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Distribution and Conservation Status of the Northern Studfish, *Fundulus Catenatus*, in Indiana



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DISTRIBUTION AND CONSERVATION STATUS OF THE NORTHERN STUDFISH, *FUNDULUS CATENATUS*, IN INDIANA.

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ABSTRACT

Robust populations of northern studfish, *Fundulus catenatus*, a "species of special concern" in Indiana, were found at 13 sites, East Fork White River drainage, in southeast central Indiana. Populations in the Muscatatuk River seem to have been extirpated. Restricted distribution in Indiana, and potential threats from siltation and low-water dam construction, continue to justify its present conservation status classification.

INTRODUCTION

The northern studfish, *Fundulus catenatus*, has been designated a "species of special concern" by the Indiana Department of Natural Resources because of its limited distribution and presumed small numbers in Indiana. Previous to this study, it had been documented as occurring, in small numbers, at only six localities in Indiana. Four of these localities were on tributaries to the Flat Rock River in Johnson, Shelby, and Bartholomew counties (Gerking, 1945; Thomerson, 1969; Bill James, *in litt.* 1984-Herriot Creek in Johnson Co., probably extirpated by impoundment). The fifth collection (Gerking, 1945) was from Flat Rock River in Bartholomew Co. The sixth collection, two specimens, was taken in a rotenone sample from the Vernon Fork, a tributary of the Muscatatuk River, near Zenas in Jennings Co. (Zook, 1972). All localities (Fig.1) are in upper tributaries of the East Fork White River.

Gerking's (*in litt.*, 1966) assessment of northern studfish abundance in Indiana, "... in my opinion this species is very rare in Shelby and Johnson counties. I never found this species abundant, and I doubt very much whether you would be able to obtain 100 specimens even though you work very long and very hard," strongly suggests that their populations were small in the past.

METHODS

During 9-12 July and 14-19 September, 1985, we examined 59 potential northern studfish sites (several more than once) (Fig.1). Presence of northern studfish was documented

either by catching them with a 10' x 6', 1/4" Delta mesh seine, or by seeing them swimming at the water surface, or both. In Fig. 1, a "not-present" site means we did not get them there by seining. Seven general fish collections were made during the September period (Table 1). Because of their conservation status, we did not intentionally preserve any northern studfish. Twenty specimens were collected from upper Leatherwood Creek for electrophoretic analysis.

RESULTS

We found northern studfish at 13 sites. Six of the sites were on first order streams, two on second order streams, and five on third order streams. We did not find northern studfish as far down the Flat Rock River as we had expected, and they seem to have been extirpated in the Muscatatuk River.

Leatherwood Creek-Sugar Creek population (Johnson Co.):

The population occurs in Leatherwood Creek, a small tributary of Sugar Creek, and downstream in Sugar Creek to above the confluence of Franklin Creek. Early collections reported from Sugar Creek and Cress Creek were taken from this population. We did not encounter northern studfish at 14 other sites in Sugar Creek and its tributaries, nor were they found in the Big Blue River drainage. None were encountered in the lower Driftwood River and its small tributaries, between Sugar Creek and Flat Rock River, even though suitable habitat appeared to be present.

Lewis Creek-Flat Rock River population (Shelby and Bartholomew cos.):

Gerking (1945) reported two records from this population, but we did not find northern studfish as far down the Flat Rock River as he did (2 mi. NE Columbus). Below our downstream northern studfish site, just south of the county line (Fig. 1), the Flat Rock River has been ponded by a series of low-

Table 1. Collections at sites wi

SPECIES	SUGAR CREEK		FLAT ROCK NO. 1		LEWIS CREEK	
	Number	Percent	Number	Percent	Number	Percent
<i>Esox americanus</i>			2	0.43%		
<i>Catostomus commersoni</i>						
<i>Hypentelium nigricans</i>	1	0.61%	6	1.28%	1	0.19%
<i>Minytrema melanops</i>						
<i>Moxostoma duguesnei</i>						
<i>Moxostoma erythrurum</i>					3	0.56%
<i>Campostoma anomalum</i>	15	9.09%	30	6.38%	8	1.48%
<i>Ericymba buccata</i>	20	12.12%	44	9.36%	39	7.22%
<i>Hybopsis amblops</i>			5	1.06%	4	0.74%
<i>Hybopsis dissimilis</i>						
<i>Hybopsis x-punctata</i>						
<i>Nocomis biguttata</i>			1	0.21%	4	0.74%
<i>Nocomis micropogon</i>			24	5.11%		
<i>Notropis atherinoides</i>	9	5.45%	8	1.70%	10	1.85%
<i>Notropis boops</i>			27	5.74%	14	2.59%
<i>Notropis chrysocephalus</i>	21	12.73%	54	11.49%	238	44.07%
<i>Notropis photogenis</i>	12	7.27%				
<i>Notropis spilopterus</i>	17	10.30%	110	23.40%	29	5.37%
<i>Notropis stramineus</i>	22	13.33%			13	2.41%
<i>Notropis umbratilil</i>	4	2.42%	38	8.09%	13	2.41%
<i>Notropis volucellus</i>					1	0.19%
<i>Notropis whipplei</i>	8	4.85%	24	5.11%		
<i>Notropis sp.</i>			10	2.13%		
<i>Phenacobius mirabilis</i>			1	0.21%	3	0.56%
<i>Pimephales notatus</i>	1	0.61%	27	5.74%	125	23.15%
<i>Rhinichthys atratulus</i>						
<i>Semotilus atromaculatus</i>	4	2.42%	7	1.49%		
<i>Ictalurus natalis</i>						
<i>Noturus flavus</i>			18	3.83%		
<i>Noturus miurus</i>						
<i>Fundulus catenatus</i>	yes		yes		yes	
<i>Fundulus notatus</i>					20	3.70%
<i>Labidesthes sicculus</i>	1	0.61%	6	1.28%		
<i>Ambloplites rupestris</i>	2	1.21%				
<i>Lepomis cyanellus</i>						
<i>Lepomis macrochirus</i>	1	0.61%				
<i>Lepomis megalotis</i>			6	1.28%	13	2.41%
<i>Lepomis microlophus</i>					1	0.19%
<i>Micropterus dolomieu</i>			1	0.21%		
<i>Micropterus punctulatus</i>	2	1.21%	4	0.85%		
<i>Micropterus salmoides</i>						
<i>Etheostoma blennioides</i>	17	10.30%	12	2.55%		
<i>Etheostoma caeruleum</i>	2	1.21%				
<i>Etheostoma flabellare</i>			1	0.21%		
<i>Etheostoma nigrum</i>	4	2.42%	2	0.43%	1	0.19%
<i>Etheostoma spectabile</i>			1	0.21%		
<i>Percina caprodes</i>						
<i>Percina maculata</i>						
<i>Percina phoxocephala</i>			1	0.21%		
<i>Percina sciera</i>	2	1.21%				
Total	165		470		540	
Number of Species	21		28		20	

*** SITE LOCALITIES IN INDIANA**

Sugar Creek at Hwy. 44, E of Franklin, Shelby Co. 14:IX:1985.

Flat Rock R. (#1) at Hwy. 252 W of Flat Rock, Shelby Co. 15:IX:1985.

Vernon Fork, Muscatatuck R. @ 1 mi. below Zenas, Jennings Co.

Zook's collection: 7/8/71, Our collection: 18:IX:1985.

Clifty Creek. at Hwy. 31 SE of Columbus, Bartholomew Co. 17:IX:1985.

Driftwood R., Lowell Access NW of Columbus, Bartholomew Co. 18:IX:1985.

and without northern studfish.

species at each collection site.*

Zook's	MUSCATATUCK	Our	MUSCATATUCK	FLAT ROCK NO. 2	CLIFTY CREEK	DRIFTWOOD RIVER			
Number	Percent	Number	Percent	Number	Percent	Number	Percent		
						1	0.53%		
9	1.07%	1	0.10%	10	3.14%	6	1.00%	2	1.06%
				1	0.31%			1	0.53%
188	22.35%	359	37.63%	15	4.72%	30	5.02%		
17	2.02%	171	17.92%	55	17.30%	74	12.37%		
81	9.63%			11	3.46%	127	21.24%		
				1	0.31%	5	0.84%		
				14	4.40%	1	0.17%		
				1	0.31%				
				2	0.63%			14	7.41%
				23	7.23%				
6	0.71%			35	11.01%	72	12.04%	10	5.29%
174	20.69%	7	0.73%	60	18.87%			17	8.99%
						77	12.88%	26	13.76%
						1	0.17%	5	2.65%
5	0.59%			15	4.72%	55	9.20%	31	16.40%
								13	6.88%
4	0.48%	326	34.17%	15	4.72%	34	5.69%	1	0.53%
115	13.67%	27	2.83%	37	11.64%	81	13.55%	30	15.87%
						1	0.17%		
42	4.40%	42	4.40%	2	0.63%	14	2.34%	1	0.53%
3	0.36%								
				1	0.31%			4	2.12%
41	4.88%								
yes		no		no		no		no	
				1	0.31%	2	0.33%		
				13	4.09%			1	0.53%
12	1.43%					1	0.17%	2	1.06%
1	0.12%							1	0.53%
				1	0.31%	4	0.67%	2	0.53%
92	10.94%			2	0.63%			7	3.70%
3	0.36%			1	0.31%	3	0.50%	2	1.06%
4	0.48%			1	0.31%				
						1	0.17%	2	1.06%
8	0.95%								
20	2.38%	1	0.10%			2	0.33%		
		20	2.10%	1	0.31%	5	0.84%	2	1.06%
2	0.24%								
10	1.19%								
1	0.12%							15	7.94%
814		954		318		598		189	
23		9		24		23		23	

water dams. We found them at five sites in the Lewis Creek drainage, but they seem to be absent from the upper Flat Rock River.

Haw (or Howe) Creek population (Bartholomew Co.):

Northern studfish were found at two sites in Haw Creek, but were not found in a small tributary, Tough Creek. The lower site (Fig. 1) is in downtown Columbus across from the Cummings Company parking lot. An additional nine sites in Clifty Creek, the next tributary to the south, and Sand Creek (in Jennings Co.) did not have northern studfish.

Vernon Fork population (Jennings Co.):

This population, reported by Zook (1972), seems to have been extirpated. In July, we seined intensively at the site where they had previously been taken without encountering northern studfish. We revisited the locality (18/IX/85) and made a general seine collection of 954 specimens for comparison with Zook's collection (Table 1). We inspected the river at a number of sites along the county roads which closely parallel the river from near Zenas to near the western county line, but did not encounter northern studfish habitat.

DISCUSSION

Northern studfish are usually found in relatively clear water over a sand and gravel substrate (Pflieger, 1975; Fisher, 1981). They spawn by burying their eggs individually in sand, gravel, or plant debris. The eggs take about two weeks to hatch, and can easily be smothered if a silt load is being deposited. Juveniles are most abundant in shallow, slackwater nursery areas. In larger streams, adults also concentrate in or near these shallow areas, but in smaller streams they swim along the surface out over deeper areas, as well as in the shallows (McCaskill et al., 1972). When alarmed, juveniles hide motionless in or near cover or on the bottom. Larger fish will swim rapidly some distance away, or will dive into cover or loose substrate.

Density of the Indiana populations seemed to be about the same as that we have seen in other parts of the species' range. In fact, the most adults we have ever seen in one place was at Slash Creek (a Lewis Creek tributary), where we estimated we could see well over 100 adults from our vantage point on a small bridge over the creek. Everywhere we found studfish we found several individuals, and there were almost always young of the year present.

For at least the last ten years (Charlie Grimes, personal communication), aquarists have collected northern studfish for personal use from the sites in Leatherwood Creek. This has occurred one or more times each year, and has resulted in small numbers of northern studfish being removed from the population. This population seems to be tolerating the current collecting pressure without harm, perhaps because sites with easy access constitute only a small part of the stream reach inhabited by the northern studfish. Lewis Creek has also been collected by aquarists. In September, we heard that two aquar-

ists from Ohio had recently visited the creek to collect northern studfish.

The seine collection we made at the Vernon Fork locality (Table 1) contained 954 individuals in comparison to the rotenone collection of 843 fishes reported by Zook (1972). Our collection comprised only nine species compared to 23 species collected by Zook on 07/08/71. The central stoneroller, *Campostoma anomalum*, was numerically dominant in both collections, but no other dominant species was shared by the two collections. Six species (*C. anomalum*, 22.3%; *Notropis chrysophephalus*, 20.6%; *Pimephales notatus*, 13.6%; *Lepomis megalotis*, 10.9%; *Noturus miurus*, 9.9%; and *Hybopsis amblops*, 9.6%) comprised 86.9% of the total individuals in Zook's collection. Three species (*C. anomalum*, 38.0%; *Phenacobius mirabilis*, 34.5%; and *Ericymba buccata*, 18.1%) made up 90.6% of our collection. Modified Sorenson Similarity (Barbour et al., 1980) between the two collections was only 32%. It may be that differences between the two collections reflected different seasonal collecting dates, different water levels, or collecting bias. As to the latter, the water was low, much of the bottom was smooth rock, and seining was very effective.

The fishes collected by Zook (1972) represent a reasonable group of associate species for northern studfish, but we would not expect northern studfish to be associated with the fauna we collected at the Zenas locality. Our collection at this site stands out as different from other collections listed in Table 1. In comparison with Zook's collection, its fewer dominant species, order of magnitude fewer total species, and shift in species composition suggest considerable environmental degradation, as did the cm or so of silt we found deposited on the bottom.

Table 1 includes significant distributional records for four species. Gerking (1945; Map 27) shows *Hybopsis amblops* widely distributed in East Fork White River, but it was not recorded from that drainage by Clemmer (1980). Gerking (1945, p. 50) lists *Hybopsis dissimilis* from Bartholomew Co.: Flat Rock R., 2m. NE Columbus, and from Crawford Co., Blue R., Milltown. Harris (1980) shows only two Indiana records, both in the Tippecanoe River drainage in northern Indiana. Gerking (1945, p. 50) lists three White River drainage records for "*Erimystax* new species Hubbs and Crowe", which we presume is, at least in part, *Hybopsis x-punctata* Hubbs and Crowe. One of Gerking's records is in West Fork, and his two East Fork records are well downstream of our study area. Gilbert (1980) does not show any records of this species in the White River drainage. Gerking (1945, map 33) shows a record of *Notropis atherinoides* in the Upper Muscatatuck drainage, near the Zenas locality. Gilbert and Burgess (1980) include all of Gerking's dots for *N. atherinoides* except this one, so perhaps the record is suspect. Our collections of *N. atherinoides* document its presence in the Flat Rock River drainage.

SUMMARY AND CONCLUSIONS

The northern studfish is more widely distributed in the upper part of the East Fork White River drainage than had been thought. It is locally present in robust populations, and is

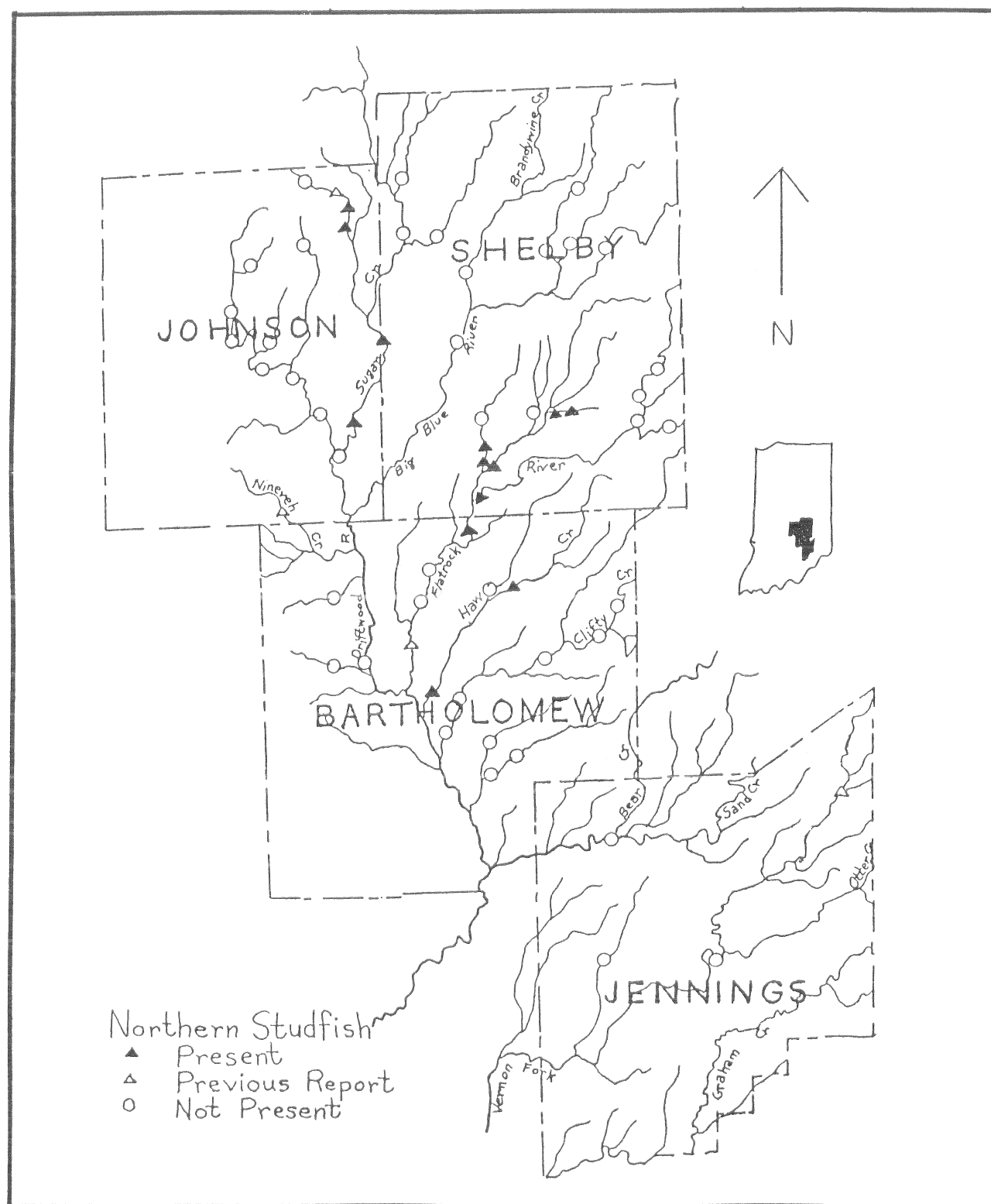


Figure 1. Distribution of northern studfish, *Fundulus catenatus*, in Indiana.

in no immediate danger of needing a more endangered classification. Its present "Species of Special Concern" classification seems to us to be appropriate in that it calls attention to the northern studfish's restricted distribution in Indiana without subjecting it to presently unnecessary protective regulation. We think the northern studfish is now extirpated from the Muscatatuck River where it was taken in 1971. If so, obvious probable causes are siltation, which smothers northern studfish eggs, and construction of low-water dams, which flood shallow areas used by juvenile studfish as nursery areas. These two factors adversely affect not only the northern studfish, but also the rest of the clear-water, gravel-bottom, pool-riffle-pool fish fauna. We would subsequently applaud efforts of State of Indiana, Federal, and local agencies to reduce siltation and restore free flow to rivers within the northern studfish's range.

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