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MONTANA DEPARTMENT OF FISH,
WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State of Montana

Title Lower Missouri River Basin

Project No. FW-2-R-14

Investigations (Missouri River Segment

Job No. 1-B

Title Planning Inventory, Fisheries

Period Covered July 1, 1984 through June 30, 1985

ABSTRACT

Fisheries studies and related aquatic work were continued on the Missouri River from Fort Peck Dam to the Montana-North Dakota border. Data are presented in this report on zooplankton communities in the river; age and growth studies of shovelnose sturgeon; paddlefish distribution; and fish populations of the lower Milk River.

Survey sampling of the river zooplankton indicated that Fort Peck Reservoir contributed much of the plankton found in the main channel habitat areas of the river. Cyclops and Daphnia dominated the samples comprising 71% of the organisms sampled. Off-channel pool areas maintained significant densities of plankton, some endemic to the river.

Shovelnose sturgeon ages ranged from seven to 33 years. The yearly growth rate was slow averaging 0.25 inches and 0.09 pounds for the sturgeon sampled.

Fish populations in the lower Milk River were dominated by goldeye. Resident sportfish numbers in the catch were somewhat low, this being attributed to the extremely low river flows.

OBJECTIVES

The overall objectives include activities to determine the status, reproductive success, movement, diet, age and growth of sport fish populations. Other objectives include river channel profile measurements and aquatic macroinvertebrate sampling and identification.

Specific objectives include the following:

(1) To qualitatively describe the zooplankton communities in the river.

(2) To complete age and growth studies of shovelnose sturgeon.

(3) To continue monitoring paddlefish residency in the river.

(4) To survey fish populations in the lower Milk River.

(5) To compile and analyze data for final report.

All of the above objectives were completed. Progress with the final report for this investigation have been made including preliminary conclusions for five of the twelve sections. This final report will be completed during 1985.

DESCRIPTION OF STUDY AREA

The study area is described in previous reports (Stewart, 1980 and Gardner, 1984).

PROCEDURES

Most procedures have been described in previous reports (Stewart 1980, 1981, 1982 and 1983 and Gardner 1984) and only new procedures will be described here.

Zooplankton samples were collected using a 1 ft diameter Wisconsin-type net 3.3 ft. long with 0.006 inch mesh. A detachable plankton bucket was secured to the net to allow for removal of the sample. Samples were collected in backwater pools and main channel areas and the sampling method varied depending upon the area where the collection was made.

The pool areas were sampled with 25 foot horizontal tows, and main channel sampled by positioning the net in the river current for 15 seconds. Flow velocities at the mouth of net were determined with a Price AA current meter. Sampling in the main channel was brief because of the problems associated with heavy turbidities, consequently, two samples were usually taken in these areas to compensate for the short sampling duration. The samples were transferred to collecting jars and preserved with five percent formaldehyde.

In the laboratory, samples were diluted, agitated to attain a homogenous suspension and subsamples were withdrawn using a 2 ml Hensen-Stempel pipette. Three 2-ml samples were counted for each sample using a modified Ward plankton counter (Ward 1955). Counts and identifications were made using a dissecting microscope at 30 X total magnification. Taxinomic keys by Edmondson (1959) and Pennak (1953) were used to identify the zooplankters, usually determined to genus.

Shovelnose sturgeon were aged from sectioned pectoral fin rays. The process involved cutting a 0.02 inch section about 0.4 inches from the base of the articulation using a dremel saw arranged similar to that described by Witt (1961). These sections were emersed in a five percent solution of hydrochloric acid for partial decalcification. The sections were washed in tap water and placed in glycerin between two microscope slides. Annuli appeared as narrow, translucent single or banded lines, similar to that reported by Roussow (1957) and Cuerrier (1951). Spine samples were projected at 66X on a Northwest nmi 90 microfiche reader.

FINDINGS

Missouri River

River zooplankton

Zooplankton could be an important trophic level in a river such as the Missouri described in this report. Cummins (1975) mentions that large turbid rivers with heavy sediment loads characteristically possess plankton communities.

Zooplankton samples were collected to determine trophic level significance in the river system. Samples were taken in the borders of the main channel and in off-channel pools. These off-channel pools, either abandoned river channels or pools formed by lateral sand bars situated near the channel margins, were 20 to 180 feet wide, 100 to 600 feet long with maximum depths between 3 and 8 feet. Collections were taken at three reaches; upper, middle and lower stations (72, 138 and 180 miles below Fort Peck Dam) on May 25, July 24 and October 10, 1984.

Composition

Fair densities of zooplankton were sampled in the river. Cyclops and Daphnia dominated the collections for both the main channel and off-channel pool sites comprising an average of 52.5 and 18.5% of the organisms sampled, respectively (Table 1). These major taxa sampled in the river were similar with that found in the reservoir. Wiedenheft (pers. com.) reported that in Fort Peck Reservoir Cyclops and Daphnia were the two most prevalent zooplankters. Bosmina, a taxon uncommon in the Missouri River system above the study area (Frazer, 1985) was collected in high densities on one occasion. Although the two types of sampling methods are not entirely comparable (horizontal tows vs. stationary river tows) gross density differences were apparent. Average zooplankton densities in the main channel sites were never greater than 3 organisms per liter, whereas, in the off-channel pool sites the highest densities were nearly 26 organisms per liter.

The highest zooplankton densities at the main channel sites were regularly recorded in the upper reach station (Table 1). Middle and lower reach stations exhibited densities only about 25% that of the upper station. The reverse was the case for the off-channel pool sites. Here, the middle and lower stations had zooplankton densities at least 15 times that of the upper station. The high zooplankton densities of the main channel sites at the upper station were most likely the result of this station's proximity to Fort Peck Dam. Frazer (1985) attributed high densities of zooplankton in the Fort Peck Dam tailpool to large quantities of zooplankton being flushed from the reservoir during the spring turnover period. A possible explanation for the greater zooplankton densities in the off-channel pool sites of the middle and lower reach stations may be related to the more stable flows experienced in these reaches further from the dam. Daily river fluctuations at the upper reach station were most likely greater because of the proximity to the dam. This may have resulted in excessive flushing of the off-channel pool sites in this area.

Seasonal Abundance

There appeared to be seasonal differences in zooplankton densities. For the main channel sites, the greatest densities were sampled during the spring, and

consisted of densities at least 9 times that of summer and fall samples (Table 2). At the off-channel pool sites both spring and summer collections exhibited high zooplankton densities, although this was not always consistent at all stations.

Table 3 compares the seasonal abundance of zooplankton populations in the nearby Missouri River system. There are some similarities and differences between these locations.

Comparisons indicate that during the spring the reservoir was probably the main source of zooplankton to the river system, yet in the summer the off-channel pool sites were the only areas in the river where there were fair concentrations of zooplankton

Even though there were high densities of zooplankton in the reservoir and tailpool of the dam during the fall there were, perhaps, only slight increases in plankton densities from the summertime low; these increases only being noted at the upper reach site. It was believed that another peak in zooplankton abundance occurred throughout the study area in the main channel sites. This was probably not detected because sampling was not continued during late October and November when Fort Peck Reservoir was experiencing fall turnover. Repsys and Rogers (1982) described a bimodal peak of Missouri River zooplankton densities, one in the spring and fall. These two seasonal peaks were associated with the spring and fall turnover periods of the large mainstem impoundments. Peak river zooplankton densities were reported to occur in late October through early November.

It appeared that true river production of zooplankton was chiefly limited to off-channel pool sites. Here was where the only significant quantities of the uncommon taxon, Bosmina, was collected, and this habitat was the main area where high densities of zooplankton were collected during the summer. Kallemeyn and Novotny (1977) reported that most zooplankton present in the Missouri River (in South Dakota and Nebraska) originated in the mainstem reservoirs. This was the case here, however during both the spring and summer there also were substantial zooplankton densities in the off-channel pool habitats.

Fish Populations

Age and growth analysis

Shovelnose Sturgeon. A total of 77 shovelnose sturgeon pectoral spines were collected, however, only 56 of these could be used in the sturgeon aging analyses. Cross sections of the spines were difficult to age because numerous annuli were crowded on the narrow (0.07-0.16 inches diameter) pectoral spine cross sections. A sample of these cross sections was aged by four individuals to insure the precision of the assigned ages. Only those spines with determined ages within five years agreement were used. Assigned ages, as determined by the four individuals, were usually within two years agreement.

Annuli were read according to the technique used by Cuerrier (1951). Under transmitted light the narrow clear bands were considered annuli. Annuli belt patterns were characteristic of most sturgeon spines. Zweiacker (1967) and Berg (1981) identified similar annuli belt patterns on shovelnose sturgeon pectoral rays from the Missouri River. Roussow (1957) found annuli belts on pectoral fin

ray sections of lake sturgeon. These researchers attributed the belts of annuli to slower growth during periods of gonadal development.

Assigned ages ranged from seven to 33 years (Table 4). An average age of these 56 samples was not determined because the samples were not taken randomly, but were collected selectively to insure that all sturgeon sizes and ages were represented. The observed growth rates from sturgeon between the ages of seven and 30 years averaged 0.25 inches and 0.09 pounds of growth per year. This was considered to be a slow growth rate for shovelnose sturgeon compared to the upstream population of the middle Missouri River which Berg (1981) reported as exhibiting an average growth rate of 0.72 inches and 0.31 pounds per year.

Seasonal Distribution

Paddlefish. Residency of paddlefish in the Missouri River was monitored during the fall, 1984 and spring, 1985. Water run-off patterns during this period were below normal. Two paddlefish survey counts in the middle reach of the river were completed during the fall, September 10-13 and October 3. Very few paddlefish were counted during these runs. Only nine fish were sampled while electrofishing for 20 hours. Fair densities were noted in this reach during the spring, usually amounting to five fish per hour.

One spring survey run was conducted on June 10, 1985. The intent of this effort was to determine if the paddlefish moved up into the Milk/Missouri River confluence area given the abnormally high spring flow of the Missouri combined with low spring flows of the Milk River. About six miles of the lower Milk River and general confluence area was electrofish sampled. No paddlefish were observed, although large concentrations of other migratory fishes from the Missouri were noted. (Bigmouth and smallmouth buffaloes and blue suckers). From this observation it was believed that high volume discharges from Fort Peck Dam during the spring, alone, are not enough to attract paddlefish to their major spawning areas in the Missouri and Milk rivers. High volume spring run-off flows in the Milk River are essential for attracting paddlefish upstream from their mid-river staging areas.

Milk River

Fish Populations

Composition

Three sites on the lower Milk River were sampled with gill nets during summer and fall, 1984. These sites were located 60, 23 and 4 miles above the confluence with the Missouri River and were labeled as the Glasgow, Nashua and confluence sites, respectively. River flows were extremely low and very little flow, if any, occurred over the riffle areas. The pools where the gill nets were set were at least six feet deep.

A total of 1104 fish representing 14 species were caught in the 16 gill net sets. Goldeye far outnumbered any other species sampled constituting at least 71% of the total catch for all sites (Tables 5-7). The average sizes of goldeye found at Nashua and the confluence sites were considered large for this species with some specimens weighing well over a pound. Shorthead redhorse and river carpsucker were the other two predominant species. Sportfish were generally low comprising between six and 13% of the catch. Sauger, channel catfish and northern pike were the more common sportfish sampled. Walleye and shovelnose sturgeon were sampled less frequently.

The results of this gill net survey indicate that there are resident sportfish populations in the lower Milk River, however in low numbers. It was believed that the low flow conditions during 1984 and the previous year, most likely, limited the distribution of sportfish in the river. With a more normal water year and maintained minimum instream flows, the Milk River could support a more substantial warmwater sport fishery.

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List of Waters Referred to

	Hydrological Unit	Code	Reach	Water Type
Milk River	10050012	6-15-2680	001	02
		6-15-2680	002	02
Missouri River	10060001	6-16-2500	000	01
		6-16-2420	001	02
		6-16-2420	002	02

300/1

Table 1. Percent composition of zooplankton genera and average zooplankton densities for samples collected in main channel and off-channel pool habitats in the Missouri River, 1984.

		Diaptomus	Cyclops	Nauplii	Daphnia	Bosmina	Average Total Number/liter
Main Channel	Upper[a/]	12	47	5	36	0	2.93
	Middle	17	59	4	20	0	0.68
	Lower	11	63	14	12	0	0.70
Off-Channel Pool	Upper	22	35	13	30	0	0.77
	Middle	1	26	2	12	59	25.88
	Lower	7	85	7	1	tr.[b/]	11.86
Average Percent Composition		11.7	52.5	7.5	18.5	9.8	

[a/] Reach of river where sample was collected.

[b/] Demotes values less than 0.5%.

300/1.1/1

Table 2. Longitudinal and seasonal zooplankton densities sampled in main channel and off-channel pool habitats at three reaches of the Missouri River, 1984.

Habitat Areas	Stations			Average Number Organisms/liter
	Upper[a]	Middle	Lower	
Spring				
Main channel	7.68	1.96	1.86	5.75
Off-channel pool	1.08	2.14	35.21	12.81
Summer				
Main channel	0.31	0.01	0.02	0.11
Off-channel pool	0.51	49.60	tr.[b]	16.70
Fall				
Main channel	0.84	0.04	0.04	0.31
Off-channel pool	0.71	No Sample	0.04	0.25

[a] Reach of river where sample was collected.

[b] Denotes values less than 0.5%.

300/1.1/2

Table 3. Seasonal comparisons of zooplankton densities (average number of orgnaisms per liter) in three habitat areas of the Missouri River and Fort Peck Reservoir. All samples taken concurrently during 1984.

	River Main Channel	River Off-channel Pool	River Dam Tailpool[a/]	Ft. Peck Reservoir[b/]
May	5.8	12.8	8.5	10.3
July	0.1	16.7	1.3	27.0
October	0.3	0.3	14.5	21.4

a/ Frazer 1985
b/ Wiedenheft 1985

a/ Frazer 1985

b/ Wiedenheft (pers. comm.)

300/1.1/3

Table 4. Age-frequency of shovelnose sturgeon sampled in the lower Missouri River during 1983 and 1984 with average lengths and weights and standard deviations.

Age	Number of fish	Avg. Total length (in.)	Avg. Fork length (in.)	Standard deviation (total length)	Avg. Weight (lb.)	Standard deviation (weight)
7	2	21.5	18.6	0.35	0.85	0.35
8	2	23.0	20.2	0.78	1.18	0.03
9	1	22.9	20.1	----	1.48	----
10	0	----	----	----	----	----
11	4	24.8	22.1	1.03	1.78	0.41
12	6	24.6	21.9	1.72	1.72	0.40
13	1	23.6	20.8	----	1.58	----
14	3	24.9	22.2	1.53	2.00	0.41
15	2	24.7	22.0	1.70	1.85	0.49
16	3	25.6	23.0	1.71	2.02	0.43
17	4	26.7	24.1	1.20	2.54	0.52
18	2	28.0	25.5	0.57	2.40	0.42
19	3	27.3	24.8	3.03	2.70	1.07
20	1	25.7	23.1	----	1.98	----
21	2	29.4	27.0	1.66	2.94	0.19
22	4	27.5	25.0	1.23	2.52	0.23
23	3	28.5	26.1	1.53	2.82	0.67
24	3	28.8	26.4	1.04	3.13	0.35
25	2	29.4	27.0	1.70	3.14	0.56
26	0	----	----	----	----	----
27	1	31.3	28.8	----	4.48	----
28	2	27.7	25.2	2.12	2.45	0.47
29	2	28.5	26.1	2.12	2.91	0.78
30	2	28.6	26.2	0.71	2.90	0.70
31	0	----	----	----	----	----
32	0	----	----	----	----	----
33	1	28.2	25.7	----	2.81	----

300/1.1/4

Table 5. Species composition, number, and size of fish sampled by experimental gill netting in the Milk River - Glasgow study section, 1984. (A total of four overnight sets)

Fish Species	Number Captured	Average Length (inches)	Length Range	Average Weight (pounds)	Weight Range
Goldeye	102	9.7	(6.0-13.8)	0.35	(0.08-0.91)
Northern pike	3	28.6	(22.0-32.5)	4.25	(3.20-5.20)
River carpsucker	11	15.6	(14.0-17.5)	1.90	(1.50-2.70)
Smallmouth buffalo	2	19.8	(18.7-20.9)	3.80	(3.20-4.48)
Shorthead redhorse	15	12.9	(10.5-14.5)	0.85	(0.48-1.08)
Channel catfish	8	17.8	(14.2-20.0)	1.64	(0.78-2.22)
Sauger	1	13.2	----	0.79	----
Walleye	1	18.1	----	1.70	----

300/1.1/5

Table 6. Species composition, number, and size of fish sampled by experimental gill netting in the Milk River - Nashua study section, 1984. (A total of four overnight sets)

Fish Species	Number Captured	Average Length (inches)	Length Range	Average Weight (pounds)	Weight Range
Goldeye	195	11.8	(7.3-15.3)	0.56	(0.16-1.18)
Northern pike	9	18.6	(12.6-29.1)	1.86	(0.48-5.00)
Carp	2	18.3	(16.1-20.1)	2.50	(2.05-3.00)
River carpsucker	2	15.5	(15.3-15.7)	1.70	(1.68-1.75)
Smallmouth buffalo	1	22.4	----	----	----
Shorthead redhorse	13	13.1	(9.5-17.5)	0.95	(0.26-2.05)
White sucker	1	12.6	----	1.00	----
Channel catfish	12	16.0	(7.5-19.3)	1.80	(0.35-2.20)
Sauger	8	12.5	(12.2-17.3)	0.65	(0.50-1.25)
Walleye	2	19.7	(13.4-26.0)	4.40	(0.78-8.00)
Freshwater drum	1	4.5	----	0.06	----

300/1.1/6

Table 7. Species composition, number, and size of fish sampled by experimental gill netting in the Milk River - confluence study section, 1980 and 84. (A total of eight overnight sets)

Fish Species	Number Captured	Average Length (inches)	Length Range	Average Weight (pounds)	Weight Range
Shovelnose sturgeon	4	26.8	(24.7-30.0)	2.21	(1.85-2.80)
Goldeye	605	12.2	(8.4-15.0)	0.60	(0.22-1.19)
Northern pike	3	24.3	(18.0-29.1)	3.24	(1.10-6.50)
Carp	3	17.3	(16.9-17.7)	2.30	(2.10-2.50)
Blue sucker	4	25.4	(25.0-25.6)	4.77	(4.45-5.00)
River carpsucker	21	15.9	(13.5-17.7)	1.73	(1.22-2.55)
Smallmouth buffalo	5	-- not measured --			
Bigmouth buffalo	1	-- not measured --			
Shorthead redhorse	27	15.0	(12.0-19.6)	1.50	(0.60-3.11)
Channel catfish	7	18.5	(7.9-23.6)	2.50	(0.15-4.80)
Sauger	30	13.4	(10.1-19.7)	0.66	(0.26-2.22)
Walleye	5	15.4	(11.5-17.9)	1.33	(0.36-2.10)

300/1.1/7