# Fishes of Battle Branch, Delaware County, in northeastern Oklahoma

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**A survey of the fishes of Battle Branch was conducted from August 1985 through January 1987. A total of 118 collections were made at 11 stations by seining, using capture and release techniques, and by snorkeling observations. The presence of 9 families and 29 species typical of Ozark streams was confirmed. This faunal composition is compared to that of other Ozark and Oklahoma streams. A large population of the Ozark-endemic stippled darter *(Etheostoma punctulatum)* is reported.**

## INTRODUCTION

Battle Branch is in the Ozark biotic district (1) at the western edge of the Ozark Uplift in Delaware County, Oklahoma (Fig. 1). It is a small, clear-water, spring-fed creek in the Illinois River drainage. Until now, no detailed survey has been made of the ichthyofauna of Battle Branch.

The stream originates just southeast of Colcord, Oklahoma as a spring pool and maintains a gradient of 7 m/km (0.7%) flowing approximately 6 km to its confluence with Flint Creek (Fig. 1). From upstream to downstream, mean depth ranged 15-93 cm and mean width 3-15 m (February 1986-January 1987). Mean temperature throughout the stream at this time was 14.2-15.4 ºC. Substrata included gravel and cobble with some boulders at lower stations. Though spring seeps occur along its course, flow is interrupted during low rainfall periods in summer and winter, in some places for several hundred meters (M. Shelly and B. Lovelace, pers. comm.). This regime is characteristic of numerous creeks in this area (e.g., Spring Creek [2]).

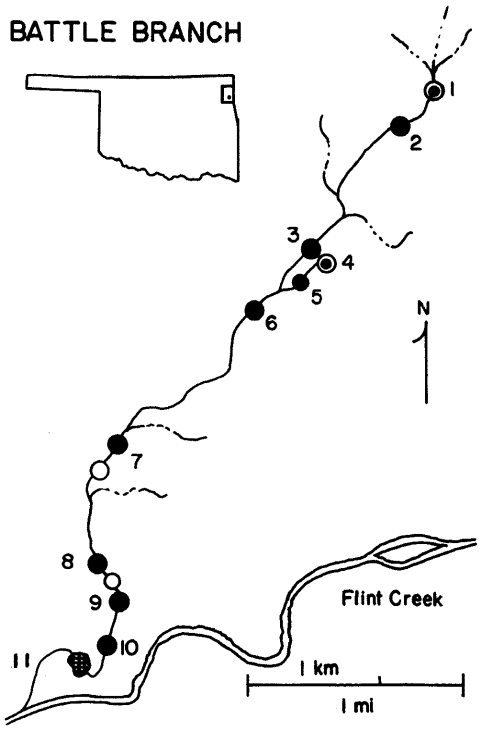


Figure 1. Location of Battle Branch in Delaware County, Oklahoma. Filled circles indicate collecting stations; open circles, known spring; crosshatching, pond.

## METHODS

Monthly fish surveys were made for one year (February 1986-January 1987) at nine stations (Fig. 1, stations 1 - 3 and 5 - 10), each approximately 200 m long. Additional samples were taken opportunistically (August 1985-May 1986) at supplementary sites so that available habitats along most of the stream reach were surveyed at least once. Collections were made by two persons using heavily-leaded seines, 1.8 or 4.6 m long (as appropriate for each habitat), 1.3 m deep, with 5-mm mesh. Snorkeling surveys documented larger individuals not captured by seining and abundance of *Campostoma* sp., noted for their ability to maneuver under a seine.

Fishes were preserved in 10% formalin

and transferred to 40% isopropyl alcohol to document species identifications and relative abundances. Specimens are housed in the Oklahoma Museum of Natural History at the University of Oklahoma. After initial collections, only voucher specimens or individuals of uncertain identity were retained. To minimize the impact of disturbance and collecting on populations (3, 4), fish were retained in an insulated container of stream water. They were then identified, counted, and returned to the collection site as quickly as possible. Juveniles and young-of-year were identified and counted separately (5). Abundances are summarized in Table 1. Scientific names follow Miller and Robison (6) or Cashner and Matthews (7).

**Collecting Stations** (Unless otherwise indicated, all stations were within Township 20 North, Range 25 East.)

**Station 1.** Sec. 5, NE 1/4. Springhead pool and limestone bedrock riffle, bordered by pasture.

**Station 2**. Sec. 5, NE 1/4. Dense oak-hickory gallery forest. Pools with undercut banks, tree roots and woody debris.

**Station 3.** Sec. 5, SW 1/4. Well developed pools and riffles. Open pasture.

**Station 4.** Sec. 5, SW 1/4. Spring-fed. Pools and riffles with exposed shale bedrock. Open canopy. A small concrete dam approximately 100 m downstream of the springhead.

**Station 5**. Sec. 8, NW 1/4. Spring-influenced. Riffles dominant. Oak- hickory shaded pasture.

**Station 6.** Sec. 7, NE 1/4. Bottom-land pasture. Well developed pools, undercut banks. Limestone bedrock riffles.

**Station 7**. Sec. 7, SW 1/4. Shaded pasture, limestone bluffs. Undercut rock banks; large slabs of shale and limestone in pools. Interrupted flow in July and December 1987 left isolated pools.

**Station 8.** Sec. 18, NW 1/4. Mostly open pasture. Well developed riffles and pools. A scour pool 2 m deep was the deepest pool in Battle Branch.

**Station 9.** Sec. 18, SW 1/4. Limestone bluffs, shaded pasture. Spring-influenced.

**Station 10.** Sec. 18, SW 1/4. Open pasture, gravel flood plain.

**Station 11.** T20N, R24E, Sec. 13, SE 1/4. Pond created by a gravel dam. Approximately 200 m of reach across flood plain pasture. Silt and mud substrata. Another 300-m reach to the confluence of Battle Branch with Flint Creek. Deciduous gallery forest, gravel substratum.

## ANNOTATED CHECKLIST

Cyprinidae

*Campostoma anomalum* (Rafinesque) - Central stoneroller.

*Campostoma oligolepis* Hubbs and Greene - Largescale stoneroller.

These two species were found sympatric throughout Battle Branch in early collections for which these fishes were identified to species in the laboratory. In later collections, field identification to species was not possible because scale counts are necessary to distinguish individuals, other than breeding males, to species (7, 8, 9). Stonerollers were one of the most abundant fishes, occupying both pools and riffles. However, due to their mostly benthic habit, the highly uneven substrata and their noted ability to maneuver under seines, their abundance was underrepresented in seining collections. Snorkeling surveys better represented their abundance.

*Nocomis asper* Lachner and Jenkins - Redspot chub. Active gravel-mound nest at station 8.

*Luxilus cardinalis* Mayden - Cardinal shiner.

Cashner and Matthews (7) note the elevation of *Luxilus* (formerly in *Notropis)* to generic level by R. L. Mayden (10). Mayden (11) elevated the specific status populations formerly referred to as *Notropis pilsbryi* from the Arkansas River drainage in Oklahoma. This species was one of the most abundant pool species in Battle Branch, absent only from small shallow pools.

*Notropis nubilus* (Forbes) - Ozark minnow. Abundant in deep pools.

*Notropis rubellus* (Agassiz) - Rosyface shiner.

Adults were found sporadically. Only two juveniles and no YOY were collected. Several adults were taken in the pond downstream of station 10. Habitat use by this species was enigmatic. Whereas it is often collected in swift water below riffles in most Ozark streams (6, 8, 9), it was common only in non- or slow-flowing habitats in Battle Branch.

*Phoxinus erythrogaster* (Rafinesque) - Southern red-bellied dace.

This was the most abundant minnow throughout the middle and upper reaches. The distribution of this species in Battle Branch coincides with its known proclivity for spring-influenced habitats.

*Semotilus atromaculatus* (Mitchell) - Creek chub. Main predatory fish in upstream pools.

*Hybopsis amblops* (Rafinesque) - Bigeye chub. No juveniles or YOY were taken. This species may have been a transient from Flint Creek.

Catostomidae

*Catostomus commersoni* (Lacepede) - White sucker.

This species was never in abundance and no adults were collected. Moore and Paden (12) considered this species rare in Oklahoma, collecting it only from Caney Creek in Cherokee County. Cox

TABLE 1. Total fish abundance (adult + juvenile) by species, recorded at each station summed across all surveys (seining + visual). Fish were returned to each site and the number of surveys were different at each station. Therefore, the mean abundance of each species in Battle Branch is calculated as the abundance per survey at each site, summed across all sites. The % total abundance for each species is calculated from the mean abundance of each species and the total of these means summed across all species (approximately 2,144 fish per survey).

| | Upstream | | | STATIONS | | | | Downstream | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | (12) | (13) | (11) | (2) | (14) | (13) | (13) | (14) | (13) | (13) | (4) | Mean | % |
| *Campostoma* spp. | 7 | 10 | 82 | 1 | 10 | 315 | 145 | 930 | 279 | 842 | 20 | 203 | 9.47 |
| *Nocomis asper* | | | | | | | | 57 | 70 | 121 | 11 | 22 | 1.03 |
| *Luxilus cardinalis* | | | 55 | | 23 | 390 | 198 | 988 | 577 | 699 | 130 | 253 | 11.80 |
| *Notropis nubilus* | | | | | | | 18 | 994 | 193 | 902 | 172 | 200 | 9.31 |
| *Notropis rubellus* | | | | | | | | 65 | 12 | 9 | 72 | 24 | 1.13 |
| *Phoxinus erythrogaster* | 1718 | 1090 | 3547 | 201 | 737 | 1244 | 1051 | 314 | 196 | 956 | 122 | 1021 | 47.60 |
| *Semotilus atromaculatus* | | 11 | 28 | 10 | 85 | 61 | 201 | 51 | 45 | 12 | 69 | 54 | 2.51 |
| *Hybopsis amblops* | | | | | | | | 2 | | 3 | 3 | 1 | 0.05 |
| *Catostomus commersoni* | | | 1 | | 1 | 1 | 12 | 2 | | 5 | | 2 | 0.08 |
| *Hypentelium nigricans* | | | | | | 4 | 1 | 9 | 2 | 3 | | 1 | 0.07 |
| *Moxostoma erythrurum* | | | | | | | | 2 | | 2 | 2 | 1 | 0.04 |
| *Ictalurus natalis* | | | | | | | | 2 | | | | <1 | 0.01 |
| *Noturus exilis* | | | 1 | 1 | 1 | 17 | 1 | 55 | 74 | 101 | 1 | 20 | 0.92 |
| *Fundulus catenatus* | | | | | | | | | | 1 | | <1 | <0.01 |
| *Gambusia affinis* | | | | | | | | | 1 | 21 | 26 | 8 | 0.38 |
| *Labidesthes sicculus* | | | | | | | | | | 1 | 16 | 4 | 0.19 |
| *Ambloplites rupestris* | | | | | | | | 23 | | 16 | | 3 | 0.13 |
| *Lepomis cyanellus* | 2 | 8 | 2 | 19 | 2 | 3 | 1 | 6 | 1 | 20 | 2 | 13 | 0.63 |
| *Lepomis macrochirus* | | | | | | | | 1 | | | 2 | 1 | 0.03 |
| *Lepomis megalotis* | | 2 | | | | 1 | 1 | 4 | 3 | 6 | 11 | 4 | 0.19 |
| *Lepomis microlophus* | | | | | | | | | | | 1 | <1 | 0.01 |
| *Micropterus dolomieui* | | | | | | | | 33 | 3 | | | 5 | 0.22 |
| *Micropterus salmoides* | | | | | | | | | | | 1 | <1 | 0.01 |
| *Etheostoma flabellare* | | 4 | 144 | 8 | 124 | 154 | 10 | 7 | 23 | 19 | | 43 | 1.99 |
| *Etheostoma punctulatum* | 1 | | 3 | 19 | 6 | 3 | 4 | 5 | 3 | 15 | | 13 | 0.59 |
| *Etheostoma spectabile* | 2 | 10 | 47 | 13 | 1 | 93 | 43 | 138 | 86 | 240 | 31 | 65 | 3.03 |
| *Etheostoma zonale* | | | | | | | | | 1 | | | <1 | <0.01 |
| *Cottus carolinae* | 90 | 267 | 144 | 17 | 410 | 190 | 88 | 265 | 245 | 523 | 24 | 184 | 8.59 |

(13) did not collect it from Flint Creek. However, McNeely (2) reports it from upper Spring Creek in the Neosho River drainage in Delaware County.

*Hypentelium nigricans* (Leseur) - Northern hog sucker.

*Moxostoma erythrurum* (Rafinesque) - Golden redhorse.

The golden redhorse was rare, and only adults were taken. This species is probably more abundant in larger creeks. Moore and Paden (12) did not list it from Flint Creek, but reported it from Tyner Creek, another Ozarkian tributary of the Illinois River, comparable in size to Battle Branch.

Ictaluridae

*Ictalurus natalis* (Lesuer) - Yellow bullhead. One adult only was observed, by snorkeling in a deep pool.

*Noturus exilis* Nelson - Slender madtom.

Although common in "kick-sets", collections were probably low due to the nocturnal habits of the species (surveys were made only in daylight).

Fundulidae

*Fundulus catenatus* (Storer) - Northern studfish.

Only one specimen was collected; a robust male in breeding color, taken in October 1985. This species is rare in the Illinois River drainage, and may have entered Oklahoma via bait-bucket introduction (14). The species was not reported anywhere in the Illinois River drainage by Moore and Paden (12). However, Cox (13) and Matthews (unpubl. data) collected it from Flint Creek.

Poeciliidae

*Gambusia affinis* (Baird and Girard) – Mosquitofish.

This species occurred only in slow backwater areas, which were rare habitats in Battle Branch.

Atherinidae

*Labidesthes sicculus* (Cope) - Brook silverside.

This silverside was collected only near flooded vegetation and in shallow pools. Only adults were collected.

Centrarchidae

*Ambloplites rupestris* (Rafinesque) - Rock bass.

The precise taxonomic status of *Ambloplites* species in northeast Oklahoma is hopelessly confused as a result of introductions, but Dr. Robert C. Cashner (University of New Orleans) confirms that our specimens are most similar to *A. rupestris.*

*Lepomis cyanellus* Rafinesque - Green sunfish. One of the dominant piscivores in many Battle Branch pools.

*Lepomis macrochirus* Rafinesque - Bluegill.

Only 3 specimens (adults) were collected. This species is rare in Ozark streams; specimens may have escaped from farm ponds.

*Lepomis megalotis* (Rafinesque) - Longear sunfish.

*Lepomis microlophus* (Gunther) - Redear sunfish.

One specimen was collected in May in a deep pool habitat with much leaf litter and woody debris. This introduced species (15) is probably present only as an escapee from stocked ponds.

*Micropterus dolomieui* Lacepede - Smallmouth bass.

Adults and juveniles of this deep-pool-dwelling predator were collected. Snorkeling surveys at station 8 in May 1987 revealed the presence of approximately two-week-old YOY being guarded by the adults. This important game species apparently can complete its life cycle in this very small Ozark stream.

*Micropterus salmoides* (Lacepede) - Largemouth bass.

An adult was taken by seining near the confluence with Flint Creek. The species occurs, but is rare, in mainstreams of the Illinois River drainage.

Percidae

*Etheostoma flabellare* (Rafinesque) - Fantail darter. Most common darter upstream.

*Etheostoma punctulatum* (Agassiz) - Stippled darter.

The population at station 4 was an unusually dense one for Oklahoma streams (W. Matthews, pers. comm.). It is probably well protected, because the spring at this site is a source of drinking water and the landowner allows no trespass.

*Etheostoma spectabile* (Agassiz) - Orangethroat darter.

Overall the most abundant darter. Found in both riffles and pools. Adult numbers were greatly reduced in collections from June through October when snorkeling observations indicated they apparently moved from riffles into pools, where they were more difficult to collect by seining.

*Etheostoma zonale* (Cope) - Banded darter.

The adult male collected was likely a transient. It was collected at 40 cm depth in a swift current that made seining difficult. Moore and Paden (12) reported it from Flint Creek. It was common in lower reaches of Flint Creek (F. Gelwick and W. Matthews, pers. observ.).

Cottidae

*Cottus carolinae* (Gill) - Banded sculpin.

Although most abundant in riffles, they occupied a wide range of benthic habitats, from small headwater pools and riffles to fast, deep riffles further downstream. The smallest YOY were collected at stations 1 and 2, associated with tangled strands of moss *(Fontinalis* sp.*).*

## DISCUSSION

These collections and observations comprise one of the most detailed surveys of the fishes of a small stream in the Ozark uplands. Most published studies of Ozark stream fishes in Oklahoma and neighboring states have consisted of single or of seasonal samples at fixed localities. Sites on Battle Branch were selected to include virtually every kind of habitat available to fish in this stream, and samples were repeated every month. Thus, along with additional collections and observations, it is likely that the fish fauna for this stream was comprehensively documented.

The total of 29 species in 9 families found in Battle Branch is relatively rich for a small Oklahoma stream. Although few studies exist of watersheds as small as Battle Branch (6 km mainstream), detailed collecting in slightly larger (35-75 km) streams in the midwest have produced comparable or fewer numbers of species [e.g., Tyner Creek (12), Adair County (25 species); Spring Creek (2), Mayes, Delaware and Cherokee counties (28 species); Salt Creek (16, 17), Osage County (28 species); Stillwater Creek (18), Payne and Noble counties (30 species); Brier Creek (19), Marshall County (30 species); Mill Creek (20), Murray and Johnson counties (46 species); Crutcho Creek (21), Oklahoma

County (17 species) and West Cache Creek (22), Comanche County (20 species)].

The relatively high diversity of fishes found in Battle Branch likely reflects the high diversity of habitat conditions which mimic those of larger streams. In addition there are permanently flowing water sources of apparently good quality (5) and a lack of obvious habitat destruction by cultural activities (e.g., channelization and clearing of riparian timber) that have harmed fish faunas in other systems. In many similar-size Oklahoma streams further west, habitat diversity is lower. Sand and mud substrata, unreliable flow, and physicochemical stress (23) apparently limit the numbers of fish species that can exist.

On a larger scale the fish fauna of Battle Branch demonstrates the well-known principle of longitudinal zonation. It is a small subset of the 69 (24) to 92 (12) species known from the Illinois River drainage, or the 45 (12, 13) species from Flint Creek to which Battle Branch is a direct tributary. It lacks taxa typical of larger streams in the region, such as buffalo *(Ictiobus* spp.*),* carpsuckers *(Carpiodes* spp.), or gar *(Lepisosteus* spp.). A low-water dam at Highway 33 on Flint Creek may discourage upstream movements of these known migratory forms (8).

Some species may have occurred in Battle Branch primarily as waifs or migratory individuals from the larger Flint Creek, such as *Hybopis amblops, Etheostoma zonale, Notropis rubellus, Ictalurus natalis,* or *Fundulus catenatus.* However, the species that dominate the Battle Branch ichthyofauna clearly do not rely on influx of individuals from larger streams for sustenance. On the basis of this sampling over 17 months, Battle Branch appears to have a complex, self-sustaining fauna, typical of small Ozark streams without any serious habitat degradation. Through public and landowner awareness, we should encourage efforts to maintain small streams such as these as viable, if not pristine, environments for such interesting and diverse native fish faunas.

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