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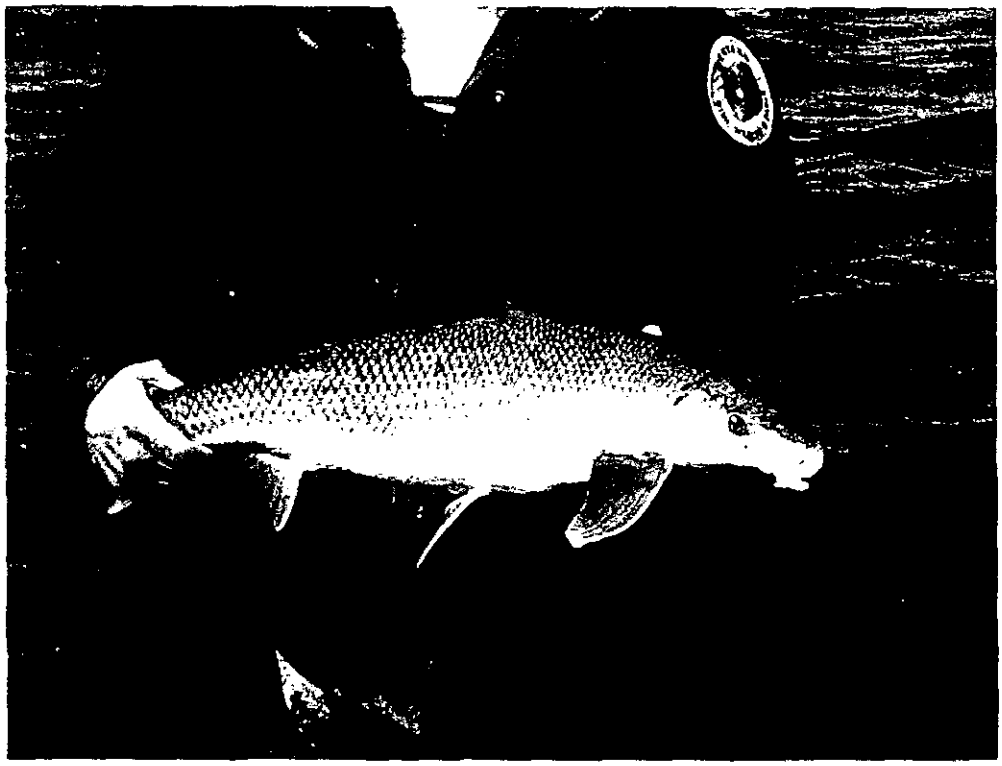
LOWER MILK RIVER FISHERY STUDY

2001 REPORT



by

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Background

The Milk River is one of the longest tributaries, extending over 700 miles, of the Missouri River in the upper great plains draining approximately 22,332 square miles. The headwaters of the Milk are in Glacier National Park, then it flows 45 miles northeast before entering Canada (western crossing). The river flows 170 miles through Canada before re-entering Montana (eastern crossing), then flows an additional 490 miles to its confluence with the Missouri River near Nashua, Montana.

Since the 1880's, the Milk River Basin has provided fertile land and water for agricultural based communities. Irrigation in the upper valley of the Milk River began in 1890 when a diversion dam built of brush and rocks was installed in the vicinity of the present Fort Belknap Diversion Dam. However, it soon became evident that the Milk River was strongly influenced by cyclic and extreme precipitation events leading to water shortages during summer months. The scarcity of facilities for storing spring runoff prompted investigations in 1891 to find a means of supplementing low summer flows.

The Federal Milk River Project, initiated in 1903, was a response to these investigations. The objective of this project was to provide a more consistent and long-term water source for the agricultural community. Dodson Diversion Dam, the first permanent structure built on the river, in 1910, to alleviate increasing irrigation demands in the valley was the. Six years later, in 1916, water from the St. Mary River was diverted into the North Fork of the Milk River through a 29 mile canal to supplement the Milk River's natural flow. Another permanent irrigation structure on the lower Milk, the Vandalia Diversion Dam, went into operation in 1917. The Lake Sherburne Dam, built on the St. Mary River, was completed in 1921 to provide additional storage for water

diversions to the North Fork Milk River. Fresno Dam, approved under the National Industrial Recovery Act in 1935 and completed in 1939 (BOR 1983), was built on the Milk River 15 miles west of Havre, Montana. The 2,170 ha Fresno Reservoir had an original capacity of 127,200 acre-feet of active storage and serves as the primary irrigation storage structure for the Milk River Project (BOR and Montana Department of Natural Resources and Conservation (DNRC) 1984).

Today, the Milk River Project consists of seven major diversion dams, 200 miles of canals, 219 miles of laterals, 295 miles of drains, and over 200 pumps. This provides water to 121,000 acres (R. DeVore, BOR, Billings, personal communication). Principal crops produced are alfalfa, native hay, oats, wheat, barley, and sugar beets. Other uses of Project water include municipal supplies, recreation, and allotments for fish and wildlife.

Despite the developments, water shortages in the Milk River Basin still exist during years of low annual precipitation. This hinders the efforts of the BOR to provide water to all water right holders. Other conditions contributing to the shortages are periodic severe droughts, over appropriation of available irrigation water, and aging canals that can no longer transport the amount of water needed for current irrigation operations. The Fort Belknap Water Rights Compact mentions the possibility of developing an off-stream storage reservoir with up to 60,000 acre-foot capacity. Water to fill the reservoir would be diverted from the Milk River during high flows in the spring. This may result in reduced flows in the lower 120 miles of Milk River where native fish species are attempting spring migration from the Missouri River to areas below Vandalia dam.

Introduction

The lower reach of the Milk contains many Missouri River fish species identified in a 1986 survey (Needham 1987) which included historic or current ranges of the following listed and/or candidate species of special concern: pallid sturgeon, paddlefish, sturgeon chub, blue sucker and sauger. Paddlefish are seen in large concentrations, within the first ten miles of the Milk, during the spring. Larval paddlefish were collected in the late seventies and early eighties approximately ten miles below the Vandalia Diversion Dam and are commonly found in the mouth area. Sturgeon chub and young of the year blue suckers have been captured immediately below the Milk. Adult blue suckers, in spawning condition are found in fair numbers in the spring and early summer, in the lower Milk. Sturgeon chub above the Montana Highway 13 bridge are rarely captured and may be a drift from a Milk River population. Other species collected below Vandalia Dam include the following: freshwater drum, shovelnose sturgeon, goldeye, river carpsucker, smallmouth and bigmouth buffalo, shorthead redhorse, white sucker, longnose sucker, channel catfish, stonecat, black bullhead, yellow perch, walleye, Iowa darter, smallmouth bass, white crappie, burbot, northern pike, carp, flathead chub, plains and western silvery minnows, emerald shiner, fathead minnow, longnose dace, spottail shiners, and lake whitefish. Of these, paddlefish, sturgeon and blue suckers are not found above Vandalia Dam.

The Milk River plays an important role in providing habitat for recruitment of warm water species for both resident and Missouri River migratory fish. The purpose of this study is to collect data and report on baseline resident and migratory fish communities, which will help evaluate current and proposed operations. Data and reports generated by these investigations may be used to support federal actions as repairs to project facilities, contract renewals, facility

construction or other sources of additional depletions.

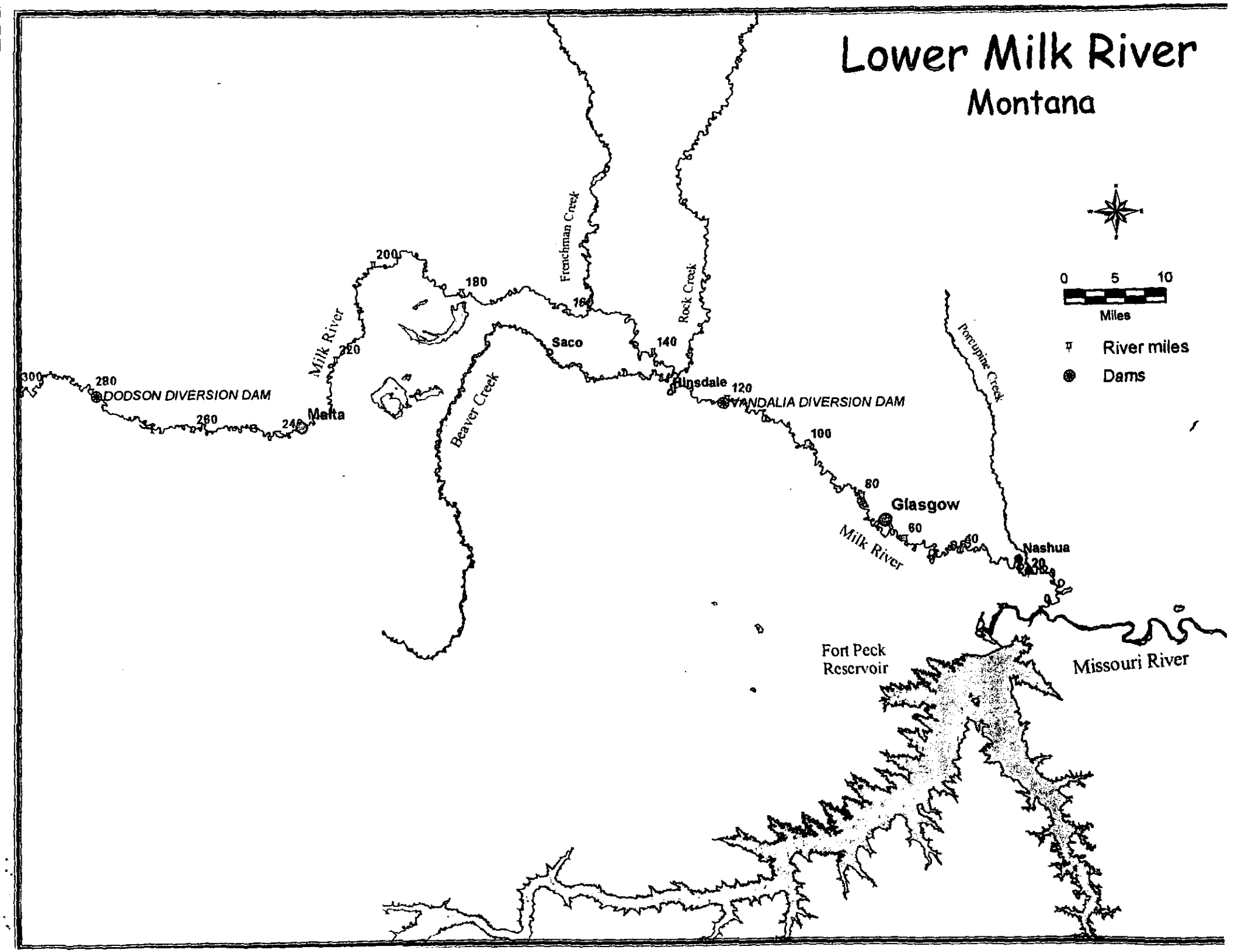
Principle objectives of this project are to: 1) Estimate relative abundance of Milk River fish; 2) Document successful spawning; 3) Document length frequency of all species; 4) Collect and process age and growth structures; 5) Document habitat values associated with fish capture site.

Study Area

The study area for this project was concentrated on the segment of the Milk River from the Hinsdale area above Vandalia dam to its confluence with the Missouri River and three miles of the Missouri River downstream from the Milk (Figure 1).

Table 1. Section number, physical location, and river mile of Milk River sections.

Section	Location
1.0	Missouri River from mouth of Milk and downstream three miles.(RM 1561-1558)
1.1	Mouth of Milk area.(RM 0 – RM 10)
1.2	Nashua (RM 10 – RM 40)
1.3	Glasgow (RM 40 – RM 90)
1.4	Tampico to Vandalia Dam (RM 90 – RM 120)
2.1	Vandalia dam to above Beaver Cr. (RM 120 – RM 140)


Lower Milk River
Montana
0 5 10
Miles
River miles
Dams
Milk River
Frenchman Creek
Rock Creek
Beaver Creek
Porcupine Creek
Saco
Hinsdale
VANDALIA DIVERSION DAM
DODSON DIVERSION DAM
Malta
Glasgow
Nashua
Fort Peck Reservoir
Missouri River
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20

Methods

The sampling methods used during this project were similar to those employed by the Missouri River Benthic Fishes project, with slight modifications (Sappington et al 1998). The following list describes the fish collecting gears, how they were used, and where they were used during this project.

Bag Seine (BS) – 10.7-m long by 1.8-m tall; 1.8-m x 1.8-m x 1.8-m bag at center of net; 5-mm Ace mesh; "many ends" mudline attached to entire length at the bottom. Seining was used to sample inside bends and riffle areas. To deploy the seine, one end was held at the shoreline while the other end was stretched upstream and parallel to the shoreline. The upstream end of the net was then pulled into the water and swept in a 180-degree arch downstream while making sure the mudline stayed in contact with the substrate. Sometimes both ends of the seine were pulled downstream to more effectively sample an area. The distance seined was then recorded. If snagging occurred, the haul was abandoned and another nearby site was selected.

Electrofishing (EF) – Coffelt VVP 15 electrofishing box and Honda 5000ex generator; Pulsed DC-60cps. Sampling started at a determined upstream point and progressed downstream. Length of habitat sampled and the shocking time (seconds) were both recorded to standardize the effort. Since electrofishing is so versatile, it was used in all the macrohabitats.

Stationary Gill Nets (SGN) – 50 ft and 100 ft sinking nets; 6 ft high; divided into four equal segments of ¾", 1 ½", 2", and 3" mesh size. These nets were used to sample tributary mouths and were also used in the main river in areas of very slow current. These nets were deployed with a heavy weight on the lead line, to prevent any drifting, and a bullet float on the float line, to aid in retrieval. In the tributary mouths, one net was deployed at least 50m upstream

of the confluence with the main river and was stretched across the entire width of the tributary. Start times and end times were recorded for each effort and all nets were fished at least 12 h.

Drift Trammel Nets (DTN) – 75 ft; 1" inner mesh and 6" outer mesh. These nets were used to sample areas with velocities greater than .2 m/s, which were generally riffle areas. Each sample consisted of at least a 75m drift where both the start-time and end-time of each drift was recorded. To deploy the net, one member of the crew fed out the net while the other crew member waded across the channel with the net. Once the net was stretched, the crew members held on to the ends of the net and walked an even pace with the drift. At the end of the drift, One person made a downstream arc to end up on the same side as the other person and the net was pulled onto shore. To assure that the net was dragging on the substrate, sash weights were attached to the leadline of the net with carabineers.

Hoop Nets (HOOP) – 3 ½ ft diameter, 1" mesh. This gear was used in areas greater than 1.5 meters deep. Hoop nets were set by tossing a hoop net anchor, with 4 to 5 m of rope attached, off the bow of the boat. After the anchor was secured in the substrate, the hoop net was attached to the rope and fed off the bow as the boat drifted downstream. Once the hoop net was stretched, it was released and allowed to sink to the bottom. An additional buoy line was also attached to the anchor to help locate and retrieve the nets. In order to be fished effectively, water velocities at these sights had to be quick enough to keep the hoops standing on edge. This year, there was rarely enough current to do this, so an additional anchor was added to the back hoop to keep the net from collapsing. Nets were fished for a minimum of 12 h. Both baited, with bleu cheese, and non-baited nets were used.

Larval Nets (LVN) - Sampling for larval fish was done in the Milk River during May through July. Samples were collected near the surface using paired, 1/2 m x 1.8 m long conical nets (750 um Nitex mesh) with attached buckets and weighted with a 4.5 kg. Lead ball. A flow meter (230 OR G.O. Environmental Inc.) was suspended in the mouth of the net for calculation of volume sampled. If there was not enough flow to keep the nets open, the boat was idled upstream. Then the two nets were deployed off both sides of the boat, at the same time. When there was adequate flow the boat was anchored. Average sampling time was ten minutes. Contents of collecting buckets were transferred to jars and preserved in 10 percent formalin solution containing Phloxine-B dye for specimen staining.

Fish were sampled using a wide variety of gears to effectively sample the greatest diversity of fishes. Gears included; electrofishing, drift trammel nets, gill nets, seines, hoop nets, trawls, and larval nets. Sampling began in April and continued through October. All species were measured to the nearest 2 mm. Fish weighing less than 800 grams were weighed to the nearest gram and fish greater than 800 grams were weighed to the nearest 50 grams.

Results and Discussion

A total of 4820 fish representing 27 species was captured in the Milk River in 2001 (Table 1). Minnow species (Cyprinids) comprised 62 % of the catch; most of these fish were captured in bag seines. Goldeye, river carpsuckers, and shorthead redhorse made up 10.8%, 7.8% and 5.3% of the catch, respectively. Section 1.4 yielded 36.2% of the total catch, however, one seine haul captured 67% of these individuals. Section 1.1 accounted for the second most fish sampled, capturing 28.1% of the total, however, the greatest effort (40 gear deployments) was

concentrated in this section. This was also the most species diverse section; 24 of the 27 species were sampled in this section. For the fourth consecutive year, a sauger was not captured above Vandalia dam (Fuller 2001).

Table 2. Fish species and numbers collected in the lower Milk River, 2001, parenthesis indicates number of gear deployments

		Section number						
Species	CODE	**1.0** (16)	**1.1** (40)	**1.2** (16)	**1.3** (18)	**1.4** (22)	**2.1** (12)	Total (124)
Black crappie	BKCP						1	1
Bigmouth buffalo	BMBF	2	19		1		2	24
Blue sucker	BUSK	3	28					31
Common carp	CARP		17	3	3	22	17	62
Channel catfish	CNCF	7	99	14	36	54	17	227
Cisco	CSCO	1	1					2
Emerald shiner	ERSN	1	208	108	5	184	333	839
Flathead chub	FHCB	3	179	128	51	261		622
Fathead minnow	FHMW		23	49	55	350	4	481
Freshwater drum	FWDM		7	1	2	1	7	18
Goldeye	GDEY	15	309	67	34	36	60	521
Hybognathus spp.	HBNS		49	161	3	587	20	820
Lake whitefish	LKWF		5					5
Longnose dace	LNDC		1	7		60		68
Longnose sucker	LNSK	1	18	1				20
Northern pike	NTPK	1	7	3	8	10	8	37
River carpsucker	RVCS	28	226	16	16	34	54	374
Sauger	SGER	13	39	5	1			58
Shorthead redhorse	SHRH	21	33	18	51	86	48	257
Smallmouth buffalo	SMBF	6	51	5	14	27	13	116
Smallmouth bass	SMBS						5	5
Shovelnose sturgeon	SNSG	3	20	11				34
Stonecat	STCT		1	1	1	1	2	6
Spottail shiner	STSN		1			9	66	76
Walleye	WLYE	1	2	4	7	8	13	35
White sucker	WTSK	4	15	13	3	17	27	79
Yellow perch	YLPH	1					1	2
Grand Total		110	1358	616	291	1747	698	4820

Bag seining accounted for 61.4% of the total fish collected, followed by stationary gill nets (17.3%) and electrofishing (13.4%). Electrofishing was the most species diverse gear; 23 of the 27 species were collected with this gear type. Bag seines and gill nets both captured 18 of 27 species, whereas hoop nets and drift trammel nets both caught 12 different species (Table 3).

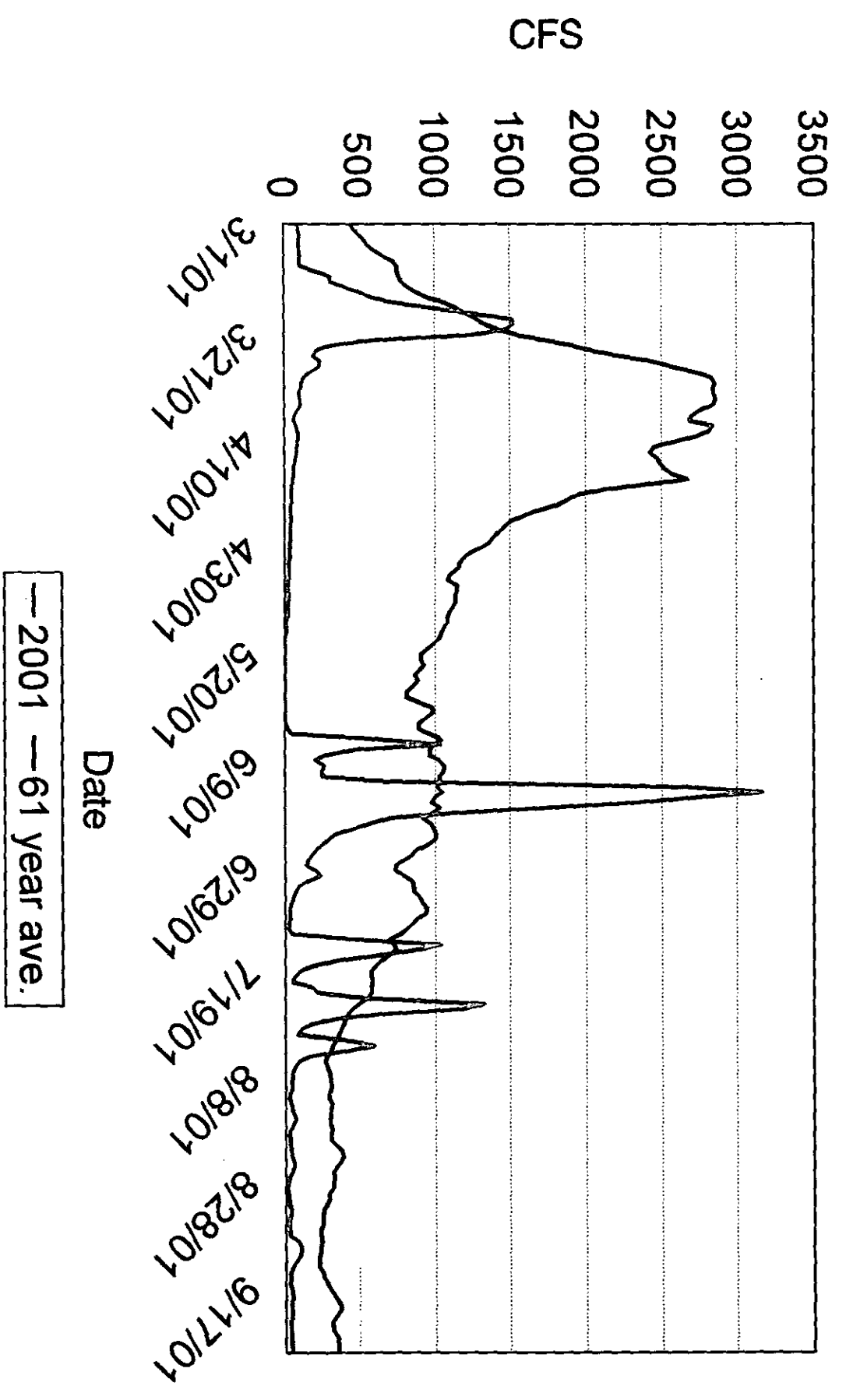
Table 3. Numbers of fish species by gear, parenthesis indicates number of gear deployments.

	Gear					
Species	BS (14)	DTN (15)	EF (44)	HOOP (31)	SGN (20)	Total(124)
Black crappie					1	1
Bigmouth buffalo			20		4	24
Blue sucker		2	1	1	27	31
Common carp	7	4	45	2	4	62
Channel catfish	8	15	5	75	124	227
Cisco			1		1	2
Emerald shiner	761		78			839
Flathead chub	614	1	5	2		622
Fathead minnow	481					481
Freshwater drum			16	1	1	18
Goldeye	6	11	111	51	342	521
Hybognathus spp.	790		30			820
Lake whitefish			2		3	5
Longnose dace	68					68
Longnose sucker	19		1			20
Northern pike	2		5	3	27	37
River carpsucker	25	55	96	81	117	374
Sauger	2	4	36	2	14	58
Shorthead redhorse	30	8	125	12	82	257
Smallmouth buffalo	1	22	30	8	55	116
Smallmouth bass			5			5
Shovelnose sturgeon		19		1	14	34
Stonecat	1	1	1		3	6
Spottail shiner	75		1			76
Walleye	1		19		15	35
White sucker	68	1	10			79
Yellow perch			1		1	2
Grand Total	2959	142	645	239	835	4820

Flows and Temperature

Flows were very low this year (Figure 2). The Milk acted as a backwater rather than a river. Historically, a large spring pulse starts in mid March as snows melt. This usually continues through the spawning season during April and part of May. Stewart (1982) reported significantly higher numbers of paddlefish below the Milk when Milk River flows were high enough to produce a warm, turbid plume on the north side of the Missouri River. This year, the only large pulse of warm Milk River water occurred on June 16, after a heavy rain. This pulse, of 3180 cubic feet per

Figure 2. Milk River Discharge (USGS gaging station at Nashua, Mt)



second (cfs), was probably a little too late to trigger any additional spawning runs. However, a fair number of shovelnose sturgeon were collected in the lower Milk just days after this surge of water. Very few shovelnose were collected prior to this pulse. During 1999, catch rates of shovelnose at the first riffle in the Milk, were much higher at the first riffle about seven days after a large flow (Figure 3). Drifted trammel nets captured 458 shovelnose. This was the largest number captured on record, in this area.

Temperature loggers were deployed in the Milk (river mile 3) and Missouri (river mile 1761) Rivers (Figure 4). Temperatures recorded in this section of Missouri River were significantly cooler than above the Fort Peck Reservoir (Galat et al, 2001). Due to these cold water releases out of Fort Peck dam, temperatures do not reach preferred spawning ranges of many of the native Missouri River fishes (Figure 5), nor does the Missouri River possess spawning cues such as high turbidity or a natural hydrograph, with a spring rise. This further shows the importance of the Milk River for spawning, rearing and recruitment of fish into the Milk and Missouri rivers.

Tagging

Since 1999, 992 fish were tagged in the Milk River below Vandalia Dam, by the Milk River fishery crew. The pallid sturgeon recovery team has also been tagging fish in this same area (Liebelt 2000). This year 300 new fish were tagged and 2 sauger and 4 shovelnose were recaptured. Sauger # 2424 was tagged on June 12, 2001 at the confluence with the Missouri River and recaptured on July 30 in the same area. Sauger # 1239 was tagged 3 miles up the Milk, at the first riffle, on October 20, 2000 and recaptured in the same area on April 22, 2001, and showed no growth. Shovelnose sturgeon (SNSG) # 739 was originally tagged on May 25, 1999,

Figure 3. Catch rate of shovelnose sturgeon vs. flow in 1999

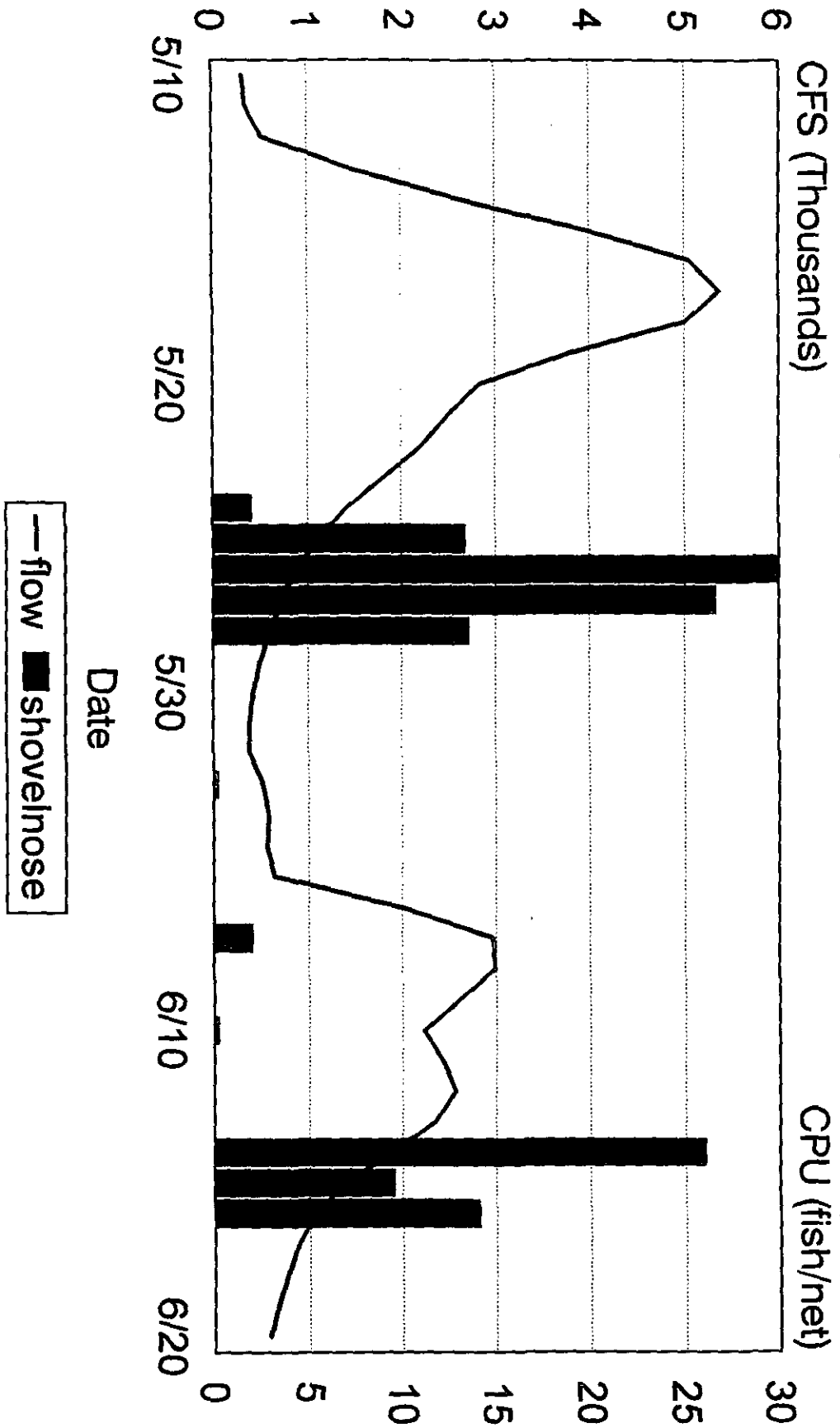


Figure 4. Mean Daily Temperature of the Milk and Missouri Rivers

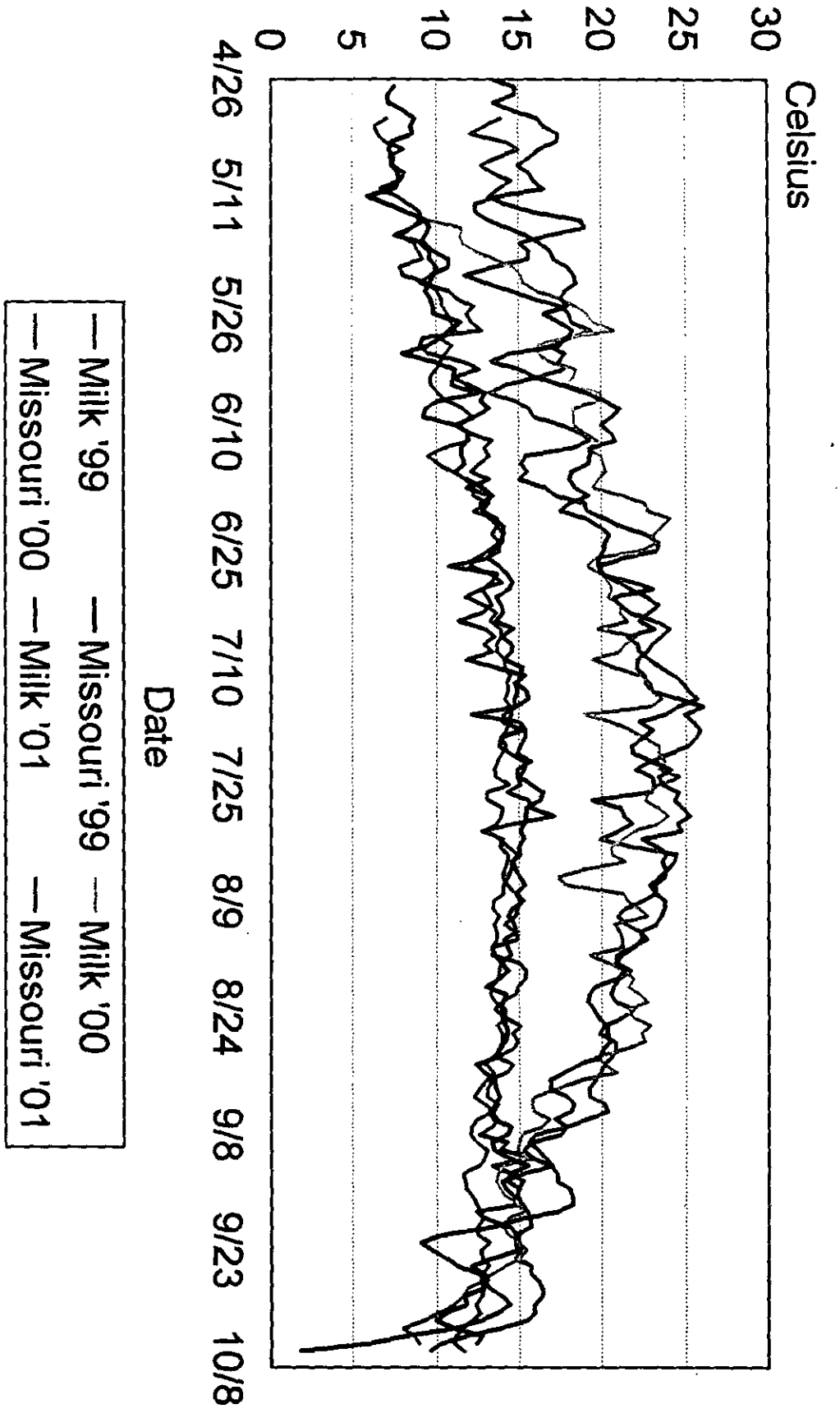
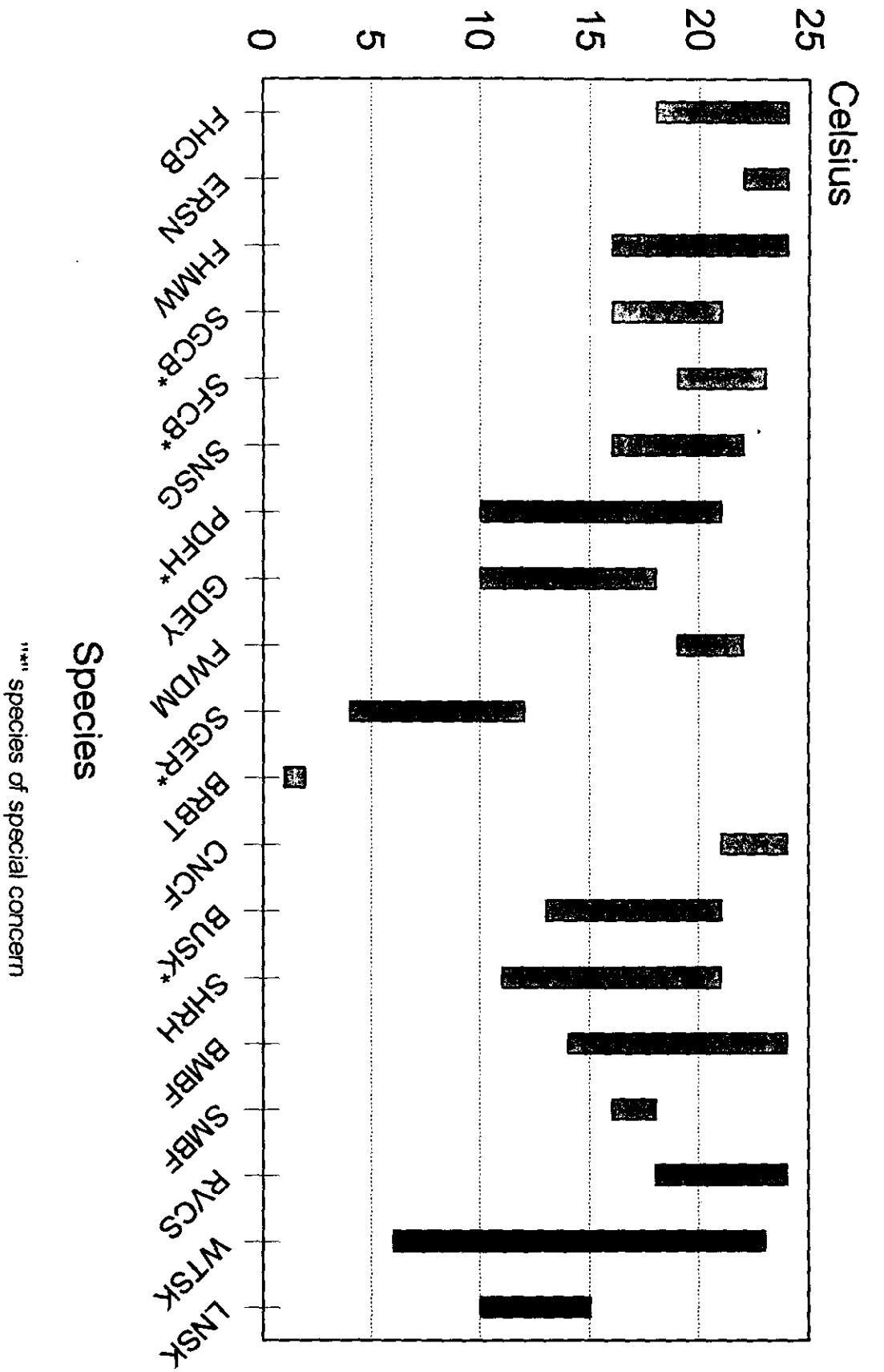


Figure 5. Spawning Temperatures of Native Missouri River Fishes



at the first riffle and was recaptured June 21, 2001 approximately 12 miles above this location, but did not show any growth. SNSG # 757 was tagged May 25,1999, at the first riffle and recaptured April 22, 2001 in the same area. This fish grew 13mm and added 25 gms. SNSG # 9963 was originally tagged in the tail water below Fort Peck dam on June 19, 2000 swam 8 miles down the Missouri, 2 miles up the Milk and was recaptured on June 11, 2001. During this time, the fish grew 5 mm.

Larval fish sampling

Stewart (1983) reported catching larval paddlefish, *Stizostedion spp.*, goldeye, common carp, river carpsucker, blue sucker, *Ictiobus spp.*, shorthead redhorse, white sucker, and freshwater drum, (total of 15 samples) in the first 3 miles of the Milk River. In 2001, larval fish sampling was conducted in the first three miles of the Milk River twice each week, throughout June and July. Each day of sampling yielded twelve samples for a total of 216 samples. Very large numbers of larval fish were collected, primarily in late June and early July. The larvae are currently being identified. Numerous Catostomid species, some fresh water drum, *Stizostedion spp.*, and paddlefish have been observed. When identification of these larvae is completed and quantified, results will be submitted to the BOR.

Age and Growth

Thirty-seven catfish, 14 walleye, 12 sauger, eight freshwater drum and one smallmouth bass had structures removed from them for age determination. Tissue samples were taken from 19 sauger for genetic analysis. The results will be submitted to the BOR, once this information has been analyzed.

Fall Sampling

Fall sampling efforts were a continuation of a study initiated in 1999 and repeated in 2000. Due to the drought this year, access and sampling were very difficult. Very low waters made it difficult to access different macrohabitats such as riffles. Additionally there were not many deep holes to set gill or hoop nets in. In addition, the reservoir behind Vandalia diversion dam was drawn down after the irrigation season to perform repairs on the dam for the past several years. This causes severe siltation in the tail water zone below the dam, filling in any deep holes that existed. Both in 2000 and 2001, a significant fish kill was observed. In 2000 sampling was conducted in this area with all gears. The result was a handful of adult common carp, shorthead redhorse and goldeye, and several cyprinids. In section 2.1 (above Vandalia Dam) there was very little water. A boat was launched at the Hinsdale ramp but there was only three inches of water covering two feet of silt. Therefore these two sections were not sampled in the fall of 2001. It is unknown if this sediment load was backed up all the way from Vandalia or not. Either way, it is likely there will be another fish kill below the dam again in the fall of 2002.

A total of 2455 fish representing 21 species was collected in the lower Milk River during the fall of 2001 (Table 4). However, it should be noted that one seine haul yielded 1167 fish or 47.5% of the total. Minnows (emerald shiner, fathead minnow, flathead chub, *Hybognathus spp.*, longnose dace, and spottail shiner) made up over 80% of the total catch. Of the remaining catch, 43.1% were goldeye followed by channel catfish (18.8%) and river carpsuckers (8.1%).

Table 4. Total number of individual fish species sampled in the lower Milk River, fall, 2001.

	Section					
Species	1.0	1.1	1.2	1.3	1.4	2.1	Total
Bigmouth buffalo		1		1			2
Common carp		6		2	6		14
Channel catfish		31	8	24	29		92
Emerald shiner		139	50	5	172		366
Flathead chub		178	88	51	220		537
Fathead minnow		18	40	55	274		387
Freshwater drum		1		1	1		3
Goldeye		161	38	6	6		211
Hybognathus spp.		35	151	3	470		659
Lake whitefish		4					4
Longnose dace		1	5		12		18
Longnose sucker		18	1				19
Northern pike		2		3	6		11
River carpsucker		20	4	10	6		40
Saucer		4		1			5
Shorthead redhorse				14	11		25
Smallmouth buffalo		3	1	5	12		21
Stonecat				1			1
Spottail shiner					1		1
Walleye		1		4	4		9
White sucker		8	6		16		30
Grand Total		631	392	186	1246		2455

Table 5. Comparison of fall catch rates of individual fish species 1999-2000 versus 2001.

GEAR	BS CPUE (n/haul)		EF CPUE (n/hour)		HOOP (n/hour)		SGN CPUE (n/hour)	
Species/Years	1999-2000	2001	1999-2000	2001	1999-2001	2001	1999-2000	2001
Bluegill	0.000	0.000	0.337	0.000	0.000	0.000	0.000	0.000
Black crappie	0.176	0.000	0.405	0.000	0.000	0.000	0.002	0.000
Bigmouth buffalo	0.000	0.000	0.810	0.244	0.001	0.000	0.000	0.008
Common carp	0.412	1.000	9.784	1.951	0.008	0.000	0.016	0.000
Channel catfish	0.706	1.000	1.552	0.488	0.060	0.207	0.139	0.298
Creek chub	0.294	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Emerald shiner	19.760	14.167	19.230	8.293	0.000	0.000	0.000	0.000
Flathead chub	7.765	17.333	4.049	0.000	0.000	0.000	0.000	0.000
Fathead minnow	5.647	14.167	6.005	0.000	0.000	0.000	0.000	0.000
Freshwater drum	1.824	0.000	2.159	0.488	0.000	0.005	0.000	0.000
Goldeye	2.618	0.667	17.410	6.098	0.009	0.143	0.608	0.969
Hybognathus spp.	68.000	9.500	3.576	5.610	0.000	0.000	0.000	0.000
Lake whitefish	0.000	0.000	0.675	0.244	0.000	0.000	0.034	0.023
Longnose dace	0.500	3.000	0.135	0.000	0.000	0.000	0.000	0.000
Longnose sucker	0.000	3.167	0.000	0.000	0.000	0.000	0.000	0.000
Northern pike	0.176	0.167	2.092	0.244	0.004	0.000	0.096	0.069

Table 5. cont.

GEAR	BS CPUE (n/haul)		EF CPUE (n/hour)		HOOP (n/hour)		SGN CPUE (n/hour)	
Species/Years	1999-2000	2001	1999-2000	2001	1999-2001	2001	1999-2000	2001
Sauger	0.118	0.167	2.227	0.732	0.003	0.000	0.000	0.008
Shorthhead redhorse	1.500	0.000	20.040	4.878	0.021	0.014	0.127	0.015
Smallmouth bass	0.030	0.000	1.147	0.000	0.001	0.000	0.000	0.000
Smallmouth buffalo	1.147	0.167	0.742	0.244	0.005	0.000	0.081	0.145
Stonecat	0.000	0.167	0.270	0.000	0.001	0.000	0.004	0.000
Spottail shiner	13.650	0.167	69.700	0.000	0.000	0.000	0.000	0.000
Walleye	0.090	0.000	4.386	1.220	0.004	0.000	0.100	0.031
White crappie	0.353	0.000	0.202	0.000	0.000	0.000	0.000	0.000
White sucker	1.353	5.000	3.171	0.000	0.000	0.000	0.002	0.000
Yellow perch	1.618	0.000	5.870	0.000	0.000	0.000	0.006	0.000
Grand Total	131.200	73.000	183.200	34.878	0.120	0.368	1.295	1.595

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Table 6. Size distribution of fish species captured in the Milk River by section.

Species	Section	1	1.1	1.2	1.3	1.4	2.1	total
BKCP	Numbered measured						1	1
	Average length (mm)						209	209
	Average weight (gms)						125	125
BMBF	Number measured	1	19		1		2	23
	Average length (mm)	648	695.053		546		512.5	670.652
	Minimum length	648	490		546		480	480
	Maximum length	648	800		546		545	800
	Average weight (gms)	4900	5577.63		2575		2125	5117.39
	Minimum length	4900	1725		2575		1750	1725
	Maximum length	4900	8050		2575		2500	8050
BUSK	Number measured	3	28					31
	Average length (mm)	673	711.393					707.677
	Minimum length	652	534					534
	Maximum length	690	805					805
	Average weight (gms)	2391.67	3174.11					3098.39
	Minimum length	2025	1150					1150
	Maximum length	2625	5150					5150
CARP	Number measured		17	3	3	21	17	61
	Average length (mm)		427.059	486	502.333	412.952	438.059	431.869
	Minimum length		58	450	450	62	307	58
	Maximum length		666	518	542	575	599	666
	Average weight (gms)		1618.64	1475	1525	1144.13	1194.12	1325.31
	Minimum length		2.9	1100	1375	3.4	400	2.9
	Maximum length		4175	1825	1600	2250	2725	4175
CNCF	Number measured	7	98	14	36	54	17	226
	Average length (mm)	379.857	374.337	361.285	378.722	433.778	425.176	392.425
	Minimum length	340	46	52	252	225	295	46
	Maximum length	477	593	495	540	666	695	695
	Average weight (gms)	492.857	482.742	547.336	473.611	795.37	771.529	582.024
	Minimum length	300	1.1	1.2	125	75	200	1.1
	Maximum length	1050	2175	1250	1260	2925	3400	3400
CSCO	Numbered measured	1	1					2
	Average length (mm)	221	187					204
	Average weight (gms)	50	50					50
ERSN	Number measured		41	46	2	31	20	140
	Average length (mm)		53.5122	50.1957	27.5	70	49.95	55.1929
	Minimum length		33	25	26	45	37	25
	Maximum length		99	77	29	107	79	107
	Average weight (gms)		1.23659	1.00435	0.15	2.67097	1.03	1.43286
	Minimum length		0.2	0.1	0.1	0.6	0.4	0.1
	Maximum length		6	3.2	0.2	8.9	2.8	8.9
FHCB	Number measured	2	40	57	20	41		160
	Average length (mm)	240	53.025	71.7895	53.35	106.927		75.9
	Minimum length	220	35	42	40	40		35
	Maximum length	260	114	192	60	198		260
	Average weight (gms)	150	1.415	6.05789	1.32	17.7756		9.10688
	Minimum length	100	0.3	0.4	0.6	0.4		0.3
	Maximum length	200	14	100	2.2	70		200

Species		1	1.1	1.2	1.3	1.4	2.1 total	
FHMW	Number measured		18	29	17	52	4	120
	Average length (mm)		47.8333	46.4828	42.4706	49.25	49	47.4
	Minimum length		34	33	30	39	38	30
	Maximum length		58	60	50	69	54	69
	Average weight (gms)		1.07778	1.01724	0.74706	1.28077	1.125	1.10583
	Minimum length		0.3	0.3	0.2	0.4	0.4	0.2
	Maximum length		1.9	2.3	1.4	3.4	1.6	3.4
FWDM	Number measured		6	1	2	1	7	17
	Average length (mm)		359.333	450	390	383	382.143	379.059
	Minimum length		217	450	370	383	128	128
	Maximum length		404	450	410	383	438	450
	Average weight (gms)		727.5	1350	800	700	924.286	852.059
	Minimum length		90	1350	600	700	20	20
	Maximum length		1000	1350	1000	700	1225	1350
GDEY	Number measured	9	243	67	34	36	60	449
	Average length (mm)	279.889	280.173	287.343	261.706	276.389	317.333	284.501
	Minimum length	149	61	170	121	112	204	61
	Maximum length	355	408	353	344	356	381	408
	Average weight (gms)	217.222	213.021	201.299	182.088	209.219	296.367	219.846
	Minimum length	20	1.8	50	25	12.6	67	1.8
	Maximum length	400	750	360	400	350	507	750
HBNS	Number measured		12	30	3	44	20	109
	Average length (mm)		47.1667	57	52.3333	61.4545	46.55	55.6697
	Minimum length		38	37	52	38	38	37
	Maximum length		71	111	53	122	55	122
	Average weight (gms)		0.875	2.17333	1.3	2.75	0.895	2.00459
	Minimum length		0.4	0.2	0.9	0.2	0.3	0.2
	Maximum length		2.5	11.6	1.7	15.6	1.5	15.6
LKWF	Number measured		5					5
	Average length (mm)		488.2					488.2
	Minimum length		465					465
	Maximum length		524					524
	Average weight (gms)		1210					1210
	Minimum length		1050					1050
	Maximum length		1625					1625
LNDC	Number measured		1	7		32		40
	Average length (mm)		33	39.7143		54.3125		51.225
	Minimum length		33	33		42		33
	Maximum length		33	63		76		76
	Average weight (gms)		0.3	0.64286		1.57188		1.3775
	Minimum length		0.3	0.2		0.6		0.2
	Maximum length		0.3	2.7		4.2		4.2
LNSK	Number measured	1	18	1				20
	Average length (mm)	519	64.6111	61				87.15
	Minimum length	519	50	61				50
	Maximum length	519	75	61				519
	Average weight (gms)	1800	2.51111	2.5				92.385
	Minimum length	1800	1	2.5				1
	Maximum length	1800	3.6	2.5				1800

Species		1	1.1	1.2	1.3	1.4	2.1	total
NTPK	Number measured	1	7	3	8	10	8	37
	Average length (mm)	537	804.571	305.333	754.5	588.1	531.75	628.541
	Minimum length	537	670	243	651	278	325	243
	Maximum length	537	975	377	960	805	731	975
	Average weight (gms)	725	3692.86	177.6	2918.75	1544.6	1199.38	2040.51
	Minimum length	725	2000	80.8	1550	125	206	80.8
	Maximum length	725	6200	277	6000	3250	2350	6200
RVCS	Number measured	28	224	16	15	34	54	371
	Average length (mm)	479.143	459.473	305.125	302.533	338.324	425.407	431.895
	Minimum length	395	42	42	37	50	297	37
	Maximum length	560	620	602	470	452	488	620
	Average weight (gms)	1559.82	1516.88	769.925	625.44	749.759	1234.63	1340.48
	Minimum length	100	0.9	1	0.4	1.4	410	0.4
	Maximum length	2650	3850	2200	1200	1300	1725	3850
SGER	Number measured	12	39	6	1			58
	Average length (mm)	321.583	330.538	365.5	402			333.354
	Minimum length	244	261	283	402			244
	Maximum length	440	463	535	402			535
	Average weight (gms)	269.583	304.026	488.5	525			319.793
	Minimum length	110	144	174	525			110
	Maximum length	700	750	1380	525			1380
SHRH	Number measured	21	31	18	51	86	47	254
	Average length (mm)	389.476	393.161	215	321.51	296.605	216.255	300.417
	Minimum length	272	142	108	170	58	68	58
	Maximum length	485	488	420	397	405	472	488
	Average weight (gms)	680.238	859.677	188.506	348.627	317.58	161.226	381.88
	Minimum length	210	50	13.1	50	1.7	3.8	1.7
	Maximum length	1150	1875	725	700	650	700	1875
SMBF	Number measured	6	51	5	13	27	13	115
	Average length (mm)	599.667	589.706	594.8	501.692	490.333	460.154	542.522
	Minimum length	537	44	565	446	410	294	44
	Maximum length	691	747	650	625	645	530	747
	Average weight (gms)	3350	3057.86	3260	1917.31	1830.56	1562.31	2495.75
	Minimum length	2000	1	2800	1300	950	500	1
	Maximum length	5250	5700	3750	4350	3900	2650	5700
SMBS	Number measured						5	5
	Average length (mm)						340	340
	Minimum length						178	178
	Maximum length						425	425
	Average weight (gms)						626	626
	Minimum length						70	70
	Maximum length						1050	1050
SNSG	Number measured	3	20	11				34
	Average length (mm)	638.667	644.8	626.455				638.324
	Minimum length	580	551	534				534
	Maximum length	695	764	783				783
	Average weight (gms)	1000	1113	1050.91				1082.94
	Minimum length	850	600	550				550
	Maximum length	1200	1975	2300				2300

Species		1	1.1	1.2	1.3	1.4	2.1	total
STCT	Number measured		1	1	1		2	5
	Average length (mm)		192	95	141		171	154
	Minimum length		192	95	141		162	95
	Maximum length		192	95	141		180	192
	Average weight (gms)		50	7	26.8		49	36.36
	Minimum length		50	7	26.8		36	7
	Maximum length		50	7	26.8		62	62
STSN	Number measured					9	20	29
	Average length (mm)					78.6667	63.9	68.4828
	Minimum length					67	43	43
	Maximum length					91	75	91
	Average weight (gms)					4.5	2.465	3.09655
	Minimum length					2.4	0.6	0.6
	Maximum length					7.2	3.6	7.2
WLYE	Number measured	1	2	4	7	8	13	35
	Average length (mm)	330	491	324.75	315.571	365.25	359.308	354.657
	Minimum length	330	427	216	185	194	194	185
	Maximum length	330	555	488	453	759	516	759
	Average weight (gms)	350	1075	387.5	314.143	946.125	484.769	574.857
	Minimum length	350	750	100	40	60	57	40
	Maximum length	350	1400	1000	825	4700	1260	4700
WTSK	Number measured	4	8	13	3	17	23	68
	Average length (mm)	364.75	60.25	107.077	360	109.118	121.957	133.426
	Minimum length	275	46	58	320	91	78	46
	Maximum length	458	79	458	418	146	372	458
	Average weight (gms)	700	2.45	101.285	525	14.0588	37.3391	100.134
	Minimum length	300	0.9	2.2	325	7.3	1.9	0.9
	Maximum length	1250	5.2	1250	750	33.1	550	1250
YLPH	Numbered measured						1	1
	Average length (mm)						179	179
	Average weight (gms)						62	62

Figure 6. Length frequencies of selected Milk River Species

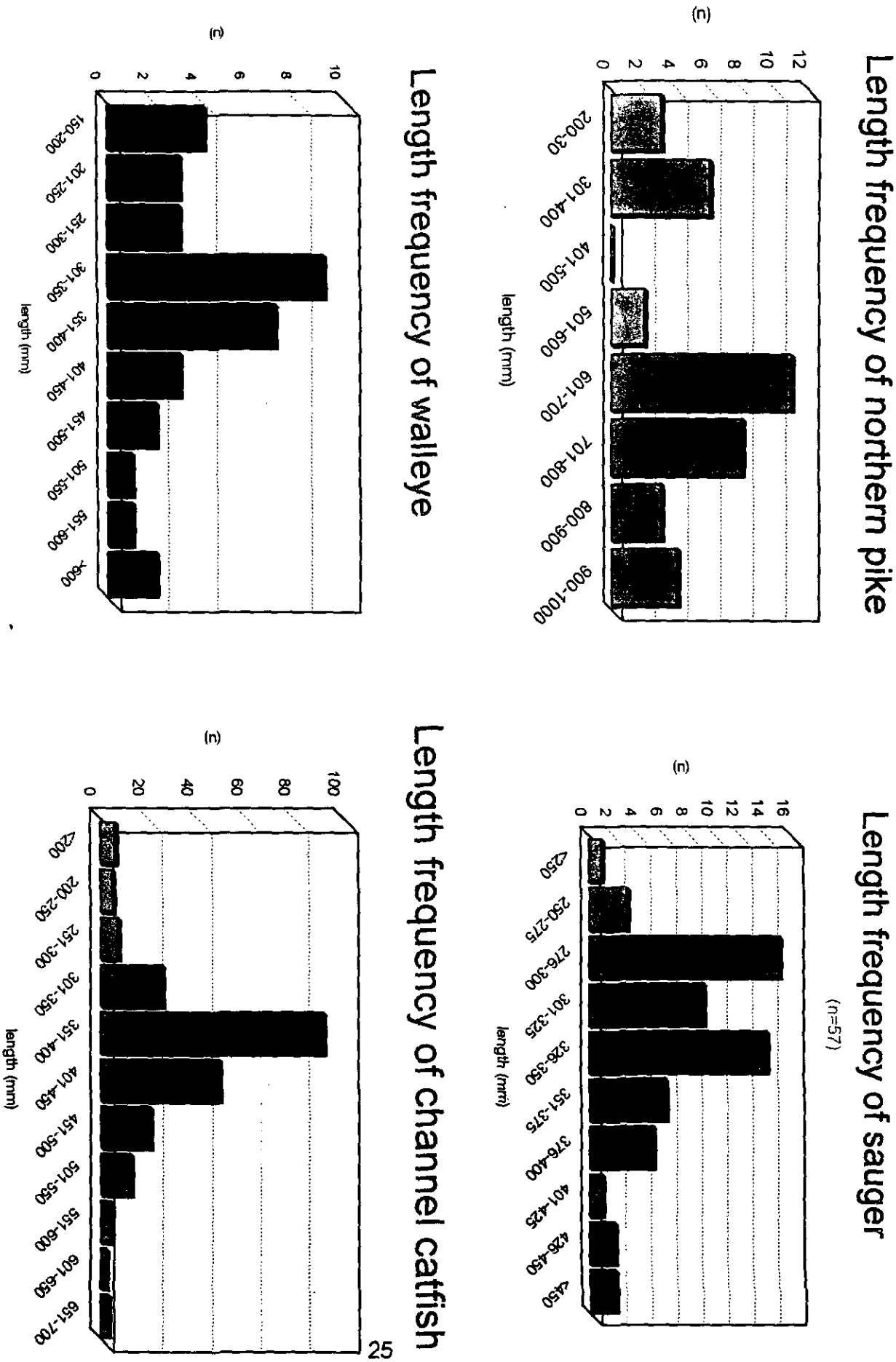

Figure 6. Length frequencies of selected Milk River Species