THE EFFECT OF STREAM AGING ON THE SUCCESSION OF FISHES IN THE EMBARRAS RIVER IN CHAMPAIGN COUNTY, ILLINOIS

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The phenomenon of succession of fish species in streams was first discussed by Shelford (1911). He demonstrated that the composition of species in a stream will differ in relation to the age of the stream at the points that are sampled. The fewest species, often only a single species, would be found at or near the origin, the youngest part of the stream. As one samples downstream, additional species should be found. As one samples in even deeper waters downstream, the headwaters species may be replaced by other species that are better adapted to the conditions at that location. If not hindered by man, the headwaters will often erode land at the origin of the stream allowing the stream to increase in length. Should this erosion occur, those species adapted to the headwaters conditions will move upstream following the creation of favorable habitat. Thus, the successional pattern of fishes of a stream should be seen to shift upstream as the stream experiences erosional aging.

Menzel (1952) studied the succession of fishes in the headwaters region of the Embarras River in Champaign County, Illinois. At the time of his study, Menzel noted that the source of the river had been tiled, thus preventing erosion at its origin. Tiling would effectively prevent the increase in length of the river but may not prevent its aging below the point of tiling. The successional pattern of fishes sampled in 1970-71-72 can be compared to the pattern found by Menzel in 1950-51 yielding information concerning the possible response of fishes to the aging of the river.

MATERIALS AND METHODS

Menzel (1952) designated nine collecting stations on the Embarras River in Champaign County (Fig. 1). Fishes collected in August 1970, October 1971, and March 1972 were taken from Menzel's nine original stations. All recently collected fishes were captured by means of ten and twenty foot minnow seines of 1/8 and 1/4 inch mesh. The vast majority of the recently collected fishes were identified in the field and released. The common names of fish used in this paper are those used by Bailey (1970).

RESULTS AND DISCUSSION

The distribution of fishes collected by Menzel (1952) can be seen in Table 1. The distribution of fishes collected in 1970, 1971, and 1972 can be seen in Table 2. A comparison

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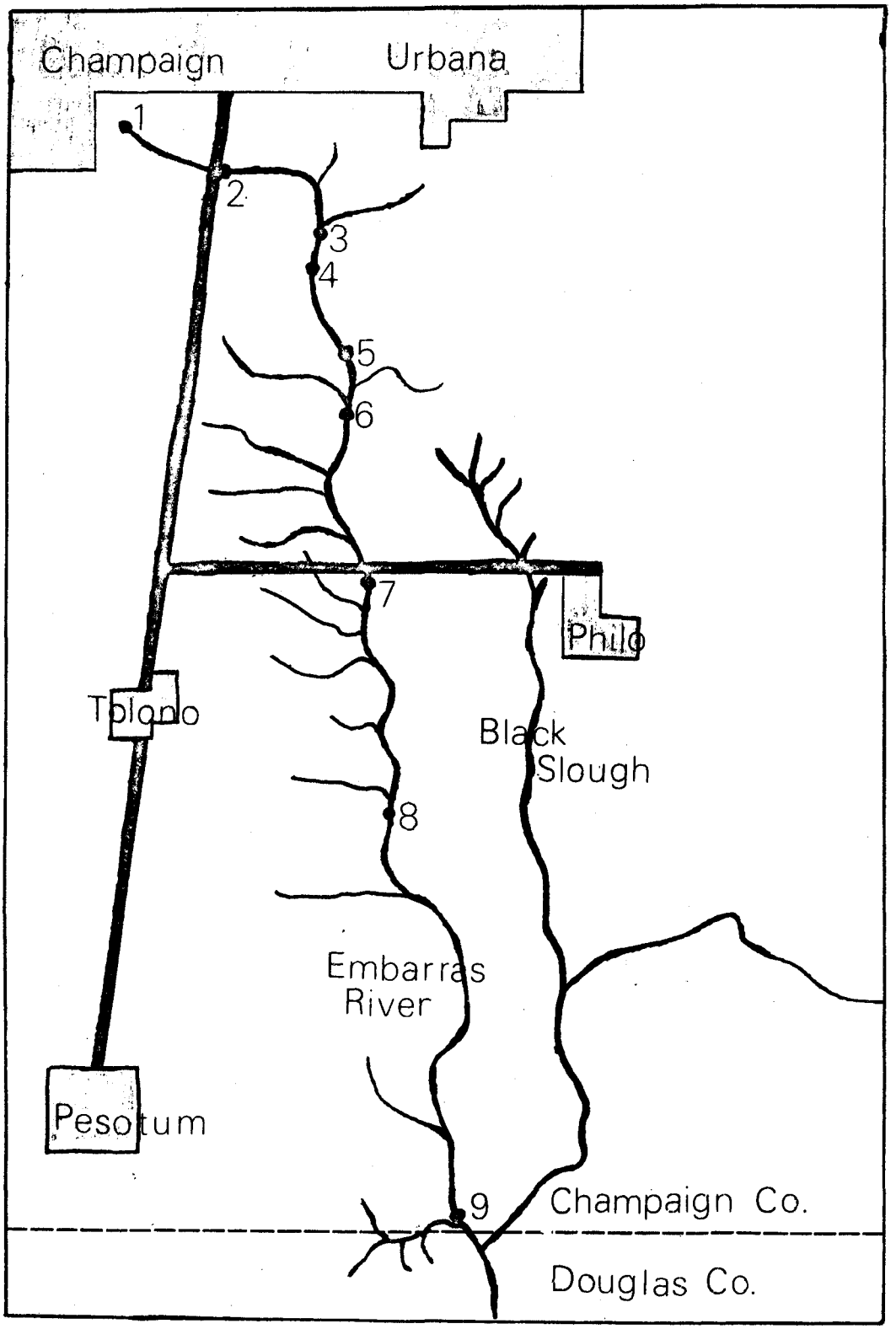

Fig. 1. Collecting stations on the Embarras River in Champaign County, Illinois, as taken from Menzel (1952). Scale; one inch equals two miles.

Table 1. The distribution of fish in the Embarras River collected from November, 1950, to June, 1951, as taken from Menzel (1952).

Species	Stations									Total
	1	2	3	4	5	6	7	8	9	
Creek chub	11	39	74	257	60	200	97	126	39	893
Stoneroller	11	6	2	31	13	28	230	52	4	377
Redfin shiner		13		29	2	2	20	112	168	336
Green sunfish		6		5	3	2	4	1	1	22
Johnny darter			15	32	9	40	95	6	32	229
Spotfin shiner			3	9	9	20	14	13	13	81
Creek chubsucker			5	33	12	46	39	15	2	152
Bluntnose minnow			3	50	110	440	566	543	411	2123
Striped shiner				2	3	8	28	51	6	99
Longear sunfish				2	1	2	28		5	38
Silverjaw minnow				8	27	205	285	2090	232	2875
Sand shiner				3	9	34	236	544	68	894
Blackstripe topminnow					7	3	22	2	8	42
White sucker						1	17	1	31	50
Grass pickerel							1			1
Rainbow darter							6			6
Quillback							2	1	1	4
Golden shiner							1		1	2
Suckermouth minnow							1		1	2
Blackside darter							5		3	8
Carp									1	1
Golden redhorse									1	1
Yellow bullhead									1	1
Total no. of specimens	22	64	102	451	245	1021	1735	3558	1039	8238
Total no. of species	2	4	6	12	13	14	20	14	21	23

Table 2. The distribution of fish in the Embarras River collected during 1970, 1971, and 1972.

Species	Stations									Total
	1	2	3	4	5	6	7	8	9	
Creek chub	34	115	36	51	168	105	67	216	8	800
Bluntnose minnow	28	195	15	31	133	25	49	47	5	528
Green sunfish	2	98	6		21	21	30			178
Spotfin shiner	2	10			3	4	17	73	56	165
Blackstripe topminnow		1	4	1	5	38	73	412	19	553
Bluegill		65	2	1	3	4	37	1	7	120
Orangespotted sunfish		22	5	1	2	3	84	5		122
Stoneroller		56	17	6	49	15	9	339		449
Sand shiner		49	4	56	113	35	16	179		452
Redfin shiner		39	2		15	69	367	209	263	964
Silverjaw minnow		9	1	14	117	20	3	387		551
Yellow bullhead		1	15		1	1	5		1	24
Creek chubsucker		2	3		1	2	51	11	1	71
Carp		2	3						1	6
Golden shiner		14			1	2	113	2	7	139
Suckermouth minnow		3		1		1		12		17
Longear sunfish		5				3	45		2	55
White sucker		1					91	8	1	101
Striped shiner					2		3	7	2	14
Quillback					1		9			10
Pirate perch							1	6	1	8
Grass pickerel							5		4	9
Spotted sucker							2		1	3
White crappie							6			6
Johnny darter							3			3
Dusky darter							1			1
Largemouth bass							1			1
Black bullhead							1			1
Total no. of specimens	66	667	113	162	635	348	1089	2922	379	5401
Total no. of species	4	18	13	9	16	16	26	16	16	28

of Tables 1 and 2 indicate an upstream shift of many of the species since 1950-51 (Table 3). Only three species were found only at stations further downstream from the highest point at which they were found in 1950-51. However, two of these three species, the Johnny darter and the striped shiner, have decreased in abundance since 1950-51. These decreases are seen as responses to the increased siltation (Trautman, 1957) of the region. Thus, the decreases in frequency of occurance of these two species should not be seen as exceptions to the upstream shift exhibited by most of the other species.

Table 3. Distributional changes in the species reported by Menzel (1952) relative to the furthest upstream station at which they were recorded in 1970-71-72.

Species	Furthest station upstream 1950-51	Furthest station upstream 1970-71-72	Change since 1950-51 (sign)
Creek chub	1	1	0
Stoneroller	1	2	-
Redfin shiner	2	2	0
Green sunfish	2	1	+
Johnny darter	3	7	-
Spotfin shiner	3	1	+
Creek chubsucker	3	2	+
Bluntnose minnow	3	1	+
Striped shiner	4	5	-
Longear sunfish	4	2	+
Silverjaw minnow	4	2	+
Sand shiner	4	2	+
Blackstripe topminnow	5	2	+
White sucker	6	2	+
Grass pickerel	7	7	0
Quillback	7	5	+
Golden shiner	7	2	+
Suckermouth minnow	7	2	+
Carp	9	2	+
Yellow bullhead	9	2	+

Total: 14 +, 3 -, 3 0.

The application of the paired sign test (Seigel, 1956) to the data in Table 3 yields significance at the 0.05 level.

The upstream shift of the successional pattern of fishes is seen as a response to the aging of this region of the Embarras River and gives some hint as to the degree of this response during a twenty year period.

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