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Completion Report

Special Sampling of Flathead Catfish in the Minnesota River

by
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ABSTRACT

Little was known about flathead catfish *Pylodictis olivaris* in the Minnesota River because of difficulty in sampling; therefore, this study was undertaken to identify effective and efficient protocol for sampling the entire population. Data were also gathered on age, growth and movement. A total of 4,327 fish were collected between 1989 and 2000 primarily using setlining, low-frequency electrofishing, and early winter electrofishing. Additionally, weigh-ins for the Franklin, MN, Catfish Derby were conducted from 1989-2000. Standard electrofishing, hoopnetting, gillnetting and yo-yo setlining were also used, but found to be ineffective. Significant differences were found in mean lengths and weights of fish collected by early winter and low-frequency electrofishing and all other gear. The most effective sampling combination is trotlining for large fish and low-frequency electrofishing for small fish. Future work is needed to quantify habitat parameters and to correlate these with catch rates in order to estimate population sizes and year class strength. A total of 2,114 fish were tagged between 1990 and 1999, of which 532 were recaptured by Minnesota Department of Natural Resources, Division of Fisheries personnel and sport anglers. Upstream and downstream movement was observed in fish recaptured both by investigators and anglers. Radio telemetry tracking of fish is needed to elucidate seasonal and life stage habitat use and movements.

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INTRODUCTION

Walleye *Stizostedion vitreum* may be preferred by anglers statewide (Cook and Younk 1998), but their preference on the Minnesota River is catfish (Chapman 2001). Blue catfish *Ictalurus furcatus* have not been documented in the river, but flathead catfish *Pylodictis olivaris* and channel catfish *Ictalurus punctatus* are prized by resident and non-resident anglers alike. Although these two species are found in similar habitats, they differ in many respects. Adult flathead catfish are almost exclusively piscivorous (Turner and Summerfelt 1971), generally solitary (Hackney 1966) and large. In Minnesota, Phillips et al. (1982) report flathead catfish maximum weights that approach 70 lbs (32 kg). Channel catfish, on the other hand, are omnivorous (Hesse et al. 1982), found in large numbers (Jacobs et al. 1987), but smaller in size. In Minnesota, Phillips et al. (1982) report channel catfish maximum weights only around 40 lbs (18 kg).

Several studies sampled flathead catfish from the Minnesota River as part of fish community analyses, but with limited success (Huber 1959; Huber 1971; Schneider 1966; Kirsch et al. 1985). Little was known about the population; therefore, when the Minnesota Department of Natural Resources, Division of Fisheries began conducting the weigh-in at the Franklin, MN, Catfish Derby in July 1989. Many gear were tried to determine an effective sampling protocol in the Minnesota River and Stauffer and Koenen (1999) reported on results through September 1996. They recommended three years of confirmational sampling which are summarized in this report.

STUDY AREA

The Minnesota River has been described in numerous studies (Ojakangas and Matsch 1982; Kirsch et al. 1985; Fandrei et al. 1988; Underhill 1989; Quade and Nielsen 1993; Senjem 1997). Figure 1 depicts five principle sampling sites at New Ulm, Kettner's Landing, Franklin, North Redwood, and Minnesota Falls. River discharge between 1989 and 2000 from four gauging stations is presented in Figure 2.

METHODS

Following the recommendations of Stauffer and Koenen (1999), setlining, low-frequency electrofishing and early winter electrofishing were repeated in 1997-1999 with the following modifications to setlining. Sets were made during the pre-spawn period only and each site was sampled with four consecutive 24 h sets. Size 8/0 straight shanked hooks were exclusively used and baited with live 6-8 in (150 - 200 mm) black bullhead (*Ameiurus melas*). Lastly, 5- and 10-hook lines were set in 1997, but only 10-hook lines were set in 1998 and 1999 to standardize protocol. Flathead catfish were also collected during the 1998 riverwide population assessment (Chapman 2000), but only included in recapture analysis. Standard electrofishing, hoopnetting, gillnetting and yo-yo setlining were not used because they were deemed ineffective (Stauffer and Koenen 1999).

All flathead catfish collected were measured (mm total length), weighed (g) and released at the sampling site. Locations were recorded on maps from Kirsch et al. (1985). Fish 300 mm and longer were tagged with a numbered disc-dangler tag through 1999. Pectoral spines were removed for age and growth analysis through 1996 and in 1998. These were taken from a

maximum of five fish per 10 mm length group up to 300 mm and per 25 mm length group over 300 mm. We continued the weigh-in for the annual Franklin Catfish Derby through 2000. Fish recaptures were recorded from the derby and other sport anglers through 2000.

Data was compiled using Access™ database software and analyzed with Excel™ and Statistix™ software. Distances and some fish measurements are reported in both metric and English units to accommodate the scientific community and the public. Catch rates were calculated as number/mi (number/km) and number/h on-time for electrofishing and number/hook for set lines. DisBcal89 software (Missouri Department of Conservation) was used to determine back-calculation of growth and a minimum of two fish per length group were required by the program to perform calculations. Fish released during the Franklin Catfish Derby were excluded from recapture analysis to eliminate bias caused by displacement from capture site.

RESULTS AND DISCUSSION

A grand total of 4,327 flathead catfish were collected between 1989 and 2000 (Table 1). Between 1994 and 1999, 6,280 hooks were set on trot lines that were 5 to 15 hooks in length (Table 2) and 999 fish collected. A total of 1,166 limb lines were set (Table 3) and 239 fish collected. During 12 annual Franklin Catfish Derbies, 386 flathead catfish were handled. A total of 93 mi (150 km) of primarily bank habitat was sampled during 78 hours of low-frequency electrofishing from 1996 to 1999 and 2,558 fish collected (Tables 3 and 4). Lastly, 31 different pools were sampled during 77 early winter electrofishing runs and 145 fish collected.

The mean catch rate for trot lines was 0.16 fish/hook and ranged between 0.05 and 0.28 fish/hook (Table 2). The mean catch rate for limb lines was 0.21 fish/hook and ranged between

0.07 and 0.40 fish/hook (Table 3). The mean catch rate for low-frequency electrofishing was 27.5 fish/mi (17.1 fish/km) and ranged between 6.3 to 54.9 fish/mi or 4.0 to 34.1 fish/km (Table 4). The low-frequency electrofishing mean catch rate by time was 32.6 fish/hr and ranged between 12.6 and 55.8 fish/hr (Table 5). Mean catch rates for early winter electrofishing for pools where flathead catfish were present ranged from 1.7/hr to 66.7/hr. Flathead catfish were not sampled in 53 of the 77 runs. Variation in catch rates was due in part to modifications in protocol, but environmental variation at the macro- and micro-habitat levels, and their interactions, need to be quantified and then correlated with catch to be able to estimate populations (Layher and Maughan 1985; Lee and Terrell 1987; Layher and Brunson 1992; Sheehan, Lewis and Bodensteiner 1994; Filipek 1995; Cunjak 1996; Cunningham 1998; Hoel 1998; Tripe and Guy 1998; Mangan 1999).

Means comparison (Kruskal-Wallis, $p < 0.05$) resulted in three groups of gear which length and weight are significantly different and selective for progressively larger fish (Table 6). Low-frequency electrofishing sampled the smallest fish which averaged 270 mm (10.6 in) and 547 g (1.2 lbs). Early winter electrofishing sampled intermediate fish that averaged 677 mm (26.7 in) and 5,548 g (12.2 lbs). Sport angling fish were also intermediate in size, but since these were exclusively recaptured fish, they did not represent a genuine angling sample.

Trot lines, limb lines and the Franklin Catfish Derby sampled the largest fish which averaged between 828 and 868 mm (32.6 and 34.2 in) and 8,240 and 9,356 g (18.2 and 20.6 lbs). Mean lengths and weights for registered fish from the Franklin Catfish Derby are presented in Table 7. Size selectivity of gear is also shown by length frequency distributions (Table 8; Figure 3) and relative stock densities (Table 9). Only one trophy size (35.8 in or 910 mm; Gabelhouse

1984) fish was collected by low-frequency electrofishing, whereas other gear had relative stock densities of 20 to 44 for trophy size fish.

A length-weight regression was calculated for all gear types except sport angling and the Franklin Catfish Derby (Figure 4). An R^2 value of 0.938 indicates a strong relationship, but weight became more variable when length exceeded 900 mm. Variation in weight is likely caused by seasonal changes in body condition, sexual condition of females and weight of stomach contents (Stauffer and Koenen 1999).

A total of 305 pectoral spines were collected in 1998 (Table 10). These fish ranged in age from 1 to 21 years and all age classes were represented. An estimate of one to four annuli were missing from fish beginning at age five. Other studies reported five to seven missing annuli that first appeared in the three to five year old range (Turner 1982; Nash and Irwin 1999). Growth rates were lower for fish collected in 1998 than those presented in Stauffer and Koenen (1999). Gear selectivity is reflected in age distributions as well as length and weight differences. Low-frequency electrofishing sampled fish predominantly four years of age and younger, whereas set lines sampled fish beginning at six years of age (Figure 5). Age, growth and length frequency data generally confirm Stauffer and Koenen's (1999) contention that the flathead catfish population in the Minnesota River has good consistent reproduction and recruitment, and that large fish mortality appears to be low.

A total of 2,114 fish were tagged between 1990 and 1999 (Table 11) and of these, 532 were recaptured by DNR personnel, individual sport anglers and participants in the Franklin Catfish Derby. Recapture rates were as high as 4.9% of available tags during trotlining in 1997. The tagging was conducted over many years which limited the interpretation of recapture rates

because of migration and unquantified environmental conditions. Flathead catfish showed some movement both upstream and downstream of release sites (Table 12). The movement was greater for angler recaptured fish than for investigator recaptures, but without the intermediate location data which radio telemetry provides, the interpretation of movement data should be considered provisional (Chapman 1995).

To effectively sample flathead catfish in the Minnesota River different gear types need to be used to collect the different size and age classes. The most efficient sampling protocol appears to be low-frequency electrofishing for small fish and set lines for large fish. Limb lines may catch larger fish at a somewhat higher rate, but trot lines collect a larger sample with less effort by personnel (Stauffer and Koenen 1999). Early winter electrofishing samples fish intermediate in size between the other two gear, but has limits because of weather and high catch rate variability.

RECOMMENDATIONS

1. Manage the flathead catfish population in the Minnesota River as a part of the entire fish community, and manage the fish community on a watershed level. Conduct specialized sampling on a long-term predetermined schedule to monitor populations and communities.
2. Conduct research to identify and quantify important environmental variables and correlate these with populations and communities. Use radio telemetry to assess seasonal and life stage habitat use and movement and use GPS/GIS technology to georeference data.
3. Participate in the Franklin Catfish Derby and other tournaments on the river as a public relations activity. Sampling can be effectively conducted by DNR or other research personnel.
4. Assess angling interest and pressure on a predetermined and long-term schedule using riverwide creel surveys or public opinion surveys.

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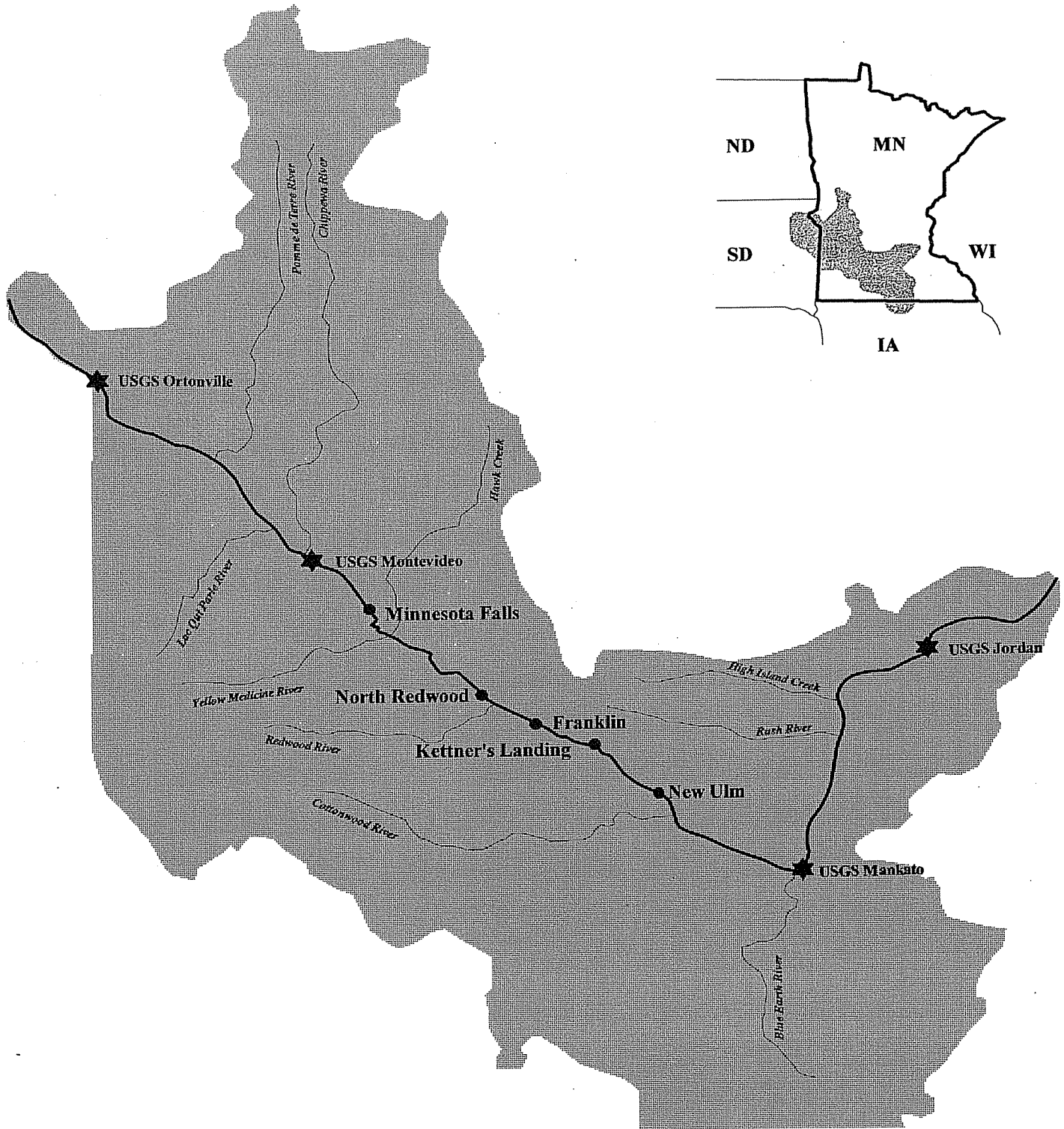


Figure 1. The Minnesota River watershed with sampling sites and USGS gauging stations.

Ortonville ———
 Montevideo
 Mankato ———
 Jordan

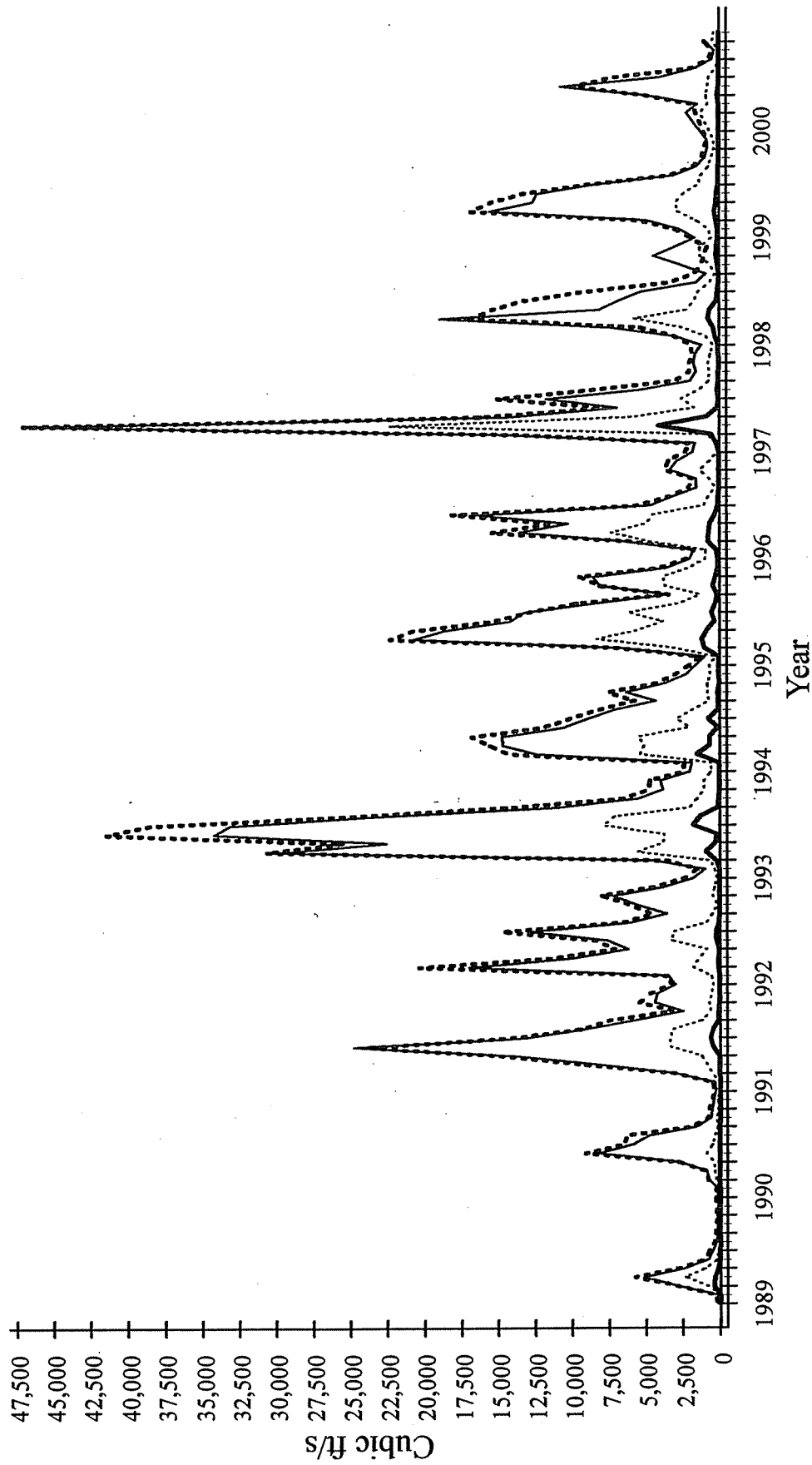


Figure 2. Flow (cubic ft/s) at four USGS gauging stations on the Minnesota River for 1989-2000.

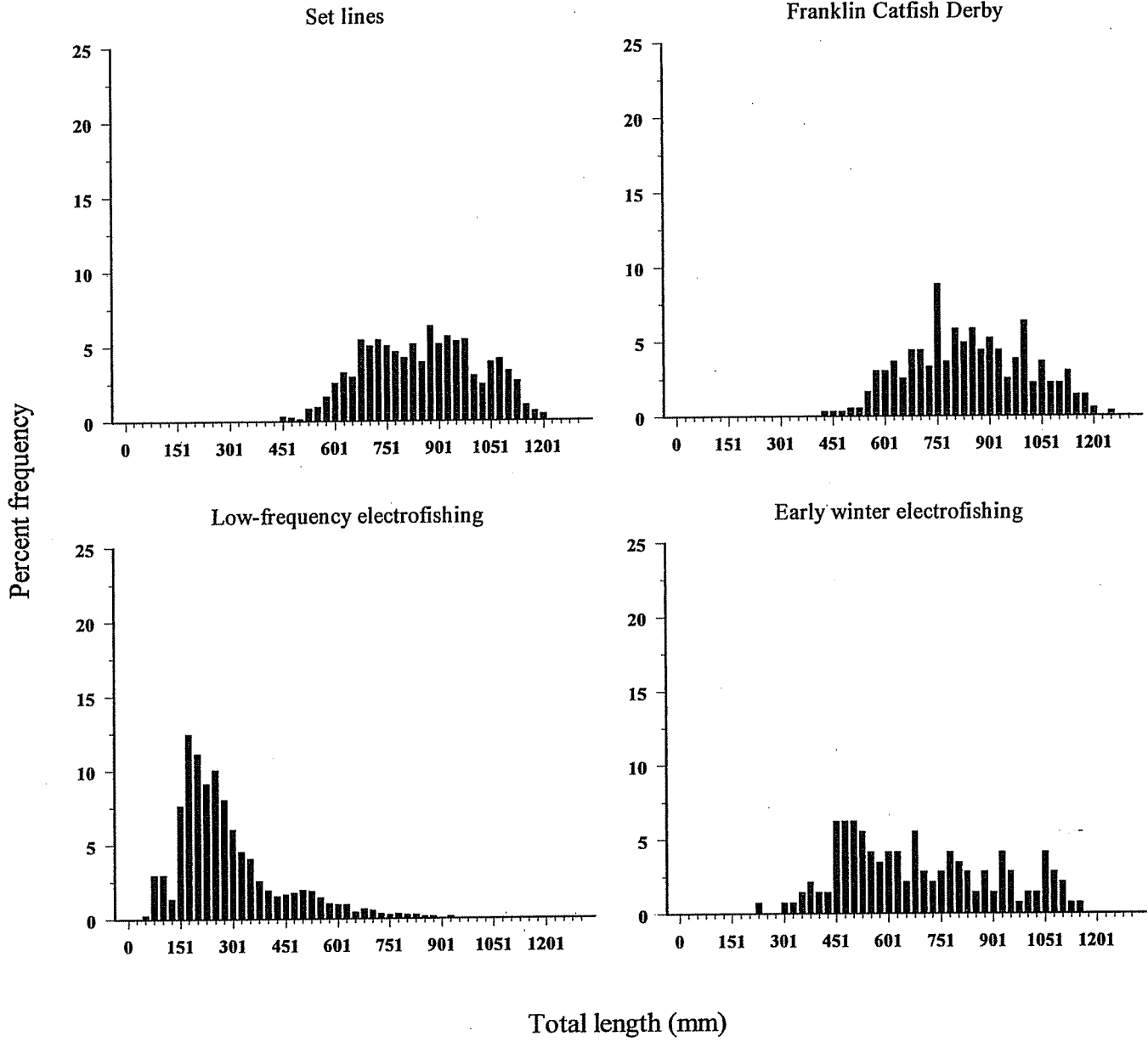


Figure 3. Length frequency histograms (25 mm length groups) of flathead catfish by gear from the Minnesota River 1989-2000.

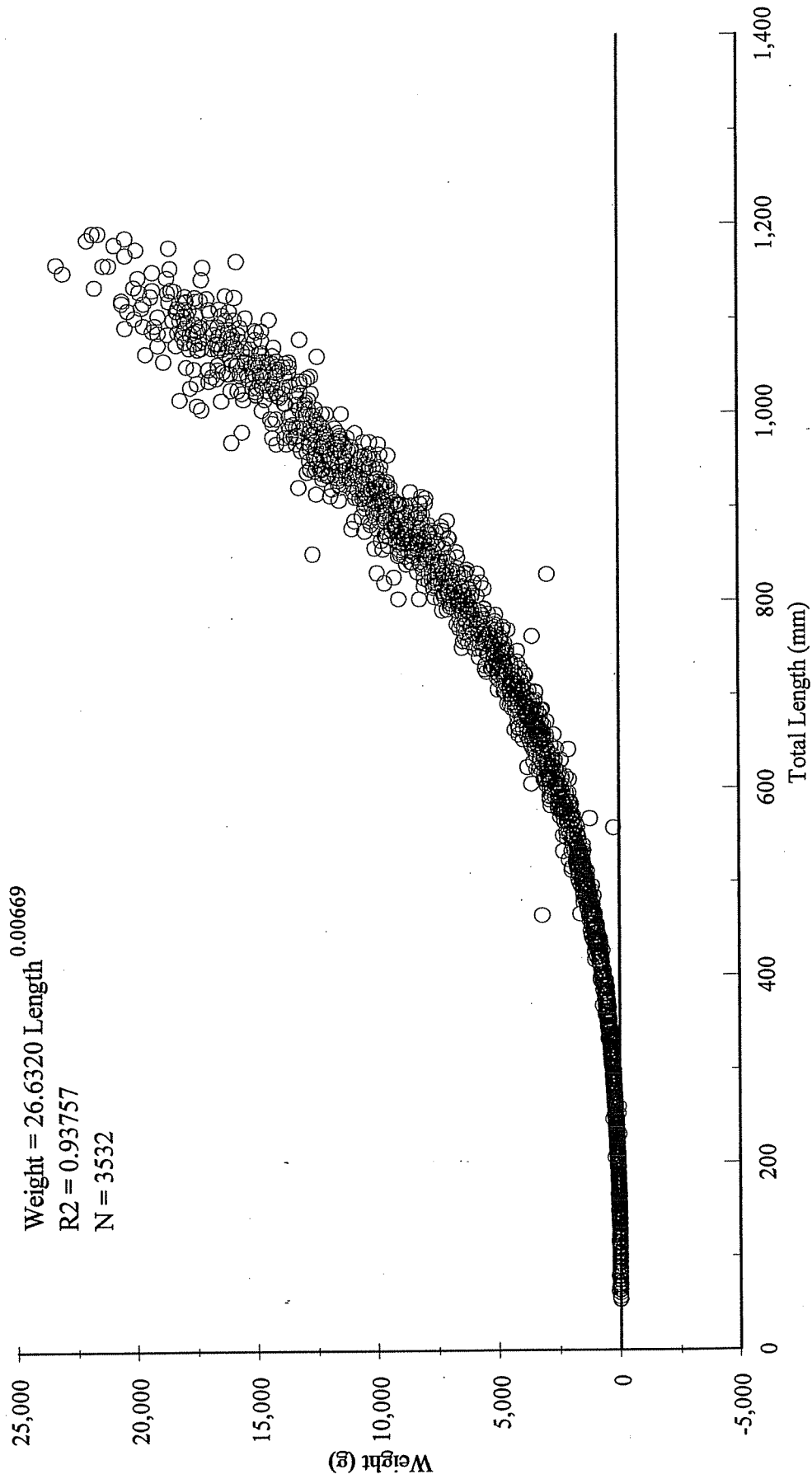


Figure 4. Length-weight regression for flathead catfish for all gear excluding sport angling and Franklin Catfish Derby from the Minnesota River 1989-2000.

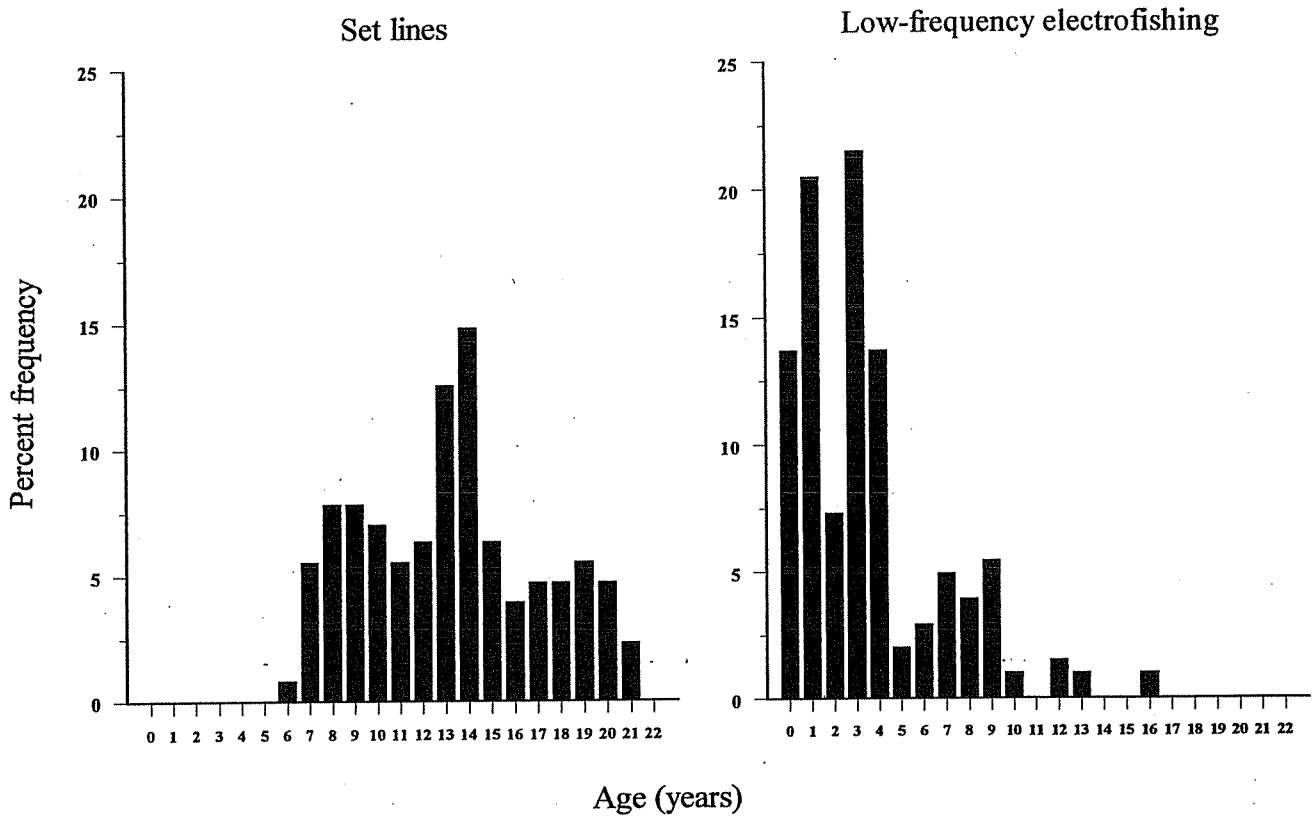


Figure 5. Age frequency histograms of flathead catfish sampled with set lines and low-frequency electrofishing from the Minnesota River 1989-2000.

Table 1. Total number of flathead catfish caught by gear from the Minnesota River 1989-2000.

	Trot lines	Limb lines	Franklin Catfish Derby	Low-frequency electrofishing	Early winter electrofishing	Total
1989	—	—	17	—	—	17
1990	—	—	34	—	—	34
1991	—	—	18	—	—	18
1992	—	—	23	—	—	23
1993	—	—	18	—	15	33
1994	87	30	28	—	49	194
1995	151	84	22	—	8	265
1996	—	—	49	697	30	776
1997	297	50	34	590	21	992
1998	233	40	62	626	22	983
1999	231	35	43	645	—	954
2000	—	—	38	—	—	38
Total	999	239	386	2,558	145	4,327

Table 2. Catch per unit effort (CPUE) by number of hooks for trotlining of flathead catfish in the Minnesota River 1989-2000.

Site	1994			1995			1997			1998			1999		
	Total fish	Total hooks ^a set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)
North Redwood	--	--	--	78	695 / 691	0.11	96	430 / 430	0.22	83	400 / 400	0.21	80	400 / 400	0.20
Franklin	28	585 / 585	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Kettner's Landing	59	705 / 700	0.08	73	655 / 655	0.11	93	400 / 395	0.24	67	400 / 400	0.17	91	400 / 398	0.23
New Ulm	--	--	--	--	--	--	108	410 / 390	0.28	83	400 / 396	0.21	60	400 / 400	0.15
Total	87	1,290 / 1,285	0.07	151	1,350 / 1,346	0.11	297	1,240 / 1,215	0.24	233	1,200 / 1,196	0.19	231	1,200 / 1,198	0.19

^a Total hooks fished equals the total hooks set minus those cut, broken or missing.

Table 3. Catch per unit effort (CPUE) by number of hooks for limblining of flathead catfish from the Minnesota River 1989-2000.

Site	1994			1995			1997			1998			1999		
	Total fish	Total hooks* set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)	Total fish	Total hooks set / fished	CPUE (hook)
North Redwood	--	--	--	40	269 / 269	0.15	13	56 / 56	0.23	16	40 / 40	0.40	5	39 / 39	0.13
Franklin	5	69 / 69	0.07	--	--	--	--	--	--	--	--	--	--	--	--
Kettner's Landing	25	163 / 163	0.15	44	238 / 238	0.18	21	68 / 63	0.33	11	28 / 28	0.39	15	40 / 40	0.38
New Ulm	--	--	--	--	--	--	16	56 / 56	0.29	13	48 / 48	0.27	15	40 / 39	0.38
Total	30	232 / 232	0.13	84	507 / 507	0.17	50	180 / 175	0.29	40	128 / 116	0.34	35	119 / 118	0.30

* Total lines fished equals the total lines set minus those cut, broken or missing.

Table 4. Catch per unit effort (CPUE) by distance shocked (miles and kilometers) for low-frequency electrofishing of flathead catfish from the Minnesota River 1989-2000.

Site	1996			1997			1998			1999		
	Total fish	Distance (mi / km)	CPUE (mi / km)	Total fish	Distance (mi / km)	CPUE (mi / km)	Total fish	Distance (mi / km)	CPUE (mi / km)	Total fish	Distance (mi / km)	CPUE (mi / km)
Minnesota Falls	113	6.4 / 10.3	17.7 / 11.0	98	6.3 / 10.1	15.6 / 9.7	84	6.3 / 10.1	13.3 / 8.3	121	6.3 / 10.1	19.2 / 12.0
North Redwood	107	4.8 / 7.7	22.3 / 13.9	64	5.2 / 8.4	12.3 / 7.6	106	5.2 / 8.4	20.4 / 12.6	249	5.2 / 8.4	47.9 / 29.6
Franklin	87	2.3 / 3.7	37.8 / 23.5	69	2.7 / 4.3	25.6 / 16.0	74	2.7 / 4.3	27.4 / 17.2	17	2.7 / 4.3	6.3 / 4.0
Kettner's Landing	121	2.7 / 4.3	44.8 / 28.1	166	4.9 / 7.9	33.9 / 21.0	180	4.9 / 7.9	36.7 / 22.8	108	4.9 / 7.9	22.0 / 13.7
New Ulm	269	4.9 / 7.9	54.9 / 34.1	193	4.9 / 7.9	39.4 / 24.4	182	4.9 / 7.9	37.1 / 23.0	150	4.9 / 7.9	30.6 / 19.0
Total	697	21.1 / 33.9	33.0 / 20.6	590	24.0 / 38.6	24.6 / 15.3	626	24.0 / 38.6	26.1 / 16.2	645	24.0 / 38.6	26.9 / 16.7

Table 5. Catch per unit effort (CPUE) by time shocked (hours) for low-frequency electrofishing of flathead catfish from the Minnesota River 1989-2000.

Site	1996		1997		1998		1999		
	Total fish	On time (hr)	Total fish	On time (hr)	Total fish	On time (hr)	Total fish	On time (hr)	
Minnesota Falls	113	4.94	98	4.54	84	4.58	121	4.45	
North Redwood	107	4.49	64	3.87	106	4.30	249	7.95	
Franklin	87	2.20	69	2.24	74	1.42	17	1.35	
Kettner's Landing	121	3.08	166	3.97	180	3.95	108	3.43	
New Ulm	269	4.82	193	3.97	182	3.68	150	5.16	
Total	697	19.53	590	18.59	626	17.92	645	22.34	
									28.9

Table 6. Mean length and weight of flathead catfish by gear from the Minnesota River 1989-2000. Different letters in a column indicate significantly different means (Kruskal-Wallis, $p < 0.05$).

Sampling Gear	Mean Length (mm / in)	S.E. of Mean Length	Mean Weight (g / lbs)	S.E. of Mean Weight
Trot Lines	833 / 32.8 a	5 / 0.2	8,251 / 18.2 a	147 / 0.3
Limb Lines	868 / 34.2 a	11 / 0.4	9,356 / 20.6 a	324 / 0.7
Franklin Catfish Derby	828 / 32.6 a	9 / 0.4	8,240 / 18.2 a	249 / 0.5
Sport Angling	803 / 31.6 ab	24 / 0.9	8,017 / 17.7 ab	443 / 1.0
Low-Frequency Electrofishing	270 / 10.6 c	3 / 0.1	547 / 1.2 c	24 / 0.1
Early Winter Electrofishing	677 / 26.7 b	18 / 0.7	5,548 / 12.2 b	474 / 1.0

Table 7. Total number, mean and maximum length and mean and maximum weight of flathead catfish registered in the Franklin Catfish Derby 1989-2000. Different letters in a column indicate significantly different means (Kruskal-Wallis, $p < 0.05$).

Year	Number registered fish	Mean length (mm / in)	Maximum length (mm / in)	Mean weight (g / lbs)	Maximum weight (g / lbs)
1989	17	941 / 37.0 ab	1,245 / 49.0	10,231 / 22.6 a	17,236 / 38.0
1990	34	843 / 33.2 ab	1,170 / 46.1	8146 / 18.0 abc	17,191 / 37.9
1991	18	733 / 28.9 ab	1,069 / 42.1	6091 / 13.4 bc	17,916 / 39.5
1992	23	771 / 30.4 ab	1,197 / 47.1	6929 / 15.3 abc	17,780 / 39.2
1993	18	766 / 30.2 ab	1,031 / 40.6	6659 / 14.7 abc	15,604 / 34.4
1994	28	741 / 29.2 a	1,107 / 43.6	6164 / 13.6 bc	16,924 / 37.3
1995	22	764 / 30.1 ab	986 / 38.8	6421 / 14.2 abc	13,183 / 29.1
1996	49	840 / 33.1 ab	1,124 / 44.3	8813 / 19.4 abc	19,958 / 44.0
1997	34	813 / 32.0 ab	1,072 / 42.2	7,933 / 17.7 abc	15,365 / 33.9
1998	62	837 / 33.0 ab	1,151 / 45.3	8,385 / 18.5 abc	19,419 / 42.8
1999	43	880 / 35.0 ab	1,171 / 46.1	9,496 / 20.9 ab	19,561 / 43.1
2000	38	914 / 36.0 b	1,165 / 45.9	10,703 / 23.6 a	21,338 / 47.1
Total	386	828 / 32.6	1,245 / 49.0	8,240 / 18.2	21,338 / 47.1

Table 8. Length frequency distribution of flathead catfish with recorded lengths by gear from the Minnesota River 1989-2000.

Total length (mm)	Trot lines	Limb lines	Franklin Catfish Derby	Low-frequency electrofishing	Sport angling	Early winter electrofishing	Total
51-75				5			5
76-100				78			78
101-125				78			78
126-150				34			34
151-175				204			204
176-200				335			335
201-225				300			300
226-250				246		1	247
251-275				270			270
276-300				215			215
301-325				161		1	162
326-350				122	1	1	124
351-375				109	1	2	112
376-400				68	1	3	72
401-425				52		2	54
426-450			1	41		2	44
451-475	2	2	1	42		9	56
476-500	2	1	1	47	1	9	61
501-525	1		2	51	1	9	64
526-550	7	4	2	48	3	8	72
551-575	10	2	6	37		6	61
576-600	18	3	11	26	1	5	64
601-625	29	4	11	24	7	6	81
626-650	38	4	13	25	8	6	94
651-675	36	2	9	10	9	3	69
676-700	62	10	16	17	8	8	121
701-725	57	9	16	14	4	4	104
726-750	62	9	12	7	4	3	97
751-775	55	11	32	5	3	4	110
776-800	50	11	13	8	3	6	91
801-825	43	13	21	6	4	5	92
826-850	56	12	18	5	7	4	102
851-875	44	8	21	4	4	2	83
876-900	70	13	16	3	5	4	111
901-925	56	11	19	1	3	2	92
926-950	62	12	16	2	6	6	104
951-975	58	12	9		4	4	87
976-1000	54	17	14		2	1	88
1001-1025	30	10	23		6	2	71
1026-1050	22	10	8	1	4	2	47
1051-1075	42	9	13		1	6	71
1076-1100	42	12	8		5	4	71
1101-1125	30	13	8		3	3	57
1126-1150	24	10	11		2	1	48
1151-1175	10	3	5		1	1	20
1176-1200	6	2	5		1		14
1201-1225	5		2		1		8
1226-1250			0		1		1
1251-1275			1				1
Total	1,083	239	364	2,701	115	145	4,647

Table 9. Relative stock densities (RSD) of flathead catfish by gear from the Minnesota River 1989-2000.

	Trot lines	Limb lines	Franklin Catfish Derby	Low- frequency electrofishing	Early winter electrofishing	Total
Proportional ^{280mm}	100	100	100	45	94	82
Preferred ^{410mm}	93	93	91	11	53	63
Memorable ^{610mm}	74	82	74	4	42	50
Trophy ^{910mm}	33	44	32	> 1	20	22

Table 10. Mean back-calculated length (mm TL) at annulus of flhead catfish sampled by all gear from the Minnesota River 1979-2000. Asterisk (*) indicates missing annulus in all fish aged in that group.

Age	N	Age Group																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	42	72																				
2	15	80	161																			
3	44	73	159	239																		
4	28	80	164	256	329																	
5	4	*	135	242	337	417																
6	7	114	207	278	397	480	533															
7	17	160	201	263	343	435	507	555														
8	18	141	217	293	373	450	527	579	616													
9	21	160	211	258	351	423	499	564	611	640												
10	11	*	187	278	408	499	564	616	670	712	743											
11	7	*	184	271	362	484	535	595	651	719	777	816										
12	11	117	196	252	299	361	440	530	582	630	682	723	749									
13	18	*	200	279	340	397	454	529	603	655	699	746	786	816								
14	19	*	196	266	341	405	459	510	597	660	714	766	812	859	887							
15	8	*	211	262	345	434	499	564	626	683	734	771	804	842	875	904						
16	7	*	172	260	314	389	451	493	535	585	648	708	750	790	823	846	867					
17	6	*	*	281	382	462	543	627	690	720	771	854	900	940	965	1009	1027					
18	6	*	153	222	286	352	427	508	574	621	668	722	770	806	836	861	888	915	938			
19	7	*	*	240	306	383	454	532	597	657	703	761	806	829	862	892	917	941	960	977		
20	6	*	215	258	337	403	489	564	643	717	780	833	865	889	912	940	958	984	1001	1017	1033	
21	3	*	*	275	345	428	513	588	654	731	796	830	876	916	935	952	970	992	1007	1020	1030	1039
Mean	86	181	261	345	424	492	554	613	663	719	766	802	845	883	906	929	968	971	1000	1032	1039	1039
Total	305																					

Table 11. Total number of flathead catfish tagged and recaptured, and total number of available tags and recapture rate by gear from the Minnesota River 1989-2000. Recapture rate is the percentage of available tags.

	Trot ^a lines	Limb ^a lines	Franklin Catfish Derby	Low- frequency electrofishing	Early winter electrofishing	Sport ^b angling	Total
1990							
Total number of new tags	—	—	17	—	—	—	17
Total number of recaptured fish	—	—	0	—	—	0	0
Total number of available tags	—	—	17	—	—	17	17
Recapture rate	—	—	0.0	—	—	0.0	—
1991							
Total number of new tags	—	—	10	—	—	—	10
Total number of recaptured fish	—	—	0	—	—	0	0
Total number of available tags	—	—	27	—	—	27	27
Recapture rate	—	—	0.0	—	—	0.0	—
1992							
Total number of new tags	—	—	18	—	—	—	18
Total number of recaptured fish	—	—	0	—	—	0	0
Total number of available tags	—	—	45	—	—	45	45
Recapture rate	—	—	0.0	—	—	0.0	—
1993							
Total number of new tags	—	—	13	—	8	—	21
Total number of recaptured fish	—	—	0	—	0	0	0
Total number of available tags	—	—	58	—	66	66	66
Recapture rate	—	—	0.0	—	0.0	0.0	—

^a Conducted concurrently and number of available tags are totaled together.

^b All fish caught by sport anglers are recaptures. Fish kept by anglers are subtracted (number in parentheses) from the total number of available tags at the end of each year.

Table 11 continued.

	Trot lines	Limb lines	Franklin Catfish Derby	Low-frequency electrofishing	Early winter electrofishing	Sport angling	Total
1994							
Total number of new tags	84	27	19	—	43	—	176
Total number of recaptured fish	1	3	2	—	2	0	8
Total number of available tags ^c	180	180	199	—	242	242	242
Recapture rate	0.6	1.7	1.0	—	0.8	0.0	—
1995							
Total number of new tags	138	78	19	28	8	—	280
Total number of recaptured fish	13	6	0	0	0	4	23
Total number of available tags ^d	459	459	478	514	522	522	522
Recapture rate	2.8	1.3	0.0	0.0	0.0	0.8	—
1996							
Total number of new tags	—	—	44	181	28	(7)	265
Total number of recaptured fish	—	—	5	9	2	13	29
Total number of available tags ^e	—	—	566	759	787	780	780
Recapture rate	—	—	0.9	1.2	0.3	1.7	—
1997							
Total number of new tags	246	43	29	190	3	(6)	511
Total number of recaptured fish	49	6	2	22	3	30	112
Total number of available tags ^f	1,069	1,069	1,098	1,294	1,297	1,291	1,291
Recapture rate	4.9	0.6	0.2	1.8	0.2	2.5	—

^c Three fish were caught and tagged by hoopnetting, yo-yoing, and investigator angling and added to the total number of tags in June.

^d One fish was caught and tagged by investigator angling and 8 fish by regular electrofishing, and were added to the total number of tags in June and August, respectively.

^e Twelve fish were caught and tagged by regular electrofishing in September and added to the total number.

^f Six fish were tagged during standard electrofishing in August and added to the total number of tags.

Table 11 continued.

	Trot lines	Limb lines	Franklin Catfish Derby	Low-frequency electrofishing	Early winter electrofishing	Sport angling	Total
1998							
Total number of new tags	233	40	52	203	21	(9)	487
Total number of recaptured fish	68	9	6	31	1	32	147
Total number of available tags ^s	1,482	1,482	1,534	1,757	1,778	1,769	1,769
Recapture rate	4.8	0.6	0.4	1.8	0.1	1.9	—
1999							
Total number of new tags	164	29	27	103	—	(9)	323
Total number of recaptured fish	67	6	5	22	—	48	148
Total number of available tags	1,962	1,962	1,989	2,092	—	2,083	2,083
Recapture rate	3.5	0.3	0.3	1.1	—	2.4	—
2000							
Total number of new tags	—	—	0	—	—	(15)	0
Total number of recaptured fish	—	—	6	—	—	54	60
Total number of available tags	—	—	2,083	—	—	2,068	2,068
Recapture rate	—	—	0.3	—	—	2.7	—
Total	793	207	248	705	111	—	2,114
Total number of recaptured fish	184	21	13	75	6	110	469

^s Twenty fish were tagged during the population assessment in August and added to the total number of tags.

Table 12. Distance moved and days at-large between release and recapture by tagged flathead catfish from the Minnesota River 1989-2000.

	Number of recaptures ^a	Distance moved (mi / km)		Days at-large	
		Mean	SE	Mean	SE
Total investigator recaptures	337	—	—	—	—
No movement	53	0.0 / 0.0	0.0 / 0.0	286.4	278.7
Upstream	135	3.4 / 5.5	11.4 / 18.3	500.0	334.3
Downstream	149	3.7 / 6.0	11.1 / 17.9	461.7	356.9
Total angler recaptures	195	—	—	—	—
No movement	9	0.0 / 0.0	0.0 / 0.0	165.4	247.8
Upstream	86	14.9 / 24.0	23.0 / 37.0	531.4	445.3
Downstream	100	18.9 / 30.4	24.1 / 38.8	617.6	517.3
Total combined recaptures	532	—	—	—	—
No movement	62	0.0 / 0.0	0.0 / 0.0	268.8	275.9
Upstream	221	7.9 / 12.7	17.7 / 24.5	512.2	385.3
Downstream	249	9.8 / 15.8	19.9 / 32.0	524.3	434.4

^a 68 recaptures were not included because fish were not released at sampling site (such as during the Franklin Catfish Derby) or because recapture data was incomplete.

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

Completion Report:

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by
Bobbi Chapman

Approved by:

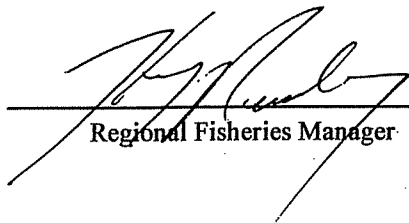


Area Fisheries Supervisor

1/25/02

Date

Approved by:



Regional Fisheries Manager

1 Feb 02

Date