PigeonWatch Analysis: Does Color Morph Affect Courting Behavior?

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Introduction

Our study observed varying pigeon morphs in regional areas to observe the relationship between female and male pigeon morphs; the study was done to see whether or not some morphs engaged in mating rituals more frequently than other morphs or if some female morphs were deemed more attractive by the male morphs than their other female counterparts.

Looking at the sexual selection of pigeons, does the distribution of courting rituals between male and female pigeons resemble the distribution of various pigeon morphs in the regional populations? Feral pigeon populations are polymorphic in plumage for both color and pattern, resulting in varying pigeon morphs in certain areas. Are there female pigeon morphs that are courted more often than others; in regards to the male morphs, are there male morphs that engage and attempt to court the female pigeons more than the other morphs?

Data and Method

Data Collection Methods

To gather data to answer these hypotheses, students from the class GEOG/ES&P 330 of Fall 2020 were sent out to collect data at different sites within LA and Orange County. Students were required to at least make three observations; to make a minimum two counts, 15 minutes apart; and to count at least a total of 30 pigeons. While out gathering data, students were to record the following: type of region the site is (this included: pak, beach, suburban, urban residential, commercial, downtown, and industrial), number of pigeons present, color morphs of pigeons if identifiable (color morphs included: blue-bar, red-bar, spread, red, checker, pied, white, and other), and pigeons engaging in courting behaviour while also noting their color morphs.

Data

A total of 28 students contributed to the gathering of data with a total of 95 entries. The total observed pigeons was 1373 pigeons and only 98 were found engaging in courtship behavior.

		Color Morph								
		Blue-bar	Red-bar	Spread	Red	Checker	Pied	White	Other	Unknown
Locations	Park	196	58	74	18	90	16	16	5	0
	Beach	78	7	35	3	66	7	2	0	7
	Suburban	55	15	8	0	12	0	2	0	3
	Urban Residence	38	7	19	0	10	11	4	0	114
	Commercial	154	26	48	10	69	21	13	0	3
	Downtown	3	2	1	0	0	0	1	0	0
	Industrial	31	5	3	1	4	0	2	0	0
	Total	555	120	188	32	251	55	40	5	127
	Population Proportion	0.44722	0.09670	0.15149	0.02570	0.20226	0.04432	0.03223		

Table 1. Regional Pigeon Population Morph Distribution throughout LA and Orange County.

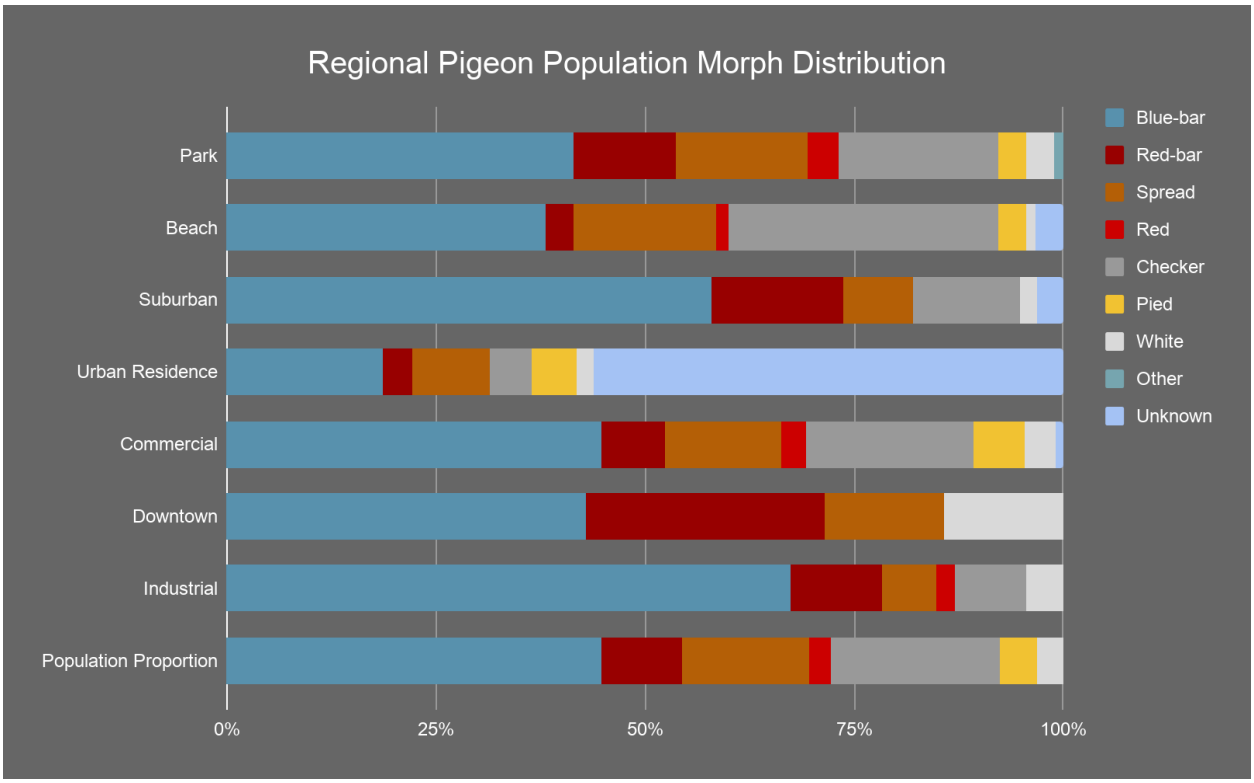

Figure 1. A visualization of the pigeon color morph population distribution in varying location type.

Courting	Blue Bar	Red Bar	Spread	Red	Checker	Pied	White	Target
Blue bar	24	3	11	0	5	0	1	
Red Bar	2	3	0	1	2	0	0	
Spread	4	1	6	0	2	0	1	
Red	0	0	1	0	0	0	0	
Checker	13	1	3	1	9	1	0	
Pied	0	0	0	0	0	1	0	
White	2	0	0	0	0	0	0	
Instigator								

Table 2. The distribution of pigeon morphs engaging courting behavior. The shaded cells indicate color morphs couriting with itself.

	Color Morph						
	Blue-bar	Spread	Checker	Red-bar	Red	White	Pied
Observed	45	21	18	8	2	2	2

Table 3. The observed targeted pigeon color morphs during courting behavior.

	Color Morph						
	Blue-bar	Spread	Checker	Red-bar	Red	White	Pied
Observed	44	28	14	8	2	1	1

Table 4. The observed courting pigeon color morphs during courting behavior

Analytic Procedure

Due comparing the frequencies of courting and courted color morphs against known population proportions of region pigeon color morphs, the use of chi-square “goodness of fit” will have to be used to analyze the significance of color morphs in courting behavior. To do this, the use of VassarStats calculator for chi-square “goodness of fit” is needed. The values that are inserted into the calculator were the frequencies of courting and courted color morphs as well as the known population proportion of color morphs.

Cate-gory	Observed Frequency	Expected Frequency	Expected Proportion	Percentage Deviation	Standardized Residuals
BB	45	43.83	0.44721998	+2.67%	+0.18
RB	8	9.48	0.09669621	-15.61%	-0.48
SP	21	14.85	0.15149073	+41.41%	+1.6
RD	2	2.53	0.02578565	-20.95%	-0.33
CH	18	19.82	0.20225624	-9.18%	-0.41
PD	2	4.34	0.04431909	-53.92%	-1.12
WH	2	3.16	0.03223207	-36.71%	-0.65
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Sums:

Observed Frequencies: 98

Expected Frequencies: 98

Expected Proportions: 1.0

Reset Calculate

[Note that for df=1, the calculated value of chi-square is corrected for continuity.]	[For df=1, this is the uncorrected value of chi-square.]
chi-square = 4.78	
df = 6	[P is non-directional]
P = 0.5723	

Figure 2. The results given from the VassarStats chi-square "goodness of fit" calculator for targeted pigeon color morphs.

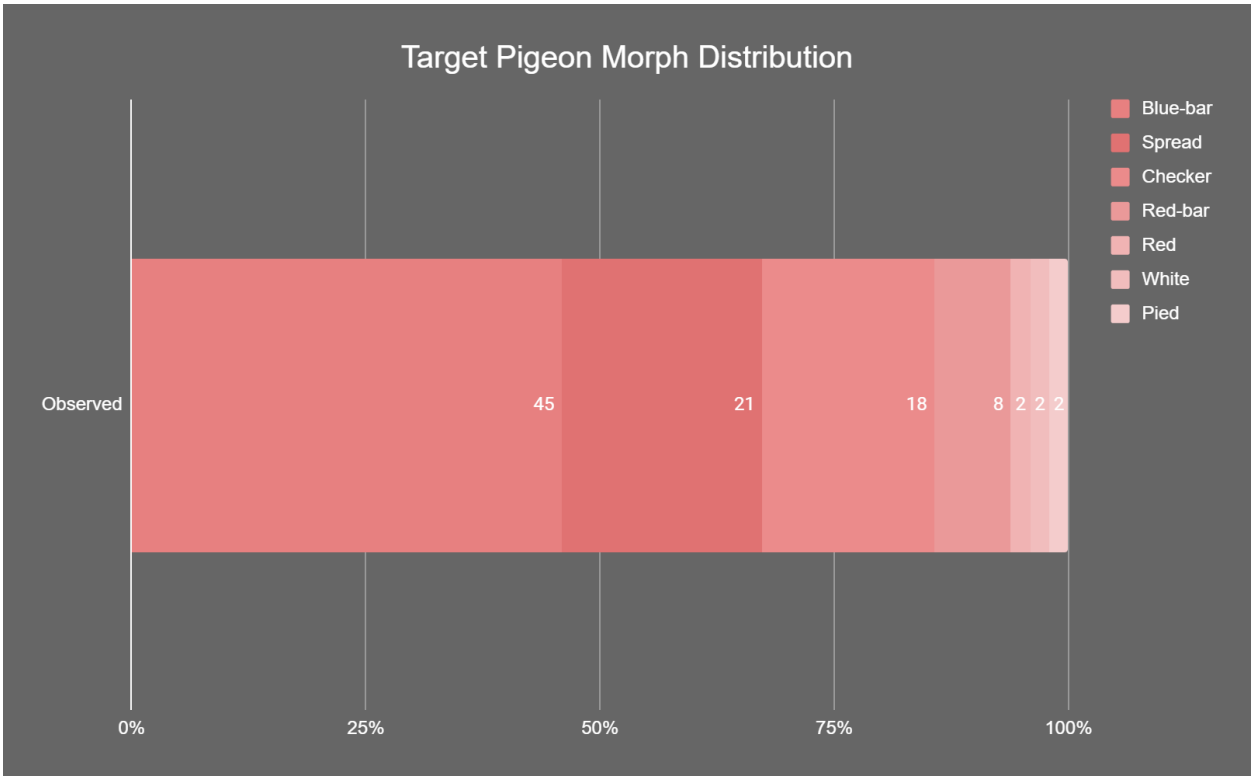

Figure 3. A visualization of targeted pigeon color morph distribution. The darkness of color indicates the significance a color morph had in being a target.

Cate-gory	Observed Frequency	Expected Frequency	Expected Proportion	Percentage Deviation	Standardized Residuals
BB	44	43.83	0.44721998	+0.39%	+0.03
RB	8	9.48	0.09669621	-15.61%	-0.48
SP	14	14.85	0.15149073	-5.72%	-0.22
RD	1	2.53	0.02578565	-60.47%	-0.96
CH	28	19.82	0.20225624	+41.27%	+1.84
PD	1	4.34	0.04431909	-76.96%	-1.6
WH	2	3.16	0.03223207	-36.71%	-0.65
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Sums:

Observed Frequencies: 98

Expected Frequencies: 98

Expected Proportions: 1.0

Reset Calculate

[Note that for df=1, the calculated value of chi-square is corrected for continuity.]	[For df=1, this is the uncorrected value of chi-square.]
chi-square = 7.58	
df = 6	[P is non-directional]
P = 0.2705	

Figure 4. The results given from the VassarStats chi-square "goodness of fit" calculator for targeted pigeon color morphs.

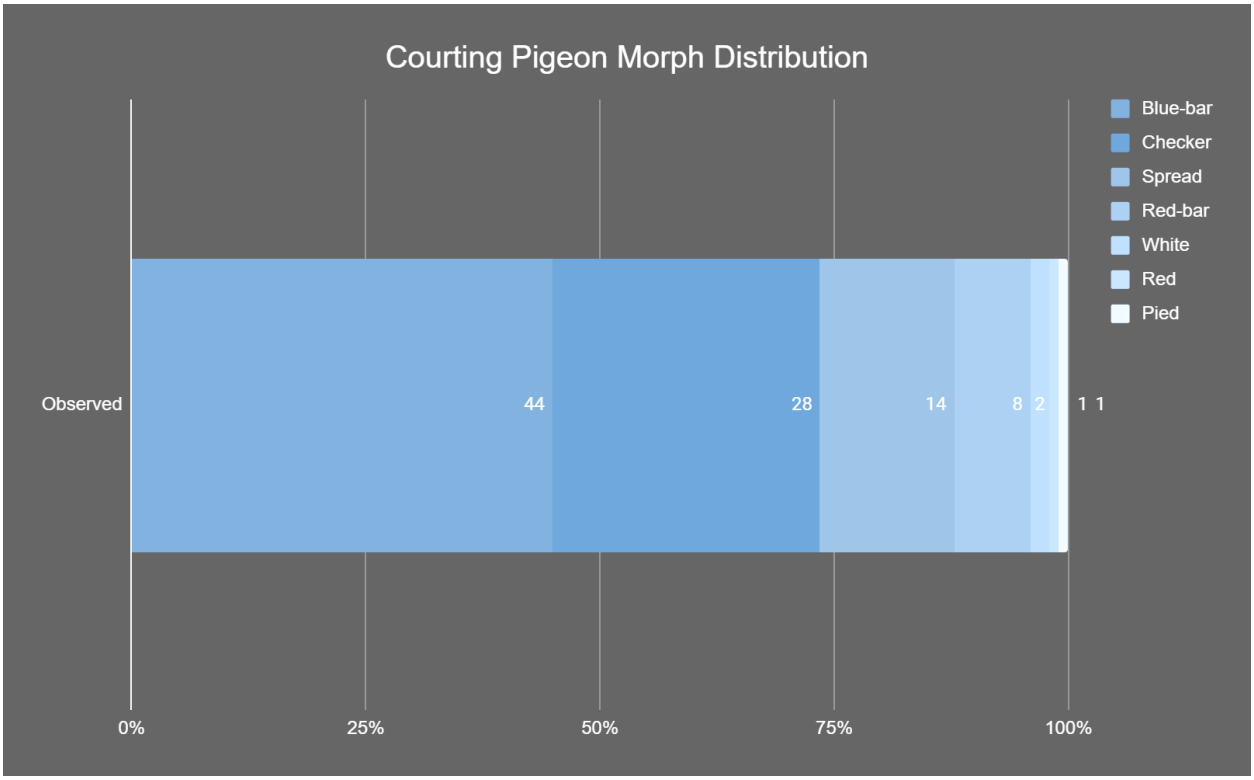

Figure 5. A visualization of courting pigeon color morph distribution. The darkness of color indicates the significance a color morph had in engaging in courting behavior.

Results

From the data we've gathered, we are left with two chi-square goodness of fit test results for courted pigeons and courting pigeons, of which we can presumably label as female and male pigeons. The significance level for our chi-square tests were both set at $\alpha = 0.05$, in order to have a smaller chance of risk for error or incorrect results. After inputting our morph data from the pigeons recorded, the results came as follows. For our female pigeon chi-square test, our results came in showing the P-value at 0.5723 at a degree of freedom at 6. For our male pigeon chi-square test, our results came in as showing the P-value at 0.0205 at the same degree of freedom. From our data, the chi-square results and the compiled graphs were able to show that the Spread morphs of female pigeons were seen to be courted the most and, for male pigeons, it was the Checker morphs were the most forward, i.e. they were doing most of the courting. From these results, tested at a significance level of 0.05, we see that, while there was some activity that could be seen as significant, the chi-square goodness of fit results show that there is a non-significance pattern of the data, indicating that we fail to reject our null hypothesis. From this, we can conclude that the pigeon morphs of our data show no difference in the likelihood of courting and/or being courted.

Discussion

There are several factors that affect mate selection in feral pigeons, and research has suggested that plumage color and pattern is an important aspect that "is probably also under sexual selection" (Derelle). Feral pigeons exhibit a variety of color morphs that can be found throughout the nation in differing settings. "No other feral animal has kept its domestic colors for more than a few generations," but as seen above, the feral pigeon population boasts a diverse range of color morphs that has been sustained for over "200 years," (LaBranche). Although we

fail to reject the null hypothesis, this study still provides important insights as to why this phenomenon may occur.

According to the results above, it appears that specific pigeons did not court or be targeted at a significant level, however there were groups of morphs that stood out. Checkered males and spread females were the most sexually active, while both male and female pieds underperformed. These smaller, nonsignificant distinctions may possibly be a result of nonrandom mating.

Nonrandom mating in pigeons can improve biological fitness, and literature has noted that pigeons often engage in courting rituals with dissimilarly colored morphs. "It has been… shown that immune responsiveness and parasite intensity correlates with coloration in feral pigeons," which may partially explain why checkered males and spread females found the most success when courting (Derelle). There is no significant difference in the perceived attractiveness of certain colored morphs, though.

Another possible reason for the variety of colored morphs is that "plumage disassortative mating may be related to rapid mating," (Johnston, "Feral Pigeons," 61). Feral pigeons may not have a specific color morph preference, and may instead consider courting others that have valuable traits regardless of their plumage pattern. A higher volume of offspring increases the likelihood of overall survival rates, so it may be worthwhile to mate with a variety of partners.

Some factors may affect the results found within this study. For example, the restrictions imposed to protect citizens from transmitting COVID-19 may inhibit the pigeon population's viability in cities and suburban regions. Food sources may dwindle as a result of closed restaurants since pigeons in these areas often rely on food scraps. Additionally, the limited access to public areas may have inadvertently created hotspots for data collection. This may

unexpectedly affect the observed morphs in a manner that does not align with past data collected by prior Geography 330 students or other researchers.

Conclusion

This study was done to observe the mating rituals and frequency in mating of various pigeon morphs. Although we fail to reject the null hypothesis, this study gave us an insight into how the pigeon morphs act. In the results above, specific pigeon morphs did not engage in courting more frequently or be courted more frequently than any other at a significant level; however, there were groups of morphs that stood out. Checkered males demonstrated that they were the most sexually active, alongside with spread females, with both male and female pied morphs engaging in courting activities much less than the others. No, there are not female pigeon morphs that are courted more often than others, and in regards to the male morphs, there are not male morphs that engage and attempt to court female pigeons more.

References

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http://www.vassarstats.net/csfit.html