

EVIDENCE OF RAINBOW TROUT SPAWNING IN SMALL, WARMWATER TRIBUTARIES OF THE CHATTAHOOCHEE RIVER, GEORGIA

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Abstract. We conducted electrofishing surveys for adult and juvenile rainbow trout *Oncorhynchus mykiss* in small (first- and second-order), warmwater tributaries of the Chattahoochee River, below Morgan Falls Dam, during winter 2004 and 2005 to document spawning. In 2004, we documented pre-spawning males and females in both streams surveyed. In 2005 and 2006, we found juveniles in two of five streams surveyed and pre-spawning adults in three of the five. This is the first documented instance of spawning by rainbow trout in this section of the river and an unusual occurrence in warmwater tributaries. The total contribution of recruitment from these systems to the rainbow trout population in the Chattahoochee River should be evaluated.

INTRODUCTION

The use of small (first- and second-order) tributaries by rainbow trout *Oncorhynchus mykiss* for reproduction is relatively unstudied, yet potentially very important phenomenon in river systems (Raleigh et al., 1984). For example, Erman and Hawthorne (1976) found that 39-47% of adult rainbow trout that resided in Segehen Creek spawned in an intermittent tributary (Kiln Meadow Tributary), while only 10-15% spawned in perennial streams.

The Chattahoochee River near Atlanta, Georgia is one of the southernmost tailwater trout fisheries in the United States, created after Buford Dam was constructed in 1957. Tailwater trout fisheries such as the Chattahoochee River usually lack sufficient spawning habitat for trout so they are heavily stocked to maintain the fishery. In these fisheries, trout are restricted to these thermally altered habitats and thought to be limited in their dispersal to other areas, particularly tributaries, which are too warm. However, successful reproduction by rainbow trout has been documented in the upper section of the Chattahoochee River, between Buford Dam and Morgan Falls Dam (C. Martin, Georgia Department of Natural Resources [GA DNR], unpublished data), but not in the

lower section below Morgan Falls Dam. Recently, GA DNR and National Park Service (NPS) biologists have collected juvenile trout in the lower section, suggesting either reproduction in this section or immigration from the upper section. Moreover, in December 2004, an NPS biologist found adult trout in spawning condition in Trout Lily Creek, a first-order warmwater tributary in the lower section of the river (D. Lairson, NPS, unpublished data), suggesting that trout reproduction in the lower section of the Chattahoochee River may be occurring in tributaries. Our objective was to document the utility of several, small warmwater tributaries in the lower portion of the Chattahoochee River tailwater for spawning by rainbow trout.

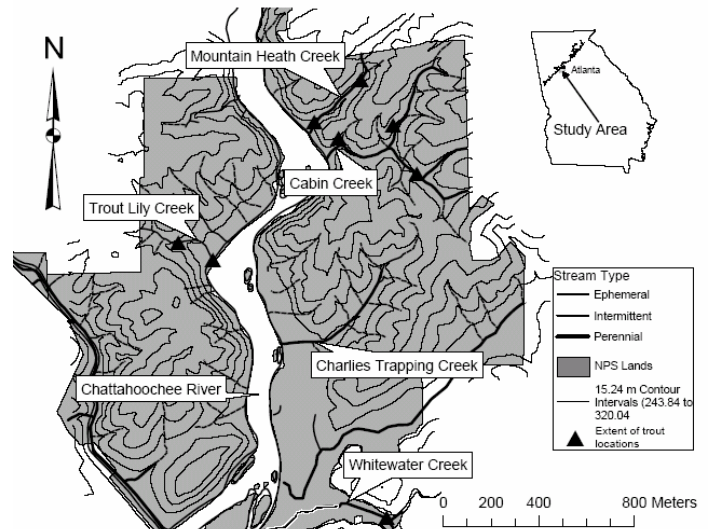


Figure 1. Map depicting the location of tributaries of the Chattahoochee River, Georgia where reproduction by stocked rainbow trout, *Oncorhynchus mykiss*, was assessed.

METHODS

During the winters of 2004 and 2005, we used backpack electrofishing equipment to survey for trout in spawning condition in five first- and second-order streams; two streams were surveyed in 2004 (Trout Lily Creek and Cabin Creek) and five in 2005 (Trout Lily Creek, Mountain Heath Creek, Cabin Creek, Charlies Trapping Creek, and Whitewater Creek) (Table 1; Figure 1). All streams were located within lands owned by the National Park Service (NPS) at Chattahoochee River National Recreation Area (CRNRA) in Atlanta, Georgia, within the Piedmont geologic province. The watersheds of these streams contain mature stands of moderate to old-growth forests and terminate at the Chattahoochee River approximately 11 km below Morgan Falls Dam.

We electrofished upstream from the stream mouth until we reached locations with insufficient cover and water depth for trout occupation. We measured total length (TL, mm) of all trout captured. Adult pre-spawning trout were examined for sex and spawning

condition by squeezing the abdomen toward the vent. Stream locations that contained trout were identified with a global positioning systems (GPS) receiver and mapped with geographic information systems (GIS) software.

RESULTS

A total of 46 rainbow trout were collected from Trout Lily Creek, Mountain Heath Creek, Cabin Creek, and Whitewater Creek during the winters of 2004 and 2005 (Table 1). Fish were collected mostly from pools less than 0.2 m in depth, up to 30 m in elevation above the Chattahoochee River and up to 600 m from the tributary mouth (Figure 1). In 2004, all trout observed were adults (mean TL = 267.19 mm) and 62.5% were ripe (i.e., spawning condition with milt or roe). Fourteen trout were males, nine of which released milt when squeezed, and two trout were females, one of which expelled viable eggs when squeezed. Only one female was found in each stream in 2004, resulting in skewed sex ratios (1:11 in

Table 1. Size, sex, and spawning condition of rainbow trout, *Oncorhynchus mykiss*, captured in small, warmwater tributaries of the Chattahoochee River, Georgia. No. = number, TL = total length (mm), SD = standard deviation, NA = not applicable, roe = eggs were released after squeezing the fish, milt = milt was released after squeezing the fish, and pre-spawn = nothing was released after squeezing the fish.

| Date | No. | Mean TL (SD) | Sex | Spawning condition |
|--------------------------------|-----|----------------|----------|--------------------|
| <u>Trout Lily Creek</u> | | | | |
| 12/21/2004 | 1 | 253.00 (NA) | Female | Roe |
| 12/21/2004 | 4 | 275.00 (12.11) | Male | Pre-spawn |
| 12/21/2004 | 7 | 268.57 (29.42) | Male | Milt |
| 12/6/2005 | 0 | NA | NA | NA |
| 2/17/2006 | 0 | NA | NA | NA |
| <u>Cabin Creek</u> | | | | |
| 12/21/2004 | 1 | 269.00 (NA) | Female | Pre-spawn |
| 12/21/2004 | 1 | 265.00 (NA) | Male | Pre-spawn |
| 12/21/2004 | 2 | 254.00 (26.87) | Male | Milt |
| 12/6/2005 | 9 | 85.56 (20.79) | Juvenile | NA |
| 1/6/2006 | 6 | 98.00 (26.85) | Juvenile | NA |
| 2/15/2006 | 4 | 102.75 (40.11) | Juvenile | NA |
| 2/15/2006 | 6 | 250.17 (27.64) | Male | Milt |
| 2/15/2006 | 1 | 200 (NA) | Male | Pre-spawn |
| <u>Mountain Heath Creek</u> | | | | |
| 12/21/2004 | 0 | NA | NA | NA |
| 12/6/2005 | 1 | 305 (NA) | Female | Pre-spawn |
| 2/15/2006 | 1 | 76 (NA) | Juvenile | NA |
| 2/15/2006 | 1 | 262 (NA) | Male | Milt |
| <u>Whitewater Creek</u> | | | | |
| 2/15/2006 | 1 | 280 (NA) | Male | Milt |
| <u>Charlies Trapping Creek</u> | | | | |
| 2/15/2006 | 0 | NA | NA | NA |

Trout Lily and 1:3 in Cabin Creek).

In the winter of 2005 (12/6/2005 – 2/17/2006), the majority of all trout (86.67%), most of which were juveniles (66.67%), were found mostly in Cabin Creek (Table 1; Figure 2). No trout were observed in Trout Lily Creek or Charlies Trapping Creek. One adult female was found in Mountain Heath Creek on 12/6/2005, whereas the remaining adults found were male and not observed until February, 2006. Sex ratios, thus, were heavily skewed toward males during any single sampling event. From 50% to 100% of all adults found in these streams were ripe (i.e., spawning condition with milt or roe).

The progression of pre-spawning and spawning adults and growth of juvenile trout was best observed in Cabin Creek (Table 1; Figure 2). The mean size of juveniles from 12/6/2006 through 2/15/2006 increased steadily, at a rate of 0.24 mm/day, from 85.56 mm TL to 102.75 mm TL. No adults were found during this time period until pre-spawning and spawning condition males were observed on 2/15/2006.

DISCUSSION

Successful reproduction appears to be stream-dependent. Based on our data, it appears that rainbow trout successfully reproduced in Cabin Creek, and in Mountain Heath Creek to a lesser degree, during the

2004/2005 spawning season and that those fry survived the subsequent summer.

The trout in Trout Lily Creek apparently were not successful at reproducing because we failed to find any juvenile trout in winter 2005. Alternatively, any juveniles produced could have emigrated out of the stream before sampling in December 2005. In a Lake Michigan tributary, juvenile rainbow trout emigrated downstream between May and June (Stauffer, 1972) and in Kiln Meadow Tributary, an intermittent stream in California, rainbow trout fry demonstrated downstream movement from natal areas in mid-July during periods of heavy precipitation (Erman and Leidy, 1975), suggesting emigration as a plausible hypothesis. However, the presence of juveniles in Cabin Creek and Mountain Heath Creek during the same time also makes it likely that the adult fish in Trout Lily Creek failed to spawn or the juveniles failed to recruit. Of significance is that a new large condominium development was occurring upstream of Trout Lily Creek during the survey and was impacting the hydrology of the stream, which could have affected the reproductive success of the trout in this stream.

The urbanization of Atlanta, which results in deforested watersheds, altered hydrology, and the delivery of fine sediments to these small tributaries (ARC, 2004), has the ability to negatively affect the reproductive capacity of these small streams for trout. Research conducted in north Georgia trout streams found that

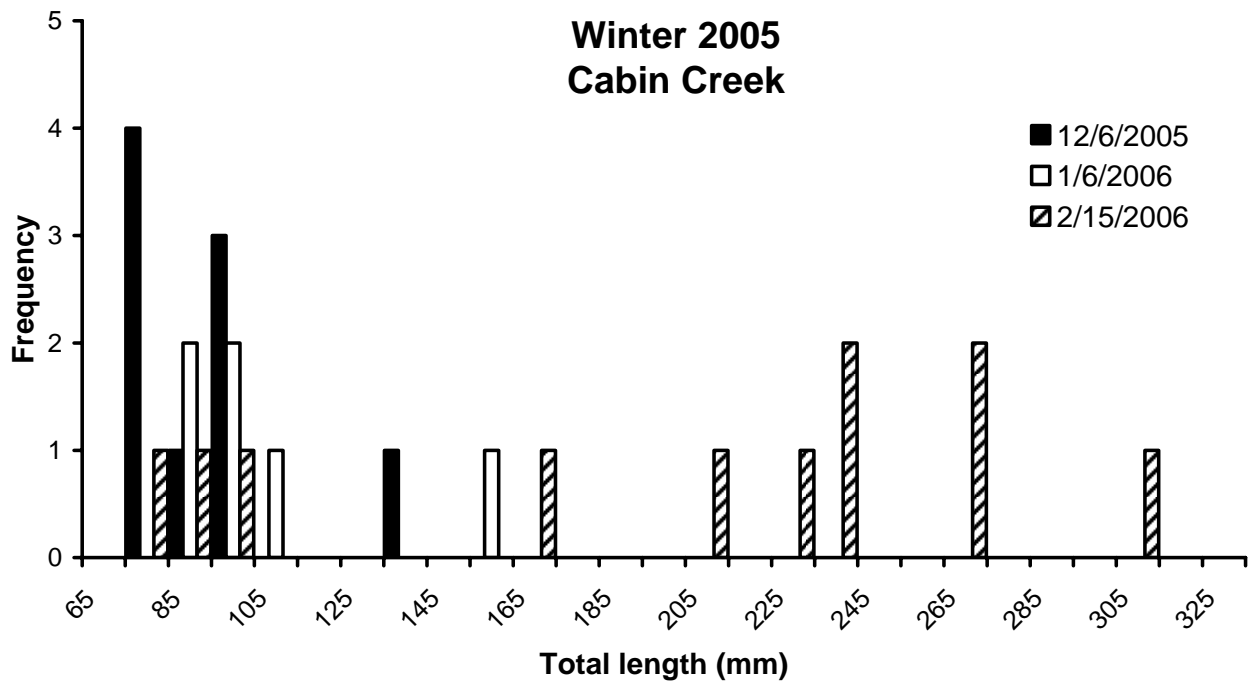


Figure 2. Length-frequency histogram of juvenile and adult rainbow trout, *Oncorhynchus mykiss*, observed in the winter of 2005 in Cabin Creek, a tributary of the Chattahoochee River, Georgia.

summer water temperatures and sediment size, as influenced largely by forested canopy cover, affected trout reproduction (Meyer et al., 2005). Streams that are protected from urban development, such as these within NPS lands, may be particularly used by trout for reproduction because they still have high canopy coverage and a more natural hydroperiod based on groundwater input (Curry et al., 1997) to reduce high summer instream temperatures lethal for juvenile trout.

Further study is necessary to document the extent that rainbow trout utilize small tributaries of the Chattahoochee River for spawning. Moreover, additional studies are needed to document if reproduction in these small tributaries contributes to the river population. Many more small tributaries such as the ones we studied exist throughout the 77 km tailwater corridor and their cumulative effect could be large. However, rainbow trout have been shown to have affinity for a relatively select number of tributaries (Erman and Leidy, 1975; Erman and Hawthorne, 1976) as is apparently the case for Cabin Creek in this section of the river. We recommend further study of the Cabin Creek population of rainbow trout and a thorough search of additional tributaries of the Chattahoochee River that are utilized by trout for spawning.

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LITERATURE CITED

- Atlanta Regional Commission (ARC). 2004. Regional development plan technical report, Atlanta. (Accessed February 8, 2007 at: http://www.atlantaregional.com/cps/rde/xchg/SID-3FS7EE7-574EF83E/arc/hs.xsl/317_ENU_HTML.htm.)
- Curry, R. A., C. Brady, Noakes, D. L. G., and R. G. Danzmann, 1997. Use of small streams by young brook trout spawned in a lake. *Transactions of the American Fisheries Society* 126:77-83.
- Erman, D. C. and G. R. Leidy, 1975. Downstream movement of rainbow trout fry in a tributary of Sagehen Creek, under permanent and intermittent

flow. *Transactions of the American Fisheries Society* 104:467-473.

Erman, D. C. and V. M. Hawthorne, 1976. The quantitative importance of an intermittent stream in the spawning of rainbow trout. *Transactions of the American Fisheries Society* 105:675-681.

Meyer, J. L., K. L. Jones, G. C. Poole, C. R. Jackson, J. E. Kundell, B. L. Rivenbark, E. L. Kramer, and W. Bumback. 2005. Implications of changes in riparian buffer protection for Georgia's trout streams. Final Report, Institute of Ecology, University of Georgia, Athens.

Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: rainbow trout. US Fish and Wildlife Service FWS/OBS-82/10.60. 64 pp.

Stauffer, T. M., 1972. Age, growth, and downstream migration of juvenile rainbow trout in a Lake Michigan tributary. *Transactions of the American Fisheries Society* 101:18-28.