Analysis of Tweets: Do Expert Birdwatchers Underreport Common Birds?

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Hypothesis

eBird.org is a citizen science project with more than 100 million bird sightings contributed each year by eBirders. Sightings are self-reported and are used to do real science, so it is important to ensure that observations are valid. In 2015, Kelling et al. designed a model to compute "expert" scores for eBirders so that more "expert" sightings could be weighted more highly when doing science. We hypothesize that "experts" in this system will report common birds less often than "novices" because their ability to sight uncommon birds diminishes any desire to report common birds. If this is the case, then putting more weight on "expert" sightings would misrepresent bird populations.

Data

Our data was collected from eBird.org, as mentioned above, which contains everything from the eBirder's location to which species and how many were observed to the time spent and distance travelled while birdwatching. For the purposes of our project, we only considered observations from 2019 from a specific region encompassing parts of the Midwest. To calculate the "expert" scores for our data, we could only keep observations that matched within three decimal places to one of the observations from the original paper. This constraint was unfortunate but necessary, as we were unable to link our dataset with the full NASA database used in the original paper. After filtering, we were left with about one million data points (from the original 500 million), but this filtering did not meaningfully alter the distribution of the data.

The Kelling expert score model uses a Poisson generalized additive mixture model to predict the log-expected-value of the number of species observed while controlling for hours spent birding, distance travelled, NASA land data, day, time of day, fixed effects across observer IDs, and a few other non-linear terms (the full model is here under the header "The Species Accumulation Curve Index"). The expert score as shown in our data is the log-expected-value of the number of species observed by the birder in one hour with other variables set to pre-determined constants, scoring each birder as if they were in the same exact circumstances. By design, expert score is very correlated with all of these other variables, and regressing expert score controlling for these other variables is not much use. As such, we had to use simple regressions to determine whether expert scores were linked with reporting common birds.

Findings

Claim #1: Increasing a birdwatcher's expert score had a significant positive effect on the number of common birds reported.
Support: We ran a single regression to predict the number of common birds reported from expert scores. The coefficient on expert score was significant and positive, indicating that increasing expert score by 1 leads to an average of 1.8552 more common birds reported. The table below shows our full results.

Variable	Coefficient	t	p-value
constant	-0.5090	-5.758	0.000
expert score	1.8552	64.612	0.000

Claim #2: Increasing a birdwatcher's expert score had an insignificant positive effect on the proportion of reported sightings that were common birds.
Support: We ran a single regression to predict the proportion of reported sightings that were common birds from expert scores. The coefficient on expert score was insignificant and positive, indicating that increasing expert score by 1 leads to an increase in the proportion of common birds reported by 0.00003572 on average. The table below shows our full results.

Variable	Coefficient	t	p-value
constant	0.3191	54.310	0.000
expert score	3.572e-05	0.019	0.985

Claim #3: After filtering the data to keep only the rows where birdwatchers reported all birds that they saw, increasing a birdwatcher's expert score had a significant negative effect on the proportion of reported sightings that were common birds.
Support: We noticed that one column in the data was an indicator variable for whether a birder had reported all birds they saw that day. Taking this column to be a good measure of reliability of the sighting, we filtered out all rows where this value was 0. Then, we ran a single regression to predict the proportion of reported sightings that were common birds from expert scores. The coefficient on expert score was significant and negative, indicating that increasing expert score by 1 leads to a decrease in the proportion of common birds reported by 0.0199 on average. The table below shows our full results.

Variable	Coefficient	t	p-value
constant	0.3908	64.463	0.000
expert score	-0.0199	-10.031	0.000

*Note that, although claim #3 gave significant results supporting our hypothesis, further research would need to recalculate expert scores ignoring these rows and then rerun the regression. Expert score computation did not ignore these rows; and, because expert scores are calculated in part by taking intra-observer variance into account, this means that the expert scores in the kept rows are at least slightly influenced by the observations in the ignored rows.