Age and Growth of Shovelnose Sturgeon, *Scaphirhynchus platorynchus* (Rafinesque), in the Mississippi River

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HELMS, DON R. (State Conservation Commission, Box 63, Route 3, Bellevue, Iowa 52031). Age and Growth of Shovelnose Sturgeon, *Scaphirhynchus platorynchus* (Rafinesque), in the Mississippi River. *Proc. Iowa Acad. Sci.* 81(2): 73-75, 1974.

Anterior pectoral fin rays and body measurements were collected from 110 shovelnose sturgeon captured from October 29 through November 5, 1971, in pool 13 of the Mississippi River. Fork length ranged from 7.4 to 23.7 inches and weight ranged from .06 to 2.02 lbs. The length-weight relationship was estimated as

$$\log_{10}W = -4.292 + 3.307 \log_{10}FL$$

with standard deviation for the regression coefficients $\pm.046$ and $\pm.038$, respectively. Condition factors (C) averaged 11.6 with a range from 9 to 17. Mean lengths at time of capture were 8.9, 13.7, 18.9 and 22.0 inches for age groups 0 through III.

INDEX DESCRIPTORS: Shovelnose Sturgeon, Age and Growth, Mississippi River.

Shovelnose sturgeon is a valuable commercial food fish in the upper Mississippi River basin. Annual harvest by Iowa fishermen has ranged up to a maximum of 60,000 lbs. with a wholesale market value of more than $15,000. Most of the catch is processed by smoking and demand greatly surpasses supply.

Lack of knowledge of the life history and harvest potential has precluded proper management and commercial utilization of this species. In 1970 the Iowa Conservation Commission initiated an investigation of this species. Many biological parameters included in the study required age determination of fish samples. The main purpose of this paper is to document and validate aging techniques and determine growth of shovelnose sturgeon.

METHODS AND PROCEDURES

Specimens for computation of age and growth statistics were collected from October 29 through November 5, 1971, from the Mississippi River, pool 13, near Bellevue, Iowa. Collection methods included a 16-ft. semi-balloon trawl and drifting trammel nets. The trawl was modified by removing the small mesh lining and adding an 8-ft. section of 1/4-inch Ace web to the cod end; it was fished by towing it upstream.

Trammel nets were weighted so they sank to the river bottom. The gear measured 6 x 100 ft. with the inner web of 1 to 1 1/2-inch square mesh, No. 177 twine. These were attached by 100 ft. of rope to wooden floats which kept the net stretched perpendicular to the current and dragged it downstream.

Anterior fin rays were collected, and body measurements recorded, from 110 fish. Fin rays were air-dried in coin envelopes and sectioned with an electric saw. The sections were cut approximately 12 mm from the basal joint and measured less than .5 mm in thickness. These were mounted between microscope slides and moistened with alcohol for examination.

Criteria used in assigning ages were similar to those described by Cuerrier (1951). Sections were examined and aged with a 10X dissecting microscope by one person and subsequently aged by a second person with a microprojector. The two then compared values and reached a common decision. Back calculation of FL at the end of each year of life was accomplished by marking annuli on paper strips and computing values by a direct proportion nomograph with the intercept on the abscissa set at 0.

TABLE 1. LENGTH-FREQUENCY DISTRIBUTION OF 110 AGED SHOVELNOSE STURGEON COLLECTED FROM POOL 13, OCTOBER 29-NOVEMBER 5, 1971

Class Mark (FL)	Age Group 0	I	II	III	All Combined
7.5	1				1
8.5	2				2
9.5	6				6
10.5					
11.5		2			2
12.5		12			12
13.5		20			20
14.5		16			16
15.5		8			8
16.5			1		1
17.5		1	4		5
18.5			9		9
19.5			3		3
20.5			4	4	8
21.5			1	5	6
22.5				8	8
23.5				3	3
Total	9	59	22	20	110

Funds for this research were partially provided by Project 2-156-R, Shovelnose Sturgeon Investigations, National Marine Fisheries Service, NOAA and Iowa Conservation Commission cooperating.

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Validity of Annuli as True Year Marks

Validity of annuli as true year marks was established by comparing assessed ages of individual fish with length-frequency distribution of the sample (Table 1). Samples not fitting into the length-frequency distribution were re-examined. Although false annuli caused some initial error, with experience most year marks were easily identified and no samples were eliminated because they could not be interpreted.

Bi-weekly length-frequency distributions of earlier 1971 catches (Table 2) supported validity of annuli. Growth of the smallest group could be traced from the first fish, measuring 2.2 inches, captured June 24 through the last bi-weekly sample when fish ranged from 7.4-9.9 inches and were identified as 0-age by the spine sectioning technique. Distribution of this group did not overlap with the next in any of the bi-weekly samples. Ages I and II, however, were superimposed toward the end of the season, and subsequent age groups became progressively more difficult to separate by length-frequency distributions.

Growth in Length and Weight

Fork length of the sample ranged from 7.4 to 23.7 inches and weight ranged from .06 to 2.02 lbs. Sexes were combined because only two mature fish were included in the sample. Both were males and measured 22.0 inches. Mean fork lengths at the time of capture were 8.9, 13.7, 18.9 and 22.0 inches for ages 0, I, II and III (Table 3). Calculated annual growth increments were 8.2, 5.8 and 4.7 inches.

The length-weight relationship was computed from the logarithmic transformation of the exponential function $W = cL^n$, where W was weight in lbs. and L was fork length in inches. The equation $\log_{10}W = -4.292 + 3.307 \log_{10}FL$ best described this relationship (Figure 1). Standard deviations for the regression coefficients were $\pm.046$ and $\pm.038$, respectively. Correlation coefficient for this regression was .986. Condition factors (C) averaged 11.6 and ranged from 9 to 17.

TABLE 2. Length-Frequency Distributions of Shovelnose Sturgeon from Pool 13, 1971

Class Mark (FL)	Sample Date 4-18	5-2	5-16	5-30	6-13	6-27	7-11	7-25	8-8	8-22	9-5	9-19	10-3	10-17	10-31
1.5							1								
2.5					1										
3.5							13								
4.5							3	1							
5.5									4						
6.5												2			
7.5												5	4		2
8.5	1											7	4		2
9.5					2		1					2	1		5
10.5					10	6	16					2	1		
11.5				2	4	3	17	1	6			3	4		1
12.5					2	1	20	2	7		6	29	9		17
13.5		1				1	1		1		4	40	15		23
14.5					1	1	3					18	18		18
15.5	3	3		2	2	5	6	1	1		1	4	5		6
16.5	1	2		13	4	14	26	3	5		3	2	2		2
17.5	1			7	10	14	34	1	11		2	10	6		3
18.5	4	5		16	11	14	35	2	5		2	17	11		13
19.5	12	11		30	21	44	64	3	13		6	6	7		6
20.5	11	3		23	11	56	63	7	13		3	10	8		7
21.5	5	6		14	10	17	25	6	6		4	18	13		5
22.5	1	5		3	4	8	4		3		2	7	2		11
23.5	2	5		2	1	2	2					3	4		3
24.5	3	6		3	2	2	1		2			1			
25.5		3		1		1									
26.5	1	2		1		1						2			
27.5	1	1					1						1		
28.5	1	2													
29.5		1			1								1		
30.5		1										1			
31.5		1													
N	47	58	0	117	96	190	336	27	77	0	33	189	116	0	124

TABLE 3. CALCULATED FORK LENGTHS (FL) AND INCREMENTS FOR EACH YEAR OF LIFE FOR 110 SHOVELNOSE STURGEON FROM POOL 13

Year Class	Age Group	N	Year of Life 1	2	3	4
Growth						
1971	0	9	(8.9)*			
1970	I	59	7.8	(13.7)		
1969	II	22	8.4	14.4	(18.9)	
1968	III	20	8.5	14.0	18.7	(22.0)
Mean estimated FL			8.2	14.2	18.7	
Increments						
1971	0	9	(8.9)**			
1970	I	59	7.8	(5.9)		
1969	II	22	8.4	6.0	(4.5)	
1968	III	20	8.5	5.5	4.7	(3.3)
Mean increments			8.2	5.8	4.7	
Sum of increments			8.2	14.0	18.7	

* Observed FL at time of capture.
** Calculated growth increment during current growing season.

DISCUSSION

Although aging techniques using sectioned bony structures have been widely used for other species of sturgeon (Cuerrier, 1951; Cuerrier and Roussow, 1951; Probst and Cooper, 1955), their reliability for shovelnose sturgeon has never been evaluated. Anterior pectoral fin rays are most often used in aging lake sturgeon. The validity of age marks in fin rays of this species was reported by Probst and Cooper (1955).

Zweiacker (1967) used anterior pectoral fin rays to determine the age of 288 shovelnose sturgeon from the Missouri River. Ages ranged from 8 to 27 years and fork length (FL) ranged from 48 to 55 cm (18-22 inches).

Fogle (1963) used sectioned pectoral rays to age and calculate prior growth of 35 shovelnose sturgeon from Oahe Reservoir, South Dakota. Sturgeon in this study ranged from 3 to 10 years of age and ranged in size from 18 to 23 inches total length (16-20.5 FL). The studies by Zweiacker and Fogle did not contain young fish and both lacked means of verifying age.

Growth was much slower than in the present study, and error is suspected to have resulted from inclusion of false annuli. The possibility of such instances of slow growth, however, is supported by recapture of tagged fish. Lyle Christenson found that tagged sturgeon in Red Cedar River, Wisconsin, grew only a few mm each year and many exhibited negative growth (personal communication). James Schmulbach found similar growth among tagged sturgeon in the Missouri River near Vermillion, South Dakota (personal communication). Tagging has resulted in retarded growth among some species and could affect sturgeon in a similar manner.

This technique was used to assess age and growth of shovelnose sturgeon in six selected pools of the Mississippi River (Helms, 1973). The oldest fish examined was estimated at 12 years old and measured 28.2 inches FL. Calculated lengths for the first years of life corresponded with observed lengths. Reduced growth occurred after the fourth year of life and was attributed mostly to sexual maturity.

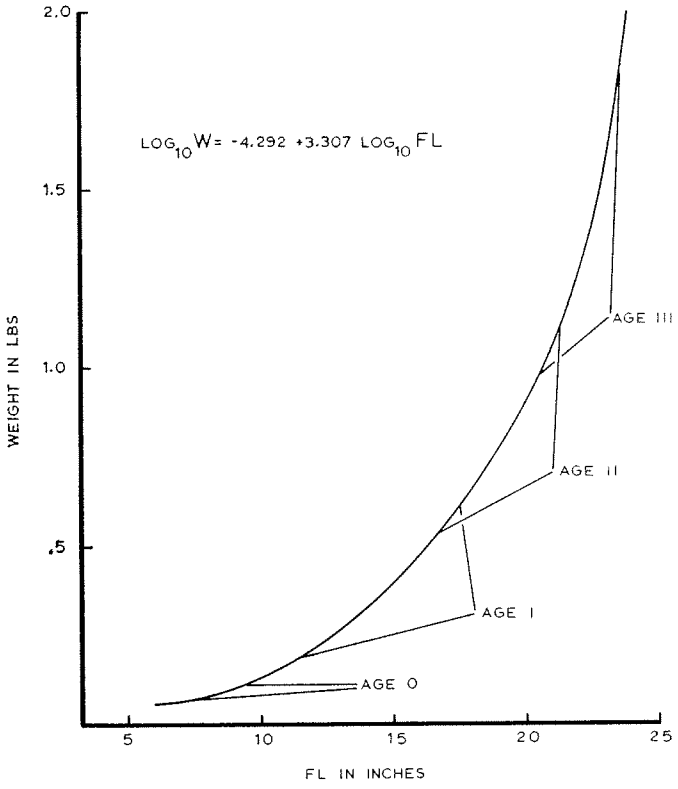

Figure 1. Fork length (FL)-weight relationship of shovelnose sturgeon in Pool 13, Mississippi River. Brackets denote range of observed body measurements by age.

ACKNOWLEDGMENTS

The author wishes to acknowledge personal communication with Lyle Christenson, Wisconsin Department of Natural Resources, and James Schmulbach, University of South Dakota, Vermillion, relating to tagging methods, growth of recaptured sturgeon and problems associated with aging slow growing fish.

LITERATURE CITED

CUERRIER, J. 1951. The use of pectoral fin rays for determining age of sturgeon and other species of fish. *Can. Fish. Cult.* 11:-10-17.

CUERRIER, J., and G. ROUSSOW. 1951. Age and growth of lake sturgeon from Lake St. Francis, St. Lawrence River: Report on material collected in 1947. *Can. Fish. Cult.* 10:17-29.

FOGLE, N. E. 1963. Report of fisheries investigations during the fourth year of impoundment of Oahe Reservoir, South Dakota, 1962. S. D. D-J Proj., F-1-R-12 (Jobs 10-12).

HELMS, D. R. 1973. Progress report on the second year study of shovelnose sturgeon in the Mississippi River. Proj. 2-156-R-2, Iowa Cons. Comm., Des Moines, Ia.

PROBST, R., and E. COOPER. 1955. Age, growth, and reproduction of the lake sturgeon, *Acipenser fulvescens*, in the Lake Winnebago region, Wisconsin. *Trans. Amer. Fish. Soc.* 87:207-227.

ZWEIACKER, P. 1967. Aspects of the life history of the shovelnose sturgeon, *Scaphirhynchus platorynchus* (Rafinesque), in the Missouri River. M.A. Thesis, University of South Dakota, Vermillion.