Analysis of Macroinvertebrates found in Upper Oconee Watershed: 2001-2016

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Abstract

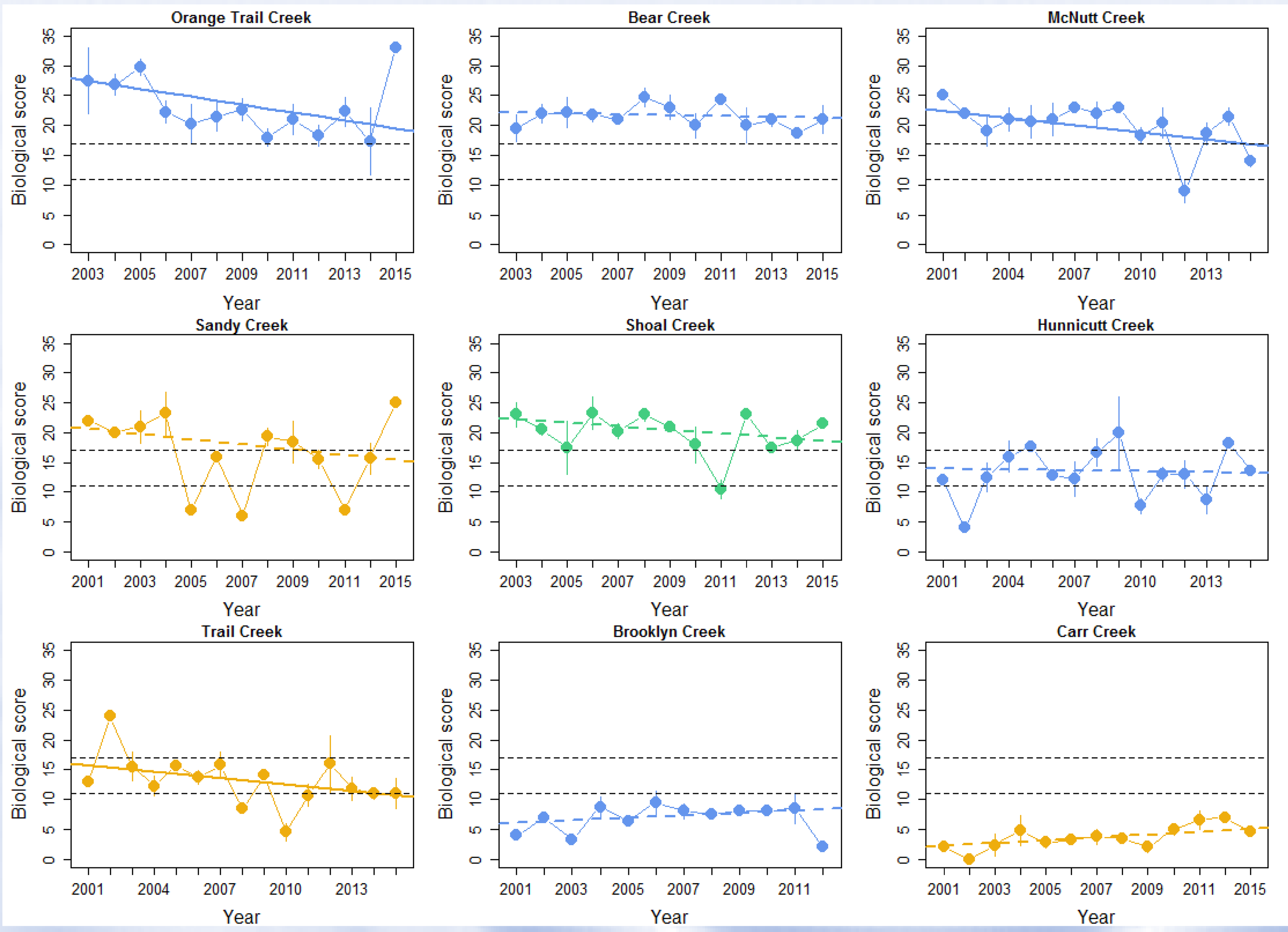
The Oconee River originates in Hall County and flows south to join the Ocmulgee River on the border of Montgomery/Jeff Davis/Wheeler Counties to form Georgia's largest river – the Altamaha which flows to the Atlantic Ocean. The Upper Oconee Watershed Network (UOWN) is dedicated to protecting water resources and improving stream health in the upper Oconee River watershed through community-based advocacy, monitoring, education and recreation. UOWN was formed in 2000 and its volunteers have collected long-term (21 years) water quality data in support of assessing instream health across a four-county area. UOWN does physical, chemical and biological monitoring on a quarterly basis. It uses Georgia Adopt-a-Stream (AAS) protocols for the biological (macroinvertebrate) monitoring. Macroinvertebrate monitoring is a standard method used to assess aquatic health. At each UOWN quarterly monitoring, some number of sites are selected for biological monitoring. The presence and relative abundance of taxa are recorded on Georgia AAS Macroinvertebrate monitoring forms and the Water Quality Index score is added to the UOWN dataset. For this project, the Georgia AAS Macroinvertebrate forms from 2001-2016 were reviewed and presence of macroinvertebrate taxa were entered into a separate dataset. This dataset was then analyzed using the python programming language to understand temporal and spatial trends in macroinvertebrate taxa between 2001-2016 for the upper Oconee watershed. The results of this analysis could be useful for other Georgia AAS volunteer groups. The UOWN data can be found at:

http://uown.org/UOWN-Wordpress/monitoring-results/

We would like to acknowledge Upper Oconee Watershed Network and Georgia Adopt-a-Stream for the use of their data and Oconee Waters group for their help and encouragement.

Background

At each UOWN quarterly monitoring, some number of sites are selected for biological monitoring. The presence and abundance of taxa are recorded on Georgia AAS Macroinvertebrate monitoring forms and the Water Quality Index score is added to the UOWN dataset. Previous analysis looked at long-term trends of the biological score (water quality index) and found some creeks were showing declining biotic integrity (figure below). Thus, the desire to look for trends in macroinvertebrate taxa.



For this project, the Georgia AAS Macroinvertebrate forms from 2001-2016 were reviewed and presence of macroinvertebrate taxa were entered into a separate dataset. This dataset was used to understand temporal and spatial trends in macroinvertebrate taxa between 2001-2016. Changes in how macroinvertebrate taxa were assigned to sensitive, somewhat sensitive and tolerant changed in 2006 and this had to be accounted for in the final dataset:

- Hellgrammite was moved from sensitive to somewhat sensitive.
- Fishfly had its own category, but it was moved to Dobsonfly / Hellgrammite / FishFly.
- Caddisfly was separated into caddisfly and common net spinning caddisfly; the impact of this is noted in the analysis
- Snipe flies were added to sensitive category
- Damselflies and dragonflies were initially counted separately, but were grouped together (labelled as Odonates in proceeding table)
- Beetle larva, Atherix and alderfly were listed as somewhat sensitive species, but were dropped. These were not considered in the analysis as few were found.

Future work should include a more formal analysis of seasonal bias, unequal sampling frequency, etc.

Analysis and Results

The data from 2001-2016 were from 404 samples taken across 16 creeks / tributaries. The data were placed in comma-separated format and were analyzed using the python programming language. In addition to the water quality index, a species richness was computed.

Creek Level Analysis

The seven creeks with the most samples over the 15-year period were chosen for detailed analysis. The table below shows the percentage of each taxa from 2001-2016.

	Carr Creek	Brooklyn Creek	Trail Creek	Hunnicutt Creek	McNutt Creek	Shoals Creek	Orange Trail Creek	Bear Creek
Total Samples	41	30	44	47	33	35	28	45
Mean Water Quality Index	3.8 (Poor)	7.7 (Poor)	12.0 (Fair)	13.6 (Fair)	18.6 (Good)	19.1 (Good)	20.8 (Good)	21.5 (Good)
Mean Richness	2.24	4.47	6.27	6.66	8.55	8.46	8.96	9.2
Stonefly	7.3%	10%	22.7%	19.1%	72.7%	71.4%	96.4%	93.3%
Mayfly	2.4%	30%	66.2%	80.9%	93.9%	94.3%	71.4%	95.6%
Snipe fly	2.4%	3.3%	0%	0%	0%	5.7%	0%	6.7%
Caddisfly	7.3%	43.3%	31.8%	59.6%	66.7%	65.7%	89.3%	91.1%
Gilled Snail	0%	0%	0%	2.1%	6.1%	8.6%	100%	8.9%
Water Penny	4.9%	6.7%	9.1%	17.0%	39.4%	51.4%	42.9%	42.2%
Riffle Beetle	2.4%	3.3%	9.1%	17.0%	21.2%	31.4%	17.9%	35.6%
Net spinning caddisfly	7.3%	33.3%	25%	48.9%	51.5%	48.6%	53.6%	57.8%
Sowbug	2.4%	0%	0%	4.3%	0%	11.4%	53.6%	57.8%
Scud	0%	3.3%	4.5%	0%	6.1%	5.7%	7.1%	2.2%
Clam / Mussel	0%	10%	77.3%	6.4%	66.7%	0%	3.6%	2.2%
Crayfish	12.2%	20%	63.6%	68.1%	57.6%	71.4%	82.1%	71.1%
Cranefly	29.3%	30%	43.2%	68.1%	66.7%	62.9%	64.3%	86.7%
Odonates	31.7%	16.7%	63.6%	76.6%	66.7%	77.1%	35.7%	97.8%
Hellgramite	2.4%	0%	4.5%	4.3%	45.5%	45.7%	50%	28.9%
Midge	56.1%	93.3%	77.3%	76.6%	84.8%	74.3%	78.6%	82.2%
Blackfly	0%	3.3%	22.7%	29.8%	42.4%	14.3%	25%	28.9%
Worm	53.7%	90%	77.3%	59.6%	57.6%	71.4%	75%	64.4%
Leech	0%	3.3%	0%	4.3%	3.0%	8.6%	0%	2.2%
Lunged Snail	2.4%	46.7%	27.3%	23.4%	6.1%	25.7%	0%	13.3%

Temporal Analysis

Analysis was performed to find percentage of site samples that have a given taxa across all years, years 2001-2005, years 2006-2010 and years 2010-2016 in order to look for trends in macroinvertebrate presence. Changes in land use and stream habitat can impact species composition and number.