Decreasing Distribution and Current Status of the Arkansas River Shiner, *Notropis girardi*, in the Rivers of Oklahoma and Kansas

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During the past 15 years, *Notropis girardi,* has been either extirpated or drastically reduced from 75% of its former range in Oklahoma and all of Kansas. This species is found in large numbers only in the South Canadian River of south central Oklahoma. Smaller numbers are present in the North Canadian River and the Arkansas River.

INTRODUCTION

The Arkansas River shiner was widespread and abundant in the large prairie tributaries of the upper Arkansas River system in Kansas and Oklahoma (1). This study addresses the status of this shiner in the major tributaries and mainstream of the Arkansas River in Oklahoma, reviews reports of past and present populations of this species in Oklahoma, and assesses future threats to this species.

The Federal Clean Water Act of 1972 stipulates that all waters capable of supporting a fishery or a swimming area be unimpaired by water pollution. In 1976 the Oklahoma State Department of Health (OSDH) began extensive surveys of fish populations in Oklahoma waters to decide the level of protection required for various Oklahoma streams and to measure progress toward the fishery goal of the Federal law. This report is based in part on those surveys.

METHODS

I collected fish at 140 sampling sites two or three times yearly from May 1976 to November 1988. At each site I used a 3.3-m by 1.3-m heavy-leaded seine with 3.0-mm mesh to ensure standardized sampling and sampled a 200-m reach of stream with 20 seine hauls of 10-m length. To ensure consistent sampling I led all seining trips. The seining required one hour at each site. The fishes were placed immediately in 10 percent formalin. After we returned to the laboratory, the fish were washed, sorted, identified, measured and weighed, and transferred to 60% isopropyl alcohol.

Current distribution patterns are deduced from 1,167 collections from 140 sites throughout the Arkansas River basin in Oklahoma during 1976-1989. Supplementing these collections was the report of Cross et al. (2) on the extirpation of this species in the Cimarron and Arkansas rivers of Kansas. I examined additional data from unpublished records of collections (UPD) from the University of Oklahoma Biological Survey (OUBS), the Oklahoma State University Zoological Museum (OSUZM), University of Kansas Museum of Natural History (UKMNH), and University of Oklahoma Zoology Museum (OUMZ) to determine past distributions. Specimens collected in this study have been deposited at OSUZM except 32 reference specimens cataloged into the OSDH museum in Oklahoma City.

The records used in this report extend from 1926 to 1989. Surveys included those by Hubbs and Ortenburger in 1926 to 1929 (1), Moore for 1936 to 1956 (M OSUZM UPD field notes), and Riggs (R OUMZ UPD field notes) from 1948 to 1960. Extensive collections from the Deep Fork, North and South Canadian Rivers were made by Houser and Lindsay (HL OUBS UPD) in 1962, and by Lindsay and Bates (LB OUBS UPD) from the North Canadian (Beaver) and Cimarron Rivers in 1963. Lindsay (personal communication) (LPC) provided baseline information on the distribution and abundance of this species in the Arkansas River the in Tulsa area for 1956-66. I examined unpublished field notes of Pigg, Harrison and Gibbs (P UPD) on the South Canadian River in 1983.

HISTORICAL DISTRIBUTION

The status of the Arkansas River shiner in Oklahoma is of concern because of its

TABLE 1. Distribution of the Arkansas River shiner for the OSHD fish-collecting sites on the Cimarron River, 1976–88. Sites are listed in order, upstream to downstream.

	Number of fish collected in year 19nm														
River site	76	77	78	79	80	81	82	83	84	85	86	87	88	A	B
N. Kenton,Cimarron Co.	--	--	--	--	0	0	0	0	0	0	0	0	0	19	0
E. Kenton,Cimarron Co.	--	--	--	--	0	0	0	0	0	0	0	0	0	15	0
S. Englewood,Harper Co.	--	--	--	--	0	0	2	0	0	0	0	0	0	14	1
E. Buffalo,Woods Co.	1	72	0	1	0	0	1	0	0	0	0	0	0	35	5
S. Cleo Springs,Major Co.	--	--	--	77	11	41	5	0	52	6	0	0	0	21	10
E. Okeene,Kingfisher Co.	--	--	--	386	87	5	24	0	0	0	0	0	0	23	6
S. Dover,Kingfisher Co.	--	--	--	1537	8	8	2	12	0	0	0	0	0	21	7
N. Guthrie,Logan Co.	28*	46*	28	94	65	0	0	0	0	0	0	0	0	25	9
N. Coyle,Logan Co.	0*	0*	--	--	0	108	17	0	2	0	0	0	0	15	3
S. Perkins,Payne Co.	25	317	35	168	15	199	1	6	1	1	0	0	0	34	16
N. Oilton,Pawnee Co.	--	--	--	--	--	0	--	--	--	--	--	--	--	1	1
															Total
Collections with shiner, *N. girardi*	3	5	3	12	10	7	9	2	4	3	0	0	0		58
Total number of collections	4	6	6	17	18	19	19	22	23	25	22	21	9		224
Total number of *N. girardi*	54	435	63	2263	186	361	52	18	55	7	0	0	0		3494

* Collections made by OCCHD UPD. A = Number of collections. B = Number of collections with *N. girardi*.

extirpation in Kansas. This shiner was once abundant throughout the main stream of the Arkansas River (2). Since 1983 this species has not been found in major tributaries of that river: the Cimarron, Medicine Lodge, and Ninnescah Rivers, and Crooked Creek. Only one recent collection of this shiner has been made: a single specimen observed from Morton County, Kansas in 1985 (Cross, personal communication).

Cross et al. (2) reported this shiner in the northern half of the Texas Panhandle, northeastern New Mexico, southeastern Colorado, and southwestern Kansas. In 1939, there was a single collection of this species from the river in western Arkansas (23). The species occurs as far west as the Canadian River drainage in New Mexico (4) and the Texas Panhandle (UKMNH UPD). The Arkansas River shiner was introduced into the Pecos River of New Mexico in 1979 and was common there in 1986-87 (5).

There are several records of this species in the Red River system of Oklahoma. Cross (6) collected one specimen (UKMNH, KU12966) in 1939 from Wildhorse Creek (a tributary of the Washita River) in Garvin County. There were three additional collections from the Red River system in Oklahoma (OUMZ UPD).

This shiner has virtually disappeared from the Arkansas River main stream. There have been no recent collections in Kansas (2), Colorado (2), or Arkansas (3). During this study I collected this shiner from five mainstream sites on the Arkansas River in Oklahoma.

The range of this species in Oklahoma was more extensive prior to 1985; since then it is limited to the Arkansas, North Canadian and South Canadian rivers.

CIMARRON RIVER SYSTEM

The Arkansas River shiner was once common in the Cimarron River. However, no large numbers were collected after 1981 and none after 1985 (Table 1). In 52 collections in 1986-88, the species was never seen. I collected 3494 Arkansas River shiners during this study from eight mainstream localities. This species was found in 26% of collections but comprised only a small percentage (1.4%) of fish collected (7) (Table 1).

Since the species is now absent from the Cimarron in Oklahoma, the pattern mimics that found in New Mexico, Colorado, and Kansas (2). The species has probably disappeared from the Cimarron River in the Oklahoma Panhandle (8). In 1926 this shiner was collected in large numbers (101 specimens) from the river near Kenton and from West Carrizo Creek northeast of Kenton (Cimarron County) (1). The only other record of this species from this section of river (Cimarron County) was a single

TABLE 2. Historical distribution before 1976 and recent OSDH collections since 1976 at four-year intervals of the Arkansas River shiner in the Cimarron River from 1976 to 1988. Historical data are from collections made near OSDH stations

River site	Historical Data A	B	D	E	1976–79 A	B	C	1980–84 A	B	C	1985–88 A	B	C	Last Year[b]
N Kenton	91	1	(1)	1926	0	0	0	0	0	7	0	0	10	1926
E Kenton	1	1	(9)	1949	0	0	0	0	0	7	0	0	7	1949
Englewood	46	1	OUBS	1963	0	0	0	2	1	6	0	0	7	1982
Buffalo	X	1	OUBS	1930	74	4	9	1	1	15	0	0	9	1982
Cleo Springs	X	1	OUBS	1930	77	2	2	109	6	11	6	2	7	1985
	71	1	OUBS	1962	--	--	--	--	--	--	--	--	--	----
	4	1	(11)	1979	--	--	--	--	--	--	--	--	--	----
Okeene	4	2	(11)	1979	386	2	4	116	5	10	0	0	7	1983
Dover	--	--	--	----	1537	2	3	30	5	11	0	0	7	1982
Guthrie	X	1	OUBS	1929	196	5	5[a]	65	4	12	0	0	7	1980
	63	1	OUBS	1965	--	--	--	--	--	--	--	--	--	----
Coyle	4	1	(11)	1979	0	0	2[a]	127	3	7	0	0	6	1982
Perkins	222	13	OSUZM	32-65	545	8	8	221	7	15	1	1	10	1985
	X	1	OSUZM	1974	--	--	--	--	--	--	--	--	--	----
	5	2	(11)	1979	--	--	--	--	--	--	--	--	--	----
Oilton	60	1	OUBS	1960	0	0	0	1	1	1	0	0	0	1981
Total for period					2815	23	33	672	33	102	7	3	77	

[a] Includes data from collections by OCCHD in 1976 and 1977.
[b] Year of last collection of the shiner at this site.
A = Number of *Notropis girardi* collected at site. B = Number of collections with *Notropis girardi*.
C = Total number of collections for period. D = Source of historical data.
E = Year of the historical collection; 32-65 = 1932–1965. X = The shiner was present, but no count was made.

specimen taken in 1949 near Kenton (9). The shiner was not found at five sites in Cimarron County during 37 collecting trips from 1980 to 1988. I did not find this species in 1984 and 1988 from Crooked Creek, a tributary from Kansas which enters Beaver County. Collections from this creek in Kansas between 1941 and 1964 contained a small population but similar surveys made during 1972, 1979, and 1983 did not find the shiner (2).

Extensive collections (12 such) in the river from Payne and Logan Counties by Moore (M OSUZM UPD) in 1938-65 consistently found large numbers of this shiner. Two collectioms by the Oklahoma City-County Health Department (OCCHD) in Logan County during the winters of 1976-77 near Crescent included 28 and 46 specimens respectively but none was obtained from the river near Coyle (12).

In the past the Arkansas River shiner was present throughout the Cimarron River and its small tributaries. This species was collected from several small tributaries (Skeleton, Headquarters, Wildhorse, Stillwater, and Red Rock Creeks) in Logan, Payne, and Pawnee Counties by Moore (OSUMZ UPD) during 1938-65. Recent collections from Stillwater (10), Skeleton (OSDH UPD), Cottonwood (OSDH UPD), and Gar Creeks (OCCHD UPD) did not include this species. In ten collections between 1978 and 1988 from Cottonwood and Skeleton Creeks, I did not see this shiner. I was also unable to find this species in several tributaries (West Carrizo, North Carrizo, East Carrizo, Horse, and Crooked Creeks) in Cimarron and Beaver Counties.

Until the present study, the most extensive recent survey was that by Felley and Cothran (11). They sampled 11 sites on the Cimarron River extending from Woods to Creek Counties and found this shiner at six sites (1-2 specimens per site). This species had been drastically reduced in abundance by 1978 or 1979. Table 2 shows this species probably continued to occur in modest numbers (30 to 221 specimens) until after 1981.

Throughout my study the shiner was not collected from the two westernmost sites (Sites 1 and 2) in Cimarron County (Table 2), but a small population was present at Sites 3 and 4 near Englewood and Buffalo in Harper County (Table 1). Downstream from Cleo Springs (Site 5) to near Perkins (Site 10), there were usually periods of seasonal high flows and long periods free from no-flow conditions. Correspondingly larger numbers

TABLE 3. Historical and recent (after 1976) distribution of the Arkansas River shiner in the North Canadian (Beaver) River.

	Historical data				1976–79			1980–84			1985–88			Last
River Site / County	A	B	D	E	A	B	C	A	B	C	A	B	C	Year[a]
Guymon / Texas	312	1	OSUZM	1949	0	0	2	0	0	8	0	0	8	1962
	X	1	(8)	1949	--	--	--	--	--	--	--	--	--	----
	151	1	UKMNH	1956	--	--	--	--	--	--	--	--	--	----
	50	1	UKMNH	1962	--	--	--	--	--	--	--	--	--	----
	318	4	OUMZ	1962	--	--	--	--	--	--	--	--	--	----
Turpin / Beaver	X	1	OSUZM	1949	0	0	0	178	3	6[b]	4	2	7	1987
	37	1	UKMNH	1951	--	--	--	--	--	--	--	--	--	----
	83	1	UKMNH	1960	--	--	--	--	--	--	--	--	--	----
Beaver / Beaver	246	4	OUMZ	1963	0	0	0	0	0	7[b]	0	0	7[b]	1972
	44	1	UKMNH	1972	--	--	--	--	--	--	--	--	--	----
	235	1	(2)	1972	--	--	--	--	--	--	--	--	--	----
Laverne / Harper	223	1	OSUZM	1947	0	0	0	0	0	0	0	0	1	1947
May / Harper	40	2	OSUMZ	1947	0	0	0	1	1	7[b]	0	0	7	1982
	163	1	OUMZ	1963	--	--	--	--	--	--	--	--	--	----
Woodward /	X	1	UOBS	1928	0	0	3	11	5	14	0	0	8	1983
Woodward	X	1	OSUMZ	1953	--	--	--	--	--	--	--	--	--	----
	16	2	OWRB[c]	1983	--	--	--	--	--	--	--	--	--	----
Seiling / Major	--	-	----	----	0	0	0	0	0	0	0	0	9	----
Watonga / Blaine	--	-	----	----	0	0	3	0	0	10	0	0	7	----
El Reno / Canadian	--	-	----	----	0	0	5	0	0	16	0	0	9	----
Harrah / Oklahoma	--	-	----	----	0	0	7	0	0	15	0	0	10	----
Little / Seminole	--	-	----	----	0	0	0	0	0	0	0	0	1	----
Wetumka / Hughes	--	-	----	----	1	1	3	0	0	13	0	0	8	1979
Dustin / Okfuskee	500	1	OUMZ	1962	--	--	--	--	--	--	--	--	--	1962
Dustin / McIntosh	1762	8	OUMZ	1962	--	--	--	--	--	--	--	--	--	----
Whitefield / Haskell	8	1	OUMZ	1962	0	0	0	0	0	9	0	0	10	1962
Total for period					1	23	1	190	9	105	4	2	92	

[a] Year of last collection of the shiner at this site.
[b] Site was dry during one visit.
[c] Oklahoma Water Resource Board.
A = Number of *Notropis girardi* collected at site. B = Number of collections with *Notropis girardi*.
C = Total number of collections for period. D = Source of historical data.
E = Year of the historical collection. X = The shiner was present, but no count was made.

of Arkansas River shiners occur in this section.

Felley and Cothran (11) noted a major decline in the abundance of this shiner after 1964. They reported that ten collections before 1964 averaged 245 specimens. In the present study, 68 collections from 1976 to 1981 averaged 49.4 specimens, and 114 collections after 1981 averaged only 1.2 specimens (Table 2). Collections before 1981 produced 96.2% of the specimens of *N. girardi*. The species appeared in 37 collections before 1981 but only 18 after that date. Only at Perkins was this species found consistently from 1976 to 1985 (Table 1).

NORTH CANADIAN (BEAVER) RIVER

The first collection of the Arkansas River shiner from the North Canadian (Beaver) River drainage was from Coldwater Creek SE of Guymon in Texas County, and in Sleeping Bear Creek, SW of Buffalo in Harper County in 1926 (1). The collection from Coldwater Creek contained 215 specimens. Two such collections in 1963 included 51 (OUMZ 32266) and 44 (OUMZ 32339) shiners.

Large numbers (223 specimens) of this shiner were first collected in 1947 by Carter and Poole (OSUZM 577) from the river north of May (Harper County) and 40 shiners (OSUZM 1715) from the Beaver River north of Laverne (Table 3). Four collections made by Lindsay and Bates in 1963 included 189 shiners from the river in Beaver County (LB OUMZ). The number of shiners per sample varied from 33 to 78 (Table 3). These records verify that this minnow occurred in large numbers in the river and in some larger tributaries prior to 1976 (Table 3). Smaller numbers of shiners were collected from tributaries in Harper and Woodward Counties (OUMZ UPD). In this study I made six collections from some tributaries (Kiowa, Palo Duro, Clear, and Coldwater Creeks) of the

North Canadian (Beaver) River in Texas and Beaver Counties, but did not find this shiner.

Six collections from McIntosh County in 1962 (HL OUMZ UPD) included large numbers (1762 specimens) of this species (Table 3). Large numbers (500 specimens) were collected from the river near Dustin (Okfuskee County) in 1962 (HL OUMZ UPD). Most of these sites are now inundated by Lake Eufaula.

In the past this species was abundant in the North Canadian (Beaver) River above and below Oklahoma City. I was unsuccessful in finding records of past fish collections from the river between the Canadian County line and the Pottawatomie County line before 1975. Since 1975 three comprehensive fishery surveys of the river in Oklahoma County have been conducted: in 1975-77 by OCCHD (12), in 1982 by USFWS (13) and in 1987 by Matthews et al. (14); this shiner was not found by any of these.

The present study showed a substantial reduction of this species in the westernmost sections of the river (Table 3). Collections made upstream of Lake Optima in Texas County in 1964 included large numbers (852 specimens) of this shiner (Table 3) (LB OUMZ). In contrast, sixteen collection trips to this section of the river between 1979 and 1989 yielded none of this species, owing to the lack of water. The river west of Lake Optima is now dry most of the year.

The river above Woodward accounted for all the shiners collected except one specimen (Table 3). Past collections verify that large numbers of this fish occurred between Lake Optima and Woodward. The only recent collections of this species are those that I made in 1987 at Turpin and in 1982 at Woodward. I never found it in large numbers except near Turpin in 1983 when I collected 147 specimens (Table 3). The river west of Woodward, where this species was abundant in 1964 (LB OUMZ UPD), now has long periods with low or no flow. The shiner was absent from 118 collections I made between 1976 and 1988 from the river between Seiling in Major County downstream to Little in Seminole County.

Historical fish records are scarce for the North Canadian River from Woodward to El Reno; I found no past record of the Arkansas River shiner in this section of the river. Extensive sampling (62 collections) between 1976 and 1988 in the river from El Reno (Canadian County) to Little (Seminole County) failed to find the shiner.

Most of the downstream sections of the river where large numbers of this species were collected in the 1962 survey (HL OUMZ UPD) are now inundated by Lake Eufaula. I collected a single specimen in 1978 from the river near Wetumka (Hughes County). I made 24 collections from this section of the river between 1978 and 1989 without finding this shiner (Table 3).

In this study most of the shiners (191 specimens) were collected before 1984; only two were collected subsequently. This species was found in only 9% of my collections from the river. There are no historical collection records of this species at six stations. Other such records verify that in 1962 and 1964 this shiner was more abundant in both the western and eastern sections; this species probably occurred throughout the drainage. The population of this shiner in the river was extremely reduced after 1963.

DEEP FORK RIVER

Few historical records of the Arkansas River shiner are available from the Deep Fork River. Four specimens (OSUMZ 1965) were collected one mile west of Okmulgee in Okmulgee County in 1932. Five specimens were taken 100 m to 600 m upstream from the mouth of Deep Fork River in 1962 (HL OUMZ 36106). This site is now inundated by Lake Eufaula. Extensive sampling in the upper Deep Fork River failed to show this shiner in Oklahoma and Lincoln Counties in 1977 (12). In Coffee Creek, a tributary of the Deep Fork River, near NE 206 Street in Edmond a single shiner was found (OCCDH UPD). I made 61 collections in the Deep Fork River from 1976 to 1988 in Oklahoma, Lincoln, and Creek Counties without finding this minnow.

CANADIAN RIVER below Lake Eufaula

The 1962 surveys verified that the Arkansas River shiner was abundant in the Canadian River below the present Lake Eufaula. Three collections from the river N of Whitefield in Haskell County included large numbers (406 specimens) of this shiner (HL OUMZ UPD). The river near the Whitefield bridge yielded 64 specimens (HL

TABLE 4. The historical and present (1976 to 1988) distribution of the Arkansas River shiner in the Arkansas River in Oklahoma and the Salt Fork of the Arkansas River.

River Site / County	Historcial data A	B	D	E	1976–79 A	B	C	1980–84 A	B	C	1985–88 A	B	C	Last Year[a]
Arkansas River														
Arkansas City / Kay	--	--	--	--	0	0	1	0	0	0	0	0	0	----
Ponca City / Osage	--	--	--	--	1	1	3	0	0	12	0	0	7	1978
Ralston / Pawnee	--	--	--	--	16	2	5	4	2	16	1	1	9	1986
Turkey Is / Pawnee	X	1	UOMZ	1934	--	--	--	--	--	--	--	--	--	1934
Keystone Dam / Tulsa	5	1	UOMZ	1960	--	--	--	--	--	--	--	--	--	1960
Sand Springs / Tulsa	X	X	LPC[b]	1968	1	1	7	5	1	12	0	0	8	1982
Tulsa / Tulsa	--	--	--	--	--	--	--	0	0	3	0	0	8	----
Bixby / Tulsa	--	--	--	--	--	--	--	0	0	6	0	0	7	----
Haskell / Muskogee	1	1	UOMZ	1981	0	0	7	0	0	12	0	0	9	1981
Muskogee / Muskogee	--	--	--	--	0	0	4	0	0	13	0	0	9	----
Webber Falls / Muskogee	--	--	--	--	0	0	0	43	1	11	0	0	7	1982
Sallisaw / Leflore	X	1	OSUZM	1963	0	0	4	5	1	11	1	1	6	1985
Fort Smith / Leflore	10	1	(1)	1927	0	0	0	0	0	0	0	0	0	1927
Muldrow / Sequoyah	X	1	OSUZM	1950	--	--	--	--	--	--	--	--	--	1950
Salt Fork River														
Ingersoll / Alfalfa	1000	1	(1)	1926	--	--	--	--	--	--	--	--	--	----
	117	1	OSUZM	1941	--	--	--	--	--	--	--	--	--	----
	1	1	OSUZM	1948	--	--	--	--	--	--	--	--	--	1948
Jet / Alfalfa	X	1	UOBS	1930	94	5	8	56	7	12	0	0	12	1982
	X	1	(26)	1949	--	--	--	--	--	--	--	--	--	----
	X	4	UOMZ	1949	--	--	--	--	--	--	--	--	--	----
	103	1	UOMZ	1951	--	--	--	--	--	--	--	--	--	----
Nash / Grant	--	--	--	--	8	1	3	109	3	12	1	1	11	1986
Ponca City / Kay	171	1	OSUZM	1961	--	--	--	--	--	--	--	--	--	1961
Total for period					120	10	42	222	15	120	3	3	93	

[a] Year of last collection of the shiner at this site.
[b] Lindsay personal comm.
A = Number of *Notropis girardi* collected at site. B = Number of collections with *Notropis girardi*.
C = Total number of collections for period. D = Source of historical data.
E = Date of the historical collection. X = The shiner was present, but no count was made.

OUMZ 36235). Near the mouth of Broken Creek 330 shiners (HL OUMZ 36224) were collected, and eight (HL OUMZ 35112) were collected from the river NW of Whitefield in Haskell County.

I made 19 collections from the Canadian River north of Whitefield in Haskell County during the years 1979-88 without finding the shiner. Two major factors could have contributed to the decline of the species at this site: 1) a rapid daily change in the water levels from 6 to 8 ft, and 2) clear water, which favors the predator species *Morone saxatilis* and *Pomoxis annularis.* The result is fish communities with few minnows. The overall minnow population is unusually low at this site. The average number of minnows for my 19 collections was 38 minnows per 2000 m².

MAINSTREAM of the ARKANSAS RIVER

Cross et al. (2) reported that the Arkansas River shiner was abundant throughout the Arkansas mainstream in Kansas prior to 1964. However, it has not been collected since 1965. This species has been taken only once in Arkansas: at the mouth of Piney Creek, Logan Co., on 23 July 1939 (23). Extensive sampling of the Arkansas River in Arkansas in 1976 by Buchanan did not include this species (3). In 1927 Hubbs and Ortenburger (1) collected ten specimens from the main stream of the river 5.5 miles SW of Fort Smith in Oklahoma and suggested that its range probably extended into Arkansas as well. Numerous collections from the river at Fort Smith during the last 16 years have failed to produced any specimens of this minnow (3).

Lindsay (personal comm.) collected large numbers of the Arkansas River shiner in the main stream of the river in the area of Sand Springs and Tulsa from 1956 until the impoundment of the river by Lake Keystone in 1968. The species disappeared soon after construction of the dam and the resultant change in flow patterns.

In this study I collected 79 specimens

from ten mainstream sites (Table 4). The shiner was taken 11 times between 1976 and 1988. It was present in six collections above Lake Keystone, once in the urbanized central section from Lake Keystone to Muskogee and three times in the eastern reaches. The most recent collections were from the main stream in 1986 at Ralston in Osage County and in 1985 S of Sallisaw below the Robert S. Kerr Lock and Dam Number 14 (Table 4).

There are evidently small populations of the Arkansas River shiner in some sections of the river. In the highly urbanized sections of both the North Canadian River and the Arkansas River this shiner has disappeared.

SALT FORK of the ARKANSAS RIVER

In 1926, 1,000 specimens of the shiner were collected northeast of Ingersoll in Alfalfa County (1). In 1941, 117 shiners were taken from the river north of Cherokee in Alfalfa County (M OSUZM UPD). Jenkins (15) reported that the shiner was very common in the Great Salt Plains Lake, uncommon below the lake, and not present two and 15 miles above the lake in 1948-49.

Collections in 1949 at locations above the Great Salt Plains Lake, in the lake, below the lake, and in Sand Creek, found few specimens (3-5) of this shiner. Similar collections in 1951 included 103 specimens in the river below the lake, and five in Sand Creek above the lake (R UOZM UPD). Large numbers (171 specimens) were found eight miles S of Ponca City on HW 10 in Kay County in 1961 (OSUMZ 11809).

In this study I found 268 specimens of the shiner in 17 collections between 1976 and 1989 (Table 4), 34% of which contained the species . There was a major decline in the number of collections containing this shiner after 1984. Before 1984, 46% of the collections included this species; after 1984 only 4% did so. In 1984 I collected my last shiner specimens from the Salt Fork River site N of Nash in Grant County (downstream from Jet). In 1982, I collected my last specimen at Jet. I never found this species in large numbers at either site (Table 4).

CHIKASKIA RIVER

Cross et al. (2) did not find the Arkansas River shiner in the Chikaskia River in Kansas between 1979 and 1983. In 1940, Moore et al. (OSUMZ 48) collected 74 specimens from the river north of Tonkawa in Kay County. In 1946 Moore and Buck (16) found this species again and reported that it did not migrate far up the river.

I made 20 collections between 1976 and 1988 from the Chikaskia but these did not include the shiner. The study site was 5 miles SE of Blackwell in Kay County.

SOUTH CANADIAN RIVER

There is now a large population of the Arkansas River shiners in the South Canadian River from the Texas state line to Lake Eufaula (Table 5). I located records of 51 past collections of this species in the river and its tributaries. This shiner has been abundant since 1924, when Ortenburger and Weese found 100 specimens near Norman in Cleveland County (OUMZ 5946).

The range of this species in the South Canadian River in Oklahoma is now smaller, owing to inundation by Lake Eufaula in the lower reaches. This species has decreased in abundance in the river below the present Lake Eufaula since its impoundment in 1964. I have not found this shiner in 19 collecting trips to the river N of Whitefield in Haskell County since 1980.

Several times in the past this shiner was collected from small tributaries of the South Canadian River (Wolf, Little Deer, Commission, Deer, Walnut, Deep, Small, Gaines, and Longtown Creeks) in Ellis, Custer, McClain, Hughes, and Pittsburg Counties. In 1959 a single collection by Riggs (R OUMZ UPD) from Deep Creek in Hughes County included 390 shiners.

Large numbers of this species were found in UKMNH, in four collections taken from the river in the Texas Panhandle between 1953 and 1972. These came from Oldham, Potter, Roberts, and Hemphill Counties. The number of shiners in the collections varied from 50 to 213.

Most of the 51 fish collections from the river and its tributaries in Oklahoma included large numbers of this shiner; several included over 600 (Table 5). Thus this species has been abundant in the river since 1924. This shiner was found 80 times (Table 6) and occurs in 90.9% of my collections from the three OSDH fish sampling sites near Bridgeport, Wanette and Calvin. Near Bridgeport this shiner was in 97% of all collections. At

TABLE 5. The historical and current (1976 to 1989) distribution records of the Arkansas River shiner in OSDH fish sampling sites on the South Canadian River.

River Site / County	Historical data A	B	D	E	1976–79 A	B	C	1980–84 A	B	C	1985–89 A	B	C
Durham / Roger Mills	1	1	1	1926	--	--	--	--	--	--	--	--	--
Arnett / Ellis	209	1	209	1963	--	--	--	69	1	1	21	1	1
Camargo / Dewey	X	1	X	1928	1	1	1	--	--	--	34	1	1
Taloga / Dewey	---	-	---	---	--	--	--	610	1[a]	1	216	1	1
Oakwood / Dewey	---	-	---	---	--	--	--	--	--	--	88	1[a]	1
Bridgeport / Blaine	X	-	X	1964	6307	6	7	5668	13	13	3088	15	15
Thomas / Custer	---	-	---	---	--	--	--	--	--	--	0	0	0
Hinton / Caddo	150	1	1	1958	X	1	1	170	1	1	--	--	--
Bridgeport / Caddo	---	-	---	---	--	--	--	--	--	--	112	1	1
I-40 / Canadian	---	-	---	---	--	--	--	230	1	1	--	--	--
Cedar Lake / Canadian	---	-	---	---	--	--	--	--	--	--	112	1	1
Minco / Grady	---	-	---	---	--	--	--	--	--	--	1248	1	1
Newcastle / McClain	---	-	---	---	--	--	--	--	--	--	323	1	1
I-44 / Cleveland	---	-	---	---	X	1	1	205	1	1	--	--	--
Norman / Cleveland	1385	6	212	24–72	--	--	--	426	1	1	382	3	3
Noble / Cleveland	---	-	---	---	--	--	--	312	1	1	--	--	--
Purcell / McClain	89	2	44	32–52	--	--	--	345	1	1	--	--	--
Wanette / Pottawatomie	--	-	---	---	965	3	3	8731	8	9	4081	9	10
Asher / Pontotoc	---	-	---	---	71	1	1	402	1	1	1	1[a]	1
Byng / Pontotoc	---	-	---	---	--	--	--	--	--	--	110	1	1
Konawa / Pontotoc	---	-	---	---	--	--	--	225	1[a]	1	--	--	--
Eufaula / McIntosh	280	2	140	29–62	--	--	--	--	--	--	--	--	-
Eufaula / Hughes	940	1	940	1962	--	--	--	--	--	--	--	--	-
Atwood / Hughes	---	-	---	---	5	1	1	--	--	--	12	1	1
Calvin / Hughes	---	-	---	---	2339	5	8	10348	10	12	17367	14	14
Canadian / Pittsburg	13	1	---	1962	--	--	--	--	--	--	--	--	--
Indian N. / Pittsburg	---	-	---	---	--	--	--	--	--	--	0	1[a]	0

[a] Pigg, Gibbs, and Harrison 1983 UPD added to period 1980–84.
A = Number of *Notropis girardi* collected at site. B = Number of collections with *Notropis girardi*.
C = Total number of collections for period. D = Mean values for the historical collections.
E = Year of the historical collection: 24–72 = 1924–1972, etc. X = The shiner was present, but no count was made.

TABLE 6. Collection and distribution of the Arkansas River shiner in the South Canadian River for 1976 to 1988.

Year	Bridgeport, Blaine Co. A	B	C	Wanette, Pottawatomie Co. A	B	C	Calvin, Hughes Co. A	B	C
1976	0	291	0/1	--	--	--	--	--	--
1977	857	4478	2/2	--	--	--	1408	33532	1/2
1978	3809	8039	2/2	--	--	--	0	8361	0/2
1979	1641	5297	2/2	965	15774	3/3	908	10319	3/3
1980	2492	9844	4/4	479	4786	2/2	1857	12867	3/3
1981	573	8882	3/3	1232	13110	2/2	519	15974	2/3
1982	856	8363	3/3	2515	12920	2/2	1218	7297	2/3
1983	1747	11479	3/3	4504	11886	2/3	6754	25231	3/3
1984	1232	11872	3/3	232	5906	2/2	1645	21494	3/3
1985	789	15779	3/3	2211	27441	2/2	7302	22424	2/2
1986	446	7140	3/3	53	916	1/2	133	4533	2/2
1987	248	8254	3/3	776	8428	2/2	7550	24848	3/3
1988	214	2433	3/3	40	3120	2/2	470	9839	2/2
No. of collections with *N. girardi*			34			20			26
Total number of collections			35			22			31
Total number of *N. girardi*			14904			12972			29764
Av no of *N. girardi* per collection			426			590			960

A = Number of *Notropis girardi* collected at site. B = Total number of fish collected at site.
C = Ratio of number of collections with *N. girardi* to total number of collections made at site.

the central sampling station S of Wanette it was found in 91% of collections since 1979, and near Calvin, the easternmost site, in 84% of collections from 1977 to 1988. It was found every year at the Calvin site except in 1978, usually in large numbers (7550 specimens); past fish collections at this site by Houser and Lindsay (OUMZ 35336) in 1962 also included many shiners (940 specimens) (Table 6).

In 1989, I conducted a survey to determine the current range for this species in the South Canadian River from the Oklahoma-Texas state line to Lake Eufaula. I made 16 collecting trips to 14 sites upstream from Lake Eufaula. The shiners were collected at 12/14 sites, usually in large numbers (Table 5). A slight change in the distribution of this shiner was observed, because of the impoundment of the river by Lake Eufaula. In 15 collections in the Gaines Creek and the South Canadian arm of Lake Eufaula this shiner was not found.

In 1985 the reproductive success of this shiner was good and in a single collection it comprised 32.6% (6551 specimens) of the fish taken that year at the Calvin site (Table 6). The numbers varied from year to year (40 to 7550 specimens). In 1978 *N. girardi* comprised 47.4% of fish collected at Bridgeport, but such percentages were highly variable (0.0% to 47.4) (Table 6). On the average this shiner comprised 12.0% to 15.0% of the fish collected at the three OSDH sites.

LITTLE RIVER

In 1926 Cooper (1) collected four specimens of the shiner from the Little River ten miles east of Norman in Cleveland County. Riggs made collections in 1953, 1958, and 1961 (OUMZ UPD) throughout the Little River basin and Wade (17) in 1962 extensively sampled at 42 sites (50 collections); neither author found this species in the upper Little River or its tributaries (Dave Blue, Elm, Clear, Hog, and Rock Creeks) near Norman in Cleveland County.

VERDIGRIS RIVER

In 1957 five specimens of the Arkansas River shiner were collected from the Verdigris River in Wagoner County near Okay (18). This species may move into from the Verdigris from the Arkansas River. In 31 collections from 1978 to 1988 in the Verdigris River from Catoosa to the Newt-Graham Lock and Dam, I did not find it.

MEDICINE LODGE RIVER

In 1941 Moore et al. collected 42 specimens (OSUMZ 222) from the Medicine Lodge River, six miles north and two miles east of Cherokee, in Alfalfa Co. Cross et al. (2) did not list this shiner in Medicine Lodge River in Kansas from 1979 to 1983. However, it was listed "rare" in 1951 and "common" in 1958. I did not sample Medicine Lodge River during present study.

MISCELLANEOUS SMALL STREAMS

In 1960 four collections by Hicks (OUMZ) from small tributaries of the Arkansas River near new Prue in Osage County included the Arkansas River shiner. These creeks included Miller Creek (4 specimens) (OUMZ 38989), Mudder Creek (5 specimens) (UOMS 38623), unnamed second creek of Salt Creek (2 specimens) (OUMZ 39063) and Walnut Creek (22 specimens) (OUMZ 39063).

Miscellaneous RED RIVER Collections

I found three unpublished records of the Arkansas River shiner in the Red River system. Hall collected 10 specimens (OUMZ 29714) from Little Pine Lake south of Broken Bow in McCurtain County in 1955. Pigg and Shelton obtained a single specimen (OUMZ 40614) in 1971 from near the mouth of Big Glasses Creek in Marshall County. Between 1976 and 1988 I carried out extensive surveys (45 collections) in the lower Washita River between Pauls Valley and Lake Texoma; this shiner was absent.

In 1964, Moore et al. (OUMZ 37672) collected 39 specimens from the mouth of Brian (Brier) Creek W of Lake Texoma in Marshall County. Extensive studies reported in 1969 by Smith and Powell (19) and by Ross, Matthews, and Echelle (20) for the period from 1976 to 1981 did not report the Arkansas River shiner in Brier Creek.

RESERVOIRS

Collections in 1948 by Jenkins (15) from the Great Salt Plains Reservoir in Alfalfa

County found small numbers of the Arkansas River shiner. Dowell collected 25 specimens (OUMZ 38172) in 1953 from the Great Salt Plains Lake near the National Wildlife Refuge headquarters in Alfalfa County. In 1980 a single specimen was collected from the reservoir during the annual ODWC lake survey. In the 1983 survey this shiner did not appear (21), and in 1985 it was not present in five collections I made in the reservoir.

I did not find this species in the 36 collections from the four mainstream reservoirs of the Arkansas River from 1976 to 1988. In the past it was present in encompassed sections of the rivers before impoundment.

Fourteen collections from four Cimarron River basin reservoirs did not include this shiner. It was absent in collections I made from reservoirs in the North Canadian River Basin (Lake Optima, Lake Canton, Lake Overholser, Lake Hefner, and Lake Eufaula). Collections in 1980 during the annual ODWC survey of Lake Canton included a single shiner; in 1984 twelve were collected (22).

SUMMARY

The South Canadian River has a large and stable population of the Arkansas River shiner, *Notropis girardi*. Smaller and/or declining populations continue in the Arkansas River and the upper North Canadian River. This species appears to be extirpated from the Cimarron, Deep Fork and Salt Fork of the Arkansas River in Oklahoma.

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