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Distribution and Status of the Ozark Shiner, *Notropis ozarcanus* Meek, in Arkansas

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Abstract

The Ozark shiner, *Notropis ozarcanus*, an endemic species of the Ozark Highlands, was studied from 1994-1995 to determine its present distribution and conservation status in Arkansas. One-hundred and four collections of fishes were made from throughout the historic range of the Ozark shiner. A total of 91 Ozark shiners was collected during the two-year study. The present state distribution is described as well as the conservation status of the Ozark shiner in Arkansas. The largest populations seem to be present in the protected Buffalo River.

Introduction

The Ozark shiner, *Notropis ozarcanus*, is a small, slender silvery minnow which occupies clear, upland streams of the Ozark Uplands of Arkansas and Missouri (Robison and Buchanan, 1988). Although once relatively commonly encountered in appropriate river systems, the federal conservation status of the Ozark shiner has recently been questioned as it appears to have declined in Missouri. Its status in Arkansas is unknown as little data exist on which to make a formal decision as to its federal protection status. A two-year status survey was initiated for the Ozark shiner in Arkansas to gather the necessary data on which to base a decision as to whether the Ozark shiner may warrant protection under the Endangered Species Act.

Materials and Methods

Field work was conducted from June, 1994 through September, 1995. A total of 104 collections of fishes was made in an effort to document the presence of the Ozark shiner in Arkansas.

Fishes were collected using standard common sense minnow seines varying in length from 4.6-6 meters and 1.8 meters in height with a bar mesh of either 0.3 or 0.6 cm. Fishes were preserved in 10 percent formalin in the field and later transferred to 50 percent isopropyl alcohol for permanent storage. Representative specimens of the Ozark shiner were preserved from certain sites where the Ozark shiner was deemed common. Associated fishes collected with Ozark shiners were also collected and enumerated.

In addition, all known contemporary and historical literature regarding the Ozark shiner was reviewed and relevant findings summarized or referenced herein. Museums known to house Ozark shiners collected in Arkansas were

canvassed. Coverage includes the University of Michigan Museum of Zoology (UMMZ), Tulane University (TU), Northeast Louisiana University (NLU), Arkansas State University Museum of Zoology (ASUMZ), University of Arkansas (UA), University of Oklahoma (OU), and University of Alabama Ichthyological Collection (UAIC).

Historical Review

The Ozark shiner was originally described from 10 specimens collected from the North Fork of the White River in Baxter County, Missouri by Meek (1891). Relatively little attention has been focused on this small shiner other than notations as to its occurrence and/or abundance in various stream surveys. Even today, little is known about the biology of the Ozark shiner.

This diminutive, slender shiner was once abundant in the White, North Fork, and Current River drainages in Missouri (Pflieger, 1971; 1975). The historic range of this species, particularly in the White River system, has been reduced by a number of impoundments such as Bull Shoals, Table Rock, Beaver, and Norfork reservoirs.

The Ozark shiner is endemic to the southern Ozark Mountains of northern Arkansas and southern Missouri with a disjunct population reported from the Illinois River (Arkansas River system) (Fig. 1) in northwestern Arkansas (Pflieger, 1971; 1975; Burr et al. 1979; Robison and Buchanan, 1988).

Type Locality.—Gilbert and Burgess (1985) erroneously gave the type locality where Meek (1891) had described the Ozark shiner as the North Fork of the White River, south of Cabool, Baxter County, Arkansas. The type locality is actually in Missouri, not Arkansas, as correctly reported by Pflieger (1971). Meek (1891) originally collected 10 specimens of the Ozark shiner from the North Fork of the

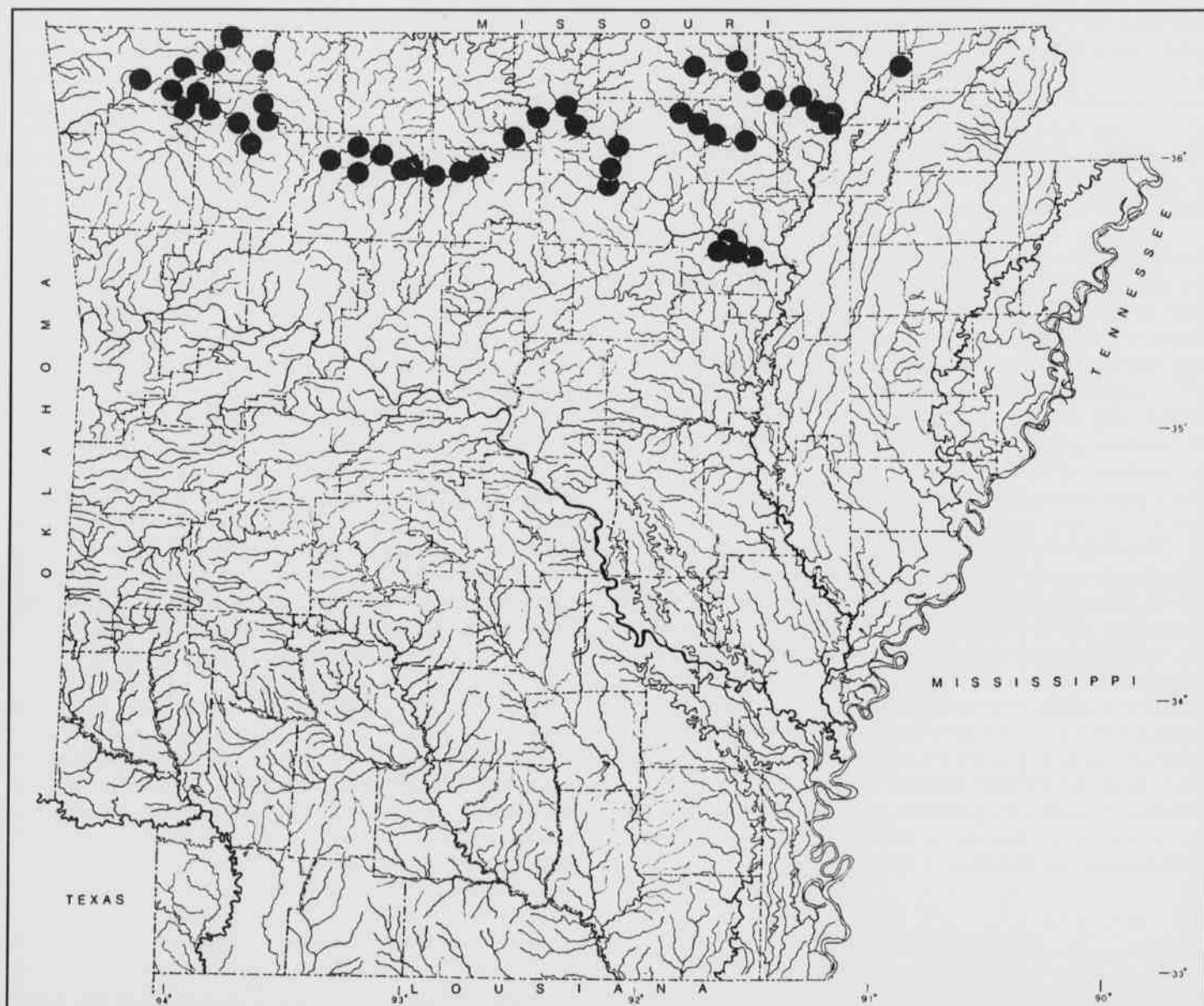
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Fig. 1. Known Distribution of the Ozark Shiner, *Notropis ozarcanus* Meek, in Arkansas.

White River. He presented the exact location on p. 115 of his 1891 paper and later repeated this in his "catalog" (Meek, 1894a:242).

Habitat and Life History Aspects

Black (1940) found *N. ozarcanus* in large creeks and small to medium-sized rivers where the water was clear and cool to cold. Cashner (1967) reported this species in clear deep water over sand and gravel bottoms. Guidroz (1975) also collected *N. ozarcanus* only in deep pools, noting the dif-

ficulty in collection of this species. Pflieger (1971) stated the Ozark shiner inhabited large, clear streams with high gradients and permanent flow in Missouri, occurring most abundantly near riffles in a slight-to-moderate current over a firm, silt-free bottom. Gilbert and Burgess (1985) reported that this shiner inhabited medium to large, clean streams with high gradient and permanent, strong flow. They said it was most common near riffles in slight to moderate current over firm, silt-free bottoms. Robison and Buchanan (1988) presented the habitat of the Ozark shiner as high-gradient stream sections below riffles in slight to moderate current in large streams and rivers.

In this study the Ozark shiner seemed to be a midwater schooling species which preferred high-gradient stream sections of clear, upland medium size to large rivers, usually occurring in areas just below riffles in slight to moderate current over gravel, cobble, or sand bottoms. There does not seem to be an affinity of the Ozark shiner for aquatic vegetation such as *Justicia americana* which is common within its range.

The Buffalo River in the Springfield Plateau near St. Joe, Arkansas, where the Ozark shiner was commonly collected, was characterized physicochemically by water temperatures ranging annually from 3.0°C degrees in winter months to 31°C in the summer, dissolved oxygen values of 6.8-13.8 mg/l, pH of 6.95-8.84, BOD of 0.0-4.3 mg/l, conductivity of 114-249 micromhos, chloride of 1.0-9.0 mg/l, alkalinity of 52-144 mg/l; discharge of 27-25,500 cfs, and turbidity levels of generally less than 1.0 NTU.

Eastward on the Salem Plateau in the Strawberry River habitat frequented by the Ozark shiner was characterized physicochemically by temperatures ranging annually from 1°C in winter months to 32°C in the summer, dissolved oxygen values of 5.9-14.0 mg/l, pH of 7.12-8.60, BOD of 0.1-3.9 mg/l, chloride of 1.0-6.0 mg/l, alkalinity of 40-238 mg/l; discharge of 58-11,200 cfs, and turbidity levels of 1.0-280 NTU.

These data presented are not intended to indicate parameter limits of the Ozark shiner, but rather to simply characterize physicochemically stream regions where the Ozark shiner seems to be moderately abundant.

Adults of *N. ozarcanus* in spawning condition have been collected in Missouri and Arkansas from late May to late August, indicating a long spawning season (Pflieger, 1975; Robison and Buchanan, 1988). Adult tubercled males in darkened breeding coloration were collected on 23 June 1995 in the Buffalo River. Little else is known about the life history of this enigmatic species.

Distribution

The following is a presentation of the distribution of the Ozark shiner by river system or main river area. Comments are made concerning its historical presence, plus the findings of this survey. Analysis of the status of the Ozark shiner in the individual river systems follows in a separate section.

White River and Smaller Tributaries.--In a pre-impoundment survey of the upper White River (Beaver Lake drainage), Keith (1964) reported *Notropis ozarcanus* probably "failed to show its true abundance" due to the fortune of his collecting methods which included electro-seining. He usually found only one or two specimens present; however, along a certain stretch of War Eagle Creek, the

shiner was collected in larger numbers. At two stations on the War Eagle, Numbers 7 and 8, Keith collected 81 and 37 individuals, respectively. Keith (loc. cit.) noted that the Ozark shiner occurred in pools of upstream sections with 1.5-6.1 m/km gradient, whereas it was rare in downstream sections where gradients were less than 1.5 m/km. He did not find this shiner in smaller tributaries to the White River. Brown et al. (1967) surveyed the fishes of the cold tailwaters of three reservoirs including Beaver Reservoir, Bull Shoals Reservoir, and Norfork Reservoir. No Ozark shiners were found in the cold tailwaters below any of the three reservoirs.

Pflieger (1971) reported the Ozark shiner to be common in the North Fork of the White River in Missouri. It was formerly abundant in the section of the White River presently inundated by Bull Shoals and Table Rock reservoirs. By 1992 however, Pflieger (*in litt.* 1993) could collect only three individuals of *N. ozarcanus* in a survey of the Missouri portion of the White River system which caused him to reassess the present status of the Ozark shiner in that system as "on the verge of extinction."

Recent collecting in the upper White River system (1993-94) by the writer while surveying for another upland species, the longnose darter (*Percina nasuta*), did not reveal any individuals of the Ozark shiner in this area, although numerous collections were made.

Matthews and Harp (1974) reported a single specimen of the Ozark shiner from Piney Creek, near its confluence with the White River. In almost 30 years of collecting from the Piney Creek system, no additional specimens of Ozark shiners have been taken (W. J. Matthews, pers. comm.).

The Ozark shiner is apparently absent from Crooked Creek, one of the premiere smallmouth bass fishing streams in Arkansas, as collections during this survey did not produce a single specimen, nor have periodic collections from Crooked Creek by the writer during the past 15 years. In addition, no other museum records are available for this species from Crooked Creek despite collecting by a number of ichthyologists.

A survey of the fishes of Sylamore Creek, another direct tributary of the White River near Mountain View, Arkansas, by Frazier and Beadles (1977) failed to find the Ozark shiner within the system.

The farthest downstream collection of the Ozark shiner in the White River system is near Batesville, Arkansas. Meek (1894b) collected *N. ozarcanus* from the lower White River tributaries of Salado Creek and Caney Creek near Batesville. In addition, museum records are available from Northeast Louisiana University from the main channel White River from 1967-1976.

Kings River System.--Black (1940) made the largest collection of *N. ozarcanus* (UMMZ 123376 - 157 specimens) ever made from the Kings River, 4.8 km east of Alabam in

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Madison County just below the inlet of a sizable cold stream from Denny's Cave. A quarter of a century later, Cashner (1967) collected just one specimen from this river. Seven specimens taken during the present survey re-established the Ozark shiner as a resident and were the first documentation of the species in this system since 1967. The seven specimens came from approximately 5.63 km north of Kingston, Arkansas on St. Hwy. 21 (Sec. 33, T17N, R24W) on 24 June 1995. A total of nine collections was made from this system with only one collection yielding Ozark shiners.

Buffalo River System.--Black (1940) recorded 26 species of fishes from six localities including 10 specimens of the Ozark shiner (UMMZ 123535 eight specimens; UMMZ 127728 - one specimen; UMMZ 169902 - one specimen). Using electroshocking, Cashner (1967) collected 375 specimens of Ozark shiners from six locations on the Buffalo River. Guidroz (1975) surveyed the fishes of this river over 20 years ago in a two-year study from 1971 to 1973. He reported 220 specimens of *N. ozarcanus* from 10 locations in this system. Guidroz (1975) reported *N. ozarcanus* to be rather common, but noted that its preference for deep pools made collecting difficult.

In a longitudinal distribution survey of the Buffalo River, Cashner and Brown (1977) documented 59 species of fishes, but did not comment specifically on *N. ozarcanus*; however, they noted in a table that this species occurred virtually the entire length of the main river.

Based on previous Arkansas collections now housed in the Tulane University and Northeast Louisiana University fish collections (many of which were over 20 years old), Robison and Buchanan (1988) suggested that the Buffalo River may hold the best populations of this enigmatic shiner due to its relatively pristine conditions. Recent collections from the Buffalo River for a three-year period (1990-1992) by Dr. James Johnson (University of Arkansas) and his students revealed a total of 72 specimens of *N. ozarcanus* from six locations (Dr. James Johnson, pers. comm.).

Collections made in May-July 1995 from the Buffalo River by the writer re-established the Ozark shiner as a rather widespread, somewhat common fish species of the Buffalo River. The Ozark shiner was found at seven localities in the system from the Ponca low-water bridge in the headwaters in Newton County downstream to St. Hwy. 14 in Marion County. It was most abundant through the Mt. Hersey and Woolum areas. A total of 63 specimens was collected from the Buffalo River during this most recent survey.

The specific collecting localities, dates, and number of specimens collected were 1) Buffalo River at St. Hwy. 74 at Ponca low-water bridge (Sec. 30, T16N, R22W). Newton County. 25 June 1995. Five specimens. 2) Buffalo River at Steel Creek Recreation Area (Sec. 17, T16N, R22W). Newton County. 26 May 1995. Eight specimens. 3) Buffalo River at U. S. Hwy. 65 (Sec. 36, T16N, R17W). Searcy

County. 23 June 1995. Eleven specimens. 4) Buffalo River at Woolum Access (Sec. 3, T15N, R18W). Searcy County. 23 June 1995. Sixteen specimens. 5) Buffalo River at Mt. Hersey Access (Sec. 31, T16N, R18W). Searcy County. 25 June 1995. Twelve specimens. 6) Buffalo River at Carver Access (Sec. 6, T15N, R19W). Newton County. 8 July 1995. Five specimens. 7) Buffalo River at St. Hwy. 14 (Sec. 33, T17N, R15W). Marion County. 23 June 1995. Six specimens.

Strawberry River System.--Meek (1894b) first collected *Notropis ozarcanus* in the Strawberry River at Smithville, Arkansas, noting that the species was scarce. A single lot (USNM 59288) collected by Meek in 1907 is housed in the United States National Museum. Robison and Beadles (1974) later surveyed the fishes of the Strawberry River system and reported *N. ozarcanus* as common, but not found in large numbers. They reported it from high gradient stream sections with clear substrates. Hilburn (1987) established 22 stations on the Strawberry River and collected 15,746 fishes comprising 72 species, including 135 specimens of *N. ozarcanus*.

Fifteen collections made from the Strawberry River system during this study yielded only 18 specimens from just two sites in Sharp County: U. S. Hwy. 167 north of Evening Shade, AR. (29 July 1994 - three specimens; 27 July 1995 - 14 specimens) and St. Hwy. 58 north of Poughkeepsie, AR. (6 October 1994 - one specimen) (Fig. 2).

Spring River System.--Fowler and Harp (1974) studied Jane's Creek, a tributary of the Spring River, and reported five *N. ozarcanus* at the mouth of Jane's Creek and Spring River. This station consisted of small, deep pools with submerged logs and undercut banks but no aquatic vascular plants.

Winters (1985) later surveyed the fishes of the entire Spring River system and reported 94 species of fishes including *Notropis ozarcanus*. He collected 84 Ozark shiners during his survey from 10 different localities. While the Ozark shiner was not commonly encountered in his survey, he did note that, interestingly, one large series of 61 specimens (NLU 43535) was collected in 1979 from the Spring River, approximately eight km upstream of Ravenden Access during flooded conditions (S. Winters, pers. comm.), and that this shiner generally preferred moderate currents over gravelly sand bottoms.

Collections during this survey revealed the Ozark shiner to be rare in the Spring River, as only three specimens were taken in 12 collections from seven localities throughout the system. These were collected from the Spring River, approximately 1.6 km south of Ravenden, Lawrence County, AR (Sec. 12, T18N, R3W) on 28 May 1995.

Eleven Point River System.--Johnson and Beadles (1977) reported *N. ozarcanus* as rare within the Eleven Point River system in Arkansas. They found it in quiet pools of the main

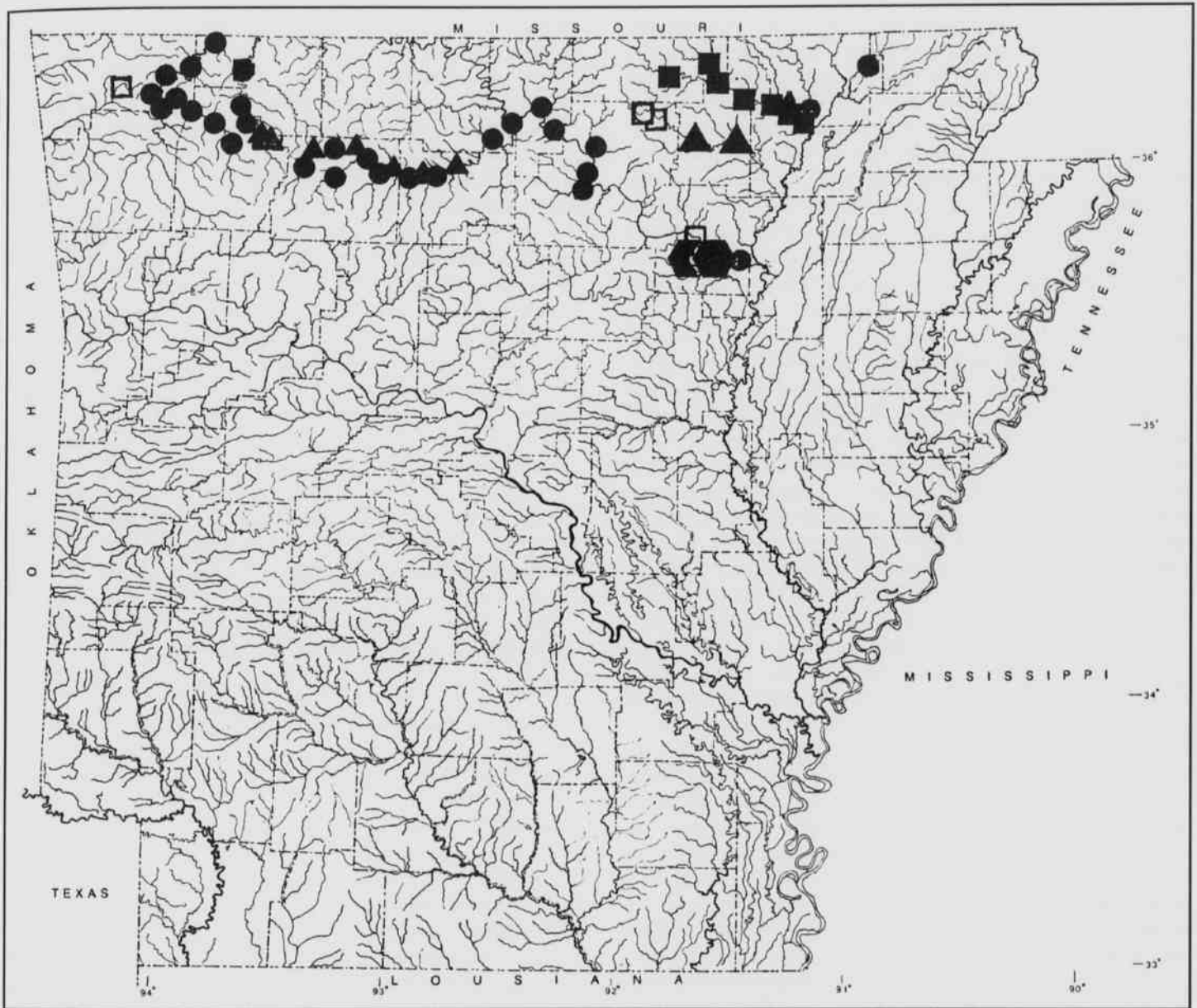


Fig. 2. Distribution of the Ozark Shiner, *Notropis ozarcanus* Meek, by Chronological Date Collected: 1881 = ●; 1939-1969 = ●; 1970-1978 = □; 1979-1989 = ■; 1990-1995 = ▲.

river.

Although 10 collections were made from the Arkansas portion of the Eleven Point River system, no specimens of the Ozark shiner were taken during this survey.

Current River System.--Green and Beadles (1974) reported the Ozark shiner as uncommon in both upland and lowland habitats. Pflieger (1971) reported this shiner to be common in the Missouri portion of the Current River. Pflieger (*in litt.* 1993) collected 43 specimens at seven collection sites in the Current River drainage, which prompted him to consider the *N. ozarcanus* population to be relatively stable in the

Missouri portion of the drainage.

No specimens of *N. ozarcanus* were collected during this survey in the Arkansas portion of the drainage. Five collections were made in the Arkansas portion of the Current River system from three localities.

Black River and Smaller Tributaries.--Neither Bounds and Beadles (1975) nor Bounds (1977) who surveyed Fourche Creek, a Black River tributary, collected any Ozark shiners from this creek. Yeager and Beadles (1976) surveyed Cane Creek, another Black River tributary, but also failed to find Ozark shiners.

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This survey failed to find the Ozark shiner in the Black River in Arkansas as did Pflieger (*in litt.* 1993) in the Missouri portion of the drainage. The river is quite large in the Arkansas portion, and suitable upland habitat for the Ozark shiner probably does not exist in the state.

St. Francis River System.--The St. Francis River has been heavily altered through land-use perturbations in the Arkansas portion of its drainage. Harvill (1989) earlier surveyed the fishes of the Arkansas portion of the St. Francis drainage and did not collect *N. ozarcanus*. No attempt was made to seine this drainage during this survey, as suitable habitat for the Ozark shiner does not occur in this system in Arkansas today.

Arkansas River System.--Burr et al. (1979) reported 17 specimens of the Ozark shiner from a single collection from Osage Creek, a tributary to the Illinois River, about two km south of Logan, Benton County, Arkansas. This is the only record of the Ozark shiner to date from the Arkansas River system. Ten recent collections by Dr. James Johnson (pers. comm.) from the upper Illinois River did not yield a single specimen of *N. ozarcanus*. No new collections were made in Osage Creek during this study.

Conservation Status

Historical Conservation Status.--Black (1940) made an interesting observation with regard to *Notropis ozarcanus* over 50 years ago. He noted that while this shiner is locally common, it is frequently absent from apparently favorable localities. Cloutman and Olmsted (1976) noted that *N. ozarcanus* was "rare" in their survey of the fishes of Washington County, AR, as they did not collect a single individual. In fact, they observed the Ozark shiner had not been collected in Washington County since Keith's (1964) preimpoundment collections, although they speculated it was probably still present in War Eagle Creek.

In independent assessments of the threatened fishes of Arkansas, neither Buchanan (1974) nor Robison (1974) included the Ozark shiner in their publications. Gilbert and Burgess (1985) reported *N. ozarcanus* was formerly common, but now has been eliminated from many impounded areas. Robison and Buchanan (1988) did not list *Notropis ozarcanus* in their discussion of rare and endangered fishes in Arkansas.

In a 1992 survey for the Ozark shiner in Missouri, Pflieger (pers. comm.) captured only three specimens of *Notropis ozarcanus* in the White River, because much of this area has been inundated by reservoirs. Such is the case in Arkansas as many of the White River localities have also been inundated by reservoirs. Habitat loss is one of the greatest causes of the declines in populations of native fishes in North America (Williams et al., 1989). Widespread

reservoir construction and decline in water quality have severely altered most of North America's clean, free-flowing riverine habitat (Benke, 1990).

Present Conservation Status.--The state of Arkansas presently has no official state list of threatened or endangered wildlife or plants. Instead, protection is afforded by the Arkansas Game and Fish Commission primarily to federally threatened species.

A total of 104 collections of fishes was made during this study within the historical distribution of the Ozark shiner. From these 104 collections only 91 specimens of Ozark shiners were captured (Table 1). After careful review of all of the major holdings of the Ozark shiner available, two years of intensive field work collecting Ozark shiners, review of all pertinent literature, and discussions with virtually all of the major collectors of Ozark shiners in Arkansas, it is readily apparent that the Ozark shiner has declined in abundance throughout its historical range in Arkansas (Map 2).

Table 2 provides a quick view of the decline in abundance of the Ozark shiner in Arkansas by decade. While certainly not definitive, Table 2 shows the Ozark shiner seeming to decline in the decade of the 1980s and continu-

Table 1. Collecting Localities, Number of Collections, and Numbers of Ozark Shiners Collected in Arkansas in 1994-1995.

Locality (River System)	No. of Collections	No. Ozark Shiners
1. White River (mainstream)	11	0
2. White River (smaller tribs)	10	0
3. War Eagle Creek	3	0
4. Kings River	9	7
5. Buffalo River	17	63
6. North Fork	2	0
7. Crooked Creek	6	0
8. Strawberry River	15	18
9. Spring River	12	3
10. Eleven Point River	10	0
11. Current River	5	0
12. Black River	4	0
TOTAL	104	91

ing into the 1990s. When the number of *N. ozarcanus* per collection is viewed, the decline of this species may have occurred much earlier than the 1980s. A closer inspection of the 1146 museum specimens of *Notropis ozarcanus* by river system reveals that 51.2 percent (587 individuals) of the specimens were collected from a single river system, the Buffalo River (Table 3).

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While data gathered from this study indicate that overall there seems to be a decline in the populations of the Ozark shiner in Arkansas, such is not typically the case in the Buffalo River. This river, where 67 of the 91 specimens

Table 2. Number of Ozark Shiners Collected By Year, Number of Collections of Ozark Shiners By Year, and Mean Number Per Collection By Year.

Years	No. Ozark Shiners	No. Collections	Mean No. Per Collection
1938-1939	242	13	18.6
1950-1959	121	3	40.3
1960-1969	143	58	2.5
1970-1979	426	48	8.9
1980-1989	13	4	3.3
1990-1995	201	32	6.3
Totals	1146	158	

Table 3. Collections of the Ozark Shiner By River System.

River System	No. Ozark Shiners	Percentage	Collections
White River	173	15.1	42
Kings River	198*	17.3	8
Buffalo River	587	51.2	81
Strawberry River	90	7.9	12
Spring River	93	8.1	13
Eleven Point River	4	0.3	1
Current River	1	0.1	1
Total	1146	100.0	158

*One collected by J. D. Black (UMMZ 123376) accounted for 157 specimens of this total.

of the Ozark shiner were collected during this study, seems to continue to support a rather large and widespread population of the Ozark shiner. However, this overall reduction in range and abundance in Arkansas necessitates a re-evaluation of the conservation status of the Ozark shiner.

Reasons for this decline seem to be multiple and complex. Destruction and modification of habitat from impoundments with concomitant cold water release remains a large part of the problem for the Ozark shiner. The Ozark shiner has disappeared from a number of stream reaches in

the White River which are now impounded and also from downstream reaches where cold water releases influence areas many kilometers downstream from reservoirs (Fig. 2). Reservoirs also effectively eliminate migration by obligate stream fishes from one tributary to another, precluding natural colonization of potentially suitable streams. Increases in turbidity and siltation have also occurred in the upland streams inhabited by the Ozark shiner as poor land practices such as road building, farming, clearing of land for pasture, clearcutting, destruction of riparian buffer strips and other human perturbations continue in these watersheds. Other possible reasons for decline of the Ozark shiner include gravel removal operations in many Arkansas streams (Filipek and Oliver, 1994), nutrient enrichment from the enormous increase in poultry and swine operations, and human population increases.

During this two-year study the continued presence of the Ozark shiner was documented in several of the river systems in Arkansas from which it was collected historically, including the Buffalo, Spring, and Strawberry river systems (Fig. 2). No specimens were collected from the upper White River above or below Beaver Reservoir, War Eagle Creek, North Fork of the White River below Lake Norfork, Eleven Point River, or the Current River. In addition to these areas where the Ozark shiner had been collected historically, collections were made in several stream systems not previously known to contain Ozark shiners. No new populations were discovered.

Thus, after carefully reviewing the collection records of the Ozark shiner from the University of Michigan, Northeast Louisiana University, Tulane University, Arkansas State University, University of Arkansas, and the University of Oklahoma, and two years of field work, the Ozark shiner is not herein recommended for official federally threatened status at this time. Rather, this small silvery cyprinid species should be accorded a status of "Special Concern" and a program be initiated to monitor its continued existence in northern Arkansas. The apparent small populations and low densities make it imperative that a careful watch on this species be maintained in the future.

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