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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-13 Investigations (Missouri River Segment)

Job No. 1-B Title Planning Inventory, Fisheries

Period Covered July 1, 1983 through June 30, 1984

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 minimum instream flows for maintenance of important fisheries habitats; analyses of flows in the rainbow trout spawning and rearing habitat areas; paddlefish distribution; and results from fish tissue analyses for pesticides, PCB's and mercury residue.

Instream flow analyses were conducted to determine minimum flows necessary for maintenance of critical aquatic habitat areas. These critical areas were identified as rearing pools for young-of-the-year (YOY) sauger, sauger spawning reefs and riffle habitats for food organisms and other unique species of fish. Minimum flows were determined for each of the 17 sites using variations of the Montana Department of Fish, Wildlife and Parks wetted perimeter computer program. A schedule of minimum instream flows will be recommended after further analyses are completed.

Habitat conditions in the important rainbow trout side channel were monitored during 1983. Intensive spawning use was noted along with some rearing of YOY trout. Hydropower peaking of Fort Peck Dam caused daily water level changes in this side channel and is believed to be the major factor surpressing numbers of rainbow trout in this tailwater fishery.

Paddlefish distribution in the study area was monitored. Summer and fall 1983 sampling indicated that paddlefish were still present in the upper reach of the study area. Paddlefish counts made during spring 1984 indicated that paddlefish did not migrate upriver and congregate in the Milk River confluence area as noted during past years. This was attributed to the extremely low flows recorded in the Milk River.

A significant number of sexually mature walleye were sampled in the Missouri River upstream from the Milk River confluence. This run was observed during early May for both 1983 and 1984. One of the 18 tagged walleye was later harvested in Garrison Reservoir.

No residue concentrations of pesticides, PCB's or mercury were detected from five rainbow trout muscle tissue samples, and only low concentrations of mercury were detected in five analyzed shovelnose sturgeon muscle tissue samples.

OBJECTIVES

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

Specific objectives include the following:

(1) To determine specific locations and general areas of the river used by sauger for spawning, by the presence of spawners and larvae. Work on this objective was confined to the upper portion of the study area.

(2) To determine sauger young-of-the-year rearing areas and abundance in late summer. Very little work was accomplished on this objective because of schedule conflicts with the higher priority WETP work. The results from the limited sampling of YOY sauger will be combined with results from 1981 and 1982 and included in the final completion report.

(3) To monitor river flows in rainbow trout spawning habitat areas. This work was accomplished and analyses completed using the department's WETP computer program.

(4) To determine age and growth of shovelnose sturgeon. A collection of spines was taken, but aging has yet to be completed.

(5) To make at least one paddlefish count over the length of the river. This work was done and findings are included.

(6) To complete river channel profile measurements as an aid in determining minimum instream flows. This work was done and findings are included.

(7) To collect a sample of resident fish for pesticides, PCB and mercury residue analyses. This work was completed and results are included.

(8) To begin compiling and analyzing data for the final report. This work has been initiated.

DESCRIPTION OF STUDY AREA

The study area is described in a previous report (Stewart 1980). Figure 1 is a map of the study area with the locations of the eight sampling sections indicated. The specific locations, gradients and lengths for each study section are given in Table 1.

Table 1. Locations and river gradients of the eight study sections on the Missouri River.

SAMPLING SECTION	LOCATION	RIVER MILE	SECTION LENGTH (MI)	GRADIENT (FT/MI)
	Dam	0		
Ft. Peck	to		11	0.9
	Milk River	11		
Nickels	to		16	0.6
	Upper Frazer Pump	27		
Frazer	to		23	1.3
	Prairie Elk Creek	50		
Wolf Point	to		20	0.8
	Hiway #13 Bridge	70		
Chelsea	to		17	1.5
	Poplar River	87		
Sprole	to		30	0.8
	Brockton	117		
Brockton	to		24	0.7
	Big Muddy Creek	141		
Culbertson	to		42	0.8
	Nohly	183		

PROCEDURES

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

To evaluate the minimum instream flow necessary for maintenance of important fish habitat areas in the Missouri River, the wetted perimeter (WETP) hydraulic simulation computer program was employed. This program is described in detail by Nelson (1983). Using standard surveying techniques, water surface elevations at three discharges were measured with a level and rod. Channel profiles were measured using a range finder and fathometer in conjunction with the level and rod.

To evaluate the success of rainbow trout spawning in relation to the river fluctuations experienced during 1983, a survey of the YOY trout was made. The YOY rainbow trout were sampled using a mobile electrofishing system. This system consisted of a

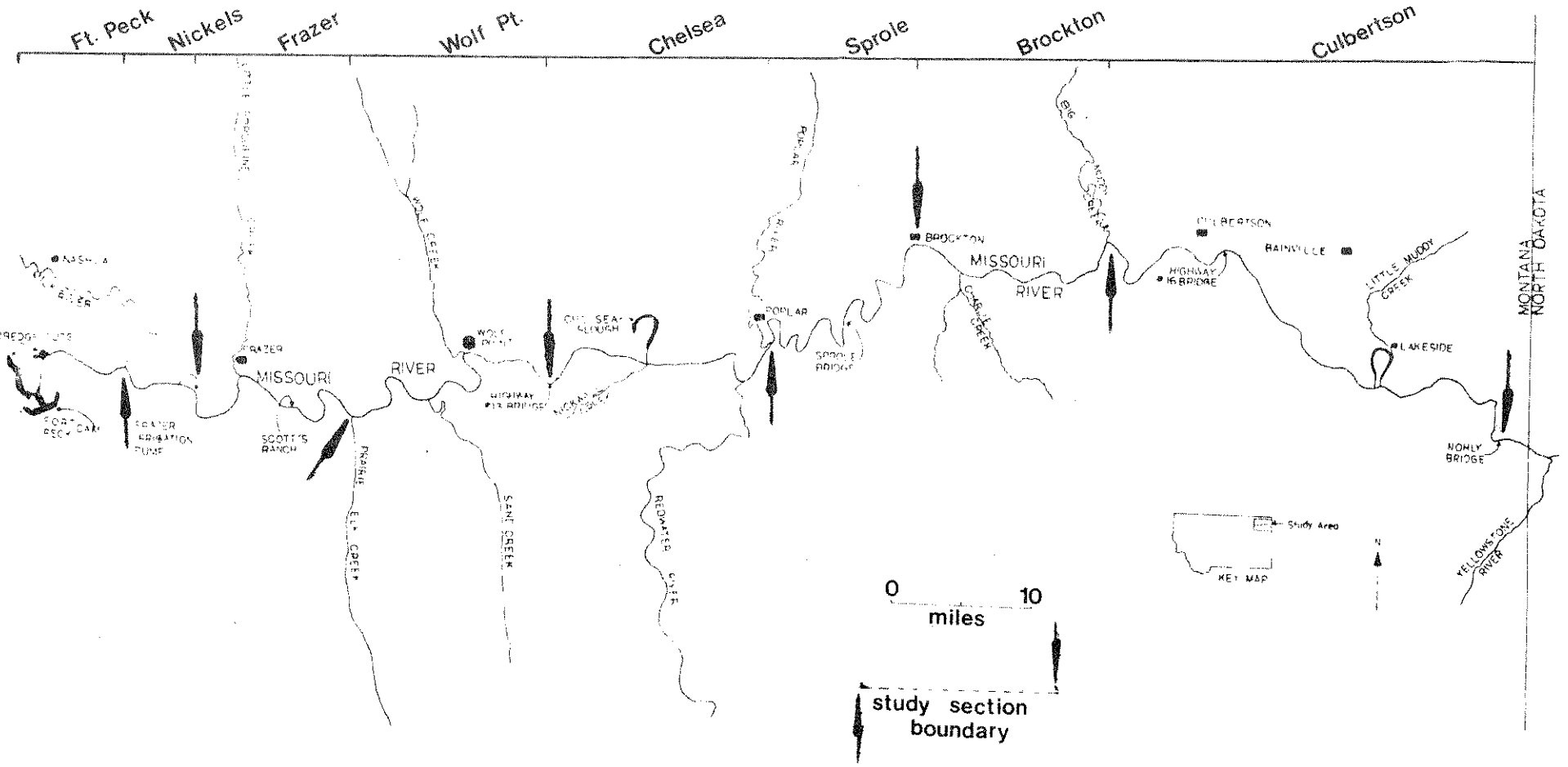

Figure 1. Map of lower Missouri River drainage in Montana.

handheld mobile positive electrode, a stationary negative electrode floated beside a Jon boat and a portable 3,000 watt, 220-volt AC generator. A Coffelt VVP-10 rectifying unit was used to change the alternating current to pulsed direct current. The electrofishing system was carried in a 14 foot fiberglass boat.

RESULTS

Instream Flow Analysis

An instream flow analysis was conducted in the study area. This analysis was concerned with identifying flows which would maintain important habitat areas that are vulnerable to dewatering. These critical habitat areas and the importance to the fishery are defined as follows:

(1) Off-channel pool areas as rearing sites for YOY sauger, and sites for zooplankton production.
(2) Rocky reefs used intensively as spawning sites by sauger and walleye.
(3) Riffles and runs which are important habitat for fish food organisms (aquatic macroinvertebrates) and the principal habitat for pallid sturgeon and sicklefin chub, fishes listed by the Montana Department of Fish, Wildlife and Parks (MDFWP) as "species of special concern."

Originally 47 locations for cross-section profiles were selected; however, only 34 of these proved to be usable. Reasons for discarding the 13 cross sections ranged from access logistics to problems with reliable modeling of the channel at the cross section site. Of these 34 cross sections, 9 were located at four off-channel pool sites, 9 at three sauger spawning reef sites, and the remaining 16 were situated at nine different riffle sites. Three sets of stage-discharge data (a high, medium and low flow) were necessary for calibration of the WETP program. Since the Missouri River below Fort Peck Dam is entirely regulated, it was necessary that the Corps of Engineers maintain steady releases from the dam for 48 hours while water elevations were measured at each cross section site. The actual water releases used for calibration were 9,800, 7,200 and 4,400 cfs.

Instream Flow Assessment For Sauger Rearing Pools

Sampling in previous years found significant concentrations of YOY sauger associated with off-channel pools. These pools are most likely formed by lateral sand bars deposited near the channel margin or an abandoned channel. Approximate dimensions of these pools at normal summer flows range from 20 to 180 feet wide, 100 to 600 feet long and with maximum depths between 3 and 8 feet.

Four typical sauger-rearing pools were surveyed establishing at least two cross sections at each pool. The cross sections were usually located at the upper end and one near the mouth of the pool. The criteria used to determine the river flow which maintains the pool habitat at a reasonable condition was judged to be the point where the profile of the pool cross section changed sharply from more vertical sloping sides to gradual sloping sides (Figure 2). At this point losses of the pool width increase and there is a rapid loss of the important shoal areas. It is important to maintain an adequate depth and size of these pools along with a vegetated shoal area for favorable sauger rearing and production of zooplankton. Figure 2 is an example of two cross sections from a pool with the indicated river stage which maintains that pool in a suitable condition. The corresponding river flow was determined from the WETP program which predicts the flow for a given river stage.

Results from the WETP analysis of the off-channel pools are given in Table 2. The river flows which would maintain a reasonable water level at each off-channel pool cross section were determined, and the values for cross sections located at the same pool were then averaged.

Table 2. Water elevations and corresponding flows at which four monitored pools are at the minimum pool maintenance conditions.

LOCATION	CROSS SECTION #	RIVER STAGE AT MIN. POOL MAINTENANCE	FLOW
Poplar	25 (lower)	18.80 ft.	7000
	26 (upper)	20.65 ft.	5000
			$\bar{x}$ = 6000
Brockton	27 (lower)	19.85	3500
	28 (upper)	21.60	5500
			$\bar{x}$ = 4500
Big Muddy	34 (lower)	20.00	9250
	35 (middle)	29.90	7500
	36 (upper)	29.70	6000
			$\bar{x}$ = 7583
Nohly	43 (lower)	18.30	4850
	44 (upper)	16.40	5800
			$\bar{x}$ = 5325

Once the flow recommendations for maintenance of the sauger rearing pools have been finalized, these flows should be maintained for the period June 1 - August 31. This was reported by Gardner and Berg (1981) as being the chief rearing period for YOY sauger in the middle Missouri River. Water temperatures for the lower Missouri River are cooler compared to the middle

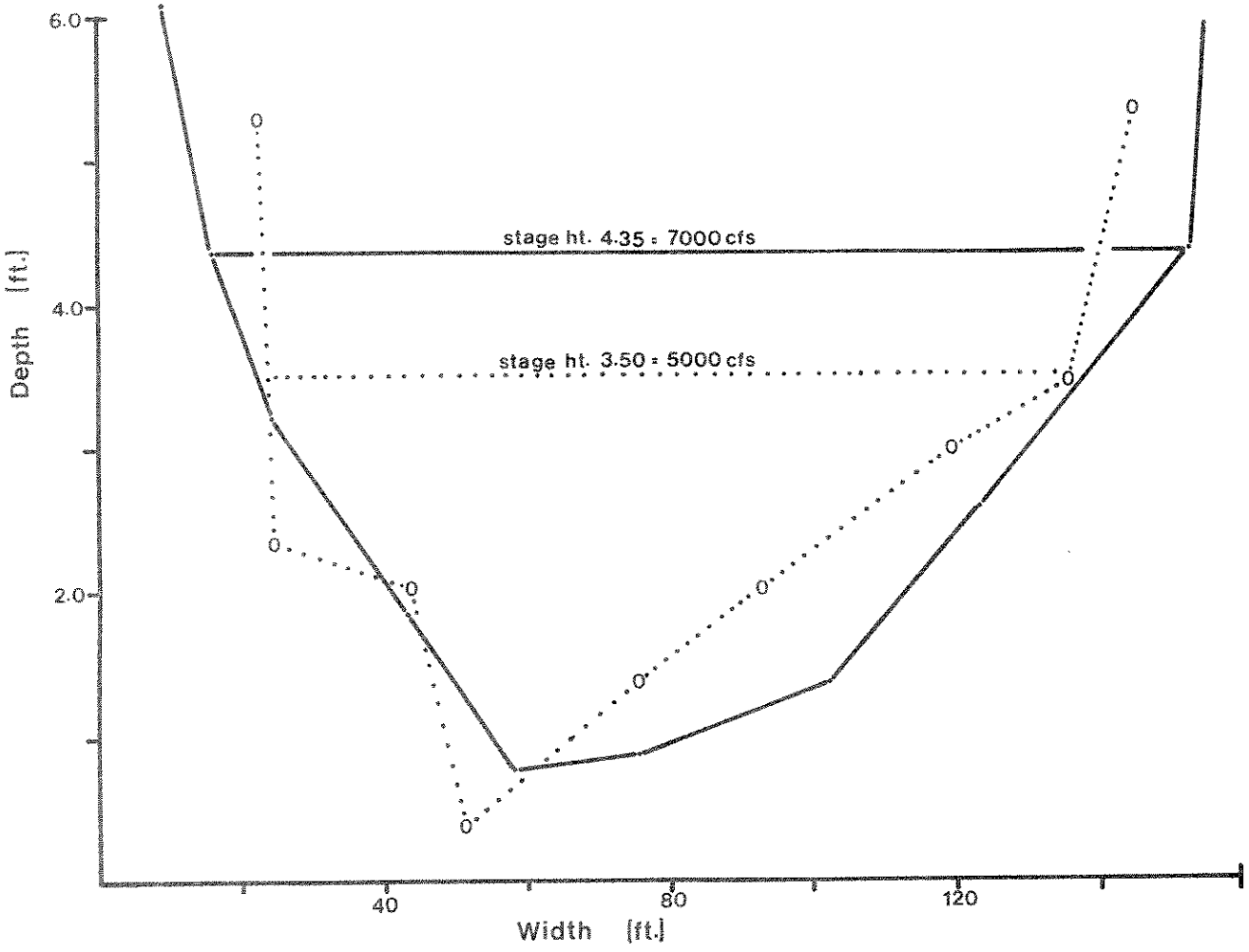

Figure 2. Two cross section profiles of a rearing pool and indicated river stage heights which will maintain the pool at a reasonable condition.

Missouri River (Stewart 1979). Peak sauger spawning is about 10 days later than that reported for the middle Missouri River population (Stewart 1982 and Berg 1981). Therefore, it is probable that the sauger rearing period may be longer and later for the lower Missouri River. The sauger rearing time period aspect may need further investigation.

Instream Flow Assessment for Sauger and Walleye Spawning Reefs

The sampling effort of previous years discovered that the major portion of sauger spawning and, to a lesser extent, walleye spawning were located at the rocky reef areas (Stewart 1983). The reefs where spawning activity was noted were associated with eroding cliffs of a hard shale formation which bordered the river and were limited to eight sites in the study area. These reef areas varied in length from approximately 200 to 600 yards.

Three of these spawning reefs were surveyed by establishing three cross sections at each reef. Since the border of rocky substrate did not extend far into the channel, portions of the reef's upper and lower elevations were mapped and elevations referenced with the WETP program. These measurements enabled the program to predict the water depth over the lower and upper limits of the reef. Nelson (1968) and Graham and Penkal (1979) observed that the majority of sauger and walleye spawning occurred in water deeper than 2 feet. Therefore, a flow which provided a minimum of 2 foot water depth at the lower edge of the reef was recommended as the minimum flow for spawning. Figure 3 is a diagramatic representation of the spawning reefs. Table 3 summarizes the results of the instream flow analysis for the spawning reefs. The flows which would maintain a 2-foot depth over the lower border of the reef varied in magnitude for the cross sections within a particular reef site. Therefore, the average of the three cross sections' predicted flow was assessed as the spawning flow for that particular reef.

Table 3. Elevations of the three measured sauger spawning reefs and flows required for minimum sauger spawning.

REEF SITE	CROSS SECTION #	AVERAGE ELEVATION OF REEF		RIVER STAGE AT MINIMUM SAUGER SPAWNING	MINIMUM FLOW FOR SAUGER SPAWNING
		LOWER	UPPER		
Wolf Pt. Reef	22	19.87	22.42	21.87	13278
	23	18.08	20.63	20.08	12800
	24	18.17	20.72	20.17	12700
				Ave.	12926
Brockton Reef	29	17.68	19.69	19.68	10265
	30	27.72	29.62	29.72	11142
	31	22.38	24.28	24.38	10833
				Ave.	10747
Culbertson Reef	39	20.64	22.15	22.64	13483
	40	15.80	18.56	17.80	10286
	41	14.74	16.77	16.74	10722
				Ave.	11497

Note, each cross section at a reef site is not necessarily based on the same benchmark.

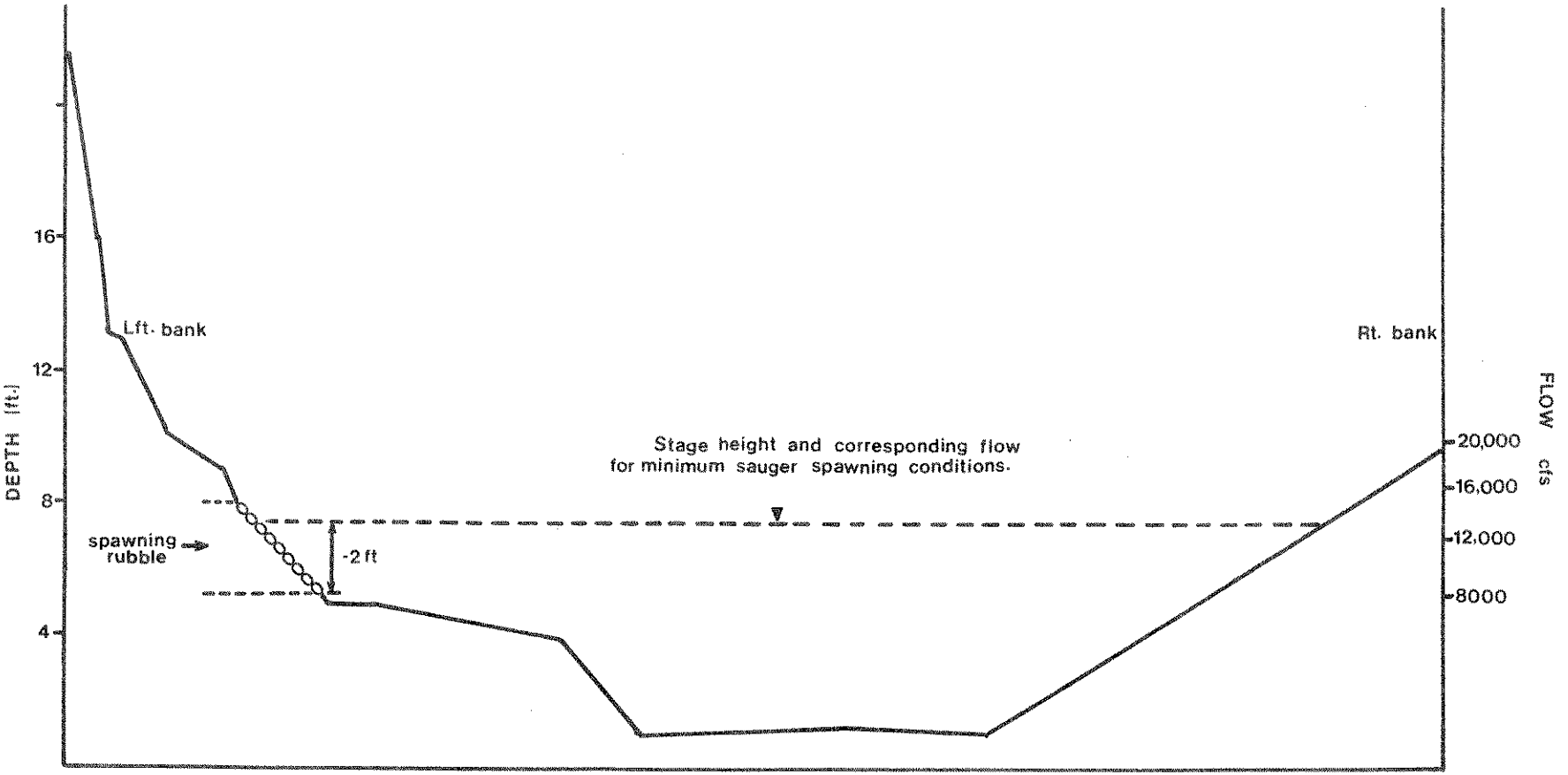

Figure 3. A diagrammatic representation of a sauger spawning reef depicting the 2 foot minimum water depth criteria. This figure is a cross-section profile of the river channel.

Once the flow recommendations for maintenance of adequate spawning conditions in the reef sites are finalized, these flows should be maintained for the period May 11 through June 30. This was the period reported previously (Stewart 1983) as the principal spawning period for sauger, the major sport fish using these reefs.

Instream Flow Assessment for Riffle Maintenance

Riffle habitats in the lower Missouri River are important for producing food organisms for sport fish and are the principal habitat areas of some unique fish found in the study area. Also, if the flow through the riffle areas is low, passage by migratory fish, such as the paddlefish, could be hindered. Most of the riffles throughout the study were considered deep enough for paddlefish passage at normal base flows. However, one extensive riffle site located below the upper Frazer Pump could hinder paddlefish passage at lower flows. An attempt will be made during 1984 to further evaluate this riffle site for paddlefish passage problems. Flow recommendations for maintenance of riffles were determined using the wetted perimeter/inflection point method. Wetted perimeter is the distance along the bottom and sides of a channel cross section in contact with water. As the flow in the stream channel decreases, the wetted perimeter also decreases, but the rate of loss of wetted perimeter is not constant throughout the entire range of flows. There is a point, called an inflection point, on the curve of wetted perimeter versus flow, at which the rate of loss of wetted perimeter is significantly changed. Above the inflection point, large changes in flow cause only very small changes in wetted perimeter. Below the inflection point, the river begins to recede from the riffle bottom, exposing the bottom at an accelerated rate. The flow recommendation was selected at this inflection point.

If flows in the Missouri River were reduced below the inflection point, the riffle and run bottom would be exposed at an accelerated rate, causing a decrease in riffle and run area and channel depth.

Riffles are also the areas of a stream most affected by flow reductions (Bovee 1974, Nelson 1977). Consequently, the maintenance of riffles should ensure the maintenance of the pool areas.

Nine of these riffle sites were surveyed, locating one to three cross sections at each site. Table 4 gives the results of the WETP/infection point analyses. Inflection points occurred at flows ranging from 4,000 to 8,500 cfs.

Table 4. River discharges where the wetted-perimeter inflection points occur for a composite or single riffles.

GAUGED REACH	LOCATION	NO. OF CROSS-SECS.	INFLECTION PT.
Dam	Tall Pilings	2	4000
Dam	Upper Gauge House	2	4700
Dam	Lower Gauge House	1	4200
Wolf Point	Nickels	3	5000
Wolf Point	Derelict	2	4200
Wolf Point	Frazer	2	7000
Wolf Point	Hiway 13	1	6000
Culbertson	Culbertson	1	7000
Culbertson	Hiway 16	1	6000
Culbertson	Pipeline	1	8500

Instream flow recommendations for the lower Missouri River will be determined and presented in the final report, 1985.

Rainbow Trout Tailwater Fishery

A trophy rainbow trout fishery occurs in the tailwaters of Fort Peck Dam (Stewart 1982). These rainbows spawn chiefly in the gravelly areas of the Duck Island side channel. Trout redd counts for 1983 and 1984 yielded well over 100 redds for each year in this side channel. For most resident river trout populations, YOY rearing will occur in nearby areas. This was found to be the case for the trout population here, although they were sampled in low numbers (Table 5). The adults generally were found scattered in the main channel of the river from June until the last sampling period in late October. They most likely continue to stay in these areas until late February, after which, they congregate near the riffle habitat at the onset of their spawning season. This population appears to exist in depressed numbers comprised of an unusually high number of large older adults and very few juveniles and young adults.

Table 5. Numbers and sizes of young-of-the-year rainbow trout sampled in the Missouri River, 1983.

DATE	LOCATION	NO. FISH SAMPLED	AVE. LENGTH (INCHES)	LENGTH RANGE
August 21	Side Channel	31	2.0	(1.4 - 2.6)
August 21	Main Channel	1	2.4	----
October 3	Side Channel	5	3.0	(2.6 - 3.1)
October 3	Main Channel	5	2.9	(2.2 - 3.5)

The operation of Fort Peck Dam for peaking power generation could be limiting the numbers of trout in this area. Severe river fluctuations are associated with the normal peaking operations. Fluctuating water levels in a river can cause significant losses of potential spawning area, adversely affect incubation and hatching success of the developing embryos, reduce trout rearing habitat and impact rearing success.

During the height of the 1983 rainbow trout spawning season, the greatest 24-hour fluctuation was an increase in water releases from 3,096 to 11,520 cfs or a change of 8,424 cfs. During late July, a drop in the river flow from 13,128 to 3,168 cfs within 24 hours resulted in a 1.45 foot change in the Duck Island side channel stage. The maximum 24-hour change in water releases from the dam during 1983 occurred July 24 and ranged from a low of 3,168 to a peak of 15,972 cfs or a 12,624 cfs difference. The average 24-hour changes in water releases during June, July and August 1983 (a critical period for trout incubation, hatching and rearing) were 6,705, 10,485 and 6,108 cfs, respectively (Frazer 1984). While the water releases from Fort Peck Dam were held constant for 48 hours, changes in the side channel stage were recorded (Table 6). The actual effect of peaking between these water releases would probably not be as severe as indicated since peaking does not last 48 hours, and the buffering effects from bank storage and the dredge pond stored water would dampen the sharp changes in the side channel flow.

Table 6. The relationships between the water releases from Fort Peck Dam (maintained constant for 48 hours) and flow conditions in the Duck Island side channel, 1983.

DAM RELEASES (CFS)	SIDE CHANNEL STAGE (FT)	SIDE CHANNEL FLOW (CFS)
10,000	2.01	690
7,200	1.48	300
4,500	0.85	55

Instream Flow Assessment for Spawning and Rearing Habitats

The wetted perimeter/inflection point analysis was applied to the Duck Island side channel flow. The maintenance of suitable flows in riffles from the onset of spawning during late March through the rearing period until the end of September is essential. A good deal of the better spawning sites are located along the margins of the riffles, therefore, flows must be maintained at a proper magnitude to accomplish this during both spawning and incubation periods. Border sites in riffles consisting of large cobbles or brush with attached growths of filamentous algae comprise the chief rearing habitat. Flows should be kept at an adequate level to insure that this habitat remains watered.

The most useful indicator for maintenance of suitable flows through riffle habitat probably is the wetted perimeter of the channel. Two cross sections in two separate riffles were surveyed. A composite of these two cross sections are shown in Figure 4. The inflection point, where the wetted perimeter losses of the channel increase at an accelerated rate, occurs at a side channel flow of 250 cfs. A relationship between the dam releases and side channel flows must be developed before minimum instream flow recommendations for rainbow trout spawning and rearing can be determined.

Paddlefish Distribution

General electrofish sampling runs were made from mid-summer to mid-fall during 1983, and electrofish sampling runs specifically for paddlefish were made mid-spring into early summer during 1984. Specific paddlefish sampling runs concentrated the sampling effort mainly in deep water areas favored by paddlefish, whereas the general type sampled a variety of water depths and habitats.

The results from the 1983 sampling effort indicated that the paddlefish resided in the upper portion of the study area at least through mid-fall (Table 7). During 1984, only the upper portion of the study area was sampled and paddlefish were present in this area from May 9 through June 22. Poor weather conditions hampered sampling efficiencies during mid-April and only a partial run could be made. It was apparent that paddlefish did not congregate at the Milk River confluence during 1984 as noted for the previous years of 1979, 1981, and 1982 when runoff was average or above (Stewart 1983). The reason why the paddlefish did not migrate upriver to the Milk River confluence area was probably related to the extremely low flows recorded for the Milk River. The flow in the Missouri River was about normal for this period.

Sauger and Walleye Spawning

Attempts were made to locate spawning sites and determine timing of the sauger and walleye using the upper portion of the river. It is generally accepted that spawning of these species does not occur randomly, but at specific sites or spawning grounds. Electrofishing was utilized during the spawning period in an effort to locate possible concentrations of fish and identify spawning sites.

Few sauger were found in the 11-mile reach of the Missouri River below the dam both in 1983 and 1984. However, for both years during early May, a significant number of walleye were sampled in a riffle area of this reach (Table 8). These walleye were large size and most were males or females in a ripe spawning condition. Considering their occurrence in significant numbers, spawning conditions and the collection of fertilized eggs at this site, it was likely that this area was a major walleye spawning ground.

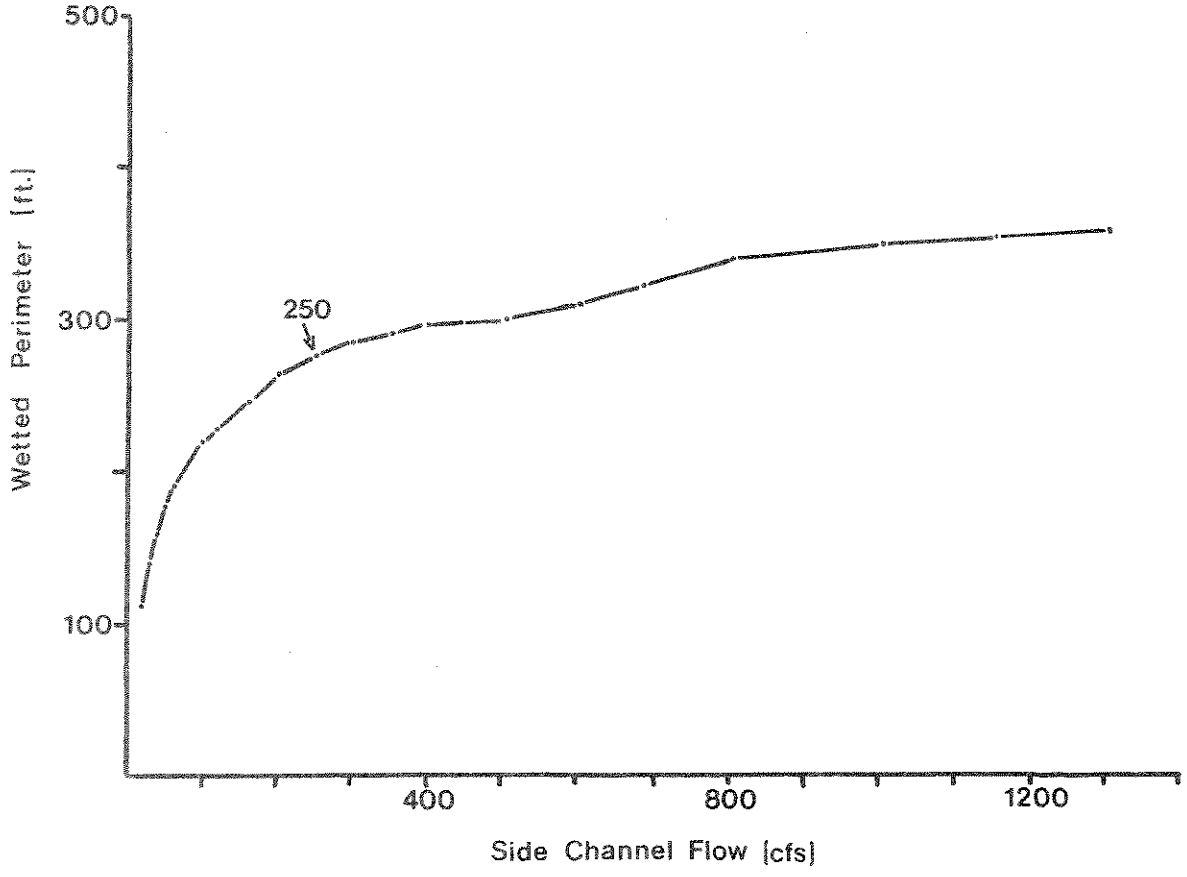

Figure 4. Wetted perimeter-flow relationship for a composite of two riffle cross sections located in the Duck Island side channel of the Missouri River, 1983.

Table 7. Number of paddlefish counted during electrofishing in the Missouri River, July 21, 1983 to June 28, 1984.

SAMPLING SECTION	SAMPLING PERIOD							
	1983			1984				
	July 21	Aug. 2-4	Oct. 12-20	April 17-18	May 9-11	May 29-31	June 19-22	June 28
Fort Peck	0[a]	0						
Nickels	29	2	0	0	0	0	0	0
Frazer		4		0[b]	13	20	17	
Wolf Point		0[b]	6[b]		42	42	25[b]	
Chelsea								
Sprole			0[b]					
Brockton								
Culbertson			0[b]					

[a] Only those sections indicated with a numeral were sampled.
[b] Only one-third of study section sampled.

Table 8. Spawning conditions and sizes of walleye sampled in the Missouri River above the Milk River confluence, spring 1983 and 1984.

DATE	NUMBER SAMPLED	SPAWNING CONDITION				MEAN LENGTH (INCHES)	MEAN WEIGHT (LBS)
		Rm[a/]	Rfm[b/]	G[c/]	S[d/]		
May 3, 1983	10	7	1	2		18.5	2.20
May 9, 1983	2	2				18.8	2.30
May 17, 1983	6	5				19.8	2.56
May 9, 1984	4	3	1			21.4	3.49
May 10, 1984	18	16		2		20.0	2.73
May 16, 1984	0						

a/ Rm - ripe male
b/ Rfm - ripe female
c/ G - gravid female
d/ S - spent female

Of the 18 walleye tagged in the 1983 run, one was harvested August 4 in Lake Sakakawea, well over 200 miles downstream. It appeared that peak spawning for both years occurred during the first half of May, and the duration of the entire spawning period seemed to be relatively short.

Fair numbers of sauger have been sampled in the lower 4 miles of the Milk River during the past years (Stewart 1979-83). Sauger concentrations in the lower Milk River during 1984 generally were considered low. This was probably related to the exceptionally low flows experienced that year. Table 9 is a summary of the sauger spawning activity for 1984. This table indicates that most of the spawning probably occurred in early May.

Pesticides, PCB and Mercury Analyses

In Montana, pesticide and other harmful residue contamination of fish are becoming items of increasing concern. It is important to determine the current condition of residue contamination in the fishery resources for the protection of the public and as a general baseline for future comparative purposes. For this study, the rainbow trout and shovelnose sturgeon were selected for evaluation because of the trout's status as a sport fish and the sturgeon's high lipid content, which is the major storage area for these types of residues. The muscle tissue from each of 10 specimens was filleted, frozen and later sent to Hazelton Raltech Laboratories for pesticide, PCB and mercury analyses.

None of the chemicals were present in concentrations to warrant concern at this time (Table 10). Only the shovelnose sturgeon samples exhibited some detectable residue concentrations; these being DDE and BHC. Mercury residue concentrations were also detectable only in the sturgeon samples, although at low levels.

From past studies, it has been reported that endrin does not persist at high levels in fish tissues, while DDT, PCB's and mercury are long-lasting in the aquatic environment (Henderson et al. 1969 and Veither 1975).

Age and Growth Analysis of Shovelnose Sturgeon

A total of 77 pectoral spines from shovelnose sturgeon was collected during the report period. These boney spines will be sectioned and examined under magnification for age determination. The sizes of the sturgeon were:

26.3 inches average total length
between 21.3 and 31.1 inches length range
2.28 pounds average weight
between 0.60 and 4.48 pounds weight range

Techniques which will be used to age the sturgeon will be those reported by Roussow (1957), Sokolov and Akimova (1975) and Cuerrier (1951).

Table 9. Spawning conditions and sizes of sauger and walleye in the lower 4 miles of the Milk River confluence, spring 1984.

	DATE	MILES SAMPLED	NUMBER SAMPLED	SPAWNING CONDITION Rm[a/]	Rfm[b/]	G[c/]	S[d/]	MEAN LENGTH (INCHES)	MEAN WEIGHT (LBS)
Sauger									
	April 24	2	10	8				13.4	0.70
	May 9	4	26	20		1		13.3	0.65
	May 29	3	11	3				12.8	0.61
	June 19	2	0						
	June 28	2	0						
Walleye									
	April 24	2	2			2		21.8	4.02

a/ Rm - ripe male
b/ Rfm - ripe female
c/ G - gravid female
d/ S - spent female

Table 10. Concentrations of chlorinated hydrocarbons and mercury in rainbow trout and shovelnose sturgeon collected in the Missouri River below Ft. Peck Dam.

	WEIGHT (LBS)	CHEMICAL CONCENTRATIONS (PPM)										
		DDE[c/]	DDD[d/]	DDT	PCB	DIELDRIN	BHC[e/]	LINDANE	HCB[f/]	ENDRIN	HEPTACHLOR EPOXIDE	MERCURY
Rb[a/]	3.90	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.01	<0.01	< 0.01	<0.01	<0.0500
Rb	2.97	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.01	<0.01	< 0.01	<0.01	<0.0500
Rb	3.70	<0.01	<0.01	<0.01	<0.10	<0.01	0.01	<0.01	<0.01	< 0.01	<0.01	<0.0500
Rb	1.92	<0.01	<0.01	<0.01	<0.10	<0.01	0.02	<0.01	<0.01	< 0.01	<0.01	<0.0500
Rb	5.07	<0.01	<0.01	<0.01	<0.10	<0.01	0.01	<0.01	<0.01	< 0.01	<0.01	<0.0500
SNS[b/]	1.87	0.02	< 0.01	<0.01	<0.10	<0.01	0.01	<0.01	<0.01	< 0.01	<0.01	0.0850
SNS	3.19	< 0.01	< 0.01	<0.01	<0.10	<0.01	< 0.01	<0.01	<0.01	< 0.01	<0.01	0.0890
SNS	1.98	< 0.01	< 0.01	<0.01	<0.10	<0.01	0.01	<0.01	<0.01	< 0.01	<0.01	0.0870
SNS	1.81	< 0.01	< 0.01	<0.01	<0.10	<0.01	< 0.01	<0.01	<0.01	< 0.01	<0.01	0.0940
SNS	1.10	< 0.01	< 0.01	<0.01	<0.10	<0.01	< 0.01	<0.01	<0.01	< 0.01	<0.01	0.0960

a/ Rainbow trout
b/ Shovelnose sturgeon
c/ Degradation product of DDT
d/ Dichloro diphenyldichlorethane
e/ Benzene hexachloride
f/ Hexachlorobenzene

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306/2