Whooping Crane Science Update

Program Context: The Program's management objective for the whooping crane (WC) is to: *Contribute to the survival of whooping cranes during migration.* To meet this objective the Program aims to increase availability of whooping crane migration habitat along the central Platte River. Performance indicators such as the area of suitable roosting and foraging habitat, proportion of the Aransas-Wood Buffalo (AWB) population using the central Platte and associated habitat, and number of crane use days are used to assess progress toward meeting the management objective.

During the Program's First Increment Extension, there are six Extension Big Questions (EBQs) related to whooping cranes (WC):

EBQ #1 How effective is it to use Program water to maintain suitable whooping crane roosting habitat?

EBQ #2 How effective is Program management of *Phragmites* for maintaining suitable whooping crane roosting habitat?

EBQ #3 Is sediment augmentation necessary to create and /or maintain suitable whooping crane habitat?

EBQ #4 Does flow influence WC decision to stop or fly over the AHR?

EBQ #5 Does flow influence WC stopover length within the AHR?

EBQ #6 Why is spring WC use of the AHR greater than fall WC use?

The Program's system-level aerial monitoring and the cellular telemetry tracking partnership together document WC use of the Associated Habitat Reach (AHR) from Lexington to Chapman, NE along the central Platte River to evaluate WC response to Program management of land and water to create and maintain WC habitat.

2021 Summary

Spring: (**Fig. 1**)	Fall: (**Fig. 2**)
6 WC	88 WC
1.19% of AWB Population	17% of AWB Population
64 crane use days	522 crane use days

Looking Back: The Program has done extensive research to understand whooping crane riverine habitat selection through analysis of system-level aerial monitoring and telemetry data. Unobstructed channel widths and distance to nearest forest have been found to be the most important predictors of selection of in-channel riverine roost sites (Baasch et al. 2019). Relative probability of whooping crane use was maximized when channel widths reached 650 ft or more and when distance to nearest forest was 525 ft or more. Various flow metrics were also evaluated, and no direct relationships between flow and roost-site selection was found within the AHR (PRRIP 2017).

The Program has also analyzed flow in relation to WC stop-over decisions. Cellular telemetry data now provides locational data at 15 min intervals, allowing the Program to evaluate habitat variables associated with location points when individual WC first encounter the AHR. Initial analyses focused on flow, unobstructed channel width, and time of day as potential predictors of WC stop-overs (**Table 1)**. Flow was not a good predictor of WC decision to stop (EDO 2021). Time of day together with maximum unobstructed channel width (MUOCW = the widest unvegetated width of the channel, including all bare-sand islands and water area between patches of dense vegetation ≥2ft in height) were the best predictors of WC stopovers, but adding MUOCW improved model predictability little more than time of day alone.

In addition to proportion of WC that use the AHR, the Program has reported crane use days as an indicator of the Program's contribution to WC survival during migration (**Figs. 1-2**). Crane use days are reported in seasonal monitoring reports, but to date Program analyses have not formally utilized stay length as a measure of WC response to land and water management.

Based off the Program's systematic aerial monitoring data going back as far as 2001, the Platte River has generally higher proportions of WC use during the spring migration than the fall migration, (Figs. 1-2). Spring flows are generally higher than those WC experience during fall migration, leading to the initial focus on flow for EBQ #6. Though monitoring and research have taken seasonal differences into account, a formal analysis of the drivers responsible for seasonal differences in WC use of the AHR has not been done.

Looking Forward: To evaluate the factors important in WC stopover decisions, cellular telemetry data will continue to be collected and analyzed (EBQ #4). Given the initial importance of time of day for predicting WC stopovers, a second tiered analysis will be required to assess effect sizes of flow, MUOCW, land cover types, and other factors outside of Program control such as weather, previous stopovers, etc. The small number of telemetry birds that stop along the AHR limits the confidence we have in preliminary analyses and may limit the ability to examine smaller effects as we move forward. Currently the Program only receives telemetry data for WC locations within 62 miles of the AHR. However, if variables outside the AHR (i.e., distance from last stop-over) are to be weighted in this model, the Program will need to request a wider area of locational data within the migration corridor from the WC Tracking Partnership.

To address WC habitat selection once the decision has been made to stop (at use locations), two rounds of iterative evaluations of habitat selection by WC using both system-level aerial monitoring data and telemetry locations are planned. These analyses will also address WC response to channel width creation/maintenance through germination suppression flow releases, *Phragmites* management, and sediment augmentation (EBQ #1-3).

The Program will begin to evaluate if stay length is a function of flow. Remote sensing and hydraulic modeling will be used to estimate wetted width and percent of channel that is ≤1 ft deep from flow. To answer alternative hypotheses of EBQ #5 (e.g., AHR length of stay has an inverse relationship with length of stay at the previous stopover and a direct relationship with distance traveled since last stopover) the Program will again need to rely on a wider dataset obtained from the WC Tracking Partnership.

The management hypothesis for EBQ #6 focuses on investigating the importance of flow for explaining differences in WC seasonal use patterns. Data from 2007-2021 show more mean spring flows over 2500 cfs than fall (**Fig. 3**). Additionally, there are more mean fall flows under 1000 cfs than spring. Highest proportional use of the AHR has occurred in the spring with mean flows between 1500-2500 cfs. Other potentially important factors to consider for understanding seasonal migration strategies include reproductive cycle, trajectory, timeline, group composition, resource availability, and weather, many of which are outside the Program's control. For example, the highest number of whooping cranes observed during a single day and total crane use days over a single season occurred in Fall of 2021 when flows during the last half of the season were low. Weather conditions gathering birds together at staging grounds prior to reaching the Platte and unfavorable weather to the south of the Platte during their stay have been suggested to explain the record number of birds observed in the AHR during this season.

Discussion Questions

What would you like to see in terms of data on atmospheric conditions to help explain how weather affects choices for stopover and stay length? Atmospheric conditions at what locations are most important?

References

Baasch DM, Farrell PD, Howlin S, Pearse AT, Farnsworth JM, Smith CB. 2019a.Whooping crane use of riverine stopover sites. PLoS ONE 14(1): e0209612. https://doi.org/10.1371/journal.pone.0209612

Executive Directors Office (EDO). 2021. Whooping Crane Cellular Telemetry Data Application. https://platteriverprogram.org/system/files/2021-07/02%20-%20WC%20Stopover_Flyover%20ISAC%20Summary.pdf

Platte River Recovery Implementation Program (PRRIP). 2017. Data Synthesis Compilation. Whooping Crane (Grus americana) Habitat Synthesis Chapters. August 15, 2017. https://platteriverprogram.org/sites/default/files/PubsAndData/ProgramLibrary/PRRIP%20Whooping%20Crane%20Habitat%20Synthesis%20Chapters.pdf

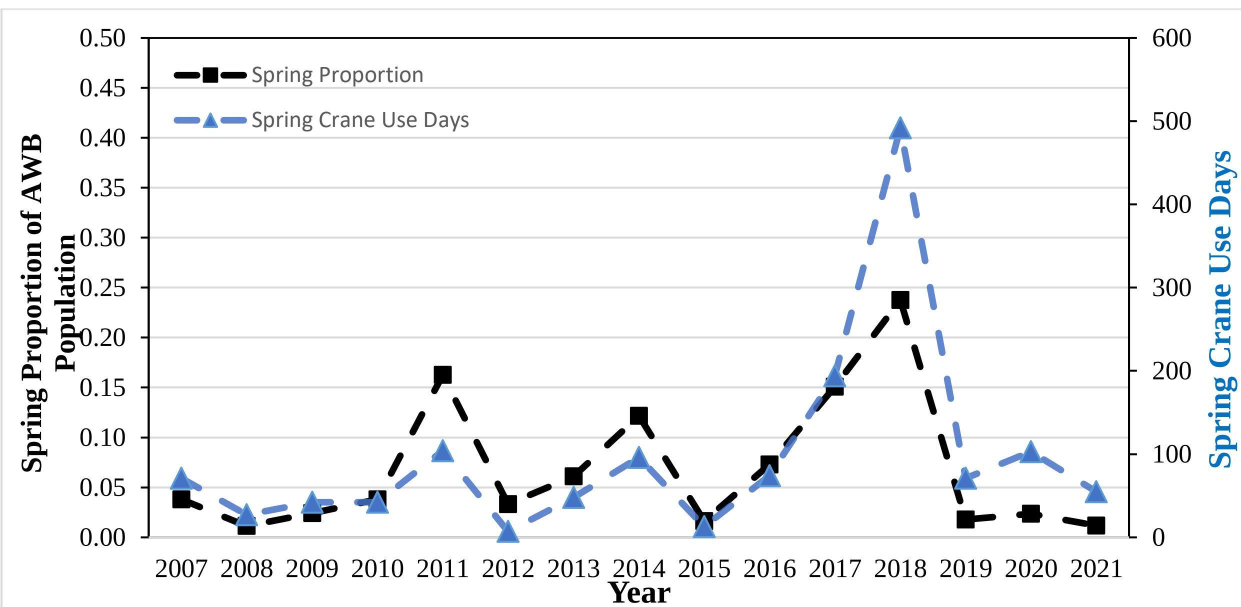

Figure 1. Spring annual proportion of the estimated Aransas-Wood Buffalo (AWB) whooping crane population observed (black squares) and number of crane use days (blue triangles) during aerial systematic and opportunistic spring migration surveys from 2007-2021.

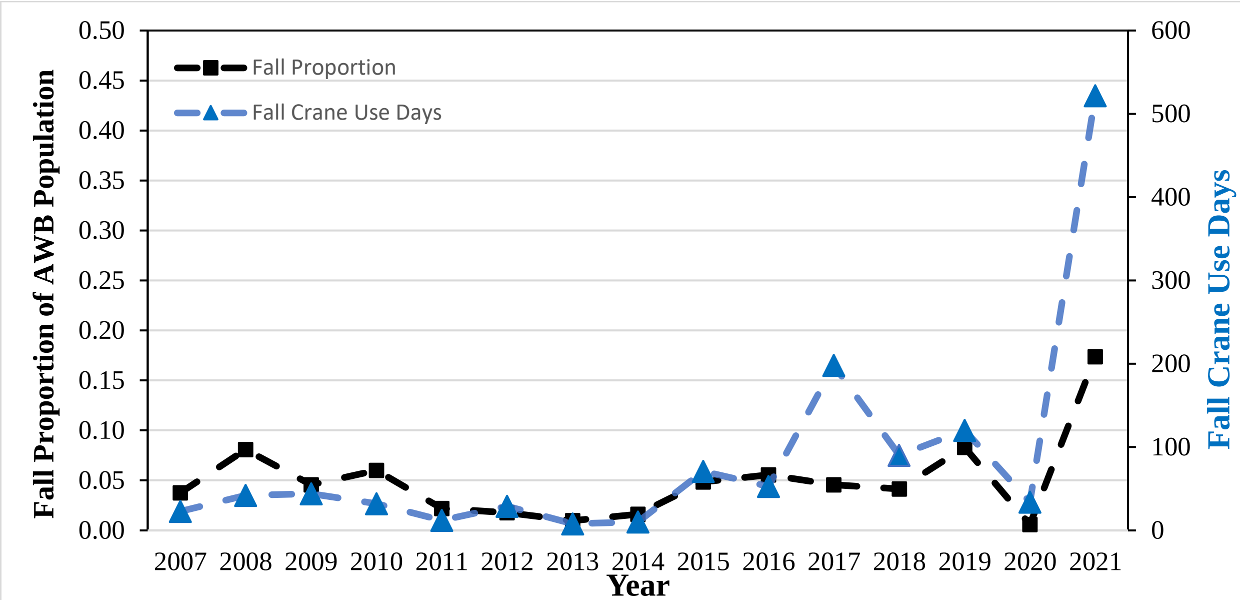

Figure 2. Fall annual proportion of the estimated Aransas-Wood Buffalo (AWB) whooping crane population observed (black squares) and number of crane use days (blue triangles) during aerial systematic and opportunistic fall migration surveys from 2007-2021.

Table 1. Whooping crane stopover decision model selection in the Associated Habitat Reach ranking variables and combinations of variables time of day, max unobstructed channel width (MUOCW), and flow. Analysis and table updated to include data up to fall of 2020.

Model Rank	Variables	AICc	ΔAICc	weight
1	Time of Day * MUOCW	31.3	0	0.199
2	Time of Day	31.8	0.5	0.157
3	Time of Day * MUOCW + Flow	33.5	2.2	0.066
4	Time of Day + Flow	33.9	2.6	0.054
5	MUOCW	56.8	25.5	0
6	Flow	59.3	28	0

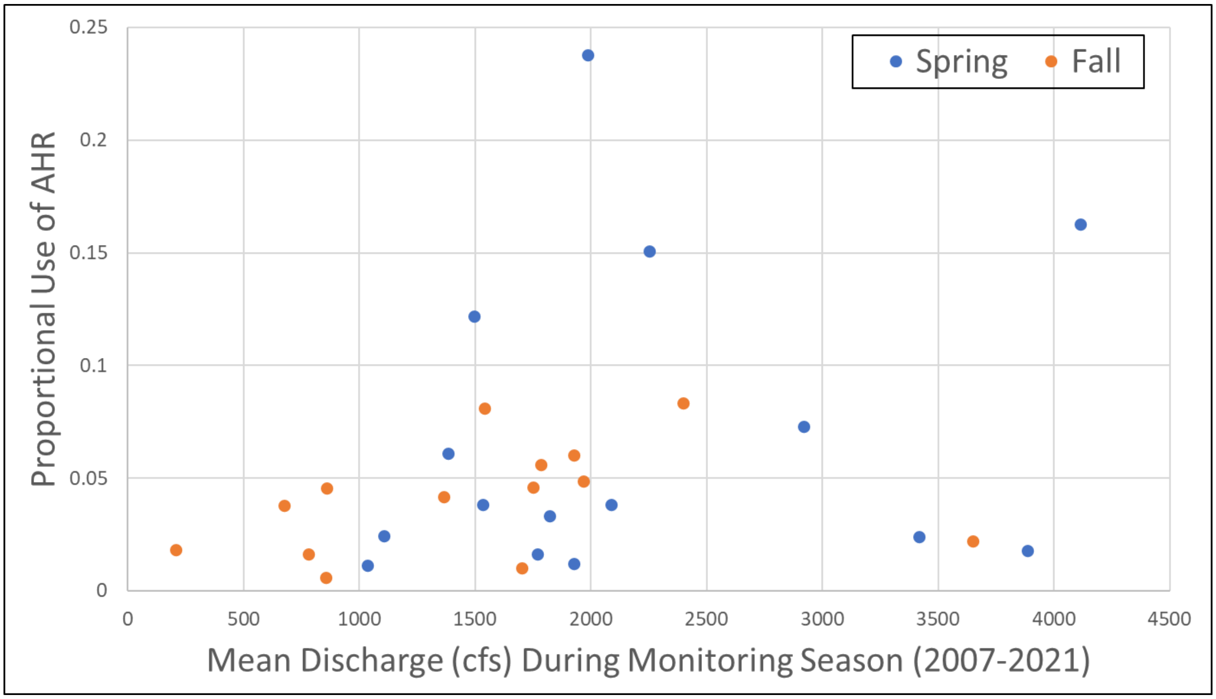

Figure 3. Proportion of population relative to the mean flow during spring migration (blue circles) and fall migration (orange circles).