Bald Eagle Watch

2020 Final Report to the American Eagle Foundation

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Bird Conservancy of the Rockies
Connecting People, Birds and Land

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Connecting people, birds and land

Mission: Conserving birds and their habitats through science, education and land stewardship

Vision: Native bird populations are sustained in healthy ecosystems

Bird Conservancy of the Rockies conserves birds and their habitats through an integrated approach of science, education, and land stewardship. Our work radiates from the Rockies to the Great Plains, Mexico and beyond. Our mission is advanced through sound science, achieved through empowering people, realized through stewardship, and sustained through partnerships. Together, we are improving native bird populations, the land, and the lives of people.

Core Values:

1. **Science** provides the foundation for effective bird conservation.
2. **Education** is critical to the success of bird conservation.
3. **Stewardship** of birds and their habitats is a shared responsibility.

Goals:

1. Guide conservation action where it is needed most by conducting scientifically rigorous monitoring and research on birds and their habitats within the context of their full annual cycle.
2. Inspire conservation action in people by developing relationships through community outreach and science-based, experiential education programs.
3. Contribute to bird population viability and help sustain working lands by partnering with landowners and managers to enhance wildlife habitat.
4. Promote conservation and inform land management decisions by disseminating scientific knowledge and developing tools and recommendations.

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Executive Summary

This report summarizes the efforts of Bald Eagle Watch for the year 2020. Nest monitoring focused on Colorado's Front Range and Eastern Plains, though a number of territories west of the Continental Divide were also monitored, especially along the Colorado River.

From January 1, 2020 to July 30, 2020, forty volunteers collected data for nest status, activity, and survival at 161 locations where occupied Bald Eagle nests have been recorded within the last 5 years; this represented an increase of 32 nest locations over the 2019 effort. Volunteers submitted 1,998 observations and donated 2,379 hours of their time to monitoring. Of 161 monitored nests, 137 were occupied, while 98 successfully produced young.

In collaboration with Colorado Parks and Wildlife, we developed an algorithm to perform analysis of nest fate and phenology using the programming language R, which extracts and calculates covariates required for nest survival modelling. This allowed us to process more than 5,000 individual nest observations from 2016 to 2020 into an input file for program MARK, which contains 323 nest attempts and associated covariates. We also incorporated PRISM weather data, adding covariates for temperature and precipitation by month for each nest location. We included a new development index from Colorado Parks and Wildlife that quantifies the degree of development-related incursion around Bald Eagle nests in the Front Range of Colorado. With these analyses complete, we are ready to compare models of nest survival and identify sources of variation in daily survival rate.

Acknowledgements

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Introduction

Bald Eagle Watch began in 1988 at Barr Lake State Park with the purpose of monitoring and protecting the first recorded post-DDT Bald Eagle nest in Colorado's Front Range region. Since that time, Colorado's Bald Eagle population has expanded significantly to more than 200 breeding pairs (Mike Sherman, personal communication). The Bald Eagle Watch program expanded as new nesting territories were located in the area. Today the program collects data on 161 Bald Eagle nests throughout the state, representing approximately 81% of the Colorado's known breeding population. This growing dataset is the largest and most comprehensive in the state for this species.

The goals of Bald Eagle Watch are to monitor the status of Colorado's nesting population of Bald Eagles, work with Colorado Parks and Wildlife (CPW) to identify threats and reduce disturbance to occupied nests, analyze data to identify habitat needs and conservation challenges, and engage the public in citizen science and conservation through volunteering.

Methods

Study Area

In 2020, Bald Eagle nests were monitored in three core areas:

A) Front Range
B) Upper Colorado River
C) Lower Colorado River

Nests were monitored in the highest number and intensity along the Front Range, largely due to the density of nests in the region and the availability of volunteers from the Denver metro area. Fewer nests were monitored along the Colorado River and other areas of the West Slope, and these nests were visited less frequently than nests on the Front Range.

Sampling Design

Bald Eagle Watch employs a convenience sampling approach based on nest location information from various sources. New nests are located by volunteers, CPW staff, wildlife consultants, and the public. Nest locations are then verified by Bird Conservancy volunteers and assigned for monitoring by the program coordinator.

Field Methods

Nest monitoring began at the start of the nesting season in January and February 2020 and continued until early July or when young fledged. Volunteers verified the location, condition, and status of nests known to be occupied in 2019. Start-of-season data also included:

- Nest tree species and height/maturity relative to surrounding stand
- Whether nest was within 2 miles of a surface water body
- Whether nest was within 2 miles of an active prairie dog colony
- Whether nest was within 1 mile of a riparian corridor
- Whether nest was within 1 mile of non-riparian wetlands
- Presence of undeveloped land around the nest
- Apparent threats to nest, if any

- Estimated severity of threats, if reported

Volunteers recorded changes in these conditions during the nesting season. These data were also recorded for new nests located during the nesting season. Following the first visit of the season, volunteers visited nest locations approximately twice a month and recorded a list of conditions and behaviors including:

- Observation start and end times
- Wind speed (Beaufort Scale)
- Sky condition
- Status of nearby surface water (frozen/not frozen/partially frozen)
- Air temperature in degrees Fahrenheit
- Number of adults present
- Number of nestlings present
- Number of fledglings present
- Territory defense (yes/no)
- Presence of other raptors
- Branching (yes/no)
- Courtship (yes/no)
- Copulation (yes/no)
- Flight with adult (yes/no)
- Flight in vicinity of nest (adult and young/young/adult/no)
- Perching in nearby structure or tree (adult and young/young/adult/no)
- Perching in nest or nest tree (adult and young/young/adult/no)
- Incubation (yes/no)
- Brooding young (yes/no)
- Nest construction (yes/no)
- Egg hatching (yes/no)
- Feeding young (yes/no)
- Feeding self (adult and young/young/adult/no)
- Human activity/disturbance (yes/no)
- Human activity notes

Data were entered into an online data-entry system at CitSci.org, and downloaded as a comma separated values document for review and analysis. Because of the uncertainty around the date of completion for Bird Conservancy's new in-house data entry platform, we plan to continue using CitSci.org. We are currently providing feedback and working with the CitSci development team on a redesign of the platform, which was scheduled for release in September 2020, but has faced development delays. We anticipate transitioning to the new platform ahead of the 2022 nesting season.

Data Analysis

Nest Fate and Apparent Success

Data were downloaded from CitSci.org in comma separated values (CSV) format, and were imported into RStudio for analysis. We evaluated nest fate based on two criteria: presence of fledglings recorded by an observer, or documented survival of young to at least 8 weeks of age (Steenhof and Newton 2007). We calculated mean apparent nest success by dividing the number of successful nests by the total number of occupied nests. Mean nest productivity for occupied nests was calculated by dividing the number of fledglings by the total number of occupied nests with a known outcome. We also calculated mean productivity of successful

nests by sub-setting the data to exclude nests that failed or had an undetermined outcome, and dividing the number of fledglings by the number of successful nests.

Nest Survival

While apparent nest success is useful for describing nest observation data, it is less useful for quantifying the likelihood of nest success or failure. Observational data of nests are likely to be biased toward active or successful nests; undercounting nests that have failed or been destroyed results in apparent success being greater than the true nesting success of a species (Mayfield 1975). This is due to differences in detectability – active or successful nests are more likely to be detected than those that failed (Rotella 2019). To adjust for this bias, nest survival models are used to produce maximum likelihood estimates of daily survival rate, and ultimately an estimate that better represents true nest success (Rotella 2019).

Before we can analyze survival models, raw data must be transformed into more interpretable covariates. From Rotella 2019, the minimum covariates needed to run a nest survival model are:

- Date Found: the first day of the nesting season the nest was observed, excluding dates prior to the onset of incubation

- Last Known: the last day of the nesting season on which the nest was known to be viable (had not yet failed)

- Fate: whether the nest succeeded or failed, if known

- End Date: the date on which the either young fledged or the nest failed; End Date and Last Known will be the same for successful nests

- Age Day 1: Date on which incubation began

We determined Date Found and Last Known by creating a subset of the data in which either incubation was recorded or nestlings were present, and taking the minimum and maximum observation date for each year within that subset.

Before determining an End Date, we assigned a Fate for each nest attempt. Nest attempts for which fledged eaglets were recorded were considered successful. For nest attempts that did not contain records of fledged eaglets, we assessed the elapsed time during which live nestlings were recorded, and considered nests successful if that time period was a minimum of eight weeks (Steenhof and Newton 2007). Nest attempts that did not meet these criteria either failed or had an undetermined outcome. If a nest attempt had observations documenting failure, or had observations after the Last Known date which did not contain records of fledged young, we considered it failed. If there were no observations after the Last Known date, we considered the Fate undetermined.

Then we assigned an End Date based on the assessment of Fate. We assigned End Date for successful attempts as the earliest date that fledglings were recorded, or the date at which eaglet presence reached at least eight weeks. Some attempts were successful by both criteria, and in such cases, the earlier date was selected as the End Date. This was done to avoid giving nests credit for survival after the nest was no longer exposed to failure (Rotella 2019). We assigned End Date for failed nests based on the date failure was recorded. If failure was not explicitly recorded, we chose the midpoint between Last Known and the date of the next subsequent observation (Rotella 2019). Nests for which we were not able to determine Fate

have been excluded from the data, though we may include them in the future. For these nest attempts, End Date will equal Last Known.

Age Day 1 was determined by estimating the date incubation began, and was done in one of two ways. First, if the nest attempt had records prior to the first record of incubation, we chose the midpoint between the maximum of those dates and the first date on which incubation was recorded, with the assumption that observations were unlikely to have been made on the very first day incubation began. If no observations pre-dated recorded incubation, Age Day 1 was determined by subtracting the incubation period from the estimated date of hatch, which was either from observation notes or backdated from the End Date.

We then joined the covariates developed from the observation data to tables containing minimum and maximum temperature and precipitation (PRISM Climate Group 2021) at each nest location for each month and year in the data. Finally, we matched nest locations to a new development index from CPW that quantifies the degree of development-related incursion around Bald Eagle nests in the Front Range of Colorado (Aagaard 2021).

Results

In 2020, forty volunteers submitted 1,998 observations, and donated 2,379 volunteer hours to the program. Of the 161 nests monitored in 2020, 137 were occupied and 98 produced young. Apparent success rate for occupied nests was 77%, and apparent productivity for occupied nests was 1.62. Successful nests produced 1.88 young per nest.

From the 519 nest attempts included in data from 2016 to 2020, we were able to process 323 into input rows containing survival model and weather covariates. Of these, 64 matched with locations from the development index, resulting in the Bald Eagle Watch survey area being significantly larger than the index's area of inference. We intend to run survival models on both groups, and hope to include development index covariates for more nests in the future. Pending future funding, we intend to publish model results in a peer-reviewed manuscript, and will inform the American Eagle Foundation when this has been accomplished.

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