St. Olaf College

Local Ecology Research Papers

Waterfowl Migration Through the Prairie Pot-Hole Region of Minnesota: Comparing Waterfowl Population and Behaviors on Two Ponds at St. Olaf College during the 2013 Fall Migration

Morgan Mathison

2013

Waterfowl Migration Through the Prairie Pot-Hole Region of Minnesota: Comparing Waterfowl Populations and Behaviors on Two Ponds at St. Olaf College during the 2013 Fall Migration

Morgan Mathison

St. Olaf College

December 13, 2013

ABSTRACT

Bird migration patterns have been long debated and there are many contending theories. Because St. Olaf College has two accessible ponds and several wetlands, it is a prime location for monitoring the waterfowl migration. I utilized the two ponds, Baseball Pond and Big Pond, to count the number of each species present and to record their behaviors. This information was used to elucidate which species are migrating through Northfield, Minnesota during November, and gives a glimpse into their behaviors. Information is also be compared with information in a report on the 2006 fall migration by Scott Williamson to contribute to the monitoring of water-fowl populations. I hypothesized there would be differences in the populations present on each pond, but there would not be a significant difference in the behaviors presented. However, results suggested no pond preference, but behavioral differences between ponds were present. These results will be able to be compared to previous information collected about the stop-over sights of waterfowl and may be used to maintain and create more wetlands at St. Olaf College as a type of waterfowl refuge. Additionally, this information can be presented in the natural lands as an educational supplement.

INTRODUCTION

In 1955, Hochbaum wrote a book detailing the trends of waterfowl migration through the Delta Marsh of Manitoba. He says, “Mayer (1942) says that the tendency of birds to return to the same place year after year has been proven by so many studies that it would be unfair to single out a single one” (Hochbaum 1955). After nearly sixty years, this statement still holds true, although changes are happening due to anthropogentic effects such as draining wetlands, increased global temperature, and erection of houses. Because of these changes and the instinctual flight patterns of waterfowl, it is important to monitor these birds to asses population size and determine if flight patterns are changing.

In 1968 G.W. Cox wrote a paper outlining the role of competition in the evolution of migration. He said that by taking everything into account, birds were simply trying to have the highest net energy gain. For some species, this means staying in one location all year round, but for others it involves expending travel energy to relocate to an environment with more resources, resulting in birds with a net gain in energy (Cox 1968). Prior to this it had been believed that migration resulted from seasonality and continental drift (Wolfson 1948, Mayr and Meise 1930, and Mayr 1953 as cited in Cox 1968). Cox would become one of the lead scientists on migration research because of his realizations. In 1985 Cox expanded his theory to account for theories of other researchers that had found significant results. He termed this theory the time-allocation and competition theory (Cox 1985). This theory recognized that some species are only partial migrants (they travel much shorter distances) and gain reproductive success because of decreased competition. His would again become the dominant theory for bird migration.

In the spirit of migration, Scott Williams (2006) performed a study in the St. Olaf College Natural Lands looking at waterfowl population presence and behaviors during the fall migration. He noted the presence of nine different species over the course of thirty days (Williamson 2006). Because Hochbaum (1995) suggests species return to the same place every year and even utilize the same flyways, I decided to recreate this study for the 2013 fall migration. However, I decided to make a few modifications to tailor it to my interests. First, I wanted to observe waterfowl in November so see which species were still present and in what concentrations. It is well documented that October is the peak migration month, but I was more interested in quantifying the species that were present until freeze out (i.e. mallards and Canada geese). Secondly, I wanted to place more emphasis on the behaviors of the birds to see what preferential trends might emerge. I hypothesized that there would be preference of a certain pond among species and that there would be no correlation between which behaviors were enacted on which ponds.

METHODS

I started my study on October 28th and ended on November 24th. I chose Baseball Pond (-93.1819, 44.4672) and Big Pond (-93.1949, 44.4649) as my study locations because they were easily accessible by paths. I visited the ponds for a total of ten days within this range, and monitored the ponds within two hours after sunrise and within two hours before sunset because this is when waterfowl are most likely to be visiting ponds (Williamson 2006). I spent thirty minutes at each pond for a total of one hour of observation each day. I used Peterson Birds of North America for identification and sorted behaviors into four categories: sleeping, swimming, eating, and preening. I counted all the individuals of a species and categorize their behaviors. Individual birds could participate in more than one behavior, so species totals and behavior totals do not add up to the same number. All statistical analyses were performed using the R statistical package. Apple Numbers was used to formulate graphs.

RESULTS

My first hypothesis stated there would be a significant difference between which pond each species preferred. However, the results of a comparison of means suggested there are no differences in preference (Table 1). The mallard ducks show a slight preference for big pond, but it is not significant.

My second hypothesis indicated there would be no behavioral differences between the two ponds, however there were large differences (Table 2 and 3). For example, I never saw Canadian geese preening or eating on Baseball Pond.

Lastly, I analyzed the differences between population presence in earl, mid, and late November (Table 4 and Figure 1). Trends indicated a preference by mallards for mid November, a preference of early November by northern shovelers, and no preference for geese.

DISCUSSION

After spending ten days viewing waterfowl in the natural lands it is safe to say they did not conform to my hypotheses, but rather did the opposite of my assumptions. None of the species showed a general pond preference or a significant time preference, but they appear to have pond preferences when it comes to behaviors such as eating and preening. However, I would argue that many of the significant differences I found were due to such a small sample size (n=10) and based less on true preference. I would like to do further research with an expanded sample size to get a better idea of the trends.

I still believe there is a correlation between which species are present in which parts of November because Hochbaum (1955) documented the trends of waterfowl migration and, more specifically, Rustad (1997) commented on the prevalence of specific species in Rice county at specific dates. Rustad (1997) documented that early in his studies (circa 1940) there were fewer Canada geese than mallards, however over time those trends changed and geese became more common than the mallards. He also explains that geese and mallards can be found wintering in Northfield, especially under the dam (Rustad 1997). Another important observation by Rustad (1997) is that area lakes typically freeze over between November 21 and December 4 (Rustad 1997). This is all concurrent with what I found in my study; there were more Canada geese than mallards and the ponds were completely frozen on November 24. Furthermore, Rustad (1997) noted that northern shovelers have been spotted as late as November 11, but often leave much earlier. This also corresponds with what I found, which leads me to conclude migration patterns through Northfield have not changed much in the last 15 years.

In 2003 John Heilprin wrote an article in The Washington Post titled “We go the duckiest route; Pilot-Biologists survey populations of waterfowl”. One of his main concerns was the disappearance of wetlands in the Mississippi Flyway, the migration corridor bird follow over Northfield. He quotes Paul Schmidt saying “If we lose wetlands through whatever practices, either through drought or development, then we are going to lose, in the long term, populations.” He also speaks with Bruce Batt, the chief biologist for Ducks Unlimited, who has similar concerns over the loss of wetlands (Heilprin 2003). Heilprin is clearly not the only one concerned with the disappearing wetlands.

1985 marked the beginning of the conservation provisions of the Food Security Act which helped restore many previously drained wetlands (O'Neal et al. 2008). The drainage of wetlands for agriculture had caused a dramatic decrease in waterfowl populations that forced the passage of the Migratory Bird Act in 1913 (U.S. FWS 2004). The restored wetlands are frequented by waterfowl but their effects are not well documented (LaGrange and Dinsmore 1989 and O'Neal 2003 as cited by O'Neal et al. 2008). O'Neal (2008) found that many of these restored wetlands do not dry and flood in the same manner as natural wetlands. Perhaps St. Olaf College should consider artificially raising and lowering the water levels to match the levels of similar unrestored ponds in the area to facilitate more visitation by waterfowl and better restoration practices.

Recently a lot of attention has been placed on the affects of humans on wildlife, specifically in response to anthropocentric climate change. In his book "Bird Migration and Global Change," George W. Cox (2010) outlines the problems humans have created for waterfowl. Cox (2010) begins the book by stating "Many biologists believe that migratory birds are at greater average risk of extinction due to changing climate than are resident species." This is because migratory birds have at least two at risk habitats and non migratory birds only have one habitat at risk (Cox 2010). Cox (2010) says climate change affects birds in four ways: 1. change in relative migration population number, 2. change in migration distance, 3. change in direction of migratory movements, and 4. change in timing and speed of migration. All of these changes act individually on waterfowl and can have a compounded effect that decreases the overall population size.

One small but significant concept is a change in stop-over sites (Cox 2010). This concept is what caused the population crash leading up to the passage of the Migratory Bird Act of 1913. At that time the changes were a result of the draining of wetlands for agricultural purposes, however now we are having a similar issue due to global warming, changing water tables, and increased urbanization. Warming will cause a decrease in Prairie-Pothole wetlands, which will result in a population decline in the region (Cox 2010). A study by Anteau (2012) shows that Prairie-Pothole wetlands are in fact drying up and decreasing in number. The study also found restored wetlands do not react to drought the same way natural wetlands do, which impacts the invertebrate communities in the ponds (Anteau 2012). This correlates with the O'Neal (2008) study. I mention this because ducks and geese feed on invertebrates in these ponds, and if the wetlands are not behaving the same way (drying and filling) the invertebrate communities are impacted. I believe this plays into the food preferences of Canada geese and northern shoveler discovered in my study. The reason they frequent baseball pond because it is the smaller and more natural of the two ponds and comes closer to drying out during the summer, which increases the invertebrate populations (Anteau 2012)

An interesting idea emerges in Cox (2010) stating long-distance migratory birds are dictated by genetics, which means to survive in this new environment waterfowl will need an evolutionary adaptation. Mallards interbred currently, and it is changing their genetic makeup and therefore their migratory memory (Cox 2010). This is important because on top of disappearing wetlands birds are affected by changing plant habitats and have to change their site fidelity (Cox 2010). This change in site fidelity will most likely result from an evolutionary adaptation which takes generations, a time span waterfowl may not have due to negative anthropocentric changes.

Regardless of all the barriers faced by waterfowl, the Minnesota Department of Natural Resources 2013 Waterfowl Report says the duck population was higher than average again this year and the goose population was down, but still above desired levels (Minnesota DNR 2013). There are many possible reasons for the increase in mallard population, including but not limited to the 12-19 day increase in the growing season above a 45 degree latitude (near Northfield) allowing for a potentially longer breeding season (Cox 2010). The longer and warmer breeding season results in higher brood numbers and potentially higher survival rates. Additionally, warming causes greater NPP in freshwater lakes and streams (Cox 2010). This allows for more invertebrates, which results in more food availability. In short, climate change has both negative and positive effects on waterfowl fitness.

As discussed in Cox (2010) populations are currently at an all time high, but that doesn't mean we can stop monitoring these populations, rather it is important to continue monitoring them in case of a population crash. This is part of the reason my study was important. There is now data on record to have a glimpse into the visitation of waterfowl to Baseball and Big Pond in the Natural Lands of St. Olaf College.

My findings are in line with suggestions about increased population size and show that Baseball and Big Pond are reacting similarly to other restored wetlands. This is good information and bad, but because of prior research on the migration patterns of waterfowl and site fidelity St. Olaf College has some decisions to make regarding these ponds. Perhaps a future study could involve monitoring the ponds in both the morning and evening everyday from October 1 through the hard freeze to have a large enough sample size to truly discover trends and relationships.

Also, it would be interesting to mark some of the waterfowl and monitor if the same families of waterfowl are visiting the ponds every year as the literature suggests.

In conclusion, I discovered waterfowl do not appear to have a preference for one pond over the other, however there is a trend for mallards to visit Big Pond more frequently (Table 1 and Fig. 1). Canada geese are present all through November at fairly consistent levels, mallard ducks are most common in mid-November, and northern shovelers have left this area by the end of November (Table 2). Geese prefer to preen and eat on Baseball Pond, northern shovelers prefer to preen on Baseball Pond and have no eating preference, and mallard ducks prefer to eat and preen on Big Pond (Table 3&4).

REFERENCES

Anteau, M. J. 2012. Do Interactions of Land Use and Climate Affect Productivity of Waterbirds and Prairie-Pothole Wetlands? Society of Wetland Scientists 32.

Cox, G. W. 1968. Role of Competition in Evolution of Migration. Evolution 22:180.

Cox, G. W. 1985. The Evolution of Avian Migration Systems between Temperate and Tropical Regions of the New World. American Naturalist 126:451-474.

Cox, G. W. 2010. Bird migration and global change. 1st edition. Island Press, Washington DC.

Heilprin, J. 2003. 'We Go the Duckiest Route'; Pilot-Biologists Survey Populations of Waterfowl. The Washington Post. Washington Post Digital, Washington, DC.

Hochbaum, H.A. 1955. Travels and Traditions of Waterfowl. University of Minnesota Press, Minneapolis.

Minnesota DNR. 2013. Breeding duck numbers improved, Canada goose population declines. Minnesota Department of Natural Resources.

O'Neal, B. J. H., E.J.; Stafford, J.D. 2008. Waterbird Response to Wetlands Restored Trough the Conservation Reserve Enhancement Program. Journal of Wildlife Management 72.

Rustad, O.A. 1997. A Journal of Natural Events in Southeastern Minnesota. River Bend Nature Center, Faribault.

Service, U. S. F. a. W. 2004. The history of North American waterfowl surveys : 50 years & still counting. U.S. Fish & Wildlife Service.

Williamson, S. 2006. Temporal Shifts in Waterfowl Behavior and Community Composition on Two St. Olaf College Wetlands during the 2006 Fall Migration. Unpublished.

Table 1. A comparison of means for the three bird species located on the two ponds. There is clearly no preference for a specific pond, overall each species is semi-evenly distributed. Mallards are the only species that may have some preference for Big Pond. I would hypothesize there is more food available to mallard ducks on Big Pond than on Baseball Pond because it is shallower.

ANOVA		**n**	Mean	**Standard Deviation**	**P-value**
Geese	Baseball	10	23.4	35.86766	p=0.5432
	Big	10	12.8	40.477115	
Mallards	Baseball	10	2.3	3.198959	p=0.1021
	Big	10	13.1	19.564423	
Shovelers	Baseball	10	1.3	4.110961	p=0.7816
	Big	10	1.9	5.3427	

Table 2. A contingency table for the distribution of each species preening on the two ponds. Results show there are clear relationships between each species and which pond they spend time preening on. I hypothesize the mallard ducks and Canada geese preen on these ponds because they are already feeding here. As for the northern shoveler, I am unsure why there is an implied preference for preening on Baseball Pond.

Preening	**Baseball**	**Big**
Geese	84	0
Mallards	7	19
Shovelers	13	0
X-squared = 83.8347	df = 2	p-value < 2.2e-16

Table 3. A contingency table for the distribution of each species eating on the two ponds. The data show a very clear relationship between species and pond in reference to eating. Geese prefer Baseball Pond, mallard ducks prefer Big Pond, and norther shovelers show no preference.

Eating	**Baseball**	**Big**
Geese	135	0
Mallards	18	111
Shovelers	13	17
X-squared = 201.0266	df = 2	p-value < 2.2e-16

Table 4. A comparison of means for the three bird species located across three different time periods. It appears as though there is some variation in what time of November each of these species is present: Canada geese show little to no variation throughout the month, mallard ducks show an increased presence during mid-November, and northern shovelers show a large presence in early November.

ANOVA		**n**	Mean	**Standard Deviation**	**P-value**
Geese	Early	6	15.5	26.18205	p=0.9234
	Mid	6	23.5	42.12244	
	Late	8	16.0	45.25483	
Mallards	Early	6	7.16667	8.06019	p=0.07817
	Mid	6	18.00	23.32381	
	Late	8	0.3750	1.06066	
Shovelers	Early	6	5.0	7.845667	p=0.09475
	Mid	6	0.3333	0.8164966	
	Late	8	0.00	0.00	

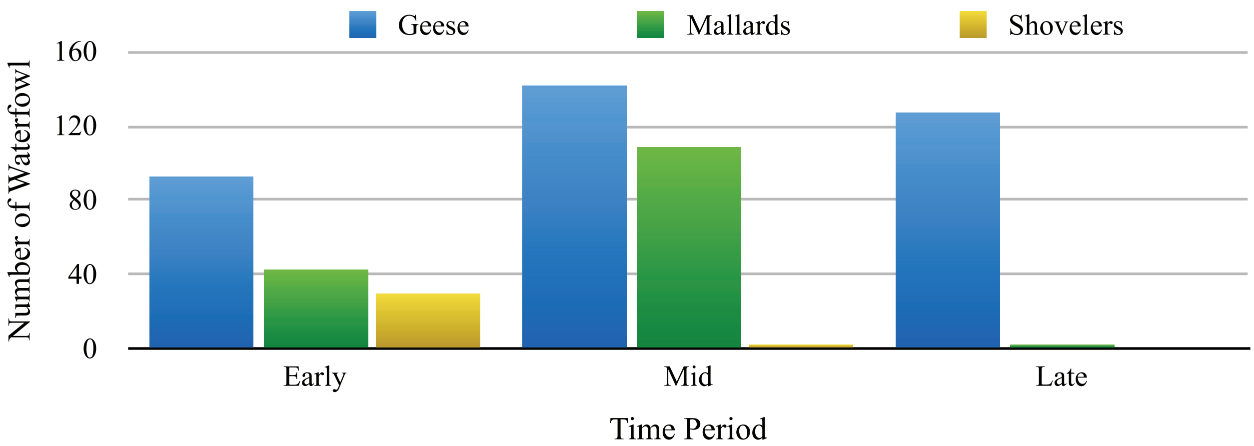

Figure 1. A graphical representation of the distribution of each species over the three time periods. This figure shows a relatively stable Canada goose population over all three time periods, a preference for mid-November by the mallard ducks, and a preference by the northern shovelers for early November.

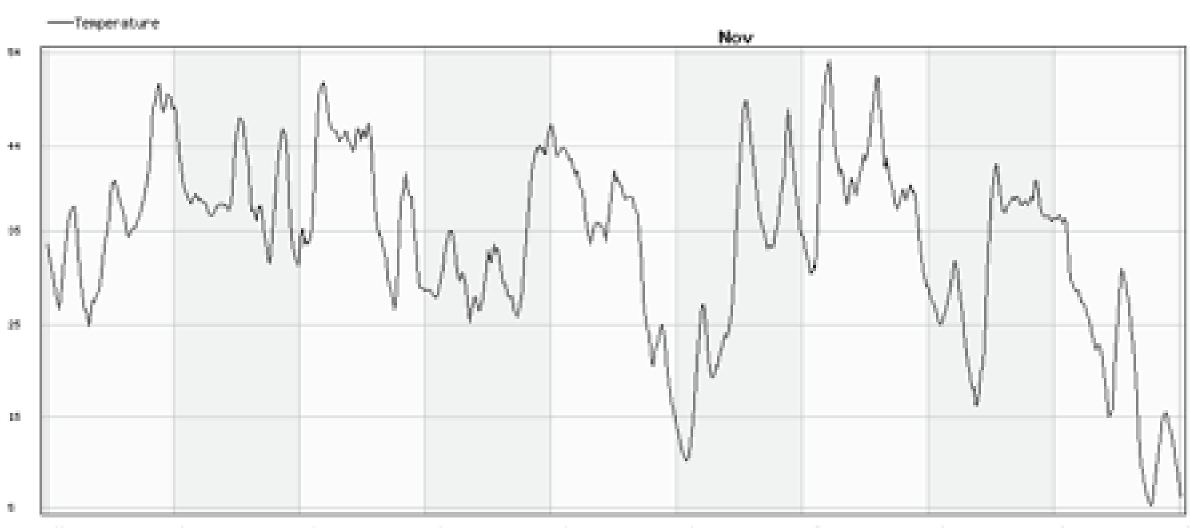

Figure 2. A temperature graph for the duration of my study period. The lakes were completely frozen on November 24, which corresponds to decreasing temperatures. Curtesy of Carleton College Website: http://weather.carleton.edu