

**Report on the research findings of the Cheoah River Restoration Project to the Cheoah
Fund Board during May – June 2009.**

**Ryan A. McManamay
Oct 2, 2009**

Description of Purpose and Objectives:

The purpose of the research was to provide information on several aspects of future management including the influence of restoration measures (flow releases and gravel addition) on the habitat and the biologic response of fish and macroinvertebrates. Because the Cheoah River is impounded, it suffers from low flow variability and limited sediment supply. Under the relicensing agreement, Alcoa Power was required to release scheduled high flow events and maintain seasonally-variable base flows to enhance biotic diversity in the lower river reaches. Also, Alcoa was also required to add gravel to lower river reaches to enhance mussel beds and enhance fish spawning habitat. Part of the management strategy to increase river diversity is to propagate and reintroduce endemic fish species and mussels. As a part of the management strategy, wounded darters were reintroduced into the Cheoah River by USFWS in August 2008.

The main purpose of the reasearch was to provide information concerning the impact of flow restoration and gravel addition on fish and macroinvertebrate diversity. Also our findings should help in developing recommendations concerning the amount and location of future gravel addition, whether future reintroductions of wounded darters should occur, and whether suitable habitat exists for various endemic species reintroductions.

The following is a list of the objectives of the research and a summary including their execution and the outcomes:

Objectives and Possible Solutions:

1) Determine the influence of flow releases on the presence and habitat use of fish

During late June and July 2009, we assessed fish species presence and habitat use by snorkeling 39 different habitats within the Cheoah River. We repeated the snorkel surveys a total of three times to assess how well we could detect fish presence. Of those 39 habitats, 16 riffle habitats were electrofished to ensure that we had adequately sampled for darter species. This data along with historical records of fish presence/absence will be used to compare to the change in flow along the river. Once comparisons of the fish data and flow indices are made and the positive or negative outcomes are isolated, recommendations of changes in the flow regime can be provided.

2) Monitor the presence and habitat use of reintroduced wounded darters

We overlapped our snorkeling assessments in the locations where wounded darters, *Etheostoma vulneratum*, were reintroduced. We did not find any wounded darters, however, we did observe greenfin darters, *Etheostoma chlorbranchium*, a close relative to the wounded darter. This indicates that habitat is at least available for some darter species. Our lack of observing wounded darters may have been due to not assessing the correct habitat or the population may not have become established. Repeat surveys of the same areas and different habitats will be necessary to determine whether the population is established and viable.

3) Measure gravel movement over a range of flows to determine what flows releases are required for gravel additions in 2010

In February of 2008, gravel was dumped at four locations in the Cheoah River. In June, we visited each location to observe the dispersion of gravel particles in the channel to determine if transport of gravel had occurred during the given flow for that time period. Gravel migration was mapped out 3 times prior to this occasion in order to determine the relationship between gravel migration and flow magnitude. The USFWS

and other agencies, will use this information to determine what flow magnitudes must be released from the dam in order move gravel from the pile into the channel to enhance the stream bed.

4) Conduct channel surveys on multiple reaches to determine areas that are appropriate for gravel additions in 2010.

Based on our findings of gravel movement at the previous dump locations, we drove the entire length of the Cheoah River to look for adequate future gravel-addition locations. We noted the slope of the stream bed and the slope of the bank that would influence gravel migration into the stream. We also noted areas with dense bank vegetation that would hinder gravel addition and noted areas that were gravel depleted. We also categorized areas that differ in how gravel addition may influence habitat formation (eg, bar formation vs. high gravel dispersal). We came up with several areas that would be appropriate for future addition in the spring of 2010.

5) Evaluate the diversity of macroinvertebrates (including mussels) in areas where gravel has been added

We sampled gravel habitats with a square-frame kicknet to collect macroinvertebrates from areas that had been 'enhanced' by gravel addition and in 'non-enhanced' areas. We are currently looking at the data to determine any differences in diversity between areas that have or have not been enhanced by gravel.

6) Determine if and where fish are utilizing gravel deposits for spawning

We only observed fish spawning activity at one out of the four gravel sites. In May, we observed 10 river chub, *Nocomis micropogon*, nests that had incorporated the newly added gravel in their mounds. River chubs move gravel particles with their mouth and construct mounds upon which they spawn. Apparently, the gravel addition provided smaller substrate beneficial to the construction of nests.

7) Determine the habitat use of river chub nests and the influence of flow on nest stability

We measured habitat use on 80 river chub nests in a variety of different habitats. Because river chubs carry particles to build their nest, they can choose specifically areas that are protected from high flows but yet allow sufficient aeration of eggs. We found that river chubs build in all habitats except steep riffle and run habitats with strong flows. They chose locations very close to the bank or islands in the channel. We re-surveyed the width and height of 30 nests before and after a high flow event to determine if high flows comprised nest stability. Interestingly, we found that some river chub nests were influenced by the flow while others were not.

8) Develop associations between the fish assemblage and morphological characteristics in the Blue Ridge Physiographical Province (BRPP).

We visited approximately 30 sites this summer including tributaries of Santeetlah Lake, the Valley, Hiwassee, Tennessee, Tuckasegee, Tellico, and Citico Systems. We have yet to visit Abrams Ck. Eventually, we will have close to 35 to 40 sites altogether. This study should relate how fish assemblages and specific species presence/absence within the BRPP relates to morphological characteristics. This should provide a large-scale template of morphological restoration in the Cheoah River and an appropriate target-species assemblage based on current habitat deficiencies and potentially restorable aspects of the river.

For any questions or comments,

Contact:

Ryan A. McManamay

rmcmanam@vt.edu

Doctoral candidate, Dept. of Fisheries and Wildlife Sciences

Virginia Tech

113 Cheatham Hall

Blacksburg, VA 24061

A case study of gravel addition in a high gradient, sediment starved river in western NC: implications for future management.

McManamay, R. A.*, D. Orth*, and C. A. Dolloff[†]

**Virginia Polytechnic Institute and State University, Blacksburg, VA 24061*

[†]USDA Forest Service, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

Report to the Cheoah Fund Board

Oct 2, 2009

On the findings of the gravel addition study.

Note: Manuscript removed to protect author's publishing rights. See link to published journal article elsewhere on the Cheoah Fund Board web page.