Faunal inventory of wetlands adjacent to Lake James - Final Report – October 2022

Joshua Holbrook, Zoe Riggs, John Strange Montreat College

Background

Wetlands are vital for a variety of ecosystem processes and services – carbon sequestration (Mitsch et al. 2012), flood control (Mitsch and Gosselink 2000), and supporting biodiversity, especially for organisms with aquatic larval forms but terrestrial adult stages (e.g. frogs, salamanders, insects; Gibbons et al. 2000). Despite their utility, wetlands are ditched, drained, or not considered in management regimes, often due to their small size in relation to other habitats such as rivers or lakes, as well as their lack of mainstream recreational value. Wetlands are rare in western North Carolina due to topographic heterogeneity, that is, water will only pool where there are basins on flat landscape for them to do so. The Lake James watershed, and especially sites associated with the floodplain of the Catawba River, however, have a number of unique wetland systems which are heretofore faunally unexamined. To this end, we conducted a survey of the amphibian, reptile, fish and macroinvertebrate communities in known wetlands within 5km of Lake James to increase our knowledge of the wildlife conservation value of these systems.

Methods

In Spring and Summer 2021 and 2022 we examined 7 wetlands, 3 floodplain wetland matrices along the Old Catawba River, three isolated wetlands adjacent to the Catawba River, and one anthropogenic isolated wetland. Several other wetlands surveyed by Holbrook et al. (2021) were too dry to survey due to low water conditions in the region, although we conducted opportunistic surveys (e.g. frog call surveys, limited trapping) at several additional wetlands in the region. We surveyed wetlands using a variety of funnel traps, a variation of sampling regime used by Holbrook and Dorn (2015). Additionally, we conducted frog vocalization surveys and dipnetting to census the macroinvertebrate assemblages in a n=3 wetlands, the rest of the sampled wetlands lacked sufficient marginal vegetation for dipnet sweeps.

Analysis of findings

We assembled a species list for surveyed wetlands, and derived Shannon-Weiner diversity values for each wetland we surveyed. Shannon-Weiner diversity (H') was calculated as

$$H'=-\Sigma pi * lnpi$$

where *pi* is the proportion of the total wetland community belonging to the *i*th species.

Results

We encountered 22 species of vertebrate in wetlands in the Lake James Watershed, including fish (7 species), frogs and toads (7 species), salamanders and newts (6 species), 1 species of snake, and turtles (4 species). Wetlands with a direct connection to the river (n=4) had a higher species richness (mean=8, range 7-11) than wetlands that did not have a hydrologic connection to a river (n=3, mean = 3, range 0-5). Shannon-Weiner diversity ranged from 1.06-1.73 (Fig. 1), although one site was not estimated because no species were encountered in it, likely because it had dried and only recently been re-inundated.

Figure 1: Shannon-Weiner Diversity estimates for 6 wetlands in the Lake James Basin and map from Holbrook et al. 2021 depicting wetland locations. Catawba Run N. and S. were not included in the Holbrook et al. 2021 report, thus are not listed on the map.



Table	1.	Locations	of	wetlands	survey	ved
rabic	т.	Locations	UI.	wettanus	Suive	/cu.

Wetland Number / Name	Location
2/10	35.732, -81.881
4	35.719, -81.996
5	35.716, -81.995
Catawba Run N	35.726, -81.876

Catawba Run S.	35.724, -81.874
Catawba Run Isolated Wetland	35.722, -81.874

Table 2: Species encountered in wetlands in the Lake James watershed. Species marked ** have not previously been documented in McDowell or Burke Counties and represent new records.

Fish	Amphibians	Reptiles	Macroinvertebrates
Green Sunfish	**Green Treefrog	Northern Water Snake	Odonata:
(Lepomis cyanellus)	(Hyla cinerea)	(Nerodia sipedon)	
Warmouth	American Toad	Painted Turtle	<i>Libellula</i> sp.
(Lepomis gulosis)	(Anaxyrus americanus)	(Chrysemys picta)	
Yellow Bullhead	Bullfrog	Eastern Musk Turtle	Coenagrionidae
(Ameiurus natalis)	(Lithobates catesbienus)	(Sternotherus oderatus)	
Creek Chub	Green Frog	Common Snapping Turtle	Hemiptera:
(Semotilus	(Lithobates clamitans)	(Chelydra serpentina)	
atromaculatus)			
Eastern Mosquitofish	Grey Treefrog	**Eastern Spiny Softshell	Neogerris hesionae
(Gambusia holbrooki)	(Hyla chrysocelis)	Turtle	
		(Apalone spinifera	
		spinifera)	
Bluegill	Spring Peeper		Hydrometra
(Lepomis macrochirus)	(Pseuacris crucifer)		
Largemouth Bass	Fowler's Toad		Unidentified Gastropods
(Micropterus	(Anaxyrus fowleri)		
salmonoides)			
	Red Salamander		Coleoptera:
	(Pseudotriton ruber)		
	Northern Dusky		Hydrophilus sp.
	Salamander		
	(Desmognathus fuscus)		
	Blue Ridge Two Lined		
	Salamander		
	(Eurycea wilderae)		
	Spotted Salamander		
	(Ambystoma maculatum)		
	Eastern Red-spotted		
	Newt		
	(Notopthalmus		
	viridescens)		
	Slimy Salamander		
	(Plethodon cylindraceus)		

Notable records

Two species were encountered that were previously unknown from the Lake James watershed. We documented green treefrogs (Hyla cinerea) chorusing in a wetland in McDowell County (35.701, -82.047) that we surveyed using frog call surveys and trapping.¹ Green treefrogs are a generalist frog and have been documented by a single observation in Buncombe County with an apparent gap in their range until Gaston and Iredell Counties (CarolinaHerpAtlas.org, accessed 10/20/22). This apparent gap could due to a lack of previous sampling efforts, a natural expansion of their range, or represent a population started by hitchhikers from elsewhere in the southeast, as treefrogs are known to attach to car undercarriages, etc.

A single Eastern Spiny Softshell Turtle (*Apalone spinifera spinifera*) was caught in a trap in Summer 2021. The identification of this turtle was confirmed by NC Wildlife Resource Commission herpetologist Gabrielle Graeter and represents not only a new record for Burke County, but the first record of this subspecies in the Catawba Watershed. Previously, this subspecies was only known from Mississippi drainages and only from Madison county in North Carolina. Eastern Spiny Softshell Turtles are listed as a species of special concern in North Carolina.

Conclusions

Overall, the wetlands we surveyed had communities consistent with faunal communities in floodplain sites throughout the piedmont of the southeastern United

States. Wetlands that were directly connected to the river system are able to be colonized more easily by a number of fish and turtles that are able to survive because these wetlands are less fluctuating in dissolved oxygen and temperature. Wetlands that were in the floodplain but not connected to the river except during large rain events have more varying dissolved oxygen and temperature, and often had a large amount of invasive hydrilla. Because of these factors, nonconnected wetlands were dominated more by fish that are tolerant of these conditions: primarily eastern mosquitofish and warmouth.

Although the overall amphibian species richness (i.e. number of species) in the region is moderately high (13 species encountered in this survey), most of this biodiversity was contributed by temporary fishless sites that we could not trap and only could survey opportunistically (e.g. the swamp near the Holly Trail in Lake James State Park, 35.7533, -81.8943). The wetlands we were able to survey with traps (figure 1, table 1) had an average of 1.17 amphibian species per wetland. This is likely from a combination of factors: fish are known to reduce amphibian species richness (Holbrook and Dorn 2015), so the apparent lack of fishless wetlands in the floodplain certainly contributes to a reduction in amphibian diversity. Additionally, several of the wetlands that were not connected to the floodplain were dominated by invasive Hydrilla and subject to biological treatment of these invasive aquatic plants. High concentrations of

¹ This wetland was not used in our Shannon-Weiner Diversity estimates because we did not use a

sufficient number of traps to assess the wetland's full community composition.

Hydrilla may cause periodic drops in dissolved oxygen concentration leading to hypoxic or anoxic conditions (Sousa 2011).

Diversity of turtles was relatively high at the sites we surveyed (4 species), with the unexpected Spiny Softshell an encouraging surprise as this species is a Species of Concern in North Carolina and not previously documented in this region, although we only encountered one individual of this species. We utilized some traps designed specifically for turtles, but we did not utilize many of these since trap setup is laborious and they typically do not capture other fauna (fish, amphibians, macroinvertebrates). Because of this, there are likely additional species in Lake James, the Catawba and other river systems in the Lake James Watershed that would be revealed with additional sampling effort.

Management recommendations and future research avenues

Fish-dominated wetlands have fewer species of amphibians and a smaller biomass of macroinvertebrates (Dorn 2008), and fishless wetlands make significant contributions to the regional biota (Gibbons et al. 2000). Thus, future wetland mitigation, creation and restoration may benefit from creating fishless wetlands or removing fish from wetlands outside of areas that normally flood.

Future research should address the extent of the Spiny Softshell Turtle in the Lake James Watershed to determine if there are robust populations of this species of concern in McDowell and Burke Counties, such a study could concurrently census populations of other turtle species in the region.

Student education and other uses of this work

Five Montreat College students (W. Kincaid, B. McEntire², M. Frady, Z. Riggs and J. Strange) participated heavily in this project and benefitted from the material and logistical support of the LJEA in their education. Additionally, I (J. Holbrook) also integrated some of the wetland surveys in the Old Catawba River with my Introduction to Environmental Science Lab, and 80-90 students participated in checking traps in this area in April 2021 and 2022. Additionally, although the regional drought precluded me from using this specific dataset in my dissertation at Clemson University (e.g. all of my wetlands in a region must be sampled at the same time to control for temporal variation), I intend to continue surveys in many of these wetlands in Summer 2023 to integrate them into my dissertation.

Acknowledgements

The investigators wish to thank J. Raker and M. Taylor for logistical assistance in the field, as well as sharing their knowledge of the watershed, as well as the Lake James Environmental Association for funding this work. Additionally, several Montreat College students assisted with fieldwork, but W. Kincaid, B. McEntire and M. Frady were the primary (non-author) participants.

² B. McEntire and W. Kincaid were on this original proposal, but graduated in May 2022 and were unable to complete fieldwork. Z. Riggs and J. Strange

took over their work and will receive a proportion of the budget allotted as stipend for McEntire and Kincaid.

Works Cited

Dorn, N. J. 2008. Colonization and reproduction of large macroinvertebrates are enhanced by drought related fish reductions. *Hydrobiologia* 605(2008):209-218.

Gibbons, J. W., D. E. Scott, T. J. Ryan, *et al.* 2000. The Global Decline of Reptiles, Déjà Vu Amphibians: Reptile species are declining on a global scale. *Bioscience* 50(8): pgs. 653-666.

Holbrook, J. D. and N. J. Dorn. 2015. Fish reduce anuran abundance and decrease herpetofaunal species richness in wetlands. *Freshwater Biology* 61(1):100-109.

Holbrook, J. D., W. Kincaid, and B. McEntire. 2021. Report: Inventory of wetland resources in the Lake James Basin. Technical Report provided to the Lake James Environmental Association.

Mitsch, W. J., B. Bernal, A. M. Nahlik, *et al.* 2013. Wetlands, carbon, and climate change. *Landscape Ecology* 28, 583–597.

Mitsch, W. J. and J. G Gosselink. 2000. The value of wetlands: importance of scale and landscape setting. *Ecological economics* 35(1):25-33.

Sousa, W. T. Z. 2011. *Hydrilla verticillate* (Hydrocharitaceae), a recent invasder threatening Brazil's freshwater environments: a review of the extent of the problem. *Hydrobiologia* 669:1-20. Appendix: Some species encountered during this survey work.



Fig 1.: Painted Turtles



Fig. 2: Green Sunfish









Fig 5.: Unidentified Centrarchid (sunfish)

Fig. 6: Eastern Red-spotted Newts