Key Largo Anglers Club Lakes Internship

Final Report

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**Introduction:**

The Key Largo Anglers Club is located on the northern end of Key Largo. It began as a fishing village, progressing into that of a private club with a reputation for “providing a unique and casually elegant fishing experience.” It is part of a 46-acre property, with both a series of condominiums and standalone homes spread along the northwest coast of the key, facing Card Sound Bay, alongside its sister community The Ocean Reef Club.

The park itself was initially a Caribbean jungle, dominated by a variety of hardwoods and species normally found on the various islands and land masses farther south. The first colonization along with the fishing village, was that of an agriculture field for pineapple. Once the Anglers Club took root and began to transform towards the present-day community, a golf course was built, and the series of 5 interconnected lakes were dug out of the coral rock. It was in 1996 that 6 acres around the lakes were dedicated as a permanent green space.

The lakes cover 2 acres of the park and contain roughly 4.5 million gallons of salt/brackish water in the system. It consists of 5 interconnected lakes, with 6 waterfall locations, along with a smaller shallow pond, referred to as the Reflection Pool/Pond, in which the highest variety of herbivore species live and where I spent most of my effort in maintaining. Also stationed at strategic points in the water system are 4 filter boxes, in which several coarse pads were implemented to filter the recycled water, and when suitable, housed the microbes that were added to combat the algae overgrowth plaguing the system in recent years.



Figure 1: Map of the Park and Lakes

Since the lakes conception, members have been relocating some of the more prominent local species to the lake system, to provide a glimpse into what could be seen out on the flats of the sound, or along the mangrove coastal waters. That includes various species of fish, from both the flats and open ocean, consisting of higher trophic level species. During my 3 months on site, I assisted with the relocation of 1573 fish and crustaceans from the surrounding waters to the lake system.

 At the time of my arrival, I was the second individual to take up the role of Lakes Intern with the Anglers Club. The first, a freshman at Williams College, had been there 6 weeks of May and June 2020, ending early due to covid restrictions. Ben Cart, one of the Parks Committee Board Members, had enlisted assistance from his alma mater, to provide interns for assistance and guidance to the club.

There are several personnel with whom I coordinated my efforts for the lakes. First, Ben Cart, who is a member of the Parks Committee, has invested much of his time and effort into the management and improvement of the lakes. His assistance and guidance were indispensable with my integration and work ethic during my time on site. Christian Schlutz, my direct supervisor, is one of the dockmasters at the marina, and graduated with a degree in marine biology. Any assistance I needed with my initial interactions with other employees of the club or any rules or ideas I would run past him to see if it had either been done in the past or had a chance of succeeding now. Brian Judge, the contracted Lake Technician, was on site 2 days per week to manage the pumps and boxes, and we conducted several experiments with various subject materials to see if there were any viable options to combat the algae overgrowth, I was growing accustomed to. Other personnel included Jeff Demott, who originally dug out the lakes, and a caretaker of the University of Miami’s Biological Station on Broad Key, and John Larkin, an environmental consultant.

Given the recent establishment of the intern position, the focus of my time here was to better streamline the activities of future interns, by better facilitating the available tech and workspace to conduct scientific research and data collection of the lakes more efficiently.

**Initial Experience/Challenge**

My initial housing was as a guest to Ben and Sarah Cart, with whom I had initially learned about the opportunity. I was their guest for the first six weeks of both the internship and my academic semester, at which point I transferred over to employee housing to better facilitate my academic and work schedule.

With my role as a lakes intern for this duration of time having no precedent, my submitted objectives covered a wide range of subjects. Coincidentally, my academics of the time were Plant Systematics, Ichthyology, and Conservation and Management of Marine Resources paired well with my efforts with the lakes. My workspace consisted of a newly built shed on the Cart’s property, and as the semester progressed, it was fitted with electricity, running water, and plans to add an A/C unit to combat the heat of the summer.

My personal learning objectives involved the transition and growth of the skills and knowledge I learned in the classroom to that of the worksite, especially in marine ecosystem management. Even more so during this time of online classes, the opportunity to acquire hands on experience with data collection and educational interactions was essential to my overall success.

The focus of the lakes management that was compiled for this internship consisted of seven objectives, covering all the basics that were to be addressed to some degree. The largest portions of my hours went towards algae control/identification (35%) and the collection of specimens (20%), with the various trails (10%), data collection (10%) and maintenance of the aeration systems and surrounding vegetation (15%) having more infrequent or shorter timeframes of activity. Lastly, educational interaction with the community (5%) and excursions off site (5%) were one off occasions.

The conducting of algae control by manually removing algae matts along the lake shore, throughout the reflection pond, and waterfalls. With at times a significant amount of plant matter being removed, the rate at which levels of algae throughout the lakes returned to similar levels was quite discouraging towards my own sense of completion. Especially in preparation for an event being held in the park on March 14th, I personally hauled an estimated 1500 pounds of algae in 20 hours over 4 days.

The collection of specimens was twofold. First, to better complete the skewed food chain hierarchy that has been built up from decades of introduced species, leading to a trophic top-heavy ecosystem. As stated, over the three months I was on site, I have assisted in the logging of over 1,530 individuals added to the lakes system. The majority being mullet and pilchards caught via cast net, or blue stripped grunts and mangrove snapper by fish trap. Especially for the Reflection Pond, there was clear evidence that the mullet presented a positive proponent to some reduction in algae growth on various rock surfaces. Secondly, over recent years, there have been several larger die-offs of species due to hurricanes and other external inputs, so species diversity was in need to be recovered.

Working alongside Lake Technician Brian Judge, I conducted several trials towards the combat of algae growth. The raising of copepods and rotifers while initially successful in growth, overall proved ineffective, as there were several variables in play. In addition, we implemented an experiment by adding Aluminum Sulfate (and equal amounts of Sodium Bicarbonate) to Lake 2, to target phosphorus levels as a possible factor in algae propagation. This also proved to be unlikely, as testing of this lake and control both released the same minute levels of phosphorus.

Unlike the original list of data variables initially anticipated to measure, the available tools were quite limited. Of the equipment accessible upon arrival were several microscopes, several pipettes, a salinity refractometer, and a dissolved oxygen meter. Eventually, adding a handheld pH meter and having several thermometers placed strategically throughout the lakes allowed me to take these four measurements consistently, and all data was collected and logged into an excel spreadsheet for viewing.

Throughout my time onsite, I interacted with many club members, guests, and employees. From hearing their views on the lakes compared to the past, to engaging in opinionated discussion over their views over aspects regarding the use of microbes, to the effectiveness of waterfalls occurred quite frequently. I also manned a table covering algae management and the reflection pond habitat during an event promoting the park on March 14th. There I educated members on my role at the park and what has been going towards the renewal of the species diversity and ecosystem health.

Finally, though I was unable to accompany University of Miami personnel to acquire specimens on their vessel, I visited their biological station on Broad key several times, either as an informational tour or to acquire a different spectrum of local specimens caught in the channel. Also conducted several trips to interact with larger specimen collection via flat-fishing and mangrove exploration.

**Data / Challenges**

Stemming from my objectives, I conducted a wide assortment of activities, varying from tasks completed each day, to singular excursions or events for the club. For the collection of specimens, I would utilize a strategically placed fish trap set on the breakwater, but the larger catch percentage was via my 8-foot cast net, a skill I take significant pride in. Also utilized were dusk/dawn expeditions for capture with hand nets, which doubled as educational experience for guests that would occasionally accompany either Mr. Cart or myself.

For algae management, it was trial and error for the most efficient way of removal, and alongside Mr. Judge we attempted several options, from usage of pumps and skimmers to simple manual labor. I must admit the number of 5-gallon buckets I have filled with plant matter is a large number and I do not wish to recount, but given the regrowth rate, it was at least mid-400s, given my constant return to the same places. The growth rate was noted to accelerate as we progressed through end of winter and into spring/summer. The club itself had invested in microbe treatment over the years, and besides some initial success, it had not proved to be effective in recent years, according to personnel familiar with the lakes. As such, my arrival was the first major attempt at algae removal in over 8 months. Those initial attempts at removal were arduous. Along with the floating mats alongside the edges, I would adjust and maintain the physical system operations to keep efficiency at its maximum. That would include the management of the four bio boxes, and the exchanging of filters of the hayward pumps. With the algae and mussels small enough to get through the plastic filter, the waterfalls themselves needed periodic cleanings, with obvious results, though the success short-lived. In addition to the lakes themselves, I also helped manage the surrounding vegetation, assisting the landscape crew with the clearing of dead branches and overgrown/unwanted flora.

The Reflection pond was where I directed my efforts most days throughout my time at the Anglers Club. It was a microcosm of sorts, given that that the majority were added either by Ben or my own hands, and that I was able to see progress on a daily basis. At the same time, the reflection pond was hit with some of the highest growth rates of algae, warranting such constant attention and work. Efforts were put in place to create more cover for the larger species, such as parrotfish and sheepshead, and generate more variable habitat for the well over 20 species in this pond.

For data collection, I had initially completed onsite salinity sampling of the bay, marina, and various locations in each of the connected lakes. As the time progressed, and my available tools increased, I transitioned from daily salinity to that of the complete available spectrum of salinity, oxygen, temperature, and pH, completed weekly, or anytime something of significance occurred (weather/algae bloom). There was a life lesson learned, regarding the finesse of the instruments. My initial readings of the waters dictated much lower readings (12-15 ppt) than in years past (20-22 ppt), which greatly pushed for action regarding finding the cause and alleviating it. Only after the attainment of the other gear and reviewing the functioning of the tools, the problem was recognized that the previously conducted sampling with the refractometer was done with it not calibrated correctly.

Expanding on the trials conducted to combat the algae overgrowth, Mr. Judge, Mr. Cart, and I worked on the propagation of first rotifers and then copepods with the intent to introduce large quantities into the lake system, both to feed on the current algae matter and add another trophic level to the food web. With the acquisition of a water barrel and aerators, the samples attained had initial success but eventually it was unsuccessful, as the algae growth was unhindered and at times even accelerated with the addition of the organisms. It was concluded that possible hindrances to the success included the schedule of transfer of food and waste to and from the various containers to be ineffective, along with the organism itself, acquired through commercial sites, was much less aggressive than what we required, due to their usage for home aquarium usage. The final trial was conducted by using a barrel and a hose flowing into lake 2, to the top left of the map, to input aluminum sulfate, commonly used to reduce phosphate levels in lakes, to see whether it could have an effect on the top water algae matter which I refer to as pond scum. Over the span of 2 weeks, we added 200 pounds of Aluminum Sulfate, both directly to the bottom of the lake and through the water pump and waterfalls along the south side of the lake. At the time of this report, Mr. Judge had taken a control and test sample for tested, and the results concluded that there was no change in phosphorus, already being at a low level to begin with.

**Summary:**

 Given my own personal situation, along with the worldwide pandemic and the associated changes to various aspects of our daily lives, this opportunity was a silver lining, of which I am greatly thankful to Ben and Sarah Cart, who introduced me to the Anglers Club and graciously hosted me during my time with the club. As mentioned throughout the report, with my role being as unprecedent for the club, especially for the longer timeframe than the initial intern, there had been multiple challenges faced and certainly the associated opportunities for improvement. With the hours required (415) to be completed in the span of 12 weeks for my academic internship, it was quite the task as I attempted to put 35 hours minimum a week on top of my full academics, especially given my personal quirks that while enthusiastic, do hinder my time management. Further, given that I was the one setting the foundation, the experience was unstructured, given the responsibilities I was tasked with. At times, the reporting structure seemed ill-defined, as my direct supervisor Christian was mainly directed at the dockmasters, but along the same lines Mr. Cart, being my host, also had a push towards my increased efforts to complete tasks out of the priority order. While I am a strong proponent for manual labor, the actual amount of labor necessary to reach the proposed exceeded my expectations greatly. Ranging from just 48 hours to roughly a week was the timeframe for algae to regrow over various waterfalls, spillway and in the reflection pool. It just became to the point where the physical overwhelmed the scientific in every way.

 The interactions with the club’s personnel, guests, and members were overall extremely positive. I was able to interact and hear their diverse opinions regarding various aspects of the management and intervention of the present/past lake system. Whether that was the usage of microbes, the addition and placement of waterfalls, the data on the various variables of the lake’s chemical and physical properties, or overall infrastructure. At times, there were misconceptions by members on my role both in the lakes and the usage of my time for their own benefit.

An identified ongoing concern is the current species complement taken through a conservation standpoint. The project would benefit from a curated acquisition of marine specimens.

 While I was unable to implement any major progress changes to the problem revolving around the abundant growth of blue/green algae, I believe that there are some real possibilities, one of which being the continued addition of herbivore species such as mullet to reduce the amount of free floating and tethered algae. In addition, the growth of filter feeding animals, such as anemones, mussels and tube worms encouraged to reduce the muck content and suspended algae.