FISHES OF MILL CREEK, A TRIBUTARY OF THE WASHITA RIVER, JOHNSTON AND MURRAY COUNTIES, OKLAHOMA

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A survey of the fishes of Mill Creek was conducted from January, 1974 to September, 1975. A total of 20,862 specimens was taken in 53 collections made at 27 stations. This survey established the presence of 12 families and 46 species in Mill Creek. The horizontal distribution of the ichthyofauna is discussed. The occurrence of one species and the first published collection site for another is reported for the first time above Denison Dam in the Washita River system.

INTRODUCTION

Mill Creek originates in the Arbuckle Mountains approximately 14 km northeast of Sulphur, Oklahoma (1) at an elevation of about 341 m (2). It flows generally south in Murray and Johnston Counties for approximately 70 km to its confluence with the Washita River in the SW 1/4, SW 1/4, Sec. 8, T4S, R5E (3) at an elevation of 192 m. Mill Creek's drainage area consists of 329 km^2 (2).

According to Ham and McKinley (1), approximately the upper half of Mill Creek flows through an area of Paleozoic sedimentary rock. Most of the remaining half of Mill Creek flows through late Pre-Cambrian Tishomingo Granite. Mill Creek then passes through the narrow Tishomingo Anticline, composed of Paleozoic sedimentary rock, entering alluvium deposits in the Mill Creek and Washita River flood plains. Ham (4) indicates that the alluvium deposits are an extension of the Gulf Coastal Plain. The general topographic impression is that of low, rolling hills, forested in many places and with low, closely spaced, parallel rows of bare sedimentary rock, often visible in grassy areas.

Mill Creek is located in the Osage Savanna Biotic District of Oklahoma (5). Blair and Hubbell (6), utilizing data from the U. S. Weather Bureau (7), describe the southern part of the district as having a climate with an average annual temperature of 18.6 C, a growing season of 235 days, and an average of 96.5 cm of rainfall a year.

The water quality of Mill Creek was measured from October, 1968 to September, 1969 by the U. S. Geological Survey (8). Thirty-six measurements showed an average mean discharge of 3.72 m^3/sec with extremes of 38.51 m^3/sec on May 7, 1969 and 0.12 m^3/sec on August 17, 1969. The pH averaged 8.5 with extremes of 8.0 and 9.0. Dissolved solids in g/m^3 averaged 198.57 with extremes of 102.96 and 323.60. Monthly water temperature averages in degrees C were: October, 19.5; November, 12.5; December, 9.0; January, 8.5; February, 10.5; March, 12.0; April, 20.0; May, 23.0; June, 27.5; July, 32.0; August, 30.5; and September, 26.5. Extremes were 35.0 on June 30, 1969 and 3.0 on January 1 and 5, 1969. The gaging station was located at km 8.3 in the SW 1/4, Sec. 29, T3S, R5E, Johnston County. The drainage area above this point is 306 km^2.

None of the early ichthyological investigators in Oklahoma collected in Mill Creek. It is not necessary to recount them here as they have already been amply discussed (9) and because the investigations were made in other drainages than that of Mill Creek and the results are thought to be of little use in predicting what species may be present. Recent studies from nearby lakes and streams indicate species that may be present in Mill Creek.

Ortenburger and Hubbs (10) reported on collections made in Oklahoma in 1925. Of the collections reported, one was taken by Mark Markowitz "in the small tributaries of the Washita River near the town of Dougherty, Murray County." Dougherty is approximately 37 air km northwest of the confluence of Mill Creek and the Washita River. Eleven species were found.

The fishes of Lake Texoma were reported by Riggs and Bonn (11) after 10 years of collecting from September, 1948 to Septem-

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ber, 1958. At a pool elevation of 195 m Lake Texoma actually inundates the lower 3.7 km of Mill Creek (3), but they made no collections in Mill Creek. The normal pool elevation for Lake Texoma is 188 m (12). They reported 68 species occurring above Denison Dam, which impounds Lake Texoma. Riggs and Bonn found all of the species reported by Ortenburger and Hubbs (10) near Dougherty. Echelle, Shelton, and Taber (13) added two species to the fishes of Lake Texoma that had been introduced by the Oklahoma Department of Wildlife Conservation and various sportsmen's clubs, thus increasing the number of species collected in Lake Texoma to 70.

A pre-impoundment survey of Rock Creek, which enters the Washita River approximately 37 air km northwest of the confluence of Mill Creek and the Washita River, was undertaken by Sandoz (14) in 1957 and 1958. This survey yielded 36 species. Two hybrids, *Cyprinus carpio* × *Carassius auratus* and *Notropis venustus* × *N. lutrensis*, and an unidentified minnow were also found. Of the species listed by Sandoz, two were not listed as occurring in Lake Texoma by Riggs and Bonn (11).

Hill and Jenssen (15) collected the southern red-bellied dace, *Phoxinus erythrogaster* (Rafinesque), from Big Springs, 5.5 km north of Tishomingo, which is approximately 15 air km east of Mill Creek in the Washita River system.

Taylor (16) reported the freckled madtom, *Noturus nocturnus* Jordan and Gilbert, from a tributary of the Washita River at the Dougherty bridge and the tadpole madtom, *Noturus gyrinus* (Mitchill), from Lake Murray, Carter County. This location is sufficiently close to Lake Texoma to permit listing this species as of possible occurrence in this area.

The big-scaled logperch, *Percina macrolepida* Stevenson, occurs in tributaries of Lake Texoma (17); however, some authors believe that more study of its systematic status and distribution are needed before it can be included in the fauna of Oklahoma (18). If this fish is accepted as a valid species, it must then be added to the list of species that may possibly occur in Mill Creek.

Range maps in *The Fishes of Oklahoma* (18) indicate that 54 species should be found in Mill Creek and an additional 16 should be found between Mill Creek and Denison Dam. The range maps are in reality "projections of the overall area within which a species is likely to be found" and may not represent areas where a species has actually been taken. Miller and Robison (18) indicate that six previously unreported species should exist in this area.

A review of the literature, which includes the total number of species from all of the investigations of the area between and including Lake Texoma and Rock Creek, Murray County, provides a list of 81 species that could possibly occur in Mill Creek.

MATERIALS AND METHODS

Fish collections were taken in Mill Creek from January, 1974 to September, 1975. Collections were taken in every month except October and November. A total of 20,862 specimens was taken in 53 collections made at 27 stations. Equipment used in making collections included gill nets, hoop nets, seines, minnow traps, and hook and line. All seines used were nylon and 3/16-inch mesh. Sizes of seines were 5 × 4-foot, 6 × 8-foot, 10 × 6-foot, 10 × 8-foot, and a 20 × 8-foot bag seine. Gill nets were 100 feet and had a 2-inch square mesh. Hoop nets were 3½ feet in diameter at the mouth, had two throats and a mesh of 1½-inch square. Gill nets were fished for 3 nights, the hoop nets for 4 nights, and minnow traps for 3 nights. A single hook and line collection was taken one afternoon.

All fish collected were preserved immediately in 10% formalin and identified in the laboratory except for some large specimens of common species that were identified in the field and then released. All collections were recorded, but some specimens of the more common species were discarded. The remaining specimens were washed in water for 3 days and then transferred to 40% isopropyl alcohol and are now housed in the Museum of Zoology at Northeast Louisiana University.

The mimic shiner, *Notropis volucellus* (Cope), was identified by drying the specimens sufficiently to make the infraorbital canal visible under a binocular dissecting microscope to distinguish it from the ghost shiner, *Notropis buchanani* Meek. In addition, the lateral line scales of *Notropis*

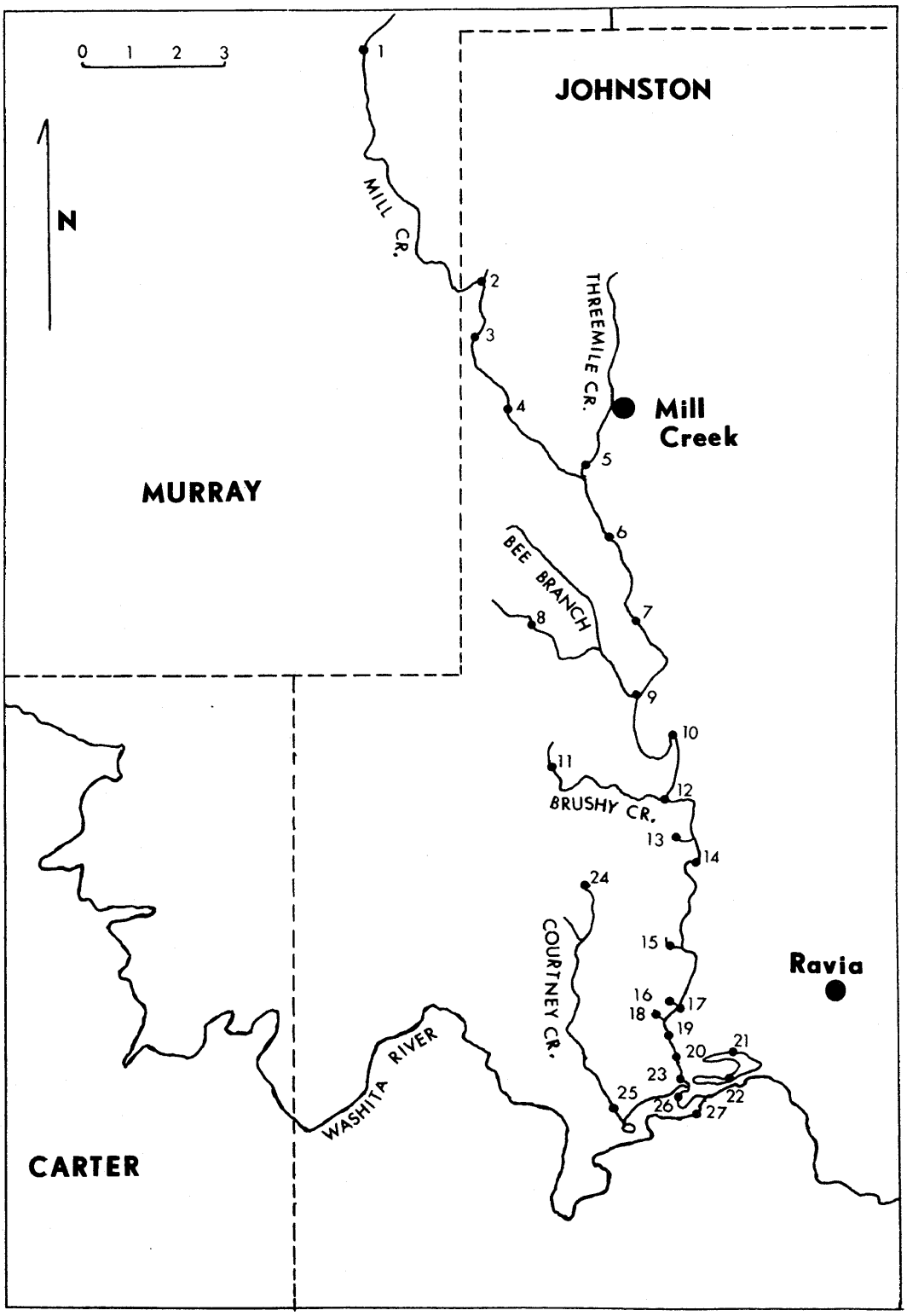

FIGURE 1. The Mill Creek area.

volucellus and *Notropis buchanani* were observed under the microscope to distinguish them from the sand shiner, *Notropis stramineus* (Cope). Scientific names are those approved by the American Fisheries Society's Committee on Names of Fishes (19).

The following abbreviations are used in the description of collecting stations:

approx.-approximately	Ni.-night collection
br.-bridge	Ok.-Oklahoma
Co.-County	P.T.-pasture trail
coll.-collection made	R.-range
con.-confluence	Rd.-road
Cr.-Creek	Riv.-river
D.-day collection	S.-south
E.-east	Sec.-section
Hwy.-highway	Spr.-spring
int.-intersection	T.-township
km-kilometer	trib.-tributary
m-meter	W.-west
N.-north	

Collecting stations are numbered consecutively from Station I near the headwaters to Station XXVII at the confluence of Mill Creek with the Washita River (Figure 1).

DESCRIPTION OF STATIONS

Murray County

Station I Mill Cr., low water br. on Co. Rd. NE ¼, NW ¼, Sec. 8, TIS, R4E. Cr. approx. 2.5 m wide; bottom silt, gravel, rock; riffles and pools. Coll. one time, D. only: May 15, 1974.

Johnston County

Station II Unnamed Spr., trib. to Mill Cr., at P.T. SW ¼, SE ¼, Sec. 27, TIS, R4E. Riffle approx. 1.5 m wide; bottom silt, rock. Coll. one time, Ni. only: September 20, 1975.

Station III Mill Cr., P.T. NE ¼, NW ¼, Sec. 3, T2S, R4E. Cr. approx. 4.5 m wide; bottom silt, coarse sand, gravel, rock. Coll. one time, D. only: July 24, 1974.

Station IV Mill Cr., br., 2 km W. of town of Mill Cr. at Co. Rd. SW ¼, SW ¼ , Sec. 2, T2S, R4E. Pool area approx. 4.5 m wide, 1 m deep; bottom coarse sand, gravel. Riffle approx. 1.5 m wide; bottom gravel, rock. Coll. two times, D. only: March 2, 1974; May 15, 1974.

Station V Threemile Cr., trib. to Mill Cr., 1 km S. and 1 km W. of Mill Cr. town at Co. Rd. NE ¼, NW ¼, Sec. 13, T2S, R4E. Pool area approx. 4.5 m wide, 0.5 m deep; bottom silt, coarse sand, rock. Riffle approx. 1 m wide; bottom rock. Coll. one time, D. only: January 9, 1975.

Station VI Mill Cr., 3.7 km S. and 2 km E. of Mill Cr. town at P.T. NE ¼, SE ¼, Sec. 24, T2S, R4E. Pool area approx. 7.5 m wide, 1 m deep; bottom coarse sand, gravel, boulders. Coll. one time, D. only: January 16, 1974.

Station VII Mill Cr., 7.4 km S. of Mill Cr. town. W ½, SW ¼. Sec. 30, T2S, R5E, at P.T. Cr. approx. 6 m wide; bottom coarse sand, gravel, rock, boulders. Coll. one time, D. only: May 29, 1974.

Station VIII Unnamed Cr., trib. to Bee Branch, trib. to Mill Cr. at Co. Rd. NW ¼, NW¼, Sec. 35, T2S, R4E. Pool area approx. 2 m wide, 1 m deep; bottom silt. Coll. one time, D. only: August 8, 1974.

Station IX Mill Cr., con. of Bee Branch with Mill Cr. SW

¼, NW ¼, Sec. 6, T3S, R5E. Pool area approx. 7.5 m wide, 1.5 m deep; bottom silt, coarse sand, gravel. Riffles approx. 2 m wide; bottom gravel. Coll. two times, D. only: August 7, 1974; August 20, 1975.

Station X Mill Cr., 2.8 km W., 2 km S. of Troy at P.T. E ½, Sec. 8, T3S, R5E. Pool area approx. 9 m wide, 1 m deep; bottom coarse sand, gravel. Riffles approx. 1 m wide. Hook and line used. Coll. one time, D. only: May 16, 1974.

Station XI Brushy Cr., trib. to Mill Cr at P.T. NE ¼, SW ¼, Sec. 11, T3S, R4E. Pool area approx. 3 m wide, 1 m deep; bottom silt, coarse sand, gravel. Riffles approx. 1 m wide; bottom gravel, rock. Coll. one time, D. only: January 8, 1975.

Station XII Brushy Cr., trib. to Mill Cr. at con. of Brushy Cr. with Mill Cr. SW ¼, NE ¼, Sec. 18, T3S, R5E. Cr. approx. 2 m wide; bottom bed rock, coarse sand, gravel; riffles and pools. Coll. one time, D. only: July 25, 1974.

Station XIII Unnamed Spr., trib. to Mill Cr. at P.T. SW ¼, SE ¼, Sec. 18, T3S, R5E. Pool area approx. 1 m wide, 0.3 m deep; bottom silt. Coll. one time, D. only: September 20, 1975.

Station XIV Mill Cr. at P.T. NE ¼, Sec. 17, T3S, R5E. Cr. approx. 9 m wide; bottom silt, coarse sand, gravel, rock, large boulders; riffles and pools. Coll. one time, D. only: September 20, 1975.

Station XV Unnamed Spr., trib. to Mill Cr. at P.T. SE ¼, SE ¼, Sec. 30, T3S, R5E. Pool area approx. 7.5 m wide, 1 m deep; bottom silt, rock. Riffle approx. 1 m wide; bottom rock. Coll. two times, D. only: January 1, 1975; June 15, 1975.

Station XVI Unnamed Cr., trib. to Mill Cr. NE ¼, NE ¼, Sec. 6, T4S, R5E. Cr. approx. 1 m wide; bottom shale; riffles and pools. Coll. one time, D. only: December 31, 1974.

Station XVII Mill Cr., 6.5 km W., 2 km N. of int. of Ok. Hwy. 12 and 22 on Co. Rd. NW ¼, NW ¼, Sec. 5, T4S, R5E. Pool area approx. 23 m wide, 2.5 m deep; bottom coarse sand, gravel, rock. Riffle approx. 2 m wide; bottom gravel, rock. Minnow traps used. Coll. seven times (3 D., 4 Ni): February 16, 1974; May 14, 1974; May 25, 1975; May 26, 1975; May 26, 1975; August 20, 1975; September 6, 1975.

Station XVIII Unnamed Cr., trib. to Mill Cr., 6.5 km W. of int. of Ok. Hwy. 12 and 22 and 1.5 km N. at P.T. NW ¼, NE ¼, Sec. 6, T4S, R5E. Pool area approx. 1 m wide, 1 m deep; bottom silt. Coll. one time, D. only: December 31, 1974.

Station XIX Mill Cr., 6.5 km W. of int. of Ok. Hwy. 12 and 22 and 1 km N. at P.T. SW ¼, NE ¼, Sec. 6, T4S, R5E. Pool area approx. 6 m wide, 1 m deep; bottom coarse sand, gravel, silt. Riffle approx. 2 m wide; bottom gravel. Hoop net used. Coll. six times (2 D., 4 Ni.): May 13, 1974; July 24, 1974; June 14, 1975;July 15, 1975; September 6 , 1975; September 20, 1975.

Station XX Mill Cr., br. 6.5 km W. of int. of Ok. Hwy. 12 and 22

at Co. Rd. NE ¼, NE ¼, Sec. 7, T4S, R5E. Pool area approx. 7.5 m wide, 2 m deep during low water; approx. 7.5 m wide, 2 m deep during high water. Bottom clay, silt. Hoop net and gill net used. Coll. nine times (5 D., 4 Ni.): April 16, 1974; June 27, 1974; August 14, 1974; April 25, 1975; May 24, 1975; June 15, 1975; July 16, 1975; August 20, 1975; September 6, 1975.

Station XXI Mill Cr., 4.6 km W. of int. of Ok. Hwy. 12 and 22 at Ok. Hwy. 12. N ½, NE ¼, Sec. 8, T4S, R5E and NW ¼, NW ¼, Sec. 9, T4S, R5E. Flood area; no water except during flood. Pool area approx. 300 m wide, 2.5 m deep during flood; bottom clay. Coll. two times, D. only: May 24, 1975; May 26, 1975.

Station XXII Mill Cr., 5.6 km W. of int. of Ok. Hwy. 12 and 22 at Ok. Hwy. 12. S ½, NE ¼, Sec. 8, T4S, R5E. Flood area; no water except during flood. Pool area approx. 120 m wide, 2.5 m deep during flood; bottom clay. Coll. one time, D. only: May 24, 1975.

Station XXIII Mill Cr., boat access only. NW ¼, SW ¼, Sec. 8, T4S, R5E. Pool area approx. 6 m wide, 2 m deep; bottom silt, clay. Logjam starts here. Gill net used. Coll. one time, Ni. only: June 15, 1975.

Station XXIV Courtney Cr., trib. of Mill Cr. at P.T. SE ¼, SW ¼, Sec. 24, T3S, R4E. Pool area approx. 3 m wide, 1 m deep; bottom silt, rock. Riffle approx. 1.5 m wide; bottom rock. Coll. one time, D. only: December 28, 1974.

Station XXV Courtney Cr., trib. of Mill Cr., 9.3 km W. of int. of Ok. Hwy. 12 and 22 at Co. Rd. SW ¼, SE ¼, Sec. 12, T4S, R4E. Pool area approx. 2.5 m wide, 0.5 m deep; bottom coarse sand, gravel, silt. Coll. one time, D. only: June 14, 1975.

Station XXVI Courtney Cr., trib. of Mill Cr., 7.4 km W. of int. of Ok. Hwy. 12 and 22 on Co. Rd. Two overflows from slough. E ½, Sec. 7, T4S, R5E. Pool area approx. 1.5 m wide, 1 m deep; bottom clay. Coll. two times (1 D., 1 Ni.): December 28, 1974; May 26, 1975.

Station XXVII Mill Cr., con. of Mill Cr. with Washita Riv. at P.T. SW ¼, SW ¼, Sec. 8, T4S, R5E. Pool area approx. 4.5 m wide, 2.5 m deep; bottom clay, silt. Coll. two times, D. only: July 18, 1974; July 24, 1974.

RESULTS

A total of 46 species in 12 families, one hybrid, and juvenile specimens in the genera *Ictiobus*, *Moxostoma*, *Micropterus*, and *Lepomis*, too small for accurate identification, were collected. The sites where each species was collected are denoted by a Roman numeral followed by the total number collected at that station. The total number of specimens taken for each species is then given.

List of Species Collected During This Survey

LEPISOSTEIDAE—gars

Lepisosteus oculatus (Winchell)—Spotted gar. XIX—3, XXI—16. Total = 19.

Lepisosteus osseus (Linnaeus) —Longnose gar. XXIII—4. Total = 4.

Lepisosteus platostomus Rafinesque—Shortnose gar. XIX—1, XX—1, XXIII—1. Total = 3.

CLUPEIDAE—shads

Dorosoma cepedianum (Lesueur) —Gizzard shad. XIX—3, XX—9, XXI—232,

XXII—12, XXVI—13, XXVII—30. Total = 299.

Dorosoma petenense (Guenther)—Threadfin shad. XX—12. Total = 12.

CYPRINIDAE—minnows

Campostoma anomalum (Rafinesque)—Stoneroller. I—7, II—36, III—44, IV—2, VII—51, VIII—14, IX—131, X—11, XI—61, XII—134, XIII—4, XIV—5, XV—2, XVII—2, XVIII—1, XIX—16, XX—4, XXI—1, XXIV—16, XXV—11, XXVII—2. Total = 555.

Cyprinus carpio Linnaeus—Carp. XIX—1, XX—34, XXI—43, XXII—33, XXIII—4, XXVI—3. Total = 118.

Hybopsis storeriana (Kirtland)—Silver chub. XX—1, XXVII—4. Total = 5.

Notemigonus crysoleucas (Mitchill)—Golden Shiner. XVII—4, XVIII—2, XX—9, XXI—115, XXII—6, XXVI—2. Total = 138.

Notropis boops Gilbert—Bigeye shiner. III—110, IV—283, V—102, VI—22, VII—875, IX—1258, X—714, XII—190, XIV—1994, XV—37, XVI—64, XVII—567, XVIII—24, XIX—459, XX—33, XXVI—1, XXVII—2. Total = 6735.

Notropis lutrensis (Baird and Girard)—Red shiner. XVI—2, XVII—39, XVIII—7, XIX—134, XX—429, XXI—14, XXII—3, XXV—4, XXVI—131, XXVII—108. Total = 885.

Notropis stramineus (Cope)—Sand shiner. VII—2, IX—19, XIV—5, XVI—1, XVII—37, XIX—31, XX—19, XXVII—1. Total = 115.

Notropis venustus (Girard)—Blacktail shiner. III—75, IV—201, V—1, VII—148, IX—452, X—200, XII—2, XIV—408, XV—1, XVI—9, XVII—530, XVIII—5, XIX—1484, XX—183, XXI—1, XXVI—4, XXVII—6. Total = 3710.

Notropis venustus X *N. lutrensis.* XVII—1, XIX—1, XX—2, XXVII—1. Total = 5.

Notropis volucellus (Cope)—Mimic shiner. III—1, VII—385, IX—190, X—38, XII—38, XIV—186, XVII—11, XIX—8. Total = 857.

Phenacobius mirabilis (Girard)—Suckermouth minnow. XVII—1, XIX—2, XX—3, XXVII—2. Total = 8.

Phoxinus erythrogaster (Rafinesque)—Southern redbellied dace. XV—152, XXIV—235. Total = 401.

Pimephales notatus (Rafinesque)—Bluntnose minnow. III—15, IV—177, V—37, VII—70, IX—247, X—18, XII—116, XIV—7, XVI—22, XVII—36, XVIII—1, XIX—41, XX—3. Total = 790.

Pimephales promelas (Rafinesque)—Fathead minnow. XX—1. Total = 1.

Pimephales vigilax (Baird and Girard)—Bullhead minnow. XVII—6, XIX—32, XX—46, XXI—2, XXVI—8, XXVII—22. Total = 116.

CATOSTOMIDAE—suckers

Carpiodes carpio (Rafinesque)—River carpsucker. XIX—1, XX—6. Total = 7.

Ictiobus bubalus (Rafinesque)—Smallmouth buffalo. XIX—3. Total = 3.

Ictiobus sp. XXI—2. Total = 2.

Moxostoma erythrurum (Rafinesque)—Golden redhorse. IX—1, XIV—2, XVII—22, XIX—24, XX—5. Total = 54.

Moxostoma sp. III—1, VII—9, IX—21, XII—7, XIX—1, XX—5, XXI—1, XXVI—1. Total = 46.

ICTALURIDAE—catfishes

Ictalurus melas (Rafinesque)—Black bullhead. I—4, XVIII—7, XIX—3, XX—5, XXI—1. Total = 20.

Ictalurus natalis (Lesueur)—Yellow bullhead. I—2, III—2, VIII—3, X—1. Total = 8.

Ictalurus punctatus (Rafinesque)—Channel catfish. IX—1, XIX—11, XX—8, XXIII—4, XXVII—6. Total = 30.

Pylodictis olivaris (Rafinesque)—Flathead catfish. XIX—4, XX—1, XXIII—1, XXVII—1. Total = 7.

CYPRINODONTIDAE—topminnows

Fundulus notatus (Rafinesque)—Blackstripe topminnow. IX—1, X—5, XII—8, XVII—13, XIX—2. Total = 29.

POECILIIDAE—livebearers

Gambusia affinis (Baird and Girard)—Mosquitofish. I—2, II—2, III—14, IV—28, VII—11, VIII—85, IX—38, XII—50,

XIII—157, XIV—7, XVII—219, XIX—289, XX—354, XXI—514, XXII—60, XXIV—31, XXV—21, XXVI—31, XXVII—23. Total = 1936.

ATHERINIDAE—silversides

Labidesthes sicculus (Cope)—Brook silverside. XVII—86, XIX—158, XX—22, XXVII—1. Total = 267.

Menidia audens Hay—Mississippi silverside. XIX—1, XX—1, XXVII—2. Total = 4.

PERCICHTHYIDAE—temperate basses

Morone chrysops (Rafinesque)—White bass. XX—1, XXIII—1. Total = 2.

CENTRARCHIDAE—sunfishes

Lepomis cyanellus Rafinesque—Green sunfish. I—13, II—4, III—10, IV—15, VI—1, VIII—19, IX—9, X—5, XI—94, XII—2, XIII—8, XV—1, XVII—46, XVIII—17, XIX—19, XX—6, XXI—2, XXIV—29, XXV—2, XXVI—7. Total = 309.

Lepomis gulosus (Cuvier)—Warmouth. XIX—2, XX—6, XXI—4. Total = 12.

Lepomis humilis (Girard)—Orangespotted sunfish. XVII—5, XIX—6, XX—9, XXVI—4. Total = 24.

Lepomis macrochirus Rafinesque—Bluegill. I—1, III—13, IV—84, VII—12, IX—4, X—10, XVII—66, XVIII—6, XIX—180, XX—46, XXI—18, XXVI—13, XXVII—1. Total = 454.

Lepomis megalotis (Rafinesque)—Longear sunfish. I—3, III—32, IV—72, V—1, VII—98, VIII—5, IX—192, X—95, XII—25, XIV—38, XVII—163, XVIII—2, XIX—374, XX—131, XXI—2, XXII—1, XXIV—11, XXV—8, XXVI—4, XXVII—3. Total = 1260.

Lepomis microlophus (Guenther)—Redear sunfish. I—2, III—15, IV—33, VII—2, IX—4, X—3, XVII—21, XIX—36, XX—9, XXVI—1. Total = 126.

Lepomis sp. XXI—3. Total = 3.

Micropterus punctulatus (Rafinesque)—Spotted bass. I—1, III—15, IV—1, VII—1, IX—27, X—1, XIV—12, XVII—28, XIX—34, XX—13, XXVII—3. Total = 136.

Micropterus salmoides (Lacepede)—Largemouth bass. III—2, IV—5, VII—2, VIII—2, X—1, XVII—3, XIX—7, XX—6, XXVII—3. Total = 30.

Micropterus sp. VII—12, XX—1, XXI—13, XXII—5, XXVI—4. Total = 35.

Pomoxis annularis Rafinesque—White crappie. XIX—2, XX—21, XXI—116, XXII—6, XXVI—57, XXVII—1. Total = 203.

Pomoxis nigromaculatus (Lesueur)—Black crappie. XX—1, XXVII—1. Total = 2.

PERCIDAE—perches

Etheostoma gracile (Girard) —Slough darter. XVII—1, XXI—1, XXII—1. Total = 3.

Etheostoma spectabile (Agassiz)—Orangethroat darter. II—160, III—135, IV—167, V—19, VI—4, VII—69, VIII—8, IX—117, X—42, XI—74, XII—26, XIII—2, XIV—19, XV—47, XVII—70, XVIII—1, XIX—23, XX—5, XXIV—12, XXVI—2, XXVII—2. Total = 1004.

Percina caprodes (Rafinesque)—Logperch. IV—6, VII—4, IX—1, X—5, XIV—1, XVII—17, XIX—1, XX—17. Total = 52.

Percina sciera (Swain)—Dusky darter. XXVII—4. Total = 4.

SCIAENIDAE—drums

Aplodinotus grunniens (Rafinesque)—Freshwater drum. XIX—4, XX—10. Total = 14.

DISCUSSION

There are two general habitat types in Mill Creek: an upland stream habitat, generally characterized by clear water flowing over a coarse sand, gravel, or rock bottom, and a lowland stream habitat, generally characterized by more turbid water flowing over a clay or silt bottom. Collecting stations XX, XXI, XXII, XXIII, XXVI, and XXVII are from lowland habitat areas. The remaining collection stations are located in upland habitat.

Twenty-three species were collected predominantly in the lowland stream habitat, 15 species were collected predominantly in the upland stream habitat, and little difference was noted in the occurrence of six species in either of the two habitat types. These findings are presented in Table 1.

Phoxinus erythrogaster was the most restrictive in its habitat. This species was collected exclusively at the origin of cool springs. Collections were not sufficient to determine the habitat preferences of *Ictiobus bubalus* and *Pimephales promelas.*

Two dams are present on Mill Creek that are capable of preventing the upstream movement of fishes. The largest is located in the NW ¼, Sec. 6, T4S, R5E. During periods of high water this dam is capable of creating a narrow pool upstream for nearly 2 km. The habitat above this dam is typically upland. Below the dam the habitat is also upland for approximately 2 km, before changing to the lowland habitat for the remaining 2.8 km until the confluence with the Washita River. Table 1 shows those species found only in that portion of Mill Creek above and/or below the main dam. Only one species, *Ictalurus natalis,* has been collected exclusively from that portion of Mill Creek above this dam.

A comparison of those species found only below the main dam and those species found predominantly in the upland stream habitat indicates that the main dam may be the major factor in the absence of *Labidesthes*

TABLE 1. *Distribution related to the main dam on Mill Creek and general habitat preferences for species collected.*

Species	Lowland habitat	Below dam only	Upland habitat	Above and below dam	No habitat preference	Above dam only
Lepisosteus oculatus	x	x				
L. osseus	x	x				
L. platostomus	x	x				
Dorosoma cepedianum	x	x				
D. petenense	x	x				
Campostoma anomalum			x	x		
Cyprinus carpio	x	x				
Hybopsis storeriana	x	x				
Notemigonus crysoleucas	x	x				
Notropis boops			x	x		
N. lutrensis	x	x				
N. stramineus			x	x		
N. venustus			x	x		
N. volucellus			x	x		
Phenacobius mirabilis	x	x				
Phoxinus erythrogaster			x	x		
Pimephales notatus			x	x		
P. promelas		x				
P. vigilax	x	x				
Carpiodes carpio	x	x				
Ictiobus bubalus		x				
Moxostoma erythrurum			x	x		
Ictalurus melas				x	x	
I. natalis			x			x
I. punctatus	x			x		
Pylodictis olivaris	x	x				
Fundulus notatus			x	x		
Gambusia affinis				x	x	
Labidesthes sicculus		x	x			
Menidia audens	x	x				
Morone chrysops	x	x				
Lepomis cyanellus				x	x	
L. gulosus	x	x				
L. humilis	x	x				
L. macrochirus				x	x	
L. megalotis			x	x		
L. microlophus			x	x		
Micropterus punctulatus				x	x	
M. salmoides				x	x	
Pomoxis annularis	x	x				
P. nigromaculatus	x	x				
Etheostoma gracile	x	x				
E. spectabile			x	x		
Percina caprodes			x	x		
P. sciera	x	x				
Aplodinotus grunniens	x	x				

sicculus above this dam since it is the only species found predominantly in the upland habitat but not above the main dam.

Seventeen of the 23 species collected predominantly in the lowland habitat were also collected in the upland habitat. Only one of these, *Ictalurus punctatus,* was collected above the main dam. This indicates that the main dam blocks the utilization of stream areas above it for many predominantly lowland species that would use the upland areas during certain times, for example; for breeding, feeding, or in times of flood.

Thirty-six species have been reported in nearby lakes and streams of the same drainage that were not collected in this survey. They are: *Scaphirhynchus platorynchus* (Rafinesque), shovelnose sturgeon; *Polyodon spathula* (Walbaum), paddlefish; *Lepisosteus spatula* Lacepede, alligator gar; *Anguilla rostrata* (Lesueur), American eel; *Hiodon alosoides* (Rafinesque), goldeye; *Esox niger* Lesueur, chain pickerel; *Astyanax mexicanus* (Filippi), Mexican tetra; *Carassius auratus* (Linnaeus), goldfish; *Hybognathus nuchalis* Agassiz, silvery minnow; *H. placitus* Girard, plains minnow; *Hybopsis aestivalis* (Girard), speckled chub; *Notropis atherinoides* Rafinesque, emerald shiner; *N. bairdi* Hubbs and Ortenburger, Red River shiner; *N. blennius* (Girard), river shiner; *N. buchanani* Meek, ghost shiner; *N. potteri* Hubbs and Bonham, chub shiner; *N. rubellus* (Agassiz), rosyface shiner; *N. shumardi* (Girard), silverband shiner; *N. umbratilis* (Girard), redfin shiner; *Pimephales tenellus* (Girard), slim minnow; *Carpiodes velifer* (Rafinesque), highfin carpsucker; *Cycleptus elongatus* (Lesueur), blue sucker; *Ictiobus cyprinellus* (Valenciennes), bigmouth buffalo; *I. niger* (Rafinesque), black buffalo; *Minytrema melanops* (Rafinesque), spotted sucker; *Moxostoma macrolepidotum* (Lesueur), shorthead redhorse; *Ictalurus furcatus* (Lesueur), blue catfish; *Noturus gyrinus* (Mitchill), tadpole madtom; *N. nocturnus* Jordan and Gilbert, freckled madtom; *Fundulus kansae* Garman, plains killifish; *Morone saxatilis* (Walbaum), striped bass; *Lepomis auritus* (Linnaeus), redbreast sunfish; *Etheostoma proeliare* (Hay), cypress darter; *E. radiosum* (Hubbs and Black), orangebelly darter; *Percina phoxocephala* (Nelson), slenderhead darter; and *Stizostedion vitreum,* (Mitchill), walleye.

Most of these species would not be expected to be a normal component of the fish fauna of a medium-sized stream such as Mill Creek because of their preference for lakes or large streams. Many of these species may occasionally utilize the mouth of Mill Creek, especially during high water. The absence of some of these species, however, raises questions which will be discussed.

Notropis atherinoides has been collected in Lake Texoma by Riggs and Bonn (11) and in Rock Creek, Murray County, by Sandoz (14). Miller and Robison (18) describe the western form of this species as "typically an inhabitant of sandy-bottomed rivers and streams that are sometimes turbid." A bottom type of very coarse sand or fine pea gravel appears the nearest to this type in Mill Creek. Lack of an adequate habitat may exclude this species from Mill Creek.

Notropis rubellus has been reported from Rock Creek, Murray County, by Sandoz (14). Moore (9) believes this population is relict in the Arbuckle Mountains. Its normal habitat in Oklahoma appears to be high-gradient streams with gravel and limestone bottoms in the eastern part of the state (18). Its distribution must be considered discontinuous and relict in this area of the state.

Miller and Robison (18) indicate that *Notropis umbratilis* occurs in this general area. The only reported collection site for this species in this area is Rock Creek, Bryan County (11). *Notropis umbratilis* appears to be rare and discontinuous in distribution in this area.

Minytrema melanops has been reported from this area only from Buncombe Creek and Little Mineral Bay in Lake Texoma (11). Miller and Robison (18) do not project the distribution of this species above Denison Dam.

Moxostoma macrolepidotum is shown by Miller and Robison (18) as occurring in Lake Texoma; however, the closest published location is from the tailwaters of Lake Texoma (20).

Taylor (16) reported a collection site for *Noturus nocturnus* from a tributary of the Washita River at the Dougherty Bridge and also for *Noturus gyrinus* from Lake Murray, Carter County. Taylor states *Noturus gyrin-*

us occurs at least as far west as Lake Altus. Miller and Robison (18) indicate both species should occur in this area. Both species are undoubtedly uncommon in this area.

Etheostoma proeliare has been reported above Denison Dam only from Limestone Creek, a tributary of Lake Texoma (11). It should be considered relict and rare above Denison Dam.

Miller and Robison (18) do not report *Etheostoma radiosum* as occurring above Denison Dam, however, Riggs and Bonn (11) found this species in Butcher Pen Creek, a tributary of Lake Texoma. This species must be considered rare above Denison Dam if not now absent from the area.

Further collecting may reveal the presence of *Hybognathus placitus, Notropis buchanani,* and *Fundulus kansae,* but the lack of suitable habitat may bar the latter species from Mill Creek. Miller and Robison (18) indicate that *Percina sciera* should occur above Denison Dam but until this study there has not been a reported collection of this species in that specified area.

This survey established the presence of 46 species, one hybrid, and 12 families in Mill Creek. *Notropis volucellus* is reported for the first time above Denison Dam in the Red River system.

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