

Correlation between Habitat Quality, Abundance and Diversity of California Birds

Abstract

Past studies have been contradictory in whether the abundance and diversity of a species is positively correlated with habitat quality. One study showed that of the 80 species of birds counted before and after a fire in a Coastal sage scrub habitat (CSS), almost 100% of the species had higher numbers in the developed habitat. Another study on land snails found that there were species that did not correlate the same way. As such, in an eight week period between November 30, 2014 to January 25, 2015, I observed ten different species of common birds native to the CSS habitat in three different qualities of habitats: highly degraded, restoration in progress and existing native habitat, all found along the Palos Verdes Peninsula. After the eight weeks, I averaged the amount of birds counted and found that with the exception of the house finch and the spotted towhee, all of the species of birds had the highest numbers in the restoration in progress habitat. These results prove that not all species have the highest numbers in a native habitat. These results can be used in several ways, including increasing the numbers of an endangered species if it is known whether the species prefers a native habitat or restoration in progress habitat. In addition, nature preserves can determine what habitat quality to insert specific species into in order to have that species thrive satisfactorily.

Introduction

When a species is downlisted or listed onto the Endangered Species List, the major concern is the reason for the occurrence. During a study on the abundance and diversity of several species of birds such as Say's Phoebe (*Sayornis saya*) and Wilson's warbler (*Wilsonia pusilla*), compared between a developed Coastal sage scrub (CSS) habitat, and the same habitat after it had been incinerated, it was found that the majority of the 80 species conducted had their numbers highly decreased in the burned habitat. The study had concluded that there was a definite correlation to the quality of the Sage Scrub Habitat and the number of birds found there for those 80 specific species.

Reviewing the results of studies like this, seeing that a burned habitat does correlate with the abundance and diversity of 80 specific species of birds, inclined me to ask the question: Is there a correlation between habitat quality and the abundance and diversity of the common species of birds in southern California? While the previous research suggests that increase in habitat quality certainly means an increase in the abundance and diversity of a species, a study on the northern spotted owl (*Strix occidentalis caurina*) proved otherwise. This study found that the diversity of the owls came from an entirely different factor- reproductive output.

Nevertheless, the common tendency for the correlation between habitat quality and the abundance/diversity of birds in particular, as shown by the study on birds in the CSS habitat by Patricia Stanton, was that abundance and diversity would increase with habitat quality, and so it led me to form the hypothesis that if habitat quality is increased, then the abundance and diversity of the common species of birds in southern California will increase as well.

The California gnatcatcher (*Poliophtila californica*) is a native species of the CSS habitat that has been considered a threatened species based on the U.S. Endangered Species Act since 1993. Around that time, several studies were conducted to see the reason for the decrease in numbers. One study, conducted in 1993, showed that the Laguna Canyon Fire, a devastating catastrophe that occurred in the San Joaquin Hills in October 1993, had damaged many CSS habitats within the area, lowering the quantity of California Gnatcatchers there heavily. Based on information from research like this, the California gnatcatcher may potentially be downlisted from the U.S. Endangered Species List after over two decades of it being threatened. Even if only two species are discovered to thrive in different levels of habitat quality, with the results of this study, other endangered species could potentially be downlisted as well if the right habitat quality is grown.

Materials

The following materials were used to gather data for this experiment: A copy of Peterson Field Guide to Birds of Western North America, Fourth Edition, by Roger Tory Peterson (used to correctly identify each the various species of birds within the CSS habitat), one pair of Bushnell Falcon 7x35 Binoculars (used to differentiate species that have similar features to other species, as well as identify species not within close proximity), a Casio FX-260 Solar Scientific Calculator to calculate the statistics after identifying the birds, a Nikon D40 DSLR to take photographs of the birds for further observation and analysis, and a scientific notebook to record data and observations.



Highly Degraded Habitat



Restoration in Progress Habitat



Existing Native Habitat

Methods

The following steps were taken in order to successfully conduct the experiment:

1) The whole study took place at the local Coastal sage scrub habitat on the Palos Verdes Peninsula. Here, every Sunday from 8:00 a.m. to 9:00 a.m., beginning on 11/30/14 and ending on 1/25/15, I observed three different habitats of differing qualities for twenty minutes each (8 weeks in total). The highly degraded habitat was observed from between 8:00-8:20, the restoration in progress habitat was observed from between 8:20-8:40, and the existing native habitat was observed from between 8:40-9:00.

2) Ten species were observed during the trials. These species are the house finch (*Carpodacus mexicanus*), California towhee (*Melospiza crissalis*), lesser goldfinch (*Carduelis psaltria*), spotted towhee (*Pipilo maculatus*), Anna's hummingbird (*Calypte anna*), white-crowned sparrow (*Zonotrichia leucophrys*), bushy-tit (*Aegithalidae*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaidura macroura*), and the American crow (*Corvus brachyrhynchos*). According to the Peterson Field Guide to Birds of Western North America, these birds are all considered "common" species. Throughout each twenty minute period, with the use of the Peterson Field Guide and the Bushnell Binoculars, I counted each bird I spotted in the specific habitat I was observing. If I saw a bird in a different habitat that was not located in the specific habitat being observed, it was not calculated.

3) At the end of the eight week period, the number of birds counted for each species in each habitat were averaged, and those numbers were written down. Finally, the averages were compared and analyzed to determine the correlation between habitat quality and the abundance and diversity of the ten specific common birds chosen for the study. In addition, the observation written down for each week was taken into account when analyzing the averages

Results: Tables and Graphs

Species	Trial # 1	Trial # 2	Trial # 3	Trial # 4	Trial # 5	Trial # 6	Trial # 7	Trial # 8
House Finch	0	1	0	0	1	0	0	2
California Towhee	0	0	0	2	1	1	0	2
Lesser Goldfinch	0	0	0	4	0	0	0	4
Spotted Towhee	0	0	0	1	1	0	5	0
Anna's Hummingbird	0	0	0	0	2	0	0	0
White-Crowned Sparrow	1	0	1	4	0	0	0	0
Bushy-tit	0	0	0	1	0	0	0	1
Western Meadowlark	0	0	0	0	0	0	0	0
Mourning Dove	0	0	0	4	0	0	1	1
American Crow	0	0	0	0	0	0	0	0

Table 1: Highly Degraded Habitat Raw Data

Species	Trial # 1	Trial # 2	Trial # 3	Trial # 4	Trial # 5	Trial # 6	Trial # 7	Trial # 8
House Finch	3	0	2	0	1	4	0	4
California Towhee	3	12	4	6	3	2	2	10
Lesser Goldfinch	2	2	0	0	2	1	0	6
Spotted Towhee	1	10	4	3	6	2	1	2
Anna's Hummingbird	0	4	2	9	2	12	11	7
White-Crowned Sparrow	2	0	2	6	7	3	0	9
Bushy-tit	2	11	4	5	8	2	0	17
Western Meadowlark	2	0	0	0	2	0	0	5
Mourning Dove	4	3	5	2	3	3	8	4
American Crow	8	0	2	2	4	0	0	0

Table 2: Restoration in Progress Habitat Raw Data

Species	Trial # 1	Trial # 2	Trial # 3	Trial # 4	Trial # 5	Trial # 6	Trial # 7	Trial # 8
House Finch	3	0	8	4	4	12	0	11
California Towhee	0	8	2	3	5	7	7	4
Lesser Goldfinch	0	0	0	0	5	5	0	0
Spotted Towhee	0	0	3	3	2	3	5	5
Anna's Hummingbird	0	7	0	6	1	19	13	10
White-Crowned Sparrow	1	0	7	3	5	4	0	6
Bushy-tit	3	10	5	5	6	10	3	22
Western Meadowlark	5	0	1	0	6	5	0	3
Mourning Dove	4	0	6	2	5	5	9	4
American Crow	3	0	10	26	6	1	2	0

Table 3: Existing Native Habitat Raw Data

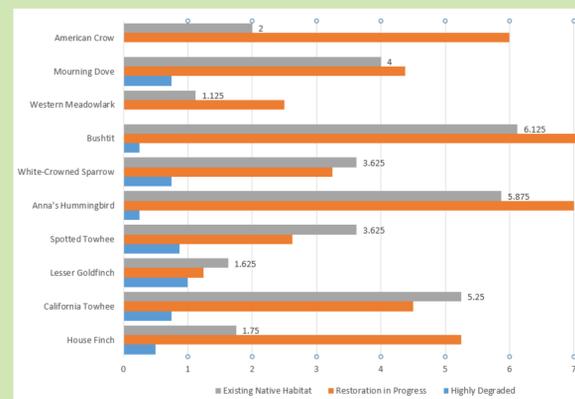


Table 4: Habitat Averages

Species	Highly Degraded	Restoration in Progress	Existing Native Habitat
House Finch	0.5	5.25	1.75
California Towhee	0.75	4.5	5.25
Lesser Goldfinch	1	1.25	1.625
Spotted Towhee	0.875	2.625	3.625
Anna's Hummingbird	0.25	7	5.875
White-Crowned Sparrow	0.75	3.25	3.625
Bushy-tit	0.25	8	6.125
Western Meadowlark	0	2.5	1.125
Mourning Dove	0.75	4.375	4
American Crow	0	6	2

Table 5: Habitat Averages

Discussion

After analyzing the results, I must deny my hypothesis.

The majority of species examined did not have an increase as habitat quality increased. On average, only the lesser goldfinch and white-crowned sparrow had the highest numbers in the existing native habitat, and it was only an increase of +0.375 each from the restoration in progress habitat to the existing native habitat. While it is unusual that the majority of species have this correlation, it makes sense keeping in mind that there were species from Stanton's research, as well as Vergeer, Rengelink, Copal and Osburg's research that had the correlation of having the greatest numbers in a restoration in progress habitat. Perhaps the species chosen for this study in particular mainly had this correlation.

The easiest explanation for this conclusion is as follows: during the first few weeks of experimentation, when the weather was cooler, (max of 23.8 degrees Celsius on the day of the first trial) the birds had most likely stayed in their native habitat where there was a higher chance of survival and less open space. In the latter trials, the weather got warmer, (about 28.8 degrees Celsius) and the birds may have gone to the restoration in progress habitat (as the conditions were still desirable with many species of plants). Reasons for traveling to the restoration in progress are searching for a new shelter, an easier source of food (as there are less plants and more open space in a restoration in progress habitat than an existing native habitat), or solely curiosity.

Looking at diversity, as it ties in heavily with abundance, the variation of species correlated roughly the same as the numbers of each species, as in the restoration in progress habitat there was the most variation of species, with the highly degraded habitat having the least variation. Reasons for this may be the same as with abundance.

Keeping in mind that experimental errors may have occurred, this information could benefit nature reserves in numerous ways. Knowing that not all species are most abundant in an existing native habitat, a study must be done on each specific species in order to discover what habitat is right for that species. In addition, a reserve that is looking for high abundance and diversity must have knowledge on the species contained there in order to know where a specific species would thrive.

Future Research

This study brings room for future questions, such as: How does habitat quality affect mortality rates of the common species of birds in southern California? In addition, this study can be expanded to further species in order to identify which specific species have this exact correlation, as well as if it applies to every species within the same genus, family, or even order. As more species' preferred habitat quality is identified, then more species can hopefully be preserved and thrive prosperously.



A California gnatcatcher in its native habitat, the Coastal sage scrub habitat.
Source: Los Angeles Times