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A PRE-IMPOUNDMENT STUDY OF THE FISH FAUNA OF INDIAN CREEK, DEKALB COUNTY, ILLINOIS

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ABSTRACT

A pre-impoundment study of the fish fauna of Indian Creek was conducted to determine both species composition and distribution patterns. Diversity indices are presented for collection stations. Increased diversity was found at stations having increased water depth. Two headwater cyprinid species are apparently replaced downstream by three other minnow species. The possible consequences of poisoning Indian Creek with rotenone are discussed.

INTRODUCTION

Indian Creek, a tributary of the Fox River, presents a unique opportunity to study the effects of impoundment on a stream in northern Illinois. The headwater area of the creek is the site of a 330-acre recreational lake proposed by the Illinois Department of Conservation (Figure 1). Construction of the lake is scheduled to begin in 1974, and will include rotenone poisoning of the entire headwater drainage to prevent the introduction of *Cyprinus carpio* into the lake (Leo Rock, Department of Conservation, personal communication). Unfortunately, rotenone is not a selective poison for *C. carpio* but is lethal to all other fish species and much of the invertebrate fauna of the creek (Hynes, 1970). The proposed activities will undoubtedly alter the present species composition and distribution patterns.

METHODS

Collections of fish were made at monthly intervals from October, 1971 through October, 1972 except for the month of February, 1972 along the headwaters of Indian Creek at stations that would be affected by the proposed impoundment. The collection of October 5, 1971 was selected for analysis because it contained the largest number of fish collected and was believed to be the most representative sample of the stream's fish fauna. The collections during 1972 were hampered by ice during the winter and by almost continuous high water levels in the spring and summer. The collections were made in an upstream direction using a minnow seine, 5.54 m. in length, having a mesh of 4.7 mm.

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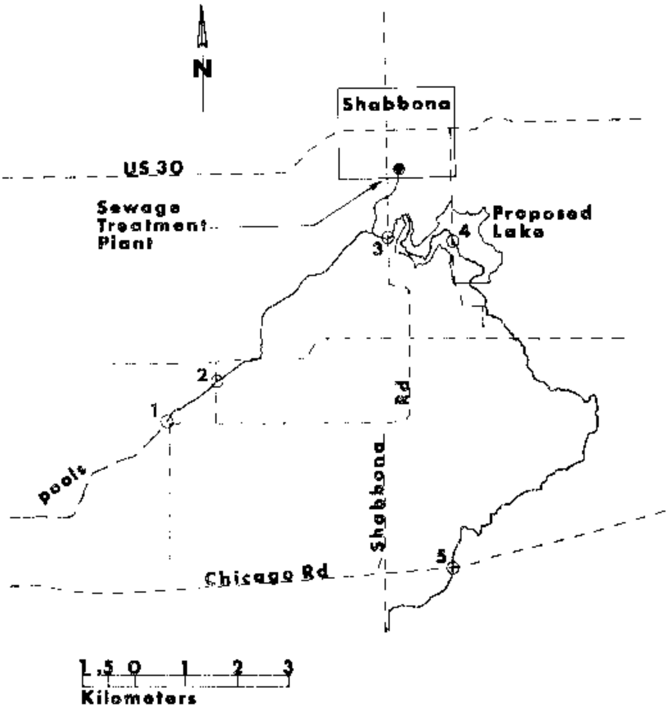

Figure 1. *Headwater area of Indian Creek showing collection stations*

The index of diversity, H', was calculated from the data of Table 1 using the formula

$$H' \approx \frac{1}{N} \; (N \log_{10} N - \sum n_i \log_{10} n_i)$$

as suggested by Lloyd, Zar, and Karr (1968), where N is the total number of individuals of all species and n_i is the number of individuals of each species. This is an information-theory measure of species diversity based upon both the number of species present and their relative abundance.

THE STUDY AREA

The headwater area of the creek was defined as the 18 km section that extends from station 1 to station 5 (Figure 1). Even at low water levels there was a continuous flow of water throughout this section originating from springs at station 1. Isolated pools, which are fed by field tiles and extend for about 3.5 km. upstream of station 1, are continuous with the head-

TABLE 1. *Characteristics of collection stations, October 5, 1971*

Station	Stream Width, m.	Water Depth, cm.	Water Temperature, °C	Cover	Substrate
1	.9-1.2	15-30	20	none	silt, gravel
2	.6-3.1	15-65	15	trees, bushes	silt, gravel, rocks
3	1.8-3.1	15-25	15	bushes	silt, gravel, rocks
4	1.8-3.1	15-30	20	none	silt, gravel
5	3.1-3.7	15-90	17	trees, bushes	silt, gravel rocks

water area during periods of high water (Figure 1). These pools were sampled in November, 1971.

The majority of the land drained by the headwaters is utilized for corn and soybean farming and for pasture. There are limited wooded areas present between stations 2 and 5. In addition to draining the above lands, the headwaters also serve as an outlet for the sewage treatment plant of the town of Shabbona. The sewage effluent enters Indian Creek via a small tributary approximately .5 km upstream of station 3.

A description of the collection stations is given in Table 1.

RESULTS

The species composition of the October, 1971 collections is given in Table 2. A total of twenty-five fish species was collected, representing five families. Names of fish species are those used by the American Fisheries Society (1970) except for *Chrosomus erythrogaster*, which follows the suggestion of McPhail and Lindsey (1970). The largest number of species (twenty) was collected at station 5, and the largest total number of specimens (1,583) was collected at station 3.

During other collections, eight additional species were taken: *Hypentelium nigricans, Notropis umbratilis, Moxostoma erythrurum, Micropterus salmoides, Etheostoma flabellare, Percina phoxocephala, P. maculata,* and *Cyprinus carpio*. *C. carpio* was found only in the series of pools above the headwaters and represented only a small portion of the fish fauna of these pools.

The results of the index of diversity (H') calculations are given in

TABLE 2. *Distribution of species at stations 1 to 5 in October, 1971*

Species	Stations 1	2	3	4	5
Notropis cornutus	63	60	466	549	389
Notropis dorsalis	294	107	441	565	215
Notropis stramineus			8	27	93
Notropis rubellus			2	40	18
Notropis spilopterus				5	33
Rhinichthys atratulus	53	26	1		
Campostoma anomalum	4	4	26	33	58
Chrosomus erythrogaster	92	43	113		
Semotilus atromaculatus	21	49	10	6	50
Pimephales notatus	291	166	473	80	133
Nocomis biguttatus	1	21	34	30	12
Notemigonus crysoleucas			1		
Phenacobius mirabilis				1	
Etheostoma spectabile	20	6	6	4	9
Etheostoma nigrum	8	15	2		5
Etheostoma zonale					7
Catostomus commersoni		2		2	10
Carpiodes carpio					8
Micropterus dolomieui		2		1	4
Lepomis macrochirus				2	2
Lepomis cyanellus		1			4
Ambloplites rupestris					1
Ictalurus natalis				1	1
Ictalurus melas		1		1	
Noturus flavus					1

Table 3. The highest values of H' were found at stations 2 and 5, which also had the greatest water depths (Table 1).

DISCUSSION

The higher diversity found at stations 2 and 5 is probably due to increased habitat diversity permitted by increased water depth at these stations. This is in agreement with Sheldon's (1968) conclusions that increased water depth results in greater species diversity. However, a second conclusion of Sheldon's, that downstream succession involves progressive additions to the headwater fauna rather than replacement, is not supported by the results from Indian Creek. A distinct restriction of *Rhinichthys atratulus* and *Chrosomus erythrogaster* to the upper reaches of the headwaters and an apparent downstream replacement of these species by *Notropis stramineus, N. rubellus,* and *N. spilopterus* were observed (Table 2). The assemblage of species in Indian Creek differs from that of the stream investigated by Sheldon (1968), and the authors suggest that the composition of the fish fauna of a stream influences the pattern of downstream succession, determining the degree of replacement and/or addition which occurs.

TABLE 3. *Index of diversity for stations 1 to 5*

Stations	1	2	3	4	5
N-total number of specimens	847	503	1583	1347	1053
S-total number of species	10	14	13	16	20
H'-index of diversity	.6947	.8409	.6607	.5903	.8496

Larimore and Smith (1963) found increased productivity of fish populations below sources of domestic sewage, perhaps explaining the increased number of specimens collected at station 3. There were no other indications that the sewage effluent from Shabbona had any significant effect on the fish fauna of Indian Creek.

The proposed rotenone poisoning of the entire headwater to eradicate *C. carpio* poses several problems. First, the extensive destruction of the animal fauna of any habitat is the antithesis of the conservation ethic, and second, such extensive faunal destruction is ecologically unsound. *C. carpio* has high reproductive and growth potentials, but both spawning activities and growth are inhibited by the presence of other fish species (Carlander, 1969). The vast reduction in the numbers of fish and variety of species now inhibiting the growth of *C. carpio* might easily permit the few carp that may survive the poisoning or that may be reintroduced into the area to expand their populations to higher levels than existed before the poisoning. Additionally, *C. carpio* is not typically a headwater species. If, however, the proposed impoundment provides a suitable habitat, then this species will certainly find a way in, thus making the poisoning of the headwater futile.

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