

## SUMMARY REPORT ON THE 2014 LTLT AQUATIC BIOMONITORING SEASON

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Last year the questions on everyone's mind had to do with the almost continual high water. Our response was that "sustained high flows are part of nature's 'reset' mechanism". This year we saw the results of the reset. High flows during the spring and summer of 2013 resulted in some unsuccessful spawning events and some involuntary displacement of weak swimming fish, particularly very young individuals. A result was reduction in total fish abundance nearly across the board – an observation echoed by our colleagues in state agencies and TVA. By itself this indicates nothing in terms of ecological health.

For us, the more moderate water levels of 2014 led to greatly enhanced efficiency. We were able to complete fish samples on all of our planned sites on larger streams – a total of 7 sites on the mainstems of the Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek, including our 2 largest sites on the Little T at Needmore and Franklin, which were done with the generous assistance of Dave Matthews and the TVA boat shocker crew.

The volume of information generated was also enhanced since 2014 coincided with a scheduled visit by a North Carolina DENR fish monitoring team, led by Bryn Tracy, assisted in all cases by one or more members of the LTLT team. Their methods differ to the extent that comparison between our results and theirs would be "apples and oranges", however, their presence does result in an increase in the amount of information generated, so that we are able to report monitoring of a total of 39 sites during 2014.

If one site is of greatest importance it is the one which appears first in the following table. The Little Tennessee at Needmore, in the heart of the Needmore Game Lands, scored 58 of a possible 60 on the Index of Biotic Integrity for an Excellent Bioclass Rating. Together with last year's result from the mainstem at Iotla Bridge (56-Excellent) and previous samples from Needmore and elsewhere downstream of Lake Emory, this confirms our identification of the Little T as the premier warm water river in the southern Appalachians. It maintains this distinction due to the filtering action of Lake Emory, but even more importantly due to the low human population and sparse development of the valley below Franklin. Few of our tributary streams are so fortunate.

Of the other 38 sites, 16 received Good bioclass ratings, 14 were classified Fair, and 8 were Poor. In terms of our long term objectives, no rating below Good is acceptable, so we have plenty of room for improvement. The theme of improvement, as expressed through resiliency, recovery and restoration is appropriate to discussion of at least 15 of our 39 sites. Five of the sites are a result of intervened restoration, while we refer to the other 10 as "natural recovery."

In terms of natural recovery and resiliency, some of the most heartening news continues to come from Peeks Creek. Ten years after a disastrous landslide/flood event, 2014 marks the first year that we find the fish assemblage of lower Peeks Creek similar to the "natural" condition before the disaster. The final step has to do with the mottled sculpin or "mollycrawbottom". As anyone who has volunteered with us knows, this is typically the most abundant fish in our rocky streams. But following the flood, sculpins were absent from Peeks Creek until 2010. Only in 2014 did they resume their normal position as the most abundant species.

Other naturally recovering streams monitored in 2014 include Caler Fork (from a massive sedimentation event in 2005, related to a failed development), Tellico Creek (trout farm pollution observed in 2010 and subsequently corrected) and Wayah Creek (residual effects from a package sewage treatment plant which went offline in 2000). Up until 2012, we also detected recovery in the Little Tennessee mainstem between Franklin and the Georgia line, related to natural and assisted recovery of the riparian vegetative buffer. We were unable to monitor this reach in 2013 due to high water, and two results from 2014 are inconclusive. Results of a DENR sample at Orlando suggest

improvement (greater species diversity, improvement in 5 of the 9 IBI metrics), but we consider the size of the sample to be inadequate. And a site at Norton produced a surprising increase in omnivores and absence from the sample for the first time of the rare olive darter, indicating a slight decline in ecological health. These results teach us to be patient in evaluating our own and others' efforts at restoration.

Results of LTLT's ongoing restoration at Watauga Creek are modest in terms of IBI, but in addition to the improvement in biological connectivity reported last year, we observed a significant improvement in habitat quality (as measured by SVAP) above the new bridge at John Brown's farm. More improvement is expected once the disturbance attendant on instream work has subsided. SVAP also documents improvement in the physical condition of Cat Creek at the Equinox Environmental restoration site, but biological improvement is slow to occur, probably related to the disastrous condition of Cat Creek on a downstream property.

Perhaps most interesting is the ongoing process on Betty Creek at the Hambidge Center for Creative Arts and Sciences by Golder and Associates. Although Betty Creek is overall the healthiest of 17 major tributaries to the Little Tennessee River above Fontana Reservoir, and the Hambidge Center has been a good land steward, certain opportunities were perceived to restore riparian wetlands and repair sections of failing stream bank (a legacy of historic grazing use). LTLT was contracted to evaluate the biological success of the restoration. We found that the first attempt at structural improvement in 2010 was actually doing damage to the stream ecosystem. This was corrected in 2013, and as of 2014 the process is back on track and should achieve its stated goals by the termination of the project in 2017.

We seized the opportunity to carry out a parallel monitoring effort on the Little Tennessee River in the Wolf Fork Valley, which flows parallel to Betty Creek just 4 miles away as the crow flies. The two streams are naturally very similar, with respect to characteristics such as size and gradient, but the history of the Wolf Fork valley is very different, featuring extensive agriculture with channelization of the river, industrial activity and more recently, residential development, as opposed to the stable land ownership pattern and good stewardship which have prevailed on Betty Creek. The results (See table.) speak for themselves.

Three of this year's samples (Bradley Creek, Lakey Creek and Crawford Branch) were conceived as "before" samples at sites scheduled for restoration in 2015. Of particular interest is Crawford Branch at Franklin Memorial Park, a classic urban stream site where LTLT, working with the Town of Franklin, will help restore a natural vegetative buffer zone, which can serve as a conveniently located educational tool.

A peculiar result from Turtle Pond Creek, a high altitude trout stream on the Highlands Plateau serves to highlight how much we have to learn about the complex of natural and anthropogenic factors influencing the health of our streams. Turtle Pond Creek contains native brook trout, but also introduced brown and rainbow trout, which function as invasives, often outcompeting the smaller and generally more environmentally sensitive native species. Our samples at a site on lower Turtle Pond Creek normally include mostly brown trout, a few rainbows and one or two adult brook trout. This year the sample contained 21.1% brook trout, with numerous young fish, suggesting reproduction at the site. A site further upstream on Turtle Pond Creek, where in 1992 we found a mix of brook and rainbow trout, had only brook trout. Normally replacement of invasive exotics by an environmentally sensitive native species would be good news, but in this case maybe not. One thing brook trout are less sensitive to than other trouts is low pH; it may be that the changes we are observing reflect the effects of acid precipitation.

One thing we do know; our biologically healthiest streams – the ones with Good IBI scores – also score high on the SVAP habitat assessment index. And the element of habitat quality we can most easily control is riparian vegetation. A strong, wide riparian buffer providing shade over most of a stream will

directly affect temperature and food supply, provide elements of habitat and help control pollution and sedimentation of local origin.

**Table. 2014 Biomonitoring Summary of sites where LTLT sampling methods were applied and Index or Biological Integrity (IBI) was calculated.**

<b>Site</b>	<b>IBI Score - Bioclass</b>	<b>SVAP Score - Class</b>	<b>Trend</b>
Little Tennessee R. @ Needmore	58-Excellent	N/A	Stable
Burningtown Cr. (lower)	48-Good	3.1-Fair	Stable
Bradley Cr. @ mouth	38-Fair	3.1-Fair	Unstable
Lakey Cr. @ mouth	45-Fair	3.3-Good	Stable
Watauga Cr. below removed culvert	44-Fair	2.9-Fair	Stable
Watauga Cr. above removed culvert	50-Good	3.1-Fair	Positive
Coon Cr. near mouth	38-Poor	2.7-Fair	Negative
Crawford Br. @ Fanklin Memorial Park	35-Poor	1.9-Poor	Stable
Cat Cr. restoration site	36-Poor	2.9-Fair	Positive
Cullasaja R. below gorge	47-Fair	N/A	Negative
Peeks Cr. near mouth	53-Good	3.4-Good	Positive
Turtle Pond Cr. near mouth	47-Good	3.7-Excellent	Stable
Little Tennessee R. @ US 441 Bypass	36-Poor	N/A	Stable
Cartoogechaye Cr. @ Rec Park	50-Good	---	Unstable
Wayah Cr. near mouth	47-Good	3.3-Good	Stable
Middle Cr. @ W. Middle Cr. Rd.	47-Good	3.4-Good	Negative
Little Tennessee R. @ Norton	39-Fair	N/A	Negative
Little Tennessee R. @ GA Hwy 246	41-Fair	N/A	Stable
Mud Cr. @ Kelly Cr. Rd.	45-Fair	2.2-Poor	Unstable
Little Tennessee R. in Dillard, GA	47-Fair	3.2-Good	Positive
Betty Cr. near mouth	55-Good	3.5-Good	Positive
Betty Cr. lower restoration	52-Good	3.1-Fair	Positive
Betty Cr. upper restoration	52-Good	3.1-Fair	Positive
Betty Cr. restoration reference	50-Good	3.7-Excellent	Stable
Little Tennessee R. @ Wolfork	33-Poor	2.5-Poor	New site