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Comparison of Channel Catfish Populations in Channeled and Unchanneled Sections of the Little Sioux River, Iowa

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Abstract. Comparisons are made of channel catfish in channeled and unchanneled sections of the Little Sioux River with regard to abundance, movement, and age and growth. Mean catches per unit effort of channel catfish were higher during May to October bi-weekly periods in the unchanneled section. Movement was predominantly downstream in both areas. In the unchanneled section 23.7% moved upstream, 69.6% moved downstream, and 6.7% were recaptured at their release site. In the channeled area 25.8% moved upstream, 39.8% moved downstream and 34.4% were recaptured at their release site. Due to the free exchange of catfish between both areas, growth rates were similar in both areas. The largest mean annual increment in both areas (4.42 inches) occurred in the second year.

In recent years an increasing number of streams have been channeled to obtain better drainage or to prevent flooding of surrounding farmland. This channelization work causes radical changes in the environmen of existing fish populations and, in general, reduces the quality and quantity of fish habitat.

Between 1962 and 1966 considerable data were collected from adjoining channeled and unchanneled sections of the Little Sioux River in western Iowa. Most of the data reported in this paper were collected during intensive field work in 1964.

The Little Sioux arises in Jackson, Minnesota and flows southwesterly through Iowa for 221 miles before entering the Missouri River at River Sioux, Iowa. The United States Army Corps of Engineers completed rechanneling the lower 35 miles in 1957 and built a low-head dam approximately 6 miles from the mouth in 1963. The unchanneled river is characterized by sharp bends, steep banks, deep-water areas around brush piles, and a mud bottom with scattered areas of sand or gravel. In contrast, the channeled section is generally straight, with a few wide sweeping bands and water depths uniform between banks. The study area included 35 miles of channelized and 30 miles of unchannelized river bed. Channel catfish are the most important game fish in both areas.

METHODS AND MATERIALS

Most channel catfish were taken in baited hoop nets; however, fish were collected with electro-fishing gear. During 1965 and 1966, 200-yard sections of channeled and unchanneled stream were enclosed with one-quarter-inch mesh block nets and treated

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Table 1. Total trap net days and mean catch of channel catfish per day for bi-weekly fishing periods in channeled and unchanneled sections of Little Sioux River, 1964.

Location		May		June	July		August		September		October	
		1-15	16-31	1-15	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31
Unchanneled	Trap days	12	42	9	13	12	19	30	16	24	35	17
	Mean catch per day	22	26	15	33	22	15	19	17	26	63	8
Channeled	Trap days	38	61	4	35	51	42	35	18	19	10	9
	Mean catch per day	3	8	7	18	10	10	18	11	49	6	2
Pool area	Trap days					7	12	16	8	15	14	23
	Mean catch per day					11	25	76	308	72	95	32

with rotenone for removal of fish. The same areas were sampled with rotenone each year.

Total lengths, weights and pectoral spines were collected from samples of all catfish. In 1964 channel catfish were tagged with internal body-cavity tags (Harrison, 1948) at four locations in channeled and unchanneled stream.

Abundance

Although several factors affect catch per unit effort (Ricker, 1958), these data can be used to measure the relative abundance of a fish population (Table 1). During 10 of the 11 bi-weekly fishing periods between May and October, 1964, more channel catfish were caught per trap net day in the unchanneled area than in the channeled section.

Although fishing effort was much less intense during 1962, 1963 and 1965, catch per trap-net day was generally larger in the unchanneled area than in the channeled section. These data, collected between 1962 and 1966 indicate channel catfish are more abundant in the unchanneled section than in the channeled area between May and October.

The most significant difference between the channel catfish populations in the two areas during late summer is the lack of catfish over 9 inches in the channeled area as indicated by rotenone sampling (Table 2). An important factor is the low water level during this period. Maximum depths in the unchanneled area during August and September are generally over 5 feet. It is difficult to find water over 2½ feet deep in most of the channeled area during this same period. Mean depth is often between 1½ and 2 feet and uniform throughout the channeled section; therefore, the opportunity for larger catfish to move into deeper water during declining water levels in late summer is not present in the channeled area.

Table 2. Number of different-sized channel catfish collected with rotenone from 200-yard sections of channeled and unchanneled river.

Location	1965				1966			
	Date	Young-of year	5-9 inches	Over 9 inches	Date	Young-of year	5-9 inches	Over 9 inches
Unchanneled	8-31	2,813	10	21	9-7	2,981	765	14
Channeled	9-2	5			9-16	2,653	92	

Few young-of-the-year catfish were collected by rotenone in the channeled area in 1965 (Table 2). Although field observations indicated more spawning in the channeled area than these data indicate, there is no explanation for the few young-of-the-year caught since a "good kill" was indicated after renovation.

The large number of young-of-the-year catfish collected in the channeled area in 1966 is also not necessarily an indication of abundance. Movement of catfish over 6 inches (discussed later) in both the channeled and unchanneled sections was predominantly downstream and often for a considerable distance. It is possible, therefore, that a significant portion of the young-of-the-year caught in the channeled area in 1966 moved downstream from the unchanneled section. Renovation in the channeled area in 1966 was conducted 2 weeks later than the 1965 renovation. This 2-week period may have allowed enough additional time in 1966 for an influx of young-of-the-year catfish from upstream. The numbers of both young-of-the year catfish and those over 9 inches caught in the unchanneled area did not vary greatly between 1965 and 1966.

Bayless and Smith (1964) found a great reduction in both the total number and total weight of game fish after channelization of a North Carolina stream. The mean total number was reduced from 1,231.3 fish per surface acre to 58.8 fish per surface acre; the mean total weight was reduced from 83.1 pounds per surface acre to 2.3 pounds per surface acre.

Movement

During 1964, 10,025 tagged channel catfish were released in the lower 65 miles of the Little Sioux. The majority of catfish recaptured over 2 miles from their release site moved downstream in both the channeled and unchanneled sections (Table 3). A considerably larger number moved downstream over 2 miles in the unchanneled area than in the channeled area. This could be expected, however, since the unchanneled section is upstream from the channeled area, thus allowing more catfish moving downstream in the unchanneled area to be caught. Recaptures downstream from the channeled area (Missouri River) were limited to sportfishing. Disregarding local movement, 23.7% of recaptures in the unchanneled section moved upstream, 69.6% moved downstream, and 6.7% were recaptured at their release site. In the channeled area 25.8% moved upstream, 39.8% moved downstream, and 34.4% were recaptured at their release site.

Table 3. Number of marked channel catfish recaptured in channeled and unchanneled sections and direction and mean distance travelled in miles.

	Upstream[1]		Downstream[1]		Local[2]
Location	Number	Mean distance	Number	Mean distance	Number
Unchanneled	49	12.0	206	27.8	100
Channeled	52	15.4	70	19.2	142
Total	101	13.7	276	25.6	242

1. Movement over 2 miles from release site.
2. Movement within 2 miles from release site.

Other evidence of downstream movement in the channeled area is the catch per unit effort data recorded at the pool area (Table 1). These data were collected from a location approximately 500 yards above the low-head dam. Although this location was in the channeled section, it was also in a pool area which extended upstream from the dam for approximately 1 mile. Mean water depth in this pool was generally 2 or 3 feet deeper than in the remainder of the channeled section during any part of the summer. Values for the number of channel catfish caught per trap net day were very similar in the pool and the remainder of the channeled section during July 16 to 31. However, during the next three bi-weekly fishing periods until 16 September, values in the pool rose dramatically from 25 to 308 fish per day while values for the remainder of the channeled area during these same periods only varied between 10 and 18 fish per day. From 16 September through 31 October, bi-weekly catch per effort values were larger in the pool area than in either the remainder of the channeled section or the unchanneled area. Since channel catfish could not move upstream over the dam after water levels declined in April, the apparent increase in relative abundance of channel catfish in the pool area during late summer was caused by downstream movement. There appears to be no distinct, individual catfish population in either the channeled or unchanneled area, but rather, due to extensive movement between areas, a single population inhabiting both areas.

Age and Growth

Since the body-spine relationship is subject to many variables, no growth correction factor was calculated to represent the body length at time of spine formation; therefore the calculated lengths in Tables 4 and 5 should only be considered approximations. Several 6- 7- and 8-year-old catfish were caught in both the chan-

Table 4. Average calculated total lengths in inches at the end of each year of life from pectoral spine cross-section of channel catfish taken in 1964 from unchanneled sections of the Little Sioux River, Iowa.

Age group	Number	Year of life 1	2	3	4	5	6
I	89	2.6					
II	62	1.9	6.2				
III	72	1.7	6.0	8.7			
IV	77	1.9	6.3	9.0	10.7		
V	76	2.0	6.1	9.0	10.8	12.4	
VI	37	2.2	6.1	8.9	10.9	12.4	14.2
Average calculated length		2.0	6.1	8.9	10.8	12.4	14.2
Average annual increment		2.0	4.2	2.7	1.7	1.5	1.8

Table 5. Average calculated total lengths in inches at the end of each year of life from pectoral spine cross-sections of channel catfish taken in 1964 from channeled sections of the Little Sioux River, Iowa.

Age group	Number	Year of Life 1	2	3	4	5
I	51	2.3				
II	23	1.9	6.1			
III	26	1.9	6.3	8.6		
IV	46	1.9	6.2	9.0	10.8	
V	48	2.1	6.2	9.1	11.1	12.4
Average calculated length		2.0	6.2	8.9	10.9	12.4
Average annual increment		2.0	4.2	2.7	1.9	1.4

neled and unchanneled sections, however, due to difficulties in aging, some of these fish were not included in these tables.

Average calculated lengths and average annual increments for each year of life were very similar in both the channeled and unchanneled areas. This could be expected, however, considering the evidence indicating a single population inhabiting both areas. The largest annual increment in both sections (4.2 inches) occurred in the second year.

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