Whooping Crane Cellular Telemetry Data Application

I. INTRODUCTION

During the First Increment the Platte River Recovery Implementation Program (hereafter, Program) used data collected through the Whooping Crane Monitoring Protocol and First Telemetry Tracking Partnership (2009-2018; Pearse et al. 2020) to understand how whooping cranes utilized available habitat within the Associated Habitat Reach (AHR). The research concluded whooping cranes were roosting in wider unobstructed channel widths and further distances from forest than availability would indicate (Baasch et al. 2019). These datasets were adequate to identify site-level characteristics selected for by birds that stopped during migration in the AHR. They were not adequate to understand what factors encountered by birds as they crossed into the AHR were associated with whooping cranes stopping compared to those that fly over the AHR during migration events. To answer this question, the Program has acquired an initial dataset of all recorded location data within 62 miles of the AHR from the Whooping Crane Cellular Telemetry Tracking Partnership (2017-2020).

Cellular telemetry data from this partnership consists of individual telemetry equipped whooping cranes providing locational data every 15 minutes. This sub-hour time frame was much more frequent than the First Telemetry tracking partnership, which provided locational data every 4-6 hours (Pearse et al. 2020). A 15-minute interval between locational data provides the opportunity to assess not only conditions encountered when whooping crane initially stop in the AHR, but also conditions encountered when whooping crane fly over the AHR instead of stopping. Our objective was to use the cellular telemetry data to identify important factors associated with stopovers compared to flyovers of whooping cranes encountering the AHR during migration events.

II. DATA COLLECTION AND ANALYSIS

Our first step was to parse the telemetry dataset into ground locations and flight locations to identify whooping crane stopover events. We used altitude and speed metadata gathered with each recorded location to determine flight and ground locations. We then identified each individual bird migration event in the dataset and determined if the bird (1) flew over the AHR without stopping (flyover), (2) stopped in the AHR (stopover), or (3) did not interact with the AHR during a migration event. For each event, we recorded the time until sunset plus 30 minutes (Time), maximum unobstructed channel width of nearest PRRIP geomorphic monitoring transect (MUCW), and instantaneous flow recorded at the Kearney USGS river gage (flow) at the time a bird interacted with the central Platte River. We used a multivariable logistic regression to understand the impact of these factors on the probability a bird initiates a stopover in the AHR during a migration event.

III. RESULTS

We identified 8 stopovers and 89 flyover events from fall 2017 – spring 2020 associated with the AHR from 49 individual birds. Preliminary analysis results indicate stopover initiation was highly influenced by time of day and less so by MUCW and flow conditions (Figure 1; Table 1). Model validation measurements indicate a very good model classification ability and fit (AUC > 0.9, Pseudo R2 >0.4) when only Time is included in the model to explain the probability of a stopover occurring and only a slight increase in fit when MUCW and/or flow is added to the model (Table 1).

IV. DISCUSSION QUESTIONS

A. Because we will likely always be limited by a low proportion of marked birds stopping in the AHR, should a different analysis technique be considered?

B. How much is enough? How many years of data are necessary to meet our research objective?

C. What other important factors should be considered, both Program manageable and unmanageable?

D. Although our preliminary results indicate Program manageable factors of MUCW and flow show less influence on predicting stopover initiation, what experimental design considerations during the First Increment Extension could increase our understanding of manageable factors beyond the limits of the current dataset with only 8 stopovers?

1. What spatial/temporal scales of MUCW should we collect?

2. Flow manipulation. Which ranges of flow should we test?

V. FIGURES AND TABLES

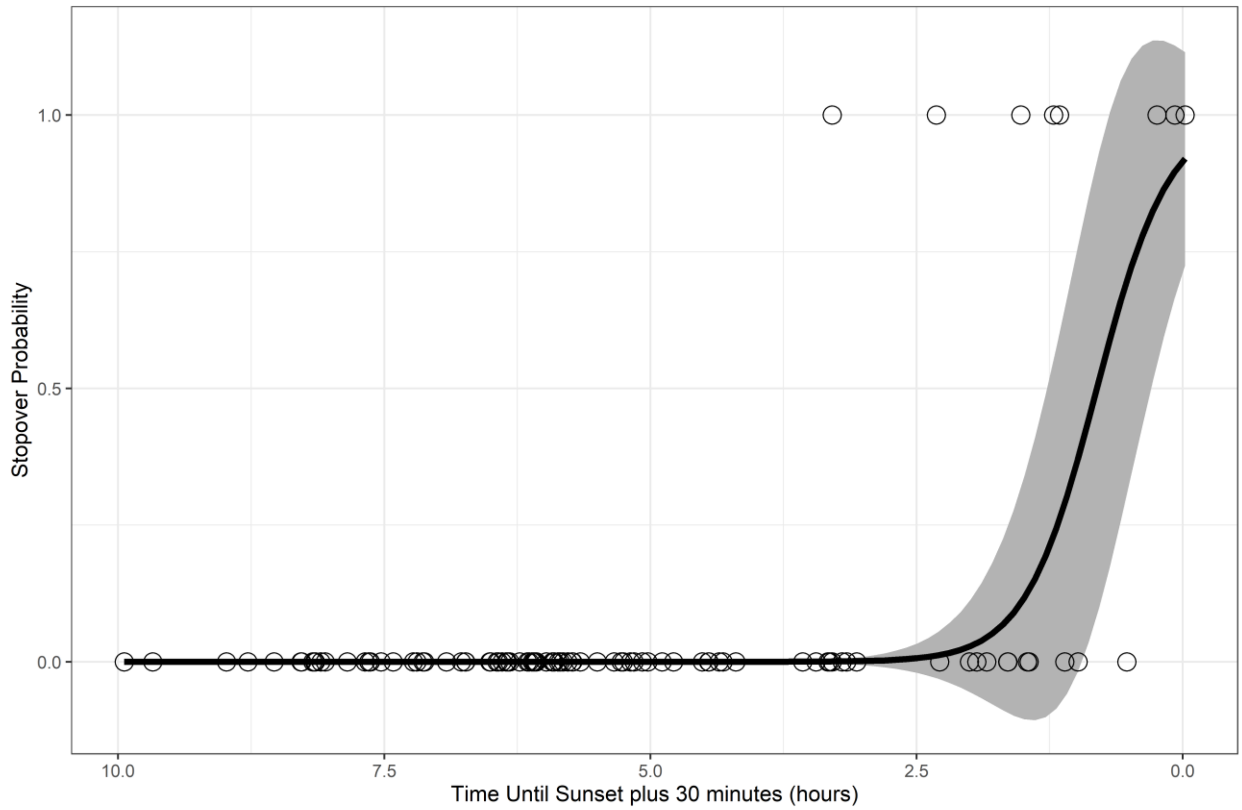

Figure 1. Predicted probability of an Associated Habitat Reach stopover in response to time until sunset plus 30 mins of cellular telemetry marked whooping cranes from fall 2017 – spring 2020. Open circles represent whooping crane stopovers (y=1) and flyovers (y=0).

Table 1. Whooping crane stopover decision model selection in the Associated Habitat Reach.

Model Rank	Variables	AUC[a]	Pseudo R^{2b}
1	Time of Day * MUCW	0.96	0.58
2	Time of Day * MUCW + Flow	0.96	0.64
3	Time of Day	0.95	0.49
4	Time of Day + Flow	0.95	0.51
5	MUCW	0.7	0.07
6	Flow	0.67	0.03

[a]Area under the receiver operating characteristic curve (AUC)

[b]McFadden's pseudo R^2 (Pseudo R^2)

VI. REFERNCES

Baasch, D. M., P. D. Farrell, S. Howlin, A. T. Pearse, J. M. Farnsworth, and C. B. Smith. 2019. Whooping crane use of riverine stopover sites. C. R. Brown, editor. PLOS ONE 14:e0209612.

Pearse, A. T., D. A. Brandt, D. M. Baasch, M. T. Bidwell, J. A. Conkin, M. J. Harner, W. Harrell, and K. L. Metzger. 2020. Location data for whooping cranes of the Aransas-Wood Buffalo Population, 2009-2018. U.S. Geological Survey. <https://www.sciencebase.gov/catalog/item/5ea3071582cefae35a19349a>. Accessed 28 Jan 2021.