Mainspring Conservation Trust, Stream Biomonitoring Program:
Summary of 2016 biomonitoring season

In 2016, as in previous years, the Mainspring Stream Biomonitoring Program was able, with ample volunteer help, to complete 30 stream samples, with fish samples leading to calculation of the Index of Biotic Integrity (IBI), plus application of the Stream Visual Assessment Protocol (SVAP) and benthic macroinvertebrate (bug) samples where necessary.

Based on fish/macroinvertebrate and SVAP assessments the final results (Bioclass ratings in the table) were, with one exception to be noted on the Cullasaja River, within normal expectations. We should note that, since some of our work focuses on problem sites, the results are skewed downward. Excellent ratings are rare in any populated landscape, but a completely random selection of sites would probably result in more Good bioclass ratings.

Little Tennessee mainstem:

With the generous assistance of Dave Matthews and his TVA crew, including an electrofishing boat (beyond our means) we were able to carry out a series of 3 samples on the Little Tennessee River mainstem. After years of impact from industrial pollution in the Rabun Gap area, a site on the river near the Georgia/North Carolina state line has rebounded to a stable IBI of around 47 (Good). This declines to 38 (Poor) just above Franklin, but recovers to 60 (Excellent) in Needmore, where the river is still home to threatened species such as the spotfin chub and sicklefin redhorse. This change is partly due to Lake Emory's role in trapping sediments and attached pollutants, but also has to do with reduced human impacts to riparian lands in the thinly populated area of northern Macon and southern Swain Counties. This is part of the payoff from Mainspring's efforts to protect the Needmore Game Lands and upstream riparian properties.

Cullasaja River:

The Mainspring Stream Biomonitoring Program strives to be visible to the people of our watershed. Even so, we were a little taken aback when news of our preliminary findings on the lower Cullasaja River came out in the press. We're not concerned with "letting the cat out of the bag" – we don't even know what kind of critter we have in the bag. For that matter we're not even sure how to open the bag. We just don't want to jump to conclusions. Here is what we do know:

A presumably routine monitoring day on the Cullasaja near Macon Middle School produced a big surprise in terms of sheer scarcity of fish. Hard work over several hours turned up only 120 fish – a fraction of normal expectation. Common species like stonerollers and warpaint shiners were missing, and pollution-tolerant species made up 28% of the sample (against a normal expectation of about 10%). The Index of Biotic Integrity (IBI) scored 24, for a Bioclass Rating of Very Poor.

The situation was alarming enough for us to contact the NC Division of Water Quality, who we hope will be helping us look into the matter. So far we have learned that mussels placed in bags in the lower Cullasaja as a first step toward possible reintroduction of endangered species experienced 100% mortality – a response not approached at any other site.

Conditions at our Fixed Station monitoring site several miles upstream on the Cullasaja at Peaceful Cove can be described as "normal" (IBI 54 – Good). Signs point toward some sort of

agrochemical contamination in the lower reaches of the river, but it is too soon to pinpoint causes. There is not much good news here yet, but it does allow us to point out that this is exactly what biomonitoring is all about. It doesn't take a team of professionals and a lot of expensive equipment to detect a "fish kill", but detecting the trends which, left undetected, can lead to extreme events requires vigilance. And Mainspring's credibility helps when it comes to the next step – calling in state agencies.

To continue with the theme of the Cullasaja, we had hopes that recent work on the Lake Sequoyah Dam in Highlands would benefit the river – it has not. The upper Cullasaja should be a cold water stream, capable of supporting a trout fishery. However, the concentration of reservoir lakes and ponds in the Highlands area (with Lake Sequoyah being the last in the chain and the largest) functions as a massive solar water heater. Trout and other cold water fish are absent from the river until a point below Dry Falls, where it starts picking up colder tributaries.

The Lake Sequoyah dam has been retrofitted to partially drain off the bottom, primarily in order to control the buildup of sediment in the reservoir. A hoped for side effect was that drawing cold water off the bottom would reduce water temperatures downstream, creating conditions suitable for trout. It has not, presumably due to the large volume of surface water which still spills over the top of the dam. Our monitoring of the Cullasaja just upstream of Dry Falls revealed a warm water fish assemblage dominated by the invasive exotic bluehead chub. Only one native fish species (longnose dace) was present, in a system so altered that it cannot even be assessed by normal methods.

<u>Stream restoration:</u>

Our biomonitoring work increasingly focuses on stream restoration sites. The only measurable payoff so far is a consequence of opening up flow and eliminating fragmentation on Watauga Creek, an important stream for the fall spotfin chub migration. However, 3 additional sites on small streams and 2 on larger ones are "in the pipeline" with restoration work completed last year. They include Crawford Branch at Franklin Memorial Park (a classic "urban stream"), plus Bradley and Lakey Creeks, where we hope provision of pool habitat will benefit spotfin chub. Larger restoration sites include Ellijay Creek and its North Prong, on the John and Tammy Stanfield property and Cartoogechaye Creek at the Frank Killian farm. The Cartoogechaye site includes experimental installation of hellbender habitat. Whle the Biomonitoring Program does not focus on hellbenders, they routinely appear in our samples and information is shared with North Carolina and Georgia wildlife authorities. Provision of habitat appears to be important – 2015 and 2016 are the first years in the history of our Program when we have not captured so much as one hellbender.

Based on visual inspection, our recent restoration sites seem to be doing well; but based on 2016 monitoring results we can't document significant improvement in the fish assemblage. This is because while most aspects of restoration (bank stabilization, culvert replacement, pool construction) are finished when the physical work is finished, restoration of the riparian vegetative buffer takes time. Once planted trees begin to grow, we expect to see response from the fish. We cannot overstate the importance of the simple concept of Shade Your Stream.

We also observe this effect at another restoration project, not done by us, but for which we have been providing biomonitoring services since 2011, on Betty Creek, at the Hambidge Center for Creative Arts and Sciences in Rabun County. There two reaches where failing banks have been restored now merit a Good Bioclass Rating, but an upstream reach which has long been fully forested, and which

we use as a control reach, rates even better – approaching Excellent. The difference is simply in the time it takes a tree to mature.

One more restoration opportunity which, if realized, should yield more immediate results is on Walnut Creek, where a former portion of highway, converted to a church driveway, creates a low dam which blocks fish movement. There we found only 4 species of fish above the barrier vs. 13 downstream. Clearly Walnut Creek needs to be biologically reconnected to the Cullasaja River if it is to fulfill its biodiversity function.

saSVAP:

Another major emphasis this year was putting into practice the saSVAP (Southern Appalachian Stream Visual Assessment) stream habitat assessment method, developed by us together with Coweeta Hydrologic Lab. We applied saSVAP at 24 of our 30 monitoring sites this summer and observed three important things

* saSvap results, expressed as Bioclass Ratings, corresponded very well with our biomonitoring results.

* Results generated independently by volunteers with brief on site training were virtually indistinguishable from those generated by the Mainspring team.

* saSVAP reinforces what the fish tell us: In most cases, the single most important thing which could be done to enhance stream ecosystem health would be to actualize the rhetoric of Save Your Stream by reestablishing healthy riparian vegetative buffers where they have been lost or damaged.

It takes about an hour, with no equipment cost, to complete a saSVAP assessment. We see saSVAP as enabling us to exponentially increase our stream coverage, while increasingly living up to the "Citizen Science" label. For Citizen Science to realize its potential requires citizen action – such as planting trees on stream banks. Mainspring stands ready to advise and assist in such efforts.

Volunteer contribution:

The work reported here would not be possible without volunteer assistance; this year we logged 857 volunteer hours on the part of 120 individuals. We see volunteering as the first step in a chain proceeding through citizen science and citizen action. And we see the Stream Biomonitoring Program as part of a feedback loop defining problems, educating, informing action and reporting on positive results.

Table 1. Results of 2016 Biotic Integrity and Stream Visual Assessment Protocol Monitoring in the Little Tennessee River Watershed.

Code	Site	IBI score/ Bioclass	SVAP	Trend	Comments
LTRNE-005	Little Tennessee R. below Brush Creek	60 Excellent	N/A	Stable	Continues to be outstanding
LPRBC-023	Left Prong Burningtown along Ray Creek Rd.	53 Good	3.58 Good	Stable	High biotic integrity, low productivity
BTNLP-024	Burningtown Cr. above Left Prong	51 Good	3.76 Excellent	Positive	Natural restoration of riparian buffer upstream
LAKMO-198	Lakey Cr. below Bryson City Rd.	43.5 Fair	3.23 Good	Positive	Restoration project (more pool habitat)
LAKMH-186	Lakey Cr. at historic Morrison Farm	40.5 Fair	3.22 Good	Positive	Restoration project (culvert replacement)
BRARC-184	Bradley Cr. Oak Grove (above mouth)	40.5 Fair	3.23 Good	Stable	Restoration project (pool habitat, bank stabilization)
ROSFW-030	Rose Cr. below Furman Welch Rd.	30 Poor	2.32 Poor	Negative	Totally sedimented
CWEWG-038	Cowee Cr. below Old Mill Rd.	47 Good	3.37 Good	Stable	Better riparian buffer
WATAB-051	Watauga Cr. above John Brown bridge	52 Good	3.39 Good	Positive	Restoration project
WATHC-053	Watauga Cr. above 1st bridge on Watauga Rd.	51 Good	2.81 Fair	Positive	Reasons for improvement unknown
RABRC-055	Rabbit Cr. above 1st bridge on Rabbit Creek Rd.	33 Poor	2.85 Fair	Stable	
CRAPA-064	Crawford Br. @ Franklin Memorial Park	31.5 Poor	1.95 Poor	Stable	Restoration not yet detectable through biomonitoring
CULWG-067	Cullasaja R. by Macon Middle School	24 Very Poor	N/A	Negative	Extreme scarcity of fish
CULPC-075	Cullasaja R. @ Peaceful Cove	54 Good	N/A	Stable	
CULDF-052	Cullasaja R. above Dry Falls	N/A	3.30 Good	Stable	
ELLSF-071	Ellijay Cr. @ Sugar Fork Rd.	50 Good	2.92 Fair	Stable	Oscillates over time, notable for scarcity of darters
WALPG-199	Walnut Cr. @ Pine Grove Church	42 Fair	2.82 Fair	New site	Biodiversity drastically reduced by downsteam barrier
BUCHR-077	Buck Cr. above Highlands Rd.	46.8 Good	3.66 Good	Stable	Trout population apparently reduced by fishing pressure
LTRBP-086	Little Tennessee R. @ US 441 bypass - Franklin	38 Poor	N/A	Stable	Apparent decline in species diversity
CARRP-087	Cartoogechaye Cr. @ Macon County Rec Park	52 Good	N/A	Stable	Unusually high quality for a stream in an urban area
WAYCR-093	Wayah Cr. below Crawford Rd.	47 Good	3.42 Good	Stable	
CARCX-095	Cartoogechaye Cr. above Wayah Cr.	47 Good	3.04 Fair	Stable	Restoration not yet detectable through biomonitoring
BATMR-199	Bates Br. @ Moffatt Cove Rd.	39 Fair	2.87 Fair	New site	Historically channelized
TESMO-117	Tessentee Cr. @ Tessentee Bottomlands	41 Fair		Stable	Restoration not yet detectable through biomonitoring
MIDHE-126	Middle Cr. above W. Middle Creek Rd.	52 Good	3.22 Good	Stable	No detectable trends in recent years
LTRSR-137	Little Tennessee R. above GA Hwy. 246-Dillard	47 Good	N/A	Stable	Leveling off after improvement after about 2010
BETBP-153	Betty Cr. - lower Hambidge Restoration Site	50 Good	3.41 Good	Positive	Restoration in process, still lacks shade
BETHC-154	Betty Cr. - upper Hambidge Restoration Site	50 Good	3.56 Good	Positive	Restoration in process, still lacks shade
BETCO-173	Betty Cr. - Hambidge Reference Site	52 Good	3.73 Excellent	Stable	Sedimentation from upstream sources
KEEWF-171	Keener Cr. below Wolf Fork Rd.	46.5 Good	2.78 Fair	Negative	Unstable banks, lack of riparian buffers