

Final Project Report to North Carolina Chapter of the American Fisheries Society
by
Montreat Landcare Committee, Montreat, North Carolina
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Mountain Stream Water Quality Baseline Quantified for Community Stewardship in Inaugural Citizen Science Studies

Summary: The project accomplished, as a pilot study, four things: (1) It achieved a first-ever quantitative documentation of the water quality of Flat Creek, a Buncombe County headwaters tributary of the Swannanoa and French Broad River system; (2) it established a “Stream Team” of citizen science volunteers who successfully conducted two related, independent, formal water sampling programs; (3) it contributed to a larger database concerning the Montreat Cove ecosystem and watershed that includes ongoing stormwater runoff planning; and (4) it built more community awareness of Flat Creek, stream ecology in general, and fishery science.

Context and rationale: The Flat Creek watershed is small, yet its few miles that flow through the community of Montreat, North Carolina are inordinately valued as an environmental and cultural resource by residents and numerous visitors. Local organizations working under Montreat Landcare Committee auspices have made its stewardship a priority. In fact, during this project a survey of resident concerns by the town government found Flat Creek to be the most highly ranked issue by citizens. The presence of Eastern Brook Trout (*Salvelinus fontinalis*) and Eastern Hellbender (*Cryptobranchus alleganiensis*) and consultation with area scientists led us to hypothesize that the waters of Flat Creek were of high environmental quality. An October 2019 reconnaissance of eight water quality indicators (identified below) verified this and formed the basis for a funding request to the Chapter (NCAFS) in 2020, which was granted in part to support the research reported here. Montreat Landcare also contributed funds.

Methods: Landcare assembled in early 2020 a volunteer “Stream Team” of citizen scientists – – whom we trained – – to conduct sampling according to two plans: 1, five locations along Flat Creek were sampled seasonally, on five dates, in 2020 to assess water physico-chemistry, with analysis by the Environmental Quality Institute (EQI) of Black Mountain (the principal use of NCAFS funds); 2, the community “swimming hole” was sampled weekly for bacteria during the summer of 2020, with analysis done by MountainTrue in Asheville, at no charge. Typically our samples were taken in periods of relatively dry weather, at which time values for turbidity and suspended solids were substantially below means from other sampling sites in western North Carolina, and with turbidity below regulatory standards. However, based on anecdotal observations of periodic siltation in the watershed we added in one round of sampling during a heavy rain event in summer. As part of the EQI regional project providing analyses of water samples taken across the western North Carolina region on the first Saturday of each month, our project was able to assess eight parameters, described under Results. Each of the two sampling plans was coordinated by a volunteer, who oversaw scheduling and was responsible for delivery of samples to the laboratories. Citizens were recognized at an autumn 2020 creekside lunch and awards ceremony, following pandemic safety guidelines.



Results and discussion: In view of the small number of samples, statistical significance is not considered. Complete samples (i.e., eight attributes) were taken on five selected first Saturdays of the month in spring (April), summer (June, July, August), and autumn (November); a rain

event sample was done on September 17. First, for the five complete “Saturday samples” there was relatively consistent uniformity in range of values across all stations for **conductivity** (7.9-18.2 umhos/cm), **alkalinity** (4.0-12.0 mg/L), and **pH** (6.5-7.1). For three chemical parameters with established standards for environmental quality, range of values for all samples at all sites and on all days for **ammonia-nitrogen** (NH₃-N, 0.01-0.08 mg/L), **nitrate/nitrite-nitrogen** (NO₃-N, 0.1-0.2 mg/L) and **orthophosphate** (PO₄, 0.01-0.05 mg/L) were below regulatory limits for, respectively, trout waters (1.0 summer, 2.0 winter), ecosystem protection (10.0), and eutrophication (<0.15), and again showed relative consistent uniformity. All six Flat Creek chemical attribute values were below regional mean levels for other Western North Carolina waters sampled on the same days and analyzed by EQI. Under dry weather conditions, **suspended solids** ranged between 0.0 and 19.2 mg/L while **turbidity** ranged between 0.5 and 13.0 NTU, with the turbidity value of 13.0 NTU--occurring at the community park (see below)--exceeding the 10 NTU standard for protection of trout.

During a rainfall event (unquantified, September 17, 2021) **suspended solid** values increased to a range of 6.0-37.2 mg/L and **turbidity** ranged between 3.0-21.0 NTU, with readings exceeding the trout standard (10 NTU) at the two most downstream sites. One of the “excessive” turbidity readings (21.0) came from the same location as in August, namely the creekside community park which even during the covid-19 pandemic was receiving foot traffic and attendant disturbance of sediment along the banks and in the waters. The second high turbidity reading came from the next and last downstream site (11.0 NTU).

For the record, our second project (non-NCAFS-funded) determined that over the period from Memorial Day to Labor Day on all but two of 16 occasions values for ***E. coli* bacteria** at the swimming hole were in the so-called safe range. Sampling error may explain the two high readings.

Flat Creek is, for almost all of the time, a completely “healthy” body of water in terms of its physico-chemical constituents and also bacteria levels, indicating habitat suitable for trout and waters safe for human recreation. Our one substantial concern is for increased turbidity and suspended solids associated with heavy rainfall and runoff. Readings at the park indicate a possible hotspot. Additional sources come from unprotected road banks and property adjacent to the creek. (Representative rainfall induced sedimentation in Flat Creek impoundment pictured.) The Town of Montreat is conducting a demonstration project on stormwater management, with results from this project provided to town officials. A logical follow-on to this pilot study is to focus on rainfall events leading to sediment runoff and impairment of water quality, focusing on a smaller number of sites which include a tributary to the aforementioned park.



These results have been reported to the Landcare Committee membership and in turn will be disseminated to the larger community, both locally and to cognizant organizations with whom the Stream Team already has partnerships, such as the State’s Wildlife Resources Commission and Department of Environmental Quality. Without the support of the North Carolina Chapter of the American Fisheries Society this work, and strengthening partnerships, would not have been possible. (Future Chapter member-in-training pictured here!)