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DISTRIBUTION AND HABITAT SELECTION OF THE SHOVELNOSE STURGEON (Scaphirhynchus platorynchus) IN THE MINNESOTA RIVER

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INTRODUCTION

The shovelnose sturgeon (Scaphirhynchus platorynchus) has recently been of some concern because of apparent population reductions throughout much of its range in Minnesota and has recently been placed on the list of Special Concern by the Fish Group Committee of the Endangered Species Advisory Committee. The Minnesota River flowing through southern Minnesota may be one such area of concern. While it apparently had once been relatively abundant, MDNR surveys (Huber 1959, Schneider 1966) did not report it and other authorities such as Eddy and Underhill (1974) believed sturgeon to be scarce or absent altogether. A more recent MDNR survey of the river in 1980 and 1982 yielded few specimens (Kirsch, et al. 1985). In contrast, rather substantial numbers of shovelnose sturgeon have been captured over the years in samples collected by personnel at Gustavus Adolphus College in St. Peter, Minnesota. The occurrence, age composition and food habits of sturgeon in the Minnesota River were reported in 1979 by Durkee, et al. (1979). Continued interest in the sturgeon led to subsequent investigations which further substantiated the sturgeon's relative abundance in the vicinity of St. Peter. The primary goal of these studies was to determine by radiotelemetry and netting, the fall movements and habitat selection of shovelnose sturgeon (manuscript in preparation).

The purpose of this present study was essentially two-fold. Because much of what we know about the sturgeon's relative abundance and habitat selection is from a rather small portion (15 km) of the total river length (533 km) it was considered important to determine

their general distribution throughout the system. Secondly, what has been learned about this fish has been primarily from fall and early winter investigations and it was considered important to supplement this information with summer gathered data. In brief, we were interested in determining if sturgeon could be captured in the summer throughout the river with about the same success rate as is possible in a small study area in the fall. We were also interested in determining if sturgeon generally utilized summer habitats similiar to those we have come to expect them to utilize during the fall.

STUDY AREA AND METHODS

The Minnesota River is characterized generally as a moderately slow, turbid stream that flows 533 km through southern and western Minnesota. It encompasses a watershed of 27040 km^2. has a flow rate that varies considerably and is prone to seasonal flooding. The study area involved the river from Rkm 107.2 near Henderson, Minnesota, upstream to Rkm 416 above the Minnesota Falls dam at Granite Falls. Eight stations were chosen within the study area on the basis of stream characteristics and known access availability (Table 1).

Sturgeon were collected using 30.5 m experimental gill nets with 7.6 m panels of 2.5 cm, 5 cm, 7.5 cm, and 10 cm mesh. Two nets were set at each station with mostly four net days (30.5 m gill net in place for a 24 hour period) logged on each net at

Table 1. Location of sample stations utilized during 1985 sturgeon (*Scaphirhynchus platorynchus*) survey.

Station	Nearest Town	River Mile	River Kilometer
1	Henderson, MN	RM 67-68	RKm 107-109
2	St. Peter, MN	RM 98-99	RKm 157-158
3	Judson, MN	RM 123-125	RKm 197-200
4	New Ulm, MN	RM 148-153	RKm 237-246
5	Franklin, MN	RM 199-202	RKm 318-323
6	North Redwood, MN	RM 222-224	RKm 355-358
7	Minnesota Falls Dam	RM 252-255	RKm 403-407
8	Granite Falls Dam	RM 258-259	RKm 413-414

each station. Nets were generally set perpendicular to the main current with one end anchored near shore and the other anchored in mid channel. Previous work (Merrick, unpublished) has shown that no difference exists between mesh size and sturgeon caught.

Based on previous experience in successfully netting sturgeon, net locations were generally chosen to sample water in deep eddies and undercut banks (3-5 m). However, to insure that most habitat types were sampled in this study, nets were placed in moderately deep areas (1-2.5 m) of shallow eddies, below rapids and riffles, and in shallow (.5-1.5 m) sandy - gravely "runs".

Nets were checked daily beginning with the midchannel end of the net and working towards shore. Captured sturgeon were measured to the nearest centimeter (caudal peduncle standard length), weighed to the nearest 0.1 Kg, marked with a MDNR dangler type tag attached to the caudal peduncle, and released. Captured game fish were measured, weighed, recorded, and released if still alive. Rough fish were only tallied.

Because gill netting in the river is a rather imprecise sampling tool for a variety of reasons (i.e. frequent net fouling by a wide variety of materials, holes torn in the netting, shifting substrate, etc.) no serious statistical methods were used to analyze the data. Generalizations, percentages and comparison with previous success is all that can reasonably be accomplished. Data was also recorded regarding water depth at the net, temperature, and stream morphology.

Although success was considered unlikely, seine hauls with a 6m bag type minnow seine was made at convenient locations in an attempt to capture sub-adult sturgeon.

An informal angler survey was made during the study. This simply involved engaging encountered fishermen in conversation and determining whether they were familiar with the occurrence of sturgeon in the river.

RESULTS

A total of 59 net days from 7/29/85 to 8/23/85 produced 215 fish representing 19 different species (Table 2). Capture rate during this period was 3.6 fish per net day. The most numerous species caught were carp, quillback, sheepshead, and sturgeon respectively and they comprised 67% of the total catch. Sturgeon made up 8.4% of the total catch with 18 individuals being captured. The highest capture rate of sturgeon occurred at Station 1 (Rkm 107), with 8 fish in 6 net days comprising 21% of the total catch at that station. Throughout the study period the average rate of capture was .3 sturgeon per net day. No sturgeon were taken at Station 8 in 10 net days, and at Station 7 no sturgeon were captured in 6 net days. Sturgeon were captured at all other stations. Tables 2-5 show the total species, number, percentage and fish captured per net at each of the eight stations.

Habitat

About 70% of the netting effort was concentrated in deep, main channel areas of the river associated with deep eddies and

Table 2. Fish species collected with gill nets from the Minnesota River between July 30 and August 22, 1985.

FAMILY Scientific Name	Common Name
ACIPENSERIDAE	
Scaphirhynchus platorynchus	Shovelnose sturgeon
LEPISOSTEIDAE	
Lepisosteus platostomus	Shortnose gar
AMIIDAE	
Amia culva	Bowfin
HIODONTIDAE	
Hiodon alosoides	Goldeye
ESOCIDAE	
Esox lucius	Northern pike
CYPRINIDAE	
Cyprinus carpio	Carp
CATOSTOMIDAE	
Carpiodes sp.	Carp sucker
Catostomus commersoni	White sucker
Hypentelium nigricans	Northern hog sucker
Ictiobus sp.	Buffalo
Moxostoma anisurum	Silver redhorse
Moxostoma aureolum	Northern redhorse
ICTALURIDAE	
Ictalurus punctatus	Channel catfish
Notorus flavus	Stonecat
Pylodictis olivaris	Flathead catfish
PERCIDAE	
Stizostedion canadense	Sauger
Stizostedion vitreum vitreum	Walleye
SCIAENIDAE	
Aplodinotus grunniens	Freshwater drum

*Because of uncertainties, these were not identified to species.

Table 3. Total number of fish caught at eight stations sampled in the Minnesota River from July 30 to August 22, 1985.

Species	Station 1	2	3	4	5	6	7	8	Total
Shovelnose sturgeon	8	2	2	3	2	1	-	-	18
Shortnose gar	1	1	2	-	-	-	-	-	4
Bowfin	1	-	-	-	-	-	-	-	1
Goldeye	-	3	-	-	-	-	-	-	3
Northern pike	2	3	-	-	-	1	-	-	6
Carp	17	11	4	10	1	18	4	10	'75
Carpsucker (sp.)	-	-	1	-	-	1	-	-	2
Quillback	4	7	2	4	-	5	6	-	28
White sucker	-	-	-	-	-	-	-	2	2
Hogsucker	-	-	-	-	-	1	-	-	1
Buffalo	1	-	-	1	-	-	1	-	3
Redhorse (sp.)	-	-	2	3	-	-	2	6	13
Channel catfish	1	2	2	1	2	3	-	6	17
Flathead catfish	1	-	1	1	-	-	-	-	3
Sauger	1	1	-	-	-	1	-	-	3
Walleye	1	7	3	2	-	-	3	1	17
Freshwater drum	-	-	1	11	1	-	-	5	18
Stone cat	-	-	-	-	-	-	-	1	1
Total	38	37	20	36	6	31	16	31	215

Table 4. Percentage of total number of fish caught at each of eight stations sampled in the Minnesota River between July 30 and August 22, 1985.

Species	Station 1	2	3	4	5	6	7	8	Total
Shovelnose sturgeon	21.1	5.4	10.0	8.3	33.3	3.2	-	-	8.4
Shortnose gar	2.6	2.7	10.0	-	-	-	-	-	1.9
Bowfin	2.6	-	-	-	-	-	-	-	0.5
Goldeye	-	8.1	-	-	-	-	-	-	1.4
Northern pike	5.2	8.1	-	-	-	3.2	-	-	2.8
Carp	44.7	29.7	20.0	27.7	16.5	58.1	25.0	32.3	34.9
Carpsucker	-	-	5.0	-	-	3.2	-	-	1.0
Quillback	10.5	18.9	10.0	11.1	-	16.1	37.5	-	1.3.0
White sucker	-	-	-	-	-	-	-	6.4	1.0
Hog sucker	-	-	-	-	-	3.2	-	-	0.5
Buffalo	2.6	-	-	2.7	-	-	6.3	-	1.4
Redhorse	-	-	10.0	8.3	-	-	12.5	19.4	6.0
Channel catfish	2.6	5.4	10.0	2.7	33.3	9.7	-	19.4	7.9
Flathead catfish	2.6	-	5.0	2.7	-	-	-	-	1.4
Sauger	2.6	2.7	-	-	-	3.2	-	-	1.4
Walleye	2.6	18.9	15.0	5.5	-	-	18.8	3.2	7.9
Freshwater drum	-	-	5.0	29.4	16.5	-	-	16.1	8.3
Stone cat	-	-	-	-	-	-	-	3.2	0.5

Table 5. Fish captured per net day at each of eight stations on the Minnesota River between July 30 and August 22, 1985.

Species	Stations 1	2	3	4	5	6	7	8	Total
Shovelnose sturgeon	1.33	.33	.25	.37	.28	.13	-	-	.31
Shortnose gar	.16	.16	.25	-	-	-	-	-	.07
Bowfin	.16	-	-	-	-	-	-	-	.02
Goldeye	-	.50	-	-	-	-	-	-	.05
Northern pike	.33	.50	-	-	-	-	-	-	.10
Carp	2.83	1.83	.50	1.25	.14	2.25	.67	1.00	1.27
Carpsucker	-	-	..12	-	-	.13	- -		.03
Quillback	.66	1.16	.25	.50	-	.63	1.00	-	.47
White sucker	-	-	-	-	-	-	-	.20	.03
Hog sucker	-	-	-	-	-	.13	-	-	.02
Buffalo	.16	-	-	.12	-	-	.17	-	.05
Redhorse	-	-	.25	.37	-	-	.33	.60	.22
Channel catfish	.16	.33	.25	.12	.28	.38	-	.60	.28
Flathead catfish	.16	-	.25	.12	-	-	.50	-	.05
Sauger	.16	.16	-	-	-	.13	-	-	.05
Walleye	.16	1.16	.37	.25	-	.13	-	.10	.28
Freshwater drum	-	-	.12	1.37	.14	-	-	.50	.31
Stone cat	-	-	-	-	-	-	-	.10	.02
Total	6.16	6.33	2.50	4.50	.85	3.88	2.67	3.10	3.64

undercut bank (5-12 m. depth). Of the sturgeon captured about 90% were found in these areas and the catch rate was .4 sturgeon per day. A total of 7 net days, 12% of the total effort, was in shallow runs (.5-1.5 m. depth). These areas yielded two sturgeon resulting in a capture rate of .27 sturgeon per net day. A total of 11 net days, or 19% of the total effort, was in moderate depths associated with shallow eddies, riffles, and rapids (1-2.5 m depth). No sturgeon were captured in these areas. (See Table 6 and 7 .)

Size and Weight

Captured sturgeon ranged in length from 31 cm to 72 cm with an average length of 57.9 cm (22.8 in.). Weights ranged from 0.3 kg to 2.0 kg with an average weight of 1.2 kg (2.67 lbs.). (See Table 7 .)

Of the 18 sturgeon captured, neither mortality or serious injury resulted from the use of gill nets. However 2 specimens were taken for the MDNR collection.

No fish tagged during this study nor fish from previous studies were captured.

Seine Hauls

Seine hauls at selected areas did not yield any sturgeon. This was not unexpected as seine hauls in the St. Peter area have never produced sturgeon.

Table 6. Sturgeon frequency and habitat selection as determined by the total netting effort during the study period July 30 to August 22, 1985.

Habitat Type	Net Days	% of Total Effort	Sturgeon Captured	Sturgeon per Net Day
Deep main channel (deep eddie or under cut bank)	41	69%	16	.39
Moderate depth (shallow eddie riffle or rapid)	11	19%	0	0
Shallow run	7	12%	2	.27
Total	59	100%	18	.30

Table 7. Composite summary of data obtained between July 30 and August 22, 1985, including tag numbers.

Tag Number	Weight (Kg.)	Length (cm)	Habitat Type	Capture Station	Capture Depth (m)	Capture Date
21421	1.2	62	D.E.	1	3.4	7/30/85
21422	1.6	68	D.E.	1	3.4	7/30/85
21425	1.1	60	D.E.	1	3.7	7/31/85
21429	1.2	61	D.E.	1	3.1	7/31/85
21438	1.0	56	D.E.	1	3.7	7/31/85
collected	0.5	47	D.E.	1	3.1	7/31/85
collected	0.3	31	D.E.	1	3.1	7/31/85
21459	0.5	44	U.B.	1	3.7	8/01/85
21412	1.4	64	U.B.	2	3.7	7/30/85
-Escaped while handling-			U.B.	2	3.4	8/01/85
21448	1.6	65	D.E.	3	3.1	8/07/85
21453	1.0	57	D.E.	3	2.4	8/08/85
21441	0.8	55	U.B.	4	4.6	8/06/85
21446	1.8	68	U.B.	4	4.6	8/07/85
21443	1.0	56	D.E.	4	3.1	8/07/85
21455	2.0	72	Run	5	0.9	8/14/85
-Escaped while handling-			Run	5	0.9	8/15/85
21454	0.9	56	D.E.	6	3.7	8/13/85

D.E.= Deep Eddie
U.B.= Undercut Bank

Angler Interviews

Information obtained from informal angler interviews (25) indicated that anglers were well aware of the presence of sturgeon in the Minnesota River. Many anglers related stories of sturgeon being caught on hook and line in every stretch of the river below the Granite Falls dam.

Discussion

Previous netting experience in the river near St. Peter suggested that if sturgeon were relatively abundant and widely distributed throughout the river they should comprise a rather consistent and significant proportion of the total catch. When fall netting success for the past five years in the St. Peter study area is compared to the summer catch rate for much of the river's length comparable values are obtained. Fall netting yields about .5 sturgeon per net day and the summer netting showed .4 sturgeon per net day. In six years of fall netting near St. Peter sturgeon comprised 15% of the total catch and the summer catch throughout the river was 8.40 of the total fish caught. Sturgeon per net day is perhaps a more significant figure because of the variable influence of carp in the sturgeon ratio to total catch. In the fall the capture rate of sturgeon to other fish increases rather dramatically because the catch rate of carp falls off later in the season.

Comparing our data using gill nets to that of electroshocking (Kirsch, et. al., 1985) in the river some differences appear. Excluding species that were electroshocked but not gill netted, we

compared the ratio of sturgeon taken to other fish. Electrofishing resulted in a ratio of .6% sturgeon to other fish while the value for netted sturgeon to other fish is 8.4%. In fact if carp were not considered, the capture rate of netted sturgeon would be very high (13%) and exceeded only by Carpiodes sp. Interestingly, the two collecting methods showed carp to comprise an identical 34% proportion of the total catch. Electrofishing captures a wider diversity and a larger number of fish than does gill netting, but Enbloom (in Kirsch, et.al., 1985) noted that deep water limited electrofishing success and that fish in deep pools may go unnoticed. Most of our success is in deep pools. Additionally, other researchers (Modde 1971, Zweiacker 1967) have noted that due to the external structure of the shovelnose sturgeon they are more susceptible to gill netting than other fish. We concur and do not propose that sturgeon contribute as much to the total population as our data indicates. It appears that electrofishing undersamples sturgeon and gill netting is over selective.

Researchers in Wisconsin (Christianson, pers. com.) have noted that shovelnose sturgeon do not occur in Mississippi River tributary systems above obstructions such as dams or waterfalls. The Minnesota River is free flowing for most of its length but dams do occur in the upper reaches, the first being at river km 407, near Granite Falls. If what is seen in Wisconsin also occurs here sturgeon could be found in the river up to the first dam but not beyond. Our data seems to support this. Sauger (Stizostedium canadense) and flathead catfish (Pylodictis olivoris) also seem to be excluded above dams on the Minnesota River (Kirsch, et.al. 1985). We deliberately increased

netting effort at Station 8, above the Minnesota Falls Dam, but in ten net days no sturgeon were captured. Sturgeon were netted at all other stations except seven where effort was reduced to six net days so that more time could be apportioned to Station 8. Substantiated reports have been made of sturgeon in Minnesota river tributaries such as the Blue Earth River below the Rapidan Dam and in the Cottonwood River below the dam at New Ulm (D. Peterson, MDNR, pers. com.). No sturgeon have been reported above the dams in either stream. It is suggested the Mississippi River is the source of sturgeon for tributaries and no reproduction seems to occur in any of the tributaries.

Christiansen (1975) defined a minimum length of 62 cm F.L. and 56 cm F.L. for sexual maturity in male and female sturgeon respectively. Although we have captured several individuals slightly below this minimum length, in six years of netting with experimental gill nets and with small mesh size and making numerous seine hauls no sturgeon that were clearly juvenile have been taken.

Based on analysis of past netting success (Merrick, unpublished) near St. Peter and in the Missouri River (Modde, 1971) most effort was concentrated in the deep main channel areas of the river. Typical netting sites were in waters 3.5 to 5 m deep and characterized by deep running eddies or next to deep undercut banks most generally on the outside of a river bend. The success rate in these situations was clearly better than nets placed in other conditions such as shallower main channels or narrow gravely runs. Although much of the river is characterized as shallow main channel, since no sturgeon were captured in this habitat, it appears to be unimportant for this species during

the late summer. Enblom (pers. com.), based on electroshocking experience, considers narrow, fast, gravely shoots to be likely situations to encounter sturgeon. Those areas when available were netted, but due to a low catch rate and relative infrequency of that habitat type it does not appear to be a significant feature for sturgeon.

CONCLUSION

In conclusion, we feel that the most important late summer shovelnose sturgeon habitat in the Minnesota River are deep main channel areas of the river. We also feel that there is a larger population of shovelnose sturgeon than previous studies have indicated. However, in comparing our data to that of Mode's from the Missouri River, and Helm's from the Mississippi where comparable capture techniques yield thousands of sturgeon, we feel that the Minnesota River population is perhaps small enough to warrant special concern.

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