0.1			0.5	10
Sand shiner		14.3	12.1	5.7		321
Sicklefin chub					0.1	1
Shorthead rehorse y	5.1	28.8	15.5	9.3	6.0	706
Smallmouth bass y	3.9	0.4				43
Smallmouth buffalo		0.8				8
Stonecat					0.2	5
Sturgeon chub				0.1		1
Walleye y				0.1		1
White sucker y	41.8	18.7	13.3	1.6		754
Yellow perch				0.1		1
Unidentified	4.2	7.2	10.2	4.5	0.1	262
Crayfish	* [3/]	*	*			
Total catch	1089	1010	1629	1134	1160	6022
Total # seine hauls	10	10	10	10	20	

[1/] y denotes age-0 fish

[2/] **Difficult to differentiate between species; could include western silvery, plains and/or brassy minnows**

[3/] Denotes presence

Table 13. Average catch rates (no./haul) sampled by seining for six trend species in the middle Missouri River, MT.

		Morony	Ft. Benton	Coal Bnks	Judith L	Robinson	Average
Emerald shiner							
	2001	--	24.7	9.4	3.8	8.0	11.5
	2002	--	--	--	10.6	7.8	9.2
	2003	4.5	38.0	17.0	--	3.3	15.7
	2004	25.7	7.8	20.1	5.7	27.0	17.3
	Average	15.1	23.5	15.5	6.7	11.5	13.4
Flathead chub							
	2001	--	1.0	2.6	11.1	19.3	8.5
	2002	--	--	--	25.8	21.5	23.6
	2003	0.2	4.0	2.5	--	35.3	10.5
	2004	0	0.6	11.6	45.3	45.0	20.5
	Average	0.1	1.9	5.6	27.4	30.3	15.8
Goldeye (age-0)							
	2001	--	0	0	0	0.4	0.1
	2002	--	--	--	0.2	0.4	0.3
	2003	0	0	0	--	1.6	0.4
	2004	0	0	0	0	0	0
	Average	0	0	0	0.1	0.6	0.2
Hybognathus spp.							
	2001	--	13.8	54.9	26.0	18.3	28.2
	2002	--	--	--	18.2	35.0	26.6
	2003	0.2	27.0	42.5	--	30.4	25.0
	2004	0.6	0.4	28.5	36.3	14.1	16.0
	Average	0.4	13.7	42.0	26.8	24.4	24.0
Sauger (age-0)							
	2001	--	0	0	0	0.3	0.1
	2002	--	--	--	0	0	0
	2003	1.4	0	0	--	0.2	0.3
	2004	0	0	0	0	0	0
	Average	0.7	0	0	0	0.1	0.1
Smallmouth bass(age-0)							
	2001	--	0	0.9	0	0	0.2
	2002	--	--	--	0	0	0
	2003	0.2	7.0	6.0	--	0	3.8
	2004	3.9	0.4	0	0	0	0.9
	Average	2.0	2.5	2.3	0	0	1.2

-- indicates not sampled

Table 14. Average trawling catch rate (no./tow) for fish sampled in the middle Missouri River, 2004.

	Coal Banks	Robinson Bridge	Total # Fish
Burbot y[1]		T	1
Carp y	0.1	T	3
Channel catfish y	0.6	2.1	305
Emerald shiner	0.1	T	5
Flathead chub	0.1	0.2	30
Hybognathus spp.		T	2
Longnose dace	9.5	T	334
Longnose sucker y	0.2		7
Pallid sturgeon		T	1
Mottled sculpin	0.1		3
Sauger y		T	2
Shorthead redhorse y		0.1	4
Shovelnose sturgeon y		T	1
Sicklefin chub		0.8	111
Stonecat	5.5	0.1	206
Sturgeon chub	0.9	1.6	248
Walleye y		T	1
Total catch	594	670	1264
Total # trawl tows	35	135	
Avg. depth (ft)	4.6	5.9	

1/ y denotes age-0 fish

Table 15. Average catch rates (no./tow) sampled by trawling for six trend species in the middle Missouri River, MT.

		Coal Bnks	Judith L	Robinson	Average
Channel catfish (age-0)					
	2001	0	0.1	2.6	0.9
	2002	--	0	0.6	0.3
	2003	0.2	0.8	4.1	1.7
	2004	0.6	--	2.9	1.8
	Average	0.3	0.3	2.6	1.2
Longnose dace					
	2001	1.8	2.9	0	1.6
	2002	--	0.2	0	0.1
	2003	4.3	1.7	0	2.0
	2004	9.8	--	T	4.9
	Average	5.3	1.6	0	2.2
Shovelnose sturgeon(age-0)					
	2001	0	0	T	T
	2002	--	0	T	T
	2003	0	0	T	T
	2004	0	--	T	T
	Average	0	0	0	T
Sicklefin chub					
	2001	0	0	1.0	0.3
	2002	--	0	1.3	0.6
	2003	0	0	2.2	0.7
	2004	0	--	0.8	0.4
	Average	0	0	1.3	0.5
Stonecat					
	2001	0.1	0.2	0.8	0.4
	2002	--	1.7	0.5	1.1
	2003	0.2	0.3	0.2	0.2
	2004	5.3	--	0.1	2.7
	Average	1.9	0.7	0.4	1.1
Sturgeon chub					
	2001	0	0.4	0.8	0.4
	2002	--	0	0.4	0.2
	2003	0.4	0.9	1.2	0.8
	2004	0.9	--	1.8	1.4
	Average	0.4	0.4	1.0	0.7

-- indicates not sampled

Monitor threatened, endangered and species of special concern

A plan to protect and provide for the recovery or threatened and endangered fish species as required by Article 417 and 421 has been completed. Generally the plan entails monitoring the populations of these species. For pallid sturgeon, a federally listed endangered species, the plan includes monitoring dispersal survival and longitudinal distribution of the hatchery released juveniles. Also, a formal population abundance survey is to be conducted annually to establish a baseline for a measure of comparisons in the future. A total of 68 pallid sturgeon were captured this year; 6 adults, 57 juvenile hatchery 1997-year class, 2 juvenile hatchery 2001-year class and 3 juvenile hatchery 2003-year class pallids. All but four of the pallid sturgeon were captured in the Robinson Bridge area. The annual work was completed and results from this years work are reported in the 2004 Pallid Sturgeon Report (Gardner 2005b). A list of the six state species of special concern and the number sampled this year is provided in Table 16.

Table 16. State species of special concern and number sampled in the middle Missouri River during the 2004 field season.

Species	Number Sampled
Blue sucker	38
Paddlefish	55
Pallid sturgeon	68
Sauger	604
Sicklefin chub	111
Sturgeon chub	248

Results from the sauger, sicklefin chub and sturgeon chub have been previously discussed and no additional information was collected for paddlefish. The 2004 blue sucker size structure (bars) was compared for size structure changes with the size structure average for past years (line) and is presented in Figure 2. As usual, most of the blue suckers were large-size, mature fish. The 2004 sample spanned a length distribution from 24 to 35 inches with 76% of the fish represented by the 27 – 32 inch groups. This was similar to the 1993-95 sample where the length distribution was from 19 – 33 inches and the 27 – 32 inch groups composed 75% of the size groups.

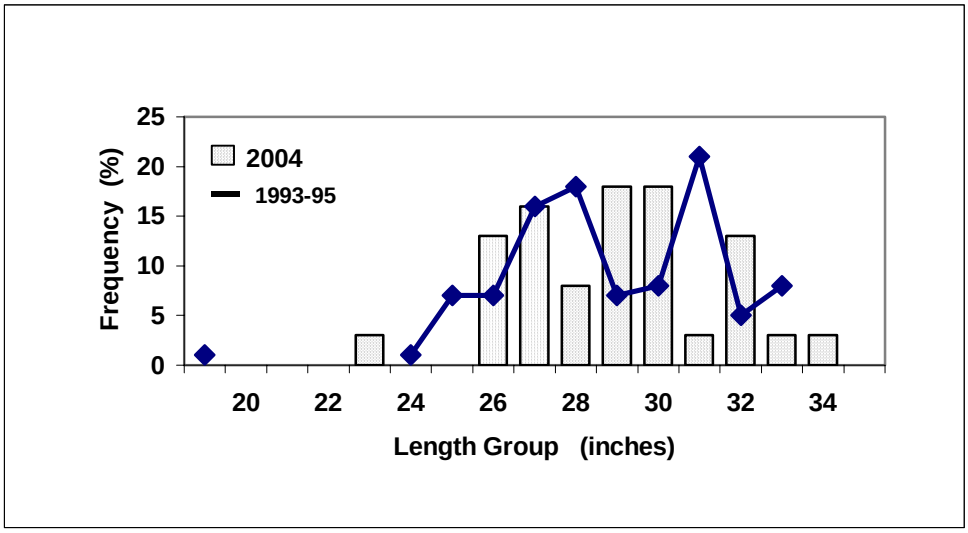

Figure 2. The 2004 length frequency histogram (N=38) and 1993-95 trend line for blue sucker sampled in the middle Missouri River, MT.

Adaptive Management practices initiated

Sauger supplementation in the Morony Dam area.

A trial sauger propagation program was initiated in 1998 for the purpose of supplementing the depressed population in the upper reach. The goal was to stock 30,000 - 50,000 sauger fingerlings in Morony (300 acre) and Cochrane (200 acre) reservoirs located on the Missouri River, 33 miles upstream of Fort Benton. The idea is to have the fingerling sauger use the reservoirs as a grow-out area and gradually pass through the dam and into the river downstream over the course of a year or two. A stocking rate of 60 – 100 fingerlings/acre was chosen because it is well within the range of stocking rates for walleye fingerlings reported by Laarman (1978). An attempt was made to spawn sauger on site at the Robinson Bridge area and collect 250,000 eggs for incubation and rearing at the Miles City State Fish Hatchery. All sauger used as brood fish would be screened for genetic purity by Dr. Neil Billington, using protein electrophoresis (Billington et al. 1996). Sexually mature sauger were captured, staged and later spawned on site near the Robinson Bridge area. A total of 1,624,400 sauger eggs were collected in 2004, but no sauger fry were produced from these eggs because of genetic contamination and poor hatching success. Subsequent sampling below Morony Dam during 2004 found no age-0 sauger in the area, indicating that no natural sauger reproduction occurs in the area at this time. Table 17 summarizes sauger propagation and stocking that has occurred in the study are over the past years.

Table 17. A summary of the sauger propagation effort in the Middle Missouri River, 1998 – 2003.

Year	Number Eggs collected	Number Fry stocked	Number Fingerlings stocked	
			Morony R.	Cochrane R.
1998	100,000	0	0	0
1999	971,762	100,000	5,000*	0
2000	240,000	0	0	0
2001	369,850	0	9,550	8,000
2002	911,235	0	13,823	10,000
2003	2,101,300	0	69,957	0
2004	1,624,400	0	0	0

* stocked out at 3.1 inches

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Appendix A. Locations and rivermile boundaries of trend areas in the middle Missouri River study area.

Section	Rivermile	Location
Trend area		
Morony	2097.8 to 2102	N47.688° / W110.985° to N47.632° / W111.032°
Fort Benton	2073.5 to 2079.2	N47.816° / W110.668° to N47.787° / W110.724°
Coal Banks	2029.5 to 2035.5	N48.032° / W110.207° to N48.018° / W110.281°
Judith Landing	1980.5 to 1986.5	N47.747° / W109.575° to N47.731° / W109.687°
Robinson Brg.	1925.5 to 1931.5	N47.646° / W108.752° to N47.705° / W108.816°