MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana

Project No. F-20-R-26 Title South Central Montana Fisheries Study

Job No. III-a Title Musselshell River Study

Period Covered April 1, 1981 through March 31, 1982

ABSTRACT

This report contains data from the fourth year of investigating fish species in the Musselshell River. The study was initiated to determine instream flow requirements of selected fish species and evaluate progress of newly introduced smallmouth bass. Information in this report was collected from Goffena diversion dam to Mosby in the warm-water environment of the lower river.

Water temperatures ranged from 33.0 to 82° F in the upper warm water zone at Roundup and 41.0 to 81° F in the middle warm water zone at Melstone. Temperatures of 75° F or above were exceeded on 55 and 53 days at Roundup and Melstone, respectively.

Three families and ten species have been added to the list of fish collected in the Musselshell River. Range extensions were recorded for mountain whitefish (Prosopium williamsoni), burbot (Lota lota), walleye (Stizostedion vitreum), freshwater drum (Aplodinotus grunniens), black bullhead (Ictalurus melas), green sunfish (Lepomis cyanellus), bluegill (Lepromis macrochirus), largemouth bass (Micropterus salmoides), black crappie (Pomoxis nigromaculatus) and northern pike (Esox lucius).

Spawning failure apparently occurred with sauger (Stizostedion canadense) and smallmouth bass (Micropterus dolomieui) as a result of extremely low and high flows, respectively.

Fish in the families Cyprinidae and Catostomidae spawned in late June. Ictalurids spawning peaked during the week July 1-7. No reproductive evidence was found for smallmouth bass.

Seven habitat types utilized by 16 forage species were identified in the Lower Musselshell River. Backwaters were the most preferred habitat type and side channel chutes the least preferred. Flathead chubs (Hybopsis gracilis) and western silvery minnows (Hybognathus nuchalis) were the most abundant and widely distributed forage species.

A total of 204 channel catfish, 58 smallmouth bass, 14 sauger, 1 walleye, 1 brown trout (Salmo trutta), 1 burbot and 1 freshwater drum were captured by hoop nets (226), gill nets (5), seines (12) and set or hook and line fishing (37).

Smallmouth bass averaged 6.5, 9.5, 11.5 and 13.2 inches on the birth dates for ages 1, 2, 3 and 4, respectively. Newly introduced smallmouth bass had moved from 43 to 119 miles downstream from stocking sites.

A significant movement pattern exists for channel catfish (Ictalurus punctatus) between the Lower Musselshell River drainage and the Middle Missouri River as

evidenced by 31 recaptures in the Musselshell River of catfish tagged in the Missouri River.

OBJECTIVES

1. To further document instream flow recommendations.
2. To identify species present in the lower 100 miles of river.
3. To monitor success of the introduced smallmouth bass.
4. To monitor instream temperatures.
5. To map migration pattern of channel catfish in lower 100 miles of river.

PROCEDURES

Thirty-one day continuous reading thermographs monitored instream temperatures at Harlowton, Roundup and Melstone (Figure 1). The Galt Ranch thermograph was discontinued and moved to Melstone.

Baited hoop nets were placed at four locations in the Musselshell River from early May through August (Figure 1). Techniques and procedures were the same as those previously used (Berg, 1978; Wiedenheft, 1980).

Floating gill nets were used at five locations on the river (Figure 1). Nets were set stationary in backwaters and eddies or drifted in main stream. Nets were monitored approximately every ½ hour to reduce mortality.

Setlines were fished at four sites on the Musselshell River (Figure 1). Six size 2 or 1/0 hooks with 50-pound monofilament leaders were attached at 2-foot intervals near the end of a 50-foot length of nylon seine twine. These setlines were tied to a stake, baited with fish meat, fished overnight and checked daily. Other setlines utilized two hooks, 30 feet of seine twine and were attached to 1-gallon milk jugs. These setlines were placed via canoe near log jams, baited with live minnows and checked twice daily.

Captured game fish were weighed, measured and fitted with either cinch or streamer tags. A sample of 12 smallmouth bass was collected to examine sexual maturity and spawning success.

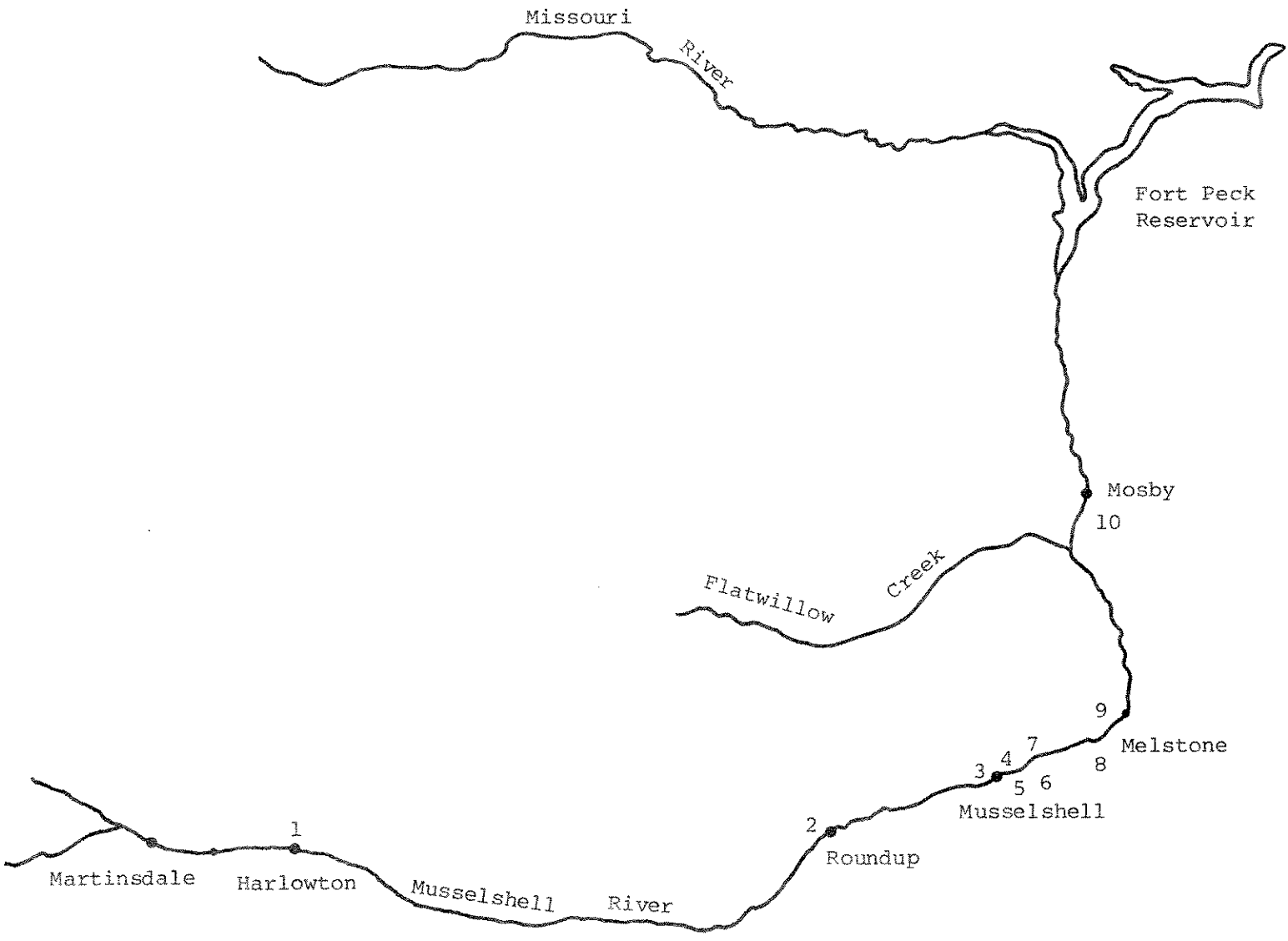
A Nitex plankton net, 1.64-foot diameter by 5.25 length and with 0.03-inch mesh, was used to collect drifting fish larvae at three locations in the Musselshell River and the Melstone-Delphia ditch (Figure 1). This net was fished stationary, while held in position by an anchored fence post. Nets were fished for 25-30 minutes daily and nightly at 1-week intervals from July 3 to August 15. The volume of water filtered was determined with a Price-type AA current meter positioned at the net opening. Samples were preserved in 10% formaldehyde colored with phloxine B- dye. Larval fish were identified by Daniel McQuire at Montana State University, Bozeman.

A 50-foot by 4 beach seine with 1/8-inch-square mesh was utilized in forage fish investigations. The seine was operated by two men in a variety of locations along the river channel. Captured forage fish were preserved in 10% formaldehyde and identified later using the key developed by Brown (1971).

FINDINGS

Water Temperatures

Water temperatures at Harlowton (cold-water zone) ranged from 32.0 to 73.0° F.



SAMPLE SITES

1 - Harlowton
2 - Roundup
3 - Goffena Dam
4 - Musselshell Diversion Melstone-Delphia Ditch
5 - Goffena Ranch
6 - Cooney Slough
7 - Korenko Dam
8 - Hogan's Bridge
9 - Melstone Bridge
10 - Mosby vicinity

	Larval tows	Hoop nets	Stationary gill net	Drifting gill net	Seining	Thermographs	Setlines
1						x	
2						x	
3		x	x		x		
4	x	x	x	x	x		x
5		x					
6			x				
7	x	x	x		x		x
8	x				x		x
9						x	
10			x	x	x		x

Figure 1. Data collection sites on the Lower Musselshell River, 1981.

Temperatures of 65° F and above were recorded on 67 days. Warmest water temperatures occurred during August.

River temperatures at Roundup ranged from 33.0 to 82.0° F equaling or exceeding 75° F on 55 days. Water temperatures at Melstone ranged from 41.0 to 81.0° F. Temperatures of 75° F or above were recorded on 53 days. July and August, as in past years, comprised the warmest period for this warm-water zone.

Temperatures in 1981 with few exceptions were warmer than all other years of record at the Harlowton and Roundup thermograph sites (Table 1).

Fish Species

Three families and eleven fish species have been added to the list of fish sampled in the Musselshell River (Table 2). Fish in the families Esocidae (one species), Gadidae (one) and Scianidae (one) have been collected since the first list was reported by Wiedenheft (1979). Additional collections were made in the families Centrarchidae (three), Cyprinidae (three), Ictaluridae (one) and Percidae (one).

Fish Species Distribution

Previous progress reports have not emphasized fish species range extensions revealed through sampling of the Musselshell River. This section will summarize notable species collections from 4 years of investigation.

Two mountain whitefish were reported by Wiedenheft (1979) in the cold-water zone above Shawmut. This collection constitutes a major range extension, as this species was not previously recorded from the Musselshell River. A brown trout collected at the Town of Musselshell on 7 July 1981 probably represented displacement downstream during high water, as this section of the river is too warm to support this fish species.

A burbot, walleye and freshwater drum were collected in 1981 at the Korenko dam, 3 river miles downstream from the Town of Musselshell. A rancher from Shawmut reported capturing burbot near that town. The presence of these three fish species probably relates to spawning movements upstream from Fort Peck Reservoir which supports substantial populations of all three. If any resident populations of walleye, burbot and freshwater drum exist, they must be low density fisheries from Mosby to the Town of Musselshell.

Numerous black bullheads were collected and observed at the Town of Musselshell upstream to the diversion dam above Musselshell (Goffena dam). These collections would constitute a substantial upstream extension for this species.

Black bullheads, green sunfish, bluegills, largemouth bass and black crappies were very abundant in Cooney Slough 2.5 miles east of Musselshell (Table 3). The slough connects with the Musselshell during high water, as evidenced by the presence of numerous river species. Green sunfish and black crappie collected at Hogan's bridge and Korenko's dam may have originated from this slough. Largemouth bass were planted in 1971 by Gerald Turley, Musselshell, Montana and all samples collected were progeny from this original stocking. Origin of the bluegill and green sunfish is unknown. These collections constitute an upstream extension from black crappie and a range extension for green sunfish, bluegills and largemouth bass.

A northern pike was collected in 1979 at the Town of Melstone. This would appear to be an upstream extension for this species and probably reflects movement out of Fork Peck Reservoir.

Table 1. Mean monthly maximum and minimum temperatures for portions of the years 1978 through 1981

Station	Year	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Harlowton	$\bar{X}$ Max. 1978	-	-	-	61.0	60.0	60.0	54.0	49.0	35.0	32.0	-
	$\bar{X}$ Max. 1979	36.0	46.0	52.0	60.0	67.0[1]	68.0	62.0	49.0	35.0	33.0	-
	$\bar{X}$ Max. 1980	-	-	-	62.6[1]	69.4[1]	65.0	58.8	47.0	37.0	33.0	-
	$\bar{X}$ Max. 1981	-	50.4	53.8	62.1	70.2	71.2					34.3
	$\bar{X}$ Min. 1978	-	-	-	52.0	55.0	57.0	49.0	45.0	34.0	32.0	-
	$\bar{X}$ Min. 1979	33.0	40.0	47.0	53.0	61.0[1]	61.0	55.0	45.0	33.0	32.0	-
	$\bar{X}$ Min. 1980	-	-	-	57.6[1]	62.6[1]	59.2	53.9	43.0	35.0	32.0	-
	$\bar{X}$ Min. 1981	-	44.2	49.6	55.7	63.8	64.7					33.7
Roundup	$\bar{X}$ Max. 1978	-	-	-	65.0	67.0	69.0	59.0	44.0	35.0	34.0	-
	$\bar{X}$ Max. 1979	36.0	47.0	59.0	68.0	75.0	72.0	66.0	48.0	35.0	34.0	-
	$\bar{X}$ Max. 1980	-	-	-	71.7[1]	76.3	69.9	62.2	47.0	39.0	33.0	-
	$\bar{X}$ Max. 1981	-	58.1	57.0	64.1	76.8	76.8					34.6
	$\bar{X}$ Min. 1978	-	-	-	59.0	63.0	61.0	52.0	41.0	34.0	32.0	-
	$\bar{X}$ Min. 1979	32.0	43.0	53.0	61.0	68.0	67.0	60.0	44.0	34.0	32.0	-
	$\bar{X}$ Min. 1980	-	-	-	64.5[1]	68.2	62.8	54.6	41.0	35.0	32.0	-
	$\bar{X}$ Min. 1981	-	49.1	52.0	59.1	68.3	69.3					33.7
Melstone	$\bar{X}$ Max. 1981		56.5	60.8	66.4	76.8	76.4					
	$\bar{X}$ Min. 1981		50.1	56.3	62.9	70.5	70.9					

[1]Based on less than 16 days of thermograph operation.

Table 2. Revised fish species list for the Musselshell River (modified from Wiedenheft, 1979)

Common Name	Family	Genus/Species
Longnose sucker	Catostomidae	Catostomus catostomus
Mountain sucker		Catostomus platyrhynchus
River carpsucker		Carpiodes carpio
Shorthead redhorse		Moxostoma macrolepisotum
Smallmouth buffalo		Ictiobus bubalus
White sucker		Catostomus commersoni
Black crappie	Centrachidae	Pomoxis nigromaculatus
[2]Smallmouth bass		Micropterus dolomieui
[2]Green sunfish		Lepomis cyanellus
[2]Largemouth bass		Micropterus salmoides
[2]Bluegill		Lepomis macrochirus
Mottled sculpin	Cottidae	Cottus bairdi
[1]Northern pike	Esocidae	Esox lucius
Carp	Cyprinidae	Cyprinus carpio
Fathead minnow		Pimephales promelas
Flathead chub		Hybopsis gracilis
Lake Chub		Couesius plumbeus
Longnose dace		Phinichthys cataractae
[2]Western silvery minnow		Hybognathus nuchalis
[2]Brassy minnow		Hybognathus hankinsoni
[2]Plains minnow		Hybognathus placutus
[2]Emerald shiner		Notropis atherinoides
Goldeye	Hiodontidae	Hiodon alosoides
Channel catfish	Ictaluridae	Ictalurus punctatus
[2]Stonecat		Noturus flavus
[2]Black bullhead		Ictalurus melas
Brown trout	Salmonidae	Salmo trutta
Mountain whitefish		Prosopium williamsoni
Rainbow trout		Salmo gairdneri
[2]Sauger	Percidae	Stizostedion canadense
[2]Walleye		Stizostedion vitreum
[2]Burbot	Gadidae	Lota lota
Freshwater drum	Scianidae	Aplodinotus grunniens

[1]New fish species collected in 1979.

[2]New fish species collected in 1981.

Table 3. Gill net data for Cooney Slough, 1981

Species	# of Fish	Length Range (In.)	Weight Range (Lb.)	$\bar{X}$ Length (In.)	$\bar{Y}$ Weight (Lb.)
Largemouth bass	12	5.7-15.4	0.12-15.4	8.3	0.43
Black crappie	28	4.9- 6.6	0.06- 0.14	5.7	0.11
Bluegill	4	3.8- 4.1	0.04- 0.06	3.9	0.04
Green sunfish	1	-	-	4.3	0.06
Channel catfish	1	-	-	12.3	0.52
Black bullhead	34	4.8- 8.2	0.06- 0.30	6.5	0.16
Goldeye	11	12.0-13.5	0.54- 0.74	12.9	0.65
River carpsucker	16	5.1-16.4	0.08- 1.68	13.3	1.11
Longnose sucker	3	7.4- 9.5	0.14- 0.36	8.8	0.26
Shorthead redhorse	5	8.9-11.4	0.28- 0.50	10.4	0.43
White sucker	37	7.7-12.8	0.20- 0.78	10.5	0.46
Carp	44	6.0-14.8	0.12- 1.50	9.5	0.49
Western silvery minnow	1	-	-	6.0	0.04

Additional sampling between Mosby and Fort Peck Reservoir would probably reveal upstream extensions for reservoir species, such as shovelnose sturgeon, and perhaps paddlefish, particularly during spring runoff spawning runs. The species composition and contribution of this part of the Lower Musselshell to Fort Peck is unknown and deserves thorough investigation.

Spawning

The year of "feast or famine" may appropriately describe water conditions in the Lower Musselshell River during 1981. The sauger spawning period (April to early May) coincided with the "famine," as during this time the entire river was diverted into the Melstone-Delphia ditch. On 4 May 1981 two ripe female sauger were collected from an isolated pool near Melstone. Spawning grounds in the vicinity were dry. It is likely that upstream migration and subsequent spawning of sauger was significantly if not completely curtailed in the Lower Musselshell River. No young-of-the-year (YOY) sauger were collected during forage fish surveys.

Between 8 and 9 May 1981 the Musselshell River rose steadily in response to heavy spring rains. On 19 May 1981 the river crested at 4,777 cfs at Roundup. These high-flow conditions continued through mid-June. The probable smallmouth bass spawning period coincided with this "feast" of flow. Three age IV and probable mature female bass (Brown, 1971) retained eggs when examined in mid-July (Table 4). These females had obviously not spawned and two were resorbing large masses of eggs. Six other age III female bass were apparently immature as indicated by egg development. Testes in nine male bass were regressed. When examined concurrently with the females, it would appear that smallmouth bass spawning was prohibited by high-water conditions and associated turbidities. Water temperatures, which exceeded 60° F from 20 May 1981 on throughout the warm-water zone, were adequate for spawning (Clancey, 1980). No YOY smallmouth bass were collected during subsequent forage fish surveys.

By late June and early July water levels had receded and were apparently adequate for spawning by the other warm-water species in the Lower Musselshell River. Spawning periods of these species were revealed by larval tows.

A total of 166 larval fish were collected by night tows during 1981 (Table 5). Day tows captured only three fish. The total night catch included 46 channel catfish, 35 stonecat (Noturus flavus), 16 shorthead redhorse (Moxostoma macrolepidotum), 15 river carpsuckers (Carpoides carpio), 6 Catostomidae (most likely longnose suckers) and 48 Cyprinidae (mostly flathead chubs).

Peak occurrence of night larval drift for fish in the families Catostomidae and Cyprinidae probably occurred just prior to the early July sampling (Figure 2). Peak drift for larval Ictalurids occurred the week of July 20. Captured larval channel catfish ranged in size from 15.0 to 19.0 mm total length (TL). These fish were approximately 2 weeks old, assuming they emerged from the nest at 14 mm TL after hatching 7-10 days previously (McGuire, pers. comm.). Allowing for a 7-day incubation period would place peak spawning activity during the week July 1-7. The required minimum spawning temperature of 75° F was exceeded consistently after July 1 and the optimum spawning temperature of 80° F (Brown, 1971) was first reached on July 4 throughout the warm-water zone.

Forage Fish

A limited investigation of the forage fish community in the Lower Musselshell River was initiated during 1981. This community is undoubtedly an important food base for the piscivorous fish species (sauger, channel catfish and smallmouth bass) upon which the sport fisheries of the lower river is based. This investigation was designed to determine the diversity and habitat distribution of forage species in

Table 4. Fecundity and ovarian condition of smallmouth bass collected in the Lower Musselshell River, 1981

Date Collected	L.	Wt.	Age	Total No. Eggs	H.O Displacement by Ovaries (ml)	Ovarian Condition
7-10-81	13.0	1.38	IV	4,520	30.8	Eggs well developed, no resorption
7-16-81	13.5	1.20	IV	832	16.0	Eggs being resorbed
7-16-81	13.5	1.32	IV	576	8.0	Eggs being resorbed
7-14-81	12.1	1.04	III	1,161	6.5	Eggs small and poorly developed
6-29-81	11.7	0.87	III	2,520	14.8	Eggs small and poorly developed
7-12-81	11.7	0.90	III	1,824	8.0	Eggs small and poorly developed
7-14-81	11.6	1.14	III	119	4.8	Eggs small and poorly developed
7-16-81	11.3	0.88	III	904	6.2	Eggs small and poorly developed
7-14-81	10.8	0.68	III	1,660	13.3	Eggs small and poorly developed

Table 5. Numbers of larval fish captured per night two in the Lower Musselshell River from early July through mid-August 1981

Sample Site	Date	No. Larvae per Taxon[1]	Total No. Larvae	No. Larvae per 100 m^3
Melstone-Delphia Ditch	July 7	5 Rh, 4 CpSu, 1 CTM, 1 Cyp	11	1.7
	July 16	1 CpSu, 1 Cyp	2	0.4
	July 20	1 CpSu, 1 CTM, 1 Rh, 5 Cyp	8	1.4
	July 28	4 STO, 1 Cyp	5	1.2
	Aug. 5	1 C Cat, 3 STO	4	0.6
Musselshell Diversion	July 7	11 Cyp, 4 CpSu, 1 Rh	16	2.1
	July 10	3 Cyp	3	0.6
	July 20	14 C Cat, 1 CTM, 2 Cyp	17	2.8
	July 28	7 STO, 1 CTM	8	1.2
	Aug. 5	2 STO, 3 CpSu, 6 Cyp	11	2.3
Korenko Dam	July 7	2 CpSu, 1 CTM, 2 Cyp	5	1.2
	July 10	4 Cyp	4	0.8
	July 20	13 C Cat, 5 STO, 1 Cyp	19	4.5
	July 28	1 C Cat, 5 STO, 1 Rh, 1 CTM, 4 Cyp	12	2.6
	Aug. 5	1 STO, 2 Cyp	3	0.8
Hogan's Bridge	July 8	3 Cyp	3	0.6
	July 17	1 C Cat, 2 STO, 6 Rh, 1 Cyp	10	1.7
	July 21	15 C Cat, 4 STO, 2 Rh	21	4.1
	July 28	1 STO, 1 Cyp	2	0.3
	Aug. 5	1 C Cat, 1 STO	2	0.4
Total				166

[1]Abbreviations: C Cat = channel catfish, STO = stonecat, CpSu = carpsucker, CTM = Catostomidae, Rh = shorthead redhorse and Cyp = Cyprinidae.

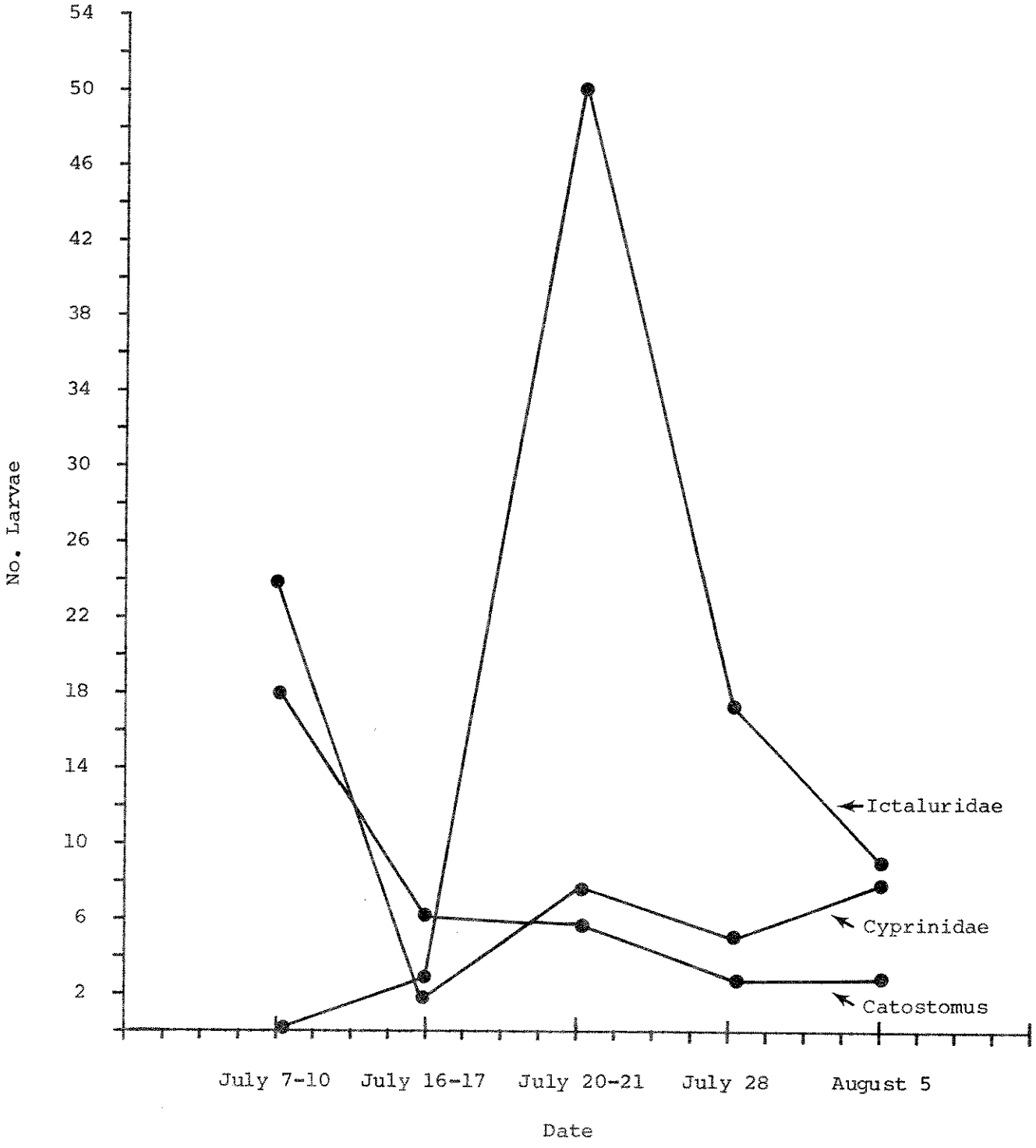


Figure 2. Peaks of occurrence of larval fish representing three families in night tows in the Lower Musselshell River during 1981.

the Lower Musselshell River. Forage species were defined as age 0 fish and adult minnows utilized by other fish as a food source (Gardner and Berg, 1980).

Seven habitat types utilized by forage fish were identified in the Lower Musselshell River (Figure 3).

The main channel riffle habitat type was defined as the zone in the main channel with current velocities exceeding 2.0 ft/sec and a depth of 1.0 feet or less. Riffles represented a visual break in surface current and were characterized by clean gravel bottoms.

The main channel run border habitat type had current velocities from 0.5 to 2.0 ft/sec and depth from 1.0 to 3.0 feet. This habitat type typically occurred along straight reaches of the main channel and was characterized by smooth surface current.

The zone in the main channel with little current and depth from 1-4 feet was defined as the main channel pool border habitat type. This habitat type usually occurred on meander bends and was characterized by a silt or sand bottom.

The main channel eddy pool habitat type occurred where riffles deviated from the channel border, creating a zone of little current. Depth in this zone ranged from 1-4 feet.

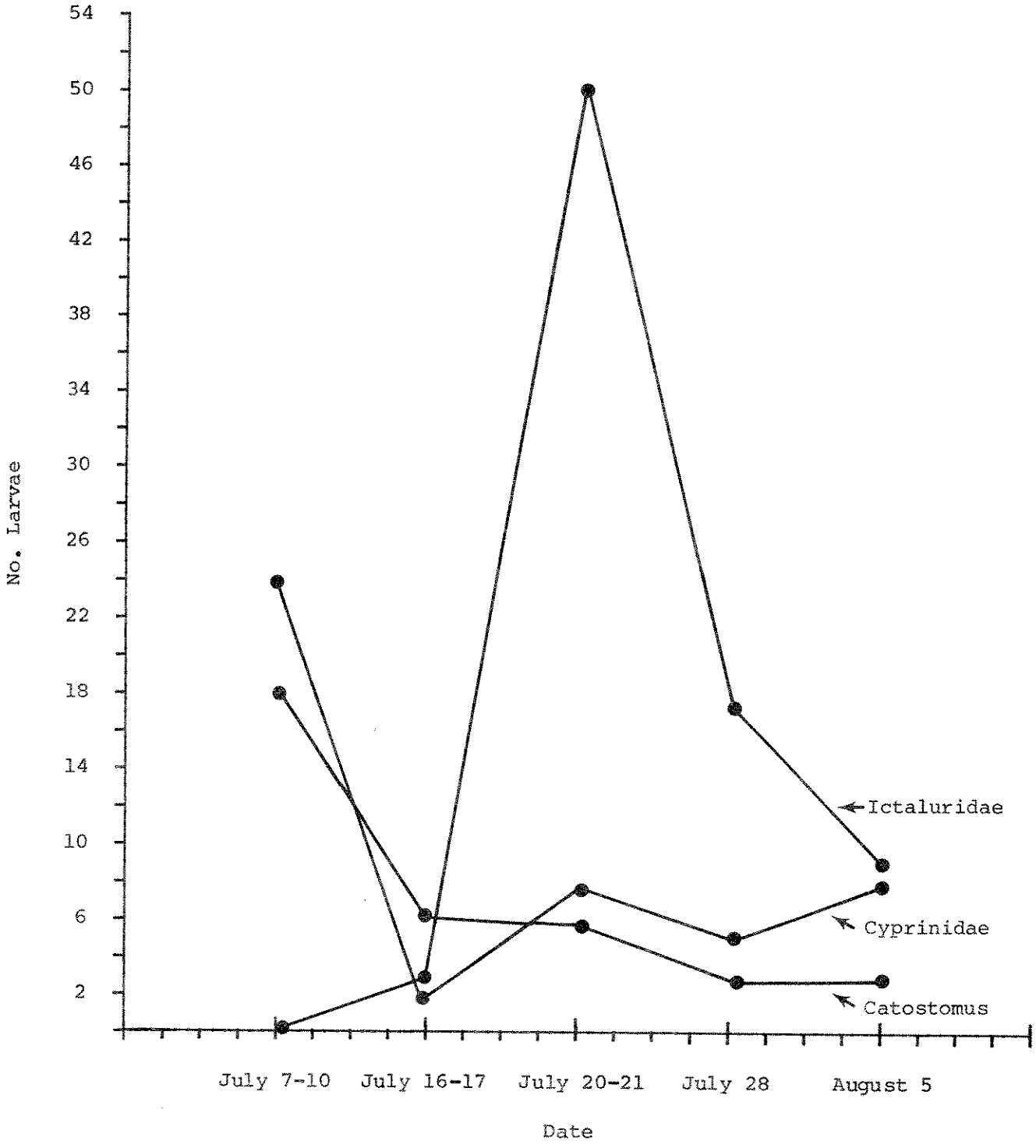
A divergence of the main channel containing less than 20% of the river flow was defined as a side channel (Gardner and Berg, 1980). Side channel pool and side channel chute were two habitat types associated with channel development in the Lower Musselshell River. The side channel pool habitat type was characterized by sinuosity leading to riffle and pool development. The side channel chute was characterized by a short, straight channel with no pool development. Depths in both habitat types were less than 4.0 feet.

The backwater habitat type had only a single connection to the main or side channel. Backwaters in the Lower Musselshell River were usually formed as declining water levels closed the upstream end of a side channel.

Sixteen fish species were collected during forage fish surveys in the Lower Musselshell River. Emerald shiner (Notropis atherinoides), plains minnow (Hybognathus placitus), brassy minnow (Hybognathus hankinsoni) and green sunfish were added to the list of species collected in this reach of river. Additional minnow species reported by Brown (1971) to occur in the lower river were probably not sampled because of the low sample size of 20 seine hauls.

The average number of forage fish captured per seine haul was greatest in the backwaters and main channel eddy pools (Table 6). The greatest variety of forage species were collected in backwaters. The side channel chute contained the lowest numbers of fish and species per seine haul. Backwaters are obviously the most preferred habitat type for forage species in the Lower Musselshell River and side channel chutes the least preferred. These results are identical to those of Gardner and Berg (1980) for the Middle Missouri River. Gardner and Berg's preface that forage fish species prefer protected slow water habitat types would also appear true for the Lower Musselshell River.

Flathead chub and western silvery minnow were the most abundant forage species collected in the Lower Musselshell River (Table 7). These species were relatively more abundant in slow water zones, but occurred in good numbers over a variety of habitat types. This diverse distribution increases the importance of these species as a food source.



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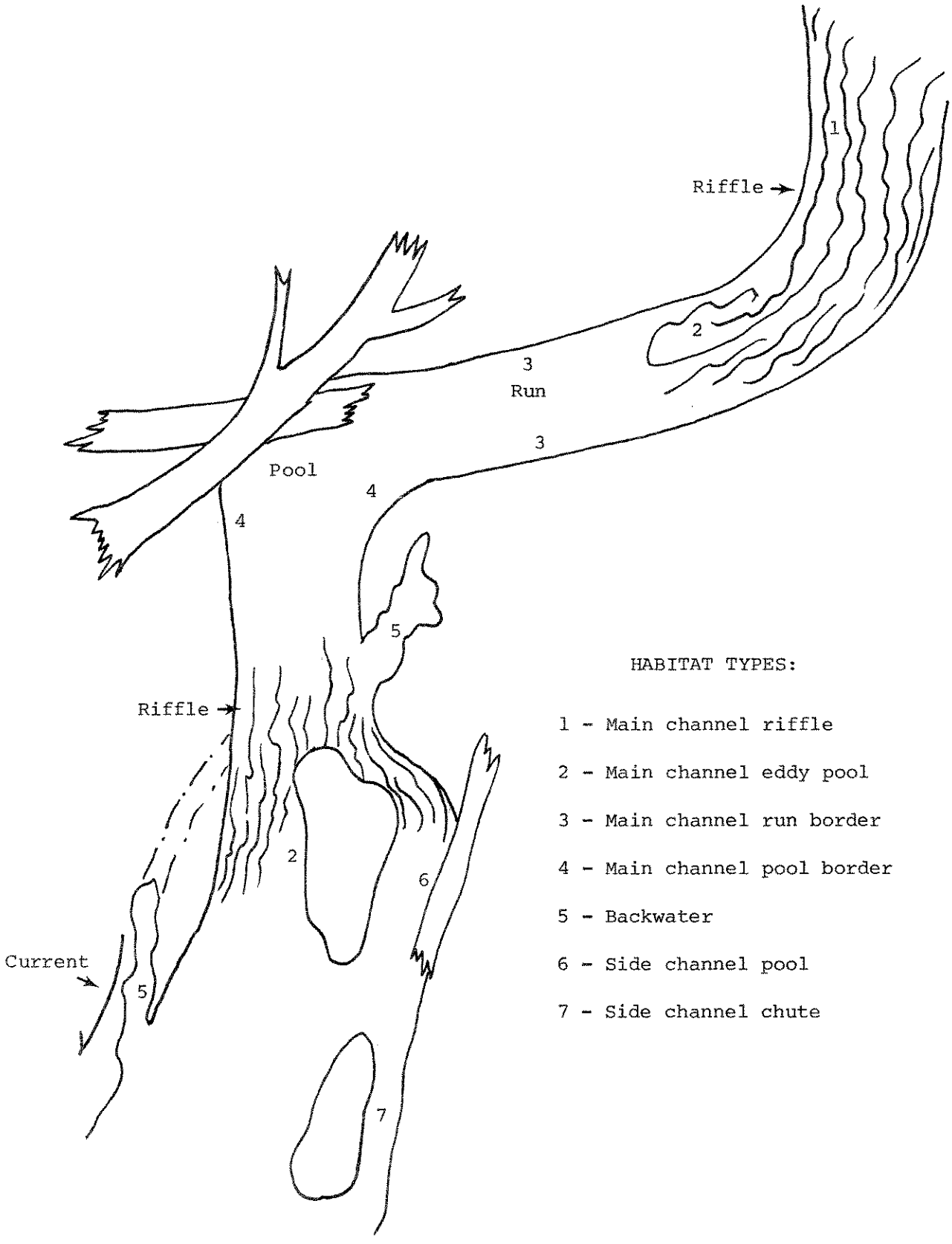

Figure 3. Diagrammatic representation of habitat types in the Lower Musselshell River.

Table 6. Relative abundance and diversity of forage fish seined in seven habitat types of the Lower Musselshell River, 1981

Habitat Type	Av. Number Fish/Haul	Av. Number Species/Haul	Total Number of Hauls
Backwater	239	7.2	5
Main channel run border	93	6.3	6
Main channel eddy pool	122	4.5	4
Main channel pool border	72	5.0	1
Main channel riffle border	66	7.0	2
Side channel chute	34	4.0	1
Side channel pool	83	7.0	1

Table 7. Habitat distribution and abundance of forage fish species expressed at the average number of fish per seine haul in seven habitat types of the Musselshell River during 1981

Fish Species	Back-water	Main Channel Run Border	Main Channel Eddy Pool	Main Channel Pool Border	Main Channel Riffle Border	Side Channel Chute	Side Channel Pool
Flathead chub	74.6	53.2	75.3	32.0	40.0	29.0	47.0
Western silvery minnow	50.6	21.7	7.8	28.0	2.5	-	10.0
Plains minnow	7.6	2.5	9.0	10.0	11.0	1.0	-
YOY Hybognathus sp.	30.4	-	7.5	-	-	-	-
Emerald shiner	1.0	1.8	12.0	-	0.5	3.0	-
Brassy minnow	-	0.3	-	-	-	-	-
Fathead minnow	3.0	0.2	3.5	-	0.5	-	-
Longnose dace	0.4	1.3	3.0	-	8.0	-	-
Carp	3.0	1.3	-	1.0	-	-	1.0
YOY river carpsucker	63.6	7.3	-	-	-	-	2.0
YOY channel catfish	0.4	1.8	6.3	1.0	1.0	-	15.0
Black crappie	3.4	0.2	-	-	-	-	6.0
Green sunfish	0.4	0.3	0.2	-	0.5	-	-
Longnose sucker	0.4	1.5	7.3	-	2.0	1.0	-
White sucker	-	-	-	-	-	-	2.0
Mountain sucker	-	0.2	-	-	-	-	2.0
Shorthead redhorse	0.4	-	-	-	0.5	-	-

Other forage species exhibited preference for a certain habitat type, black crappie, YOY river carpsucker, carp (Cyprinus carpio)and YOY minnows of the genus Hybognathus (plains and western silvery minnow) showed a preference for backwaters (Table 7). The main channel eddy pool was apparently preferred by emerald shiners and longnose suckers (C. catostomus). Longnose dace (Rhinichthys cataractae) showed a preference for main channel riffles. YOY channel catfish exhibited a preference for slack water in close proximity to shallow riffles that characterized the side channel pool and main channel eddy pool habitat types. The contribution of the side channel pool habitat to production of channel catfish should be investigated further, as side channel areas are the first zone of the river channel affected by flow reduction.

Game Fish

A total of 280 game fish, including new fish and recaptures, were collected in the Lower Musselshell River from the Goffena dam to Mosby during 1981. Game fish captured included channel catfish (204), smallmouth bass (58), sauger (14), walleye (1), brown trout (1), burbot (1) and freshwater drum (1). Cinch-up or streamer tags were attached to 195 channel catfish, 41 smallmouth bass, 8 sauger and 1 burbot.

Baited hoop nets captured 82, 76 and 93% of the channel catfish, smallmouth bass and sauger, respectively (Table 8). Gill nets, although used extensively, captured few game fish (Table 9). Seining was most effective on yearling smallmouth bass, but also captured an occasional channel catfish or sauger (Table 10). Setline and hook and line fishing were selective for channel catfish, but captured walleye and freshwater drum when live minnows were used for bait (Table 11).

Smallmouth bass continued to exhibit excellent growth in the Lower Musselshell River. Mean lengths expected on each birth date for smallmouth bass collected during 1981 were very similar to those reported by Marcuson in 1980 (Table 12). These lengths exceeded those reported for the Tongue River by 2.7, 2.9, 2.4 and 1.8 inches for ages 1, 2, 3 and 4, respectively (Clancey, 1980). Mean lengths at each birth date were also 3.5, 3.5, 3.0 and 3.2 inches greater for ages 1, 2, 3 and 4, respectively, when compared to the Montana average (Brown, 1971). The largest smallmouth bass reported during 1981 was caught by a fisherman and measured at 14.5 inches and 1.5 pounds.

Game Fish Movements

Movement data for sauger in the Lower Musselshell River were provided by two recaptures of tagged fish (Table 13). These sauger were recaptured in the same general area where they were tagged.

Movement patterns of age II and older smallmouth bass in 1981 were revealed by 14 recaptures of 10 tagged fish (Table 13). These fish showed little movement from the area of marking. Two smallmouth bass, however, traversed the Korenko diversion dam and were captured 2.8 miles upstream below the Musselshell diversion. These movements were significant, particularly since the bass tagged 5-03691 traversed the dam after high spring flows had receded considerably. Seven age I smallmouth bass captured below the Goffena diversion dam had been planted upstream near Ryegate in June 1980 and emigrated approximately 119 miles downstream. Seventeen age II smallmouth bass captured in the lower river during 1981 had been planted near Roundup and traveled 43 or more miles downstream. This phenomena of downstream drift by newly planted smallmouth bass was also recorded by Marcuson (1980). Past the initial emigration, tagging information suggests that smallmouth bass became a sedentary species in the Lower Musselshell River.

Movement patterns of channel catfish within the study area in 1981 were provided by 29 recaptures of 26 tagged fish (Table 13). Twenty-five of the catfish, including

Table 8. Baited hoop net data for Lower Musselshell River, 1981

Species	No. of Fish	Length-Range	Weight-Range	$\bar{X}$ Length	$\bar{Y}$ Weight
Channel catfish	167	11.1-33.0	0.34-14.0	18.0	2.50
Smallmouth bass	44	9.2-13.5	0.42-1.40	11.4	0.91
Sauger	13	12.5-20.1	0.60-2.32	14.9	1.06
Brown trout	1	-	-	16.6	1.32
Burbot	1	-	-	24.2	1.88

Table 9. Gill net data for Lower Musselshell River, 1981

Species	No. of Fish	Length-Range	Weight-Range	$\bar{X}$ Length	$\bar{Y}$ Weight
Channel catfish	2	13.2-16.8	0.74-1.34	15.0	1.04
Smallmouth bass	3	9.7-12.2	0.54-1.12	11.1	0.81

Table 10. Seine data for Lower Musselshell River, 1981

Species	No. of Fish	Length-Range	Weight-Range	$\bar{X}$ Length	$\bar{Y}$ Weight
Channel catfish	1	-	-	8.2	0.16
Smallmouth bass	10	6.2-8.8	0.20-0.48	7.5	0.31
Sauger	1	-	-	12.7	0.78

Table 11. Other methods of capture for Lower Musselshell River, 1981

Methods and Species	No. of Fish	Length-Range	Weight-Range	$\bar{X}$ Length	$\bar{Y}$ Weight
Set line/ Channel catfish	24	11.9-22.7	0.54-5.44	16.8	1.76
Hook and line/ Channel carfish	10	12.0-27.5	0.48-7.00	16.6	1.57
Hook and line/ Smallmouth bass	1	-	-	11.6	0.98
Set line/ Walleye	1	-	-	17.7	2.18
Hook and line/ Freshwater drum	1	1	1	12.8	0.90

Table 12. Mean lengths expected at each birth date for smallmouth bass collected in the Lower Musselshell River during 1980 (Marcuson, 1980) and 1981, Tongue River (Clancey, 1980) and Montana (Brown, 1971)

Collection	Age 1	Age 2	Age 3	Age 4
Musselshell River, 1981	6.5	9.5	11.5	13.2
Musselshell River, 1980	6.5	9.2	11.6	-
Tongue River	3.8	6.6	9.1	11.4
Montana	3.0	6.0	8.5	10.0

Table 13. Movement of tagged fish in the Musselshell River study area during the period, April 1981 through September 1981

Tag			Recapture		Time at Large (Days)	Distance Moved in Musselshell (Miles)	
Date	Location[1]	Number	Date	Location[1]		Upstream	Downstream
			SAUGER				
8-1-81	MD	5-3750	6-30-81	KD	334		2.8
7-14-81	MD	5-3697	8-11-81	MD	28	0	0
			SMALLMOUTH BASS				
7-16-80	KD	5-03812	5-5-81	MD	293	2.8	
8-12-80	MD	5-03680	5-13-81	KD	274		2.8
8-12-80	MD	5-03678	5-4-81	MD	235	0	0
			7-14-81	MD	336	0	0
			8-13-81	MD	366	0	0
			8-19-81	MD	372	0	0
			9-2-81	MD	386	0	
5-4-81	MD	5-03764	8-6-81	GR	94		0.5
5-4-81	MD	5-03765	7-10-81	KD	67		2.8
5-13-81	KD	5-03683	7-10-81	KD	58	0	0
7-10-81	KD	5-03691	8-13-81	MD	34	2.8	
7-29-81	GR	5-03827	8-14-81	GR	16	0	0
8-6-81	MD	5-03830	8-13-81	MD	7	0	0
8-13-81	MD	5-03833	9-2-81	MD	20	0	0
			CHANNEL CATFISH				
6-24-80	MD	5-03646	8-6-81	KD	408		2.8
6-24-80	MD	5-03647	7-10-81	GR	381		0.5
6-25-80	MD	5-03657	7-25-81	KD	395		2.8
7-17-80	MD	5-03793	7-22-81	GR	370		0.5
7-16-80	MD	5-03800	7-22-81	MD	371	0	0
7-31-80	MD	5-00005	7-14-81	MD	348	0	0
			8-4-81	GR	369		0.5
8-1-80	MD	5-00010	8-11-81	GR	375		0.5
9-16-80	MD	5-00025	7-22-81	MD	311	0	0
9-16-80	MD	5-00027	7-10-81	GR	299		0.5
6-25-81	KD	5-00043	7-8-81	Mel	13		29.3
6-30-81	MD	5-00049	7-12-81	MD	12	0	0
			7-20-81	GR	20		0.5
6-30-81	MD	5-00053	7-22-81	GR			0.5
7-1-81	GR	5-00059	7-10-81	GR	9	0	0
7-7-81	KD	5-00066	8-13-81	MD	37	2.8	
7-7-81	MD	5-00073	7-20-81	GR	13		0.5
7-8-81	GR	5-00077	8-4-81	GR	27	0	0
7-10-81	GR	5-00083	7-18-81	GR	8	0	0
7-12-81	GR	5-00101	7-18-81	GR	6	0	0
7-12-81	MD	5-00107	7-18-81	GR	6		0.5
7-14-81	GR	5-00104	7-18-81	GR	4	0	0
7-16-81	GR	5-00127	7-18-81	GR	2	0	0
7-20-81	GR	5-00166	8-4-81	GR	15	0	0
			8-11-81	GR	22	0	0
7-22-81	GR	5-00188	8-4-81	GR	13	0	0
7-22-81	MD	5-00198	8-11-81	GR	20		0.5
8-4-81	GR	5-00222	8-11-81	GR	7	0	0
8-11-81	GR	5-00259	8-19-81	GR	8	0	0

[1]Tag and recapture location abbreviations: MD = Musselshell Diversion, GR = Goffena Ranch, KD = Korenko Dam, Mel = Highway 12 Bridge east of Melstone.

Table 14. Movement of channel catfish tagged in the middle Missouri River study area into the Musselshell River during the inventory period from October 1977 through August 1981 (Berg, 1981 and pers. comm.)

Tag Date	Recapture Date	Time at Large (Days)	Distance Moved Up Musselshell River (Miles)	Total Distance Moved (Miles)[1]
8-11-77	7-3-78	327	1	34
8-11-77	6-27-78	321	49	82
8-12-77	6-11-78	304	171	204
8-13-77	6-10-78	302	49	82
7-13-77	8-1-78	354	54	87
8-16-77	6-25-78	314	171	204
8-27-77	6-4-78	282	52	85
8-27-77	7-26-78	334	22	55
8-27-77	5-20-78	267	49	82
8-27-77	6-10-79	653	32	65
8-28-77	6-4-78	281	25	58
8-28-77	6-14-78	291	171	204
8-28-77	5-13-78	259	2	35
8-29-77	6-6-78	282	25	58
8-29-77	7-20-78	326	2	35
8-30-77	5-29-78	273	25	58
9-1-78	6-9-79	282	49	82
9-1-78	6-22-79	295	18	51
9-2-78	7-6-80	673	17	50
9-4-78	7-23-79	323	171	204
9-4-78	7-27-79	327	1	34
9-4-78	6-30-79	300	171	204
9-4-78	6-6-81	641	86	146.9*
8-12-79	7-11-81	699	1	34
8-12-79	7-11-81	699	1	34
8-14-79	7-2-81	688	49	82
8-25-79	7-14-81	689	54	87
8-26-79	7-1-81	674	46	79
8-26-79	8-1-81	706	4	37
9-8-79	7-5-81	664	55	88
9-9-79	7-5-81	665	55	88

[1] Includes 33 miles traveled in Fort Peck Reservoir from Turkey Joe tag site.

* Recaptured 10.3 miles up Box Elder Creek and includes 17.6 miles moved up Flatwillow Creek.

nine marked in 1980, were recaptured in the general area where tagging occurred. A catfish was caught by a fisherman 29.3 miles downstream from the point of marking. The channel catfish tagged 5-00066 made a significant movement over the Korenko diversion dam to the Musselshell diversion during low summer flows.

A significant movement pattern for channel catfish exists between the Lower Musselshell River and the Middle Missouri River. Thirty-one channel catfish tagged at Turkey Joe on the Middle Missouri River have been captured at various locations in the Lower Musselshell River drainage from May 1978 to September 1981 (Table 14). Five catfish were recaptured below the Musselshell diversion dam, approximately 171 river miles from the mouth of the Musselshell River. One channel catfish had even traveled up Flatwillow and Box Elder creeks. These movements apparently reflect a seasonal spawning migration. The magnitude of this migration and its importance to the fishery of Fort Peck Reservoir and the Middle Missouri is unknown. It is obvious, however, that decisions affecting management of the Musselshell River drainage will potentially impact a much wider area. Concern should be directed toward maintaining the present status of this spawning migration and obtaining a better understanding of the Missouri River "System."

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