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Species Detection,
Collection, and
Monitoring Report

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A summary of species
detected during long-term
monitoring at the Crane
Trust and permitted
collection activities in the
calendar year.

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Introduction

During the summer of 2015 we implemented a long-term biological monitoring plan establishing survey transects in all parts of Crane Trust properties with differing soils, vegetation, management practices, and land use histories (~2,430 ha currently; main complex = 40.798306°N, -98.416298°W, NAD 1983; 597 m elev., Hall County; Figure 1). These plots consist of two parallel transects: the vegetation line, totaling 100m, and the bird, small mammal, and butterfly species of concern line, totaling 200m. Due to the complex mosaic of soil types and management histories on the property, the total number of monitoring sites totaled 73 as of 2021; new sites are added as additional conservation properties are acquired or incorporated into Crane Trust management and research efforts.

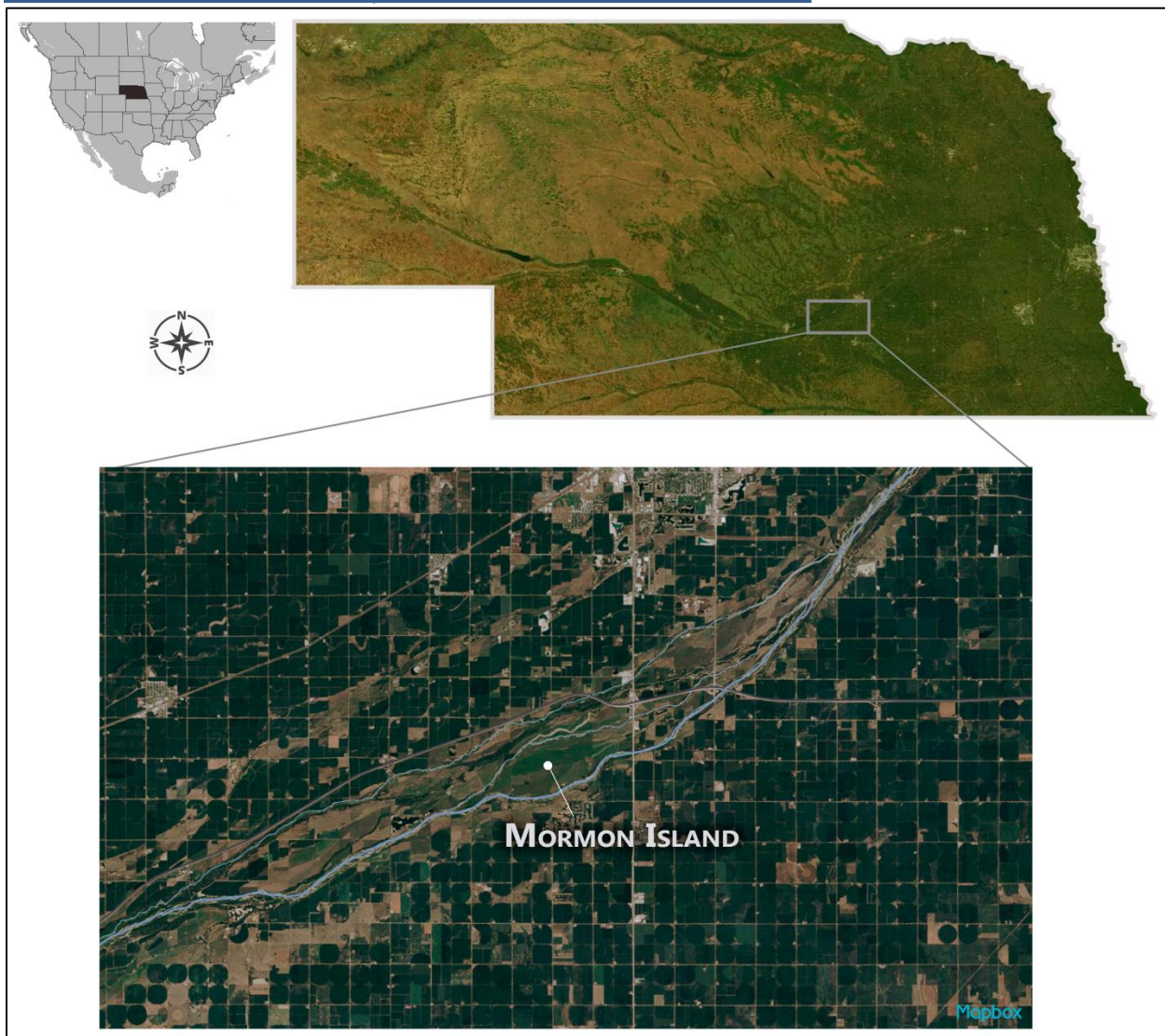
We have continued our efforts to survey the vegetation, avian community, small mammals, and butterfly species at these sites using standardized methodologies on a set rotation to monitor the effectiveness of our management techniques in promoting native biodiversity since 2015. Additionally, we have conducted surveys of native and exotic slough-dwelling fish and monitored groundwater levels since 2012 and 2011, respectively. We added anuran vocalization surveys to our monitoring program in 2018 and Whooping Crane behavioral and habitat surveys in 2019. We also took part in the Nebraska Bumble Bee Atlas project in 2020 and 2021. Finally, we conducted aerial Sandhill Crane counts from mid-February to mid-April, continuing a study which began in 2002. We discontinued the IBS's (Institute for Bird Populations) MAPS program (Monitoring Avian Productivity and Survivorship) in 2020, which involved banding at four different sites throughout the breeding season (June-July) as we determined that point count data sufficed to answer most of our current management questions and the project was labor intensive while yielding data at a limited spatial scale (Federal Bird Banding Permit No. 23224, Station Permit: Platte River Whooping Crane Trust, Wood River, NE; currently inactive). In this report we summarize all species detections from research conducted in 2021 that was subject to permitting or was supported by regional USFWS programs. All species detections were from a 13.5 km reach of the Platte River beginning 3 km west of Alda Rd. and continuing east to HWY 281 in Hall County, Nebraska, aside from aerial crane, plant, bumblebee, and soil macroinvertebrate surveys, which spanned the Central Platte River Valley (CPRV; Chapman to Overton, Nebraska) and/or the Western Rainwater Basins (Phelps and Kearney Counties). Earlier reports included data from Buffalo County, at Dippel Island, which we have since sold to the Platte River Recover Implementation Program (effective 2018).

As of 14 December 2021, the Crane Trust field team performed 140 avian surveys, 39 small mammal surveys across 13 sites totaling 1950 trap nights, 50 vegetation surveys, 6 days of fish seining, 63 butterfly species of concern surveys, 9 aerial Sandhill Crane surveys, 144 anuran call surveys, and assessed habitat conditions and monitored behavior related to 30 unique Whooping Crane groups including 148 individuals. We also captured, identified, and released 278 individual bumblebees of 6 different species. Below is a summary of species detections from 2021 and general methods for surveys.

The 2021 Crane Trust research team consisted of *Director of Conservation Research* Andrew J. Caven, *Threatened and Endangered Species Specialist* David M. Baasch, *Habitat Ecologist* Joshua D. Wiese, Jr. *Wildlife Biologist* Jenna Malzahn, *Lila O. Wilson Biological Monitoring Intern* Matthew Schaaf, *Saunders Conservation Fellow* Amanda Medaries, University of Nebraska at Kearney *MS student* and *Biological*

Science Technician Bethany Ostrom, Oklahoma State University *PhD student* Abraham Kanz, and Oklahoma State University *Biological Science Technician* Sam Heilman. Volunteers and student interns included Sam Johnson (Hastings College) and Phoebe Dunbar (University of Nebraska at Kearney). External researchers associated with our 2021 projects included Dr. Craig Davis (Oklahoma State University), Dr. Mary J. Harner (University of Nebraska at Kearney), Emma M. Brinley Buckley (U.S. National Park Service), and Matthew R. Rabbe (U.S. Fish and Wildlife Service). We also want to thank The Nature Conservancy, Audubon Nebraska, and the Platte River Recovery Implementation Program for land access and logistical support during the 2021 field season.

Figure 1. Map of Mormon Island, Hall County Nebraska, the largest site owned and managed by the Crane Trust since 1978. Also depicting the Big Bend Region of the Platte River and Nebraska's position within the United States.



Footnote: Aerial imagery clearly depicts the prairie habitat of Mormon Island within a largely agricultural landscape (Map credit – E. M. Brinley Buckley).

Small Mammal Monitoring

We used Sherman Box Traps baited with a seed mixture of sterilized (autoclaved or baked) oats, sunflower seeds, and cracked corn. For general methods see Newsome (2015). Mealworms were also added in areas suspected or known to have high proportions of Soricomorpha to limit trap mortality. Traps were placed every 5m along a 200m set transect with an additional 10 traps placed within 10m of the transect for incidental detections. Small mammals were generally identified to species; the age, sex, and reproductive status of each individual were also recorded when possible. Measurements such as weight and length were not recorded unless necessary for identification. Our trapping began in early August and ended in late September. Total survey trap effort concluded at 1950 trap nights in 2021 (trap number per site (50)*sites trapped (13)*trap nights per site (3)).

No individuals were euthanized for voucher specimens; however, individuals that died in trap were taken as samples to be submitted to teaching or scientific collections (UNSM, UNL, NE or FHSM, FHSU, KS). This year trap mortality was 1.6%, which was the second lowest we have observed in our 7 years of data collection following 2019 when only 1.1% of captured small mammals died in trap (Table 1). This year's mortality rate was relatively low considering other past years (2016, 3.3%; 2017, 3.5%; 2018, 2.9%; 2020, 2.5%). We captured 8 total species, which represents about 66.7% of the species we have detected during the 7 -year study. Overall, 2021 represented a very poor year in terms of small mammal capture rates. Captures declined from 197 to 61 from 2020 to 2021 given the same trapping effort, which represented a 69.0% decline. This represents the lowest number of small mammals captured during a single monitoring season in our database. Common species such as the Prairie Vole and White-footed Mouse demonstrated >88% declines compared to last year's data. Only the Meadow Jumping Mouse increased (+20%) compared to 2020, but it was still 55.0% below mean annual abundance across the 7-year study.

Methods:

Newsome, S. 2015. Small Mammal Mark-Recapture Population Dynamics at Core Research Sites at the Sevilleta National Wildlife Refuge, New Mexico (1989-present). Sevilleta Long Term Ecological Research program (LTER), University of New Mexico, Albuquerque, NM, USA.

Table 1. Small Mammals Detected at the Crane Trust 2021

<i>Genus species</i>	Common Name	Count	Mortality	% Ann. Change
<i>Blarina brevicauda</i>	Northern Short-tailed Shrew	3	0	-80.0%
<i>Cryptotis parva</i>	Least Shrew	0	0	0.0%
<i>Ictidomys tridecemlineatus</i>	Thirteen-lined Ground Squirrel	0	0	0.0%
<i>Microtus ochrogaster</i>	Prairie Vole	6	0	-88.5%
<i>Microtus pennsylvanicus</i>	Meadow Vole	30	1	-53.1%
<i>Perognathus flavescens</i>	Plains Pocket Mouse	0	0	0.0%
<i>Peromyscus leucophagus</i>	White-footed Mouse	3	0	-90.0%
<i>Peromyscus maniculatus</i>	Deer Mouse	12	0	-29.4%
<i>Reithrodontomys megalotis</i>	Western Harvest Mouse	0	0	-100.0%
<i>Reithrodontomys monatus</i>	Plains Harvest Mouse	1	0	-90.0%
<i>Sorex spp.</i>	Masked/Prairie Shrew	1	0	-50.0%

<i>Zapus hudsonius</i>	Meadow Jumping Mouse	6	0	+20.0%
Total	-	61	1	-69.0%

Avian Monitoring

We conducted stationary focal point surveys for 15 minutes at long-term monitoring sites throughout the year, with two surveys conducted at each site during the breeding season. During these surveys, all species detected by sight and/or vocalization were recorded. The total number of individual birds detected of each species was estimated, taking efforts not to double-count individuals. Each bird detection was recorded as within 50m or outside 50m of the observer. We did not try to estimate the real population based off the number of birds detected, but instead treated each count as an index for discerning the relative abundance of species. In some ways this data equates to *bird detection days*, as individual birds (i.e. - Whooping Cranes, breeding songbirds, etc.), which stayed for a significant length of time, were regularly counted multiple times across rotational surveys. Common names are consistent with AOU standards.

Point-count surveys were conducted at 56 monitoring sites across Crane Trust-managed properties in 2021, thus far totaling (as of 12/14/2021) 140 surveys and 137,035 birds counted of 156 species (including incidental sightings from 76 locations; Table 2). Total counts of each species are presented in Table 2. We detected several priority species for the US FWS Mountain-Prairie Region (6) as well as several species designated as Tier-1 or Tier-2 species of concern by the Nebraska Game and Parks Commission. Bald Eagles were common and detected throughout the year, including 3 nesting locations on/near Crane Trust properties. A significant density of Sandhill Cranes roosted between HWY 281 and Alda Rd., along the Crane Trust’s main conservation property (aerial survey estimates are presented in a later section of the report). We recorded 38 Upland Sandpipers, 287 Grasshopper Sparrows, 822 Bobolinks, and 10 Henslow’s Sparrows during breeding season surveys. Additionally, we recorded 1 Loggerhead Shrike, 1 Short-eared Owl, and 40 Whooping Cranes through migration season surveys at or near Crane Trust properties. However, we detected several more Whooping Cranes through our behavioral monitoring efforts which are addressed later in this report. We documented a large number of Tier-2 species of concern per the NGPC including 130 Eastern Meadowlarks, 68 Northern Pintails, 47 Swamp Sparrows, 14 Savannah Sparrows, 8 Lesser Scaup, and 1 Scissor-tailed Flycatcher.

Methods:

Gregory, R.D., D.W. Gibbons, and P.F. Donald. 2004. Bird census and survey techniques. Pages 17–56 in W.J. Sutherland, I. Newton, and R.E. Green, editors, Bird ecology and conservation: A handbook of techniques. Oxford University Press, Oxford, United Kingdom.

Table 2. Avian Detections and Abundance at the Crane Trust 2021

Common names, scientific names, alpha codes, and total counts for each species detected during Crane Trust long-term monitoring surveys. Data from point count surveys as well as incidental detections in the calendar year 2021 are included. Aerial survey data is presented separately in a later section of this report.

Common Name	Genus species	Alpha Code	Count
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American Avocet	<i>Recurvirostra americana</i>	AMAV	2
American Bittern	<i>Botaurus lentiginosus</i>	AMBI	1
American Coot	<i>Fulica americana</i>	AMCO	17
American Crow	<i>Corvus brachyrhynchos</i>	AMCR	374
American Goldfinch	<i>Spinus tristis</i>	AMGO	562
American Kestrel	<i>Falco sparverius</i>	AMKE	3
American Robin	<i>Turdus migratorius</i>	AMRO	403
American Wigeon	<i>Mareca americana</i>	AMWI	12
American Tree Sparrow	<i>Spizelloides arborea</i>	ATSP	95
American White Pelican	<i>Pelecanus erythrorhynchos</i>	AWPE	211
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BAEA	67
Bank Swallow	<i>Riparia riparia</i>	BANS	38
Baltimore Oriole	<i>Icterus galbula</i>	BAOR	82
Barn Swallow	<i>Hirundo rustica</i>	BARS	379
Baird's Sandpiper	<i>Calidris bairdii</i>	BASA	48
Black-capped Chickadee	<i>Poecile atricapillus</i>	BCCH	13
Belted Kingfisher	<i>Megaceryle alcyon</i>	BEKI	12
Bell's Vireo	<i>Vireo bellii</i>	BEVI	49
Brown-headed Cowbird	<i>Molothrus ater</i>	BHCO	1,673
Blue Jay	<i>Cyanocitta cristata</i>	BLJA	180
Blackpoll Warbler	<i>Setophaga striata</i>	BLPW	2
Black Tern	<i>Chlidonias niger</i>	BLTE	10
Bobolink	<i>Dolichonyx oryzivorus</i>	BOBO	822
Brown Thrasher	<i>Toxostoma rufum</i>	BRTH	63
Blue-winged Teal	<i>Spatula discors</i>	BWTE	71
Cackling Goose	<i>Branta hutchinsii</i>	CACG	5,953
Cattle Egret	<i>Bubulcus ibis</i>	CAEG	11
Canada Goose	<i>Branta canadensis</i>	CANG	4,728
Canvasback	<i>Aythya valisineria</i>	CANV	2
Clay-colored Sparrow	<i>Spizella pallida</i>	CCSP	51
Cedar Waxwing	<i>Bombycilla cedrorum</i>	CEDW	52
Chipping Sparrow	<i>Spizella passerina</i>	CHSP	6
Chimney Swift	<i>Chaetura pelagica</i>	CHSW	29
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	CLSW	538
Common Goldeneye	<i>Bucephala clangula</i>	COGO	8
Common Grackle	<i>Quiscalus quiscula</i>	COGR	15
Cooper's Hawk	<i>Accipiter cooperii</i>	COHA	3
Common Merganser	<i>Mergus merganser</i>	COME	25
Common Yellowthroat	<i>Geothlypis trichas</i>	COYE	392
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	DCCO	31
Dark-eyed Junco	<i>Junco hyemalis</i>	DEJU	19
Dickcissel	<i>Spiza americana</i>	DICK	1,390
Downy Woodpecker	<i>Picoides pubescens</i>	DOWO	41
Eastern Bluebird	<i>Sialia sialis</i>	EABL	19
Eastern Kingbird	<i>Tyrannus tyrannus</i>	EAKI	279
Eastern Meadowlark	<i>Sturnella magna</i>	EAME	130
Eastern Phoebe	<i>Sayornis phoebe</i>	EAPH	6
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	EATO	1
Eastern Wood-pewee	<i>Contopus virens</i>	EAWP	1
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	EUCD	3

European Starling	<i>Sturnus vulgaris</i>	EUST	1,330
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	EWPW	1
Field Sparrow	<i>Spizella pusilla</i>	FISP	108
Forster's Tern	<i>Sterna forsteri</i>	FOTE	15
Franklin's Gull	<i>Leucophaeus pipixcan</i>	FRGU	102
Great Blue Heron	<i>Ardea herodias</i>	GBHE	16
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	GCFL	17
Great Horned Owl	<i>Bubo virginianus</i>	GHOW	4
Gray Catbird	<i>Dumetella carolinensis</i>	GRCA	56
Great Egret	<i>Ardea alba</i>	GREG	1
Green Heron	<i>Butorides virescens</i>	GRHE	4
Greater Prairie-chicken	<i>Tympanuchus cupido</i>	GRPC	37
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	GRSP	287
Greater Yellowlegs	<i>Tringa melanoleuca</i>	GRYE	59
Greater White-fronted Goose	<i>Anser albifrons</i>	GWFG	73
Green-winged Teal	<i>Spatula crecca</i>	GWTE	64
Harlan's Hawk	<i>Buteo jamaicensis harlani</i>	HALH	2
Harris's Sparrow	<i>Zonotrichia querula</i>	HASP	27
Hairy Woodpecker	<i>Dryobates villosus</i>	HAWO	2
Henslow's Sparrow	<i>Ammodramus henslowii</i>	HESP	10
House Finch	<i>Haemorhous mexicanus</i>	HOFI	6
Horned Lark	<i>Eremophila alpestris</i>	HOLA	20
Hooded Merganser	<i>Lophodytes cucullatus</i>	HOME	4
House Sparrow	<i>Passer domesticus</i>	HOSP	1
House Wren	<i>Troglodytes aedon</i>	HOWR	260
Indigo Bunting	<i>Passerina cyanea</i>	INBU	2
Killdeer	<i>Charadrius vociferus</i>	KILL	345
Lark Sparrow	<i>Chondestes grammacus</i>	LASP	1
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	LBDO	24
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	LCSP	3
Least Flycatcher	<i>Empidonax minimus</i>	LEFL	2
Least Sandpiper	<i>Calidris minutilla</i>	LESA	6
Lesser Scaup	<i>Aythya affinis</i>	LESC	8
Lesser Yellowlegs	<i>Tringa flavipes</i>	LEYE	7
Lincoln's Sparrow	<i>Melospiza lincolni</i>	LISP	20
Loggerhead Shrike	<i>Lanius ludovicianus</i>	LOSH	1
Mallard	<i>Anas platyrhynchos</i>	MALL	272
Mourning Dove	<i>Zenaida macroura</i>	MODO	308
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	NAWA	8
Northern Bobwhite	<i>Colinus virginianus</i>	NOBO	137
Northern Cardinal	<i>Cardinalis cardinalis</i>	NOCA	98
Northern Flicker (undistinguished)	<i>Colaptes auratus</i>	NOFL	49
Northern Harrier	<i>Circus hudsonius</i>	NOHA	19
Northern Pintail	<i>Anas acuta</i>	NOPI	68
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	NRWS	1
Northern Shoveler	<i>Spatula clypeata</i>	NSHO	39
Orange-crowned Warbler	<i>Oreothlypis celata</i>	OCWA	7
Orchard Oriole	<i>Icterus spurius</i>	OROR	93
Osprey	<i>Pandion haliaetus</i>	OSPR	1
Pied-billed Grebe	<i>Podilymbus podiceps</i>	PBGR	11

Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	RBGR	17
Ring-billed Gull	<i>Larus delawarensis</i>	RBGU	6
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	RBWO	18
Ruby-crowned Kinglet	<i>Regulus calendula</i>	RCKI	6
Redhead	<i>Aythya americana</i>	REDH	3
Red-eyed Vireo	<i>Vireo olivaceus</i>	REVI	7
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	RHOW	60
Rough-legged Hawk	<i>Buteo lagopus</i>	RLHA	7
Ring-necked Duck	<i>Aythya collaris</i>	RNDU	31
Ring-necked Pheasant	<i>Phasianus colchicus</i>	RNEP	250
Rock Pigeon	<i>Columba livia</i>	ROPI	43
Red-shafted Flicker	<i>Colaptes auratus cafer</i>	RSFL	1
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RTHA	10
Ruddy Duck	<i>Oxyura jamaicensis</i>	RUDU	16
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	RWBL	5,556
Sandhill Crane	<i>Antigone canadensis</i>	SACR	86,291
Savannah Sparrow	<i>Passerculus sandwichensis</i>	SAVS	14
Lesser Canada Goose	<i>B. c. parvipes</i>	SCGO	600
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>	STFL	1
Short-eared Owl	<i>Asio flammeus</i>	SEOW	1
Semipalmated Plover	<i>Charadrius semipalmatus</i>	SEPL	1
Semipalmated Sandpiper	<i>Calidris pusilla</i>	SESA	40
Sedge Wren	<i>Cistothorus platensis</i>	SEWR	16
Snow Goose	<i>Anser caerulescens</i>	SNGO	18,962
Sora	<i>Porzana carolina</i>	SORA	4
Solitary Sandpiper	<i>Tringa solitaria</i>	SOSA	1
Song Sparrow	<i>Melospiza melodia</i>	SOSP	208
Spotted Sandpiper	<i>Actitis macularius</i>	SPSA	38
Spotted Towhee	<i>Pipilo maculatus</i>	SPTO	93
Sharp-shinned hawk	<i>Accipiter striatus</i>	SSHA	1
Swainson's Hawk	<i>Buteo swainsoni</i>	SWHA	3
Swamp Sparrow	<i>Melospiza georgiana</i>	SWSP	47
Swainson's Thrush	<i>Catharus ustulatus</i>	SWTH	4
Tree Swallow	<i>Tachycineta bicolor</i>	TRES	231
Turkey Vulture	<i>Cathartes aura</i>	TUVU	3
Upland Sandpiper	<i>Bartramia longicauda</i>	UPSA	38
Vesper Sparrow	<i>Poocetes gramineus</i>	VESP	3
Warbling Vireo	<i>Vireo gilvus</i>	WAVI	35
White-breasted Nuthatch	<i>Sitta carolinensis</i>	WBNU	28
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	WCSP	14
Western Meadowlark	<i>Sturnella neglecta</i>	WEME	728
White-faced Ibis	<i>Plegadis chihi</i>	WFIB	16
Whooping Crane	<i>Grus americana</i>	WHCR	40
Willow Flycatcher	<i>Empidonax traillii</i>	WIFL	71
Willet	<i>Tringa semipalmata</i>	WILL	3
Wilson's Phalarope	<i>Phalaropus tricolor</i>	WIPH	29
Wilson's Snipe	<i>Gallinago delicata</i>	WISN	14
Wild Turkey	<i>Meleagris gallopavo</i>	WITU	17
Wood Duck	<i>Aix sponsa</i>	WODU	11
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	WRSA	3

White-winged Scoter	<i>Melanitta deglandi</i>	WWSC	3
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	YBCU	5
Yellow Warbler	<i>Setophaga petechia</i>	YEWA	231
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	YHBL	187
Yellow-rumped Warbler	<i>Setophaga coronata</i>	YRWA	2
Yellow-shafted Flicker	<i>C. a. auratus</i>	YSFL	10
Total	-	-	137,035

Slough Fish Monitoring

Each fish seine survey consisted of six to eight runs totaling ~150m of the slough/channel. Using a seine net sized to the general width of the slough channel, we ran the net at the slough bottom capturing as many fish as possible. We then dumped those fish into a 5-gallon bucket for identification and counting purposes. No individuals were collected as vouchers, but photos were taken of rarer species. Two sloughs as well as one stretch of the North Channel of the Platte River were sampled on two occasions each. We detected 7,201 individual fish of 16 species across 39 seine runs in 2021 compared to just 1,770 individuals of 11 species across 27 runs in 2020 (Table 3). In 2021 we increased effort by 44% but overall captures increased by 307% compared to 2020. In total counts, all species aside from the Green Sunfish (*Lepomis cyanellus*) increased from 2020 to 2021. However, the Western Mosquito Fish (*Gambusia affinis*; 54.35% vs. 75.60%), Plains Topminnow (*Fundulus sciadicus*; 6.72% vs. 10.70%), and Johnny Darter (*Etheostoma nigrum*; 0.04% vs. 0.10%) decreased as a relative proportion of the sample captured. The decrease was relatively large for the exotic Mosquito Fish, which is a positive development. Additionally, proportional declines for the native Plains Topminnow and Johnny Darter were relatively small and likely within the margin of error compared to last year's sample.

Methods:

Onorato, D.P., R.A. Angus, and K.R. Marion. 1998. Comparison of a small-mesh seine and a backpack electroshocker for evaluating fish populations in a North-Central Alabama stream. *North American Journal of Fisheries Management* 18:361-373.

Table 3. Fish Detected at the Crane Trust during 2021 Slough and River Surveys.

Common Name	Genus species	Count	%
Western Mosquito Fish	<i>Gambusia affinis</i>	3,914	54.35%
Brook Stickleback	<i>Culaea inconstans</i>	1,377	19.12%
Creek Chub	<i>Semotilus atromaculatus</i>	508	7.05%
Plains Topminnow	<i>Fundulus sciadicus</i>	484	6.72%
Brassy Minnow	<i>Hybognathus hankinsoni</i>	413	5.74%
Sand Shiner	<i>Notropis stramineus</i>	197	2.74%
River Shiner	<i>Notropis blennioides</i>	197	2.74%
Red Shiner	<i>Cyprinella lutrensis</i>	72	1.00%
Northern Plains Killifish	<i>Fundulus kansae</i>	15	0.21%
Green Sunfish	<i>Lepomis cyanellus</i>	11	0.15%
River Carpsucker	<i>Carpionodes carpio</i>	4	0.06%

Johnny Darter	<i>Etheostoma nigrum</i>	3	0.04%
Iowa Darter	<i>Etheostoma exile</i>	3	0.04%
Silver Chub	<i>Macrhybopsis storeriana</i>	1	0.01%
Gizzard Shad	<i>Dorosoma cepedianum</i>	1	0.01%
Black Bullhead	<i>Ameiurus melas</i>	1	0.01%
Total	-	7,201	100.00%

Vegetation Monitoring

We targeted plants in excellent condition, in fruit or flower (ideally both), to fill in distribution gaps and verify species for collection to the Crane Trust herbarium. We recorded the area where the plant was found to the nearest transect, the date it was collected, and its relative abundance in the area. We collected plant specimens from across Crane Trust properties and the Central Platte River Valley (Table 4). Collections and identifications were made primarily by J. Wiese and A. Caven.

Most of the plants collected were encountered on vegetation surveys which include both point-line intercept (every two meters) and quadrat (0.5m x 1.0m every 10m) ocular cover estimation methods along a 100m permanently-marked transect. We conducted 50 such surveys during the 2021 growing season from 24 May to 13 October, just before the first frost. Notable finds in 2021 included Cup Plant (*Silphium perfoliatum*) that was likely introduced through restoration as well as Silky Prairie Clover (*Dalea villosa*), which are both native species and Hall County records per Kaul et al. (2012). Additionally, we detected Hairy Cupgrass (*Eriochloa villosa*), which also represents a record for Hall County but is an exotic species. In total, we made collections of just 89 plants of 22 species in 2021, as we already have quality specimens for most local species in our herbarium. We also report here 5 specimens of 5 different species from earlier survey years (2019-2020) that were previously unprocessed. We expect collection efforts to remain moderate over the next several years.

Methods:

Symstad, A.J., C.L. Wienk, and A.D. Thorstenson. 2008. Precision, Repeatability, and Efficiency of Two Canopy-Cover Estimate Methods in Northern Great Plains Vegetation. *Rangeland Ecology and Management* 61:419-429.

Additional Relevant Sources:

Kaul, R.B., D. Sutherland, and S. Rolfsmeier. 2012. The flora of Nebraska, second edition. School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE, USA.

Nagel, H.G., and O.A. Kolstad. 1987. Comparison of plant species composition of Mormon Island Crane Meadows and Lillian Annette Rowe Sanctuary in central Nebraska. *Transactions of the Nebraska Academy of Sciences* 15:37-48.

Table 4. Plant Specimens Collected for the Crane Trust Herbarium in 2021.

Collection dates, nomenclature, status as native or introduced (i.e., “exotic”), number of individual plants collected, and status as a county recorder per Kaul et al. (2012).

Date Collected	Family	Genus species	Common Name	Status	No. Collected	Co. Record
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7/15/2021	Fabaceae	<i>Dalea villosa</i>	Silky Prairie Clover	N	1	Hall
7/17/2021	Fabaceae	<i>Amorpha canescens</i>	Leadplant	N	1	-
6/1/2021	Asteraceae	<i>Crepis runcinata</i>	Fiddle-leaf Hawksbeard	N	1	-
6/1/2021	Cyperaceae	<i>Carex meadii</i>	Mead's Sedge	N	1	-
7/13/2021	Fabaceae	<i>Pediomelum argophyllum</i>	Silverleaf Scurfpea	N	1	-
7/28/2021	Polygonaceae	<i>Polygonum coccineum</i>	Scarlet Smartweed	N	1	-
7/28/2021	Polygonaceae	<i>Polygonum persicaria</i>	Lady's Thumb Smartweed	I	1	-
7/29/2021	Poaceae	<i>Elymus canadensis</i>	Canada Wild Rye	N	1	-
8/6/2021	Asteraceae	<i>Silphium perfoliatum</i>	Cup Plant	N	1	Hall
8/9/2021	Asteraceae	<i>Lactuca ludoviciana*</i>	Prairie Lettuce	N	1	-
8/23/2021	Poaceae	<i>Muhlenbergia racemosa</i>	Marsh Muhly	N	1	-
8/23/2021	Poaceae	<i>Muhlenbergia sylvatica*</i>	Woodland Muhly	N	1	-
9/28/2021	Asteraceae	<i>Eupatorium altissimum</i>	Tall Boneset	N	7	-
9/28/2021	Asteraceae	<i>Ratibida columnifera</i>	Upright Prairie Coneflower	N	8	-
9/28/2021	Asteraceae	<i>Helianthus maximilliani</i>	Maximilian Sunflower	N	8	-
9/28/2021	Asteraceae	<i>Helianthus annuus</i>	Common Sunflower	N	8	-
9/28/2021	Asteraceae	<i>Grindelia squarrosa</i>	Curlycup Gumweed	N	7	-
9/28/2021	Asteraceae	<i>Solidago canadensis</i>	Canada Goldenrod	N	8	-
9/28/2021	Asteraceae	<i>Solidago rigida</i>	Still Goldenrod	N	6	-
9/28/2021	Asteraceae	<i>Aster ericoides</i>	Heath Aster	N	7	-
9/28/2021	Asteraceae	<i>Aster novae-angliae</i>	New England Aster	N	7	-
9/28/2021	Asteraceae	<i>Aster lanceolatum</i>	Panicled Aster	N	6	-
6/2/2020	Brassicaceae	<i>Arabis pycnocarpa</i>	Rock Cress	N	1	-
8/5/2020	Poaceae	<i>Eriochloa villosa</i>	Hairy Cupgrass	I	1	Hall
6/4/2019	Cyperaceae	<i>Carex sartwellii</i>	Sartwell's Sedge	N	1	-
6/2/2020	Cyperaceae	<i>Carex praegracilis</i>	Clustered Field Sedge	N	1	-
6/2/2020	Cyperaceae	<i>Carex molesta</i>	Troublesome Sedge	N	1	-
Total	-	-	-	-	89	3

Notes: *Identification remains preliminary.

Butterfly Species of Concern Monitoring (w/ Bumblebee Notes)

We counted butterflies using linear walking transects. Surveys were conducted by two research personnel; the observer spotted butterfly species of concern, while the recorder utilized a GPS and a compass to navigate the monitoring transect, record data, and aid in the detection of butterflies. We counted "butterflies observed ahead and to the sides to the limit at which a species can be identified with binoculars" (Swengel 1996). Detections were recorded as within 10m of the transect or outside of this area. Only Regal Fritillaries within 10m of the transect line were sexed. Males have a lower line of orange spots on the hind wing, while females have two lines of white spots. Monarchs were not sexed since male and female morphological differences are slight, and accuracy may be compromised.

Monarchs and Regals were incidentally recorded on the walk to and from biological monitoring plots using GPS as well. All sightings within 200m of the start of a monitoring transect and their corresponding GPS locations were included as incidental detections associated with specific monitoring plots. In total, we surveyed 21 monitoring sites 3 times each in 2021. Surveys lasted 15 minutes and were only conducted during favorable weather conditions (sunny, wind under 10mph) between the late morning (10:00am) and the midafternoon (4:00pm). All plots were visited three times during the Regals' active period, from June 15th to September 15th, and at least once during peak Regal activity, from June 15th to August 1st, based on the timing of Regal activity demonstrated from previous work conducted in the region. We also recorded incidental detections of Monarchs and Regal Fritillaries made off long-term monitoring plots while out conducting other survey work. Previous to 2020 we only reported abundance estimates from systematic monitoring surveys. Generally, this works well for Regal Fritillaries considering their strong associations with particular habitats and their resident life history. However, as migrants, Monarch concentrations can shift widely from year to year, and sometimes their highest densities are detected outside of our monitoring plot system. Furthermore, there is significant temporal variability in peak Monarch abundance, and the highest densities can migrate through the CPRV outside of our standardized survey periods. Therefore, starting in 2020 we also began reporting incidental butterfly species of concern detections in our annual *Species Detection, Collection, and Monitoring Report*.

The total number of Regal Fritillaries detected during systematic monitoring surveys decreased by 18% (261 to 214) from 2020 to 2021 (Table 5). Similarly, detections per survey also declined, but to a lesser extent from 4.08 to 3.40 (-16.7%). Monarch numbers increased by 65.7% in total and 68.3% on a per survey basis from 2020 to 2021 (134 to 222 and 2.09 to 3.52, respectively; Table 5). Relative to the mean number of individuals detected per survey from 2017-2020 both Regal Fritillaries (3.40 vs. \bar{x} = 2.60, +30.9%) and Monarchs (3.52 vs. \bar{x} = 1.50, +135.0%) demonstrated above average abundance in 2021. As participants in the Nebraska Bumble Bee Atlas Project coordinated by the Xerces Society the Crane Trust captured, identified, and released 154 Brown-belted Bumblebees (*Bombus griseocollis*), 53 American Bumblebees (*Bombus pensylvanicus*), 40 Common Eastern Bumblebees (*Bombus impatiens*), 27 Southern Plains Bumblebees (*Bombus fraternus*), 2 Black and Gold Bumblebee (*Bombus auricomus*), and 2 Bumblebees (*Bombus* sp.) only identified to genus (for methods see - www.nebraskabumblebeeatlas.org).

Methods:

Caven, A.J., K.C. King, J.D. Wiese, and E.M. Brinley Buckley. 2017. A descriptive analysis of Regal Fritillary (*Speyeria idalia*) habitat utilizing biological monitoring data along the big bend of the Platte River, NE. *Journal of Insect Conservation* 21:183–205.

Swengel, A.B. 1996. Effects of fire and hay management on abundance of prairie butterflies. *Biological Conservation* 76(1):73-85.

Table 5. Butterfly Detections at the Crane Trust in 2021

Common Name	Regal Fritillary	Monarch
Surveys Total	214	222

Count per Survey	3.4	3.5
Incidental, On-Plot	31	42
Incidental, Off-Plot	34	59
Total	279	323

Herpetofauna Research

In 2018 we began an anuran monitoring program estimating general abundance and species presence or absence based on vocalization activity following the methods of USGS (2012). Abundance is broken up into 3 differentiable categories (Weir and Mossman 2005; USGS 2012; Table 6):

Table 6. Amphibian Calling Index (Weir and Mossman 2005; USGS 2012)

- 1 “Individuals can be counted; there is space between calls”
- 2 “Calls of individuals can be distinguished but there is some overlapping of calls”
- 3 “Full chorus, calls are constant, continuous and overlapping”

Surveys were conducted as early as 30 minutes after official sunset in humid and low wind (<15 mph) conditions, with early spring temperatures above 42° F (March-15 to May-15) and late spring-summer temperatures above 50° F (May-15 forward) (Weir and Mossman 2005; USGS 2012). Surveys lasted 5 minutes per site and were conducted at 12 sites at least 4 times per survey season (≥ 48 total surveys), with 2 surveys conducted in the early spring period and 2 surveys conducted in the late spring-summer period at each site (USGS 2012). However, since beginning the study in 2018 we have generally attempted to survey weekly from mid-April to mid-July given staff availability and have completed an average of 85 surveys annually. A recording device was brought to each site to record novel calls and to provide evidence for species not previously detected on Crane Trust properties. Novel calls were investigated physically following timed survey periods at a set location. Playback was also used to look for rare species following the official survey, but not during. In 2020 we began categorizing whether vocalization activity was present locally (within 20 m of the observer) or simply present at the landscape-level.

We detected five species across 144 anuran call surveys in 2021 including the Cope’s Grey Treefrog. Several new reports (pers. comm. K. Geluso, McLean et al. 2015) suggest that Cope’s Grey Treefrogs have significantly expanded their range west along the Platte River in recent years. In 2021, Boreal Chorus Frogs had both the highest mean calling index and were the only species detected at 100% of sites but calling index values for the species were down 29.3% compared to 2020 (2.0 vs. 2.8; Table 7). Woodhouse’s Toads were the second most widespread anuran and were detected at 91.7% of sites and demonstrated a mean calling index of 1.7 where detected, which represented a 16.2% increase over last year’s estimates. Calling index values were slightly lower for the Plains Leopard Frog and Cope’s Gray Treefrog but both species were more widespread in 2021 compared to 2020, with presence across plots increasing from 50.0% to 83.3% for both species. This likely represents a return to “normal” per our four years of data following the spatial contraction of species across plots associated with relatively dry conditions last year in 2020. Bullfrog abundance and distribution decreased by all metrics from 2020 to 2021. Plains Leopard Frogs were the species most likely to be documented vocalizing locally (45.7%

within 20m) while all other species were detected vocalizing locally <19% of the time. We failed to detect any Plains Spadefoot Toads in 2021.

Table 7. Mean Anuran Species Calling (i.e., “Abundance”) Indices, Percent of Plots Detected, and Percent of Surveys Detected Locally (≤ 20 m) during 2021 Crane Trust Monitoring Surveys.

Common Name	Scientific Name	\bar{x} Call Index	% Plots	% Local
Boreal Chorus Frog	<i>Pseudacris maculata</i>	2.00	100.00	18.75
Woodhouse’s Toad	<i>Anaxyrus woodhousii</i>	1.70	91.67	3.57
Plains Leopard Frog	<i>Lithobates blairi</i>	1.37	83.33	45.71
Cope’s Gray Treefrog	<i>Hyla chrysoscelis</i>	1.25	83.33	0.00
Bullfrog	<i>Lithobates catesbeianus</i>	1.13	58.33	18.75
Plains Spadefoot Toad	<i>Spea bombifrons</i>	0.00	0.00	0.00

Methods:

US Geological Survey. 2012. North American Amphibian Monitoring Program (NAAMP): NAAMP Protocol. Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Weir, L.A., and M.J. Mossman. 2005. North American Amphibian Monitoring Program (NAAMP). Pages 307-313 in M.J. Lannoo, editor, Amphibian declines: the conservation status of United States species. University of California Press, Berkeley, California, USA.

Additional Relevant Source:

McLean, R.P., G.D. Wright, and K. Geluso. 2015. Cope’s Gray Treefrog (*Hyla chrysoscelis*) along the Platte River, Hall County, Nebraska. *Collinsorum* 4(1):2-4.

Sandhill Crane Aerial Surveys (w/ Whooping Crane Notes)

We counted a total of about 1.5 million Sandhill Cranes in the Central Platte River Valley (Chapman to Overton, NE) across 9 weeks of surveys in 2021 (total of bias-corrected mid-point estimates). Relative error estimates per survey ranged from -36.9 to +36.9% comparing ocular to photo counts. Our counts accurately capture cranes on the river as well as those in post-roost aggregations within 3 km of the river (Caven et al. 2020). However, cranes departing the river early and leaving this narrow band were potentially not counted or were counted at a reduced rate. Therefore, our numbers represent a systematic underestimation. The peak count of 573,600±153,400 was observed on 19 March 2021 (Table 8). Peak abundance occurred within a relatively short period in 2021, with point estimates exceeding 220,000 for just two survey weeks in mid-March. We also attempted to count other large-bodied waterbird species as time allowed including dark geese, Trumpeter Swans, Bald Eagles, American White Pelicans, and Whooping Cranes. We counted 56,932 dark geese, 43 Bald Eagles, and 16 Trumpeter Swans across the first three survey weeks. Finally, we documented 872 American White Pelicans during the last four survey weeks from late March to mid-April. We also detected a total of 11 Whooping Cranes during March via aerial surveys (some individual WHCRs may have been counted across multiple surveys).

During Whooping Crane behavioral monitoring in the spring of 2021, we observed 8 unique Whooping Crane groups that were comprised of 20 individuals including 18 adults and 2 juveniles. We collected 815 instantaneous behavioral scan samples totaling 1,966 individual behaviors documented. We obtained nearly 5 hours of video and >300 photographs and observed Whooping Cranes utilizing several different landcover classes including corn field, wet meadow, shallow marsh, soybean field, river, and lowland tallgrass prairie. During the fall of 2021, we observed 22 unique Whooping Crane groups comprised of 128 individuals including 106 adults and 22 juveniles. We collected 1,443 instantaneous behavioral scan samples which totaled 13,716 individual behaviors documented. We obtained >500 photographs and observed Whooping Cranes utilizing several different landcover classes including river, corn field, natural lacustrine, shallow marsh, winter wheat field, open-water palustrine wetland, alfalfa, and wet meadow. In total, across both spring and fall migrations in 2021, we observed 30 unique Whooping Crane groups including 148 individuals of which 24 were juveniles and completed 2,258 scan samples and documented 15,682 behaviors. Use was comparatively high in the Rainwater Basins in the spring but well above average on the Platte River in the fall of 2021.

Methods:

Caven, A.J., E.M. Brinley Buckley, K.C. King, J.D. Wiese, D.M. Baasch, G.D. Wright, M.J. Harner, A.T. Pearse, M. Rabbe, D.M. Varner, B. Krohn, N. Arcilla, K.D. Schroeder, K.F. Dinan. 2019. Temporospatial shifts in Sandhill Crane staging in the Central Platte River Valley in response to climatic variation and habitat change. *Monographs of the Western North American Naturalist* 11(1):33-76.

Caven, A.J., D.M. Varner, J. and J. Drahota. 2020. Sandhill Crane abundance in Nebraska during spring migration: making sense of multiple data points. *Transactions of the Nebraska Academy of Sciences and Affiliated Societies* 40:6-18.

Table 8. Sandhill Crane Counts of the CPRV[‡] by Survey Week 2021

Date	Point Est. ± C.I.
2/15/2021	4,300±1,250*
2/22/2021	4,600±200
3/1/2021	135,800±18,300
3/8/2021	459,700±99,300
3/19/2021	573,600±153,400*
3/28/2021	216,700±58,500
4/6/2021	35,800±5,300
4/12/2021	18,900±1,100*
4/19/2021	1,200†

Notes: *Bias correction not applied due to insufficient photo-subplot data. †Confidence intervals not applied due to insufficient data. ‡Central Platte River Valley, Nebraska.

Soil Macroinvertebrate Collections

We collected soil macroinvertebrates in partnership with A. Kanz and Dr. C. Davis of Oklahoma State University as part of a 3-year study funded by the EPA to examine macroinvertebrates in conjunction with vegetation communities and soil characteristics as indicators of wet meadow function in the CPRV.

Macroinvertebrates were collected from 20 X 20 X 25cm blocks of excavated soil, which were sampled 6 times at each site across a 100m transect. We sampled 34 total sites during the summer of 2021. We detected a total of 593 earthworms (Annelida) of 3 total taxa, with *Diplocardia* spp. (native earthworms) being the most abundant (n = 371) and the exotic-invasive European earthworm *Aporrectodea trapezoides* being the second most abundant (n = 220; Table 9). We detected a total of 1,477 arthropods (Arthropoda) of 27 taxa, with ants (Formicidae) being the most abundant taxa followed by pill bugs (Armadillidiidae). Sample identifications were made primarily by A. Kanz.

Methods:

Davis, C.A., J.E. Austin, and D.A. Buhl. 2006. Factors influencing soil invertebrate communities in riparian grasslands of the Central Platte River floodplain. *Wetlands* 26(2):438-454.

Table 9. Counts of Soil Macroinvertebrates Collected from the CPRV[‡] in 2021

Taxa	Common name	Count
Armadillidiidae	Pill Bug	254
Anobiidae	Wood Borer Beetle	2
<i>Aporrectodea trapezoides</i>	Earthworm, family Lumbricidae	220
Araneidae	Spiders	18
<i>Bimastos</i> spp.	Earthworm, family Lumbricidae	2
Bruchidae	Bean Weevil	3
Cantharidae	Soldier Beetle	4
Carabidae	Ground Beetle	62
Chrysomelidae	Leaf Beetles	10
Cicadidae	True Cicadas	1
Coccinellidae	Lady Bugs	1
Curculionidae	Weevils	41
<i>Diplocardia</i> spp.	Earthworm, family Acanthodrilidae	371
Dolichopodidae	Long-legged Flies	1
Elateridae	Click Beetle	118
Formicidae	Ants	757
Fulgoromorpha	Planthoppers	6
Heteroceridae	Variiegated Mud-loving Beetles	7
Lampyridae	Firefly	1
Lygaeoidea	Seed bugs	1
Meloidae	Blister Beetles	15
<i>Popillia japonica</i>	Japanese beetle	1
Ptiliidae	Feather-winged Beetles	1
<i>Rhipicephalus</i> spp.	Ticks, family Ixodidae	1
Sarcophagidae	Flesh Fly	1
Scarabaeidae	Scarab Beetles	122
Scydmaeninae	Ant-like Stone Beetles	1
Staphylinidae	Rove Beetle	25

Tabanidae	Horse-fly	5
Tipulidae	Crane fly	18
Totals	-	2,070

Notes: ‡Central Platte River Valley, Nebraska.

Conclusion

Continued implementation of our long-term biological monitoring program will help us more critically assess the impacts of our management actions upon Whooping Cranes, Sandhill Cranes, other migratory/breeding bird species, and the ecosystem on which they depend in the Big Bend reach of the Platte River, Nebraska. In 2021 we conducted 140 avian point count surveys across 56 monitoring sites and detected 137,035 individual birds of 156 species. We conducted 1950 trap nights to detect 61 individuals and 8 species of small mammal. We conducted 50 vegetation surveys and collected and pressed 89 vascular plant specimens of 27 species for our herbarium. We conducted 63 butterfly species of concern surveys and detected 222 Monarchs and 214 Regal Fritillaries via systematic surveys and 323 Monarchs and 279 Regal Fritillaries including incidental detections throughout Crane Trust-managed properties. We conducted 144 anuran vocalization surveys and documented 5 species of anurans and their relative abundances at 12 sites. Finally, we conducted 39 fish seine pulls (~18 hours, 900 m of slough/channel) and detected 7,201 individuals of 16 species of fish. We conducted 9 aerial Sandhill Crane surveys and counted about 1.5 million cranes (individuals counted multiple times), with an estimated peak abundance of 573,600±153,400 on 19 March 2021. Finally, we conducted soil macroinvertebrate surveys at 34 sites and collected 2,070 individuals. These data are all integrated into our long-term research and monitoring plan and will be used to develop models to improve management actions. This report represents preliminary findings and thus should be interpreted as such; our intention with this data is to produce peer-reviewed research that addresses issues of conservation concern in the Central Platte River Valley, southcentral Nebraska, and the Great Plains at large. As we publish results from our studies they will be posted on our website and available to the public (<https://cranetrust.org/what-we-do/conservation/research/>). We have also included a list of 2021 publication and scientific report activity in Appendix 1.

We thank the Rainwater Basin Joint Venture, the US Fish and Wildlife Service, and the Nebraska Game and Parks Commission for their continued support of our research program. We thank the Crane Trust science team including B. Krohn, D. Baasch, J. Wiese, J. Malzahn, M. Schaff, A. Medaries, B. Ostrom, A. Kanz, S. Heilman, S. Johnson, and P. Dunbar for going above and beyond the call of duty to support Crane Trust research efforts in southcentral Nebraska. Finally, we thank E.M. Brinley Buckley for providing an editorial review of this report.

[Appendix 1. Publications and Scientific Reports by Crane Trust Staff During the Calendar Year \(2021\)](#)

1. Baasch, D.M., A.J. Caven, and B. Krohn. 2021. Whooping Crane Diurnal Behavior and Natural History during Migration in the Central Great Plains: Interim Report – Fall 2020. Platte River Whooping Crane Maintenance Trust, Wood River, Nebraska, USA, 10 pp.

2. Baasch, D.M., J.F. Dwyer, B. Taddicken, A.J. Caven, A. Hegg, C. Wagner, C. Worley, A. Medaries, P. Dunbar, and N. Mittman. 2021. Avian Species' Response to Powerlines Illuminated by Near-ultraviolet Avian Collision Avoidance Systems: Summary Report. Audubon's Rowe Sanctuary, Gibbon, Nebraska, USA, 18 pp.
3. Brinley Buckley, E.M., A.J. Caven, J.D. Wiese, and M.J. Harner. 2021. Assessing the hydroregime of an archetypal riverine wet meadow in the central Great Plains using time-lapse imagery. *Ecosphere* 12(11):e03829.
4. Brinley Buckley, E.M., B.L. Gottesman, A.J. Caven, M.J. Harner, B.C. Pijanowski. 2021. Assessing ecological and environmental influences on boreal chorus frog (*Pseudacris maculata*) spring calling phenology using multimodal passive monitoring technologies. *Ecological Indicators* 121: 107171.
5. Caven, A.J., K.D. Koupal, D.M. Baasch, E.M. Brinley Buckley, J. Malzahn, M.L. Forsberg, and M. Lundgren. 2021. Whooping Crane (*Grus americana*) family consumes a diversity of aquatic vertebrates during fall migration stopover at the Platte River, Nebraska. *Western North American Naturalist* 81(4):592–607.
6. Caven, A.J., K.G. Leung, D.H. Ranglack, C. Vinton, B. Krohn, J.D. Wiese, and J. Salter. 2021. A Behavioral Index for Assessing Bison Stress Level during Handling and Demographic Predictors of Stress Response. *Journal of Applied Animal Welfare Science* 2021:1-13.
7. Caven, A.J., and J.M. Malzahn. 2021. Bison Genetics Results & Analysis: Bison Genetic Value Index Update for the Crane Trust Bison Herd. Platte River Whooping Crane Maintenance Trust, Wood River, NE, USA, 12 pp.
8. Malzahn, J.M., A.J. Caven, S. Warren, B.L. Ostrom, and D.M. Ferraro. 2021. Habitat associations and activity patterns of herpetofauna in the Central Platte River Valley, Nebraska, with notes on morphometric characteristics. *Transactions of the Nebraska Academy of Sciences* 41:88–105.
9. Schultz, C., and A.J. Caven. 2021. Lined Snake (*Tropidozon lineatum*) Prescribed Fire Mortality. *Transactions of the Nebraska Academy of Sciences* 41:42–45.
10. Thompson, H.L., A.J. Caven, M.A. Hayes, A.E. Lacy. 2021. Natal dispersal of Whooping Cranes in the reintroduced Eastern Migratory Population. *Ecology and Evolution* 00:1-9.
11. Wiese, J.D., A.J. Caven, D.S. Zarlenga, C.L. Topliff, C.L. Kelling, and J. Salter. 2021. Gastrointestinal parasites of a reintroduced semi-wild plains bison (*Bison bison bison*) herd: Examining effects of demographic variation, deworming treatments, and management strategy. *International Journal for Parasitology: Parasites and Wildlife* 14: <https://doi.org/10.1016/j.ijppaw.2021.02.004>