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SPAWNING BEHAVIOR, AGE AND GROWTH, AND SPORT FISHERY FOR THE SILVER REDHORSE, *MOXOSTOMA ANISURUM* (RAFINESQUE), IN THE FLINT RIVER, ALABAMA

by

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ABSTRACT

Spawning behavior, age and growth, and sport fishery for the silver redhorse, *Moxostoma anisurum* (Rafinesque), in the Flint River, Madison County, Alabama, were studied in 1969 and 1970. Spawning silver redhorse were first observed on April 1, 1969, and April 8, 1970, at a water temperature of 14.4°C. (58° F.) Females appeared to mature between the sixth and seventh year at a length of 548-600 mm. Males appeared to mature at 510-530 mm., but most seemed to mature at the same age. Growth of males and females was approximately the same until age group VI. After this age, males grew slower than females. Mature specimens moved into Flint River from Wheeler Reservoir to spawn during February through April. Immature silver redhorse returned to Wheeler Reservoir where they remained until sexually mature. The most important fishery on the Flint River during early spring is for silver redhorse.

INTRODUCTION

A sport fishery of local importance exists each year from February through April for the silver redhorse, *Moxostoma anisurum* (Rafinesque), in the Flint River, a tributary of the Tennessee River in Alabama. This fishery is heavily utilized by local anglers and to a lesser degree by nonresident anglers. Little has been published concerning the biology and sport fishery utilization of the silver redhorse. Meyer's (1962) study is the only comprehensive report on the biology of this species, although the silver redhorse is commonly found in both reservoirs and streams (Robins and Raney, 1956). A need for a study of the

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biology of and sport fishery for the silver redhorse existed due to the aforementioned facts plus a survey report by the U. S. Army Corps of Engineers of planned channelization of 44.3 miles of stream bed in the Flint River.

Five species of redhorse are known from the Tennessee River drainage (Smith-Vaniz, 1968), and all five were collected from the Flint River during this study. The silver redhorse is the principal constituent of the redhorse fishery. The shorthead redhorse, *M. breviceps* (Cope), although common in the stream during spring, does not enter significantly into the fishery. The golden redhorse, *M. erythrurum* (Rafinesque), and black redhorse, *M. duquesnei* (LeSueur), although common throughout the year, do not enter into the fishery. The river redhorse, *M. carinatum* (Cope), is apparently too uncommon to offer a significant contribution to the fishery.

MATERIALS AND METHODS

The major study area was the Flint River, Madison County, Alabama. Headwaters of this stream begin in Lincoln County, Tennessee, and flow in a southerly direction for 54 miles before entering the Tennessee River at river mile 539. The stream is characterized by a series of pools broken by rapids and shoals. The lower five miles of the stream is impounded as a portion of Wheeler Reservoir.

Wheeler Reservoir was sampled to collect additional specimens for age and growth studies and to determine locations of immature individuals.

The study period was March, 1969 - May, 1970. Methods used to collect silver redhorse for age and growth, and spawning habit studies included examination of anglers creels, electrofishing, and gill nets.

Methods used to determine seasonal distribution of silver redhorse included anglers creel investigation, electrofishing, and population samples taken with rotenone.

The electrofishing gear was mounted on a 16-foot boat. Electric current was provided by a 110/220-volt alternator with a rated capacity of 3000 watts. Output was controlled with a variable voltage pulsator. Electrodes were mounted approximately 10 feet in front of the boat and 10 feet apart.

Specimens were weighed to the nearest one-hundredth pound, measured to the nearest millimeter of total length, and examined to determine sex, stage of gonadal development and sexual dimorphism. Scales were removed from the area between the dorsal fin and lateral line. Scales were read with a scale projector and readings to successive annuli were recorded for back calculations.

Interviews with sport fishermen were conducted during the spring of 1969 and 1970 to determine the utilization of redhorse in the Flint River.

RESULTS AND DISCUSSION

Spawning Behavior: Spawning silver redhorse were first encountered April 1, 1969, and April 8, 1970, at a water temperature of 14.4° C. (58° F.). Males were ripe prior to this period at water temperatures of 10° C. (50° F.). Of ten females examined on April 1-2, 1969, one was spent, one was of running ripeness and eight were gravid. Spawning activity was most intense in early morning and evening hours. Meyer's (1962) estimate of 56° F. for the initiation of spawning activity by the silver redhorse in the Des Moines River, Iowa, appears to be a good estimate for the beginning of spawning by this species in Flint River.

Spawning sites for the silver redhorse were characterized by shallow riffle areas with rocky and gravelly bottoms. The proportion of males to females on one spawning site was approximately 4 to 1 on April 8, 1970.

Male silver redhorse are strongly tuberculated on the anal fin and ventral

lobe of the caudal fin during the spawning season. Weak tubercles are scattered on the pelvic fins and dorsal lobe of the caudal fin. Females frequently display weak tubercles on the anal fin. The presence of large tubercles on the anal and caudal fins of males is a reliable method of distinguishing between the sexes during the spawning season.

Sexual dichromatism was not noted. Trautman's (1957) color description for the silver redhorse is accurate with regard to Flint River specimens with the following exceptions: Nuptial coloration of pectoral and pelvic fins was orange, not "light-slate and white." This orange is not synonymous with the brilliant crimson fins of species such as the shorthead and river redhorse. Breeding specimens of the silver redhorse are noticeably more brassy in body coloration than the impression conveyed by Trautman's description.

Sixty-eight of 69 specimens examined from Flint River during the spring were mature. One specimen 400 mm. in total length was not mature. The smallest mature female measured 548 mm. and was seven years old. Most females appear to mature between 548-600. The smallest and youngest mature male measured 507 mm. and was six years old. Males appear to mature at a slightly smaller size (510-530 mm.) than females, but most seem to mature at the same age.

AGE AND GROWTH

Meyer (1962) noted a June to August annulus formation interval for redhorses in the Des Moines River. Tatum and Hackney (in press) reported a late spring to early summer annulus formation interval for river redhorse in the Cahaba River, Alabama. Time of annulus formation for silver redhorse in Flint River was in late April and May.

Small specimens were not available to determine the length at which scale imbrication is completed. The minimum length of complete scalation in black-tail redhorse, *M. poecilurum* (Jordan), was found to be 31 mm. (unpublished data of P. A. Hackney). Tatum and Hackney (in press) estimated a scalation length of 30 mm. for the river redhorse. Myer's (1962) calculated estimate of 32 mm. (1.25 inches) for silver redhorse, therefore, seems accurate, and this value (32 mm.) was used as the correction factor for the age and growth calculations in this study.

The growths of male and female silver redhorse are shown in Tables 1 and 2, respectively. Growth for sexes combined, including immature specimens is presented in Table 3. Since most specimens for age and growth studies were obtained during winter and early spring before time of annulus formation, they were placed into the age group equal to the number of annuli plus one because growth for the previous growing season was complete. In reading the scales, the margin was defined as another annulus. This must be taken into account in the interpretation of Tables 1, 2, and 3. An examination of Tables 1 and 2 reveals that growth in length for males and females is approximately the same until the fish reach age group VI. Growth of females appear not to slow down at this point as much as does growth of males. The faster growth rate of females after the sixth year of life may be related to the advent of sexual maturity.

Table 1 does not include males younger than age group VI. Table 2 does not include females younger than age group V. Younger age classes were not collected apparently due to their absence in the Flint River during the spawning season. Immature specimens of age group II, Table 3, were collected from Wheeler Reservoir. Table 4 compares growth of silver redhorse from the Flint River and Wheeler Reservoir area with that of silver redhorse from the Des Moines River in Iowa (Meyer, 1962). Silver redhorse in Flint River grow larger than silver redhorse in the Des Moines River and grow faster in the first two years.

TABLE 1
**AVERAGE CALCULATED TOTAL LENGTH FOR EACH AGE GROUP OF MALE SILVER REDHORSE COLLECTED
 IN FLINT RIVER DURING 1969-1970.¹**

Age group	Number of fish	Mean length at capture (mm)	1	2	3	4	5	6	7	8	9	10
I	0											
II	0											
III	0											
IV	0											
V	0											
VI	6	544	186	305	398	472	513					
VII	22	559	180	301	387	456	507	540				
VIII	13	568	169	294	373	446	494	528	552			
IX	3	573	142	239	318	387	454	506	539	564		
X	1	620	150	297	373	414	461	526	549	585	602	
Average calculated total length (weighted mean)			174	289	380	450	499	515	550	569	602	
Increment of average calculated lengths			174	115	91	70	49	16	35	19	33	

¹Fish were placed into the age group equal to the number of annuli plus one since period of capture was just prior to resumption growth.

TABLE 2
 AVERAGE CALCULATED TOTAL LENGTH FOR EACH AGE GROUP OF FEMALE SILVER REDHORSE
 COLLECTED IN FLINT RIVER DURING 1969-1970.¹

Age group	Number of fish	Mean length at capture (mm)	Mean calculated total length (mm) at annulus											
			1	2	3	4	5	6	7	8	9	10		
I	0													
II	0													
III	0													
IV	0													
V	1	569	166	322	419	505								
VI	1	570	193	398	462	511	543							
VII	10	578	176	289	383	460	514	551						
VIII	9	598	162	290	368	444	500	536	567					
IX	2	646	158	318	412	476	530	570	610	626				
X	0													
Average calculated total length (weighted mean)			168	298	385	459	511	546	575	626				
Increment of average calculated lengths			168	130	87	74	52	35	29	51				

¹Fish were placed into the age group equal to the number of annuli plus one since period of capture was just prior to resumption growth.

TABLE 3
 AVERAGE CALCULATED TOTAL LENGTHS FOR EACH AGE GROUP OF MALE, FEMALE, AND IMMATURE
 SILVER REDHORSE COLLECTED IN FLINT RIVER AND WHEELER RESERVOIR 1969-70¹.

Age group	Number of fish	Mean length at capture (mm)	1	2	3	4	5	6	7	8	9	10
I	0											
II	8	305	157									
III	0											
IV	0											
V	2	484	178	295	380	434						
VI	7	548	187	319	407	478	517					
VII	32	565	178	297	386	457	509	543				
VIII	22	581	167	293	371	445	497	531	558			
IX	5	603	149	271	356	422	484	532	568	589		
X	1	620	150	297	373	414	461	526	549	585	602	
Average calculated total length (weighted mean)			171	296	381	451	503	537	559	589	602	
Increment of average calculated lengths			171	125	85	70	52	34	22	30	13	

¹Fish were placed into the age group equal to the number of annuli plus one since period of capture was just prior to resumption growth.

TABLE 4
COMPARISON OF GROWTH RATE OF FLINT RIVER SILVER
REDHORSE FROM DES MOINES RIVER, IOWA (MEYER, 1962).

Age group	Flint River		Des Moines River	
	Calculated length (mm)	Observed length (mm)	Calculated length (mm)	Observed length (mm)
I	171	--	109	108
II	296	305	195	168
III	381	--	271	302
IV	451	--	328	349
V	503	484	379	392
VI	537	548	432	452
VII	559	565	470	497
VIII	589	581	505	514
IX	602	603	513	518
X	--	620	--	--

SEASONAL DISTRIBUTION

Mature specimens were obtained from Flint River during the period of February through April. Males arrived in Flint River and were found on spawning sites earlier than females. Electrofishing samples indicated that young-of-year silver redhorse move downstream to Wheeler Reservoir where they remain until becoming sexually mature. Sampling with electrofishing gear and gill nets revealed the presence of age groups I-IV in Wheeler Reservoir, but not in Flint River. Only one silver redhorse, a six-inch fish, was found in a series of rotenone samples conducted on Flint River and its major tributaries during August, 1969, while the golden and black redhorse were abundant.

SPORT FISHERY

The most important fishery on Flint River during the early spring (March to mid-April) is for silver redhorse. A 20- to 25-mile section of stream receives a high degree of utilization by residents of the surrounding area. During peak periods of the season, many Tennessee residents also fish the stream for silver redhorse. The main technique employed for harvesting is with hook and line with earthworms as bait prior to the spawning season. When the silver redhorse are on the shoals, snagging or snatching is the principal harvest method. Snatching or snagging is described as the use of one or more single, double, or treble hooks tied to a line which is jerked through the water in such a manner as to impale or hook a fish.

Discussions of sport fisheries for redhorses are largely lacking in the literature. The various species of this genus are generally regarded as occasional and/or incidental specimens (Harlan and Speaker, 1956). Hackney, et al. (1968) reported a sport fishery for river redhorse in the Cahaba River, Alabama.

An extensive sport fishery encompassing five redhorse species including the silver redhorse occurs in the Duck, Elk, and Buffalo rivers, Tennessee (Stubbs, personal communication)¹. These fisheries are of great local importance where

¹ Stubbs, John M., 1969. Supervisor of Development, Tennessee Game and Fish Commission, Nashville, Tennessee.

redhorse clubs operate hatcheries exclusively for the production of redhorse fry and fingerlings. The redhorse fishery on Duck River, Tennessee, usually extends from mid-March to mid-May. The late spawning river redhorse, rare in the Flint River, is responsible for the longer fishing season on Duck River.

According to Pflieger (personal communication)², a fishery of local importance exists for five species of redhorses primarily in the Ozark area during late April and early May. This fishery is managed entirely by harvest regulations. In the Ozark area of Missouri, gigging in streams is legal from October 1 to December 31. Snagging, snaring, and grabbing are also legal during that period and from March 15 to May 15. The daily limit is 25 pounds plus one fish and the possession limit is 50 pounds plus one fish.

Fleener (1969) reports that on a 44-mile stretch of the Big Piney River, Missouri, approximately 4,230 fish were harvested during a 92-day gigging season in 1968. Ninety-six percent of these fish were suckers, principally redhorses.

Redhorse fisheries are known to occur during the spring in many of the streams in the following states: Kentucky (Carter, personal communication)³; Virginia (Hoffman, personal communication)⁴; North Carolina (Cornell, personal communication)⁵; Arkansas (Smith, personal communication)⁶, and Oklahoma (Bennett, personal communication)⁷.

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