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Evaluation of Christmas Bird Counts and Landscape Factors as Indicators of Local Blackbird and European Starling Winter Roosts

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Introduction-

Red-winged Blackbirds (RWBL) and Common Grackles (COGR) are the two most abundant blackbird species on the continent; Brewer's Blackbirds (BRBL) are a much less common, but closely related species, and along with European Starlings (EUST), they are two of the most common groups of birds in North America, with combined populations that reach into the several hundreds of millions; making up a significant portion of the avian population. Although one of the most common birds on the continent, certain regions have seen declines in RWBL for a number of decades. In Ohio and North Dakota, this has been attributed to certain agricultural practices. Population sizes of Rusty Blackbirds, a related species, have also been on the decline for some time due largely to habitat loss, while populations of COGR, BRBL, and EUST are either stable or increasing.

Despite the decline of the RWBL in certain areas, farmers continue to endure annual monetary losses to depredation by these crop pests. In some areas, complaints of blackbird depredation have increased, giving impressions that populations in those areas are on the rise instead of decline. Damage to sunflower has been estimated at 2-4% of the value of the crops, or approximately $4-$11 million dollars. Yearly losses to corn and rice growers in the US are even higher, estimated at $25 million and $21.5 million respectively. A better understanding of blackbird population trends and how and where populations select wintering roosts would permit quicker responses and reduce the costs of identifying and managing roosts for the purposes of resource protection, and disease outbreak prevention.

Bird occupancy in an area is influenced by the surrounding landscape and climate. In agricultural areas, the greater habitat diversity means higher nest success for RWBL when compared to areas with large expanses of crop fields. The suitability of a wetland may be increased by surrounding cropland, and the amount of cropland in a landscape has been found to have more effect on the density of male RWBL than the amount of wetland. Several studies have attributed the abundance of RWBL to the amount of corn and hayfield present in the landscape. Changes in global climate have begun affecting blackbird populations as well. Birds nest earlier in years with milder springs; up to 1.8 days earlier per degree Celsius increase. They also end nesting later during years with cooler springs. If the surrounding landscape and climate affect habitat selection and behavior during the breeding season, it should be reasonable to expect similar effects for habitat selection during the wintering season, while changes in these could cause unpredictable shifts in population size, habits, and locations.

The goals of this study are to analyze trends in blackbird and starling population data obtained from Christmas Bird Count (CBC) data, to identify landscape level factors that influence selection of winter roosting sites, and to evaluate the Christmas bird count as an indicator for changes in roost locations due to changes in climate. The fulfillment of these goals will have several important results; the first of which is the quick identification of roost sites for routine or emergency management actions. This will make it easier to protect crops from blackbird depredation, and will also make it easier to manage disease outbreaks that could potentially

affect commercial bird farms. This study will also generate baseline data for monitoring changes in roost selection and how it can be affected by changes in climate.

Methods-

Blackbird and European starling data from the CBC will be analyzed from 1988-2008. Population trends will be identified and catalogued within and between bird conservation regions, which then can be used to construct longer-term population models on both local and regional scales. Blackbird and starling count numbers for each site will be used as the dependent variable in modeling; independent variables will include land use and weather covariates. Counts will be adjusted for effort and populations will be standardized both to a mean population size and to a baseline year yet to be determined.

Standard weather data was obtained from the National Climatic Data Center, a division of the National Oceanic and Atmospheric Administration (National Climatic Data Center 2002). Weather data will be compiled for recording stations that are within or near CBC areas. Potential weather variables that will be used in the analyses of blackbird and starling population trends include mean overall monthly temperature, mean minimum/maximum monthly temperature, total yearly precipitation, mean winter monthly temperature, mean winter minimum/maximum temperature, and meat winter precipitation as these variables are shown to affect bird populations. The measurements obtained for the winter months will be taken from November, December and January; the month before the Christmas Bird Count can be conducted and the two months that it can actually be conducted. Weather variables will be summarized across each year by averaging temperature data and summing precipitation data over the same period. Additionally, the effects of weather over the entire year as well as from the previous season will be examined as past weather has been shown to affect vegetation the following year thereby potentially influencing blackbird abundance.

Habitat selection by blackbirds will be analyzed by merging CBC data with land cover data in selected CBC count circles. Landscape-level habitat was quantified using CBC sites in eastern Texas, Tennessee, Mississippi Alabama, Missouri, Arkansas, Louisiana, Kentucky and Kansas. Landscape-level habitat variables have been quantified in a 24-km CBC survey circle using land cover spatial data (USDI Geological Survey 1992 and 2001). Each grid cell within the 24-km survey area was classified into one of nine general land cover types likely to be found in southeastern CBC survey circles. Broad scale land cover types are modified from Anderson et al. (1976) and include open water, developed, barren, forested, shrubland, herbaceous planted, herbaceous upland, non-natural woody, and wetland. Because habitat area per se has not been an adequate predictor of bird abundance changes, other landscape-level factors such as habitat diversity, edge effects and spatial organization of features will be incorporated into landscape analyses. This will be done by measuring contagion (the degree of which land types are found within continuous patches) of land types.

Results and Discussion-

Preliminary analyses have yielded several unexpected results. Where most literature and analyses have indicated a negative population trend for RWBL populations, trends in unmodified data for the majority of BCRs in this study have shown positive population trends. Five have trends that are strongly positive, four show weakly positive trends and three show trends that are strongly negative. The population trends in the sites themselves are more even, with 100 sites that show population decreases, 94 sites that show population increases and 141 sites that show either stable populations or had too few survey years to form trends. The sits

themselves show no noticeable pattern in their latitudinal distribution; sites of all three population trends pepper the landscapes of all BCRs. The sites that show the greatest declines have been those that are in close proximity or have high proportions of the developed land use type. The two BCRs that show the most extreme negative trends (Gulf Coastal Prairie and Southeastern Coastal Plain) are both Southern BCRs that have significant coastlines. Special interest has been shown in the Gulf Coastal Prairie for two reasons, first: it has the highest blackbird population levels recorded in the US by the CBC. Several count years have recorded roosts of massive proportions (20+ million RWBL). Second: it shows the greatest level of decline of blackbirds over the last 20 years; going from roost sizes in the dozens of millions in the 1980's and 1990's to roosts in the single millions over the last ten years. Another trend observed is CBC sites that have had a population decreases over the study period have also seen steady increases in mean temperatures and decreases in precipitation measurements; where when a CBC site has an increasing population, climate variables are either stable or show opposite trends from when populations are decreasing. With all population data combined over all regions, a positive population trend is shown (fig. 1).

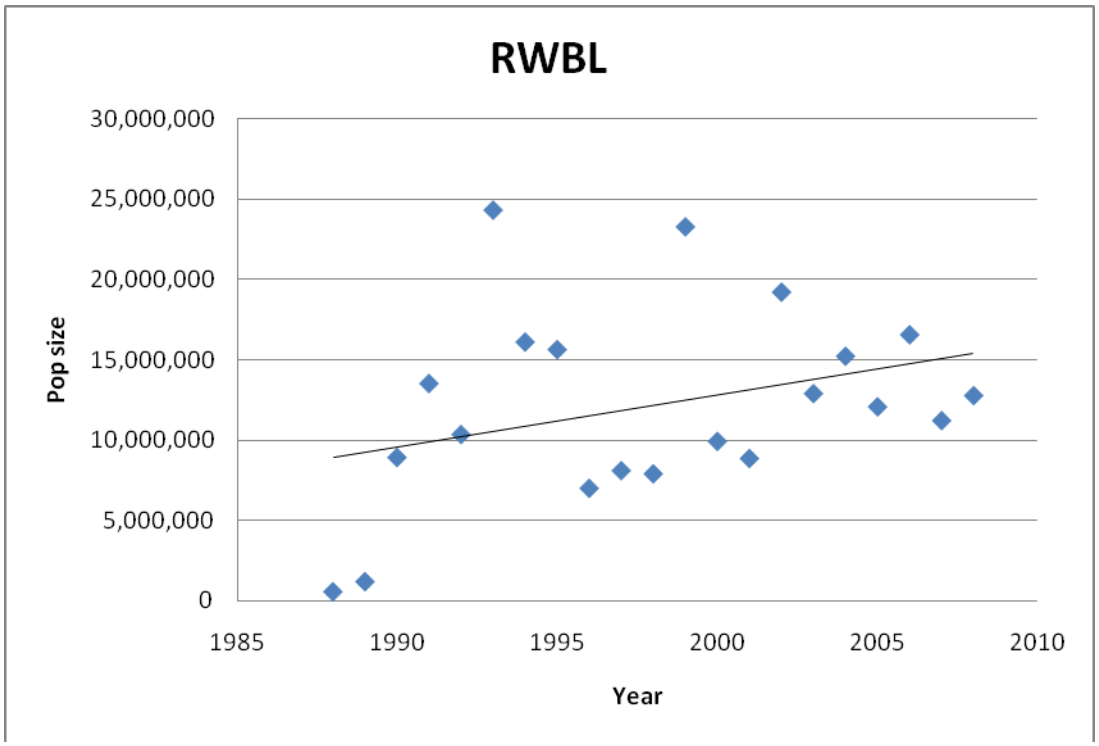

Figure 1. Total population of RWBL over 20 years of Christmas Bird Counts across 12 bird conservation regions

The Christmas Bird Count is the oldest and largest survey conducted in the US and is a valuable source of data. No other data set provides such a broad temporal and geographic coverage of bird population data. It has undisputed value in documenting patterns of change in species richness and distribution. However, despite its strengths, the CBC was not intended as a population monitoring tool; several scientists have spoken out against use of the CBC, citing the non-random distribution of count circles and the lack of strong standardization. Despite this criticism, for many species, the CBC often indicates changes in population that are roughly in agreement with the Breeding Bird Survey (BBS) which is a highly standardized survey of breeding birds conducted over the majority of the US. Parallel results have also been found for Project FeederWatch, an independent, more standardized winter bird count and the Midwinter Inventory, a winter survey of ducks, geese and swans.

One possible explanation for the pattern of RWBL decline in its southern wintering range is climate change. For several years there have been studies that focus on how climate change has been affecting the habitat of breeding birds; how their breeding ranges have shifted north and egg-laying dates have become earlier. There was recently a publication by a group of Durham scientists showing that migration distances could increase up to 250 miles in some species of migratory birds. However, if the northern edge of a species range shifts north due to climate, it should be reasonable to expect to southern edge of its range to shift north accordingly. A large part of bird occupancy in a habitat is related to climate, many species migrate south in winter to avoid seasonal changes; and then return when the climate becomes more hospitable. It would not be a far stretch to expect that as the southern edge of a species range becomes less hospitable, that edge would shift. Another possible explanation for the decrease is migrants. Migrant birds fly south each fall and north each spring, if climate changes are making the northern parts of their range more hospitable, fewer birds are going to migrate south for the winter, and those that migrate to the farthest edge of the northern range might not migrate as far south as they had in past years.

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