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Sean Meagher
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Professor Kathy Shea
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Abstract

Different waterfowl species prefer to stop at different kinds of ponds during their seasonal migration. Some prefer smaller, more covered ponds, whilst others prefer larger bodies of water. This preferential difference has an effect on where transitory aquatic birds choose to stop on their migration routes. Many areas of wetlands across the US are under threat and it is important to understand which areas need the most attention for protection. In order to study this, I observed waterfowl movements in Baseball and Big Ponds in the St. Olaf Natural Lands twice a week for five weeks. I then analyzed water quality measurements in addition to size and landcover surroundings to establish a difference between the two areas. The number of species observed in the two ponds was vastly different, 8 species at Big Pond and 3 species at Baseball Pond. The Secchi depth and conductivity between the ponds were both significantly different from one another. Furthermore, the number of individuals of Canadian geese and mallards at Big Pond per week were significantly different, showing an increasing rate of migration at that pond, whilst Baseball's two most commonly observed species did not significantly increase per week. Overall, these results show that more species of migratory waterfowl prefer Big Pond, the larger and more open pond with less pollutants, despite having less clear water and an overall shallower death. These results underpin the importance for protecting large wetland areas as a refuge for migratory birds.

Introduction

Birds across the US are in decline, due to many factors such as habitat decline and predation by cats. Even common species are in decline, which will have catastrophic repercussions for the ecosystem since they fill many important ecological niches (Pennisi 2019). According to Pennisi, only a few species buck this general trend, such as raptors and waterfowl. Raptors have increased in numbers in the last 30 years due to the banning of the insecticide, DDT. Waterfowl have been prevented from experiencing the same decline as other birds because of extensive conservation and habitat restoration initiatives that have focused on their primary habitat, wetlands. However, despite these efforts, wetlands across the US are still some of the fastest degrading environments, and many areas are still significantly damaged or otherwise disrupted, even after being restored (Vanausdall & Dinsmore 2019). This presents a

significant problem, since the immense amount of resources being poured into conserving wetland habitat for waterfowl is clearly not sufficient to fully maintain all of their potential habitat. Therefore, we must understand which types of wetland habitat will be preferred by different waterfowl species so as to best be able to focus our efforts towards preventing waterfowl from declining like the rest of the bird species in North America.

By studying which ponds are preferred by waterfowl during migration, we can then know which ponds are best to protect since by focusing conservation efforts on ponds that are heavily trafficked during migration, more birds can be protected overall. Therefore, it is important to understand which wetland systems are most important to conserve because of their roles as lay-over ponds for waterfowl during migration. Essentially, we can protect not only that wetlands' avian community, but also the waterfowl communities of every pond and wetlands area who travel through that target pond during the migration, thereby increasing the effectiveness of the conservation effort. Therefore, for my research project, by observing waterfowl during the fall, in October and November, I can best understand waterfowl migration habitat preference for wetlands (Schummer et. al 2010). Also, the behavior of waterfowl changes in response to migratory time periods, such as feeding and resting rates, which could shift their lay-over pond preference (Frederick et. al 1987). In order to be able to survive migration more effectively and conserve energy, Frederick et. al found that snow geese were more likely to exhibit more feeding and resting behavior closer to migration, presumably to increase the amount of available energy so as to best be able to traverse the huge distances, flying southwards. However, the waterfowl species also differ in lay-over pond preference during migration, as different species prefer different pond aquatic conditions such as water clarity, and body of water size (Webb et. al 2010). Furthermore, the more polluted a pond is, according to Webb et. al (2010), the more

negative effects on migration traffic that pond receives, which clearly would affect wetland habitat preference.

Therefore, in order to best understand which wetland habitats are better for migratory waterfowl as migration lay-over ponds, there must be several observed trends. Firstly, there should be increasing numbers of waterfowl moving through the area as it experiences higher amounts of migration throughout the season (Schummer et. al 2010). Secondly, the community around the wetland habitat will have high levels of diversity and species richness, for waterfowl (Vanausdall & Dinsmore 2019). Thirdly, there should be a difference in preference of species for different wetland habitats based on the surrounding habitat and chemical composition of the pond or lake (Web et. al 2010). And finally, there will be elevated levels of feeding and resting exhibit by waterfowl during migration (Frederick et. al 1987). In order to study these observed trends, I examined two ponds in the St. Olaf Natural Lands for an extended period of 5 weeks, October 3rd to November 3rd.

For my independent research project, I created the following alternative hypotheses based off of the previously stated literature findings:

1. The numbers of waterfowl spotted at the preferred pond from week to week will increase as migration proceeds.
2. The more preferred pond for migration will have higher levels of species richness and Shannon and Simpson diversity indices.
3. The two ponds I analyze will be chemically distinct and have different surrounding habitats.
4. Waterfowl will exhibit changes in their behavior as the migration season progresses

Therefore, the objectives of this study were to A) note differences in numbers and species of waterfowl between two different ponds to understand preference and use that to calculate diversity and migration rate, B) analyze water quality to establish the difference between the ponds and compare that to migration rates and diversity, and C) observe whether there was a change in behavior of migrating waterfowl as migration progresses at either pond.

Methods

Pond Choice

In order to better understand what kind of habitat different species of waterfowl would prefer, I observed birds at two habitat distinct ponds in the St Olaf Natural Lands, Big Pond and Baseball Pond. Baseball Pond was small, around an acre in surface area, and surrounded by heavy woods, bordered by a path and around 100 meters from a road, Cedar Ave. A drainage ditch ran directly into the pond from the road, and the water was very deep, going past my waste a meter from shore, thusly roughly a meter deep a meter out. Big Pond was much larger than Baseball Pond, nearly 9 acres in size, and was very shallow, only a few centimeters deep a meter from shore. Half of its shoreline was as heavily wooded as Baseball Pond, the other side being completely bordered by open prairie, and since having an induced drawdown, the body of water was surrounded by 3-4 meters of mud flats. These were ideal ponds as they possessed very different habitats and were easily accessible.

Waterfowl Observations and Water Quality

In order to analyze the differences in observed species and diversity, I went out to one of the ponds, arriving half an hour before sunrise to observe what species and how many

individuals were present initially and how many flew in or out for two hours. Simultaneously, I also noted the types of behavior exhibited by a select group of mallards within the present community for half an hour. After completing the two-hour observation session, I took water quality measurements, analyzing Secchi depth, temperature, conductivity, and pH. Then, I headed to the other pond to take water quality measurements there as well, and whilst doing so, I noted down the species present at the time, as well as their numbers for a snapshot of what species were there as well, so I could include more species observations in my community measurements. I took measurements for 5 weeks, starting on October 3rd, and ending on November 3rd. I always started with a two-hour observation period at Big Pond on Thursday, and Baseball Pond on Sunday.

Statistical Analysis

Contingency table analysis was performed on total number of observed Canadian geese and mallards at Big Pond and mallards and wood ducks at Baseball Pond, week to week for five weeks. I also performed contingency table analysis on observed behavior of mallards at each pond for the four weeks I had data. Furthermore, a multiway ANOVA test was conducted on the water quality analysis data, compared to site and time period. The two sites were Big and Baseball Ponds, and the time periods were early migration, 10/3-10/20, and late migration 10/24-10/31. I performed the contingency table analysis for total weekly numbers of the species of waterfowl that were at each pond almost every week, which were Canadian geese and mallards for Big Pond, and mallards and wood ducks for Baseball Pond. Since mallards were the only species present at both ponds, almost every week, I chose them to use for the model behavior and completed separate contingency tables by pond.

Results

Waterfowl Observations

I found that Big Pond massively outstripped Baseball Pond in the sheer size of the community and the species richness, 8 to 3 and a community of 2520 to 33 individuals (Table 1). However, Baseball Pond had higher diversity than Big Pond, even though it was less species rich, since it had more balanced numbers of each species within the observed community. The huge number of Geese I observed likely skewed the Shannon and Simpson indices. I chose to include aquatic shore bird species (greater yellow legs, killdeer, and solitary sandpiper) in with waterfowl, as they are wholly dependent on wetland habitat for survival and are also migratory (Table 1). Overall, Big Pond had higher levels of diversity, based solely off of species richness and its community size.

Furthermore, in order to quantify the desirability of Big Pond compared to Baseball Pond for waterfowl, I created a bar graph of how many mallards, which were consistently observed at both ponds, spent the night at each of the ponds (Figure 1). Big Pond had vastly more mallards that spent the night, and on week four, more mallards were present initially at Big Pond than I saw after 5 weeks of observations at Baseball Pond.

Migration by Pond

To examine the extent of migration at each pond, I analyzed the total number of individuals of the most common species observed each week at both ponds using contingency table statistical analysis. I found that Big Pond had a significant increase in observed Canadian geese and mallards each week, with a p-value of 2.2×10^{-16} (Table 2). Baseball pond had no

significant change in its weekly observations of mallards and wood ducks, which were its most common species each week.

Waterfowl Behavior

In order to analyze my results from waterfowl behavior, I also used contingency table statistical analysis, one for each pond's weekly behavior data. I could only observe mallards' behavior since they were the only common species between each pond, and I found no significant changes in the behavior of either pond's mallards from week to week (Table 3).

Water Quality

Using a multiway ANOVA test, I found that Secchi depth and Conductivity varied significantly by pond site (Table 4). Big Pond's average Secchi depth of 10.5 cm was significantly smaller than Baseball Pond's average Secchi depth of 52.8 cm, with a p-value of 3.613×10^{-7}, which showed Baseball Pond to have clearer water than Big Pond. However, the average conductivity of 131.9 mS at Baseball was significantly more than the 101.7 mS average at Big Pond, with a p-value of 0.000305. There was no significance by the temperature, or the pH proton values, by either pond site or date, and there was no significant variance of conductivity or Secchi depth by date.

Discussion

General Discussion

The ponds appear very different in their species and quality, and that trend shows throughout the migration period, starting from early migration at the beginning of October, and

entering into the middle of migration at the beginning of November. Most importantly, I observed that there was a large difference in species richness, in favor of Big Pond, and that Big Pond had statistically significant increases in individuals of mallards and geese each week, while Baseball Pond did not exhibit that same significance. This showed that as the migration proceeded, and more waterfowl moved through the area, they chose to land at Big Pond in increasing numbers, whilst avoiding Baseball Pond. Furthermore, it also demonstrates that more species overall preferred to land at Big Pond, during their migration. Finally, the water quality results further illustrate the differences between the two ponds, with Baseball Pond being more polluted by road run-off, and the water clarity of Big Pond not affecting its desirability to passing waterfowl.

Difficulties with Data Collection

Throughout the study, several challenges arose that I could not always compensate for, which may have skewed the data. First of all, the pH meter malfunctioned close to the end of my observations and would not zero to 7 pH in a buffer solution, until eventually no longer reading pH at all. Secondly, an early freeze hit the ponds, causing Big Pond and Baseball Pond to both began to partially ice over on the 27th of October. This made it nearly impossible to take reliable water clarity readings at Big Pond because of its shallowness, and extremely difficult at Baseball since I had to break through the ice to get to the water, which would disturb the sediment and cloud the water. Thirdly, the joggers on the path around Baseball Pond repeatedly scared away birds, which led to never observing a static population of waterfowl there for longer than 45 minutes. Furthermore, there was an extremely territorial muskrat that had taken up residence within the pond and would chase away any interlopers with stunning alacrity. These two factors

combined likely reduced the desirability of Baseball Pond to passing waterfowl. If given the chance to continue this experiment, I would ensure my equipment was in working order, and that I would put up a sign on one end of the path by Baseball Pond, requesting joggers be quiet and walk slowly so as not to intrude upon my duck observations. The weather cannot be planned for, but if given the opportunity, I would start my observations earlier, to get more measurements before the ice came in.

Behavior, I found, was extremely difficult to quantify, and is an area where I could definitely have improved my methodology. I could only take one behavioral assessment per observation period, and since I started on the second week, I had a severe shortage of data. This made it difficult to come up with statistically significant results, since I was only able to go out twice a week, rather than every day. Furthermore, since only mallards were consistently at each pond, I could only really take observations for that species, since Canadian geese only visited Baseball Pond once, while I was there, and wood ducks both never visited Big Pond and never stayed long enough for me to make half an hour's worth of observations. I think if I were presented with the opportunity to do an experiment like this again, I would focus less on spending two hours observing waterfowl movements, and more time simply completing snapshot visits rather than staying for an extended period of time. This would allow me to then take more measurements more consistently each week overall, and therefore obtain more behavioral observations each week. Furthermore, by going out more often, I would be able to get a better idea of the species composition of the community and more reliable data on late and early season differences in water quality and migration rates. Overall, more data is always better for more reliable test statistics.

Comparison to Other Studies

My results of significantly increasing numbers of mallards at Big Pond as opposed to Baseball Pond contradict the findings of two other St. Olaf studies; a significant trend showing a decrease in mallard numbers at Big Pond found by Williamson (2006) and an insignificant trend found by Mathison (2013) that also supports a preference of mallards for Big Pond. However, Williamson's (2006) results on the number of geese increasing at Big Pond match my results that show the same significant trend. Furthermore, both studies appeared to see geese consistently at Baseball Pond, however, I only ever saw geese at Baseball Pond once, and mallards were the only consistent species. The differences I observed may have been due to Big Pond undergoing a drawdown this year, which created large mudflats, which is ideal habitat for dabbling waterfowl, especially geese and mallards (Sibley 2003). Furthermore, other studies have found drawdowns to increase species richness of communities as well as the number of individuals of each species (Kadlec 1962). This phenomenon results from duck food plants thriving in the shallower waters of a drawdown, which in turn draws in more ducks and more species of fowl to feed on the thriving vegetation (Carney and Chabeck 1977). Also, the presence of a rather territorial muskrat, scaring off birds, may have had an effect on the number of birds stopping at Baseball Pond, as would the morning joggers, whose loud noises scared away many ducks at Baseball Pond.

My behavioral results do not match either study's findings since I was unable to find any significance in behavior since I did not collect enough data. Since I didn't observe a trend for a change in waterfowl behavior, this also contradicts Frederick et. al (1987), which found waterfowl would increase feeding and resting prior to and through migration.

Neither of the two St. Olaf studies examined the water quality differences between the two ponds, however, and my results do show higher levels of pollution in Baseball Pond. Furthermore, one possible reason that the water was clearer at Baseball Pond was perhaps due to the pollution reducing the amount of waterfowl food plants able to grow in the water. Also, another important food source of waterfowl, macroinvertebrates and macrophytes, have been found to be reduced in diversity and numbers in ponds and ditches with more runoff (Ecke 2009). Additionally, most waterfowl also prefer to rest in cleaner water, and will not stay for long in water that is polluted, learning to avoid it over time (Webb et. al 2010). Since Big Pond had fewer pollutants, it most likely had a more robust food source and was overall more attractive for that reason to passing waterfowl. Baseball Pond had a drainage ditch running directly into it from Cedar Ave., which caused its pollution levels to be elevated, and explains the significantly higher conductivity. This would likely have a negative impact on food availability to waterfowl, and therefore reduce its appeal for them as a long-term resting spot.

Other Factors Influencing Preference

Other factors that may have influenced waterfowl preference towards Big Pond were its size. Since Big Pond is nearly 9 acres in surface area, according to Google Earth, it makes it very visible to waterfowl that fly through the air, especially since it is partly bordered by prairie, while Baseball Pond is surrounded heavy woodland and is only around one acre in size. Furthermore, the presence of shore birds at Big Pond instead of Baseball Pond speaks to the difference in habitat and size of the wetland habitat. Since the water was particularly low and shallow at Big Pond, with large mudflats, that was most likely very attractive for dabbling ducks and geese, specifically the mallards and Canadian geese (Sibley 2003, Webb et. al 2010).

Additionally, large, shallow ponds and wetland habitat with high amounts of shoreline and mudflats have been found to attract more species of waterfowl and shorebirds (Vanausdall & Dinsmore 2019).

Another factor that may influence preference is the presence of other waterfowl. Since waterfowl will call out to each other, the presence of waterfowl in a body of water will attract passing, airborne aquatic birds, leading to a compounding increase in individuals, as they see the water as safe since there are other birds present (Sibley 2003). This implies that as migration proceeded, and more and more waterfowl passed by on the wing, they spotted the elevated levels of waterfowl at Big Pond, and landed at Big Pond because of its ideal habitat and presumed safety, which no doubt contributed to the significant increases in observed individuals each week. Baseball Pond, on the other hand, with its already low population of resting ducks, did not have the same attractive qualities and presumed safety, and therefore, because of its proximity to Big Pond, would have been in direct competition for waterfowl preference. Since Big Pond had the more desirable features and already established numbers of waterfowl, it clearly won the preference of passing aquatic birds during the 2019 migration. However, one caveat to note in terms of species preference, wood ducks were only seen at Baseball Pond, most likely because the close, heavily wooded habitat is ideal for that species of duck, as opposed to the more open, large body of water possessed by Big Pond (Sibley 2003).

Waterfowl Preference Significance

Since waterfowl chose to land at Big Pond in significantly larger numbers each week, but not at Baseball Pond, this showed a preference for Big Pond as a lay-over pond during migration, as well as its much larger community size and species richness (Table 1). From these results,

and previous research, I am led to believe that most migratory species of waterfowl will prefer the larger, more open water bodies during their migration, as shown by Big Pond. Thusly, Big Pond is a sufficient representation of the sort of wetlands habitat that is incredibly important to preserve because of its disproportionate impact on the communities that migrate through it. Therefore, my research project underpins the need to protect large wetland habitats as Big Pond demonstrated how essential it was to the species migrating southwards by how many more species and individuals stopped at the habitat. By focusing on protecting habitats like Big Pond, we can prevent waterfowl from going the same way as so many other species of birds in North America, thereby maintaining a key ecological niche and seasonal occurrence with massive implications for the wider ecosystem.

Future Research

In order to see if this trend held true in the future, I would continue to study this for multiple years in the same sort time frame, going out more often to collect snapshots of numbers once in the morning at sunrise and once in the evening right before sunset, rather than spending two hours making extended observations. I would continue to study both Big Pond and Baseball Pond, taking both waterfowl measurements and water quality assessments, as well as attempting to note down behaviors in a more standardized and efficient manner. By continuing this research project for multiple migrations, I would be able to establish whether my findings were cursory or a significant trend each year. Furthermore, this could also show whether the drawdown was a significant factor in affecting species composition and preference, as the drawdown will not be done every year. Overall, if this project could be continued, I believe it could find or confirm

some very important factors influencing waterfowl layover preference, in addition to being amazing in every way.

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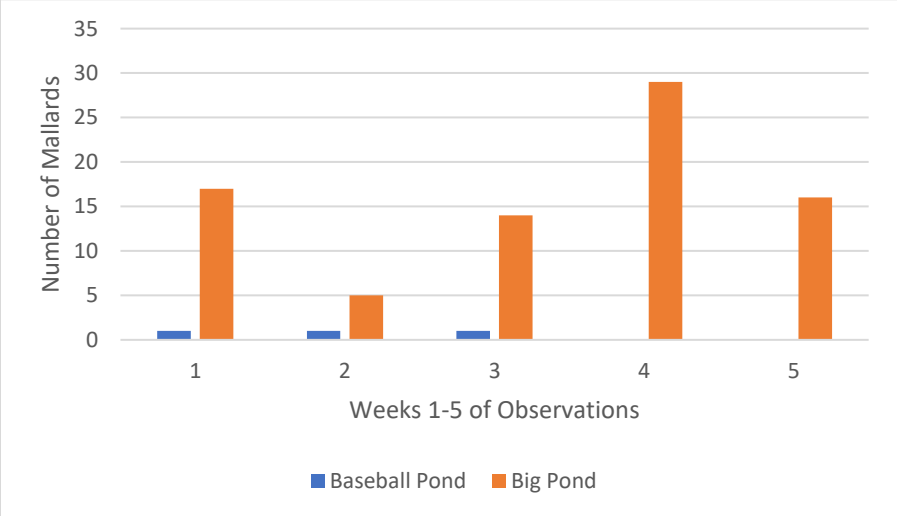
Tables and Figures

Species	Big Pond	Baseball Pond
Canadian Geese	2254	10
Mallards	195	15
Hooded Merganser	8	0
Wood Ducks	0	8
Blue Wing Teals	10	0
Greater Yellow Legs	17	0
Killdeer	25	0
Solitary Sandpiper	1	0
Ring Billed Seagulls	10	0
Species Richness	8	3
Shannon Index	**0.443**	**1.064**
Simpson Index	**1.240**	**2.799**
Community	2520	33

Table 1. **The Total Number of Individuals of Each Species of Bird Observed at Either Pond During the Observation Periods, Used to Calculate Diversity.** These are the total number of individuals and species spotted each time I made observations at either pond on both times I visited each week. Big Pond had a larger community size and higher species richness, but Baseball Pond had the higher diversity, since the large numbers of geese that were seen at Big Pond distorted the diversity.

Figure 1. **Initial Counts of Mallards at Both Big Pond and Baseball Pond**. I collated the initial count of mallards at both ponds, which would be the population of mallards that spent the night at each pond, and Big Pond had many more mallards that spent the night than those that did at Baseball Pond. On week 4, more mallards spent the night at Big Pond than I saw individuals at Baseball Pond after 5 weeks of observations.



Big Pond		
Week	Geese	Mallard
1	42	22
2	23	11
3	5	19
4	493	46
5	889	53
Baseball Pond		
Week	Mallard	Wood Duck
1	4	0
2	1	3
3	2	2
4	2	3
5	2	0

Table 2. **The Weekly Totals of the Most Common Birds Observed at Each Pond to Represent the Migration Rate.** I examined geese and mallards at Big Pond since they were consistently seen there week by week, and mallards and wood ducks for Baseball Pond for the same reason. I performed a contingency table statistical analysis of the numbers of individuals by date and found there to be a significant change in geese and mallard migration at Big Pond with a p-value of 2.2×10^{-16}, a X^2 value of 220.88, and 4 degrees of freedom. This shows that there was a significant increase in migration at Big Pond. Baseball Pond's contingency showed no significance, so therefore there was no detectable change in numbers of individuals, and therefore negligible signs of migration.

Big Pond	*Behavior Types*			
Week	Feeding	Preening/ Resting	Socializing	Warry/ Watching
2	0.73	0.27	0	0
3	1	0	0	0
4	0.67	0.33	0	0
5	0.73	0.2	0.07	0
Baseball Pond	*Behavior Types*			
Week	Feeding	Preening/ Resting	Socializing	Warry/ Watching
2	0.74	0.11	0.15	0
3	0.88	0	0.22	0
4	0.38	0	0	0.62
5	0.59	0.06	0	0.35

Table 3. **Percent of Time Spent Exhibiting Specific Types of Behavior for Mallards at Both Ponds.** I chose mallards since they were present at both ponds, consistently, and therefore comparable amongst each other. Feeding behavior was typified by the mallards dabbling and feeding in the water. Preening/Resting was typified by the mallards either sitting on the shore or

a log and sleeping or cleaning their feathers. Socializing was usually when they would call or fight with other mallards or waterfowl species. Warry/Watching was typified by mallards wandering around the pond, not feeding, and watching all the different coves and cover spots along the ponds' shoreline, and general acting nervous or skittish, but not feeding, socializing or resting. I performed a contingency table statistical analysis on my results but found no significant changes in data over the 4 weeks of behavioral observations, most likely due to a lack of data and observations.

Big Pond	**Date of Observations**									*Day Light Savings	**Average**
Tests	*10/3/19*	*10/6/19*	*10/10/19*	*10/13/19*	*10/17/19*	*10/20/19*	*10/24/19*	*10/27/19*	*10/31/19*	*11/3/19*	
Sun Rise Time	7:13	7:16	7:21	7:25	7:30	7:34	7:39	7:43	7:48	6:52	
Observation Start Time	7:00	---	7:00	9:17	7:00	9:57	7:05	9:32	7:10	8:27	
Secchi Depth (cm)	15	---	12.4	9.2	12.6	8.4	6.8	9.2	Iced Over	NO GEAR	10.5
Conductivity (mS)	---	---	---	102.3	111.4	104.2	86.6	94.3	111.4	NO GEAR	101.7
pH	---	---	---	7.37	6.65	6.7	6.51	6.68	NotWorking	NO GEAR	6.78
Water Temperature (˚C)	---	---	---	3.5	4.9	12	3.9	3.8	1.4	NO GEAR	4.92
Baseball Pond	**Date of Observations**									*Day Light Savings	**Average**
Tests	*10/3/19*	*10/6/19*	*10/10/19*	*10/13/19*	*10/17/19*	*10/20/19*	*10/24/19*	*10/27/19*	*10/31/19*	*11/3/19*	
Sun Rise Time	7:13	7:16	7:21	7:25	7:30	7:34	7:39	7:43	7:48	6:52	
Observation Start Time	---	7:00	---	7:10	9:46	7:00	9:36	7:10	9:35	6:25	
Secchi Depth (cm)	---	55	---	55.8	56.4	57	55.4	58.2	31.6	NO GEAR	52.8
Conductivity (mS)	---	---	---	125.5	132.5	144.8	131.7	132.4	124.5	NO GEAR	131.9
pH	---	---	---	7.1	6.46	6.54	6.64	6.78	NotWorking	NO GEAR	6.70
Water Temperature (˚C)	---	---	---	6.6	7.2	8.7	6.7	5.5	3.5	NO GEAR	6.37

Site	***Date***	Secchi	Cond	Water Temp	pH
Big Pond	Early	15			
Big Pond	Early	12.4			
Big Pond	Early	9.2	102.3	3.5	23442288.15
Big Pond	Early	12.6	111.4	4.9	4466835.922
Big Pond	Early	8.4	104.2	12	5011872.336
Big Pond	Late	6.8	86.6	3.9	3235936.569
Big Pond	Late	9.2	94.3	3.8	4786300.92
Big Pond	Late		111.4	1.4	
Baseball Pond	Early	55			
Baseball Pond	Early	55.8	125.5	6.6	12589254.12
Baseball Pond	Early	56.4	132.5	7.2	2884031.503
Baseball Pond	Early	57	144.8	8.7	3467368.505
Baseball Pond	Late	55.4	131.7	6.7	4365158.322
Baseball Pond	Late	58.2	132.4	5.5	6025595.861
Baseball Pond	Late	31.6	124.5	3.5	

Table 4. **Water Quality Measurements at Both Ponds During Early and Late Migration Periods, so as to Establish the Difference Between the Ponds.** Using a multiway ANOVA statistical test, I ascertained that Secchi depth and conductivity varied significantly by pond. Big Pond's average Secchi depth of 10.5 cm was significantly different than Baseball Pond's average clarity of 52.8 cm, with a p-value of 3.613×10^{-7}, and an F value of 137.63. However, the average conductivity of 131.9 mS at Baseball was significantly more than the 101.7 mS average at Big Pond, with a p-value of 0.000305, and an F value of 36.63.

Figure 2. **A Coot is not Even Closely Related to a Duck and is Evident of Sympatric Evolution to Fulfill a Similar Ecological Niche, but Still Lives in the Same Ecosystem as Waterfowl.** It's just a bird that wants to be a duck so bad, it hangs around them all the time, but it will always be just a bit too silly and wonky to fit in properly.