Lower Red River Watershed Stream Fish Community Monitoring Survey

Oklahoma Department of Wildlife Conservation, Stream Program

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Executive Summary

In 2016, stream fish community monitoring protocols were implemented to meet new Stream Program goals and objectives. Stream fish surveys were designed to generate data to update information on contemporary species distributions in the state of Oklahoma and evaluate and draw inferences on potential changes in those distributions over time. The chosen study design works within an occupancy modeling framework that makes it possible to tease apart the complex relationship between species' occupancy and detection probabilities. Sites were sampled three times within the summer season to generate replicate survey data. Stream fish community surveys took place from June to August at a total of seventeen sites in thirteen streams within the Red River watershed downstream of Lake Texoma. Fifty-one surveys yielded a total of eighty-one species, which included one invasive species, eleven species of greatest conservation need, and fifteen species of recreational importance. This report presents a short description and summary of sampling sites and species collected throughout the lower Red River watershed in 2025.

Introduction

The Oklahoma Department of Wildlife Conservation (ODWC) Streams Program was founded in 1998 with the initial goals of improving water quality and fish habitat in lotic waters of the state. The main priority of the original program was site-scale stream habitat restoration projects in eastern Oklahoma. Consequently, historical ODWC river and stream fish surveys are lacking, and are largely represented by opportunistic point samples, periodic targeted sampling of state species of greatest conservation need (SGCN) and sport fishes, or surveys for federally listed or candidate species in conjunction with the U.S. Fish and Wildlife Service. This is a mismatch between effort and resources as Oklahoma is home to approximately 175 species of freshwater fishes. Standardized, routine monitoring of stream fish communities is necessary to identify temporal shifts in community structure. Therefore, in 2016, the Stream Program shifted focus towards ecologically based fisheries management and large-scale, long-term monitoring of stream fish communities. The goal of the stream fish community monitoring effort is to document and conserve Oklahoma's native fish biodiversity for future generations. Objectives for stream fish community monitoring include (1) updating current understanding of species distributions within Oklahoma by documenting contemporary stream fish communities on a statewide scale (2) utilize contemporary data collected by the stream program, historical data (when available), and future survey efforts to identify potential shifts in stream fish community structure (3) identify mechanisms contributing to changes in species' distributions (4) evaluate current Oklahoma fish SGCN listings with empirical data and inform future decisions related to conservation priorities within Oklahoma and (5) identify and promote public river and stream access and fishing opportunities for citizens of Oklahoma.

The state of Oklahoma has approximately 167,600 miles of rivers and stream winding through its two main river basins. Running waters in the northern part of the state drain into the Arkansas River while rivers and streams in the southern portion of the state drain into the Red River. Annual sampling of stream fish communities at this basin scale is impractical for numerous reasons. Thus, the Stream Program divided the two main river basins into 17 distinct watersheds for sampling purposes. Here, a watershed is defined as the land area encompassing a collective group of streams that drain into a common, major lotic system (e.g., upper Red River, Grand River, Kiamichi River, Illinois River, etc.). Annually, one to three watersheds will be sampled by Stream Program staff with the current watershed monitoring schedule set to take 12 years to complete one full statewide rotation.

Large-scale stream-fish community monitoring poses numerous unique challenges. Logistical constraints include the time and manpower required to survey many sites spread over a substantial geographic area. Fish community surveys also necessitate the use of numerous fisheries survey gears to adequately sample the entire fish community. Sampling fewer sites in each watershed would reduce the time needed to complete a statewide rotation. However, prioritizing maximum feasible effort, in terms of additional sampling sites, not only improves geographic coverage within a watershed, but also leads to increased sample size and greater statistical power for analyses. Additionally, lotic fish communities in Oklahoma have been shown to be largely resistant to changes in community structure over short time frames. The "loose equilibrium concept" described by Matthews et al. (1988) is based on long-term studies of stream fish communities in Oklahoma, and states that interannual species abundances are highly variable; however, stream fish communities are "loosely stable" (i.e., communities return to an average condition over time (Matthews et al. 2013; Matthews and Marsh-Matthews 2016). The data collected by this effort will be used to analyze long-term trends in stream fish community structure, species' distributions, and assess potential deviations from a loose equilibrium. Therefore, a 12-year rotation is suitable for addressing the Stream Program's goals. Furthermore, a 12-year rotation aligns closely with past recommendations for decadal monitoring of stream fish communities in Oklahoma (Matthews et al. 2016).

Efforts to understand the current status of freshwater fish communities are especially critical as increases in imperilment for many species throughout North America have occurred over the last few decades (Jelks et al. 2008). In particular, fish communities in the Midwest and Interior Plains portion of the United States have drastically changed as a result of anthropogenic modifications to landscapes such as: conversion of prairie for agricultural uses, increased water withdrawals, and fragmentation of river systems as a result of reservoir construction (Anderson et al. 1995; Dodds et al. 2004; Hoagstrom et al. 2007; Gido et al. 2010). These modifications are usually associated with increases in nonnative and generalist species coupled with decreases in specialist species and ultimately homogenization of the fish community as a whole (Rahel 2002; Smith et al. 2014; Matthews & Marsh-Matthews 2015). All the aforementioned studies (and others with analogous objectives) were made possible because of quality baseline datasets with which robust statistical comparisons could be made. Therefore, sound stream fish monitoring protocols are needed to develop quality contemporary datasets essential for the maintenance and monitoring of freshwater fish biodiversity (Magurran et al. 2010).

Study Area

The Red River is a braided prairie stream which spans ~ 860 kilometers between Oklahoma and Texas. Lake Texoma is the only impoundment on the Red River, which was created by the Denison Dam in 1944. This lake generates tremendous revenue for the surrounding counties, with one study calculating total directed expenditures to be $42-$46 million per year. (Sager et. al.) Lake Texoma is one of the most popular Federal recreation facilities in the country, with more than 6 million visitors annually. While Lake Texoma provides many recreational opportunities such as boating, camping, swimming, hunting, and fishing, it is best known for its Striped Bass and Blue Catfish fishery, which extends to the lower Red River as well.

The Lower Red River and its tributaries were sampled from the Denison Dam to the Arkansas border which equates to ~320 river kilometers. Sampling excluded its major tributaries such as the Muddy Boggy, Blue, Kiamichi, and Little Rivers. Two sites on the mainstem Red River and fifteen sites in twelve of its minor tributaries were sampled from June-August of 2025. Mainstem Red River sites were limited due to its large size, many shallow sand bars, and lack of boat ramps. This is one of our most variable rivers, with every flood event changing its fluvial geomorphology.

The lower Red River begins in the East Texas Central Plains ecoregion and flows east into the South-Central Plains ecoregion around Yuba, Oklahoma. Here, the Red River and its tributaries have predominantly sandy substrate and a few gravel riffles with relatively low turbidity. The mainstem contains many sandbars, islands, and large woody debris. As a result, the fish communities of the tributaries contained many Blacktail Shiners, Orangebelly Darters, and Sand Shiners while the mainstem contained many River Darters, Blue Suckers, Shovelnose Sturgeon, and Chub Shiners. As this river flows east it increases exponentially in size, becomes slower, and increases in turbidity and silt.

The Red River enters the Red River Bottomlands ecoregion, also known as the Gulf Coastal Plains, as it flows into McCurtain County. There are many oxbows along this stretch of river, which are important to the lowland species found here which prefer slow, swampy habitats. The rivers' tributaries change drastically in McCurtain County, becoming turbid, warmer, siltier, and low in dissolved oxygen. Many of the sites sampled had >50% of the water covered in emergent sawgrass and 100% silt substrate. As a result, the fish communities are very different. Golden Topminnows, Banded Pygmy Sunfish, Redspotted Sunfish, and Bantam Sunfish become abundant in this area, which are found nowhere else in the state. It is a unique system that is more reminiscent of the swamps of Louisiana or Mississippi than Oklahoma.

Methods

Selection of sample locations

Potential access points were first assessed by satellite imagery. All potential access points on lotic waters within the watershed were marked and given a coarse classification based on ecoregion, stream size (small, medium, or large) and stream type (low gradient, high gradient, or braided). Mean wetted widths of small, medium, and large streams were classified as < 7.5 m, > 7.5 m and < 30 m, and > 30 m, respectively. Potential sites were then visited to obtain landowner permission, when necessary, and to assess sampling feasibility and gear types required at each site based on water depth, water conductivity, and habitat complexity. To ensure each potential unique stream fish assemblage within a watershed is sampled, final sites were selected in a stratified random fashion so that a representative number of samples were collected from each ecoregion and stream type.

Study design

Stream fish community data was collected within an occupancy modeling framework, which permits the estimation of species' occupancy and detection probabilities by utilizing replicate surveys that generate detection histories (i.e., binary data; 0 for non-detections and 1 for detections) at each site for each species. To guide occupancy modeling field efforts, MacKenzie and Royle (2005) provide recommendations and formulas to determine the optimum number of replicate surveys and the target number of sampling sites. Based on an "average" species with theoretical occupancy and detection probabilities of 50%, with a desired standard error level of 10%, a guideline of ~38 sites per watershed with three replicate surveys was established. Theoretically, this sampling design ensures that the "average" species has an 87.5% chance of being detected if present at a site. However, flexibility within an occupancy modeling framework permits uneven replicate survey effort across sites. Ultimately, the total number of survey sites per watershed will vary based on access, geographic area, and length of perennial streams. A goal of 38 sites per season is implemented to properly determine species distributions and occupancy needs.

Fisheries surveys

For occupancy modeling, MacKenzie et al. (2006) recommend site lengths be large enough to provide reasonable probability that a species is present yet remain small enough to survey with reasonable effort. Thus, sites for community monitoring are defined as follows: non-wadeable sites are standardized to 750 m and wadeable sites are standardized to 20x the mean wetted channel width (MWCW) with a maximum site length of 500 m. A minimum site length of 150 m is sampled for streams with MWCW < 7.5 m. Fish assemblages were sampled using multiple gears that targeted all potential members of the fish community at each site. Site-specific gear use was dictated by physical site variables (Figure 1) and the amount of effort differed by gear type (Table 1). Most fishes were identified in the field and released. Voucher specimens, as well as unidentified specimens, were preserved in 10% formalin and returned to the laboratory for identification using keys developed by Pflieger (1997) and Miller and Robison (2004).

A suite of abiotic data was collected at each site on each visit. Water temperature and conductivity were measured using a portable water-quality meter (Gain Express, Hong Kong, China, model 99720) once on each site visit. Additional site-level data recorded on each trip included: MWCW (m), bankfull width (m), sechii depth (cm), and number of large woody debris complexes >0.5 m^2 within the sampled area. Furthermore, point estimates of velocity, depth, and dominant substrate type were made at equally spaced intervals across three transects at each site. Points within each transect were spaced 3 m apart, unless the MWCW was < 15 m, in which case a minimum of five equally spaced points were used. Velocity was measured using a portable flow meter (Hach, Loveland, CO, USA, model FH950). Depth was recorded using a wading rod. In the event equipment was damaged or out of commission, habitat variables were taken from the nearest site on the same waterbody. The substrate at each point was classified as clay, silt, sand, gravel, cobble, boulder, or bedrock according to characteristics listed in Barbour et al. (1999). The point measurements of substrate type were summed to calculate proportions of the various substrate types at each site. Discharge was recorded using U.S. Geological Survey (USGS) stream gauge data when available. If stream gauge data was not available, discharge calculations were made at each transect using the modified "Midsection Method" (Gore 2007).

Site descriptions

Each site number is listed along with waterbody name, location, gear deployed, and abiotic data collected at each site. Habitat measures are presented as an average (range in parentheses) of replicate surveys at that site. For the location of each site, see figure 2.

Site 489 **Clear Creek**, 34.0151, -95.1559, backpack electrofisher/seine/mini-fyke net/hoop net, **surface water temp** 23.1 °C (22.6-23.6), **secchi depth** 85 cm (45-105), **conductivity** 63 µS/cm (60-65), **wetted width** 9.1 m (5-13), **bankfull width** 9.9 m (6-14), **depth** 59 cm (5-250), **discharge** 8.6 cfs (6.1-11.2), **substrate** 69% sand, 13% boulder, 7% cobble, 7% gravel, 2% silt, and 2% woody debris.

Site 490 **Buzzard Creek**, 33.9132, -95.0366, backpack electrofisher/seine/mini-fyke net/hoop net, **surface water temp** 25.0 °C (24.4-25.5), **secchi depth** 72 cm (45-110), **conductivity** 311 µS/cm (244-378), **wetted width** 11.9 m (9-18), **bankfull width** 13.5 m (9.5-18.5), **depth** 50 cm (5-145), **discharge** 11 cfs (3.1-20.7), **substrate** 38% sand, 29% gravel, 20% clay, and 13% silt.

Site 491 **Whitegrass Creek**, 33.8967, -94.9846, backpack electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 25.7 °C (25.2-26.6), **secchi depth** 107 cm (100-115), **conductivity** 204 µS/cm (163-275), **wetted width** 6.2 m (4.2-8), **bankfull width** 8.3 m (4.5-10), depth 37 cm (5-90), **discharge** 6.0 cfs (4.6-8.7), **substrate** 82% silt, 9% organic matter, 4% woody debris, 2% gravel, and 2% cobble.

Site 492 **Whitegrass Creek**, 34.0243, -96.0227, backpack electrofisher/seine, **surface water temp** 24.0 °C (23.1-25), **secchi depth** 43 cm (30-55), **conductivity** 253 µS/cm (168-306), **wetted width** 4.3 m (3-6), **bankfull width** 5.7 m (4.5-7.5), **depth** 13 cm (1-92), **discharge** 0.86 cfs (0.2-1.7), **substrate** 49% sand, 29% gravel, 18% bedrock, and 4% clay.

Site 493 **Island Bayou**, 33.8599, -96.3757, backpack electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 25.5 °C (24.7-25.9), **secchi depth** 33 cm (20-50), **conductivity** 351 µS/cm (351-462), **wetted width** 5.3 m (4.1-6.9), **bankfull width** m (), **depth** 24 cm (2-100), **discharge** 9.5 cfs (6.5-11), **substrate** 62% sand, 16% clay, 13% gravel, and 9% silt.

Site 494 **Sandy Creek**, 33.825, -96.5191, backpack electrofisher/seine/mini-fyke net, **surface water temp** 27.7 °C (26.3-28.8), **secchi depth** 65 cm (45-85), **conductivity** 297 µS/cm (283-319), **wetted width** 5.2 m (3.7-6.2), **bankfull width** 6.7 m (4.4-9.2), **depth** 10 cm (1-44), **discharge** 4.2 cfs (3.6-4.8), **substrate** 44% sand, 24% bedrock, 11% gravel, 11% cobble, 7% clay, and 2% boulder.

Site 495 **Island Bayou**, 33.9214, -96.4439, backpack electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 27.5 °C (26.6-28.8), **secchi depth** 29 cm (25-32), **conductivity** 388 µS/cm (312-463), **wetted width** 4.4 m (3-7.1), **bankfull width** 6.4 m (3.6-8.2), **depth** 20 cm (1-65), **discharge** 3.5 cfs (2.1-5.9), **substrate** 58% gravel, 13% sand, 9% silt, 9% cobble, 7% clay, and 4% boulder.

Site 496 **<u>Norwood Creek</u>**, 33.8424, -94.6875, backpack electrofisher/mini-fyke net, **surface water temp** 27.3 °C (25.4-30.8), **secchi depth** 57 cm (25-90), **conductivity** 138 µS/cm (75-169), **wetted width** 3.7 m (2.4-5), **bankfull width** 4 m (3.4-6), **depth** 33 cm (7-100), **discharge** 0 cfs, **substrate** 40% sand, 24% silt, 13% clay, 11% organic matter, and 11% gravel.

Site 497 **<u>Holly Branch</u>**, 33.7851, -94.7627, barge electrofisher/backpack electrofisher/seine/mini-fyke net, **surface water temp** 29 °C (29), **secchi depth** 58.3 cm (35-85), **conductivity** 130 µS/cm (127-134), **wetted width** 9.2 m (8-15), **bankfull width** 9.2 m (8-15), **depth** 39 cm (5-106), **discharge** 0 cfs, **substrate** 100% silt.

Site 498 **<u>Push Creek</u>**, 33.7382, -94.6942, backpack electrofisher/seine, **surface water temp** 27.8 °C (27.6-27.9), **secchi depth** 27 cm (25-30), **conductivity** 122 µS/cm (112-132), **wetted width** 3.4 m (1.2-6.2), **bankfull width** 3.9 m (2-7.2), **depth** 18 cm (1-72), **discharge** 0.12 cfs (0.07-0.19), **substrate** 33% gravel, 27% sand, 18% silt, 16% organic matter, and 7% clay.

Site 499 **<u>Push Creek</u>**, 33.7335, -94.6421, backpack electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 27.9 °C (27.8-28), **secchi depth** 68 cm (35-90), **conductivity** 192 µS/cm (188-197), **wetted width** 4.8 m (2.5-9), **bankfull width** 5.8 m (3.7-10), **depth** 48 cm (5-112), **discharge** 4.2 cfs (3.3-5.7), **substrate** 40% sand, 36% silt, 13% organic matter, and 11% gravel.

Site 500 **<u>Norwood Creek</u>**, 33.7131, -94.6074, barge electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 27.4 °C (27.2-27.6), **secchi depth** 23 cm (15-35), **conductivity** 258 µS/cm (239-282), **wetted width** 8.1 m (5-13), **bankfull width** 9.9 m (6-15), **depth** 44 cm (5-130), **discharge** 4.7 cfs (2.1-6), **substrate** 38% sand, 29% silt, 24% gravel, 4% clay, 2% cobble, and 2% trash.

Site 501 **<u>Unnamed Creek</u>**, 33.7734, -94.7404, backpack electrofisher/seine, **surface water temp** 29.4 °C (28.2-30.6), **secchi depth** 42 cm (25-60), **conductivity** 141 µS/cm (136-146), **wetted width** 2.9 m (1.5-7), **bankfull width** 3.6 m (2-7), **depth** 13.6 cm (0-35), **discharge** 0.58 cfs (0.5-0.65), **substrate** 69% silt, 20% sand, 7% boulder, and 4% organic.

Site 502 **<u>Waterfall Creek</u>**, 33.7816, -94.7942, backpack electrofisher/seine/hoop net/mini-fyke net, **surface water temp** 28.5 °C (27.3-29.3), **secchi depth** 25 cm (15-40), **conductivity** 176 µS/cm (173-178), **wetted width** 9.4 m (7-12), **bankfull width** 12.3 m (9-15), **depth** 55 cm (5-126), **discharge** 0 cfs, **substrate** 100% silt.

Site 503 **<u>Unnamed Ditch</u>**, 33.7410, -94.6421, backpack electrofisher/mini-fyke net, **surface water temp** 27 °C (26.6-27.2), **secchi depth** 27 cm (20-35), **conductivity** 185 µS/cm (176-193), **wetted width** 4.9 m (4-7), **bankfull width** 6.3 m (5-10), **depth** 29 cm (55), **discharge** 0 cfs, **substrate** 100 silt.

Site 524 **Red River**, 33.7638, -96.4148, barge electrofisher/seine/buffalo net/hoop net/mini-fyke net, **surface water temp** 27.1 °C (23.9-30), **secchi depth** 87 cm (75-110), **conductivity** 1126 µS/cm (1058-1218), **wetted width** 93 m (45-147), **bankfull width** 260 m (215-292), **depth** 27 cm (0-140), **discharge** 68.3 cfs (57-85), **substrate** 67% sand, 29% gravel, 2% cobble, and 2% silt.

Site 529 **Red River**, 33.9074, -95.2833, boat electrofisher/seine/buffalo net/mini-fyke net, **surface water temp** 32.1 °C (31.4-32.7), **secchi depth** 25 cm (15-30), **conductivity** 723 µS/cm (410-924), **wetted width** 104.1 m (79-138), **bankfull width** 145.6 m (89-181), **depth** 127 cm (24-381), **discharge** 1467 cfs (1000-2000), **substrate** 100% sand.

Results

In 2025, eighty-two species representing 20 families were collected from two sites on the lower Red River and fifteen sites in twelve of its minor tributaries. This report does not present detailed occupancy and detection probabilities but instead serves to summarize species assemblages at each site in the lower Red River watershed. Therefore, site lists represent the cumulative species pool generated from replicate surveys. Species collected in the watershed are reported below and linked to each site via the site number. Within the mainstem Red River, fifty-three species were collected with two invasive species, eight species of greatest conservation need (Alligator Gar, Blue Sucker, Chub Shiner, Orangebelly Darter, Pallid Shiner, River Darter, Shovelnose Sturgeon, and Western Sand Darter), and twelve species of recreational importance. In the tributaries there were sixty-six species collected which consisted of one invasive species, five species of conservation need (Blackspot Shiner, Goldstripe Darter, Orangebelly Darter, Pallid Shiner, and Southern Brook Lamprey), and eleven species of recreational importance. The highest species diversity observed in the entire study area was at site 500 on Norwood Creek with forty-three species collected.

Species collected

C = species of greatest conservation need, **R** = species of recreational importance, **I** =invasive species.

ACIPENSERIDAE – sturgeons

(C) Shovelnose Sturgeon *Scaphirhynchus platorynchus* (Rafinesque, 1820) – Site 524.

AMIIDAE – bowfins

(R) Bowfin *Amia calva* (Linnaeus, 1758) – Sites 491, 496, 497, 499, and 502.

APHREDODERIDAE – pirate perches

Pirate Perch *Aphredoderus sayanus* (Gilliams, 1824) – Sites 490, 491, 496, 497, 498, 499, 500, 501, 502, and 503.

ATHERINOPSIDAE – new world silversides

Inland Silverside *Menidia beryllina* (Cope, 1867) – Sites 490, 524, and 529.

Brook Silverside *Labidesthes sicculus* (Cope, 1865) – Sites 490 and 529.

CATOSTOMIDAE – suckers

River Carpsucker *Carpiodes carpio* (Rafinesque, 1820) – Sites 500, 524, and 529.

Highfin Carpsucker *Carpiodes velifer* (Rafinesque, 1820) – Site 524.

(C) Blue Sucker *Cycleptus elongatus* (Lesueur, 1817) – Sites 524 and 529.
Lake Chubsucker *Erimyzon sucetta* (Lacépède, 1803) – Sites 498, 500, 501, and 503.
Smallmouth Buffalo *Ictiobus bubalus* (Rafinesque, 1818) – Sites 502, 524, and 529.

Bigmouth Buffalo *Ictiobus cyprinellus* (Valenciennes, 1844) – Sites 490, 499, 500, and 501.

Spotted Sucker *Minytrema melanops* (Rafinesque, 1820) – Sites 489, 490, and 500.

Black Redhorse *Moxostoma duquesnei* (Lesueur, 1817) – Site 495.

Golden Redhorse *Moxostome erythrurum* (Rafinesque, 1818) – Site 500.

CENTRARCHIDAE – sunfishes

Flier *Centrarchus macropterus* (Lacépède, 1801) – Sites 496, 497, 498, 499, 500, 501, and 503.

(R) Green Sunfish *Lepomis cyanellus* (Rafinesque, 1819) – Sites 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 524, and 529.

Warmouth *Lepomis gulosus* (Cuvier, 1829) – Sites 489, 490, 491, 493, 495, 496, 497, 498, 499, 500, 501, 502, 503, and 529.

Orangespotted Sunfish *Lepomis humilis* (Girard, 1858) – Sites 491, 500, 502, and 529.

(R) Bluegill *Lepomis macrochirus* (Rafinesque, 1819) – Sites 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 524, and 529.

Dollar Sunfish *Lepomis marginatus* (Holbrook, 1855) – Site 496.

Longear Sunfish *Lepomis megalotis* (Rafinesque, 1820) – Sites 489, 490, 491, 492, 493, 494, 495, 496, 498, 499, 500, 501, 502, 524, and 529.

(R) Redear Sunfish *Lepomis microlophus* (Günther, 1859) – Sites 490, 493, 495, 500, 501, and 529.

Redspotted Sunfish *Lepomis miniatus* (Jordan, 1877) – Sites 490, 491, 496, 497, 500, and 502.

Bantam Sunfish *Lepomis symmetricus* (Forbes, 1883) – Site 498.

(R) Smallmouth Bass *Micropterus dolomieu* (Lacépède, 1802) – Site 494.

(R) Spotted Bass *Micropterus punctulatus* (Rafinesque, 1819) – Sites 489, 490, 494, 495, 500, 524, and 529.

(R) Largemouth Bass *Micropterus nigricans* (Lacépède, 1802) – Sites 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, and 529.

(R) White Crappie *Pomoxis annularis* (Rafinesque, 1818) – Sites 491, 493, 496, 499, 500, 501, 502, and 529.

(R) Black Crappie *Pomoxis nigromaculatus* (Lasueur, 1829) – Sites 501, 502, 524, and 529.

CYPRINIDAE – carps

(I) Common Carp *Cyprinus carpio* (Linnaeus, 1758) – Sites 499, 500, 501, and 524.

DOROSOMATIDAE – thread herrings

Gizzard Shad *Dorosoma cepedianum* (Lesueur, 1818) – Sites 490, 491, 493, 494, 497, 500, 502, 524, and 529.

Threadfin Shad *Dorosome petense* (Günther, 1867) – Sites 494, 500, and 529.

ESOCIDAE – pikes & mudminnows

Grass Pickerel *Esox americanus* (Gmelin, 1789) – Sites 489, 496, 497, 498, 500, 501, 502, and 503.

ELASSOMATIDAE – pygmy sunfishes

Banded Pygmy Sunfish *Elassoma zonatum* (Jordan, 1877) – Sites 491, 496, 497, 498, 499, 500, 501, 502, and 503.

FUNDULIDAE – topminnows

Golden Topminnow *Fundulus chrysotus* (Günther, 1866) – Sites 501 and 502.

Blackstripe Topminnow *Fundulus notatus* (Rafinesque, 1820) – Sites 490, 494, and 502.

Blackspotted Topminnow *Fundulus* olivaceus (Storer, 1846) – Sites 493 and 500.

ICTALURIDAE – bullhead catfishes

Black Bullhead *Ameiurus melas* (Rafinesque, 1820) – Sites 491, 496, 497, 499, and 503.

Yellow Bullhead *Ameiurus natalis* (Lesueur, 1819) – Sites 489, 491, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, and 503.

(R) Blue Catfish *Ictalurus furcatus* (Valenciennes, 1840) – Site 529.

(R) Channel Catfish *Ictalurus punctatus* (Rafinesque, 1818) – Sites 500, 524, and 529.

Tadpole Madtom *Noturus gyrinus* (Mitchell, 1817) – Sites 490, 491, 495, 500, 501, and 502.

Freckled Madtom *Noturus nocturnus* (Jordan & Gilbert, 1886) – Sites 489, 500, and 529.

(R) Flathead Catfish *Pylodictis olivaris* (Rafinesque, 1818) – Sites 500, 524, and 529.

LEPISOSTEIDAE – gars

(C/R) Alligator Gar *Atractosteus spatula* (Lacépède, 1803) – Site 529.

Spotted Gar *Lepisosteus oculatus* (Winchell, 1864) – Sites 499, 500, 501, 502, 503, and 529.

Longnose Gar *Lepisosteus osseus* (Linnaeus, 1758) – Site 529.

Shortnose Gar *Lepisosteus platostomus* (Rafinesque, 1820) – Sites 493, 524, and 529.

LEUCISCIDAE – minnows

(C) Chub Shiner *Alburnops potteri* (Hubbs & Bonham, 1951) – Sites 524 and 529.

Central Stoneroller *Campostoma anomalum* (Rafinesque, 1820) – Sites 490, 492, 493, 494, 495, and 524.

Red Shiner *Cyprinella lutrensis* (Baird & Girard, 1853) – Sites 490, 491, 492, 493, 494, 495, 499, 500, 502, 524, and 529.

Blacktail Shiner *Cyprinella venusta* (Girard, 1856) – Sites 493, 494, and 495.

(C) Pallid Shiner *Hybopsis amnis* (Hubbs & Greene, 1951) – Site 500 and 529.

Ribbon Shiner *Lythrurus fumeus* (Evermann, 1892) – Sites 499, 500, and 501.

Redfin Shiner *Lythrurus umbratilis* (Girard, 1856) – Sites 489, 490, 495, and 500.

Shoal Chub *Macrhybopsis hyostoma* (Gilbert, 1884) – Site 524.

Silver Chub *Macrhybopsis storeriana* (Kirtland, 1845) – Site 529.

Bigeye Shiner *Miniellus boops* (Gilbert, 1884) – Sites 490 and 524.

Sand Shiner *Miniellus stramineus* (Cope, 1865) – Sites 490, 494, and 524.

Golden Shiner *Notemigonus crysoleucas* (Mitchill, 1814) – Sites 490, 491, 496, 497, 498, 499, 500, 501, 502, and 503.

Emerald Shiner *Notropis athernoides* (Rafinesque, 1818) – Sites 490 and 529.

(C) Blackspot Shiner *Notropis atrocaudalis* (Evermann, 1892) – Sites 492 and 499.

Ghost Shiner *Paranotropis buchani* (Meek, 1896) – Site 529.

Mimic Shiner *Paranotropis volucellus* (Cope, 1865) – Sites 490 and 524.

Suckermouth Minnow *Phenacobius mirabilis* (Girard, 1856) – Sites 493, 494, and 495.

Bullhead Minnow *Pimephales vigilax* (Baird & Girard, 1853) – Sites 490, 491, 494, 495, 500, 524, and 529.

MORONIDAE – temperate basses

(R) Striped Bass *Morone saxatilis* (Walbaum, 1792) – Site 529.

(R) White Bass *Morone chrysops* (Rafinesque, 1820) – Sites 524 and 529.

PERCIDAE – perches

(C) Western Sand Darter *Ammocrypta clara* (Jordan & Meek, 1885) – Sites 524 and 529.

Bluntnose Darter *Etheostoma chlorosum* (Hay, 1881) – Sites 498, 499, 500, and 529.

Slough Darter *Etheostoma gracile* (Girard, 1859) – Sites 489, 490, 491, 492, 493, 495, 496, 498, 499, 500, 501, and 502.

(C) Goldstripe Darter *Etheostoma parvipinne* (Gilbert & Swain, 1887) – Sites 491 and 498.

Cypress Darter *Etheostoma proeliare* (Hay, 1881) – Sites 500 and 501.

(C) Orangebelly Darter *Etheostoma radiosum* (Hubbs & Black, 1941) – Sites 489, 490, 492, 494, 500, and 524.

Common Logperch *Percina caprodes* (Rafinesque, 1818) – Sites 490, 498, 500, and 529.

Slenderhead Darter *Percina phoxocephela* (Nelson, 1876) – Site 524.

Dusky Darter *Percina sciera* (Swain, 1883) – Sites 489, 490, 493, 500, 524, and 529.

(C) River Darter *Percina shumardi* (Girard, 1859) – Site 524.

PETROMYZONTIDAE – lampreys

(C) Southern Brook Lamprey *Ichthyomyzon gagei* (Hubbs & Trautman, 1937) – Site 489.

POECILIIDAE – livebearers

Western Mosquitofish *Gambusia affinis* (Baird & Girard, 1853) – Sites 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, and 529.

SCIAENIDAE – drums

Freshwater Drum *Aplodinotus grunniens* (Rafinesque, 1819) – Sites 499, 500, 502, and 529.

XENOCYPRINIDAE – sharpbellies

(I) Grass Carp *Ctenopharyngodon idella* (Valenciennes, 1844) – Site 524.

Discussion

The lower Red River was the thirteenth watershed sampled as part of the stream fish community monitoring effort. The 2025 surveys will serve as contemporary baseline data for the Red River going forward. 81 species were captured among only 17 sites, with 11 of those being SGCN's. This drainage had one of the highest number of species captured and lowest number of sites sampled in the entire program, which makes the lower Red River a biodiversity hotspot.

This report presents a summary of the findings as it pertains to site characteristics and species' presence (i.e., naïve occupancy) within the watershed. Results of fisheries surveys covering large geographic areas were routinely published in the past (see Hubbs and Ortenburger 1929; Cross and Moore 1952; Branson 1967; Pigg 1987; Taylor et al. 1991) and serve as valuable resources for contemporary research examining changes in species' distributions, trends in stream fish community structure, and the effects of anthropogenic disturbance on stream fish assemblages (Luttrell et al. 1999; Rahel 2002; Gido et al 2010; Gillette et al. 2012; Smith et al. 2014; Senecal et al. 2015; Perkin et al. 2015). Therefore, the summarized data from fish community surveys in the Red River watershed has value in and of itself and is reported for the benefit of researchers working within the watershed. In addition, data from this watershed will be later analyzed in an occupancy modeling framework for the entire state. Within this framework, occupancy models can be summarized for any species of interest at various spatial scales (i.e., watershed, ecoregion, statewide) depending on the research question of interest. Upon completion of the monitoring rotation, watershed data will be combined to allow analyses at the statewide scale with the goal of having ~500 sites on which to base statewide estimates of species' occupancy and detection probabilities. Thus, occupancy modeling will provide a powerful tool for accomplishing Stream Program goals and objectives because of its advantages over other methods that do not leverage replicate surveys.

A downfall of traditional fisheries survey methods is ignoring the inherent biases associated with imperfect detection of species. Aside from the error of misidentifying collected species (i.e., false-positive), there are three possible outcomes resulting from traditional fisheries surveys. First, a species is present at a site and is detected by the sampling crew (i.e., true-positive). Secondly, a species is not present and therefore not detected by the sampling crew (i.e., true-negative). Lastly, a species is present at a site but is not detected by the survey crew. This last scenario is referred to as a false-negative, and this source of error will arise whenever the detection probability of a species is less than 100%. In biological surveys, imperfect detection is the rule, not the exception (MacKenzie et al. 2002; MacKenzie et al. 2006). Therefore, ignoring detection probabilities in fisheries studies may lead to biased models of species occurrence, which underestimate the true distribution of the species (MacKenzie et al. 2006). While repeat surveys require more effort than one-time point samples, and occupancy models generally require large datasets, the benefits of teasing apart the complex relationship between occupancy and detection probabilities that confound other methods justify the use of this analysis for deriving accurate assessments of species status (MacKenzie et al. 2002). While occupancy is not a direct measure of species abundance, the underlying principle is that occupancy probabilities are directly related to population densities and thus provide a useful surrogate for examining trends over time. In addition, occupancy is considered the parameter of choice when estimating distributions of species, a primary goal of this effort (MacKenzie et al. 2006). This sampling methodology has other applications that will be beneficial for long-term monitoring programs including: identifying additional populations of at-risk species, highlighting areas of conservation priority, identifying potential repatriation sites for species of concern, and informing SGCN listings in conjunction with the Oklahoma Comprehensive Wildlife Conservation Strategy. Efforts to develop long-term datasets are imperative to achieve the goal of updating our understanding of the status of Oklahoma stream fish communities and providing retrospective analysis and comparisons to historical datasets (Magurran et al. 2010). Therefore, the stream fish monitoring protocols presented within will develop quality datasets necessary for the maintenance and monitoring of fish biodiversity in Oklahoma.

Public Access and Recreational Opportunities

Public property is abundant on the Lower Red River since it is a "navigable waterway". One can fish below Denison Dam or at the many highway bridges that cross the river. The lower Red River is best known for its Catfish, Striped Bass, and White Bass fishing but has adequate Black Bass, Crappie, Paddlefish, and Alligator Gar fishing as well. Other than the Red River mainstem and its major tributaries though, fishing access is limited.

Most of the minor tributaries are too small to fish except for Push and Norwood creeks at Red Slough WMA. The most abundant, catchable fish here are Bullheads, Gar, and Bowfin, however, and are not usually sought after. There is public access at Grassy Slough WMA and Whitegrass Flats WMA but lack sufficient water to angle.

Recommendations

The Red River has great angling opportunities, but due to the lack of boat ramps, anglers are restricted to bank fishing. The best place to launch a boat on public property is a sandbar at the dam, which is not very user friendly. Because the Red River is highly variable, it is understood that implementation of a permanent boat ramp may not be feasible. This being said, boat ramps on the lower Red River would be beneficial to Oklahoma's anglers as well as our streams program for accessibility in the future.

Unlike many places in the state, the lower Red River seems to have healthy populations of pelagic, migratory spawners like Blue Suckers, Sturgeon, and Paddlefish. This is likely attributed to the large section of undammed river. Since large river species are the most imperiled group of fish in Oklahoma, any future dams on the Red River and its tributaries should be avoided.

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References

Anderson, A.A., C. Hubbs, K.O. Winemiller, and R.J. Edwards. 1995. Texas freshwater fish assemblages following three decades of environmental change. The Southwestern Naturalist 40:314-321. doi: http://www.jstor.org/stable/30055175

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish, second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Branson, B. A. 1967. Fishes of the Neosho River system in Oklahoma. The American Midland Naturalist 78:126-154.

Crews A., B. Hawkinson, G. Duffy, H. Namminga, M. Howery, R. Hatcher, R. Suttles, S. Amend, T. Shropshire. 2005. Oklahoma comprehensive wildlife conservation strategy. Oklahoma City, Oklahoma: Oklahoma Department of Wildlife Conservation. (State Wildlife Grant T-2-P-1).

Cross, F. B., and G. A. Moore. 1952. The fishes of the Poteau River, Oklahoma and Arkansas. The American Midland Naturalist 47:396-412.

Dodds, W.K., K. Gido, M.R. Whiles, K.M. Fritz, and W.J. Matthews. 2004. Life on the edge: the ecology of Great Plains prairie streams. BioScience 54:205-216. doi: 10.1641/0006-3568(2004)054[0205:LOTETE]2.0.CO;2

Gido, K.B., W.K. Dodds, and M.E. Eberle. 2010. Retrospective analysis of fish community change during a half-century of landuse and streamflow changes. Journal of the North American Benthological Society 29:970-987. doi: 10.1899/09-116.1

Gillette, D. P., A. M. Fortner, N. R. Franssen, S. Cartwright, C. M. Tobler, J. S. Wesner, P. C. Reneau, F. H. Reneau, I. Schlupp, E. C. Marsh-Matthews, W. J. Matthews, R. E. Broughton, and C. W. Lee. 2012. Patterns of change over time in darter (Teleostei: Percidae) assemblages of the Arkansas River basin, northeastern Oklahoma, USA. Ecography 35:1-10.

Gore, J. A. 2007. Discharge measurements and streamflow analysis. Pages 51-78 *in* F. R. Hauer and G. A. Lamberti, editors. Methods in stream ecology, 2nd edition. Academic Press, Burlington, Massachusetts.

Hoagstrom, C.W., A.C. DeWitte, N.J.C. Gosch, and C.R. Berry Jr. 2007. Historical fish assemblage flux in the Cheyenne River below Angostrura Dam. Journal of Freshwater Ecology 22:219-229. doi: 10.1080/02705060.2007.9665041

Hubbs, C. L., and A. I. Ortenburger. 1929. Fishes collected in Oklahoma and Arkansas in 1927. Publications of the Oklahoma Biological Survey 1:47-112.

Jelks, H.L., S.J. Walsh, N.M. Burkhead, S. Contreras-Balderas, E. Diaz-Pardo, D.A. Hendrickson, J. Lyons, N.E. Mandrak, F. McCormick, J.S. Nelson, S.P. Platania, B.A. Porter, C.B. Renaud, J. J. Schmitter-Soto, E.B. Taylor, and M.L. Warren Jr. 2008. Conservation status of imperiled North American freshwater and diadromous fishes. Fisheries 33:372-408. doi: 10.1577/1548-8446-33.8.372

Luttrell, G. R., A. A. Echelle, W. L. Fisher, and D. J. Eisenhour. 1999. Declining status of two species of the Macrhybopsis aestivalis complex (Teleostei: Cyprinidae) in the Arkansas River basin and related effects of reservoirs as barriers to dispersal. Copeia 1999: 981-989.

MacKenzie, D.I., J.D. Nichols, G.B. Lachman, S. Droege, J. A. Royle, and C.L. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83:2248-2255. doi: 10.1890/0012-9658(2002)083[2248:ESORWD]2.0.CO;2

MacKenzie, D.I., J.D. Nichols, J.A. Royle, K.H. Pollock, L.L. Bailey, and J.E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Elsevier, San Diego, USA.

MacKenzie, D.I. and J.A. Royle. 2005. Designing efficient occupancy studies: general advice and allocating survey effort. Journal of Applied Ecology 42:1105-1114.

Magurran, A.E., S.R. Baillie, S.T. Buckland, J.M. Dick, D.A. Elston, E.M. Scott, R.I. Smith, P.J. Somerfield, and A.D. Watt. 2010. Long-term datasets in biodiversity research and monitoring: assessing change in ecological communities through time. Trends in Ecology & Evolution 25:574-582. doi: 10.1016/j.tree.2010.06.016

Matthews, W. J. 1988. North American prairie streams as systems for ecological study. Journal of the North American Benthological Society 7:387-409.

Matthews, W.J., R.C. Cashner, and F.P. Gelwick. 1988. Stability and persistence of fish faunas and assemblages in three midwestern streams. Copeia 1988:945-955.

Matthews, W.J., E. Marsh-Matthews, R.C. Cashner, and F.P. Gelwick. 2013. Disturbance and trajectory of change in a stream fish community over four decades. Oecologia 173:955-969.

Matthews, W.J. and E. Marsh-Matthews. 2015. Comparison of historical and recent fish distribution patterns in Oklahoma and western Arkansas. Copeia 103:170-180.

Matthews, W.J. and E. Marsh-Matthews. 2016. Dynamics of an upland stream fish community over 40 years: trajectories and support for the loose equilibrium concept. Ecology 97:706-719.

Miller, R.J. and H.W. Robison. 2004. Fishes of Oklahoma. University of Oklahoma Press, Norman, Oklahoma.

Perkin, J. S., K. B. Gido, K. H. Costigan, M. D. Daniels, and E. R. Johnson. 2015. Fragmentation and drying ratchet down Great Plains stream fish diversity. Aquatic Conservation: Marine and Freshwater Ecosystems 25:639-655.

Pflieger, W.L. 1997. The fishes of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Pigg, J. 1987. Survey of fishes in the Oklahoma panhandle and Harper County, northwestern Oklahoma. Proceedings of the Oklahoma Academy of Science 67:45-59.

Rahel, F. J. 2002. Homogenization of freshwater faunas. Annual Review of Ecology and Systematics 33:291-315.

Sager, Cliff, Hull, N., Mauck, M. 2024. Lake Texoma Fisheries Management Plan. https://www.wildlifedepartment.com/sites/default/files/2021-08/Texoma%20Lake%20MAnagement%20Plan%202011.pdf.

Senecal, A. C., A. W. Walters, and W. A. Hubert. Historical data reveal fish assemblage shifts in an unregulated prairie river. Ecosphere 6:287.http://dx.doi.org/10.1890/ES14-00361.1

Smith, C.D., J.R. Fischer, and M.C. Quist. 2014. Historical changes in Nebraska's lotic fish assemblages: implications of anthropogenic alterations. The American Midland Naturalist 172:160-184. doi: 10.1674/0003-0031-172.1.160

Taylor, C.M., M. R. Winston, and W.J. Matthews. 1991. Distribution and abundance of sport and forage fishes of the upper Red River drainage (above Lake Texoma) in Oklahoma. Oklahoma Department of Wildlife Conservation Project F-48-R, Oklahoma City, Oklahoma.

Table 1. Gear and gear effort deployed by the Oklahoma Department of Wildlife Conservation Stream Program community sampling protocol.

Gear Type	Gear Description	Minimum Effort
Seine Net	3x1.5m, 6.0mm mesh	Wadeable = 20 hauls Non-Wadeable = 10 hauls
Backpack Electrofisher	ETS Electrofishing Systems ABP-4-MR	150m single pass
Tow-Barge Electrofisher	Midwest Lakes Infinity Control Box	150m single pass
Boat Electrofisher	Midwest Lakes Infinity Control Box	750m single pass, 60 Hz & Low Frequency
Mini-Fyke Net	69x1011 cm, 2 hoops, 4.5m lead (Miller Nets)	One net-night
Hoop Net	3m long, 0.65m diameter, 4cm bar mesh (Miller Nets)	One net-night
Buffalo Net	5m long, 0.65m diameter, 4cm bar mesh (Miller Nets)	One net-night
Benthic Trawl	38mm outer mesh, 12mm inner mesh, Hybrid Siamese trawl (Innovative Net Systems)	MWCW <150 m = 200m Trawl MWCW >150m = 400m Trawl

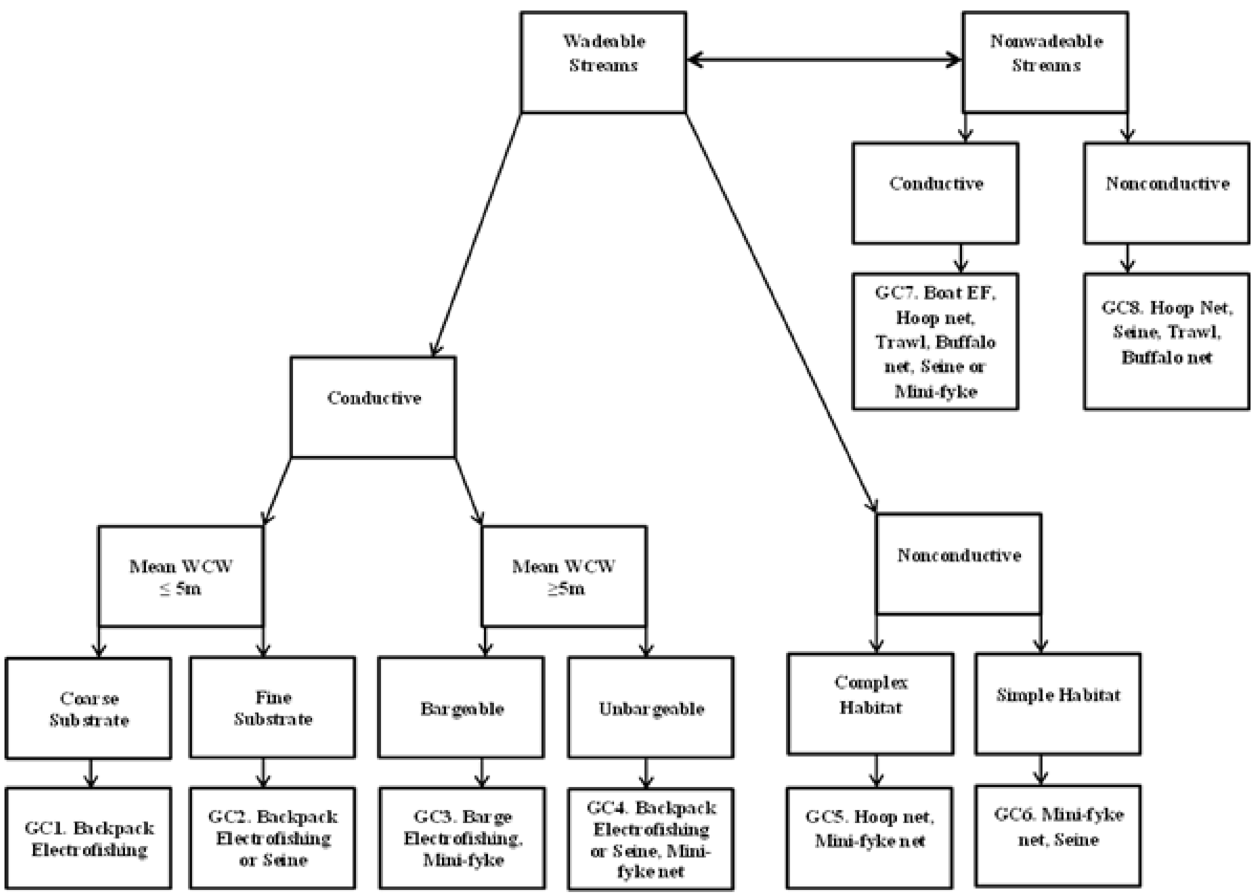

Figure 1. Gear flowchart for Oklahoma Department of Wildlife Stream Program Community Sampling Protocols.

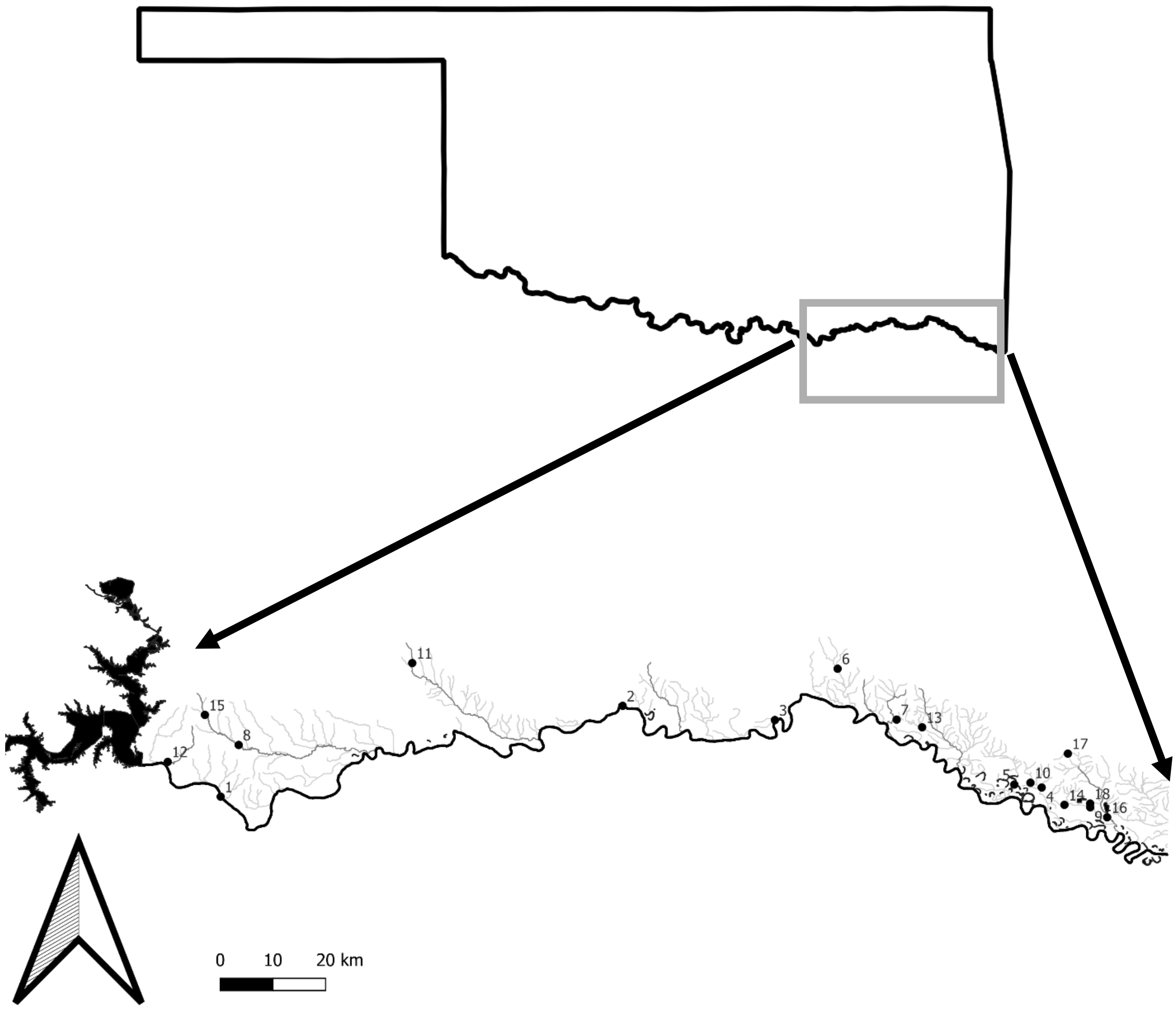

Figure 2. Fish community sites in the Red River watershed sampled by ODWC stream program in the summer of 2025.