# The Effect of Fishing Regulation Changes on Fish Populations in Overflow Creek, North Carolina


**Southern Research Station**
**Coldwater Fisheries Research Unit**
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United States Department of Agriculture Forest Service
**Southern Research Station - Coldwater Fisheries Unit**

C. Andrew Dolloff
Unit Leader

Prepared by

United States Department of Agriculture Forest Service
**Center for Aquatic Technology Transfer**

Kevin N. Leftwich
Lead Fisheries Biologist
and
Martin K. Underwood
Fisheries Biologist

Department of Fisheries and Wildlife
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061-0321

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## Background

Between Spring 1989 and Fall 1993 we inventoried stream habitat and fish populations in the Chattooga River basin in Georgia and North Carolina. Since 1989 the fishing regulations in the North Carolina portion of the Overflow Creek sub-basin have changed from allowing fishing with bait (prior to 1992) to single-hook-artificial-lures-only (1992), to fishing with 'natural' bait (1993 - present).

In 1996 we resurveyed the North Carolina portion of the Overflow Creek sub-basin to determine if the change of fishing regulations has resulted in detectable changes in trout populations. Here we report trends of density and length frequency for trout in three streams in North Carolina for the Pisgah National Forest and the North Carolina Wildlife Resources Commission. These streams are 1) Overflow Creek, 2) East Fork Overflow Creek, and 3) West Fork Overflow Creek. This project was a cooperative effort between the North Carolina Wildlife Resources Commission (NCWRC), USFS Coldwater Fisheries Research Unit, Pisgah National Forest, and USFS Center for Aquatic Technology Transfer.

## Methods

*Note* - Sampling protocol used in the original survey (Dolloff et al. 1993) was modified during this survey due to unfavorable weather conditions and inter-agency scheduling conflicts. The most notable changes are 1) underwater and electrofishing surveys were not paired to estimate total fish abundance as outlined by Hankin and Reeves (1988) and 2) habitat units, although chosen systematically, were limited to stream segments which were shorter than the original sampled stream-segment.

*Underwater Surveys* - Underwater surveys started at stream confluences and progressed upstream to the end of the respective segment. The Overflow Creek survey began at the North Carolina  Georgia stateline and ended at the confluence of West Fork Overflow Creek and Abes Creek. The survey of West Fork Overflow Creek began at its confluence with Overflow Creek and ended when survey crews determined the stream to be intermittent. East Fork Overflow Creek was not surveyed using underwater observation because of adverse weather conditions at the time of sampling.

Trout abundance was determined by underwater observations made in systematically selected habitat units (pools and riffles). When a sampling-unit was encountered, two observers, using face masks and snorkels, started at the downstream end and proceeded slowly upstream to the head of the unit while searching for fish.

Relative abundance of all salmonids was estimated as the number of fish counted by divers divided by the area of the habitat unit sampled and was expressed in number of fish per 100 $m^2$. We used Kruskal-Wallis one-way-analysis of variance on ranks (Dunn's method) to determine if the relative density of salmonids differed significantly ($P < 0.05$) between years.

*Electrofishing Survey* - Electrofishing surveys began 1) about 200 m below the East Fork Overflow Creek confluence on **Overflow Creek,** 2) about 200 m below the Forest Service Road 79-C crossing on **East Fork Overflow Creek,** and 3) at the confluence of Abes Creek on **West Fork Overflow Creek.** From the starting point for each stream, we traveled upstream and systematically sampled every third pool and riffle.

Electrofishing surveys were conducted using two AC backpack electrofishing

units and three-pass depletion techniques (Zippin 1958); all fish captured were identified, weighed (g), and measured (mm). We used Kruskal-Wallis one-way-analysis of variance on ranks (Dunn's method) to determine if the total length of salmonids differed significantly ($P < 0.05$) between years. We also used the Kolmogorov - Smirnov test to investigate possible significant differences ($P < 0.05$) between distributions of species total-length among sampling years. Salmonids less than 96 mm total-length were not used in the analyses.

## Results

Mean relative densities of all trout species based on diver counts, in both Overflow Creek and West Fork Overflow Creek varied between years (Table 1; Figure l) but were not statistically different. Observations made in the 1990 Overflow Creek survey were not included in these analyses because of the low number of units sampled (n = 6).

Rainbow trout were the predominant species captured in Overflow Creek and West Fork Overflow Creek in all years sampled. Although brook trout dominated captures in East Fork Overflow Creek in 1990, 1991, and 1992, we captured more brown trout in the 1996 sample (Table 2).

Overall, sample sizes were too small to allow valid statistical analyses of the number of trout captured during the electrofishing surveys (Table 2). Statistical analyses were performed on two data sets: rainbow trout in Overflow Creek 1990, 1991, and 1996 and in West Fork Overflow Creek 1991, 1992, and 1996. In general, there was no significant evidence that the mean total length or the distributions of total

length differed between years (Figure 2). The only significant differences observed were 1) the mean total length between 1990 and 1991 in Overflow Creek, 2) the mean total length between 1992 and 1990-91 in East Fork Overflow Creek (total lengths for brook trout captured in 1996 were not included in these analyses because of the low number of brook trout captured; n = 4), and 3) the distributions of total length between 1991 and 1992 in West Fork Overflow Creek (Figure 2).

## Discussion

Our results provide no evidence that the change of fishing regulations in the Overflow Creek sub-basin has resulted in changes in trout populations or lengths. These results were not unexpected because the short duration (one year) of the single-hook-artificial lures-only regulation. Nevertheless, data were not collected in this drainage between spring 1993 and summer 1996 and detectable changes may have been missed.

We observed a change in electrofishing catches in East Fork Overflow Creek from predominately brook trout in our original survey to mostly brown trout in 1996. Although it is possible that the changes in the regulations favored the survival of brown trout, this interpretation of the data should be viewed with caution because of possible sampling error. For example, the upper portion of East Fork Overflow Creek was not sampled in 1996, and the upper portion of the stream was more intensively sampled in 1996 than any other years in our study. Thus the greater proportion of brown trout in the 1996 sample may be the result of species-specific requirements, such as water temperature, competition, or predation, which were not detected in the earlier surveys.

Sampling design may also have affected our results. The objectives and the scale of these studies changed between the original survey and the 1996 survey. The objectives for the original survey required the data to be collected at a much larger scale than the 1996 survey: the West Fork Chattooga River basin verses the upper Overflow Creek sub-basin, respectively. Habitat-units were selected systematically from a 'pool' of all habitat-units in the Overflow Creek sub basin beginning at the confluence of Holcomb and Big Creek in Rabun County, Georgia. Therefore a smaller number of habitat units were often selected in the upper portion of the drainage than may be necessary to detect significant changes in species populations in this sub-section of the original survey. This problem was exacerbated during some years of reduced sampling intensity in the sub-basin.

Although the data are incomplete for some species and years, analyses of appropriate data-sets revealed no significant differences in the salmonid populations between 1996 and pre- 1993 in the upper Overflow Creek sub-basin. Monitoring in the years immediately following the regulation changes, however, may have improved our ability to detect possible changes in the fish populations. Finally, unmeasured variables, such as changes in physical habitat, fishing pressure, etc. make inferences about regulations in the Overflow Creek sub-basin equivocal.

## Literature Cited

Dolloff, C. A., D. G. Hankin, and G. H. Reeves. 1993. Basinwide estimation of habitat and fish populations in streams. General Technical Report SE-83. Asheville, North Carolina: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experimental Station. 25 pp.

Hankin, D. G. and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences. 45: 834-844.

Zippin, C. 1959. The removal method of population estimation. Journal of Wildlife Management. 22 82-90.

Table 1. Estimations of mean relative density (number of trout per 100 $m^2$) in Overflow Creek and West Fork Overflow Creek by sampling year. Asterisks indicate no individuals observed.

| Species | Year | Habitat-units Sampled | Mean | Standard Deviation | Maximum | Minimum |
|---|---|---|---|---|---|---|
| | | | **Overflow Creek** | | | |
| **Rainbow Trout** | 1990 | 6 | 2.1 | 1.2 | 3.2 | 0.0 |
| | 1991 | 25 | 1.3 | 1.8 | 7.7 | 0.0 |
| | 1992 | 26 | 1.7 | 1.4 | 4.8 | 0.0 |
| | 1996 | 22 | 1.9 | 1.7 | 5.9 | 0.0 |
| **Brook Trout** | 1990 | 6 | 0.5 | 0.9 | 2.5 | 0.0 |
| | 1991 | 25 | * | * | * | * |
| | 1992 | 26 | 0.03 | 0.1 | 0.5 | 0.0 |
| | 1996 | 22 | 0.3 | 0.9 | 3.5 | 0.0 |
| **Brown Trout** | 1990 | 6 | * | * | * | * |
| | 1991 | 25 | 0.4 | 0.2 | 0.9 | 0.0 |
| | 1992 | 26 | 0.03 | 0.2 | 0.8 | 0.0 |
| | 1996 | 22 | 0.02 | 0.1 | 0.5 | 0.0 |
| | | | **West Fork Overflow Creek** | | | |
| **Rainbow Trout** | 1990 | 42 | 0.8 | 2.2 | 11.3 | 0.0 |
| | 1991 | 34 | 2.1 | 3.4 | 12.9 | 0.0 |
| | 1992 | 36 | 0.4 | 0.9 | 4.0 | 0.0 |
| | 1996 | 35 | 2.2 | 4.8 | 25.0 | 0.0 |
| **Brook Trout** | 1990 | 42 | 0.3 | 1.1 | 6.0 | 0.0 |
| | 1991 | 34 | 0.03 | 0.2 | 1.1 | 0.0 |
| | 1992 | 36 | 0.2 | 0.6 | 2.8 | 0.0 |
| | 1996 | 35 | 0.6 | 2.4 | 13.3 | 0.0 |
| **Brown Trout** | 1990 | 42 | 0.01 | 0.08 | 0.5 | 0.0 |
| | 1991 | 34 | 0.04 | 0.2 | 1.4 | 0.0 |
| | 1992 | 36 | 0.02 | 0.1 | 0.7 | 0.0 |
| | 1996 | 35 | * | * | * | * |

Table 2. Mean length (mm) of all trout captured during electrofishing surveys of Overflow Creek, East fork Overflow Creek, and West Fork Overflow Creek by year. NA = Not Applicable.

| Species | Year | n | Mean Length | Standard Deviation | Maximum | Minimum |
|---|---|---|---|---|---|---|
| | | | **Overflow Creek** | | | |
| **Rainbow Trout** | 1991 | 20 | 153.6 | 34.4 | 238 | 103 |
| | 1992 | 17 | 163.1 | 46.5 | 242 | 95 |
| | 1996 | 12 | 158.8 | 25.7 | 220 | 130 |
| **Brown Trout** | 1991 | 0 | NA | NA | NA | NA |
| | 1992 | 2 | 121.0 | 8.5 | 127 | 115 |
| | 1996 | 1 | NA | NA | 171 | 171 |
| | | | **East Fork Overflow Creek** | | | |
| **Brook Trout** | 1990 | 25 | 120 | 36.5 | 189 | 66 |
| | 1991 | 15 | 124.6 | 34.8 | 203 | 85 |
| | 1992 | 24 | 150.1 | 35.9 | 212 | 76 |
| | 1996 | 4 | 110.8 | 20.9 | 139 | 93 |
| **Brown Trout** | 1990 | 1 | NA | NA | 125 | 125 |
| | 1991 | 1 | NA | NA | 121 | 121 |
| | 1992 | 3 | 203.3 | 76.9 | 255 | 115 |
| | 1996 | 19 | 192.2 | 73.3 | 396 | 140 |
| | | | **West Fork Overflow Creek** | | | |
| **Rainbow Trout** | 1991 | 20 | 153.6 | 34.4 | 238 | 103 |
| | 1992 | 17 | 163.1 | 46.5 | 242 | 95 |
| | 1996 | 12 | 158.8 | 25.7 | 220 | 130 |
| **Brown Trout** | 1991 | 0 | NA | NA | NA | NA |
| | 1992 | 2 | 121 | 8.4 | 127 | 115 |
| | 1996 | 1 | NA | NA | 171 | 171 |

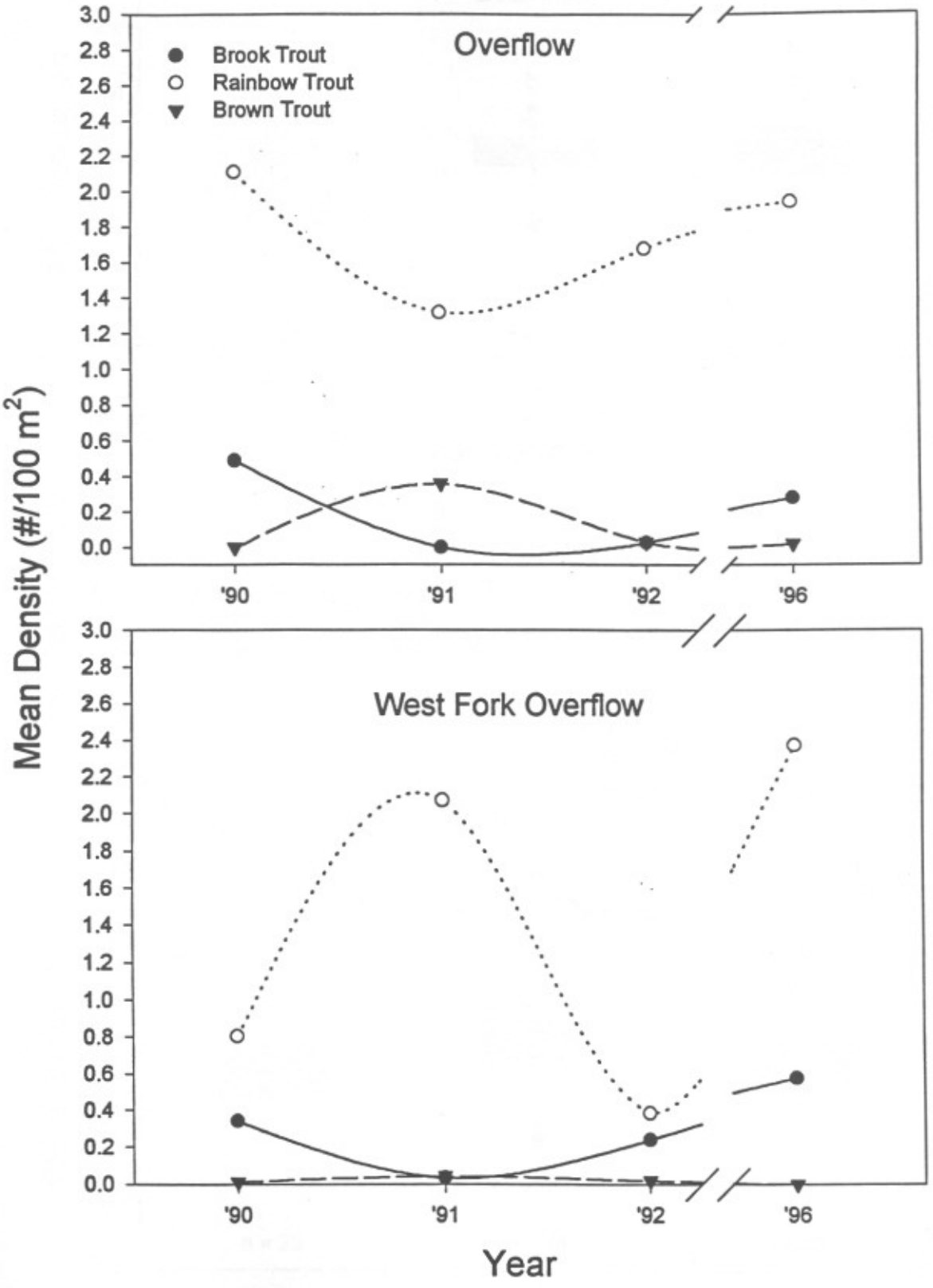


Figure 1. Changes of relative mean densities (number per 100 $m^2$) of trout over time in Overflow Creek and West Fork Overflow Creek. Note the breaks in the x - Axes.

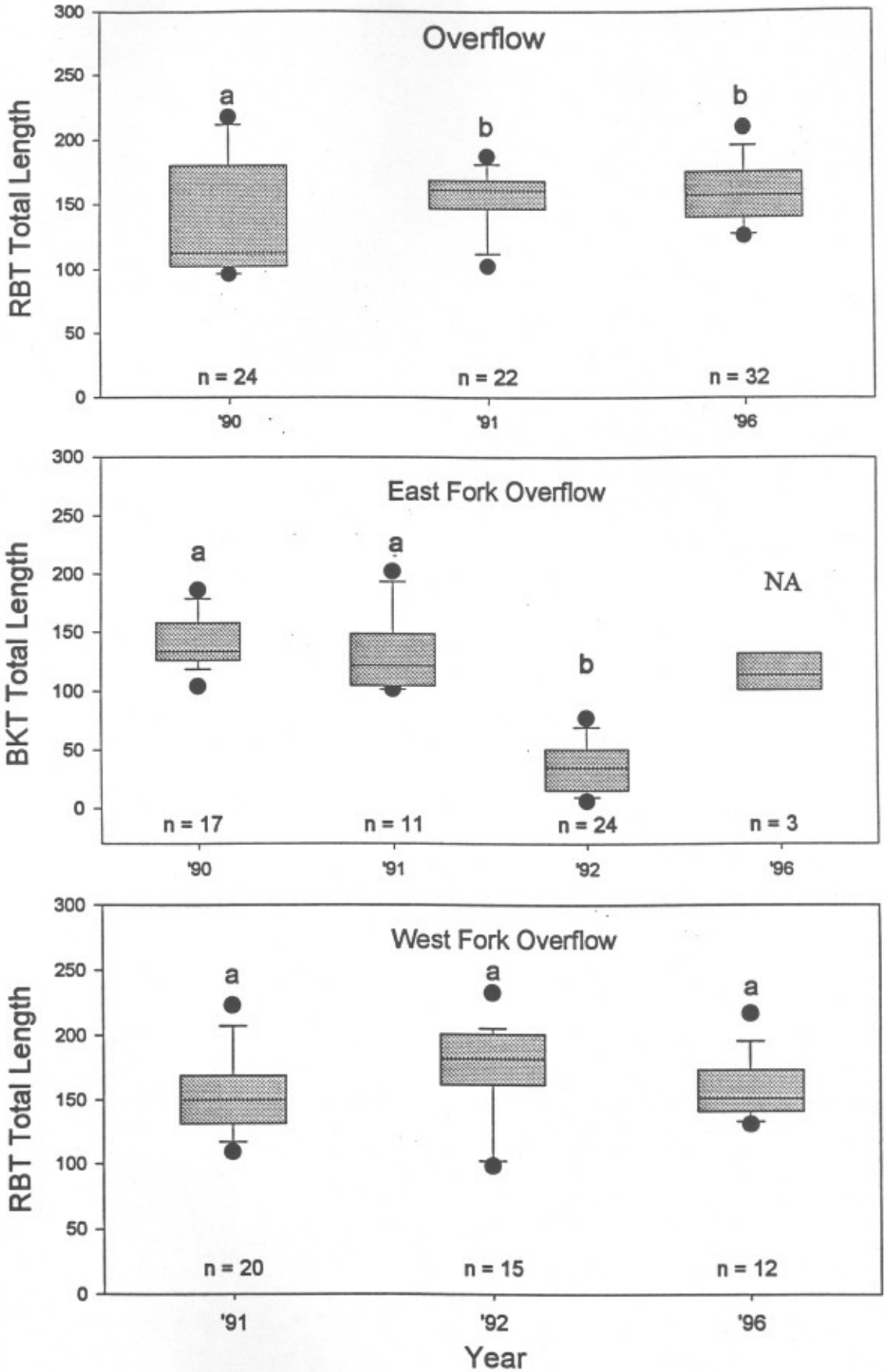


Figure 2. Box plots of total length (mm) of trout (TL ≥ 95 mm) captured in Overflow Creek drainage of North Carolina by year. The box encloses the middle 50% of the observations, the capped lines below and above the box represents the 10% and the 90% quantiles, respectively, the solid line in the box represents the median, and the dot represents outliers. Sample sizes are denoted by n. Box plots with the same letters are not significantly different. NA = not applicable.