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Abstract: During 1963 and 1964, catfish populations were sampled in various rivers in eastern Iowa, and 1,391 spines were collected and analyzed for age. Growth rates varied considerably, with fish from the Wapsipinicon River at Anamosa being the slowest growing, followed by fish from the Wapsipinicon River at Independence, the Cedar River at Gilbertville and Cedar Rapids, and the Iowa River at Marshalltown. Faster growth was exhibited by fish from two renovated areas —the Iowa River in the Iowa Falls-Steamboat Rock area and Fontana Mill Lake—, from the lower 8 miles of the Skunk River, and from various pools in the Mississippi River. It is suggested that the removal of a portion of the catfish population in selected areas, perhaps in conjunction with a rough fish removal program, would stimulate catfish growth.

INTRODUCTION

Since the channel catfish [*Ictalurus punctatus* (*Rafinesque*)] is the most important game fish in most of our inland waters, and because of the commercial importance of this species in the Mississippi and Missouri Rivers, increased studies have been directed toward the many phases of its life history. It is anticipated that as answers to these inquiries are found they can be incorporated into applicable management techniques to increase desirable catfish populations.

The primary intent of this paper is to present a comparative study of age and growth of channel catfish in selected Iowa waters. Population samples have been acquired from a variety of stream habitats. Representing typical eastern Iowa rivers are the Cedar, Iowa, and Wapsipinicon. Representing a commercially fished river is the Mississippi, and representing chemically renovated areas are Fontana Mill Lake and the Iowa Falls—Steamboat Rock section of the Iowa River.

METHODS

During 1963 and 1964 channel catfish populations were sampled in various areas at various times of the year by netting. Commercially caught fish from the Mississippi River were examined at fish markets. Emphasis was placed upon obtaining a cross section of sizes of fish. One pectoral spine was taken from each fish and the location, date, weight, and total length of the fish were recorded. One thousand three hundred ninety-one

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spines were sectioned and aged with a conventional binocular microscope. Growth was determined by calculating the average length of a given age group of fish at the time of sampling.

Results and Discussion

Growth rates in inland rivers of the state varied considerably (Table 1). Fish from the Cedar River at Gilbertville and Cedar Rapids and the Iowa River at Marshalltown had similar growth rates, at least for the first 4 years of life. The Wapsipinicon River at Independence, which has a reputation for good catfishing, has a slower growing population with fish from age groups IX and X fairly abundant.

Fish from the Wapsipinicon River at Anamosa were slower growing. This area has a reputation for producing small catfish to the angler, and a program is in progress to reduce the population in an attempt to increase the growth rate. Bait net catches in the Anamosa area generally yield very large numbers of small catfish, with 90% or more of the fish under 10 inches in length.

Growth of catfish from the Iowa Falls-Steamboat Rock area of the Iowa River and Fontana Mill Lake is faster. This is due to chemical renovation of the areas. The Iowa River was treated in 1960, and channel catfish fingerlings have been stocked each year since then. Natural reproduction should alleviate this need in the future and the growth rate will probably decline as the population increases.

Fontana Mill Lake was rotenoned in late 1963 and stocked with fingerling catfish from the Humbolt Hatchery as well as about 2,000 sub-adult and adult catfish from the Anamosa area on the Wapsipinicon River—the area of slow growing catfish. Netting in late summer of 1964 disclosed a good population of catfish up to 17 inches in length. Age and growth studies indicated that these fish—the results of the Anamosa stocking—grew extremely fast when stocked in the "void" of the renovated impoundment. Age III catfish from Fontana Mill averaged 13 inches in length, whereas these same fish in 1963 at age II averaged less than 7 inches. Age IV fish from the impoundment averaged 14.3 inches, whereas at age III they averaged 8 inches. Tiemeier and Elder (1960) found that the growth rate of stunted channel catfish transferred to ponds without high concentrations of catfish increased very rapidly. They attributed the rapid growth to an abundance of food.

Fish from the Skunk River exhibited fast growth comparable to the growth of fish from the renovated waters. These fish were taken in the lower 8 miles of the Skunk River just before it

Table 1. Average observed total length of channel catfish at various ages from various rivers in eastern Iowa.

Location	Date	Length at various ages I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Cedar River,	Aug., '63		7.1	9.9	12.1	17.2	19.0	20.6	21.2				
Gilbertville			(22)*	(4)	(11)	(3)	(1)	(1)	(1)				
Cedar River,	July, '64			10.1	12.4	13.4	14.6	18.7					
Cedar Rapids				(2)	(20)	(16)	(3)	(1)					
Wapsipinicon River,	April, '64					13.3	14.6	16.2	17.5	19.7	21.8	24.1	27.9
Independence						(11)	(13)	(19)	(10)	(7)	(5)	(3)	(2)
Wapsipinicon River,	Aug., '63		6.7	8.0	11.0	10.1							
Anamosa			(2)	(28)	(6)	(5)							
Iowa River,	Sept., '64		7.8	9.3	11.2	15.5							
Marshalltown			(2)	(6)	(4)	(7)							
Iowa River,	Sept., '64	6.7	8.2	12.9	13.2								
Iowa Falls-Steamboat Rock		(9)	(13)	(17)	(4)								
Fontana Mill Lake,	Aug., '64	7.6	9.2	13.0	14.3	17.0							
Hazelton		(4)	(1)	(4)	(2)	(1)							
Skunk River,	Aug., '64	5.9	8.5	12.6	16.8	19.0	22.0			30.6		24.8	
Lower 8 miles		(32)	(35)	(22)	(34)	(18)	(2)			(1)		(1)	

* Numbers in parentheses indicate sample size.

Table 2. Average observed total lengths of channel catfish at various ages from the Mississippi River.

Location	Date	Length at various ages I	II	III	IV	V	VI	VII	VIII	IX
Pool 9	June, '63			12.6*	15.4	16.8	18.1	20.4	21.3	20.7
				(5)**	(30)	(45)	(33)	(16)	(10)	(5)
Pool 11	May, '63		7.6	10.3						
			(40)	(8)						
Pool 13	Aug., '63	6.6	9.2							
		(17)	(24)							
Pool 14	July, '63			13.2*	14.8	17.6				
				(92)	(52)	(5)				
Pool 14	July, '63		9.1	10.7						

		(10)	(57)			
Pool 16	July, '64			13.8*	16.5	18.5
				(26)	(7)	(1)
Pool 17	July, '64		13.4*	14.1	17.4	
			(6)	(67)	(4)	
Pool 18	June, '63		12.9*	15.1		
			(16)	(132)		
Pool 19	May, '64		13.1*	15.6	21.8	21.7
			(18)	(51)	(4)	(3)
Pool 19	June, '63		13.2	16.6	20.2	
			(9)	(120)	(17)	

* Average size exaggerated because of 13 inch size limit.
** Numbers in parentheses indicate sample size.

Table 3. Average observed total lengths of channel catfish from various areas in Iowa (Harrison, 1957)

		Length at various ages										
Location	Sample size	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Des Moines River Bonaparte	26	3.0	5.6	8.2	9.8		17.0					
Des Moines River Humboldt area	655		5.5	7.0	8.6	9.4	11.9	12.1	13.6	14.3	14.5	17.6
Boone River Webster City	93		7.5	8.5	11.8	13.8	16.5	17.2				
Storm Lake Storm Lake	40		5.7	7.5			24.7	25.5				
Little Sioux River Linn Grove	31	2.8	7.1	8.5	10.3							
Missouri River Mondamin	16		7.1	8.9	10.0			18.4				

enters the Mississippi, and their growth rate is similar to that in several places on the Mississippi (Table 2).

Fish from the Mississippi River grow faster than fish from any in-state river. The species is fished commercially on both sides of the river and the harvest undoubtedly has an accelerating effect on growth rate. There is an inherent error in the average size of some of the fish because of the 13-inch size limit For instance, the size limit does not always allow the commercial fisherman to harvest the smaller age III catfish, so the average size of age III catfish in the commercial catch is larger than the average size in the river population.

Fish from eastern Iowa rivers generally grew faster than those from central and western Iowa; i.e. Storm Lake, Des Moines River, Boone River, Little Sioux River, and Missouri River (Harrison, 1957) (Table 3).

A comparison can be made between the age composition of fish in the commercial catch from the Mississippi River where there is a 13-inch size limit and the age composition of the commercially unexploited fish taken at Independence, since the gear used at Independence tended to catch only fish 13 inches and larger. In the Mississippi River in 1963, 51% of the 9,415 commercially caught fish examined were age III and 40% were age IV (Schoumacher, 1964). In 1964, 47% of 4,861 fish examined were age III and 49% age IV. Of 320 fish taken at Independence, however, five age classes contributed at least 10% of the catch: V (23%), VI (17%), VII (25%), VIII (15%), and IX (11%). Age X (6%) and XI (2%) were also present. This indicates that the bulk of the Mississippi River catfish are harvested before they reach age V.

Harrison (op. cit.) suggested that channel catfish growth in many Iowa rivers could be increased through management. It is the opinion of the authors that one of the primary reasons for the faster growth of catfish in the Mississippi River is the annual commercial harvest of a portion of the population. Increased growth in chemically renovated areas also suggests that intra- and/or inter-specific competition slows growth. Harrison (op. cit.) believes that high rough fish populations have a repressive effect on growth. Tiemeier and Elder (op. cit.) found no apparent relation between growth of stocked catfish and the presence of populations of largemouth bass and bluegills. They did not, however, encounter high populations of rough fish.

The proper management technique for stimulating catfish growth, it seems, would be a reduction in the catfish and/or rough fish populations. In most Iowa rivers the removal of significant numbers of rough fish is impractical if not impossible without using chemicals which remove the catfish and other

game fish as well. Unless long stretches of rivers are treated, or suitable barriers exist, re-invasion of undesirable fish occurs rapidly.

Catfish, however, may be taken readily with selective gear throughout much of the open water season, so it would be possible to harvest a portion of a catfish population in an attempt to stimplate the growth of the remaining fish. The possibility of rough fish removal, where economically feasible, could also be tried, either separately or in conjunction with the catfish removal. Careful scientific evaluation of the effects of the program would be a real contribution to catfish management.

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Spawning Periodicity of the River Carpsucker, *Carpiodes carpio*[1]

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Abstract: The sex ratio of river carpsuckers collected from the Des Moines River differed significantly from 1:1, females being most abundant. Spawning had already begun in early June and some fish were found ripe as late as August. No carpsuckers younger than age IV were found mature. All ripening carpsucker ovaries contained a group of eggs that seemed to be degenerating. It is not certain if carpsuckers spawn more than once in a season.

Introduction

Although the river carpsucker, *Carpiodes carpio* (Rafinesque), is abundant in many midwestern rivers, little is known about its life history and ecology. In this study, special attention was given to its mode of spawning.

Starrett (1948) found three sizes of eggs in the ovaries of ripe female carpsuckers and, from this, inferred that the carpsucker is an intermittent spawner (e.g., spawns more than once in a single season). Many other species of fish have been reported as intermittent spawners, but few studies have dealt specifically with this subject, and many questions remain un-

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