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## **BACKGROUND**

The Great Blue Heron (*Ardea herodias*) spends much of its life as a solitary hunter, but in the spring these birds abandon their solitude to congregate into large breeding colonies (Vennesland and Butler 2011). One such colony exists in the Slate River wetlands located outside of Crested Butte, Colorado. This specific heronry is unique in its high elevation (nearly 9,000 feet), occurrence in coniferous trees, large size (> 20 nests), and its long-term persistence (Magee and Zareba 2019). The Crested Butte Land Trust (CBLT) owns and manages the land that contains this heron rookery and is currently faced with the challenge of protecting the ecological integrity while also allowing human access to the river and surrounding landscape. River recreation has become increasingly popular on the upper Slate River; this section of the river takes floaters directly under the heron colony. Most researchers recommend a buffer zone of 250-300 m for any human activities during the heron nesting season, or temporal closures during this sensitive time. We initiated research in 2018 and documented heron nesting biology throughout the summers of 2018 and 2019. In 2019, a voluntary no-float period from spring arrival to 15 July was adopted by the stakeholders in the Slate River Working Group to effectively remove most human disturbance near the heron rookery. The timing of the closure was based on our 2018 nesting phenology data. We documented compliance of this voluntary closure and the impacts of rivercraft on herons during the open floating season after 15 July 2019.

## **RESEARCH OBJECTIVES**

The purpose of this study is to observe and document breeding phenology and population demography of Great Blue Herons in the Slate River wetlands near Crested Butte, Colorado. Further, we will quantify heron activities at the nest colony along with identifying and quantifying heron activity in their foraging habitats, document human disturbances and heron responses to human activities; and attempt to assess effects of river recreation through the implementation of a novel index we call the Floater Ethics Index (FEI). The data provided from this study will help ensure the long term persistence of this colony through guiding river and wetland management developed by a stakeholder's group in Crested Butte.

## **METHODS**

### ***Study Design and Data Collection:***

***Great Blue Heron Phenology.*** We will document Great Blue Heron breeding season phenology by individually monitoring each nest throughout the season. During observations we will record time, date, weather, presence of herons, and heron behaviors that indicate the annual cycle events. More specifically, we will document nesting, timing of incubation, hatch dates, and ending of nestling stage indicated by fledging.

***Great Blue Heron nesting demographics.*** We will conduct a systematic scan of all the nests and count the number of adults, the number of nests with incubating adults, number of chicks produced in each nest, the number of nests that produce at least one successful fledge, and the number of fledged chicks, to provide a measure of heronry productivity.

**Time activity budgets.** We will record behaviors of herons using two time budget methods, scan and focal sampling (Altmann 1974), rotating observation times by time of day and assessing seasonally specific behaviors in relation to the egg stage and nestling stage of development for both adults and chicks.

**Energetic costs of foraging.** We will assess energetic costs of foraging and availability of foraging habitats within 15 km of the colony. A spatial analysis will be conducted to map and inventory potential foraging habitats and cameras, direct observation, and a citizen science approach will be used to determine distribution of foraging herons. Flight distance in relation to foraging habitat availability will be used to measure energetic costs of foraging.

**Adult Provisioning:** We will record all departures and arrivals of adult herons from the colony throughout our observations bouts. We will also record every brood provisioning event that occurs within our observation bouts.

**Human activities and heron disturbance.** We will conduct 1-hour observations bouts and record all human activities on the Slate River Road, in the aerial environment overhead, in the wetlands, and on the Slate River. Locations and duration of the human activity will be recorded along with the number of people associated with each event, and heron response to activity. We will record the number of herons exhibiting disturbance behaviors which include altered posture and/or flushing from the nest. We focus on watercraft disturbance and will record type of craft, number of crafts and people, and various measures of floater behavior (group size, posture, loudness) associated with each floating event through the heronry.

**Data Analysis.** Heron phenology and nesting demography are descriptive in nature. We will compare heron behaviors among times of day (morning, day, evening), nesting phenology stages (pre-incubation, incubation, early nestling stage, post-guardian stage), and between adults and juveniles using inferential tests (ANOVA for three-way comparisons and t-tests for two-way comparisons). We will use regression to evaluate relationships between heron behaviors and floater behaviors to assess the value of a Floater Ethics Index.

**Expected Results.** This research is a collaborative effort with the Crested Butte Land Trust and the Slate River Working Group to study a unique, high elevation Great Blue Heron colony in a wildland urban interface of Colorado's southcentral Rocky Mountains. The study focuses on the growing concern of human recreation impact on wildlife and colonial herons represent a highly vulnerable species to human activities. These data will provide additional recommendations to the stakeholder's group for sound protection of the colony and will yield a better understanding of whether and how herons and humans can coexist in this river valley. These data inform decision-making and guide adaptive management of the Slate River Management Plan. A final report will be prepared for the Slate River Working Group and I will present these results at several venues including a meeting of the Denver Field Ornithologists.