TRANSACTIONS, ILL. STATE ACAD. SCI.
Vol. 67, No. 1 (1974)

AN ANALYSIS OF THE FISH FAUNA OF THE EMBARRAS RIVER IN CHAMPAIGN COUNTY, ILLINOIS

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ABSTRACT. Thirty of the thirty-seven recorded species of fish presently inhabit the Embarras River in Champaign County, Illinois. A comparison of quantitative data available from 1950-51 and 1970-71-72 yields evidence for increases in silt, soft-bottom tolerant species and decreases in those species not favoring this type of habitat. Six species, including the northern pike, gizzard shad, bluegill, orange-spotted sunfish, largemouth bass, and dusky darter, were not collected prior to 1970.

INTRODUCTION

The fishes of the Embarras River in Champaign County, Illinois, have been collected and studied for over seventy years. Forbes and Richardson (1908) collected during the period of 1882-1901. Thompson and Hunt (1930) studied the Embarras River in even greater detail. Menzel (1952) studied the succession of the fishes of the Embarras River compiling quantitative data on species present at various collecting stations in Champaign County. Larimore and Smith (1963) analyzed changes in the streams and in the fish fauna of Champaign County. In their study of the fishes of the Embarras River basin, the Illinois Department of Conservation did not sample the headwaters region (Lopinot, 1968). However, the distribution of fishes of this headwaters region was recently studied by students at the University of Illinois (Haverkamp and Hansen in undergraduate research reports in 1970 and 1971, respectively).

In most of the previously listed studies, only the presence of each species was reported rather than the numbers of individuals collected of each species. A comparison of presence-absence data would yield minimal information concerning faunastic response to environmental change. The data collected by Haverkamp and Hansen in the two most recent studies was quantitative in nature and, when supplemented with data collected in 1972, can be compared to the data of Menzel's (1952) study. In this paper, an attempt will be made to document a sequence of changes in the fish fauna through time in this region of the Embarras River and account for any such changes.

MATERIALS AND METHODS

Menzel (1952) designated nine collecting stations in Champaign County. Fishes collected by Haverkamp and Hansen in 1970 and 1971, and those collected in 1972 were taken from Menzel's nine original collecting stations. Since Menzel's collecting period spanned several seasons and the number of fish collected was large, the data of 1970-71-72 was combined for a more accurate comparison. All of the recent samples were taken using small-mesh minnow seines. The vast majority of the fish collected in 1972 were determined in the field and released alive. All recent collections were biased in favor of periods of low or average water levels as several stations were inaccessable during periods of high water. Sampling at times of low water levels would yield a higher proportion of the total population since the fish population would be more concentrated (Paloumpis, 1958).

Data on other collections from single stations during 1971 and 1972 was also available. While this data cannot be quantitatively compared to the other complete collections, it can be valuable in noting the occurrence of species not reported in the other studies.

RESULTS

A comparison of presence-absence data on fishes of this region from all available studies (Table 1) yields only relatively minor changes in the fish fauna through time. A comparison of those studies where quantitative data was available (Table 2) indicates differences in quantity in several of the species. Conversion to a measure of relative abundance (Table 3) allows a more accurate means of comparison. Any difference in relative abundance for a particular species can be considered in light of environmental changes that have occurred during this time period. A brief discussion of each species reported from the Embarras River in Champaign County follows.

An Annotated List of Fish

A single specimen of the American eel, Anguilla rostrata, was reported from this region of the Embarras River by Thompson and Hunt (1930), but this species has not been taken since. However, Larimore and Smith (1963) noted that this particular specimen had been collected in adjacent Douglas County rather than in Champaign County.

The gizzard shad, Dorosoma cepedianum, was represented by a single specimen collected in April of 1972. This species was previously listed as being present in a tributary of the Embarras River in Champaign County by Larimore and Smith (1963). However, this tributary joins the river in Douglas County rather

Table 1. Species reported from the Embarras River in Champaign County, Illinois.

Species	Forbes & Richardson (1908)	Thompson & Hunt (1930)	Menzel (1952)	Larimore & Smith (1963)	1970	1971	1972
Anguilla rostrata	-	+	-	-	-	-	-
Dorosoma cepedianum	-	-	-	-	-	-	+
Esox americanus	-	+	+	+	+	+	+
Esox lucius	-	-	-	-	-	+	-
Campostoma anomalum	-	+	+	+	+	+	+
Cyprinus carpio	-	+	+	+	-	+	+
Ericymba buccata	+	+	+	+	+	+	+
Notemigonus crysoleucas	-	+	+	+	+	+	+
Notropis atherinoides	-	-	-	+	-	-	-
Notropis chrysocephalus	-	-	+	+	+	+	+
Notropis spilopterus	-	+	+	+	+	+	+
Notropis stramineus	-	+	+	+	+	+	+
Notropis whipplei	-	+	-	+	-	-	-
Notropis umbratilis	-	+	+	+	+	+	+
Phenacobius mirabilis	+	-	+	+	+	+	+
Pimephales notatus	+	+	+	+	+	+	+
Semotilus atromaculatus	-	+	+	+	+	+	+
Carpiodes cyprinus	-	+	+	-	+	+	+
Catostomus commersoni	-	+	+	+	+	+	+
Erimyzon oblongus	+	+	+	+	+	+	+
Minytrema melanops	-	-	-	-	-	+	+
Moxostoma erythrurum	-	+	+	+	-	-	-
Ictalurus melas	-	+	-	-	+	-	-
Ictalurus natalis	-	-	+	+	+	+	+
Fundulus notatus	+	+	+	+	+	+	+
Aphredoderus sayanus	-	+	-	+	+	+	-
Lepomis cyanellus	+	+	+	+	+	+	+
Lepomis humilis	-	-	-	-	-	+	+
Lepomis macrochirus	-	-	-	-	+	+	+
Lepomis megalotis	-	+	+	+	+	+	+
Micropterus salmoides	-	-	-	-	-	+	-
Pomoxis annularis	+	-	-	-	+	+	-
Etheostoma blennioides	-	+	-	-	-	-	-
Etheostoma caeruleum	-	+	+	+	-	-	-
Etheostoma nigrum	+	+	+	+	-	+	+
Percina maculata	-	-	+	+	-	-	-
Percina sciera	-	-	-	-	-	-	+

Table 2. The total number of fish collected per species from the studies of the Embarras River where quantitative data was available.

Species	Menzel (1952)	1970	1971	1972	Total of 1970-71-72
Esox americanus	1	3	5	1	9
Campostoma anomalum	377	215	213	71	499
Cyprinus carpio	1	0	4	2	6
Ericymba buccata	2875	146	306	99	551
Notemigonus crysoleucas	2	29	81	29	139
Notropis chrysocephalus	99	2	8	4	14
Notropis spilopterus	81	2	158	5	165
Notropis stramineus	894	69	290	93	452
Notropis umbratilis	336	285	541	138	964
Phenacobius mirabilis	2	12	4	1	17
Pimephales notatus	2123	133	284	111	528
Semotilus atromaculatus	893	484	185	131	800
Carpiodes cyprinus	4	1	1	8	10
Catostomus commersoni	50	75	1	25	101
Erimyzon oblongus	152	51	11	9	71
Minytrema melanops	0	0	1	2	3
Moxostoma erythrurum	1	0	0	0	0
Ictalurus melas	0	1	0	0	1
Ictalurus natalis	1	15	6	3	24
Fundulus notatus	42	76	472	5	553
Aphredoderus sayanus	0	1	7	0	8
Lepomis cyanellus	22	33	116	29	178
Lepomis humilis	0	0	106	16	122
Lepomis macrochirus	0	22	81	17	120
Lepomis megalotis	38	12	21	22	55
Micropterus salmoides	0	0	1	0	1
Pomoxis annularis	0	1	5	0	6
Etheostoma caeruleum	6	0	0	0	0
Etheostoma nigrum	229	0	2	1	3
Percina maculata	8	0	0	0	0
Percina sciera	0	0	0	1	1
Total no. of specimens	8238	1668	2910	823	5401
Total no. of species	23	22	26	24	28

Table 3. Relative abundance of species, expressed as percentages of the number of fish collected per species, as reported from the studies of the Embarras River where quantitative data was available.

Species	Menzel (1952)	1970	1971	1972	Total of 1970-71-72
Esox americanus	0.01	0.18	0.17	0.12	0.16
Campostoma anomalum	4.58	12.89	7.32	8.63	9.24
Cyprinus carpio	0.01	0.00	0.13	0.24	0.11
Ericymba buccata	34.90	8.75	10.51	12.02	10.20
Notemigonus crysoleucas	0.02	1.74	2.78	3.52	2.57
Notropis chrysocephalus	1.20	0.12	0.28	0.49	0.26
Notropis spilopterus	0.98	0.12	5.43	0.61	3.06
Notropis stramineus	10.85	4.14	9.96	11.30	8.37
Notropis umbratilis	4.07	17.09	18.59	16.77	17.85
Phenacobius mirabilis	0.02	0.72	0.13	0.12	0.31
Pimephales notatus	25.77	7.97	9.76	13.49	9.77
Semotilus atromaculatus	10.84	29.02	6.36	15.92	14.81
Carpiodes cyprinus	0.05	0.06	0.03	0.97	0.18
Catostomus commersoni	0.61	4.50	0.03	3.04	1.87
Erimyzon oblongus	1.84	3.06	0.38	1.09	1.31
Minytrema melanops	0.00	0.00	0.03	0.24	0.06
Moxostoma erythrurum	0.01	0.00	0.00	0.00	0.00
Ictalurus melas	0.00	0.06	0.00	0.00	0.02
Ictalurus natalis	0.01	0.90	0.21	0.36	0.44
Fundulus notatus	0.51	4.56	16.22	0.61	10.24
Aphredoderus sayanus	0.00	0.06	0.24	0.00	0.15
Lepomis cyanellus	0.27	1.98	3.99	3.52	3.29
Lepomis humilis	0.00	0.00	3.64	1.94	2.26
Lepomis macrochirus	0.00	1.32	2.78	2.06	2.22
Lepomis megalotis	0.46	0.72	0.72	2.67	1.02
Micropterus salmoides	0.00	0.00	0.03	0.00	0.02
Pomoxis annularis	0.00	0.06	0.17	0.00	0.11
Etheostoma caeruleum	0.07	0.00	0.00	0.00	0.00
Etheostoma nigrum	2.78	0.00	0.07	0.12	0.06
Percina maculata	0.10	0.00	0.00	0.00	0.00
Percina sciera	0.00	0.00	0.00	0.12	0.02

than in Champaign County and was not included in any of the other studies. Although not reporting this species in Champaign County, Lopinot (1968) did report it in adjacent Douglas County as well as in several other locations downstream.

The grass pickerel, Esox americanus, represented a very small percentage of the total fish collected and was found only at the two stations in which deeper water was present.

The northern pike, Esox lucius, was represented by a single specimen collected by seine on November 21, 1971. The specimen exceeded four pounds in weight and was preserved in the University of Illinois collection. Lopinot (1968) reported no northern pike anywhere in the Embarras River basin in 1967. Northern pike had not previously been reported in Champaign County and this individual is believed to be a county record. This individual possibly entered this county as a result of post-1967 stocking of this species downstream, although no documentation exists for any such stocking in the Embarras River basin (Rodney Horner, personal communication).

The stoneroller, Campostoma anomalum, showed an increase in relative abundance since 1950-51. This minnow is listed as prefering swift water, with clean sand or gravel bottoms, and inhabiting riffles (Forbes and Richardson, 1908; Trautman, 1957; Pflieger, 1971). The increase in relative abundance did not seem to be seasonal in nature and could not be correlated with any type of favorable habitat change.

The carp, Cyprinus carpio, represented only a small fraction of the total fish collected in recent years. The individuals captured have usually been juveniles found at stations nearer to the source of the river.

The silverjaw minnow, Ericymba buccata, was the most common species collected (34% of total) by Menzel in 1950-51. The percentage has declined to 10% of the total fish as indicated by recent collections. Smith (1968) noted that the silverjaw minnow had been decimated in the Embarras River basin due to habitat destruction. This species inhabits sandy stretches of small, clear, permanent streams with sand bottoms free from silt (Trautman, 1957; Pflieger, 1971). Siltation would thus create a less favorable habitat.

The golden shiner, Notemigonus crysoleucas, has shown a slight increase in relative abundance since 1950-51. This species is relatively tolerant of turbidity (Trautman, 1957) and should be favored by siltation (Smith, 1968).

The emerald shiner, Notropis atherinoides, was reported only by Larimore and Smith (1963). This species is tolerant of turbidity and many bottom types but is usually associated only with larger lakes and rivers (Forbes and Richardson, 1908).

The emerald shiner was not reported from the Embarras River basin in 1962 and was found in only 20% of the collecting stations, although not in Champaign County, in 1967 (Lopinot, 1968). It is possibly the water depth requirement that limits the distribution and numbers of this species in the Embarras River.

The striped shiner, Notropis chrysocephalus, has decreased in relative abundance since 1950-51. Although this species is somewhat tolerant of turbidity, lower stream gradients, and silted bottoms, the striped shiner usually prefers clear streams with gravel, bedrock, or sand bottoms (Trautman, 1957).

Recent collections showed that the relative abundance of the spotfin shiner, Notropis spilopterus, varies seasonally. Combined data from recent collections indicate an increase in relative abundance of this species since 1950-51. Trautman (1957) noted that the spotfin shiner is tolerant of turbidity, siltation, and certain pollutants.

The sand shiner, Notropis stramineus has remained a common species in the Embarras River with little change in relative abundance since 1950-51.

The steelcolor shiner, Notropis whipplei, was reported by Thompson and Hunt (1930) and by Larimore and Smith (1963) but was not found in recent collections. Pflieger (1971) reported that the steelcolor shiner is less tolerant of turbidity than the spotfin shiner. The steelcolor shiner has been reported from the Embarras River in adjacent Douglas County (Lopinot, 1968) and may only come upstream when conditions are temporarily favorable.

The redfin shiner, Notropis umbratilis, has seen a dramatic increase in relative abundance since 1950-51. The redfin shiner is known to be tolerant of turbidity, siltation (Trautman, 1957), and pollution (Thompson and Hunt, 1930).

The suckermouth minnow, Phenacobius mirabilis, has remained a rarer species in the Embarras River in Champaign County.

In spite of its preference for headwater regions and its resistance to pollution (Thompson and Hunt, 1930), the bluntnose minnow, Pimephales notatus, has decreased in relative abundance from 25.7% in 1950-51 to 9.7% of the total fish fauna in recent years. This species is usually found in quiet water over soft bottoms (Larimore, Pickering, and Durham, 1952) but shows a preference for pools with sand bottoms rather than silt-bottomed headwaters (Zach, 1967).

The creek chub, Semotilus atromaculatus, has increased in relative abundance since 1950-51. This pollution-resistent, headwaters species (Thompson and Hunt, 1930) would benefit from siltation as this factor would create more favorable habitat (Smith, 1968).

The quillback, Carpiodes cyprinus, was present in low quantities in each of the years studied. All of the recently collected specimens were under six inches in length.

The white sucker, Catostomus commersoni, showed a slight increase in relative abundance since 1950-51. The white sucker is known to tolerate a wider range of environmental conditions than any other species of sucker. Migration would account for the seasonal differences in relative abundance seen in the data of recent collections (Trautman, 1957).

The creek chubsucker, Erimyzon oblongus, although listed by Smith (1968) as a species which should be favored by siltation, showed a decrease in relative abundance since 1950-51. However, Trautman (1957) described the habitat of the creek chubsucker as clear streams of moderate and high gradients and noted a decrease in abundance of this species in those Ohio streams that had increased in turbidity. Thus, the turbidity of this region of the Embarras River could be the limiting factor for this species.

The spotted sucker, Minytrema melanops, has been listed as being decimated in the Embarras River basin and had not been reported from the Embarras River in Champaign County prior to 1968 (Smith, 1968). This species is present at several locations in the Embarras River to the south of Champaign County (Lopinot, 1968). In the recent collections, three specimens were taken; two juveniles and one adult of about sixteen inches in length. Smith (1968) noted that this species was decreasing its range in Illinois. The presence of the spotted sucker further upstream may indicate a reversal of this trend.

The golden redhorse, Moxostoma erythrurum, was reported by Thompson and Hunt (1930), Menzel (1952), and Larimore and Smith (1963). All three of these studies reported this species only at the station furthest downstream at the Champaign-Douglas County line. Menzel (1952) reported only a single specimen in his study. The golden redhorse is a larger-river species that is tolerant of turbidity but prefers rocky or gravelly bottom types (Trautman, 1957). This species would be limited by appropriate bottom type in this region of the Embarras River and thus would not be expected to be a common species.

The black bullhead, Ictalurus melas, was represented by a single fourteen-inch specimen captured by Haverkamp in 1970. This species was reported prior to this only by Thompson and

Hunt (1930). The low numbers of this species in what appears to be optimum habitat was noted by Smith (1968). The factors involved in the maintenance of the low population level of this species are not known at this time.

The yellow bullhead, Ictalurus natalis, has shown a very slight increase in relative abundance since 1950-51. The habits of the yellow bullhead making it difficult to capture by seine have been noted (Larimore, Pickering, and Durham, 1952). Thus, the population level of this species may be greater than the seining data indicate.

The large increase in the relative abundance of the blackstripe topminnow, Fundulus notatus, since 1950-51 can possibly be attributed to increased siltation that would create more favorable habitat for this species (Smith, 1968). Seasonal variation in relative abundance was seen in the data from the recent collections.

The pirate perch, Aphredoderus sayanus, has been reported from the Embarras River in Champaign County since 1930. The population level is extremely low, although this region should represent favorable habitat for this species (Thompson and Hunt, 1930; Smith, 1968). The pirate perch was not collected in the Embarras River basin in 1967 and was reported at only one location in 1962 (Lopinot, 1968). The factors maintaining this low population level are not known.

The green sunfish, Lepomis cyanellus, has increased in relative abundance since 1950-51. This species is tolerant of turbidity and siltation (Trautman, 1957) and should be favored in this region.

The orangespotted sunfish, Lepomis humilis, had not been reported from the Embarras River in Champaign County prior to 1971. This species was first collected in the summer of 1971 and these specimens were deposited in the Illinois Natural History Survey collection. Lopinot (1968) reported one individual in 1962 and two individuals in 1967 in the Embarras River basin. In 1971, the orangespotted sunfish made up 3.6% of the total collection. This species was noted by Smith (1968) as benefiting from siltation. However, Smith noted that this species maintained low population levels. Apparently the factor or factors that maintained a low population level has now allowed the orangespotted sunfish to increase in numbers. Young of the year were noted in the fall of 1971.

The bluegill, Lepomis macrochirus, has spread up the Embarras River and increased in numbers during the 1960's. Bluegills were not reported in the Embarras River in Champaign County in 1963 (Larimore and Smith, 1963). Lopinot (1968) reported bluegills at two locations (10% of the stations) in the southern quarter of the Embarras River basin in 1962 and

reported bluegills at twelve locations (44% of the stations) throughout the Embarras River basin in 1967. In recent years, bluegills made up 2.2% of the fish collected.

The longear sunfish, Lepomis megalotis, was first reported from the Embarras River in Champaign County by Thompson and Hunt (1930). This species has shown a slight increase in relative abundance since 1950-51, although it is known to be intolerant of excessively turbid conditions (Trautman, 1957).

The largemouth bass, Micropterus salmoides, was represented by a single specimen collected by Hansen in 1971. The largemouth bass had not been reported from the Embarras River in Champaign County prior to this collection, although this species had been reported in small quantities in a few locations in the remainder of the Embarras River basin (Lopinot, 1968).

The white crappie, Pomoxis annularis, had been reported by Forbes and Richardson (1908) but had not been collected again until 1970 when Haverkamp reported a single specimen. Recent collections indicate that the population level of this species is quite low, although it is tolerant of turbidity and siltation (Trautman, 1957; Pflieger, 1971). The low population level in this region may be a reflection of the small size of the river and competition from sunfishes (Trautman, 1957).

The greenside darter, Etheostoma blennioides, was reported only by Thompson and Hunt (1930). This species is usually associated with clear, moderate- or high-gradient streams often in swift riffles over a gravel or rubble bottom (Thompson and Hunt, 1930; Trautman, 1957), conditions which are now unavailable in this region of the Embarras River. Trautman (1957) also noted a decrease in the abundance of this species in certain Ohio streams that had increased in turbidity.

The rainbow darter, Etheostoma caeruleum, was reported as recently as 1963 (Larimore and Smith, 1963) but was missed in recent collections. The habitat requirements of this species are similar to that of the greenside darter (Trautman, 1957; Pflieger, 1971) which was also missing. Siltation would account for the decline in the rainbow darter population.

The johnny darter, Etheostoma nigrum, has shown a pronounced decrease in relative abundance since 1950-51. The johnny darter is known for its resistance to pollution (Thompson and Hunt, 1930) and is relatively tolerant of turbidity but avoids streams that are excessively turbid and silty (Trautman, 1957; Pflieger, 1971).

The blackside darter, Percina maculata, was reported by Menzel (1952) and Larimore and Smith (1963) but was not captured in recent collections. Lopinot (1968) reported the blackside

darter from several localities on the Embarras River downstream from Champaign County including adjacent Douglas County. This darter is known to tolerate mild turbidity provided a sufficient current is present (Trautman, 1957). It is possible that this darter enters Champaign County only when current conditions are favorable and may have been missed in recent collections for this reason.

The dusky darter, Percina sciera, was represented by a single adult specimen collected in the winter of 1972. This individual was identified in the field and then released. This species had not previously been reported from the Embarras River in Champaign County, although it had been collected in adjacent Douglas County (Page and Smith, 1970). The dusky darter has been described as a species characteristic of clear, low-gradient streams with silt-free sand or gravel bottoms (Pflieger, 1971). This species is known to migrate downstream to the deeper water of river channels in the winter (Page and Smith, 1970). The factors allowing its presence in this shallow, silty region of the Embarras River are not known.

DISCUSSION

Although not supported by actual data, it is generally assumed that the siltation of the Embarras River has increased during the past forty years (Larimore and Smith, 1963; Smith, 1968, 1971). P. W. Smith (1968) studied the factors involved in the changes in the fish fauna of the Embarras River drainage and found that siltation was a very important factor in such faunastic change. He noted that while siltation decimated the populations of certain species, it could be assumed that certain other species should be favored by this change, although no data was available to confirm this at the time. The results of this study confirm Smith's assumption showing an increase in relative abundance of carp, golden shiner, redfin shiner, creek chub, yellow bullhead, blackstripe topminnow, green sunfish, orange-spotted sunfish, and bluegill since 1950-51. Also gizzard shad, black bullhead, pirate perch, largemouth bass, and white crappie are now present in small quantities. All of the previously listed species show some degree of preference or tolerance for silt bottoms (Trautman, 1957; Pflieger, 1971) as are found in this region of the Embarras River. These species were all listed by Smith (1968) as species which should benefit from the conditions created by siltation.

Siltation and stocking of game fish downstream have created a situation beneficial to local fishermen with northern pike, pickerel, yellow bullhead, white crappie, largemouth bass, bluegill, green sunfish, and longear sunfish present within this region of the Embarras River.

ACKNOWLEDGMENTS

I would like to thank Dr. L. L. Getz and Mr. Charles R. Peterson of the University of Illinois Provisional Department of Ecology, Ethology, and Evolution, Dr. N. Alger of the University of Illinois Provisional Department of Genetics and Development, Dr. P. W. Smith of the Illinois Natural History Survey, and Mr. W. J. Rainboth, Jr. of the University of Michigan Department of Zoology for their helpful comments and criticism of the manuscript.

I would also like to thank the following individuals who gave of their time to assist in collecting the fish in this study; Karen Allen, Robert Cermak, Dawn Cizmar, Thomas Conlin, Karen Gustafson, John Hudson, Robert Jost, Robert Kay, Martha Knapp, Brian Riggs, and Michael Rigsby. Walter J. Rainboth, Jr. and Douglas Schemske assisted in identifying the specimens as well as assisting with collecting.

I am indebted to David Hansen and Lanny Haverkamp for supplying the collection data from their studies. Mr. Rodney Horner, district fishery biologist of the Illinois Department of Conservation, supplied information concerning stocking of game species.

The cooperation on the part of the landowners along the Embarras River in Champaign County was greatly appreciated.

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