PigeonWatch Analysis - Group 1

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Introduction

Despite how common pigeons are in our everyday lives, it's incredible just how little we know about how and why they are as they are. However, there are a lot of things that we can learn from them. For example, how animals adapt to urban environments, the effects on human life, as well as life for the animal. Feral pigeons have established themselves all across urban environments and their populations have been established in North America for 200 years (Labranche, Melinda S.). In spite of all this time, individuals of many different colors continue to pop up. We want to figure out how sexual and natural selection play a part in the mysterious lives of pigeons.

How do birds, and particularly pigeons, choose a mate? Natural and sexual selections can both play a part. Natural selection favors traits depending on how they affect an individual's survival, while sexual selection favors traits depending on the ability to mate with more or better partners (Bird Academy). In this context, the fact that pigeons fly in flocks together, rely on handouts for food source, and differ only in color (usually) are important to consider. In these, we can analyze selection on how the sexes interact, competition for a food source, and whether their differences (color) determine survivability. In sexual selection, individuals have a "generally increased reproductive success" (Schindler, Susanne) if they have more attractive traits. However, these traits are "costly to develop and maintain" (Schindler, Susanne) and evolve through physical competition of males trying to mate with more females. And yet, some female pigeons are the outliers, in that *they* can be the colorful or attractive ones. As the genes for different morphs carry on, this can indicate that differing colors are certain adaptations to "allow organisms to thrive in their environment" (Josephs, Molly).

So can we say that different morphs of pigeons are preferred depending on the habitat through natural selection? This is what our group is specifically trying to figure out, whether there is a significant difference in morphs across three main habitats. Our null hypothesis is: there is no significant difference in the distribution of morphs by the three core habitats (downtown, residential, park/beach). As we'll go over in the following sections, we analyzed data collected by students in the GEOG 330 fall 2020 class, trying to figure out if we could reach a conclusion. The rest of this report will go into these details and the meanings behind our findings, collected from out in the field.

Data and Methods

To accomplish solving our hypothesis, we were assigned to work with the data received from this semester (Fall 2020). Our first objective was to locate feral pigeons in three different areas: downtown/industrial/commercial, residential, and beaches/parks. Overall, the class found the most success locating pigeons in beach/park areas with a total of 666 pigeons. Next was the downtown/industrial/commercial areas that had a total of 394 pigeons. Lastly, pigeons located in residential areas totaled to 181. A majority of the pigeon morphs across all three locations were blue-bar (555), checkered (248), spread (191), and red-bar (120). Pied (56), white (39), and red (32) color morphs were more rare. Each student was provided with a tally chart from Dr. Rodrigue to help us count all of the pigeons we see in our daily routines. They were then tallied based off of their specific color morphs. In addition, we were also tasked to record any signs of courting. The class spotted 98 signs of courtship. The most commonly seen female targets were towards blue-bar (45), spread (21), and checkered (18) color morphs, while red-bar (8), red (2), white (2), and pied (2) were the least commonly spotted.

The class then entered all of their gathered data into a chi-square model spreadsheet that was also provided by Dr. Rodrigue, to help us identify whether or not the data coincided with our hypothesis. When analyzing our chi-squared test, it is important that we considered a few things. First, we began by brainstorming what alpha level we should use. This number is dependent on which type of error we were hesitant to make. We chose to use 0.05 for our alpha level to avoid making a Type 1 error, or rejecting a true, null hypothesis. This stemmed from our probability value of 0.006, which identifies that our data is statistically significant.

Results

After we ran the chi-squared test, we were given the probability value of .006. Since our probability value is .006 is less than than our alpha level of .05, we will reject the null hypothesis. This means that there is significant evidence that natural selection favors different mixes of pigeon morphs in different habitats. The effect size is small, which means it is a weak effect. Because it is less than 0.8, it is underpowered.

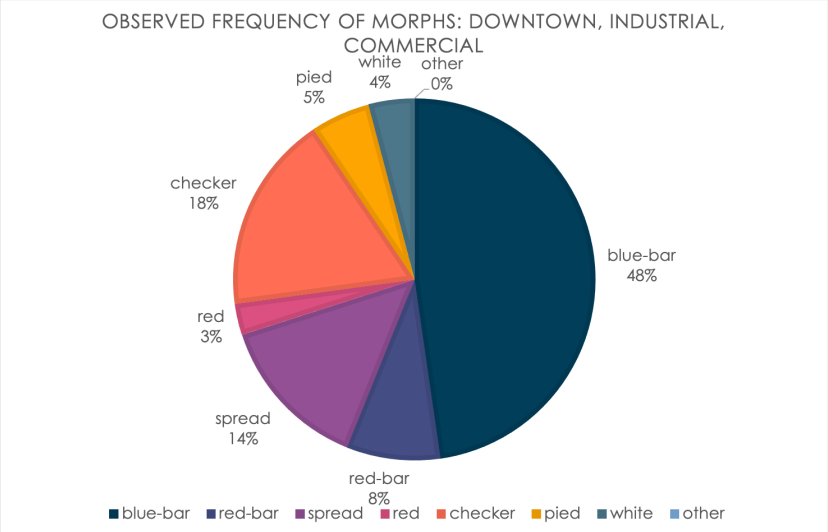

Figure 1- Observed Frequency of morphs: Downtown, Industrial, Commercial

A pie chart shows the observed frequency of morphs (blue-bar, red-bar, spread, red, checker, pied, white, other) in downtown, industrial, and commercial habitats. Blue-bar morphs have the

highest observed while white morphs have the lowest observed morphs. Total observed morphs is 394.

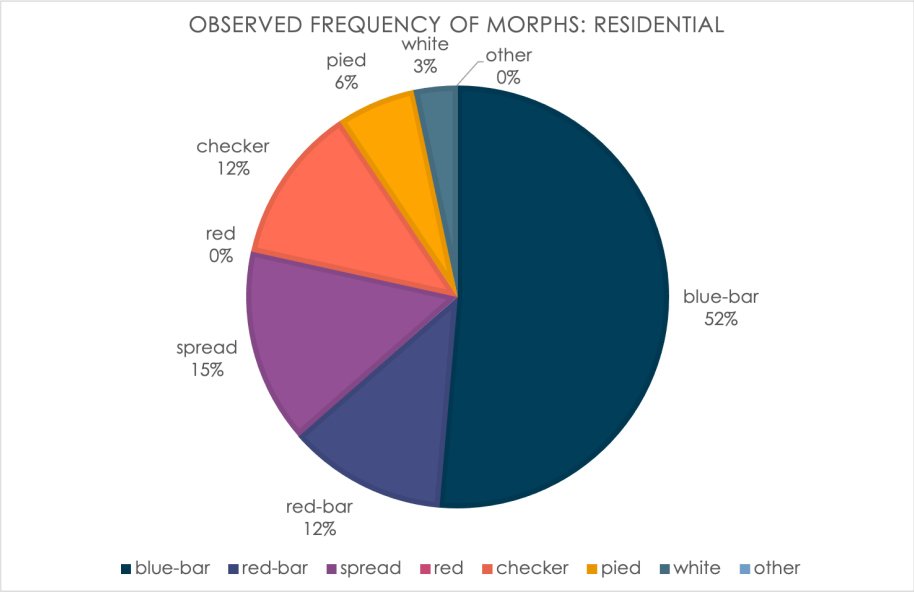

Figure 2- Observed Frequency of morphs: Residential

A pie chart shows the observed frequency of morphs (blue-bar, red-bar, spread, red, checker, pied, white, other) in residential habitats. Blue-bar morphs have the highest observed while white morphs have the lowest observed morphs. No red morphs were observed. Total observed morphs is 181.

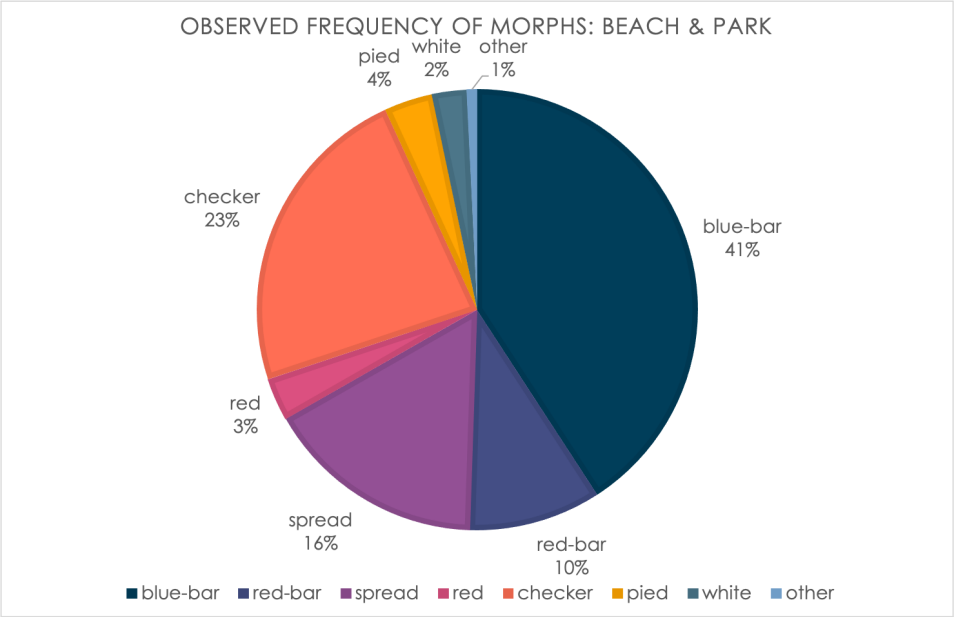

Figure 3- Observed Frequency of morphs: Beach & Park

A pie chart shows the observed frequency of morphs (blue-bar, red-bar, spread, red, checker, pied, white, other) in beach & park habitats. Blue-bar morphs have the highest observed while white morphs have the lowest observed morphs. Total observed morphs is 671.

Observed and Expected Value of Morphs across Habitats			
	Habitats		
VAR 1	Downtown/Industrial/Commercial	Residential	Beach/Park
Blue-Bar			
Obs	188	93	274
Exp	*176.205*	*80.947*	*297.849*
Red-Bar			
Obs	33	22	65
Exp	*38.098*	*17.502*	*64.4*
Spread			
Obs	55	27	109
Exp	*60.64*	*27.857*	*102.503*
Red			
Obs	11	0	21
Exp	*10.16*	*4.667*	*17.173*
Checker			
Obs	70	22	156
Exp	*78.737*	*36.171*	*133.093*
Pied			
Obs	21	11	24
Exp	*17.779*	*8.168*	*30.053*
White			
Obs	16	6	17
Exp	*12.382*	*5.688*	*20.93*
Total Observed	394	181	671

Figure 4- Observed and expected morphs across habitats

A table shows the observed and expected value of morphs (blue-bar, red-bar, spread, red, checker, pied, white, other) in habitats (downtown/ industrial/ commercial and residential, residential, and beach/park).

For blue-bar, pied, white morphs, it was more common in downtown /industrial /commercial and residential habitat than expected while it was less common in a beach/park habitat. For red-bar morphs, it was less common in downtown/ industrial/ commercial and residential habitat than expected while it was more common in a beach/park habitat. For spread morphs, it was less common in downtown/ industrial/ commercial habitats than expected while it was more in a beach/park habitat. It was also exact in residential habitat. For red morphs, it was more common in downtown/ industrial/ commercial and beach/park habitat than expected while it was less common in residential habitat. For checker morphs, it was more common in beach/park habitat while it less common in downtown /industrial/commercial and residential habitat.

Discussion

In our results we saw that blue bars are underrepresented in beaches/parks and that spread and checkers are over represented. Although, blue bars were more common in urban and residential areas than any other pigeon morph. We did not expect this, it seems to be counterintuitive because the natural morph of pigeons (blue bars) are not found in their natural habitat. A possibility for this could be that there was not enough data collected on the beach and parks habitat, or that the data on beaches and parks were joined. The joined data from the beaches and parks habitats does not allow us to see where blue bars were more common between the two. Another possibility could be due to the current pandemic we are in. Pigeons, specifically

blue-bar, are leaving their natural habitat and flocking to industrial locations to find food as people stay home due to Covid-19; This scarcity of food in their natural habitat (fewer people at beaches and parks) might cause them to take the risk to compete for food outside their normal domain which explains the underrepresentation at beaches and parks. Because we rejected our null hypothesis and found significance in our results, we can say that there is a difference in the distribution of the pigeon morphs in the three core habitats data was collected on. The importance of our findings show the count for blue bars is lower than expected and they are doing less well in their natural habitat.

Conclusion

To conclude this study, we find that melanic (checkers, spread) pigeons are more common in natural areas while blue bars are more common in urban areas and at the same time being underrepresented in parks and beaches. We would like to see in future studies an emphasis on pigeon watch data in locations such as beaches and parks. The reason for this is due to concern that the observed frequency of the pigeon is lower than that what is expected, specifically for blue bars. We expect by having more future data on beaches and parks, this could allow us to see how different the results may be compared to the results in our current study group data. Another area of inquiry that can be visited with future studies can be to have somebody separate the data between beach and park habitats. In this study the beach and park habitats are being placed together although they are two very different types of environments. At beaches, the cliffs resemble more of their natural habitat compared to parks. In future studies, separating these two environments can provide us with a different result than what we ended with in this study.

Works Cited

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