

Community Science Bird Monitoring at BIG BEND RESTORATION AREA

2022 Project Report



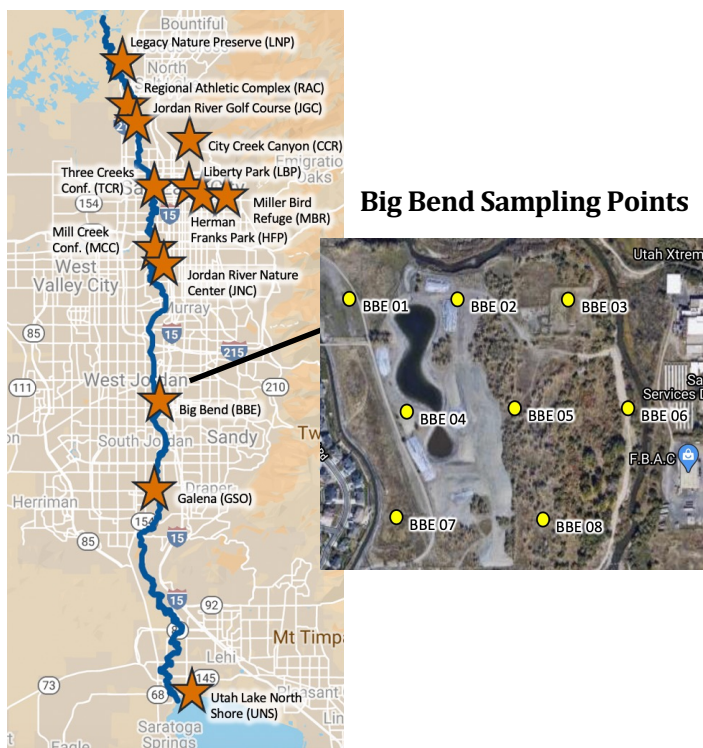
PROJECT OVERVIEW

Big Bend is an 80 acre restoration area situated along the Jordan River in the city of West Jordan. Plans for restoration of the Big Bend site include ambitious habitat alteration which will involve hydrologic restoration of the mile of river through the project area, removal of exotic vegetation, re-vegetation with native trees and shrubs to create 40 acres of floodplain gallery forest, and various amenities for human use and recreation. Several aspects of the planned restoration are currently underway, including the addition of a fishing pond, river bank restoration at the north end of the site, and vegetation work. Since 2013, Tracy Aviary has conducted a community science bird monitoring project in Big Bend Restoration Area. Here, we summarize results from our 2022 field season.

STUDY SITES

We generated eight sampling points across the Big Bend site where we conducted bird and vegetation surveys. These surveys are part of a larger community science bird monitoring program that includes twelve other study sites in the Salt Lake region.

Bird Monitoring Sites



BIRD SURVEY METHODS



Breeding Season Point Count Surveys

During April – July of 2022, 7 community scientists and Tracy Aviary staff conducted 4 breeding season point count surveys at Big Bend. Point count surveys were conducted by pairs of community scientists between dawn and 10am. The ‘observer’ identified all birds seen and heard during six minutes, and noted the number of individuals, distance, and direction. The ‘recorder’ wrote all of the observations on the datasheet, and also noted weather and site variables, such as wind speed and cloud cover.



Non-breeding Season Group Surveys

Information from point count surveys was supplemented by non-breeding group surveys conducted at each site in January, February, March, August, September, October and November, 2022. During non-breeding surveys, groups of volunteers led by a trained Tracy Aviary staff person walked a transect through the site and noted all birds seen and heard in the area.



Owl Playback Surveys

During May, when owls are most likely to be vocalizing, a group of volunteers led by a trained aviary staff person walked the site in the evening listening for owls, stopping periodically to play owl calls and listen for responses.

2022 BIRD MONITORING RESULTS

4 Breeding Season Surveys

- 1,112 bird observations
- 59 species

7 Non-breeding Surveys

- 5,475 bird observations
- 86 species

1 Owl Survey

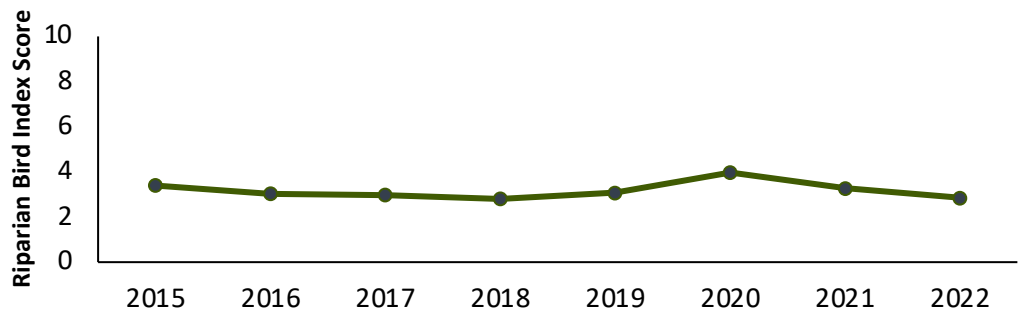
- 0 owl detections
- 0 species

95 total bird species were detected at Big Bend in 2022

Riparian Bird Species Richness Index

We created an index, based on riparian nesting species (Young et al. 2013) to help measure the health and function of riparian bird habitat across the site. For each year of bird monitoring, we sum the number of riparian shrub and tree-nesting species detected at each survey during the breeding season (excluding points in the active recreation zone) and average those values across the number of surveys and sampling points.

Riparian Bird Species Index Score from 2015 - 2022



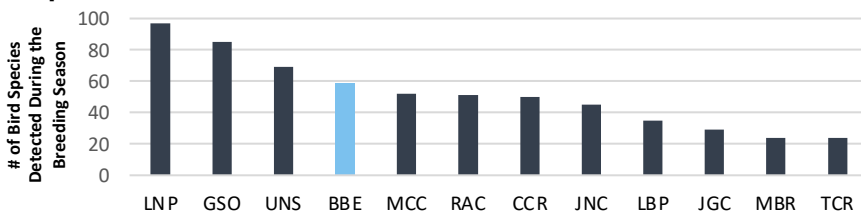
2022 Riparian Bird Species index:

2.85

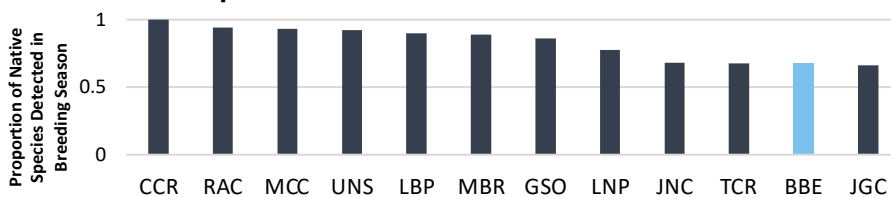
Comparison to Other Sites Along the Jordan River

We can measure the health of an urban riparian site such as Big Bend by looking at several metrics, including species richness (the number of species detected), and the proportion of native and urban-sensitive birds that use the site. When comparing Big Bend (light blue) to other monitoring sites (dark blue), we found mid- high breeding season species richness, average native and urban bird species.

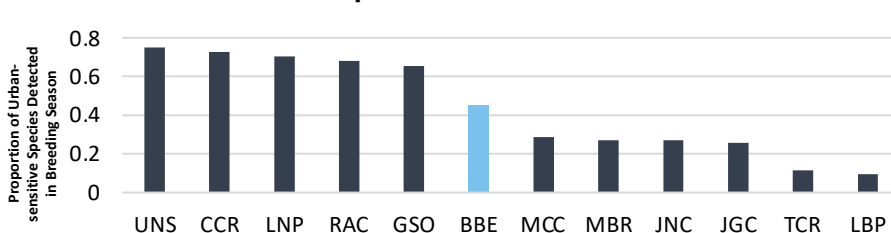
Species Richness



Native Bird Species



Urban-Sensitive Bird Species

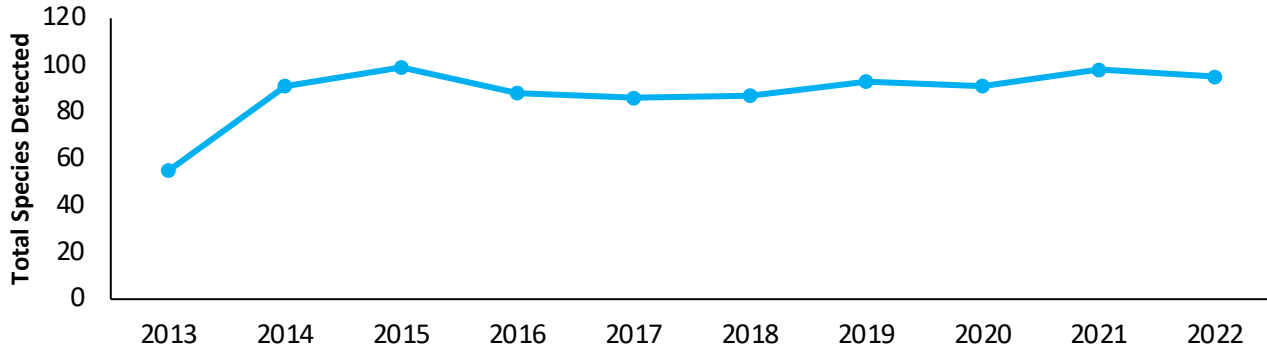


2022 BIRD MONITORING RESULTS

Trends Over Time

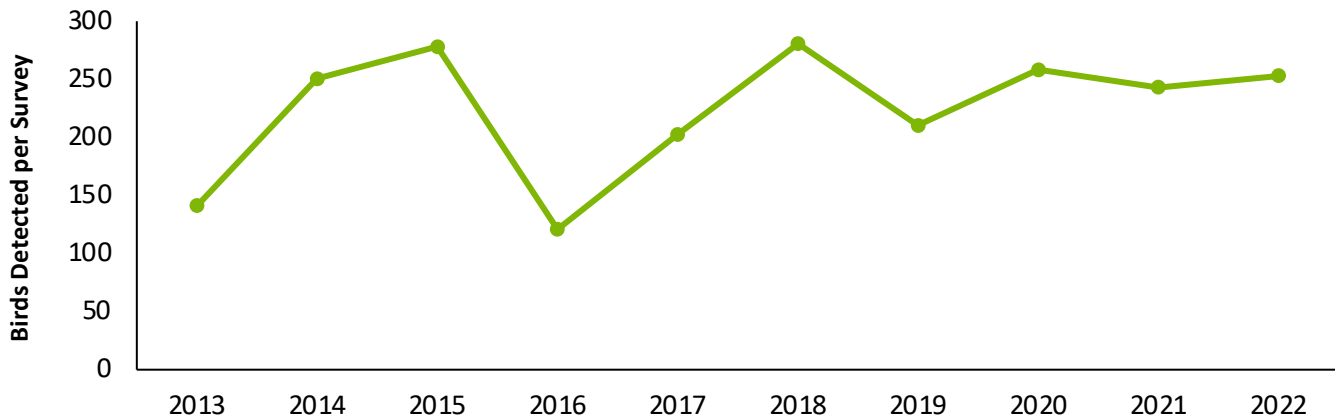
We measured trends in bird habitat use at the site over our bird monitoring period by examining changes in breeding season and non-breeding season species richness (number of bird species detected), and relative abundance (detections per survey).

Species Richness

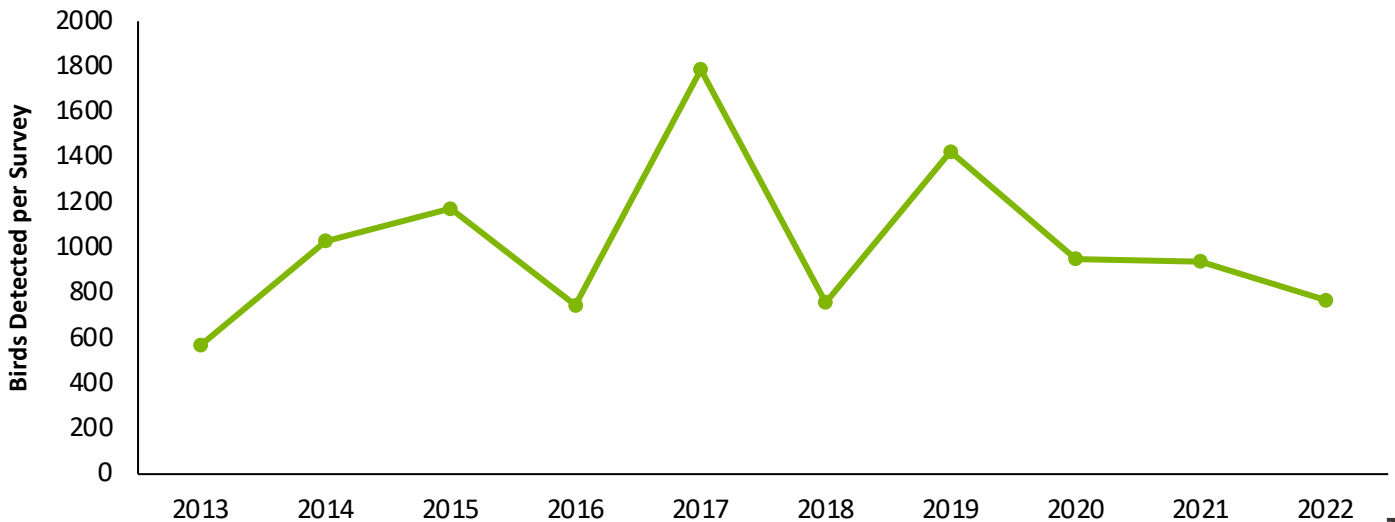


Relative Abundance

Breeding Season (April – July)



Non-breeding Season (August – March)



2022 BIRD MONITORING RESULTS

Bird Habitat Use Patterns Throughout the Jordan River

We use breeding season data to help understand how habitat features and landscape attributes impact where different bird species are found; information that could help with land management and restoration decisions that create, protect, or enhance healthy bird habitat for target species. A multi-season occupancy modeling analysis using bird survey data from 2013-2022 identified the most important factors influencing habitat use by three target riparian-associated and three urban-associated species across our bird monitoring sites. Our analysis examined which habitat attributes (Table 1) influenced the probability that these species would use an area within our sampling sites, or locally colonize or go extinct from an area.

Occupancy Analysis: Species Results

Canopy Cover was found to be an important factor for habitat use by Song Sparrows. They were more likely to occupy and less likely to go locally extinct from areas with higher canopy cover. Bullock's Orioles were more likely to occupy areas with more herbaceous vegetation, and were more likely to locally colonize areas with greater shrub cover. **These results highlight the importance of maintaining and enhancing vertical structure, including canopy trees, shrubs, and herbaceous plants on the ground.**

Distance to River was found to be an important factor for habitat use by all of the target species examined. All species had decreased habitat use as distance from river increased, and Yellow Warblers were also less likely to locally colonize areas further from the river. **This finding highlights the importance of enhancing habitat directly surrounding the river.**

Urban-associated species such as House Finches and House Sparrows were less likely to use habitat with a greater **Buffer Distance** to the developed area, and House Sparrows were more likely to go locally extinct from areas further from development. This finding highlights the importance of providing a large area of protected space that can buffer sites from development, and decrease use by non-target urban-adapted species.

Table 1. Habitat and landscape attributes included in occupancy analysis.

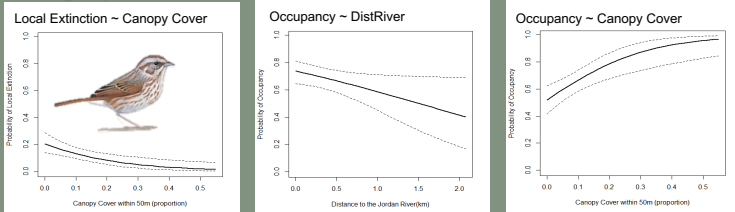
Variable	Measurement (unit)
Canopy Cover	Tree canopy cover within 50m (%)
Canopy Lost*	Decrease in canopy cover from first to last year of monitoring
Shrub Cover	Shrub cover within 50m (%)
Shrub Lost*	Decrease in shrub cover from first to last year of monitoring
Herb Cover	Herbaceous cover within 50m (%)
Water Cover	Cover of water within 50m (%)
Native Canopy	Cover of native canopy trees within 50m
DistRiver	Distance to the river or stream (km)
Riparian125	Riparian or wetland habitat within 125m (%)
Buffer	Buffer distance to nearest developed area (km)

*Variable only included as covariate for local extinction or colonization parameters

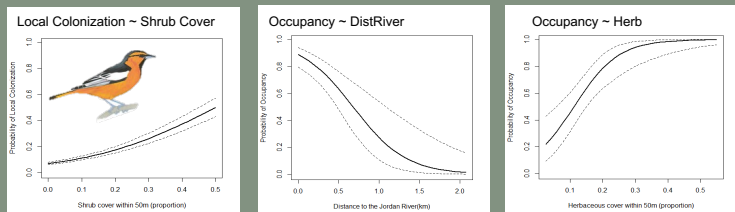
Riparian-Associated Birds

Habitat Relationship Graphs

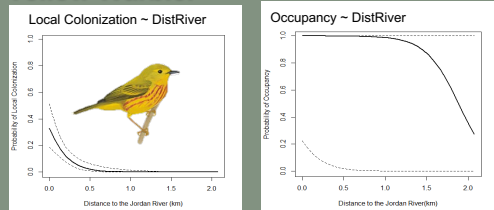
Song Sparrow



Bullock's Oriole



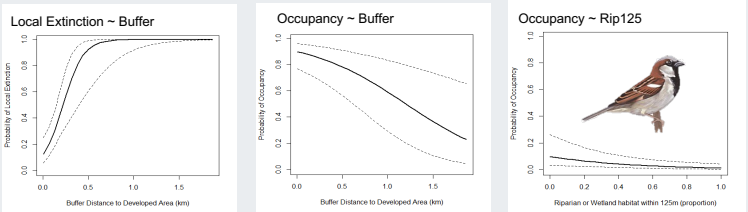
Yellow Warbler



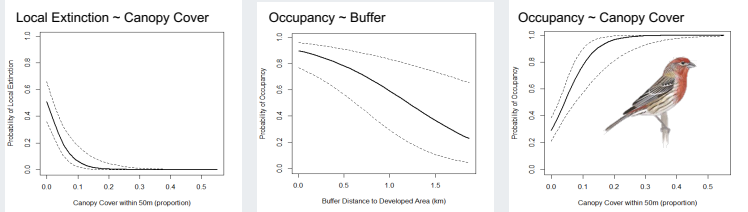
Urban-Associated Birds

Habitat Relationship Graphs

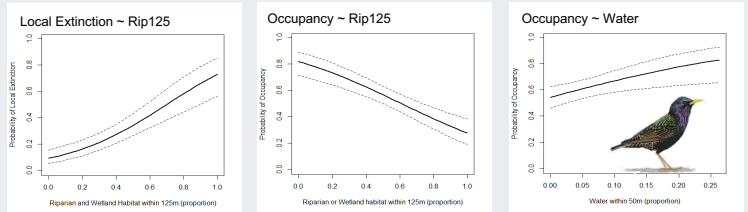
House Sparrow



House Finch



European Starling



RECOMMENDATIONS TO ENHANCE AND PRESERVE BIRD HABITAT

Plant and maintain trees, shrubs, and other native vegetation over a large footprint of the site. This vegetation will enhance the contiguous habitat along the Jordan River corridor and provide a buffer from the surrounding roads and residential development.

Promote vertical structure and canopy cover throughout the site by protecting existing trees/shrubs and/or replacing trees that are removed. This will enhance habitat for riparian-associated birds such as warblers, flycatchers, and orioles.

Keep dogs on leash and discourage use of site by cats. These domestic animals can cause direct mortalities or disturbance to birds.

Maintain standing dead trees to provide habitat for cavity-nesting species. Avoid complete removal if possible; cutting them to a height of 10ft can mitigate safety concerns while still providing cavities.

No tree removal or thinning activities should take place during the breeding and nesting season (April – July). If trees are to be removed, mature trees should be thinned out slowly while they are replaced so vertical structure and fruiting resources are maintained throughout the restoration process.

Improve water quality in the river to support healthy aquatic invertebrate communities.

Add and enhance wetland and ephemeral water elements. On the east side of the property where the river will be able to keep a more natural meandering path, enhancing ephemeral water components and adding wetland vegetation could enhance habitat for species such as Red-winged and Yellow-headed Blackbirds, Virginia Rails and Sora, Marsh Wrens, and Common Yellowthroats.



BIRD MONITORING AT BIG BEND

Complete List of Birds Detected during Breeding Season (BSS) and Non-breeding Season (NBS) Surveys

Species	Number of Observations (detections/survey)																			
	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022	
	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS
American Avocet	0.2	0	0	0	0	0.3	0.2	0	0.3	0	0	0	0	0	4.7	0	0.8	11.7	0	0
American Coot	0	16	0	3.8	0	5.3	0	11.7	0	5.7	0	6.4	0	4.3	0	12.8	0.3	7.5	4.5	4.43
American Crow	0	0	0	0.3	0	0.1	0	0	0.2	1	0.3	1.4	0	3.1	0.1	0.6	0.3	0.5	0.25	9.57
American Dipper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14
American Goldfinch	0	3	1.6	2.3	0.5	7.4	1.3	1.4	1.2	4.2	1	1.3	1.4	1.9	2	3.4	0.8	1	1	1.14
American Kestrel	0.4	1	2	1.5	2	2.6	3.2	2.7	4.2	5.2	5.3	4.3	0.6	3.6	1.9	3.1	0.3	2.3	3.25	3.29
American Pipit	0	0	0	0.3	0	2.4	0	0.4	0	2.3	0	3.1	0	1	0.1	1.3	0	0.5	0	0.14
American Robin	1	73	10.7	41	4.8	60.1	4.5	24.9	4.3	89	5.6	45	8.2	90.6	6.4	34.3	13.2	49.5	8.5	55.7
American Tree Sparrow	0	0	0	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
American White Pelican	1.4	0	2.6	0	6	0.5	1.3	0	1.2	0	1.9	0	0.4	0	0.4	0	0	0	0.25	0.57
American Wigeon	0	0	0	0	0	0	0	0	0	0	0	5.6	0	3.1	0	1.8	0.2	1.5	0.25	3.86
Ash-throated Flycatcher	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0
Bald Eagle	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0	0
Bank Swallow	6	0	2.6	0	7	0.1	2.8	0.9	1	0	1.9	0.3	13.4	2.6	18.1	2.8	1.5	3.3	0.5	5.71
Barn Swallow	2.8	0	4.3	3.3	1.3	11.9	2.3	3.3	4.5	5.5	6.7	23.9	3.6	14.9	4	5.4	8.8	10	3.25	4.29
Belted Kingfisher	0.2	1	1	0.6	0.8	1.5	0.7	0.9	0.8	1.8	1.7	1.4	0.8	0.9	0.4	0.9	0.2	0.7	1	1.43
Black-billed Magpie	28.6	31	49.9	23	57.3	37.3	20	30.3	37.3	39	27.1	26.4	25.8	22.4	25.7	29.4	24	22.5	21.75	19.6
Black-capped Chickadee	1.4	1	1.4	2.9	1.5	4.4	1.5	1.7	1.7	1.8	0.6	2.3	1.4	2.3	2.3	3.8	2.2	2	0.25	2.86
Black-chinned Hummingbird	1.2	0	0.8	0.4	2.5	0.4	1.5	0.9	1.8	1.2	1	0.9	1.6	1.8	3.7	2.6	3.2	2.3	1.25	1.71
Black-crowned Night Heron	0	0	0	0.1	0	0	0	0.1	0	0	0	0	0	0	0	0	0.2	0	0	0
Black-headed Grosbeak	0.4	0	0.1	0	0.3	0	0.3	0	0.2	0	0.4	0	0.8	0	0.7	0	1.3	0	1	0
Blue Grosbeak	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue-gray Gnatcatcher	0	0	0.2	0.5	1	0.6	0.2	1.3	0.5	1.3	0.1	0.7	0.2	1	1.1	0.3	0	0.5	0.5	0.57
Blue-winged Teal	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brewer's Sparrow	0	0	0	0	0	0	0	0	0	0.2	0	0.3	0	0	0	0	0	0.2	0	0
Brewer's Blackbird	0	0	6.8	10.8	0.3	25.1	0	2.9	0	11	0	2.1	0.6	3.4	0.1	0.8	0.3	1.5	0	0
Broad-tailed Hummingbird	0.2	0	0.2	0	0	0.1	0	0.9	0.2	0	0	0	0	0	0.3	0	0	0	0	0
Brown Creeper	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Thrasher	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown-headed Cowbird	2	0	1.8	0	4.8	0	3.5	0	2.5	0	4.4	0	2.2	1.3	1.9	0.3	2.8	0	1.25	0.29
Bufflehead	0	1	0	0	0	0.5	0	1	0	0.2	0	0	0	0.5	0	0.3	0	1.5	0	0.43
Bullock's Oriole	4.6	0	5.8	0	5	0.4	7.2	0	6.3	0.2	6.6	0.4	7.6	0.3	8.3	0	6.3	0.3	7.5	0.14
Cackling Goose	0	0	0	0	0	0.3	0	0.3	0	0	0	0	0	0.1	0	0	0	0	0	0.14
California Gull	1.2	2	3.9	1.4	1.8	0.5	1	2	0.5	0.8	5.6	0.6	0.4	0.1	1.1	1.1	3.5	0.7	0.25	0.57
California Quail	3.6	5	12	25	9.5	10.8	4.2	9.6	3.3	23.5	2.4	5.6	3.2	11.5	2.7	2	4.8	10.5	3.25	6.43
Canada Goose	7.2	104	10.4	61.4	7.3	97.1	1.3	100	2	69.8	7.9	78.3	6.4	76	31.1	114	17.8	56.2	17.5	87.1
Canvasback	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.29
Caspian Tern	0	0	0.8	0	1	0	0.7	0.3	1.3	0	0	0.3	0.4	0	1	0	0.8	0.3	0.25	0.29
Cedar Waxwing	0	28	0.1	6.5	18.3	3.6	0	2.1	0	3.2	0	0.1	0.2	0.4	0.1	0	0	1.5	0.25	12.4
Chipping Sparrow	0	0	0	0	0	0.8	0	0	0	0.5	0	0.1	0	0	0	0.1	0	0.7	0	0.14

BIRD MONITORING AT BIG BEND

Complete List of Birds Detected during Breeding Season (BSS) and Non-breeding Season (NBS) Surveys

Species	Number of Observations (detections/survey)																			
	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022	
	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS
Cinnamon Teal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	1.5	0.25	0
Cliff Swallow	0.4	0	6.2	0	0	0	0.3	0	2.5	0	1.1	0.1	1.4	0.1	8.1	0	9.5	0	1.5	0
Common Goldeneye	0	3	0	0.1	0	1.8	0	1.3	0	1.3	0	1.6	0	3.9	0	3.9	0	2.8	0	2.57
Common Grackle	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Merganser	0	0	0	0	0	0	0	5.4	0	1	0	0	0	2.5	0	0	0	0	0.25	0.14
Common Nighthawk	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.29
Common Raven	0	0	0.1	0.6	0	0.8	0	0.6	0	0.7	0	1	0	0.1	0	0.5	0	0	0	0
Common Yellowthroat	0.2	0	0.1	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0
Cooper's Hawk	0	0	0	0.5	0	0.4	0.2	0.3	0	0.3	0	0.9	0	0.3	0	0.8	0	0.3	0.25	1
Coturnix Quail	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0.8	0	0
Dark-eyed Junco	0	2	0	2.8	0.3	3.1	0	3	0	8.5	0	2.9	0	4.9	0	4.1	0	0	0	1.86
Double-crested Cormorant	0.8	0	5.9	0.5	5.3	0.6	2.3	1.7	2.3	0.7	8	3.3	2.2	0.1	1.7	2.5	3.2	0.5	4.25	4.71
Downy Woodpecker	0	0	0.2	0.8	0	0.4	0.5	0	0	0.3	0	0.7	0.4	0.9	0.1	0.6	0.8	0.2	0	0.29
Dusky Flycatcher	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eared Grebe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.1	0	0.2	0	0.14
Eurasian Collared-dove	0	0	0.6	1.8	1.3	16.4	1	5.4	1.3	20.3	6	45	5.4	27.4	4.4	50.8	5.8	52.2	8.25	45.3
European Starling	21.4	204	13.3	466.4	13	295.5	6	141.1	51	1118	71	213.7	44.8	863.1	23.3	337.4	6.2	418.3	65.25	94.3
Evening Grosbeak	0	0	0	15.6	0	28.1	0	0	0	3.3	0	4.4	0	0.1	0.1	3.3	0	0.8	0	0
Forster's Tern	0	0	0.4	0	0.5	0	0	0	0	0	0	0	0.2	0	0.1	0	0	0	0	0
Fox Sparrow	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
Franklin's Gull	1.2	0	1.1	0	12.5	0	0.2	1.6	10.8	0.2	0.3	0	0.2	0	0.1	0	8.3	27.5	1	0
Gadwall	0	4	0	0.3	0	0.4	0	2.6	0	0.8	0	3.6	0	0.88	0	4.1	0	2.2	3.5	4.86
Great Blue Heron	0.8	1	0.3	0.3	0.3	0.9	0.3	1.3	0	1.3	0.1	0.9	0.2	0.8	0.9	0.9	0.7	1.7	0.5	0.71
Great Egret	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0
Great Horned Owl	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
Great-tailed Grackle	0	0	0	0	0	0	0	0	0	0	0	0.6	0.6	0.1	0	0	0	0	0.75	0.14
Greater Yellowlegs	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.2	0	0
Green-winged Teal	0	3	0	1	0	0.8	0	3.7	0	4.7	0	5.4	0	0.6	0	2.5	0.2	1.7	0.25	2.14
Hammond's Flycatcher	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris' Sparrow	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Hermit Thrush	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0.2	0	0
Herring Gull	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14
Horned Lark	0	0	0	0.4	0	1.1	0	0	0	0	0	0.3	0	0.3	0	0	0	0.2	0	0.14
House Finch	7.6	8	4.2	36.9	2.5	27.1	2	6.4	2	15.3	2.3	19.6	7.6	20.6	5.6	28.9	7.8	32.5	6	29.9
House Sparrow	1	10	1	3.5	2.8	1.9	1	1.6	0	1.3	0.3	0.4	0	3.9	1.4	5.3	1	8.3	0.5	3
Killdeer	0.2	0	0.8	0	2.3	1.4	1.8	1.4	2	2.7	3.9	1.3	1	7.8	10.1	1.5	10.5	2.5	8	4.71
Lapland Longspur	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Lark Sparrow	0	0	0	0	0	0.6	0	0.1	0	0	0	0	0	0	0	0	0.2	0.3	0	0.14
Lazuli Bunting	0	0	0	0	1.5	0.4	1.3	0.1	0	1.2	0	0.1	0	0.5	0	0.3	0	2	0	0.71
Lesser Goldfinch	2.8	0	1.7	1.8	1.3	2.8	2	3.3	3.7	2.7	1.3	1.3	1	9.6	1.7	8.1	1.5	4.2	0.5	2.57

BIRD MONITORING AT BIG BEND

Complete List of Birds Detected during Breeding Season (BSS) and Non-breeding Season (NBS) Surveys

Species	Number of Observations (detections/survey)																			
	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022	
	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS
Lesser Scaup	0	1	0	0	0	0	0	0.3	0	0	0	0	0	0.1	0.1	0	0	1.8	0	0.29
Lincoln's Sparrow	0	0	0	0.3	0	0.1	0	0.3	0	0.2	0.3	0	0	0.1	0	0.1	0	0	0	0
Long-billed Curlew	0	0	0	0	0	0	0	0	0	0.7	0	0	0.2	0	0	0	0	0	0	0
Long-billed Dowitcher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
MacGillivray's Warbler	0	0	0	0.1	0.5	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0.3	0	0.14
Mallard	2.6	11	6.7	43.9	15.5	75.4	4.5	65.8	3.8	52.3	5	69.5	4.4	48.4	23.4	49	17.8	53.2	10	52.6
Marsh Wren	0	0	0	0.1	0	0.6	0	0.1	0	0.7	0	0.3	0	0	0	0.3	0	0.2	0	0.29
Merlin	0	0	0	0.3	0	0	0	0	0	0	0	0.1	0	0.1	0	0.3	0	0	0	0.14
Mountain Bluebird	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Mourning Dove	15.4	21	20.4	38	4.8	35.3	4	24.4	5.8	30.3	9.3	19.9	6	19.3	5.6	31.1	4.7	16.7	7.25	21.7
Nashville Warbler	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.2	0	0
Northern Flicker	0	8	0.1	4	0	5.9	0.2	6.4	0.2	7	0.4	5.7	0.2	4.5	0.1	4.6	0.7	7	0.5	4.71
Northern Harrier	0	0	0	0.3	0	0.6	0	1	0	0.2	0	0	0	0.3	0	0.1	0	0	0	0
Northern Mockingbird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0
Northern Pintail	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0	0	0	0	0	0
N. Rough-winged Swallow	9.2	0	9.1	0	11.5	0.5	7.2	1.4	9.8	2.2	16.1	0.7	9.6	2.1	6.1	0.6	5.2	0	0.75	1.43
Northern Shoveler	0	0	0	0.3	0	0.1	0	4.1	0	0	0	0	0	0	0	0.4	0	0	0	0
Olive-sided Flycatcher	0	0	0	0	0.3	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.14
Orange-crowned Warbler	0	0	0.1	1.3	0	0.5	0	1	0	0.7	0	0.4	0	1.5	0	0.1	0.2	1.2	0	1.29
Osprey	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0.3	0.75	0
Peregrine Falcon	0.2	0	0	0.1	0	0.1	0	0.1	0	0	0	0.1	0	0	0	0.1	0	0.2	0	0.29
Pied-billed Grebe	0	0	0	0	0	3.1	0	0.4	0	0.3	0	0.6	0	0.3	0	0.3	0	0.5	0	0.86
Pine Siskin	0	0	0	0.5	0	0.4	0	0	0	0	0.3	0	0	0.3	0	0	0	0	0	0
Pinyon Jay	0	0	0	0.1	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0
Plumbeous Vireo	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Prairie Falcon	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0	0.1	0	0	0	0	0	0.43
Red-tailed Hawk	1.6	1	1.2	0.9	1.5	1.5	1.5	1.3	2	2.7	1	1.6	1.6	1.1	0.9	1.1	0.7	1.5	0.5	1.71
Red-winged Blackbird	3.6	13	11.6	146.1	6.8	309.4	6.7	176.3	7.7	55	5.6	53	9.8	74	9	125.5	16	21.7	21.5	194.3
Redhead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0.2	1	0	1.43
Ring-billed Gull	0	1	0	0.8	0	3.8	0	0.6	0	1.5	0	0.3	0	2.4	0	0.6	0.2	3.3	0	1.57
Ring-necked Duck	0	0	0	0.3	0	0	0	2.6	0	0.2	0	4.3	0	0	0	1.3	0.3	5.5	1.25	2
Ring-necked Pheasant	0.2	2	2.7	0.4	4.8	0.3	3.8	0.1	1.5	0.2	2.4	0	1.8	0.4	1.6	0.4	0.5	0.2	0.5	0
Rock Pigeon	0.4	0	2.9	43.5	31.5	33.9	2	32.9	6.8	141	11.1	43.3	2	18.8	5.4	15	4	21.7	4	13.4
Ruby-crowned Kinglet	0	0	0.2	0.9	0	1.3	0	1	0	0.8	0.3	0.9	0.4	0.1	0	0.8	0	0.3	0	0.71
Rufous Hummingbird	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0.1	0	0	0.3	0	0.14
Sandhill Crane	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14
Savannah Sparrow	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0.1	0	0	0	0.5	0	0
Say's Phoebe	0	0	0	0	0.3	0.1	0.3	0.1	0.3	0	0.7	0.3	0.6	0.5	0.1	0.1	0.3	0.2	0.75	0
Sharp-shinned Hawk	0	1	0	0.3	0	0.1	0	0.1	0	0.5	0	0.1	0	0.6	0	0.1	0.2	0	0	0.14
Snowy Egret	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0

BIRD MONITORING AT BIG BEND

Complete List of Birds Detected during Breeding Season (BSS) and Non-breeding Season (NBS) Surveys

Species	Number of Observations (detections/survey)																			
	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022	
	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS	BSS	NBS
Song Sparrow	5.2	3	5.6	4.1	10	6.9	4.5	4.9	4.8	7.3	5.4	5.3	3.4	5.4	5.4	4.1	3.5	5.5	4.5	4
Spotted Sandpiper	0	0	0.4	0.1	0	0.4	0.8	0.4	0.2	0.3	0.4	0.1	0.6	0.4	1.1	0.3	0.8	0.8	0.25	0.14
Spotted Towhee	0.2	2	0.4	1.5	0	1.9	0	0.6	0	2.5	0	3.1	0	1.8	0	2.5	0	1.8	0	3.29
Swainson's Hawk	0	0	0.1	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.43
Townsend's Warbler	0	0	0	0.1	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Tree Swallow	0	0	0.3	0	1	0	0	0	0	0.2	0	2.9	0	0	0.1	0.1	0	0	0	0
Turkey Vulture	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.2	0.75	0.14
Varied Thrush	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0
Vesper Sparrow	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.2	0	0.14
Violet-green Swallow	0	0	0.3	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	3.3	0	0
Virginia's Warbler	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warbling Vireo	0	0	0	0	0	0	0	0	0.5	0	0	0.1	0.6	0.4	0	0	0	0.2	0	0
Western Kingbird	3.2	0	4.3	0	3.8	1.1	5.3	0.6	4	0.8	4.3	0.4	6.8	2.3	6.3	1	3.3	0.3	6	0.57
Western Meadowlark	0	0	1.4	0	1.5	0.1	1.8	0	0.2	0	0.3	0	0.8	0	0	0.1	0	0.2	0.5	0
Western Tanager	0	0	0.6	0.4	1	0	0.3	0	1.2	0.3	0.6	0.4	0.2	0.1	1	0	0.2	0	0	0.14
Western Wood-pewee	0	0	0	0	0	0	0	0	0	0	0.1	0	0.6	0.1	0	0	0	0.2	0	0
White-crowned Sparrow	0	3	0	12.3	0	16.9	0	14.4	0.2	11.3	0.3	9.7	0.2	19.4	0.4	23.6	1.7	25.3	1	16.4
White-faced Ibis	0.2	0	25.7	0	3.5	0	0.3	1.4	0	3.3	41.1	1.4	9.2	8.3	14.4	0	31.7	0	12.25	7.14
Willow Flycatcher	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilson's Snipe	0	0	0	0	0	0.1	0	0	0	0.2	0.1	0	0	0	0	0	0	0	0	0.57
Wilson's Warbler	0	0	0	0.1	0	0	0	0	0	0	0.1	0.4	0	0.8	0	0	0	0.2	0	0.29
Wood Duck	0	0	0	0	0	0.1	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0
Woodhouse's Scrub-jay	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Warbler	0	0	0.1	0.1	0.8	0.5	0.2	0.9	0.2	0.3	0.3	0.6	0.2	1.1	0.1	1.3	0.2	3	0.5	1.43
Yellow-headed Blackbird	0.2	0	0.6	0.6	1	4.1	0.2	8.1	0.7	2.3	0.3	0	5.8	0	0.3	0	1	0.3	0.25	0
Yellow-rumped Warbler	0	0	0.7	9.1	0	6.8	0.3	10.9	1.2	8.3	0	14	0.4	13.1	0.1	7.4	0	9	0.5	10.3



Acknowledgements: We'd like to thank the extremely dedicated team of volunteers from Tracy Aviary's Community Science Program who braved early mornings and long hours to collect these data. Thanks also to the Big Bend project partners.