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USE OF FRESHWATER PONDS BY WHOOPING CRANES DURING A DROUGHT PERIOD

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Whooping cranes (*Grus americana*) spend nearly half their annual cycle in coastal habitats within and around the Aransas National Wildlife Refuge Complex (ANWRC) located in the central portion of the Texas Coast. When drought conditions prevail in their winter range and salinities in the local bays exceed 23 parts per thousand (ppt), whooping cranes must seek alternate sources of dietary drinking water (Stehn 2008, Chavez-Ramirez and Wehtje 2012). They begin frequent (often daily) trips to freshwater sources in upland areas. These trips may result in extra energy expenditures that can impact their overall health and ability to store energy for spring migration (Canadian Wildlife Service and U.S. Fish and Wildlife Service 2007). We opportunistically

used game camera images obtained from a physiological research project (B. Hartup, unpublished data) to gain additional information on how whooping cranes used refuge-managed freshwater resources in relation to prevailing environmental conditions.

Game cameras were used during the winter from November through April 2012-2015 (referred to as winters 2012, 2013, and 2014) at 7 excavated freshwater pond sites along an 8.3-km transect of the Blackjack Peninsula (28.2094°N, 96.8532°W) within the ANWRC (Figure 1). Each site consisted of a pond (mean = 843 m²) and a 5-20-m mowed border. Pond size varied with local rainfall and weather conditions; all ponds contained some water throughout the study.



Figure 1. Locations of excavated pond sites at the Aransas National Wildlife Refuge Complex, Blackjack Peninsula, Texas, 2012-2015. The 7 sites extend southwest to northeast from South Pipeline pond to Williams mill pond.

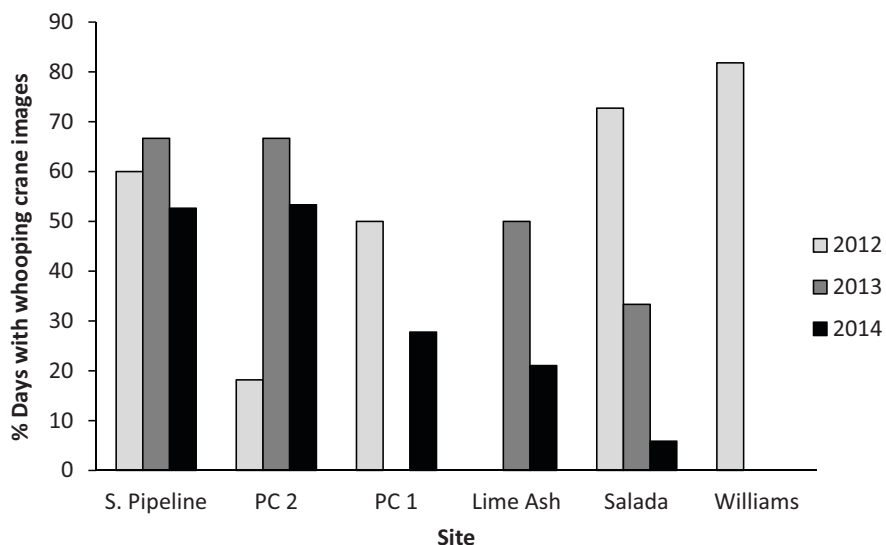


Figure 2. Percentage of days with at least 1 game camera image of a whooping crane by site and winters 2012-2014. Sites are listed from southwest to northeast along the Blackjack Peninsula, Aransas National Wildlife Refuge Complex, Texas. Salada = both Salada sites 1 and 2 (see Figure 1) combined. No bar indicates game cameras were not deployed due to lack of crane sign.

Whooping crane sign (droppings, footprints) and direct observation were criteria used to decide at which of the ponds to deploy cameras each year. Cameras were mounted on T-posts facing north approximately 1.5 m above the ground and positioned to capture the majority of the site in each image. Camera models and settings differed due to resource and personnel constraints for the physiological study, but resulting images were

a minimum of 1.7 megapixels and captured using an infrared motion sensor or time lapse setting (every 5 min) between 0700 and 1700 hours. The total number of images available for analysis was 37,879 (2012 = 13,491, 2013 = 2,320, 2014 = 22,068).

We used the percentage of days in which at least 1 image contained a whooping crane to evaluate crane presence among all sites and years. To reduce the number

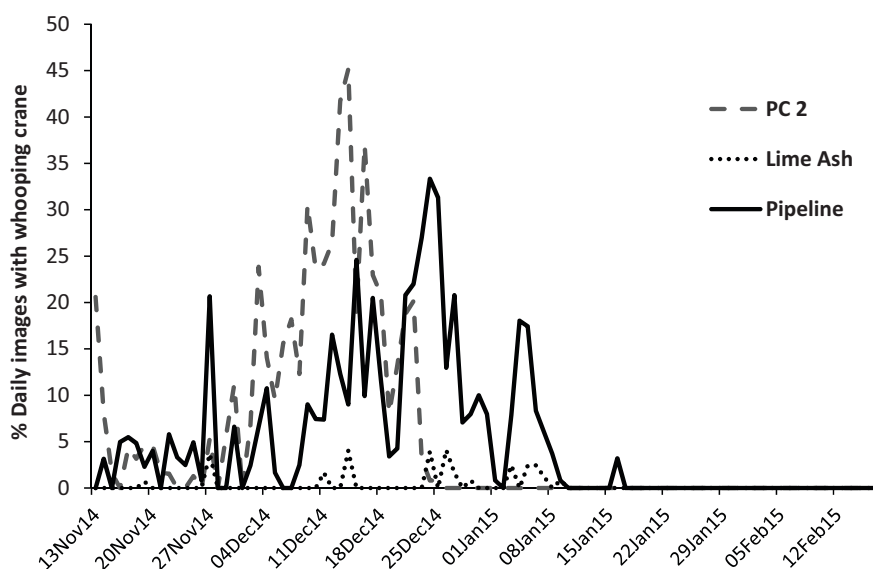


Figure 3. Percentage of daily game camera images containing at least 1 whooping crane at 3 sites during winter 2014. PC2 = Pump Canal 2. Graph terminated mid-February 2015 for clarity (no whooping crane use continued through April).

of images that were evaluated, and to support data needs for our other study, we used only data from every other week during the 3 winters, i.e., the dates of fecal sampling, for all 7 sites. In addition, for 3 of the 7 sites, we used all images for continuous monitoring in 2014. This approach appeared valid for estimating overall crane presence at the sites, i.e., there was no statistical difference in the proportions of days with a whooping crane based on either periodic or daily sampling at 3 sites during 2014. The continuous monitoring from the 3 sites in 2014, however, allowed us to compare the magnitude of daily site use by determining the proportion of images with at least 1 whooping crane each day for the entire winter. Finally, to summarize use by time of day, we recorded the time of each image containing at least 1 whooping crane for pond Pump Canal 2 (PC2) in 2014, and categorized them into 1 of 4 time periods (hr): early morning (0700-0900), late morning (0901-1200), early afternoon (1201-1500), and late afternoon (1501-1700).

Whooping crane use of freshwater pond sites varied greatly by year (Figure 2). Of the sites monitored, the furthest southwest site (South Pipeline) was used at least once a day more than 50% of days monitored in all 3 years. All other sites showed considerable year-to-year variation in whooping crane use. Figure 3 shows variable daily use of 2 southwest sites (South Pipeline and PC2) in 2014, with peak use observed in mid to late December (>30% of images per day contained whooping cranes), followed by rapid decline after significant rainfall events in late December and January. These sites were used regularly and for progressively

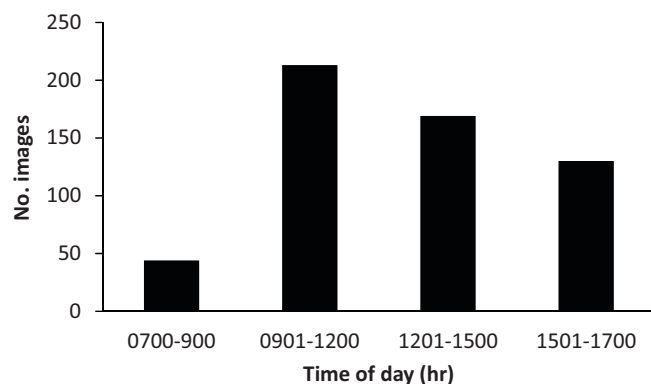


Figure 4. Number of game camera images with at least 1 whooping crane by time of day at Pump Canal 2 in winter 2014. Data were pooled over the period 13 November 2014 through 4 February 2015 and were based on review of 9,768 images.

greater periods in early winter compared to the Lime Ash site to the northwest, which was infrequently used and for only short periods in 2014. The lower usage at the beginning of the winter may have been a reflection of lower numbers of whooping cranes having completed fall migration in November and/or settling within range of the SW sites. The peak abundance of the Aransas-Wood Buffalo population at ANWRC is estimated to occur shortly after 1 December each year (Butler et al. 2014). During 2014, whooping cranes used the PC2 site least during early morning hours and most during late morning, with a decline in afternoon use toward sunset (Figure 4). Distinctive individuals or groups of cranes were observed at the pond for longer periods (up to 30 min), suggesting the site was also used for foraging, loafing, or perhaps socialization.

Whooping cranes were documented drinking from ponds at all sites. Individuals, pairs, families, and even groups of birds as large as 11 were photographed. There were also several sightings of groups including multiple adult plumage birds and juveniles congregating in close proximity to each other. These anecdotal observations, as well as the substantial changes in the use of individual pond sites among years, suggest that ponds may be used opportunistically when fresher water is needed instead of habitually.

Seventeen of 18 months of the study occurred in conditions categorized as abnormally dry (8 months) or moderate drought (9 months) by the U.S. National Drought Mitigation Center for Aransas County, Texas (NDMC 2016). No drought condition existed by April 2015. Heavy rain in January 2015 appeared to signal the end of the multi-year drought. No cranes were observed in any images after 16 January 2015 through to the end of the study in April. Field observations from crane and habitat surveys conducted within coastal marsh habitat along the Gulf Intracoastal Waterway documented cranes drinking in shallow depressions within the marsh vegetation throughout January-March 2015 (E. Smith, personal observation). Salinity data collected in a separate study in coastal marsh ponds in late February, however, recorded salinities above 23 ppt and higher than bay waters (J. Wozniak, Texas Research Institute for Environmental Studies, personal communication). We believe rainfall pooling in depressions increasingly provided drinking water in marsh habitat and correlated with absence of crane use of managed freshwater sites prior to significant declines of bay and marsh pond salinities more favorable to whooping cranes.

MANAGEMENT IMPLICATIONS

While much further investigation is required, the use of game cameras allowed us to characterize some aspects of crane behavior around freshwater ponds during periods of drought. Whooping cranes utilized the ponds throughout the day, but use was greatest between 0900-1200 hours. Birds were rarely seen before 0900, suggesting that early morning or later afternoon may be optimal times to conduct potentially disruptive activity near the ponds or along this area of the Blackjack Peninsula. Ponds were used frequently throughout the drought, with most sites experiencing some use on at least 30% of the sample days. With drought increasing in length and severity associated with regional changes in climate, the mitigation effects of these communal spaces on whooping cranes may be worthy of further study. Standardized camera traps and weather measurements taken directly in the coastal marsh may provide a better correlation of the factors affecting crane behavior and physiology, particularly when the localized weather patterns in this area of coastal Texas may drive discrete habitat condition improvements within the wintering range of the whooping cranes.

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