Correlation Between Habitat Composition and Fish Populations in Silas Creek

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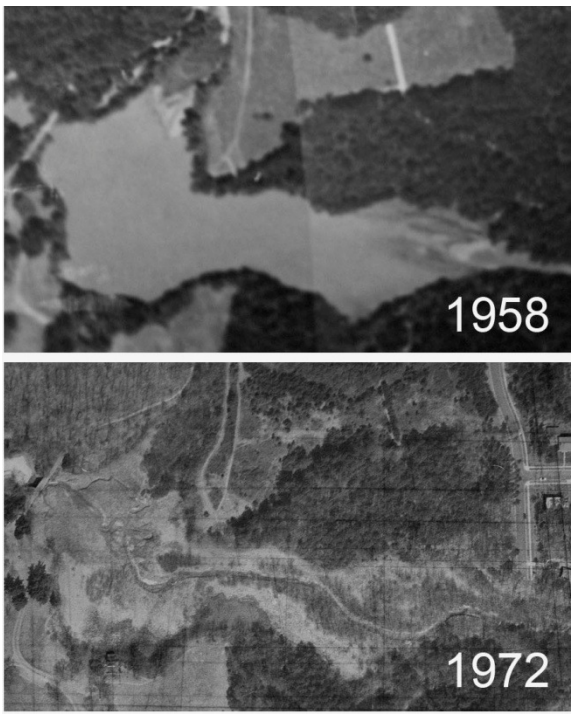
Introduction/background: In the early 1900s Lake Katharine was built in the headwaters of Silas Creek in Forsyth County. It was built with the intention of creating a recreational park and fishing resource. In 1952, the 16 acre lake started to shrink as it began filling with sediment from construction in the watershed and has now transformed into a wetland that contains only streams. This transformation can be seen in picture to the right.



The main-stem flow of Silas Creek derives from three primary locations. Those are the runoff water from the Wake Forest University campus, drainage from Reynolda Gardens of Wake Forest University (which is adjacent to the campus), and a stream originating from the Old Town Club golf course. The different stream origins create different biotic and abiotic variables along Silas Creek creating a range of different habitat compositions. These different habitats permit for a number of different fish species to live in the streams. Generally, a species of fish has a preferred habitat or one that it survives and reproduces in better than others. This generates different fish populations throughout the different areas of streams. Today, Silas Creek is split into four different streams within the remnants of Lake Katharine and its watershed. There is one main stream below the damn and three streams above it where the water originates.

Methods/materials: For this study, main-stem Silas Creek and its three feeder streams above the dam were investigated, each containing different areas for examination. The entire study area of Silas Creek for this project extended from the Old Town Club golf course to Reynolda Road. A total of eleven different places throughout all four streams were picked as sites to record data. These areas for examination were picked to make sure that all different habitats were selected and that all parts of the streams were accounted for. This included both flowing and woodland impounded sites (Swan Pond). The environmental factors that were recorded were dimensions of the water present for volume calculation, sun exposure, surrounding vegetation, water flow, soil composition, water clarity, other organisms found, and any outside factor that could affect the stream. To determine what species were present, fish were caught using different types of nets and no time limit nor minimum number of attempts were put on the capturing of fish. Each spot was visited multiple times throughout the months of June and July to ensure accurate recording of environmental factors. Each site was fished three times throughout the months of June and July. The species, number of fish, and size range of each species were recorded.

The fish population of each site was quantitatively sampled by using a cast net. The net was thrown into the water three times at each location and the number of fish caught was recorded in order to establish a fish per effort/cast ratio. This allowed for fish populations to be measured relative to other sites within the stream. This will give the fish population size along with the ratio of each species within the areas.

Location compositions: Table 1 shows the conditions of each selected location that was used for fish collection. Each aspect was given to a range of standardized descriptions for comparison purposes. Volume is an approximate measurement of gallons in the site location. This was found my measuring the site's water volume and then converting this to gallons. The vegetation

around the creek is abundant for the stream in total meaning that "low" on the chart expresses a location with some vegetation surrounding it. Figure 1 shows the locations of the sites on a map of Reynolda Gardens.

Table 1: The locations and environmental factors that were measured (from left to right) water volume, surrounding vegetation, sun exposure, water clarity, soil composition and water flow/aeration.

3	Reynolda Road	56,552	moderate	high	murky	mainly rocks	moderate
4	above dam	45,446	moderate	high	murky	mud	high
5	side stream	5,325	high	low	murky	mud	low
6	boat house	1,666	high	moderate	murky	mud	low
7	ponds	70,286	moderate	low	clear	mud and wood	low
8	walkway	1,009	low	low	clear	sand	low
9	golf course	4,241	high	high	murky	mud	moderate
10	middle walkway	6,665	high	low	moderate	sand/mud	moderate
11	near dam	3,231	high	moderate	murky	mud	moderate

Data and Results: A total of seven species of fish were found and the locations at which each was found are listed in Table 2.

Table 2: Each species of fish found and the locations they were found in.

Fish Species	Location(s) found
Red breast sunfish (*Lepomis auritus*)	1,2,3,4,5,7,9,11
pumpkinseed sunfish (*Lepomis gibbosus*)	7
bluegill sunfish (*Lepomis macrichirus*)	7
bluehead chub (*Nocomis leptocephalus*)	8,10
roseyface dace (*Clinostomus funduloides*)	2,3
mosquito fish (*Gambusia affinis*)	all
greenhead shiner (*Notropis chlorocephalus*)	2,3

The mosquito fish is found along the entire length of Silas Creek and the redbreast sunfish was found in almost all locations throughout the creek. These two species were by far the most abundant fish species in the feeder streams. All other species seemed to be isolated within only a

couple sections of the creek. The pumpkinseed sunfish and bluegill sunfish were only found at the pond location which is practically blocked off to other sections downstream. The bluehead chub was only found in the stream near the walkway entrance to the Wake Forest campus entrance. The roseyface dace and greenhead shiner were found to live in the same two locations which are both below the dam. Relative fish populations were found using an effort ratio and can be seen in Table 3.

Table 3: Relative fish population at each site using a catch per effort ratio.

Location	Fish Population
1	2
2	1.7
3	3.7
4	0.3
5	1.3
6	0
7	3
8	0.7
9	0.7
10	1
11	1.3

Discussion: As can be seen by the distribution of the fish there are barriers between fish populations. The boat house location on Lake Katharine, even after thunderstorms, does not contain enough water for fish to swim in. This means that it acts as a disconnect from the rest of the stream, thereby isolating species. The pumpkinseed sunfish and bluegill sunfish are only found in Swan Pond. This limited distribution decreases their chance of survival over time. A drought or contamination of the pond site could kill the fish in the pond and therefore wipe out the species. The other disconnect is the dam which creates a physical barrier for fish. The fish that are currently only found in the section below the dam are limited to their possible habitat locations. These species are bluehead chub and roseyface dace. These two barriers block off

more than half the species within the stream from spreading throughout the stream and increasing their populations. The redbreast sunfish is found at every site besides one and the mosquito fish appears at all locations. These two species also had the highest populations throughout most of the locations. This displays their dominance of the creek. The strong number of redbreast sunfish brings competition to all other species of fish making their stability of existence perhaps more difficult.

The pond location contains all three species of sunfish within an isolated area. Due to the limited resources and small volume of water for many different places the possibility of cross breeding is realistic. All three species, with the limited resources, will likely not persist as discreet species forever. Most likely either one species will dominate or a type of hybrid species will become prevalent.

The future of habitat composition of Silas Creek will most likely continue along the same path that it is currently on, that is, continued wetland encroachment with less open water habitat above the dam. The water from the golf course, which is enriched in fertilizer, causes eutrophication. This means that there is a greater amount of nutrients in the water than normal. This allows for increased plant and algae growth. The wetlands above the damn are continuously supplied, throughout all seasons, with nutrients to grow rapidly. This creates a vast root system that allows for increased trapping of sediment and less erosion of soil due to water. This cycle will continue to trap soil runoff from the golf course and from construction on the campus of Wake Forest. One possibility is that this will cause the streams to become wetlands and the incoming water to spread thinly over the area and be largely absorbed before it reaches the dam. This could cause less water to drain into the lower stream decreasing the amount of habitable area for the species below. The other option is that once the stream is cutoff from the middle by

wetlands, the water will run off to the side and connect with one of the other feeding streams. This would be the most beneficial for fish species since there will be greater water volume of the stream. If the first option occurs then most likely all species of fish besides the redbreast sunfish that survive below the dam will be wiped out due to competition and reduced habitat from low water flows. Pollution will also take a larger toll with less water.

Due to Reynolda Gardens being an open park to the public there is a large amount of human interaction. This interaction comes in the form of pollution or physical interruption to the habitat. The pollution comes from runoff oils from the cars and trash left in the park by people. The physical interruption comes from people fishing or capturing frogs. This disrupts the already diminishing ecological balance within the stream. As the stream continues to hold less water the pollution will not be diluted as rapidly and become more potent thereby proving more dangerous to all species of organisms dependent on the stream.

Conservation: Although the habitat of Lake Katharine has been changing for the past 100 years there is a possibility to preserve the habitat that exists now. This can be done by securing the paths of the waterways that still remain. This ensures that the fish will still have sufficient waterways to live in. The two methods of preserving the stream are by using rocks or a synthetic liner to line the streams and stream banks. These two materials will prevent plants from extending into the water and trapping sediment. The materials will also provide easy access to all parts of the stream since they can be walked on. This access allows for maintenance, if any, to be done quickly and efficiently. An example would be if a large tree branch fell and blocked the stream it could easily be removed from the stream. Another preservation method would be to deepen the waterways. This would increase the overall water volume of the system especially right above and below the damn. This could decrease the effect of eutrophication and any other

sort of contamination. It would also increase habitat space for the fish and other species in the streams. Both of these suggestions should result in net positive effects on organisms of Reynolda Gardens and should increase the overall carrying capacity of the streams.

Figure 1: An overhead view of Reynolda with site locations marked along the streams.