Fishing for Diversity:

Aquatic Community Surveys and Habitat Characterization in Parkers Creek

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Biodiversity: a biological concept that aims to define the myriad of ways that life expresses and arranges itself. But what does this term truly encapsulate and why is it of significant importance to the ACLT as we progress into the future? Firstly, biodiversity is defined in a *diversity* of ways but can generally be summed up as the variation of living organisms found on earth, in all shapes, sizes, and functions. The diversity of life is usually thought of on the species level—e.g., observing a great variety of tree species in the forest. Yet, it is much more intricate than this description.

The term 'biodiversity' spreads its roots back to 1986, when the National Forum on Biodiversity, held in Washington DC, published the meeting's proceedings. This was the first publishing that contained the term 'biodiversity' in its title (Chiarucci et al, 2011). During this time period, many researchers, environmentalists, global leaders, and other citizens were becoming distressed at the rapid loss of global species. Since then, the concept has frequented itself in conservation research and political decision-making. The Ecological Society of America (1997) defines biodiversity as such: "Short for biological diversity, biodiversity includes all organisms, species, and populations; the genetic variation among these; and all their complex assemblages of communities and ecosystems. It also refers to the interrelatedness of genes, species, and ecosystems and their interactions with the environment. Usually three levels of biodiversity are discussed—genetic, species, and ecosystem diversity."

Genetic diversity describes the immense variety of genes found within a species or population. This foundational level of diversity is why some have brown eyes and others have blue; it is genetic diversity that allows for the evolution and expression of species. By possessing a strong genetic diversity, a species is able to adapt to a dynamic environment and avoid extinction. For example, the resiliency of the Atlantic Salmon (*Salmo salar*) during colonial times up until the mid-20th century can be chalked up to the variety in this species' genetic makeup. When faced with constant habitat degradation, sub-populations of *S. salar*, which possessed distinctive genetic composition, were able to push on and spawn in diverse habitats along these rivers and streams (Greenberg, 2010). It was their genetic elasticity that liberated them from extinction.

Species diversity can be summed up as the variety of different species that occupy a habitat or a given region. This region can be as small as a puddle or as large as the planet. This level of biodiversity accounts for species richness (S), or the sheer number of species present, and evenness (E), or how spread out the individuals are across species (i.e., 500 striped bass and 1 bluefish in a region would show a low evenness). We most often think of this level of diversity when faced with the term 'biodiversity'. Similar to how genetic diversity perpetuates a species, species diversity perpetuates an ecosystem. Think of a pond that contains one species of fish (pond A) versus a different pond that supports 10 species of fish (pond B). Now, a fish killing disease comes along and infects both ponds. In pond A, the single species is wiped out. In pond B, 2 species are wiped out but the other 8 species were not affected and therefore can continue to function in the ecosystem.

Finally, there is **Ecosystem diversity**. This level focuses on the variety of ecosystems present in a particular region. It factors in community diversity (how living things interact with each other in an ecosystem) and abiotic diversity (morphology, etc. of an environment). A diverse range of ecosystems throughout the world is vital

Diversity of Species

for supporting a great variety of species as well as providing mankind with a plethora of services.

All three of these levels cooperate and culminate into what could be viewed as life's defense systems; genetic diversity keeps species from inbreeding and/or extinction, species diversity keeps an ecosystem functioning, and ecosystem diversity supports large communities of diverse species which will retain a robust genetic make-up within their populations and sub-populations. It is all connected. Our actions, such as habitat degradation, have continually threatened the world's biodiversity. Although there are checks and balances that keep life's diversity tenacious in the face of change, there is a limit. Referring back to the story of the *wild* Atlantic salmon, this species is no longer commercially harvested and there only remain small populations in northern latitudes; mere fractions of what this species used to be (Greenberg, 2010). Why, you may ask? Even though their genetic diversity allowed the species

to survive blow after blow of habitat loss, it was not enough as the vast majority of suitable spawning habitat was devastated by human expansion. The species could no longer reproduce, as many of these streams were not conducive to salmon spawning anymore. Our actions as a species clearly have a lasting ripple effect that echoes throughout ecosystems, however, what effect does biodiversity have on mankind?

Besides aesthetic purposes, biodiversity assumes the role of providing society with an array of ecosystem functions. Basically, the services provided meet all of our fundamental needs: food, shelter, water, and medicine. Food and medicine are found in the variety of plants and animals inhabiting ecosystems. Shelter, water, and protection are from the variety of ecosystems. Wetlands buffer storms along the Gulf of Mexico, forests provide timber for construction and the quality of air that we breathe, and the list goes on. Biodiversity and habitat ecosystem services from Calvert County alone were valued at roughly $47 million dollars annually in 2010 (Campbell, 2017). Understanding the value of diversity economically and biologically speaks to a large amount of people and the ACLT seeks to understand the value of diversity throughout the Parkers Creek Watershed.

Recent initiatives have our staff and science committee focusing on projects that are dedicated towards establishing baselines of diversity that can be analyzed and monitored over time. This data illuminates our ecosystems and allows for habitat to be properly managed. Our 2017 fish diversity survey in Parkers Creek was one of the most recent of these baselines to be documented.

The methods we employed for this fish diversity survey focused on capturing data for three characteristics in the Parkers Creek ecosystem: aquatic communities, water quality, and shoreline vegetation composition. A total of 12 sites were selected along the creek. 7 of these sites (yellow in **Fig. 1**) were sampled using a 15 meter seine net in March, June, August, and October of 2017. In addition, a beach site (white in **Fig. 1**) was also sampled with the seine net during each of these surveys in hopes to observe somewhat of a comparison between the creek and bay ecosystems. Seine hauls commenced after slack low tide and continued throughout the flood tide with one pull at each site. During the lower tide, fish have less of a chance to escape into the marsh grasses that constitute the shoreline. After capture, all organisms were identified, counted, measured to the nearest millimeter, and subsequently released back into the creek. In the upper reaches of the creek, much of the bottom is obstructed by fallen debris due to the fact that the shoreline vegetation shifts to riparian forest and the water becomes shallow and sluggish in these sections. Hauling a seine net was not feasible in this portion of the creek, yet we did not want to leave it unsampled. Instead of seining, 5 fish traps were placed throughout this segment (red in Fig. 1) in May and September. Traps were baited and left in the creek for one day, after which all organisms were identified, measured, and released. While this methodology differed from seining, it allowed for a view into fish assemblages that are distinct from the populations observed downstream in higher salinity.

Water quality and shoreline vegetation were two other habitat characteristics that were sampled in conjunction with the seine hauls. At each of the seven seine netting sites, shoreline vegetation was identified roughly 5 feet inland. The benefit of documenting this vegetation is not only to observe plant community structure, but also to understand how favorable the habitat is for fish. For example, research has shown that shoreline vegetation is vital in creating ideal habitat for certain larval and juvenile fish development. On top of this, the abundances of larval and juvenile Mummichogs (*Fundulus heteroclitus*) were observed at lower numbers when in a predominantly *Phragmites australis* (invasive reed) marsh versus a *Spartina* (genus of native cordgrass) marsh (Able and Hagan, 2003).

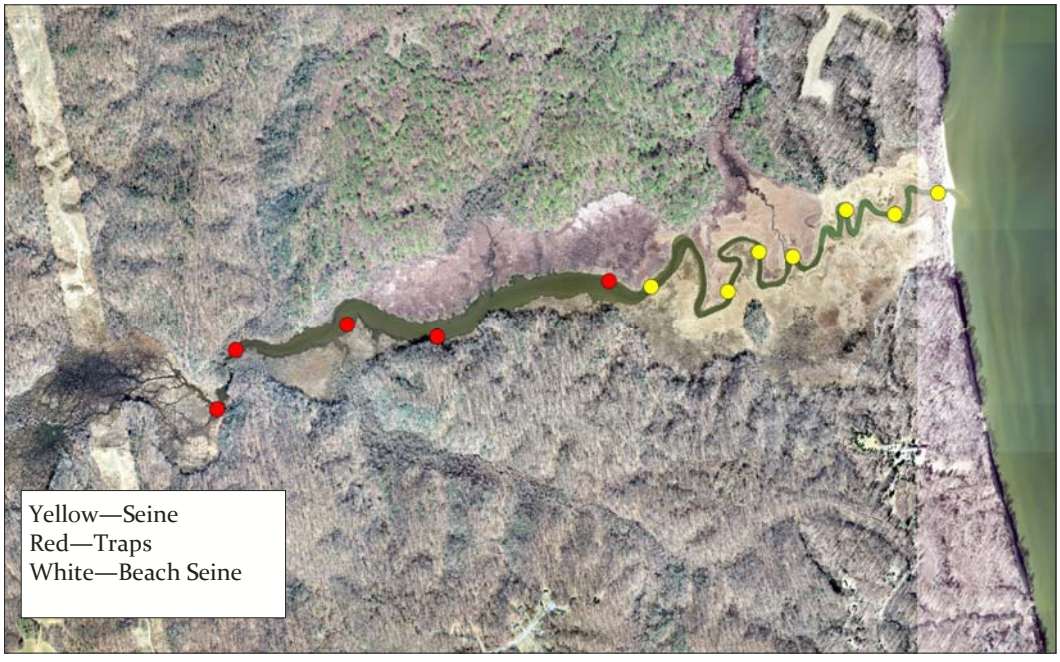

Figure 1. Master map of fish trap and seine sites along Parkers Creek.

Mike Molina and Tim Wells hauling a seine net in June of 2017.

Each site was also sampled for various water quality parameters such as dissolved oxygen, conductivity, salinity, pH, depth, temperature, and turbidity. These measurements factor into the environment's capacity to support a diverse community of aquatic species. Furthermore, this data provides clues that aid in understanding any ecosystem imbalances, such as anoxic conditions, that could potentially be observed in the future.

Separate from the sampling in the creek was a daylong electrofishing excursion within tributaries that feed into Parkers Creek. Following the Maryland Biological Stream Survey's (MBSS) protocols and aiming to collect data from streams that were not previously sampled by MBSS, two stream sites were sampled with backpack electro shockers; one on the North Side of the creek known as the Horse Swamp stream, and the other near the North-South connector trail within the South Side properties. Sampling took place in July of 2017.

The results of this study will be reported in the spring 2018 edition of the *Watershed Observer*.

Works Cited

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http://www.thecompetitionworld.com/2014/11/biodiversity-and-its-value.html—Diversity of Species

A Bountiful Year at the Farm

In 2014, ACLT's Board of Directors changed the purpose of Double Oak Farm from a CSA to a donation and educational farm. Since then Double Oak Farm has engaged new volunteers, developed visionary regenerative projects, and inspired increased involvement from local community groups and schools. Overall, 2017 was outstanding! Here are just a few highlights:

- An unstoppable force named the Lavender Girls, began their work on a row of native flowers. The project was a stunning addition to the farm and more is yet to come.
- Volunteer Project Manager Birgit Sharp continued work on ACLT's Food Forest. She spoke on the project to several prominent local groups and was also featured in the *Bay Weekly*.
- Long time friend and partner, the Tidewater School, participated in a year long "Peanut Project". Beginning with a lesson from Volunteer Farm Manager, R.T. West last February, students raised peanut seedlings, planted them in their own row, then in November picked, dried and shelled them. The project wrapped up with the class visiting ACLT before the holidays to make peanut brittle and candy.
- Without question, we are most excited to share that, through the hard work of a small team of weekly volunteers and staff and the supporting help—an hour here and there of many—a record breaking **7,000 lbs.** of naturally grown produce was donated to St. John Vianney's Interfaith Food Pantry.

The ACLT Staff and Board are extremely proud of the people and work that has made the Double Oak Farm program a tremendous success. Plans are in the works for 2018. For more information on how you can get involved at the farm, contact ACLT's Community Relations Coordinator, Pam Shilling at volunteer@acltweb.org.