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Introduction

The purpose of our study is to determine if natural selection is at play in our local communities by observing the best known and easily accessible animal, the pigeon. Natural selection is known as the gradual process of species that are better adapted and fit to their environment, being able to live longer and therefore produce more offspring. In UC Santa Cruz's'newsletter they did a study on 2 types of pigeons, the passenger pigeon (now extinct) and the related band-tailed pigeon. Researchers stated, "when we looked at rates of adaptive evolution and purifying selection in both species, we found evidence that natural selection had resulted in both a faster rate of adaptive evolution...". Pigeons are not new to the process since the study was done on passenger pigeons, an extinct type of pigeon that last lived in 1914. They lived over a century ago and underwent natural selection so the pigeon species today are not completely new to the process. The pigeon is a great sample for this study because we know from seeing them daily that they vary in patterns meaning they have gone through changes and have predators such as cats and other larger birds. If natural selection is happening to the local pigeons, we can assume stabilizing selection is happening as well. Stabilizing selection occurs when natural selection happens and as a result the most noticeable morph or morphs (to predators) are killed off by predators leaving the "original" morph to be the dominant type in the flock. The most common and "original " morph of pigeon is the blue bar which in theory should be the dominant morph if natural and stabilizing selection is occurring but as everyone can notice driving down the street in certain areas, they are not the most dominant. In LaBranche's article, Why Study Pigeons? he states, "No other feral animal has kept its domestic colors for more than a few generations—why, then, aren't feral pigeons all blue-bars?" (Labranche, 1). The question has always been, why are blue bar pigeons not the dominant morph? Our group has predicted that natural selection is present in the observed flocks. In addition, we do believe there will be a difference in the mix of morphs with the mixes of habitats.

Methods

The first part of the data needed for this research was collected by our group. We traveled throughout Los Angeles County for six areas we deemed likely to have pigeons, the six common habitats were, downtown zones, industrial, commercial, and residential areas, as well as beaches and parks. All of these locations are likely to have pigeons due to the open spaces, elevated surfaces, like trees or buildings, and a likely abundance of food litter or grains. Once we found a

location with a fair amount of pigeons, more than 5, we would monitor and record what the habitat was and what morphs of pigeons were present. If we were lucky, we would be able to record different courtships between the pigeons. As well as our own data, we also had an abundance of pigeon flock data that was recorded in a similar way from the 2000's to present day. Those groups recorded data in a very similar way, traveling through Los Angeles County searching for pigeon flocks and recording what they found. Each group went to four to six locations in order to achieve enough data.

Data

For the data, it consisted of what we had collected as well as the data from GEOG442 spanning from Fall 2000 up till now, including GEOG/ESP 330 data from 2000 till now. From this, we tallied up all the data to include into the F2021 sheet and by doing so, it updated the Summary spreadsheet that has all the data ever collected since 2000. By doing so, we were able to calculate the number of each morph from the three given categories: downtown/industrial/commercial being one, residential being another, and beach/park being the third. Once this data was added up, we were able to begin our chi square analysis. This method is the most effective because chi square analysis is designed to handle frequency count data. On this spreadsheet, we had taken the combined data of the morphs count and plugged it into the highlighted areas and the rest of the values were taken care of automatically through OpenOffice or Excel.

Results

Now for the results, the first key indication that the data we produced was effective was from the blue box which shows the percentage of expected counts and the number of expected counts. If the percentage of expected counts was determined to be under 20 percent, then our data prove viable which it did, coming at zero percent. This allowed us to stick with the 3 by 7 table of data without collapsing any data we configured, meaning we could continue to determine the results of our data. Now that we know we produced accurate data, it was time to see whether our null hypothesis was correct or if we would be able to reject it. As we go below to see the values we produced in comparison to our alpha, we can see that our prob value is zero while the alpha value is 0.05, meaning there is significant difference among the three habitats in terms of the mixes of pigeon morphs found in them because the prob value was smaller than the alpha value. Another way to check for significance is if the x squared calculated is larger than the x squared critical and in this case the x squared calculated is 62.766 while the x squared critical is 21.026, showing significant difference. This meant that we could reject the null hypothesis because there is significant difference among the habitats in their "bird herds". Since we rejected the null, this means there is something going on to make the flocks different in the three habitats, such as natural selection, predation, stabilizing selection, etc. However, as we look at the rest of the data we can see that the measure used to determine the size of the effect, aka the Cramer's V, is very weak based on the value determined from inputting the data. As we got 0.060 for this

measure, we can determine that the significance of changes in habitat to pigeon morphs is not as strong of a variable. Lastly, the corrected power was a good assurance that our data set was strong enough to make the proper statements and conclusions that we want to. By having a corrected power of 0.989, higher than the average of 0.8, we can safely say that there were enough pigeons recorded and analyzed for this result. Overall, we can say that we reject the null hypothesis that states there is no predation and stabilizing selection affecting the mixes of morphs by the three habitats. Our original hypothesis/alternative hypothesis was true and there was in fact significance.

Discussion/Conclusion

The results that we received from this lab proved that our original hypothesis was correct, and the null hypothesis was rejected. What this means for our lab is that if you were to observe and analyze pigeon morphs in different outdoor settings, there is a high probability that one will witness any predation or stabilizing selection in progress. Our Habitat Project Pigeon Watch lab was performed in order to observe whether natural selection occurs in different groups of pigeons located in three different types of habitats in Southern California. With the use of 20 years worth of data from our predecessors in combination with the data we collected, we were able to calculate and analyze that data to find that there was a significant difference between habitat and pigeon morphs. In conclusion, our findings rejected the null hypothesis, meaning that stabilizing selection is at play in our local communities, and that our original hypothesis was correct. In the future, in order to continue creating accurate data, we can continue to record data about pigeons in different locations.

References

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