F-78-R3 III-B
3741
Region 7

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: Montana **PROJECT TITLE:** Statewide Fisheries Investigations

PROJECT: F-78-R-3 **STUDY TITLE:** Survey and Inventory of Warmwater Streams

JOB NO: III-B **JOB TITLE:** Southeast Montana Warmwater Streams Investigations

PROJECT PERIOD: July 1, 1996 through June 30, 1997

ABSTRACT

Sturgeon chub were again present in 1996 fall Yellowstone River electrofishing samples, but only downstream of the Tongue River. Sauger numbers remain low and larger sauger are especially uncommon. Sauger young-of-the-year were not found in the Yellowstone River in 1996, but are reported from Lake Sakakawea in fall 1996. Anglers returned, in the first year following tagging, only 2.5% of tags from 200 sauger tagged in fall 1995. Shovelnose sturgeon were collected for the first time upstream of the Cartersville Diversion Dam. Several Yellowstone River fish species were collected downstream, but not upstream of the Cartersville Diversion Dam.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To collect up to 100 million walleye eggs each year at Fort Peck Reservoir in collaboration with R-6 fisheries personnel. This objective was met. Joint regional efforts at Fort Peck Reservoir produced approximately 80 million walleye eggs.

2. Collect detailed fish information to allow design of fish passage at Cartersville Diversion Dam and prevention of fish entrainment in the Intake canal. Appropriate data was collected and is summarized in the RESULTS section.

3. To understand the significance to game fish of Yellowstone River non-game fish species. Almost no sauger collected had recognizable fish food items in guts. No data is reported.

4. To have needed Tongue River flows recognized in the operating plan for the rebuilt Tongue River Dam. No new progress was made toward this objective during the report period.

5. Participate in project selection and design of Tongue Basin enhancement projects. Projects selected for fisheries enhancement were construction of fish excluding devices for major irrigation canals.

6. To ensure that legally mandated instream flows are met. Instream flows were largely met during the report period. Exceptions were caused by weather related low streamflows and legal withdrawal by senior water users.

7. To maintain existing water quality and bank-channel condition. Projects were reviewed under two state laws. Project were approved as planned, modified or denied depending on potential effect on fish habitat and other required considerations.

8. To monitor status and effect of angler harvest on selected Yellowstone River game fish. This objective was met. Progress is reported in the RESULTS section.

9. To monitor status of non-game species - especially sturgeon chub, blue sucker and sicklefin chubs. This objective was met. Progress is reported in the RESULTS section.

10. Add new fishing access sites at key locations on the Yellowstone and Tongue Rivers. Discussions are on-going with landowners at two sites, but no new sites were added during the report period.

METHODS

River fish populations were sampled with boat mounted electrofishing gear, drifted gill and trammel nets, fike nets, minnow traps and 1/4" and 1/8" bag seines of varying lengths. Fish total

lengths (fork length for sturgeon) were measured to the nearest millimeter and weights to the nearest gram for small fish or nearest 10 grams for larger fish. Sauger gut contents were removed by placing thumb pressure on the gut area of the fishes ventral side. This usually forced regurgitation of gut contents.

RESULTS

Yellowstone River Fish Population Work

Fish were sampled in 5 sections of the Yellowstone River by electrofishing in fall. Non-game fish species sampled are shown in Table 1. Four species were collected in the section immediately downstream of Cartersville Diversion Dam but not in the section immediately upstream. These were blue sucker, emerald shiner, freshwater drum and bigmouth buffalo.

A total of ten sturgeon chub were collected in fall electrofishing in 1996. This species has not been observed in the Yellowstone River upstream of the mouth of the Tongue River.

Sauger is a key species in the Yellowstone River. Along with the less abundant walleye it is probably the most popular species with anglers. Numbers collected in 1996 (Table 2) were lower than in 1995, but electrofishing effort was also lower in 1996. Electrofishing catch rates from 1985 to 1996 in four river sections are given in Table 3. Catch rates in 1996 were noticeably lower than in 1995 for three of four sections. Only the Hathaway to Kinsey Bridge section showed a small increase from 1995 to 1996. This index of sager abundance remains very low compared to the mid to late 1980's (Table 3).

Sauger young-of-the-year were not found in the Yellowstone River in 1996, following large numbers in 1994 and 1995 (Table 4). This probably does not indicate a failure of the 1996 year class. Communication with North Dakota Game & Fish personnel (Fred Ryckman, Williston) indicated significant catches young-of-the-year sauger in late summer and early fall 1996 in Lake Sakakawea. These fish were probably spawned in the Yellowstone River, forced to drift into Lake Sakakawea after hatching and remained in Lake Sakakawea. These fish may still move into the Yellowstone River and increase the abundance of Yellowstone River sauger in later years.

Sauger length frequency in the Yellowstone River for the years 1994-1996 is shown in Table 5. Smaller sauger were relatively abundant all three years. Sauger of 400 mm total length or longer made up an average of only 15.8% (range 13.7 to 19.3% for the three years). In 1985, in a sample of 482 Yellowstone River sager, 48% were at least 400 mm total length (Stewart 1986). In experimental gill nets in Lake Sakakawea in 1996, 55% of the sager exceeded 400 mm total length (Fred Ryckman). Sauger movement between Lake Sakakawea and the Yellowstone River is common. Movement of sauger from the reservoir to the Yellowstone River could increase the percentage of larger sauger in the near future.

Angler return of tagged sauger in the first year following tagging since 1985 is summarized in Table 6. Tag returns have been low in recent years because of the low sauger abundance and low numbers of fish tagged. Only 5 (2.5%) of 200 sager tagged in fall 1995 were returned by anglers through fall 1996. Overall, since 1985, 5.1% of tagged sauger/walleye have been harvested by anglers in the first year after tagging. The actual exploitation rate is higher because some tags are not returned by anglers.

Hoop Net Permits

Hoop net permits have been required since 1994. They are available only in the Miles City and Glasgow regional offices. Seventeen of these permits were issued from the Miles City office in 1996. This compares with 22 and 17 in 1994 and 1995, respectively. Most people receiving these permits lived at towns along the Yellowstone River between Billings and Fairview.

Yellowstone River Fish Passage/Entrainment Study

In 1996, MFW&P Regions 5 and 7 began a cooperative study with the Bureau of Reclamation to investigate the loss of fish into irrigation canals and determine if diversion dams limited upstream fish populations by prevention of upstream passage. Bureau of Reclamation field work in 1996 centered on measurement of fish entry into Intake canal, the largest point withdrawal on the Yellowstone River. FW&P work was directed toward measurement of fish community differences upstream and downstream of Cartersville Diversion Dam and use by fish of the high water by-pass channel around Intake Diversion Dam. Cartersville Diversion Dam had previously been indicated as a controlling factor for sauger density upstream of Intake Diversion Dam (Stewart 1990).

A summary of work done in 1996 is given in Appendix Tables 1 through 25. Tables 1 and 2 summarize gill net drifting and electrofishing in the Intake high water channel. Although June flows were above average in 1996, relatively few fish were sampled in gill net drifts. This sampling will be repeated in 1997.

Shovelnose sturgeon were found upstream of Cartersville Diversion Dam for the first time in 1996. Sturgeon work in 1997 is planned to determine distribution and density upstream of CDD compared to density downstream. The following fish species were collected downstream of CDD but not upstream; stonecat, creek chub, northern pike and blue sucker. Very few stonecats, creek chubs and northern pike were sampled at downstream points. Data collected to date are probably insufficient to detect numbers or size differences upstream and downstream for any fish species.

LITERATURE CITED

Stewart, P.A. 1990. Southeast Montana Warm Water Streams Investigations. Job. Prog. Rept. F-46-R-3. Job III-b. MT. Dept. Of Fish, Wildl & Parks. 10 pp.

Stewart, P.A. 1986. Southeastern Montana Fisheries Investigations. Job. Prog. Rept. F-30-R-22. Job I-b. MT Dept. Of Fish., Wildl. & Parks. 9 pp.

Key Words:

non-game fish - distribution
sauger - exploitation rate, size structure, abundance
Diversion dams - fish passage

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Date: March 27, 1997

Table 1. Non-game fish species sampled by electrofishing from five sections of the Yellowstone River in September and October 1996.

Species	N(total)	N(measured)	Length Range (mm)	Weight Range (gm)
Cartersville Diversion Dam to 8 Miles Upstream				
Shorthead redhorse	252	93	108-486	15-1410
White sucker	32	32	241-435	140-910
Longnose sucker	23	23	90-420	10-910
Mountain sucker	11	11	107-198	10-900
River carpsucker	113	93	213-452	150-1360
Smallmouth buffalo	2	2	656-657	4230-4500
Goldeye	38	38	303-392	240-620
Flathead chub	23	23	74-173	-
Carp	41	41	325-640	520-3280
P/S minnow	3	3	106-124	-
Longnose dace	8	8	44-64	-
Cartersville Diversion Dam to 2 Miles Downstream				
Shorthead redhorse	278	76	112-500	10-1230
Longnose sucker	23	22	96-442	10-780
White sucker	57	52	217-414	80-850
Mountain sucker	12	12	86-150	-
River carpsucker	106	71	322-433	420-1210
Blue sucker	2	2	632-665	2070-2490
Goldeye	275	107	215-372	210-420
Flathead chub	113	44	71-222	-

Table 1 continued.

Species	N(total)	N(measured)	Length Range (mm)	Weight Range (gm)
P/S minnow	134	40	78-120	-
Emerald shiner	18	3	67-91	-
Carp	29	29	438-580	560-2700
Longnose dace	6	0	-	-
Freshwater drum	10	10	245-341	160-410
Smallmouth buffalo	4	4	570-722	2800-4500+
Bigmouth buffalo	1	1	670	4500+
Miles City Vicinity				
Freshwater drum	2	2	296-383	300-720
Goldeye	64	42	291-361	220-380
Flathead chub	25	21	81-163	-
Longnose dace	1	1	83	-
Emerald shiner	2	2	67-80	-
Carp	9	9	467-658	1270-3430
Shorthead redhorse	99	60	142-476	20-1240
White sucker	7	7	293-350	240-550
Longnose sucker	8	8	288-460	280-1020
Blue sucker	1	1	662	2570
River carpsucker	14	14	351-482	540-1640
Stonecat	1	1	179	40

Table 1 continued.

Species	N(total)	N(measured)	Length Range (mm)	Weight Range (gm)
		Fallon Vicinity		
Stonecat	1	1	157	40
Goldeye	70	27	260-363	150-380
Flathead chub	20	20	88-225	-
Longnose dace	5	5	57-82	-
Sturgeon chub	10	10	72-89	-
Plains/Silvery minnow	8	8	75-120	-
Carp	3	3	423-570	850-2410
Shorthead redhorse	18	18	60-473	5-1500
River carpsucker	4	4	325-482	450-1680
		Intake Diversion Dam to 2 Miles Downstream		
Freshwater drum	1	1	244	340
Goldeye	42	31	85-349	5-430
Flathead chub	19	19	93-200	5-90
Plains/Silvery minnow	1	1	130	20
Carp	4	4	462-666	1150-3870
Shorthead redhorse	8	8	143-340	40-450
Longnose sucker	2	2	240-263	150-180
River carpsucker	12	12	210-514	80-1920
Smallmouth buffalo	4	4	485-553	1530-2290
Bigmouth buffalo	2	2	620-677	4600-4750

Table 2. Game fish sampled by electrofishing from five sections of the Yellowstone River in September and October 1996.

Species	N	Length range (mm)	Mean length (mm)	Weight range (gm)	Mean Weight (gm)
Cartersville Diversion Dam to Eight Miles Upstream					
Sauger	8	305-415	342	200-570	303
Walleye	1	-	520	-	1280
Smallmouth bass	6	185-322	258	100-600	308
Smallmouth bass YOY	2	75-77	76	-	-
Burbot	1	-	300	-	110
Channel catfish	5	275-640	385	160-3100	1324
Cartersville Diversion Dam to 2 Miles Downstream					
Sauger	16	273-525	347	170-1420	374
Sauger/Walleye	1	-	354	-	330
Smallmouth bass	20	145-321	234	30-610	237
Channel catfish	11	262-674	381	90-3240	782
Shovelnose sturgeon	2	815-880	848	-	-
Northern pike	2	625-803	714	2570-4160	3365
Brown trout	1	-	329	-	360

Table 2 continued

Species	N	Length range (mm)	Mean length (mm)	Weight range (gm)	Mean weight (gm)
Miles City Vicinity					
Sauger	22	266-464	357	150-740	369
Smallmouth bass	1	-	103	-	15
Channel catfish	8	306-703	525	220-4300	1969
Burbot	1	-	348	-	200
Fallon Vicinity					
Sauger	4	302-366	330	200-370	273
Walleye	1	-	163	-	30
Channel catfish	14	185-425	336	50-650	356
Burbot	2	220-348	284	60-250	155
Downstream of Intake Diversion Dam					
Sauger	6	240-360	283	100-370	178
Sauger/Walleye	1	-	277	-	180
Walleye	2	192-510	351	60-1250	655
Channel catfish	3	300-695	435	220-4700	1730
Northern pike	2	500-830	665	700-3450	2075
Brown trout	1	-	575	-	1730
Shovelnose sturgeon	3	547-678	618	600-1260	947

Table 3. Electrofishing catch rate (fish per day) for Yellowstone River sauger in the autumn.

Year	Number of days	Number of sauger	Sauger per day
Intake to Seven Sisters			
1996	2	6	3.0
1995	6	80	13.3
1994	7	77	11.0
1993	6	103	17.2
1985	3	58	119.3
Bonfield to Glendive			
1996	2	4	2.0
1995	8	109	13.6
1994	8	40	5.0
1993	5	54	10.8
1992	8	51	6.4
Hathaway to Kinsey Bridge			
1996	3	22	7.3
1995	4	20	5.0
1994	5	6	1.2
1993	8	8	1.0
1992	12	33	2.8
1990	17	135	8.1
1985	5	135	27.0

Table 3 continued.

Year	Number of days	Number of sauger	Sauger per day
	Forsyth to Rosebud		
1996	4	16	4.0
1995	4	56	14.0
1994	4	8	2.0
1993	6	10	1.7
1992	6	23	3.8
1990	1	25	25.0
1988	8	233	29.1
1987	15	273	18.2

Table 4. Historical relative abundance of sauger young-of-the-year sampled by electrofishing in the Yellowstone River during autumn.

	Upstream of Intake			Downstream of Intake		
Year	No. of days	No. of sauger	No. per day	No. Of days	No. Of sauger	No. Per day
1996	9	0	0.00	2	0	0.00
1995	16	2	0.13	6	19	3.17
1994	17	12	0.17	7	47	6.17
1993	19	0	0.00	6	1	0.17
1992	26	0	0.00	0		
1990	18	10	0.56	0		
1988	8	20	2.50	0		
1987	15	0	0.00	0		
1985	20	3	0.15	3	8	2.67

Table 5. Length frequency of sauger in the Yellowstone River in 1994, 1995 and 1996.

Length class (mm)	1994		1995		1996	
	Number	Percent	Number	Percent	Number	Percent
<200	42	32.1	20	7.5	0	0.0
200-249	18	13.7	9	3.4	3	5.5
250-299	4	3.1	66	24.9	10	18.2
300-349	26	19.8	57	21.5	21	38.2
350-399	23	17.7	62	23.4	13	23.6
400-449	10	7.6	25	9.4	5	9.1
450-499	6	4.6	15	5.7	2	3.6
>500	2	1.5	11	4.2	1	1.8

Table 6. Yellowstone River sauger/walleye harvest rate in the first year following tagging.

Year Tagged	Location Tagged	Number Tagged	First year	Harvest rate
1985	Miles City	143	17	11.9
1987	Below Forsyth	276	17	6.2
1988	Below Forsyth	196	2	1.0
1989	Above Forsyth	30	1	3.3
1990	Below Forsyth	37	2	5.4
1990	Miles City	161	12	7.5
1991	Above Forsyth	30	3	10.0
1992	Below Forsyth	22	3	13.6
1992	Miles City	46	4	8.7
1992	Fallon Bridge	51	0	0.0
1993	Below Forsyth	21	1	4.8
1993	Miles City	10	0	0.0
1993	Near Fallon	54	1	1.9
1993	Below Intake	42	0	0.0
1994	Below Forsyth	8	0	0.0
1994	Miles City	8	0	0.0
1994	Near Fallon	28	3	10.7
1994	Below Intake	31	0	0.0
1995	Forsyth to Hathaway	56	0	0.0
1995	Miles City to Bonfield	31	1	3.2
1995	Terry to Glendive	73	2	2.7
1995	Intake to Elk Island	40	2	5.0
All years		1394	71	5.1

Appendix Table 1. Gill Net Drifting in the Intake Side Channel.

Species	N Total	N Measured	Mean Length (mm)	Mean Weight (g)
	6/4/96 - Exp. Gill Net - 3 drifts - 30 minutes			
CCAT	1	1	330	
SNS	1	1	335	
GE	1	1	334	
FHC	2	2	213	
CARP	1	1	587	
TOTAL	6			
	6/4/96 - 1 ½" (bar) Gill Net - 2 drifts - 10 minutes			
GE	53	25	333	
	6/11/96 - 5" (bar) Gill Net - 3 drifts - 15 minutes			
SNS	1	1	750	
GE	1	1	334	270

Appendix Table 2. Electrofishing in the Intake side channel.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
			5/31/96			
SAUG	8	8	215-445	296	60-670	215
RCSU	1	1	--------	386	-------	760
BM BUF	5	5	677-806	770	-------	---
GE	36	36	98-381	313	10-500	254
FHC	5	5	106-185	152	-------	---
CARP	1	1	--------	487	-------	1400
TOTAL	56					
			6/25/96 & 6/28/96			
SAUG	5	5	235-476	311	90-760	266
BURBOT	1	1	------	430	-------	430
RHSU	1	1	------	159	-------	30
WSU	2	2	220-254	237	100-150	125
LNSU	1	1	------	253	-------	150
BLSU	1	1	------	653	-------	1750
RCSU	2	2	365-556	461	620-1450	1035
BM BUF	1	1	------	710	-------	-----
GE	195	30	224-374	327	200-440	268
FHC	1	1	------	127	-------	10
P/SM	1	1	------	115	-------	5
CARP	4	4	305-630	498	300-3400	1913
TOTAL	215					

Appendix Table 3. Electrofishing in the first two Yellowstone River miles downstream of Cartersville Diversion Dam, 4/9/96 & 4/10/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
WE	9	9	373-632	485	450-2700	1364
CCAT	1	1	--------	595	-------	2400
SCAT	1	1	--------	195	-------	50
BURBOT	3	3	207-312	259	40-170	103
MTWF	1	1	--------	375	-------	400
RHSU	95	74	134-520	358	20-1490	569
WSU	6	6	125-428	353	10-1080	712
LNSU	9	9	247-460	332	160-1180	464
MTSU	1	1	--------	150	-------	25
RCSU	13	13	338-442	389	460-1250	788
GE	91	81	270-366	327	200-380	277
FHC	12	12	45-153	117	-------	-----
LN DACE	6	6	40-61	52	-------	-----
CARP	17	17	362-582	483	580-2900	1576
TOTAL	265					

Appendix Table 4. Electrofishing on the Yellowstone River in the first 100 yards downstream of the Cartersville Diversion Dam, 4/8/96 & 4/10/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
CCAT	1	1	-----	363	-----	380
Burbot	3	3	230-275	259	70-110	93
RHSu	47	5	120-387	265	10-600	290
WSu	7	7	288-444	376	270-1130	721
LNSu	2	2	250-306	278	170-370	270
RCSu	6	6	361-488	411	570-1430	920
GE	80	12	284-355	323	190-1430	259
FHC	3	3	112-152	139	10-30	23
P/SM	4	4	58-65	62	-----	-----
Carp	7	7	475-524	499	1270-1900	1674
TOTAL	160					

Appendix Table 5. Yellowstone River electrofishing in the first two river miles downstream of the Cartersville Diversion Dam, 5/14/96 & 5/15/96.

Species	N	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
SMB	2	207-333	270	110-600	355
SNS	2	830-857	844	-----	2600
RHSU	96	145-469	324	25-1320	420
WSU	21	220-432	346	110-1000	523
LNSU	15	211-493	280	90-1260	285
MTSU	1	------	155	------	40
RCSU	5	356-424	392	580-1080	812
GE	59	265-348	308	120-360	242
FHC	12	95-210	154	5-80	34
LND	1	------	80	------	----
CARP	5	408-525	485	1010-2100	1662
TOTAL	219				

Appendix Table 6. Yellowstone River electrofishing downstream of the Cartersville Diversion Dam, 9/5/96 & 9/16/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
			Dam to 100 yards below Dam			
GE	24	24	282-372	324	200-420	304
			100 yards below Dam to 2 miles below Dam			
SAUG	7	7	280-444	340	170-610	314
SAUG/WE	1	1	------	354	-----	330
SMB	14	14	145-321	224	30-610	221
CCAT	8	8	262-674	354	90-3000	580
SNS	2	2	815-880	848	-----	4000 (approx)
NP	2	2	625-803	714	2570-4160	3365
FWD	10	10	245-341	301	160-410	314
GE	209	43	221-357	312	210-380	264
RHSU	196	36	112-500	323	10-1230	429
WSU	29	25	217-402	315	80-850	399
LNSU	16	15	96-415	243	10-770	237
BLSU	1	1	------	632	------	2070
MTSU	9	9	86-150	117	------	------
RCSU	62	38	322-429	383	420-1210	705
SM BUF	3	3	570-722	637	2800-4550	3560
BM BUF	1	1	------	670	------	4500+
FHC	113	44	71-222	122	------	------
LND	6	0	------	-----	------	------
ES	18	3	67-91	78	------	------
P/SM	134	40	78-120	89	------	------
CARP	20	20	358-580	457	560-2700	1291
TOTAL	861					

Appendix Table 7. Yellowstone River electrofishing upstream of the Cartersville Diversion Dam, 9/11/96 & 9/19/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
			Dam to 1 mile upstream of Dam			
RHSU	8	8	108-470	350	15-1020	568
WSU	6	6	255-420	313	170-770	370
LNSU	3	3	110-347	264	10-450	247
RCSU	25	25	247-445	379	450-1000	701
GE	6	6	328-365	342	290-500	358
FHC	7	7	81-140	112	------	----
CARP	10	10	395-570	485	850-2380	1579
TOTAL	65					
			1 mile upstream of Dam to 8 miles upstream of Dam			
SAUG	1	1	------	305	------	210
SMB	2	2	185-261	223	100-310	205
CCAT	5	5	275-640	385	160-3100	1324
LL	1	1	------	225	------	120
FWD	3	3	328-408	356	440-890	610
RHSU	113	41	201-485	381	80-1250	630
WSU	21	21	241-435	341	140-910	491
LNSU	14	14	90-410	308	310-870	519
MTSU	11	11	107-198	158	10-100	46
RCSU	51	37	213-444	372	150-1050	653
SM BUF	2	2	656-657	657	4230-4500	4365
GE	11	11	310-392	337	240-620	323
FHC	16	16	74-173	120	------	----
P/SM	3	3	106-124	117	------	----
CARP	20	20	405-640	521	940-3280	----
TOTAL	274					

Appendix Table 8. Yellowstone River electrofishing in the first two river miles downstream of the Cartersville Diversion Dam, 10/4/96 & 10/15/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
SAUG	9	9	273-525	353	190-1420	421
SMB	6	6	217-280	256	140-360	273
CCAT	3	3	330-664	456	260-3240	1320
LL	1	1	-----	329	-----	360
RHSU	82	40	287-480	399	260-1190	706
WSU	22	22	273-414	355	210-180	540
LNSU	7	7	358-442	395	490-780	673
BLSU	1	1	-----	665	-----	2490
MTSU	3	3	108-127	117	-----	10
RCSU	44	33	335-433	380	480-1160	702
SM BUFF	1	1	-----	578	-----	2900
GE	42	40	215-363	317	210-350	274
CARP	9	9	438-563	507	1070-2150	1718
TOTAL	230					

Appendix Table 9. Yellowstone River electrofishing upstream of the Cartersville Diversion Dam, 10/3/96 & 10/11/96.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)	Weight Range (g)	Mean Weight (g)
			Dam to 1 mile upstream of Dam			
SAUG	2	2	307-370	339	200-350	275
SMB	2	2	259-322	291	270-600	435
BURBOT	1	1	------	300	------	110
RHSU	4	4	138-393	228	20-580	190
LNSU	1	1	------	159	------	40
RCSU	8	8	341-452	387	510-1360	791
GE	2	2	303-325	314	260-300	280
CARP	3	3	325-555	468	520-2030	1423
TOTAL	23					
			1 mile upstream of Dam to 8 miles upstream of Dam			
SAUG	5	5	290-415	350	190-570	333
WE	1	1	-----	520	-----	1280
SMB	2	2	255-265	260	260-310	285
SMBYOY	2	2	75-77	76	-----	----
RHSU	127	40	167-486	395	40-1410	703
WSU	5	5	280-400	342	280-850	516
LNSU	5	5	103-420	328	10-900	528
RCSU	29	23	325-437	387	520-1140	755
GE	19	19	308-350	331	250-370	308
LN DACE	8	8	44-64	51	-----	----
CARP	8	8	436-583	514	1110-2500	1924
Unkn. Minn.	1	1	-----	49	-----	----
TOTAL	212					

Appendix Table 10. Minnow trapping below Cartersville Diversion Dam in rock rip-rap, north side.

Species	N	Length Range	Mean Length
	10-80 yards downstream of Dam, April 1996 - 39 trap days		
SCAT	13	81-125	107
LNDACE	2	56-62	59
FHC	1	-----	147
	10- 25 yards downstream of Dam, May 1996 - 12 trap days		
SCAT	8	83-114	102
LNDACE	105	53-70	61
FHC	3	51-60	54
RHSU	1	-----	107
TOTAL	117		

Drifted Gill Net - 1 ½" (bar) x 125' - 4/15/96

Gill nets were drifted from as close to diversion dam as possible (for 1-2 minutes per drift) to approximately 200 yards below the dam. One drift approximately one fourth of the way across (from south side) caught no fish. One drift at mid-channel starting in a back eddy caught 2 goldeye, 6 redhorse sucker and one longnose sucker. Three drifts two-thirds of the way across from the south side starting in a back eddy caught 81 goldeye, 10 redhorse suckers and one channel catfish.

Baited Set Lines - 10/1/96

A night-crawler baited set line, 250 ft. long with 24 hooks was set parallel with the dam and approximately 20 yards downstream of the dam. One end was tied to the north shore, the other end anchored. This line caught no fish. In less than 24 hours the line caught a great deal of filamentous algae.

Appendix Table 11. Seining (1/8" x 50' bag seine), gravel shoreline 1/4 mile downstream of Cartersville Dam, 8/19/96, one haul.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
FHC	28	24	63-85	71
LN DACE	396	22	21-44	27
P/S M	6	6	30-81	67
Unkn.Minn.	64	14	23-40	28
TOTAL	494			

Appendix Table 12. Seining (1/8" x 25' seine) downstream of Cartersville Dam, 8/21/96, 4 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
FHC	34	24	62-193	87
LN DACE	124	22	19-60	31
P/S M	20	20	43-76	64
ES	6	5	56-80	72
CARP	1	1	-----	90
SMB	1	1	-----	40
Unkn. Su	95	20	22-80	35
Unkn. Minn.	1728	21	24-44	33
TOTAL	2009			

Appendix Table 13. Seining (1/8" x 25') upstream of Cartersville Dam, 8/20/96 & 8/22/96, 10 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
LN DACE	468	29	17-57	27
FHM	39	20	41-88	64
ES	13	13	58-86	70
FHC	5	5	71-76	74
CARP	4	4	56-66	60
WSU	11	11	40-58	51
RHSU	7	7	41-115	88
LNSU	2	2	71-80	76
RCSU	5	5	25-48	33
SMB	17	17	27-53	35
GS	2	2	34-38	36
Unkn. Minn.	552	22	22-49	30
P/SM and FHC	117	20	38-90	76
Unkn. Sucker	497	22	22-40	29
Minn., SU, LND	2000 (approx)		20-50 (approx)	
TOTAL	3739			

Appendix Table 14. Seining (1/4" x 12') downstream of Cartersville Dam, 8/21/96, 1 haul.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
P/SM	2	1	------	60
FHC	1	0	------	100 (approx)
ES	1	1	------	58
Unkn. Su	7	7	37-50	42
TOTAL	11			

Appendix Table 15. Electrofishing above 1/4" x 100' bag seine, downstream of Cartersville Dam, 9/3/96, 2 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
ES	46	31	53-106	74
P/SM	16	5	85-126	104
FHC	29	27	63-207	84
LN DACE	5	2	23-33	28
RHSU	5	3	42-92	59
WSU	3	3	45-166	95
RCSU	1	1	------	51
LNSU	4	4	41-83	63
CARP	1	1	------	88
Unkn. Minn.	41	5	28-42	34
TOTAL	197			

Appendix Table 16. Seining below Cartersville Dam, 1/4" x 100' seine, 8/29/96 and 9/3/96, 2 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
SMB	7	7	44-173	74
SCAT	1	1	-----	185
ES	52	15	33-81	64
P/SM	20	8	69-116	88
FHC	35	16	38-88	72
LN DACE	3	3	32-52	39
Sand Shiner	10	1	-----	47
RHSU	28	10	41-91	52
WSU	2	2	61-150	106
LNSU	12	7	55-76	67
RCSU	1	1	-----	383
Unkn. Minn.	40	8	31-45	38
TOTAL	211			

Appendix Table 17. Seining upstream of Cartersville Diversion Dam, 1/4" x 100' seine, 9/4/96, 3 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
SMB	85	70	37-240	65
CCAT	3	3	324-372	341
ES	32	3	62-72	67
P/S Minn.	86	2	61-72	67
LN DACE	16	14	27-61	38
Sand Shiner	10	10	46-59	53
FHM	2	0	----	---
CARP	6	6	330-843	543
FHC	104	11	72-88	81
WSU	39	2	62-268	165
LNSU	15	8	42-207	86
RCSU	34	28	31-67	45
RCSU	3	3	340-380	362
BM BUFF	2	2	535-567	551
RHSU	208	18	31-112	54
FWD	1	1	----	270
GE	8	8	317-352	338
Unkn. Minn.	162	20	30-46	37
TOTAL	816			

Appendix Table 18. Seining downstream of Cartersville Diversion Dam, 1/4" x 100' seine, 9/20/96, 9/24/96 & 9/30/96, 5 hauls.

Species	N Total	N Measured	Length Range (mm)	Mean Length (mm)
P/SM	3	3	89-97	94
FHC	6	6	46-105	79
LND	8	8	22-36	26
ES	1	1	------	57
Creek Chub	2	2	46-55	51
Sand Shiner	10	10	36-55	51
RHSU	2	2	38-270	154
WSU	1	1	------	375
Unkn. Minn.	250	28	24-46	34
Unkn. Sucker	4	4	32-43	39
TOTAL	287			

Appendix Table 19. Frame trap nets (½" mesh) upstream and downstream of Cartersville Diversion Dam, 8/27/96, 8/28/96 & 8/29/96, (6 trap nights).

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream of Diversion Dam			
BCR	4	208-213	211	160-180	173
FHC	5	83-189	119	------	---
P/SM	2	81-101	91	------	---
LNSU	3	86-410	283	450-770	610
WSU	1	-----	412	------	740
RHSU	2	87-141	114	------	---
MTSU	1	-----	160	------	---
SMB	1	-----	55	------	---
TOTAL	19				
		Upstream of Diversion Dam			
BCR	6	117-219	160	80-150	104
CCAT	5	270-553	383	150-1540	552
SCAT	3	112-180	143	------	---
SAUG	2	65-378	---	------	---
YP	1	-----	156	------	90
RHSU	8	94-210	121	------	---
WSU	4	219-428	294	260-880	353
LNSU	9	91-375	171	------	---
RCSU	19	69-424	352	10-390	590
P/SM	18	90-125	100	------	---
FHC	7	95-185	137	------	---
GS	3	61-120	86	------	---
GE	2	347-388	368	340-390	365
Unkn. Minn.	1	-----	77	------	---
TOTAL	88				

Appendix Table 20. Frame trap nets (½" mesh) upstream and downstream of Cartersville Diversion Dam, 9/24/96 to 9/27/96 (8 trap nights).

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream of Diversion Dam			
SMB	1	----	75	----	----
SCAT	1	----	160	----	----
RHSU	6	71-140	118	----	----
LNSU	10	82-109	98	----	----
MTSU	2	106-107	107	----	----
RCSU	2	66-77	72	----	----
P/SM	5	105-126	116	----	----
FHC	3	106-128	114	----	----
ES	1	----	95	----	----
TOTAL	31				
		Upstream of Diversion Dam			
SAUG	4	122-336	267	10-280	180
WE	1	----	400	----	670
CCAT	79	226-645	304	90-2380	243
SCAT	1	----	191	----	50
SMB	6	73-322	179	----	----
BCR	2	65-80	72	----	----
BURBOT	1	----	610	----	1020
RHSU	12	90-211	153	10-100	38
WSU	23	65-429	314	5-970	463
LNSU	1	----	99	----	----
FHC	3	130-177	153	20-50	33
CARP	3	145-408	294	50-930	520
GE	7	301-376	331	250-450	317
TOTAL	143				

Appendix Table 21. Drifted ½" monofilament gill nets downstream and upstream of Cartersville Diversion Dam.

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream - 8/27/96 & 8/28/96 - 5 drifts - 81 minutes			
CCAT	1	----	342	----	----
SNS	7	627-823	746	1440-2800	2210
FHC	31	123-156	136	----	----
P/SM	4	108-136	119	----	----
RHSU	21	96-126	113	----	----
LNSU	1	----	140	----	20
MTSU	1	----	122	----	----
GE	1	----	294	----	210
TOTAL	67				
		Downstream - 10/1/96 - 7 drifts - 37 minutes			
CCAT	2	298-333	316	190-260	255
SNS	2	800-830	815	2400-2750	2575
RHSU	6	106-417	199	----	----
TOTAL	10				
		Upstream - 8/27/96 & 8/28/96 - 4 drifts - 57 minutes			
CCAT	3	147-301	249	----	301
FHC	25	120-186	140	----	----
BM BUFF	1	----	650	----	4150
RHSU	17	100-130	115	----	----
LNSU	1	----	295	----	250
MTSU	2	111-129	120	----	----
TOTAL	49				

Appendix Table 22. Drifted experimental gill nets downstream and upstream of Cartersville Diversion Dam.

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream - 8/29/96 & 9/3/96 - 3 drifts - 35 minutes			
SAUG	2	276-415	346	150-480	315
SNS	25	694-960	813	1640-4500+	2827
FHC	1	-----	177	-----	80
RHSU	5	216-390	285	100-590	290
LNSU	6	305-438	364	330-950	520
GE	1	-----	307	-----	240
TOTAL	40				
		Upstream - 9/4/96 - 1 drift - 11 minutes			
FHC	3	160-181	173	-----	----
RHSU	3	210-410	319	110-680	310
LNSU	1	-----	409	-----	740
MTSU	1	-----	175	-----	----
SM BUFF	3	615-704	651	3560-4280	3837
TOTAL	11				

Appendix Table 23. Drifted 2 ½" (bar) mesh gill nets downstream and upstream of Cartersville Diversion Dam.

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream - 9/20/96 - 3 drifts - 16 ½ minutes			
SNS	28	485-990	830	1260-4690	3138
SM BUFF	2	660-682	671	-----	4500+
BLSU	1	---	760	-----	3320
TOTAL	31				
		Upstream - 9/24/96 & 9/27/96 - 4 drifts - 33 ½ minutes			
SNS	2	803-815	809	2380-2480	2430
RHSU	2	440-504	472	880-1270	1075
TOTAL	4				

Appendix Table 24. Drifted 2" x 12" (bar) trammel nets downstream and upstream of Cartersville Diversion Dam.

Species	N	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream - 9/20/96 & 10/1/96 - 2 drifts - 13 minutes			
SNS	36	712-950	822	1650-4500+	2821
CCAT	1	----	378	-----	460
RHSU	5	406-509	455	680-1180	936
CARP	1	----	416	-----	1020
TOTAL	43				
		Upstream - 9/24/96 - 2 drifts - 17 minutes			
SAUG	1	----	311	-----	250
BLSU	1	----	667	-----	2660
RHSU	11	403-495	449	750-1160	947
TOTAL	13				

Appendix Table 25. Drifted 1 ½" x 8" (bar) trammel nets downstream and upstream of Cartersville Diversion Dam.

Species	N Total	N Measured	Length (mm) Range	Length (mm) Mean	Weight (gm) Range	Weight (gm) Mean
		Downstream - 10/22/96 - 4 drifts - 15 ½ minutes				
SAUG		1	-----	346	-----	350
SNS		9	643-837	774	1380-2700	2297
RHSU		8	350-494	403	480-1120	718
WSU		4	324-415	353	410-690	493
LNSU		7	354-473	407	500-1190	750
RCSU		5	369-393	380	690-720	700
GE	174	29	293-335	312	220-320	262
TOTAL	208	63				
		Upstream - 10/16/96 & 10/23/96 - 9 drifts - 67 minutes				
SAUG	1		-----	364	-----	350
CCAT	4		312-354	340	200-420	315
RHSU	10		300-494	370	260-1110	528
WSU	1		-----	420	-----	860
LNSU	10		353-461	397	480-1100	733
SM BUFF	1		-----	568	-----	2310
GE	1		-----	325	-----	280
TOTAL	28					

FISH NAMES ABBREVIATIONS

SNS - Shovelnose sturgeon
GE - Goldeye
RBT - Rainbow trout
LL - Brown trout
MTWF - Mountain whitefish
NP - Northern pike
FHC - Flathead chub
ES - Emerald shiner
P/SM - Plains or silvery minnow
FHM - Fathead minnow
LND, LN Dace - Longnose dace
RCS - River carpsucker
BLSU - Blue sucker
SM BUFF - Smallmouth buffalo
BM BUFF - Bigmouth Buffalo
RHSU - Shorthead redhorse
LNSU - Longnose sucker
WSU - White sucker
MTSU - Mountain sucker
CCAT - Channel catfish
SCAT - Stonecat
GS - Green sunfish
SMB - Smallmouth bass
BC - Black crappie
YP - Yellow perch
SAUG - Sauger
WE - Walleye
FWD - Freshwater drum