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First Report of a Population of Western Blacknose Dace (*Rhinichthys obtusus*) in the Brushy Creek System of the Black Warrior River Drainage, Alabama

Abstract

Alabama is home to the southernmost populations of *Rhinichthys obtusus*, the Western Blacknose Dace. Within Alabama, *R. obtusus* is found in the Tennessee, Coosa, and Black Warrior River basins, but its presence in the Black Warrior River drainage has been limited. Until now, *R. obtusus* in the Black Warrior drainage has only been reported as collections of 1 to 4 specimens at a time in the Sipsey Fork drainage. Herein, we report two novel occurrences of *R. obtusus* in the headwaters of the Brushy Creek system in the Black Warrior River drainage including a singleton and a large population. The population observed in Collier Creek is located over 21 km from the Tennessee River divide, on the divide between the Brushy Creek system and the Sipsey Fork drainage, and is in close proximity to an artificial lake, any of which may be the origin of this population. The presence of a population of *R. obtusus* in the system necessitates further sampling of the headwaters of the Black Warrior River drainage to understand its natural prevalence in the region.

Keywords

Freshwater, Fish, Distribution, New occurrence

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Cover Page Footnote

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INTRODUCTION

The Blacknose daces (Eastern = *Rhinichthys atratulus* and Western = *R. obtusus*) are members of the diverse clade Cyprinidae known as riffle daces that are native to eastern and central North America (Page and Burr 2011). Populations are often found in small headwater streams and spring-fed waters across the Atlantic drainages, the Great Lakes, and the Mississippi River (Page and Burr 2011), with its southernmost distribution reaching the Tennessee and upper Mobile Basin in Alabama (Boschung and Mayden 2004). Although Blacknose daces have an extensive range, these species rarely have become established outside of their presumed natural range. *Rhinichthys atratulus* was stocked in the Willard Bay Reservoir and Utah Lake basins of Utah in 1983 as forage fish (Sigler and Sigler 1987) but was extirpated by 1996 (Sigler and Sigler 1996, Fuller 2015). The only population officially listed as established outside of its native range is in the Yadkin drainage of the upper Pee Dee River in North Carolina (Menhinick 1991). This population has been confirmed through molecular techniques to be *R. obtusus* (Kraczkowski and Chernoff 2014), and is thought to have been the result of stream capture (Jenkins and Burkhead 1994).

The range of *R. obtusus* extends as far south as the Tennessee River and the upper Coosa and Black Warrior Rivers in Alabama and Georgia (Boschung and Mayden 2004, Kraczkowski and Chernoff 2014; Figure 1). In Alabama, populations have been documented in the upper Coosa and Tennessee River systems (Boschung and Mayden 2004). *Rhinichthys obtusus* was hypothesized to be extirpated from the Black Warrior River system based on infrequent and mostly singleton collections (Boschung and Mayden 2004; Table 1), with the most recent singleton collection made in 2001. Here we report on collections of *R. obtusus* made in the William B. Bankhead National Forest during a series of stream surveys from 2015 and 2016, including a singleton collection and one population composed of multiple size classes.

METHODS

Historical Localities

There are over 10,000 records of *Rhinichthys atratulus* on FishNet2 (Accessed through the Fishnet2 Portal, www.fishnet2.org, 2016-03-06). Of the 289 records for the state of Alabama, 220 are georeferenced (Figure 1). Based on the distribution of these specimens and the latest molecular evidence, we recognize the species residing in Alabama as *R. obtusus* (Kraczkowski and Chernoff 2014). Of the 289 records in Alabama, there are three historical localities of *R. obtusus* in the Black Warrior River (Table 1).

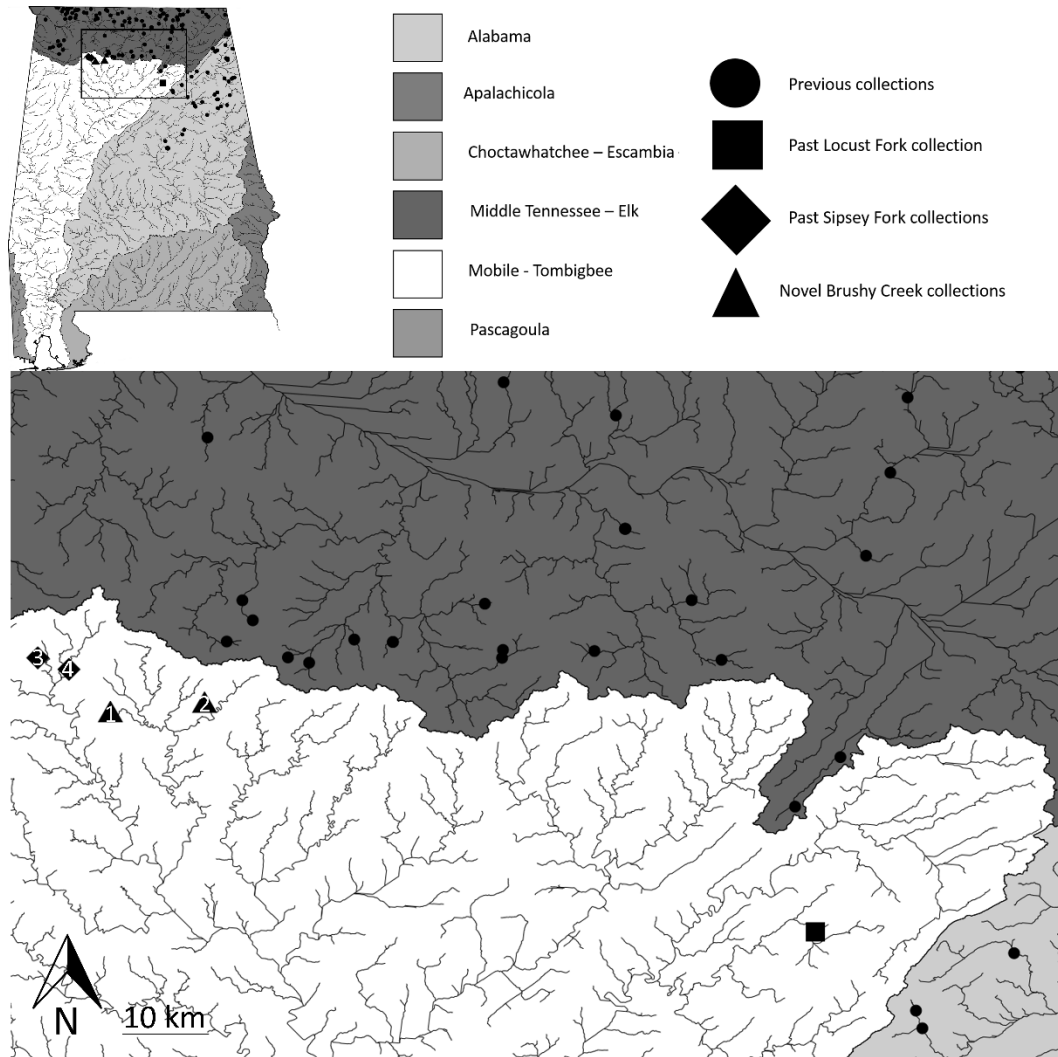


Figure 1. Range of *Rhinichthys obtusus* in Alabama. Numbers indicate as follows: 1) Collier Creek; 2) Tributary of Capsey Creek; 3) Braziel Creek; and 4) Borden Creek.

Observations and Collections

A survey for the Redspot Darter, *Etheostoma artesia*, in the Bankhead National Forest was conducted during summer low-flow conditions in 2015 (August-October) using a Smith Root LR 24 backpack electrofisher and dip nets. During these targeted surveys, *R. obtusus* was observed in two headwater streams: Capsey Creek (single specimen) and Collier Creek (multiple individuals). Due to the surveying protocol and the available resources, no quantitative estimates of the Collier Creek population size were made. However, seven of the largest *R. obtusus* were collected as voucher specimens at this time. A return trip to Collier Creek was

made in March 2016 with the proper equipment for surveying population size and collecting more vouchers.

All voucher specimens of *R. obtusus* were anesthetized with MS-222, then the right pectoral fin was clipped for DNA preservation. All fin clips were immediately stored in 95% ethanol, and the whole body specimens were fixed in 10% formalin and deposited at the Auburn University Natural History Museum (AUM) in Auburn, AL (AUM 66988, AUM 66989, and AUM 67328; Table 1). All fishes captured during the March sampling event were collected as vouchers.

Table 1. Localities of *Rhinichthys obtusus* collected in the Black Warrior River drainage 1939-2016.

Catalog Number	Locality	# of Vouchers	Latitude	Longitude	County	Year
UMMZ 158284	Trib. of Locust Fork, (flowing W) 3 mi NNE of Oneonta, Hwy 32; Black Warrior drainage	1	33.99990	-86.43870	Blount	1939
UAIC 4115.02	Brazier Creek on Northwest Road, ca. 5 mi W of AL Hwy 33	1	34.34420	-87.41611	Lawrence	1971
UAIC 4117.01	Brazier Creek on Northwest Road, ca. 5 mi W of AL Hwy 33	4	34.34420	-87.41611	Lawrence	1972
UAIC 13492.04	Borden Creek at Forest Rd. 229 (Northwest Rd.), 4.8 mi NW of Grayson	1	34.32970	-87.37694	Winston	2001
*AUM 66988	Unnamed tributary of Capsey Creek, 9.3 km NNW of Addison; Bankhead National Forest	1	34.28423	-87.20648	Winston	2015
*AUM 66989	Collier Creek, Bankhead National Forest. AL. N. fork ~500 m E of crossing at CR 63 (Cheatham Rd), ~1.5 km S Grayson.	7	34.27248	-87.32483	Winston	2015
*AUM 67328	Collier Creek, Bankhead National Forest. AL. N. fork ~500 m E of crossing at CR 63 (Cheatham Rd), ~1.5 km S Grayson.	16	34.27248	-87.32483	Winston	2016

*Samples collected in this study

Estimating Population Density and Demographics in Collier Creek

After initial observation of a large population of *R. obtusus* in Collier Creek, a second collection was made specifically to estimate population size and density in the stream (Figure 2). Using two 3.05 m seines, a 50 m stretch of the creek was blocked. To estimate population size, the stretch was sampled to depletion (three passes) by removal method (Zippin 1956, 1958, Lockwood and Schneider 2000) with a Smith-Root electrofisher and dipnets, working in an upstream direction and sweeping from bank to bank in the manner described by Barbour et al. (1999). The shocked area was left undisturbed for 30 minutes between passes. Captured fishes were removed from the stretch and processed after each pass. However, our triple-pass sampling of the 50 m reach collected fewer *R. obtusus* than expected, so we sampled an additional 100 m upstream with a single pass. Due to the small number of *R. obtusus* collected in our 50 m reach we elected to only calculate density per square meter instead of estimating population size, as we originally intended. Density for each species was estimated as the number of individuals from the first pass of the 50 m section plus individuals collected from the 100 m reach divided by the reach length times the average wetted stream width for the 150 m of stream sampled. Average wetted width was determined by 10 equally spaced transects within the 150 m reach.



Figure 2. Sampling reach of Collier Creek, tributary to Brushy Creek in the Black Warrior River drainage, Winston County, Alabama 17 March 2016.

Rhinichthys obtusus has not been studied for length at age; however, size classes are known for *R. atratulus* (Reed and Moulton 1973). We used the length at age relationships of *R. atratulus* as a proxy for *R. obtusus* with mean standard lengths of 29.0 mm, 43.8 mm, 52.9 mm, and 60.0 mm representing the 0, 1, 2, 3 yr age classes respectively (Reed and Moulton 1973). Preserved fish were measured to the nearest 0.1 mm in order to estimate year class of sampled fish.

RESULTS

A total of 24 *R. obtusus* was vouchered from two headwater streams in the Bankhead National Forest in 2015 and 2016 (Figure 1, Table 1). A single specimen from Capsey Creek was captured, collected, and deposited at AUM. In Collier Creek, initial observations noted a large number of *R. obtusus* at the site. The seven largest individuals (>50 mm standard length, SL) were chosen as voucher specimens and were cataloged in the AUM collections (Table 1).

An additional 16 specimens of *R. obtusus* were captured and vouchered from Collier Creek in March 2016 with standard lengths ranging from 35 mm to 63 mm SL (Figure 3). Of these 16 individuals, seven were collected on the first pass in the 50 m reach, one was collected on the second pass, and none were collected during the final pass. An additional eight specimens were collected in the adjacent

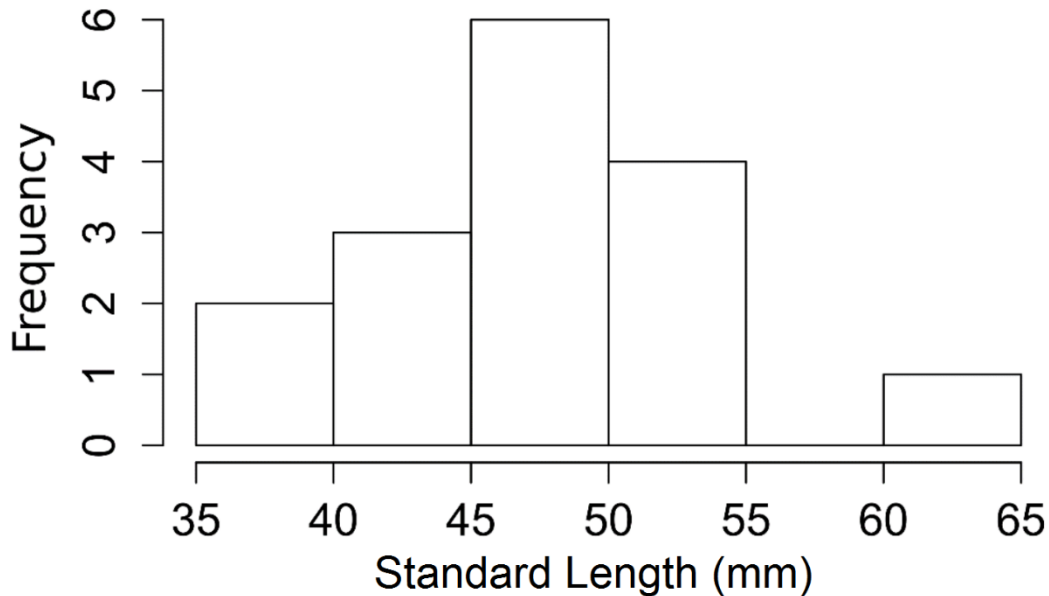


Figure 3. Length frequency histogram of *Rhinichthys obtusus* standard lengths collected from Collier Creek during the March 2016 sampling event.

100 m reach directly upstream of the depleted 50 m section. The average wetted width of Collier Creek over the 150 m reach was 3.0 m. A total of seven *E. artesia* and 102 *S. atromaculatus* were also collected from this 150 m of stream and were deposited in the AUM fish collection. The estimated density of *R. obtusus* at Collier Creek on 17 March 2016 was 0.03 fish/m². This density was higher than that of *E. artesia* (0.01 fish/m²) and less than the density of *S. atromaculatus* (0.19 fish/m²).

DISCUSSION

During a survey for *E. artesia* in the Bankhead National Forest in October 2015, a population of *R. obtusus* was observed in Collier Creek. A total of seven voucher specimens was taken at the time due to limited supplies, and was not a quantitative representation of the observed population. In March 2016, a triple-pass depletion survey was performed at Collier Creek, confirming their persistence and providing an estimation of population density in the creek. In March 2016, despite sampling during a period of high flow after heavy rains, the number and density of *R. obtusus* in the stream were greater than any number previously reported in the region (Table 1).

Using the length at age relationships of *R. atratulus* as a proxy for *R. obtusus*, we report multiple year classes present in Collier Creek. The individuals sampled varied in size from 35 mm to 67 mm SL, which would suggest the presence of at least 1-3yr old fish based on the length at age data available for the closely related *R. atratulus* (Reed and Moulton 1973). However, length at age relationships should be validated for *R. obtusus* given the potential for species specific relationships. Furthermore, growth rates may be altered due to differences in climate and growing seasons between Massachusetts and Iowa where these relationships were derived for *R. atratulus* and northern Alabama where this population of *R. obtusus* occurs. The presence of *R. obtusus* in the low flows of October and its persistence through the high flows of the winter into March suggest the species is established in Collier Creek of the Bankhead National Forest. Although this is not the first report of *R. obtusus* in the headwaters of the Black Warrior River (Dycus and Howell 1974, Boschung and Mayden 2004; Table 1), it is the first report of a persistent population in the Brushy Creek system and the first collection of multiple specimens in the region since 1972.

The upper Black Warrior basin contains multiple species (*Chrosomus erythrogaster*, *Etheostoma sp. cf. zonistium*, and *Rhinichthys obtusus*) outside of their presumed range, all of which have only been reported from the Sipsey Fork. The area has been characterized as karstic (Veni 2002) with recent stream capture events (Dycus and Howell 1974, Boschung and Mayden 2004) and hypothesized

subterranean connections with the Tennessee River basin (Ray et al. 2014). Our two most recent collections of *R. obtusus* from the upper Black Warrior River drainage were in the Brushy Creek branch, east of the historical collections in the Sipsey Fork. To our knowledge, no stream capture events nor subterranean connections have been documented in the Brushy Creek branch. The Collier Creek population of *R. obtusus* and the individual from the tributary of Capsey Creek could either represent a relict population, immigrants from a subterranean connection similar to those in the Sipsey Fork, or a bait bucket transfer given the close proximity (~1.34 km network distance) of the small impoundment (~0.042 km²) called Grayson Lake. Genetic studies and more intensive sampling in the region are needed to determine source population(s) and phylogeography of this species in the region. Further sampling throughout the Black Warrior headwaters is also needed to determine the prevalence of *R. obtusus* in headwater streams of this system.

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