

Slate River Great Blue Heron Colony Report 2021



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Great Blue Heron Colony Status and Dynamics in Relation to Human Disturbance in the Slate River Valley, Crested Butte, Colorado

Introduction

Great blue herons (*Ardea herodias*) have circled above wetlands across North America for almost 2 million years. With neck curled and legs dangling their unmistakable profile conjures thoughts of ancient origins and of nostalgia regarding the persistence of time-tested and successful routine. These arboreal social breeders gracefully alight in the tree-tops, their dexterous toes grasping thin branches. Interestingly, these usually solitary and often territorial fishers of streams, wetlands, and coasts, gather in shared tree branches nesting in colonies that sometimes number in the hundreds of nests. These birds are simultaneously both lanky and graceful as they grasp narrow tree limbs in the windy gales 60 or more feet above the ground.

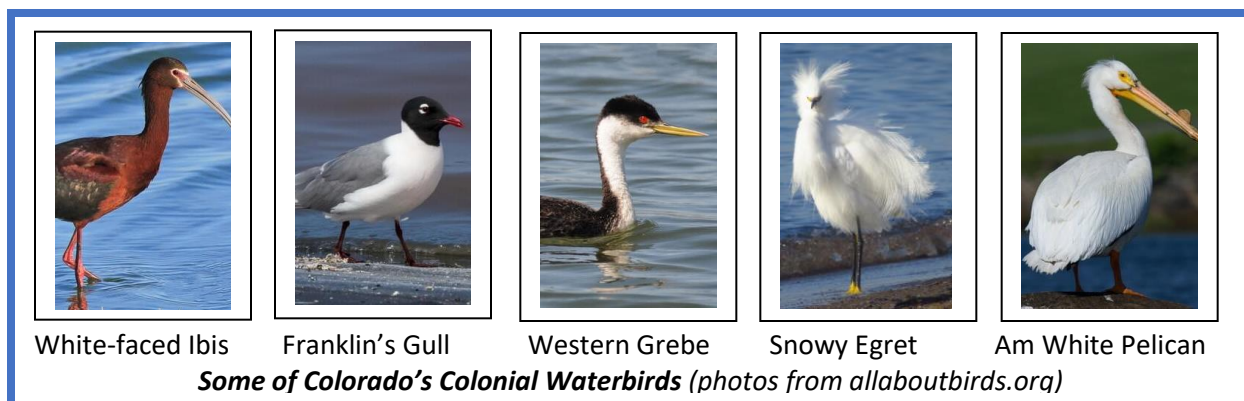
In the Upper Slate River Valley, the nesting colony of Great Blue Herons has not been well-documented historically but local lore suggests the colony has persisted at least since the 1990s. Little information has been found regarding the occupancy, status and productivity of the Slate River colony. The Bird Conservancy of the Rockies maintained a Colony Watch Program for about 20 years and they included the Slate River colony in this database (Table 1). These data were not generated by robust surveys.

Table 1. Bird Conservancy of the Rockies Colorado Colony Watch data for the Slate River Great Blue Heron colony (2002-2018). Data were not collected every year and count methods differed among years. CCW = Colorado Colony Watch, WCWS = Western Colonial Waterbird Survey (USFWS). "Breed Count" appears to be the number of active nests. In 2018 observer counted herons while rafting on the Slate River and reported to eBird. Blank spaces = no data.

Year	Date	Breed Count	Bird Count	Adult Count	Juvenile Count	Number of Active Nests	Data SOURCE
2002	5-1-02	8		8		8	CCW
2003	6-1-03	9		6		9	CCW
2004	4-15-04	9		18		9	CCW
2005	6-20-05	12		12		12	CCW
2006	?	13		0		13	CCW
2007	?	13		0		13	CCW
2008	No Data						
2009	6-21-09	12		0		12	CCW/WCWS*
2010	6-4-10	19	24			19	WCWS*
2011	No Data						
2012	No Data						
2013	No Data						CCW/WCWS
2014	4-25-14	13	15			13	eBird
2015	6-15-15	18	35				eBird
2016	No Data						
2017	No Data						
2018	6-11-18	5	10				eBird

*Data all or in-part from Cavitt et al. 2014 Western Colonial Waterbird Survey

Great Blue Herons are one of 19 species of colonial waterbirds in eight western states (Cavitt et al. 2014) and they account for 2% of all these birds in numbers, but 39% of all colonies belong to Great Blue Herons, more than any other colonial species in this region (Cavitt et al. 2014).



Great blue herons share with other colonial waterbirds a unique conservation vulnerability because a large portion of regional populations nests in a single location (Kushlan et al. 2002). In addition to the intrinsic risk posed by species that almost literally put all their eggs in one basket (or at least don't spread the baskets out), are extrinsic threats such as human activities including recreation (Cavitt et al. 2014). The combination of their breeding biology, extrinsic threats, and reliance on limited and variable aquatic habitats make colonial waterbirds particularly vulnerable to population declines (Cavitt et al. 2014). Our study not only establishes a baseline for population demography and phenology, but also quantifies several metrics to assess potential impact of human recreation on Great Blue Herons at the Slate River colony near Crested Butte, Colorado (Figure 1).

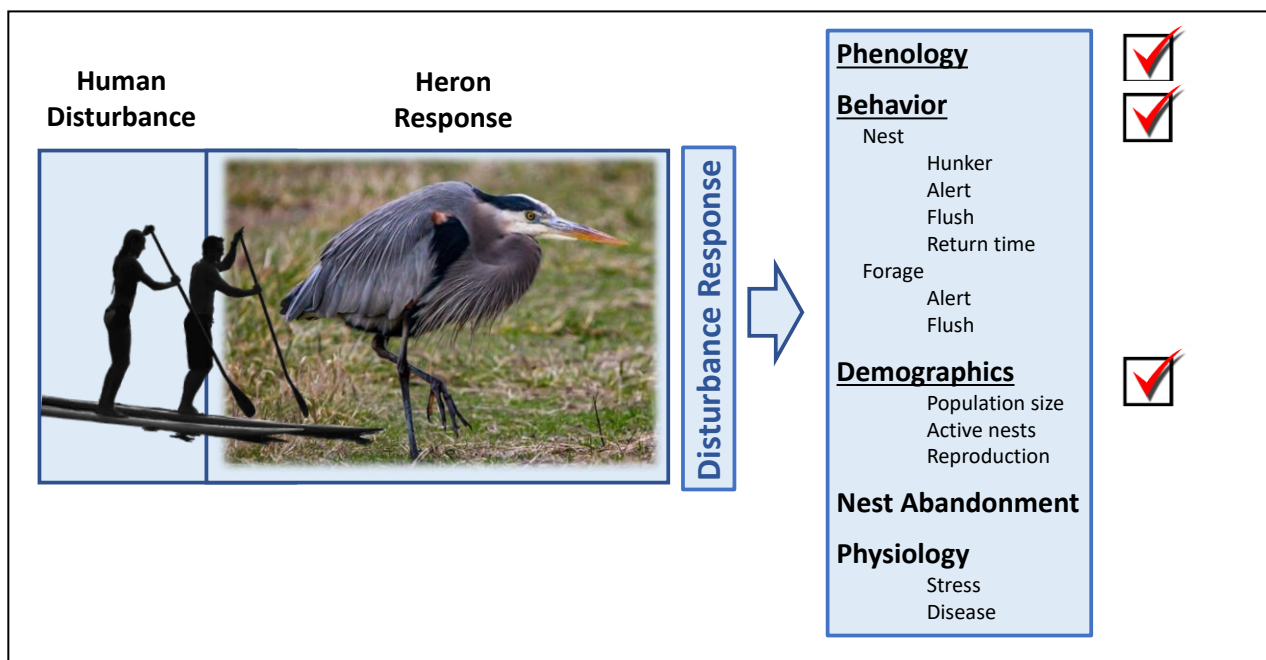


Figure 1. Potential metrics to assess Great Blue Heron response to human disturbance at their colony in the Slate River Valley in Crested Butte, Colorado. In our study, we measured phenology, behavior and demographics of herons at the colony site for four years from 2018-2021.

The purpose of this study is to document the phenology (seasonal chronology of life stage) and demography (population structure) of the Great Blue Heron colony on the Slate River, and to determine the effects of human activities on their behavior, phenology and demography. We cataloged all human activities in the local area around the colony and targeted observations of river recreationists and documented and reported the heron response to these close proximity activities. The study started in 2018 and this report represents the results of the 2021 season, or fourth year of the study. Comparative results are provided in part for the previous 3 years and the previous three annual reports are cited.

METHODS

Our study area (Figure 2) consisted of two Great Blue Heron sub-colonies approximately 2 miles northeast of Crested Butte, CO, in the Slate River Valley, a broad glacial valley dominated by a wetland complex. The herons nest about 60-80 feet above the wetlands in the canopy of lodgepole pines (*Pinus contorta*), from mid-March until mid-July through early September. High tree mortality characterizes the upper colony, whereas the lower colony contain healthier live pines.

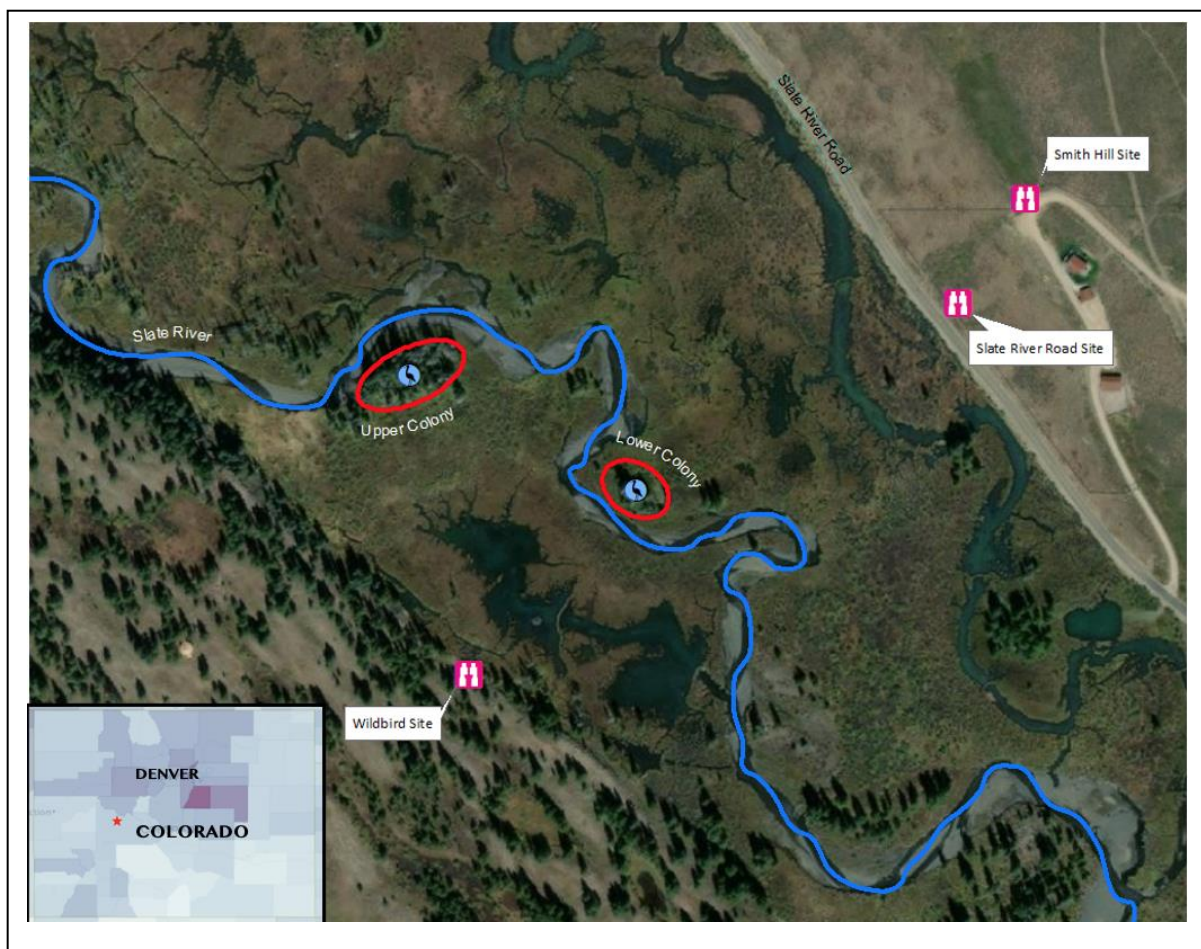


Figure 2. The Slate River Valley showing location of the Great Blue Heron colony and two sub-colonies. The image also identifies the location of the three observation sites. The portion of the Slate River and wetlands that run through the heronry are owned and managed by the Crested Butte Land Trust.

We conducted heron observations from three locations depending on time of day and weather conditions (Figure 2). The Slate River Road site was located on County Road 752 at a pull-off about 230 m east of the colony. The Elk Run site was located on private property on the southwest-facing slope of Smith Hill, about 340 m east of the colony. The Elk Run site was advantageous for its height overlooking the colony, Slate River, and road traffic. The Wildbird site was located 190 m from the lower Colony and 240 m from the upper Colony on the southwestern side of the river atop an elevated, forested moraine.

Great Blue Heron Phenology and Demography

For specific methods associated with 2018-2020 see past final reports. In 2021, we observed and documented Great Blue Heron breeding season phenology and demography from the season's initiation in mid-March until mid-to-late July when the last heron chick fledged and no adults or juveniles consistently remained at the colony or adjoining habitats. During each observation, we recorded the date, time, and weather, as well as the number of nests occupied in the colony and the individual life cycle status for each nest based on the heron behaviors. We attempted to document spring arrival dates for individual herons, as well as dates of nest building, courtship displays, copulation events, incubation, chick hatching, brooding and provisioning, fledging, and post-fledge activities.

To gather demographic data for each individual nest in the colony, we observed each nest and recorded the number of individuals present. Repeated systematic scans of all nests in the colony enabled us to document nest success, brood size, fledging success, and fledgling success. Nest success was defined as the number of nests to have at least one chick hatch. We recorded brood size for each nest once chicks were observed, and also attempted to document chick mortalities. When the number of chicks in a nest declined after a previously higher count, before the expected fledge date, we considered these to be chick losses. Fledging success was defined as the number of nests that had at least one chick fledge. Fledgling success was defined as the number of chicks that fledged relative to the total number of chicks hatched.

Due to personnel issues in 2021, we only have consistent data from 6 June to 24 July for phenology and demography. One researcher left the project due to personal reasons but did not provide the data from March-May.

Great Blue Heron Disturbance

We conducted 1-hour surveys to document human activities within 500 m of the heronry from 2018-2021. In 2018, surveys started in May and extended through the nesting season, whereas in 2019, surveys began in April. In 2020 and 2021, we collected data when the herons first arrived in mid-March and continued daily or multiple days per week (2021) until the last heron fledged and left the valley in August. In 2021, data were collected at the beginning of the season but we missed the last half of April and most of May. The early data were collected but never provided after the researcher left the project. Data collection resumed in June and July with a new student researcher who observed the colony 3-4 days per week until the last heron fledged. We classified human activities into seven categories, including 1) vehicles, 2) bicycles, 3) hikers and runners, 4) motorcycles, 5) river recreation (watercrafts), 6) airplanes and helicopters, and 7) winter recreation. Air traffic was recorded in 2018, 2020, and 2021 and winter recreation was recorded in 2019-2021. We tallied human activities by category and we observed heron behavior and documented disturbance behaviors (vigilance or alert posture, hunkering, and flushing) in response to human activity.

To document the impacts of river recreation on Great Blue Herons we observed herons and passing watercraft using a spotting scope from the Smith Hill observation site – this site afforded a good view of

the colony and the river and approaching river recreationists. Any group of floaters (consisting of one or more individuals and watercrafts) was called a "floater event". Each floater event was characterized by "floater characteristics." In 2018, floater characteristics included the number and type of watercrafts, number of individuals and dogs present. In 2019, 2020 and 2021, floater characteristics included: float duration, stopping events (when floaters stopped or walked their craft beneath the colony), noise level, the distance between floaters, the profile of the floaters, and adherence to safety regulations, as well as the number and type of watercrafts, number of individuals, and number of dogs.

In 2018, herons were observed during floater events and behavior was classified as no change, alert posture (vigilant), or flushing. In 2019, we documented the total number of heron response behaviors for each age-appropriate behavior (adult alert, chick alert, chick hunkering, and adult flushing). We also recorded flush duration, or how long a flushed heron remained away from the colony after being flushed. In 2020 and 2021, we used scan sampling to document heron behaviors before, during, and after a floater event. When watercrafts were detected upriver approaching the colony, we conducted a "pre-disturbance" scan to quantify baseline heron behaviors. When floaters entered the colony (defined as the first observation of a watercraft upstream of the location of the first or northernmost nesting tree in the upper colony), the observer conducted a "disturbance" scan. When a floater group exited the colony (defined by a private property sign downriver from the lower colony), the observer waited a minimum of 5 minutes and subsequently conducted a "post-disturbance" scan. Scans started with the northernmost nest in the upper colony. The observer viewed the nest through the spotting scope and identified the instantaneous behavior of each heron in the nest. Then the observer would move the scope to the next nest and continue this until the behavior of every heron in every nest and those birds present in adjacent habitats was categorized. For analysis, we grouped heron behavior into ten categories: foraging, self-maintenance, nest maintenance, courtship, incubation, brood rearing, agonistic, hunkering, vigilant, and flushing. We quantified a colony time budget by summing each behavior category observed and dividing those by total herons included in the scan and reported behaviors as percentages.



Photo by Kevin Kurtz (inset by Karen McDonald)

The Feet of the Heron

Great Blue Herons have large feet with four toes. The three forward projecting toes are partially webbed (semi-palmate) and long and slim. The hind toe is the hallux and is on the same plane as the front toes. It is also long and allows herons to grasp on to branches and live an arboreal life style. The bill is the hunting weapon, long and spear-like. It is also a key tool for picking up branches for the nest and as courtship gifts. The feet are more useful to scratch and preen their feathers. In fact, they have a specialized (pectinate) middle toe nail (inset) that acts as a comb.

RESULTS

Phenology and Demography

The first heron arrived on 7 March 2021 (Table 2). The first observation by our research team was on 15 March. We do not know the date of the last heron to arrive. We do not have phenological data for the egg laying and incubation period, or for the first broods to appear at hatching. Based on observations in previous years, it is likely that the first egg laying and incubation began 3-4 weeks after arrival, in early April. In 2020, the mean incubation period was 31.4 days (Magee et al. 2021), so in 2021 it is likely that the first eggs hatched around 7 May. We do know that on 6 June 2021, 13 of the 16 active nests had chicks and by 26 June all 16 nests had chicks, including Nest 31 with the first chick appearing on that date. This is a very late hatch date (in 2020 the latest hatch date was 16 June). On 30 June 2021, no chicks had fledged, but by 5 July 10 chicks had fledged. The earliest chick fledge event would have been 1 July 2021 which is 7 weeks post hatch. The last chick fledged by 18 July. We observed 36 fledging events by 14 July with 6 nestlings remaining in the colony. Four days later all 6 of these chicks had fledged. Nest 31 was the late nest that didn't hatch until 26 June. On 6 July, an adult was observed incubating and two chicks were observed. The next day the nest was empty. We assume this nest was depredated, probably by a bird of prey; an observed magpie may have been scavenging remains.

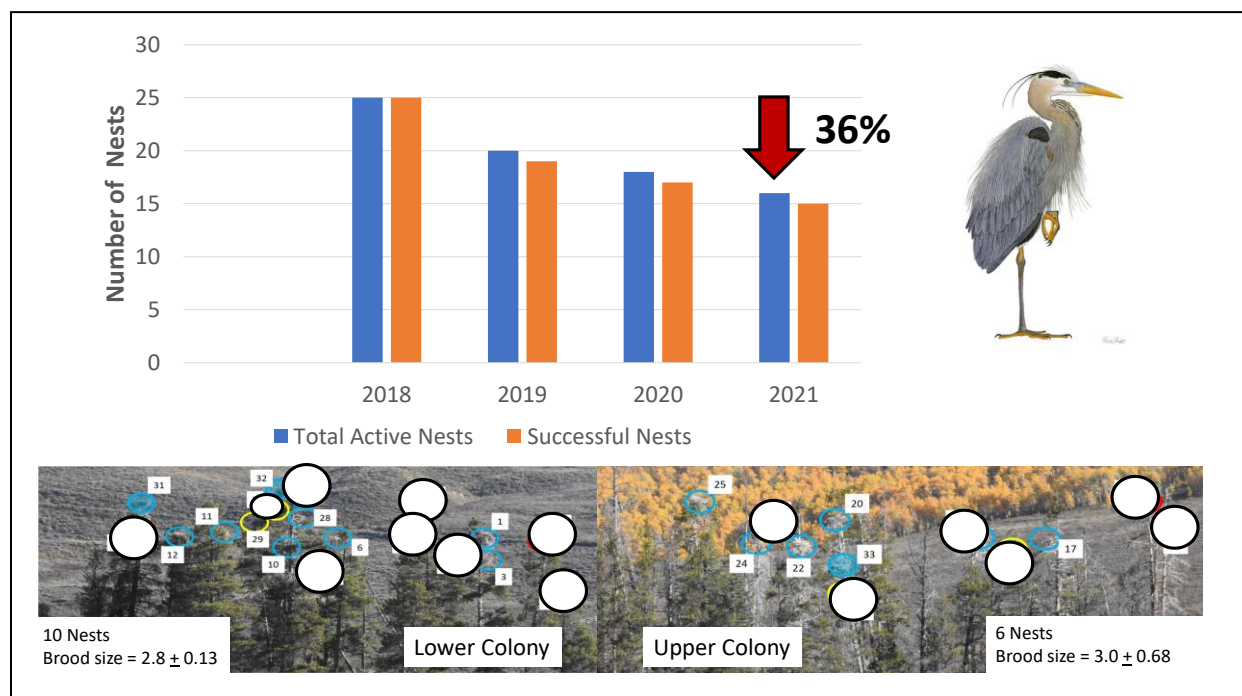
Table 2. Phenology of heron activities at the Slate River Great Blue Heron colony from 2018-2021.

Parameter	2018	2019	2020	2021	2022
Arrival	March 13	March 17	March 13	March 7	March 13
Egg Laying + Incubation	April 9	April 12	April 3	?	
Hatching + Broods	May 7	May 10	May 1	?	
First Fledge	July 3	July 7	July 2	July 1-5	
Last Fledge	August 15	September 2	August 12	July 14-18	
Active nests	25	20	18	16	
Nests Fledging Young	25	19	17	15	
Total Adults	50	38	34	32	
Total Chicks	67	47	45	46	
Fledged Chicks	67	41	43	42	
Mean Brood Size	2.7 \pm 1.2	2.5 \pm 1.0	2.7 \pm 0.9	2.9 \pm 0.23	
Brood Size Range	1-5	1-4	1-4	1-5	

The total number of active nests in the colony declined for the third straight year. In 2021, herons occupied 16 nests (Figure 3). On at least three occasions Nest 19 was occupied, perhaps by an adult from an adjacent nest, but Nest 19 did not appear to have a nesting pair and never produced chicks. No new nests were created in 2021. Prior to our study, the high active nest count was 19 in 2010 (Table 1).

The 16 active nests in 2021 were attended by 32 adult herons, we assume 16 breeding pairs (Table 3). We did not observe unpaired adults or yearlings at the colony. Of the 16 active nests, all 16 produced eggs and all of these hatched at least one chick. Therefore, the nest success was 100%. However, one nest failed to fledge any young, so the colony wide fledging success was 94%. The mean nest fledgling rate was 89% (13 nests had a 100% fledgling success, 2 nests fledged 2 of 3 chicks – 66%, and 1 nest fledged 0 chicks). Interestingly, it was Nest 31 that failed to fledge its 2 chicks. In 2020, Nest 31 also struggled and while the nest was occupied and incubation behavior was observed all the way until mid-June, no chicks were ever observed from that pair. It is unclear whether the birds occupying Nest 31 in 2021 were the same as the birds in 2020. Herons are serially monogamous (Simpson et al. 1987), so it is unlikely the two paired birds were the same individuals that occupied Nest 31 in both years. The total number of chicks produced by the 16 nesting pairs was 46 (Table 2). Of these, 42 chicks fledged which represents a colony fledgling rate of 91%. In addition to Nest 31's two unfledged chicks, one chick from the 3-chick brood in Nest 12 disappeared between 20-23 June. Another 3-chick pair in Nest 32 lost a chick between 13-16 June.

Figure 3. The number of active nests and the number of nests that successfully fledged young from 2018 to 2021 at the Slate River Great Blue Heron colony. The photographs illustrate the six upper colony nests and the 10 lower colony nests active in 2021. Empty white circles show locations of former nests that were either disintegrated by weather, dismantled by herons, or that were inactive in 2021.



The mean brood size for the 16 heron nests was 2.9 ± 0.23 chicks which was slightly higher than previous years. Brood sizes ranged from 1-5. We observed one 5-chick nest (Nest 20) from which all 5 chicks fledged. Two of the 16 nests had four chicks and again all of these chicks fledged successfully (Nests 22 and 33), while 9 of the nests had 3-chick broods (two of these only fledged 2 of the 3 chicks). Three nests had 2 chicks and one nest had 1 chick. In 2018, we also had one nest with 5 chicks.

By 15 July, the end of the voluntary no-float period, 86% of the chicks had fledged, which is higher than in previous years. The last chicks fledged between 14-18 July, leaving the colony empty by 18 July. The

late hatching nest (Nest 31) was apparently depredated on 7 July. We did not observe the nest depredation, but the day before, the nest had 2 chicks and the adult was incubating. On 7 July a corvid was observed in the nest and no adults or chicks were observed. It is unlikely that a magpie destroyed the nest and consumed the heron chicks, but it was possibly looking for left-overs from a depredation event. The late hatching of these chicks (around 26 June) would have lengthened the nesting season at the Slate River colony by more than a month. The typical 7-8 week nestling stage would have ended in mid- to late-August if the nestlings had survived and the nest successfully fledged.

Table 3. Great blue heron nest occupancy in the Slate River heronry near Crested Butte, CO, 2018 to 2021. X=active nest, N=inactive nest, R=dismantled nest (present in previous year(s) but dismantled by other herons or other factors).

Lower Colony					Upper Colony				
Nest ID	2018	2019	2020	2021	Nest ID	2018	2019	2020	2021
1	X	X	X	X	15	X	R	R	R
2	X	N	N	N	16	X	R	R	R
3	X	X	X	X	17	X	X	X	X
4	X	X	X	N	18	X	N	N	N
5	X	N	N	N	19	X	X	N	N
6	X	X	X	X	20	X	X	X	X
7	X	X	X	N	21	X	N	N	N
8	X	X	N	N	22	X	X	X	X
9	X	X	N	N	23	N	N	N	N
10	X	X	X	X	24	X	X	X	X
11	X	X	X	X	25	X	X	X	X
12	X	X	X	X	26	X	N	N	N
13	X	R	R	R	33			X	X
14	X	X	R	R					
27		X	R	R					
28		X	X	X					
29		X	N	X					
30			X	N					
31			X	X					
32			X	X					

The Slate River Great Blue Heron colony fledged 42 chicks in 2021

Human Activities and Heron Disturbance

From 6 June to 21 July 2021, we documented 1,801 human activities in 20 1-hr sampling bouts, about 90 human activities per hour. Passenger vehicles on the Slate River Road accounted for 65% of all activities (Table 4). Five airplanes, 14 bikes and 7-8 runners/hikers per hour flew over or used the Slate River and/or Smith Hill roads. During these 20 sampling bouts, we did not observe river recreation.

Table 4. The number of human activities and percent of overall activities in the vicinity of the Great Blue Heron colony in the Slate River valley. Data from 20 1-hour surveys from 6 June to 21 July 2021.

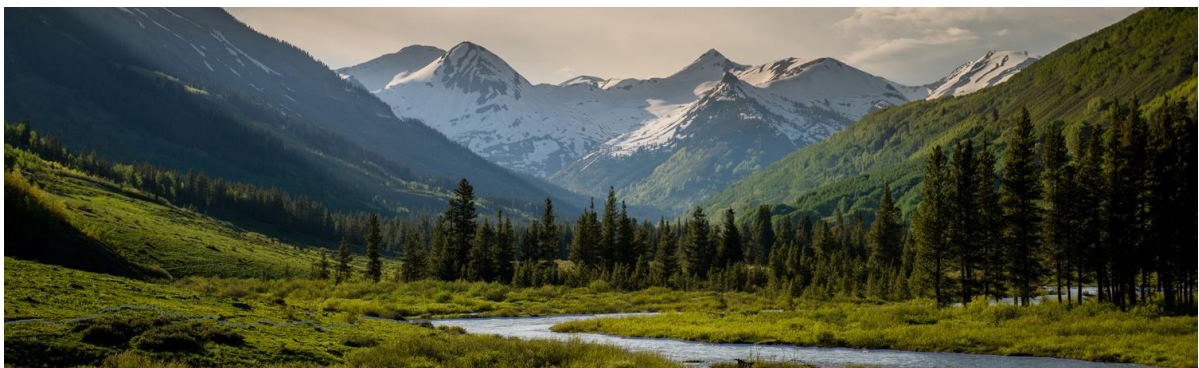
Type of Activity	Number of Occurrences	Number of Occurrences per hour	Percent of Occurrences
Passenger Vehicles	1,174	58.7	65%
Commercial Vehicles	22	1.1	1%
Trailers, Campers, RVs	47	2.4	3%
Motorcycles, ATVs	17	0.9	1%
Bikers	284	14.2	16%
Runners, Hikers	149	7.5	8%
Skiers	0	0	0%
Snowmobiles	0	0	0%
Airplanes	109	5.5	6%
Other	0	0	0%
River Recreation	0	0	0%
Total	1,802	90.1	100%

We observed 8 floater events in 2021 from 6 June to 5 July (Table 5). These 8 events occurred on summer afternoons from 1:30-4:45 pm and included a total of 27 people on 21 water crafts (13 SUP boards, 4 kayaks and 4 duckies). While moving through the colony, 38% of groups stopped from 1-6.5 minutes beneath the nests, 75% of groups floated the section in a strewn pattern thus lengthening the exposure time of herons to human disturbance, and 62% of groups made moderate to loud noises while floating through the heronry (Table 5).

During the 8 floater events, 100% of herons were in undisturbed behaviors before floaters entered the heronry section (Figure 4). Between 26% and 70% of heron behaviors were disturbance behaviors when people floated through the heronry – the mean was 47% (median 52%). During all 8 floater events some herons flushed from their nests. Post-disturbance, the herons returned to 100% undisturbed behavior.

Table 5. Floater events and characteristics on the Slate River documented by the heron researcher in 2021. Percentages refer to the number of floater events that did not follow floating protocols. For posture, the numbers refer to the number of people in each floater event that sat, knelt or stood on their craft and the percentages in the bottom row refer to the percentage of people in each posture.

Event	Date	Time	Humans	Crafts/ Type	Stopping	Grouping	Noise	Posture SIT- KNEEL- STAND	No PFDs
1	6/6/21	1337	6	5/ SUP	None	<10 feet	Moderate	4-0-2	4
2	6/6/21	1421	4	4/ SUP	None	>10 feet	Quiet	0-3-1	2
3	6/6/21	1540	2	2/ KAYAK	None	<10 feet	Quiet	2-0-0	0
4	6/12/21	1428	5	2/ DUCK	None	<5 feet	Moderate	5-0-0	5
5	6/13/21	1507	3	2/ SUP	1 minute	<5 feet	Quiet	1-2-0	0
6	6/19/21	1440	2	2/ SUP	None	<10 feet	Moderate	0-1-1	0
7	6/19/21	1604	3	2/ DUCK	6.5 minutes	<10 feet	Moderate	3-0-0	0
8	7/5/21	1643	2	2/ KAYAK	2.5 minutes	>10 feet	Loud	2-0-0	0
Total	Range: 6 June to 5 July	Range: 1:37 – 4:42 pm	27	21 13 SUP 4 KAYAK 4 DUCK	38%	75%	62%	18-6-4 66%- 21%- 14%	11 41%



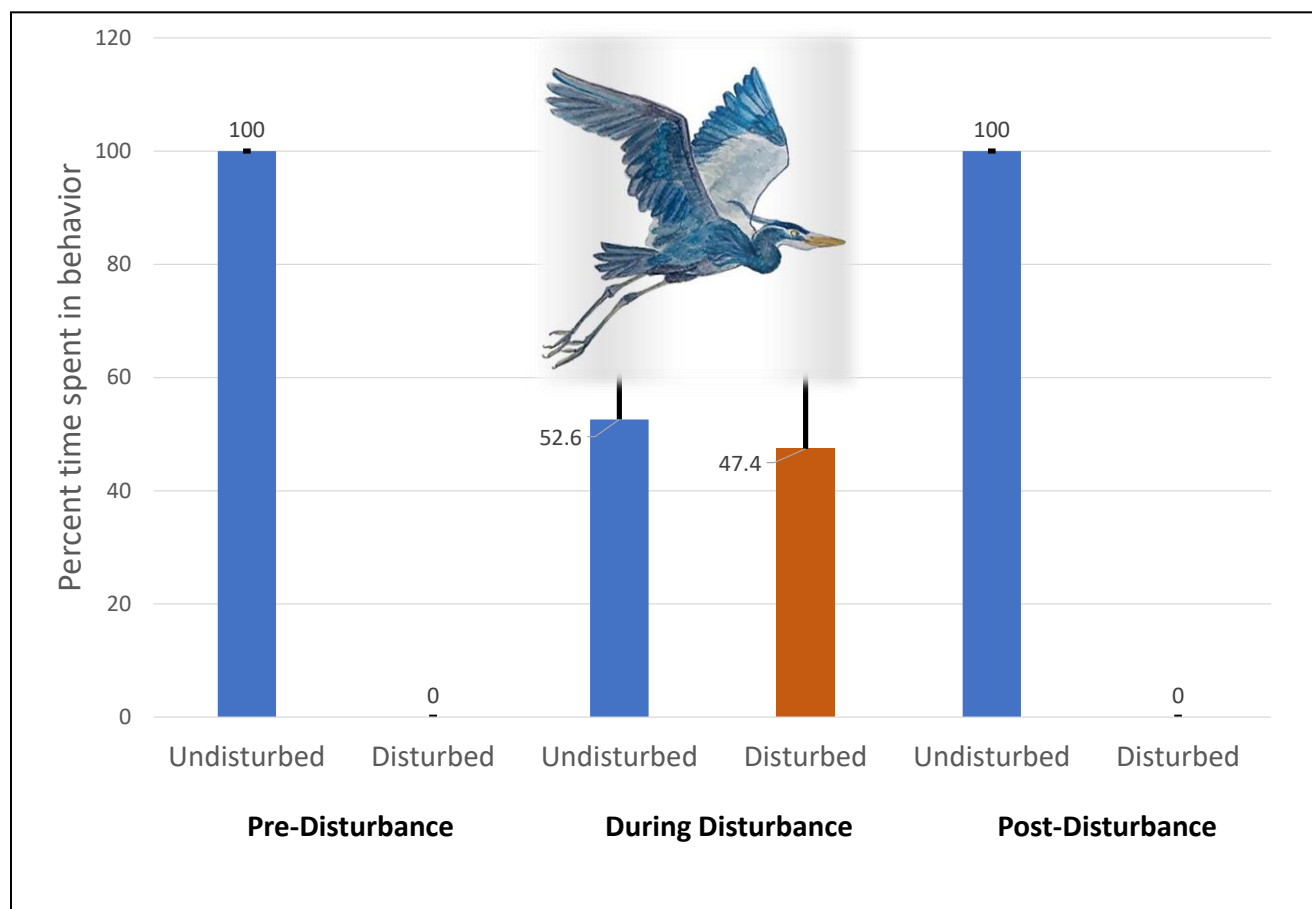


Figure 4. Pre-disturbance, during disturbance and post-disturbance time budget scans of the Great Blue Heron colony at the Slate River Valley near Crested Butte, Colorado. Disturbed behaviors included flushing from the nest, assuming an alert behavior (becoming highly vigilant) or hunkering into the nest. All other behaviors were considered non-disturbance behaviors.

DISCUSSION AND MANAGEMENT IMPLICATIONS

The Slate River Great Blue Heron rookery continues to persist in its unique high elevation, wetland, pine tree habitat. However, the colony size has declined every year since our study started in 2018. The total active nests declined from 25 in 2018 to 16 in 2021. Heron and other colonial waterbird colonies vary in size interannually, partly as a result of variable interfacing conditions associated with wetlands and climate in specific locations (Cavitt et al. 2014). Robust historic data for the Slate River colony does not exist, however, the Bird Conservancy of the Rockies and the Western Colonial Waterbird Survey (USFWS) provide some anecdotal data from the Slate River heron colony from 2002 to 2018 with active-nest counts in 11 of those 18 years. The number of active nests varied from 5-19 over this period with the high count of 19 on 4 June 2010 (Table 1). Our data documented the highest number of active nests since 2002 (25 in 2018) and for the last 4 years indicates a 36% downward trend in the number of active nests. It is not known what is underlying this downward trajectory or whether it is a short-term or long-term trend, but it could be associated with natural population fluctuations that reflect dynamic environmental conditions. In the last four years, 3 of the four have yielded below average winter

snowfall accumulation and relatively low flows in the Slate River. When the river reaches 110 cfs, the Slate River Working Group deems it too low to float safely. This date was reached between 25 June and 5 July on three of the last four years. The exception was in 2019 when the river didn't fall below 110 cfs consistently until mid-August. River flow likely impacts habitat conditions for herons as well and drought years may limit habitat quality and quantity, however, these relationships are complex and have not been studied.

Another factor that potentially contributes to a declining trend in active nests could be associated with the health and vigor of the colony trees. About 20% of the lodgepoles in the upper colony stand are alive, whereas 64% of the trees are alive in the lower stand (Data from Jake Bartholomew in 2020, Magee et al. 2021). Trees in the upper colony stand average 135 years old, whereas in the lower stand trees average 159 years old. The moist soil likely influences the health of the lodgepoles, a tree that is not known to have its roots in wetland, mesic soils. Interestingly, the ages of some individual trees suggest that at least in part, these stands have existed since 1750 (Magee et al. 2021). The viability of the upper stand is low and the long-term occupancy by herons of this stand is questionable. The lower stand is older and healthier and likely could provide suitable habitat for decades to come based on current rates of tree mortality (0.16% of stand annually) (Magee et al. 2021). Therefore, the site appears suitable to sustain a local heron colony into the future and stand conditions probably are not related to the current declining trend in nest occupancy and colony size, although this question needs more study.

A more immediate threat to the viability of the Slate River heron rookery appears to be associated with human activities (Parnell et al. 1988). Herons select colonies based on three characteristics: nest site suitability, adjacency to productive foraging habitats, and solitude (Gibbs et al. 1987). Isolation is a key habitat variable dictating vulnerability and demographic rates of colonial nesting birds (Brzezinski et al. 1988). Great Blue Herons have a low tolerance for human disturbance within a spatial "refugia" surrounding the colony (Vennesland 2000) and are particularly avoidant of roads (Gibbs and Kinkel 1987) and human activities (Watts and Bradshaw 1994). Our observations suggest that a 250 m plus spatial cushion provides an adequate safeguard for these birds. In 2021, we documented over 90 human activities per hour in the vicinity of the heronry including 1,802 individual events, none of which were within 250 m of the colony and virtually none of these triggered heron disturbance behaviors. On the other hand, we observed 8 river recreation events, which are highly proximate to the colony (directly under the nest sites and within the 250 m buffer). Each of these events led to heron disturbance including at least some individual herons flushing every time a watercraft passed below the colony.

Other forms of recreation lack the close proximity to the nests. In the early spring, the potential for nordic skiers or snowshoers to infringe within 250 m of the colony, represents an important source of disturbance, especially because the herons are particularly susceptible to abandonment of the colony upon spring arrival and nest site selection (Butler 1997). Anglers or hikers could also pose a threat. In our four years of observations we have only observed a few skiers and the CB Nordic Center has proactively decided to close-off the trail that comes closest to the colony as soon as the herons arrive in March. The marshy floodplain of the Slate River deters most people from hiking in this soggy and topographically complex (e.g., hummocky) river valley. We have not observed any hikers and only one angler at the site.

Table 6. Floater event and Great Blue Heron disturbance summary from 2018-2021 at the Slate River colony in Crested Butte, CO.

Characteristic	2018	2019	2020	2021
Climate conditions	Dry year	Wet year	Dry year	Dry year
River flow	Low water	High water	Low water	Low water
Approximate end date of floating on Slate	25 June	10 August	1 July	5 July
Voluntary no- float (VNF) period	VNF was not established	1 March - 15 July	1 March - 15 July	1 March - 15 July
Float period comments	VNF was not established	River closed due to high water 6/6-7/14	River too low to float after VNF	River too low to float after VNF
Observations of floating events	26 May – 25 June	14 July – 10 August	29 May – 1 July	6 June – 5 July
Number of events observed	20	43	6	8
Number of days events observed	9	15	6	5
Number of people	76+	123	16	27
Maximum group size	17 people on 16 crafts	6 people	4 people	6 people
Number of watercrafts	59	104	16	21
Percent SUP boarders	58%	80%	81%	62%
Percent of events that produced noise	15%	19%	0%	63%
Percent of events that stopped under colony	NA	15%	NA	38%
Number of heron flushes	37	31	19	16
Heron flushes per event	1.9	0.7	3.2	2.0
Percent of events that led to heron flushing			100%	100%
Percent of flushes associated with watercraft	95%	100%		
During disturbance percent of herons in disturbance behaviors	NA	NA	81%	52%

Over the last four summers, we observed 76 floater events on 35 individual days (Table 6). We observed 200 watercrafts floating through the heron colony section of the Slate River, and on these vessels, we counted at least 242 people with group sizes ranging from 1 craft to 16 and 1 person to 17. Thirty percent of groups produced significant noise and 25% stopped within the colony stretch, sometimes to drag their boats and sometimes for a more leisurely lunch break. On average two herons flushed during each event and between 52-81% of individual herons altered their behavior from undisturbed to disturbed. Over 90% of all observed flushes have been associated with river runners. We do not know

where the disturbance threshold lies for herons. Of the metrics we have to assess human impacts on the heronry, we do not see an obvious impact on the phenological stages of the heron life cycle. Further, we do not have strong evidence of a declining trend in nest success, brood sizes, fledging rates and fledgling success – these all remain high. The main demographic parameter that has shifted is the declining number of active nests. We have also measured a consistent negative behavioral response by herons to river recreation. We have not attempted to measure disease, stress, post-fledging survival or other valuable metrics to assess impacts of river recreation on the heronry.

Cross seasonal effects (e.g., “what happens at one time and one place effects what happens at another time and place” – Leigh Fredrickson, personal communication) in the annual cycle of Great Blue Herons have not been investigated. But a possible mechanism to explain the declining colony size at the Slate River heronry could be associated with a low rate of overwinter juvenile survival (69-71% mortality in first year; Henny 1972, Bayer 1981, IUCN 2022), leading to fewer herons returning to the colony each spring. One factor that could drive low juvenile survival is the body condition of the chicks when they fledge and their subsequent ability to capture and consume prey (Vennesland and Butler 2011). Some colonial waterbird species experience higher rates of stress and reduced nutritional condition as colony size increases the pressures of intraspecific competition (Tella 2000). Reduced body condition at the time of fledging could be related to stress of the young while developing in the nests in a disturbed environment (i.e., they are shifting caloric intake to manage stress related metabolic needs over normal developmental needs), and/or reduced foraging success of adults displaced by human disturbance that would lower their provisioning rates to the chicks.

Managing human disturbance of Great Blue Herons at the Slate River colony rightly focuses on river recreation. The best solution is to provide a temporal and spatial safeguard for the herons during the nesting season (in our four years: mid-March through mid- to late-August – the end dates varied from mid-July to early September from 2018-2021). The current framework for the voluntary no-float period in the upper Slate River section as defined by the Slate River Working Group Management Plan extends from mid-March to mid-July and provides a compromise in terms of heron protection. By mid-July in most years about 50% of the heron nests have completely fledged their young. In 2021, 86% reached this milestone by 15 July and 100% were completed by 18 July. While this timeframe has only allowed floating opportunity for river recreationists in one of the last three years, this type of management is necessary to sustain the Great Blue Heron colony in the Slate River and, on a landscape scale, balance recreational priorities with conservation and biodiversity protection. If river users do not comply with voluntary no-float period, the policy loses its effectiveness in protecting herons.

Great Blue Herons require three equally necessary habitat features during their breeding season: 1) nesting trees, 2) adjacent foraging habitat in productive aquatic habitats, and 3) isolation from predators and/or disturbance. For over 20 years, herons have successfully nested in this same location on the Slate River as a result of an intact suite of these habitat components. Some of the nesting trees are declining in viability, but the lodgepole pine stands likely will maintain their suitability to support heron treetop nests for many years. And while the upper Slate River is a high elevation low nutrient system, it appears to have relatively pristine water quality and sufficient food resources to support foraging herons. Surrounding wetlands up to 24 km from the nests may also attract Slate River herons as foraging sites (Gibbs and Kinkel 1997). What may be most limiting to the herons of the Slate River, and what has changed most dramatically in the last 10 years, is spatial isolation from human activity. Without this element, the habitat trifecta is incomplete and jeopardizes the long-term suitability of the Slate River for Great Blue Herons.

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The Slate River Working Group (SRWG) has met numerous times in the last four years to discuss issues along the Slate River and to listen to each other, compromise and collaborate on an adaptive management plan for river use. The SRWG includes a diversity of 18 stakeholders including ranchers, wildlife advocates, biologists and researchers, water conservation entities, local government, and land management agencies, private landowners, and river recreation advocates, among others. I am honored to collaborate with this thoughtful group of people who share a love for the beauty and wildness of Crested Butte, an adventurous spirit, and a desire to work together for a common solution.

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I am honored to study the Great Blue Heron, an ancient and majestic bird that graces our valley in elegance, fortitude, unimaginable patience, and loyalty to home. While I have no idea where they disperse after 5 months nesting in the Slate River valley, I enthusiastically welcome them home each spring as do so many in our community! Their arrival represents a challenge for our community to collaborate and discern a path that demonstrates the best version of ourselves. This report is dedicated to Jake Bartholomew.



Photo by Jake Bartholomew