SILVER RIVER ECOSUMMARY

Silver River above confluence with the Ocklawaha River
April 4, 2012

DEP conducted water quality and biological sampling at the Silver River in Marion County on April 4, 2012, as part of a routine monitoring of major waterbodies within the Central District's boundaries. The macroinvertebrate community was healthy and well-balanced; however, the invasive exotic *Hydrilla verticillata* dominated this stretch of the river, indicating an imbalance in the plant community. In addition, the water quality sample showed elevated nitrate+nitrite concentration.

Background

Although healthy, well-balanced river communities may be maintained even with some level of human disturbance, human activities may result in waterbody degradation. Human stressors in this instance have been minimized by the State designating the Silver River as an Outstanding Florida Water body ((62-302.700(9)(i)(32)(F.A.C)). Even with this designation there have been problems due to the introduction of nuisance (generally exotic) plants and animals, specifically the armored sail catfish, *Pterygoplichthys multiradiatus,* and the submersed plant *Hydrilla verticullata*. DEP has methods to evaluate if human activities have resulted in the condition where a particular waterbody has exceeded water quality criteria, Chapter 62-302, Florida Administrative Code (F.A.C.), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life support), and exceedances of these standards are associated with interference with the designated use. The Stream Condition Index (SCI) assesses how closely the macroinvertebrate community (*e.g.,* aquatic insects, clams, crayfish) of a stream resembles the macroinvertebrate community of an undisturbed or "reference" condition. The Stream and River Habitat Assessment evaluates the availability and quality of habitat for macroinvertebrates and can help diagnose the cause of a low SCI score.

Methods

This river was sampled on April 4, 2012 by the DEP Central District Office. Surface water samples were collected for analysis of biochemical oxygen demand, nutrients, chlorophyll-*a*, phaeophytin-*a*, color, alkalinity, turbidity, TSS, organic carbon, sulfate, chloride, and fluoride; following DEP Standard Operating Procedures (SOPs, see http://www.dep.state.fl.us/water/sas/sop/sops.htm for details). Sampling and analyses met FDEP quality assurance/ quality control standards (see http://www.dep.state.fl.us/water/sas/qa/index.htm).

The Stream Condition Index (SCI) was sampled per DEP SOP FS7420 and calculated per DEP SOP LT7200. The SCI consists of collecting macroinvertebrates via 20 D-frame dipnet sweeps (0.5 m in length) in the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled and identified to the lowest practical taxonomic level. The SCI is composed of ten metrics, eight of which decrease in response to human disturbance, with two metrics (% very tolerant and % dominant) increasing in response to human disturbance. According to DEP SOP LT 7200, the SCI score ranges and categories are: (>68) Exceptional; (35-67) Healthy; and (0-34) Impaired. As part of numeric nutrient criteria development, DEP and EPA have concluded that a balanced faunal community is achieved if the average score of at least two temporally independent SCIs, performed at representative locations and times, is 40 or higher, with neither of the two most recent SCI scores less than 35.

The Stream and River Habitat Assessment was conducted per DEP SOP FT 3100. The Habitat Assessment is a rapid field method in which a sampler scores eight in-stream and riparian components to estimate the influence of habitat factors on the resident aquatic organisms. Habitat Assessment scores range from 11-160 and overall habitat quality is assigned to one of four categories: Optimal (120-160 points), Suboptimal (80-119 points), Marginal (40-79 points), and Poor (11-39 points).

The Linear Vegetation Survey is a new, rapid assessment tool for evaluating the ecological condition of stream based on vascular plants. If at least 2 m^2 of vascular plants coverage is present in a 100 m stream reach, plants are assessed for frequency of occurrence (dominant, co-dominant, or present). In addition, each plant taxon has a coefficient of conservatism (C of C) score, which is a number from 0 to 10 that indicates how broad or narrow a taxon's ecological niche is, as determined by expert botanists. Exotic and ubiquitous weedy native taxa have low C of C scores, and taxa that display fidelity to a particular community and are sensitive to disturbance have high C of C scores. If mean C of C is >2.5 and the frequency of occurrence of Florida Exotic Pest Plants Council (FLEPPC) exotic taxa is ≤25% of the total taxa plant occurrence, then no imbalance of flora is noted (draft DEP SOP FS 7320).



Figure 1: Location of the Silver River above the Ocklawaha River in Marion County

Site Information

The Silver River is formed from the combined flow of the main cavern and a number of smaller spring vents near the Silver Springs attraction. A small, primary blackwater creek (Halfmile Creek) which drains several square miles of flatwoods enters Silver River approximately ¾ mile downstream from the headwaters and it is the only major tributary to Silver River. Until recently, this creek also carried a direct road runoff from State Road 40. In 2010, a new stormwater treatment system was installed, which diverts stormwater (1"or less) and storms up to the 10-year event into a dry retention pond. This stormwater system eliminated substantial nutrients loads to the river.
The shoreline plant community is classified as hardwood swamp and consists of cypress, red maple, swamp tupelo, Carolina willow, climbing aster, wax myrtle, cattails, duck potato, and swamp lily (see Figure 2). The aquatic plant community consisted of islands of hydrilla, strap-leaf sagittaria, pickerelweed, coontail, spatterdock, and eelgrass, with hydrilla being a dominant or co-dominant species throughout the 100 meter reach of the assessed stream.



Figure 2. Stream Condition Index transect at the Silver River on April 4, 2012

Results

Water Quality

The water quality samples collected on April 4, 2012, complied with applicable water quality criteria except for nitrate+nitrite. The dissolved oxygen (DO), total nitrogen (TN), and total phosphorus (TP) values met the water quality standards outlined in Chapter 62-302, F.A.C. (Table 1). The nitrate+nitrite value was 1.2 mg/L, which is higher than the spring vent criterion of 0.35 mg/L. The high nitrate concentration in the River is due to elevated nitrates in Silver Springs. In 2009, the springs were listed by the DEP as impaired for nutrients, especially for nitrate based on the presence of abundant algal mats. A new limit of 0.35 mg/L has been proposed for nitrate+nitrite in Florida spring vents.

Table 1. Water quality results from April 4, 2012 (STORET #:20020317)

Analyte	Result	Applicable Class III Water Quality Criteria
Water Temperature (°C)	23.4	
Field pH (SU)	7.6	Within Range
Field Dissolved Oxygen (mg/L)	5.1	≥ 5.0 (mg/L)
Field Specific Conductance (µmhos/cm)	468	Not to exceed 50% of background or 1275 µmhos/cm
Secchi Depth (m)	VOB	
Total Depth (m)	5.0	
Alkalinity (mg $CaCO_3$/L)	177	
Turbidity (NTU)	0.40	
Total Dissolved Solids (mg/L)	277	
Total Suspended Solids (mg/L)	2 U	
Chloride (mg/L)	12	
Fluoride (mg/L)	0.17	≤ 10 mg/L
Sulfate (mg/L)	48	

True Color (PCU)	2.5 U	
Chlorophyll-*a* (µg/L)	1.6	
Phaeophytin-*a* (µg/L)	0.40	
Organic Carbon (mg/L)	1.0 U	
Total Phosphorus (mg/L)	0.035	≤ 0.12 mg/L*
Orthophosphate (mg/L)	0.032	
Nitrate+Nitrite (mg/L)	1.2	≤ 0.35 mg/L
Ammonia (mg/L)	0.011 I	
Total Kjeldahl Nitrogen (mg/L)	0.088 I	
Total Nitrogen (mg/L)	1.3	≤ 1.54 mg/L*
Biochemical Oxygen Demand (mg/L)	0.58	

* F.A.C. Chapter 62-302 Surface Water Quality Standards - DRAFT

I- The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit

U - Indicates that the compound was analyzed for but not detected

VOB – Secchi disk was visible on bottom of stream

Habitat Assessment

The Stream and River Habitat Assessment score was 136 in the "Optimal" category. Three productive macroinvertebrate habitats were sampled: fallen trees (snags), leaf packs, and aquatic vegetation. Substrate availability and substrate diversity scored in the "Suboptimal" category because of an abundance of thick hydrilla covering much of the roots and snags. Otherwise, the river had natural sinuosity, an adequate diversity of depths, and showed no evidence of physical alterations. The bank stability, riparian zone buffer width and vegetation quality components all scored perfect scores in the "Optimal" category indicating that riparian disturbance is low in this watershed.

Stream Condition Index

The SCI score for this site was 52 points, corresponding with a "Healthy" designation. In this sample of 40 taxa, many sensitive macroinvertebrate groups were present including mayflies, caddisflies, dobsonflies and black flies, as well as pollution-intolerant species of damselflies and aquatic beetles. The macroinvertebrates collected in this sample represent the expected macroinvertebrate diversity for a healthy, stream community.

Linear Vegetation Survey

The Linear Vegetation Survey (LVS) indicated an imbalance in the river's plant community due to dominance or co-dominance of *Hydrilla verticillata* throughout the 100 m reach of the assessed stream. Hydrilla is listed by FLEPPC as an invasive, Category I plant. The C of C of hydrilla is 0.0 which means that the mean C of C of the stream was <2.5 and exotic taxa were present in >25% of the plant occurrences.

Conclusions

The water quality data from this sampling event met all applicable water quality criteria; although the proposed nitrate+nitrite criterion applies only at spring vents, the nitrate+nitrite concentration within this spring-fed river exceeded the spring vent criterion. The Silver Springs Basin Working Group, consisting of representatives from DEP and other State and local agencies, will have its first meeting in July 2012. The Working Group will be responsible for developing the Basin Management Action Plan to address nitrates loading in the springs' recharge area. Once nitrate concentrations are much lower, hydrilla will not be able to flourish at current levels and the LVS score should improve. The "Healthy" SCI and "Optimal" Habitat Assessment data indicate that the river provides adequate diversity of productive habitats for macroinvertebrate community which is healthy and well balanced.

Historical Water Quality of Silver River

Habitat Assessment trend for this site is downward, from 146 in 2001 to 136 this year. The average, 140.25 (N=8), is still in the "Optimal" category. SCI score was 52, corresponding with "Healthy" designation. The 40 total taxa found in this sample compare favorably with the station average of 32.6 (N=22).

Thank you for your interest in maintaining the water quality of Florida's streams and rivers. Please feel free to contact us if you have any questions.

Thank you to Dana Denson with Reedy Creek Improvement District for providing interpretation of the Silver River macroinvertebrate community.

Contact and Resources for More Information:
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http://www.dep.state.fl.us/central/Home/Watershed/default.htm

The Silver River State Park Management Plan, December 10, 2010
http://www.dep.state.fl.us/parks/planning/parkplans/SilverRiverStatePark.pdf
Silver Springs Nutrient Pathway Characterization Project, Special Publication SJ2012-SP3, SJRWMD
http://www.sjrwmd.org/technicalreports/pdfs/SP/SJ2012-SP3.pdf

DEP Biological Assessment Resources:
http://www.dep.state.fl.us/water/bioassess/index.htm