2019 Breeding Bird Surveys on the Idaho National Laboratory Site

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Executive Summary

To monitor bird populations on the Idaho National Laboratory (INL) Site, protocol Breeding Bird Surveys (BBSs) have been conducted annually almost every year since 1985. In 2019, we conducted surveys in June and early July along five routes that are part of a nationwide survey administered by the U.S. Geological Survey (USGS) and eight additional routes near INL Site facilities. We documented 3,425 birds from 53 species during those surveys.

We observed similar bird abundance patterns for those species that are typically the most numerous including western meadowlark (*Sturnella neglecta*, *n*= 806), horned lark (*Eremophila alpestris*, *n*= 633), sage thrasher (*Oreoscoptes montanus*, *n*= 442), Brewer's sparrow (*Spizella breweri*, *n*= 237), and sagebrush sparrow (*Artemisiospiza nevadensis*, *n*= 218). These five species have been the five most abundant 26 times during the past 33 years of surveys, and in the other years they were among the seven most abundant species.

Species observed during the 2019 BBS that are considered by the Idaho Department of Fish and Game as Species of Greatest Conservation Need included the sage thrasher, sagebrush sparrow, Franklin's gull (*Leucophaeus pipixcan, n*= 507), common nighthawk (*Chordeiles minor, n*= 29), ferruginous hawk (*Buteo regalis*, *n*= 15), greater sage-grouse (*Centrocercus urophasianus*, *n*= 5), grasshopper sparrow (*Ammodramus savannarum*, *n*= 4), long-billed curlew (*Numenius americanus*, *n*= 7), and burrowing owl (*Athene cunicularia*, *n*= 1).

The Tractor Flats Route had the highest bird abundance of any route. Tractor Flats Route had the highest species richness of the remote routes. The CFA Route and Tractor Flats Route had highest species richness of all routes. The TAN Route has had the highest abundance of the facility routes and CFA had the highest species richness at a facility route.

Sagebrush obligates such as the Brewer's and sagebrush sparrow continue to be observed at near-historical lows, likely as a result of large wildfires. Observations of sagebrush obligates fell dramatically since 2011 but seem to be starting to stabilize. In addition, raven (*Corvus corax*) observations continue at high levels.

The most abundant species assemblage in 2019 was the shrub-steppe/grassland, representing 47% of all BBS observations. This assemblage normally has the highest abundance because the majority of the INL Site consists of shrub-steppe and grassland habitats. The second most abundant species assemblage was the sagebrush obligate category representing 26.3% of all observations.

The CFA Route had the most diverse bird community of all 13 routes. Among remote routes, Kyle Canyon had the most diverse bird community, while Circular Butte was the least diverse based on richness. Tractor Flat was the least diverse based on Shannon's *H*.

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Acronyms

ATRC	Advanced Test Reactor Complex
BBS	Breeding Bird Survey
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MFC	Materials and Fuels Complex
NRF	Naval Reactor Facility
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Complex
TAN	Test Area North
USGS	United States Geological Survey

1.0 Introduction

The North American Breeding Bird Survey (BBS) was developed by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service to document trends in bird populations. Pilot surveys began in 1965 and immediately expanded to cover the U.S. east of the Mississippi and Canada, and by 1968 included all of North America (Sauer and Link 2011). The BBS program in North America is managed by the U.S. Geological Survey (USGS) and currently consists of over 5,100 routes, with approximately 2,500 of these being sampled each year (Sauer and Link 2011).

Breeding bird survey data provide long-term species abundance and distribution trends for > 420 species of birds across a broad-geographic scale (Sauer and Link 2011). These data have been used to estimate population changes for hundreds of bird species, and they are the primary source for regional conservation programs and modeling efforts for birds (Sauer and Link 2011). The BBS provides a wealth of information about population trends of birds in North America and is the foundation for broad conservation assessments extending beyond local jurisdictional boundaries (Sauer and Link 2011).

Five official USGS BBS routes (i.e. remote routes) are on the Idaho National Laboratory (INL) Site and have been surveyed nearly each year since 1985 (except 1992 and 1993). In 1985, the U.S. Department of Energy, Idaho Operations Office (DOE-ID) also established eight additional routes around INL Site facilities to monitor birds near the highest human activity centers (i.e. facility routes) (Figure 1). These routes are also surveyed annually using the same techniques and methods as those indicated by USGS. BBS data can benefit INL Site managers directly by providing information on local breeding bird populations, which may be useful as they consider new activities and comply with the National Environmental Protection Act. This report summarizes results from the 2019 BBS and examines long-term trends.

1.1 Study Area

The INL Site encompasses almost 900 mi^2 (2,330 km^2) on the Upper Snake River Plain in southeast Idaho (Figure 1) and is administered by the U. S. Department of Energy. The INL Site was designated a National Environmental Research Park in 1975 to facilitate research assessing environmental impacts from the development of nuclear energy technologies. This area is located within portions of Bingham, Bonneville, Butte, Clark, and Jefferson counties. The INL Site has been designated as an Important Bird Area by the Idaho Comprehensive Wildlife Conservation Strategy (Idaho Department of Fish and Game 2005). This designation recognizes wildlife species that are listed by either state or federal agencies and provides a comprehensive listing of the Idaho species of greatest conservation need (Idaho Department of Fish and Game 2017). The INL Site has also been recognized as a Global Important Bird Area by the National Audubon Society (2013).

Topography across the INL Site is mostly flat with an average elevation of 4,985 ft (1,519 m). Other than minor topographic variation created by basalt outcrops, the only significant geographical relief occurs around East and Middle buttes and the southern portion of the Lemhi Mountains located near the northwest corner of the INL Site.

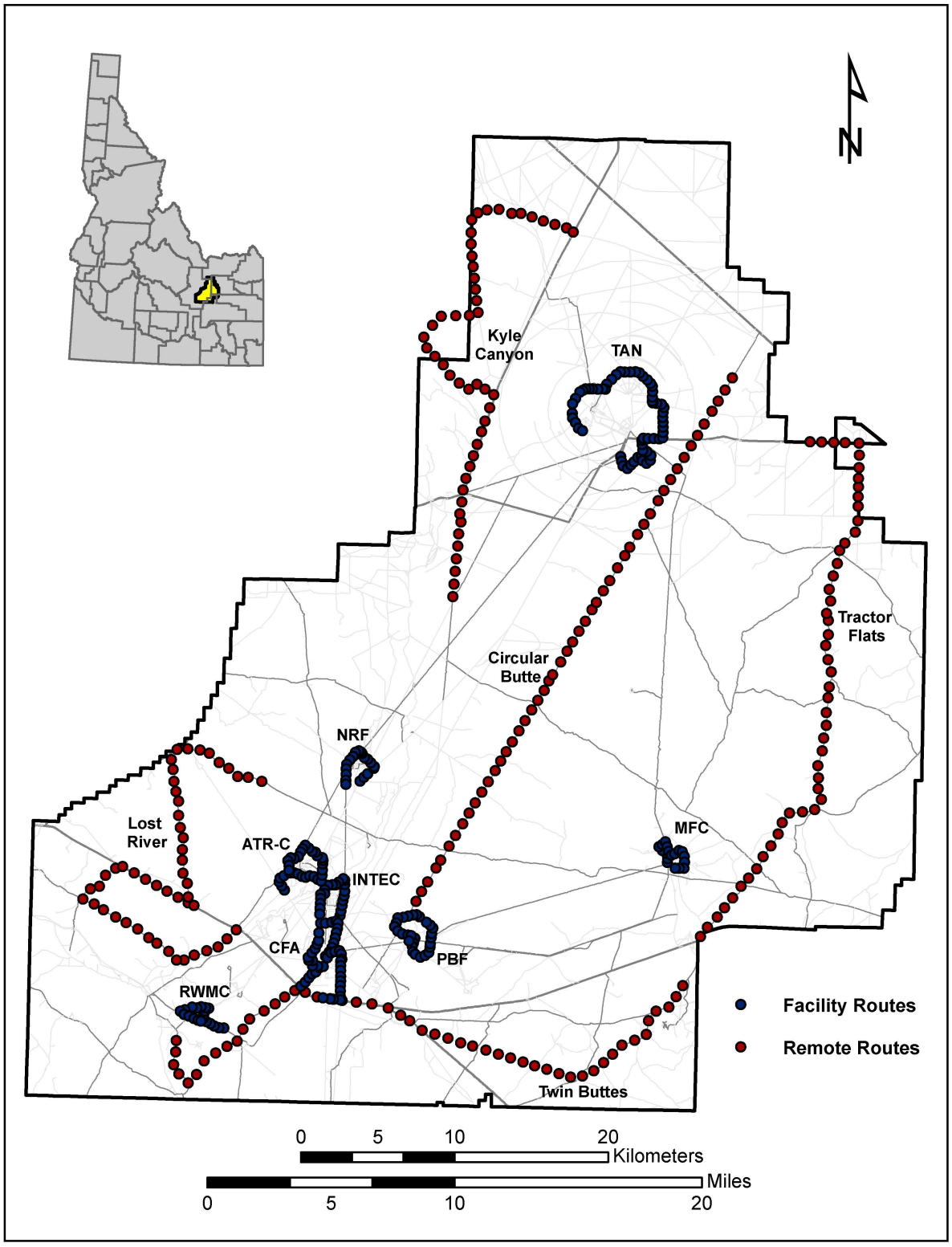

Figure 1. Breeding Bird Survey routes on the Idaho National Laboratory Site. Blue dots represent survey points along facility routes and red dots represent the same for remote routes.

The INL Site has a semi-arid climate, characterized by hot, dry summers and cold winters. Annual precipitation on the INL Site averages 8 in (20 cm), with peak precipitation commonly occurring in spring. The geology is dominated by Quaternary basalt lava flows, including many outcrops and lava tubes. Aeolian soils consisting primarily of silt loam and sandy loam are the most common soil type on the INL Site, while alluvial soils more commonly occur along the floodplain of the Big Lost River. The INL Site is a shrub-steppe ecosystem dominated by a woody shrub over-story and perennial bunchgrass and forb understory. Big sagebrush (*Artemisia tridentata* ssp.) is the most dominant shrub community on the INL Site, while other common species include: green rabbitbrush (*Chrysothamnus viscidiflorus*), spiny hopsage (*Grayia spinosa*), shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), and other sagebrush species (*A.* spp.). The most common native grasses are streambank wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*E. elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread grass (*Hesperostipa comata*). More information regarding the climate, geology, and vegetation communities on the INL Site is described in Shive et al. (2019).

Surface water on the INL is limited, especially during the summer months. The Big Lost River and Birch Creek are both diverted upstream for agricultural purposes and consequently little, if any, water from these streams reaches the INL Site. During years of high flow, however, water from the Big Lost River can reach the INL Site where it is diverted into the spreading areas on the south portion of the INL Site or drains into an ephemeral playa known as the Big Lost River Sinks on the North portion of the INL Site. The Sinks and the spreading areas provide the only substantial water source for waterfowl and shorebirds on the INL Site, although a number of man-made waste treatment ponds near facilities also provide habitat for aquatic birds as well as a water source for migratory birds.

1.2 Methods

Data Collection

The BBS is a roadside count of all birds seen or heard along predefined routes. Thirteen BBS routes were surveyed from May 30 to July 1, 2019, consisting of five official USGS BBS routes and eight facility routes developed specifically for the INL Site (Figure 1). Each remote survey route is 24.5 mi (39.2 km), consisting of 50 sampling points systematically spaced every 0.5 mi (0.8 km). Facility routes vary in length between 3.6 mi (5.8 km) and 11.9 mi (19.2 km), depending on the size of the facility. Sampling points along facility routes are separated by approximately 0.2 mi (0.32 km).

During surveys, observers followed the North American BBS protocols provided by the USGS Patuxent Wildlife Research Center (Sauer and Link 2011). At each sampling location (i.e., stop), a trained observer recorded every bird species observed within a quarter-mile radius or heard at any distance during a 3-minute interval. Any bird that was suspected of being counted on the previous stop was not recorded again (Sauer and Link 2011). Additional data such as temperature, wind speed, and sky condition were recorded after every five stops along remote routes, and at the beginning and end of each facility route. Surveys were only conducted when weather conditions were appropriate (e.g., no heavy rain or strong wind). Surveys began one-half hour before sunrise and continued for up to 6 hours or until the route was completed. The number of vehicles that passed observers during the 3-minute sampling period was recorded on

all remote routes, and observers noted whether background noise interfered with audible detection of birds.

Shannon's H and E_H were calculated for all BBS routes to show the species diversity, and measure of evenness (the relative frequency of each species or how evenly they are distributed across the landscape) and compared with standard species richness (number of species) information documented in past reports. We assumed that data obtained from each survey route was an accurate representation of the local bird community.

1.3 Results and Discussion

Summary Statistics

We documented 3,425 birds and 53 species during the 2019 surveys (Appendix A). Total observations were 24% lower than the 32-year mean of 4,649 birds (1985-1991 and 1994-2018; Figure 2), and we recorded fewer species (mean=56 species).

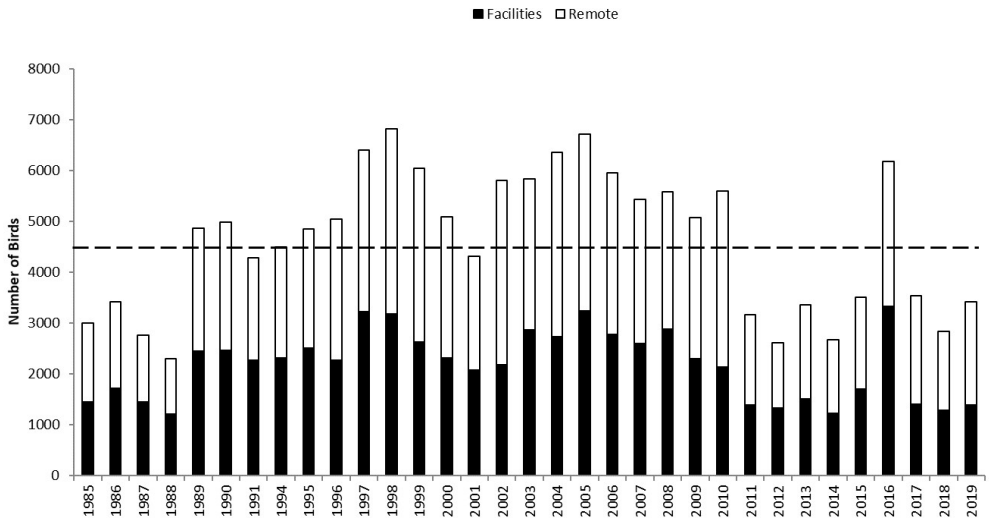

Figure 2. Number of birds observed during Breeding Bird Surveys on the Idaho National Laboratory Site. The dashed black line indicates the mean number of birds observed from 1985 to 2018. No BBSs were conducted on the INL Site in 1992 or 1993.

The six most abundant birds across all routes were: western meadowlark (*Sturnella neglecta*, *n*= 806), horned lark (*Eremophila alpestris*, *n*= 633), Franklin's gull (*Leucophaeus pipixcan, n*= 507), sage thrasher (*Oreoscoptes montanus*, *n*= 442), Brewer's sparrow (*Spizella breweri*, *n*= 237), and sagebrush sparrow (*Artemisiospiza nevadensis*, *n*= 218) (Table 1). These six species comprised >83% of all observations, and each, with the exception of Franklin's gull, was observed on every remote route (Appendix A). Horned lark, western meadowlark, sage thrasher, sagebrush sparrow, and Brewer's sparrow have been the five most abundant species in 26 of the 33 years of INL Site BBS (in the other years they were among the seven most abundant species).

Table 1. Summary of species from 13 routes, sorted by abundance, that were observed during the 2019 Breeding Bird Survey on the Idaho National Laboratory Site.

Common Name	Scientific Name	*n*	%	Routes[1]	Stops[2]	%[3]
Western Meadowlark	*Sturnella neglecta*	806	23.53	5,8	329	66.46
Horned Lark	*Eremophila alpestris*	633	18.48	5,8	262	52.93
Franklin's Gull*	*Leucophaeus pipixcan*	507	14.80	1,1	4	0.81
Sage Thrasher*	*Oreoscoptes montanus*	442	12.91	5,8	266	53.74
Brewer's Sparrow	*Spizella breweri*	237	6.92	5,8	151	30.51
Sagebrush Sparrow*	*Artemisiospiza nevadensis*	218	6.36	5,8	130	26.26
Common Raven	*Corvus corax*	107	3.12	5,7	74	14.95
Barn Swallow	*Hirundo rustica*	66	1.93	1,8	27	5.45
European Starling	*Sturnus vulgaris*	56	1.64	2,4	56	11.31
Mourning Dove	*Zenaida macroura*	33	0.96	5,5	29	5.86
Vesper Sparrow	*Pooecetes gramineus*	33	0.96	4,5	24	4.85
Common Nighthawk*	*Chordeiles minor*	29	0.85	5,4	24	4.85
Brewer's Blackbird	*Euphagus cyanocephalus*	21	0.61	1,7	11	2.22
Mallard	*Anas platyrhynchos*	19	0.55	1,4	11	2.22
Brown-headed Cowbird	*Molothrus ater*	16	0.47	3,2	7	1.41
Red-tailed Hawk	*Buteo jamaicensis*	16	0.47	4,3	14	2.83
Ferruginous Hawk*	*Buteo regalis*	15	0.44	2,1	12	2.42
Loggerhead Shrike	*Lanius ludovicianus*	11	0.32	2,4	9	1.82
Northern Harrier	*Circus hudsonius*	11	0.32	4,2	11	2.22
Red-winged Blackbird	*Agelaius phoeniceus*	11	0.32	1,2	5	1.01
Black-billed Magpie	*Pica hudsonia*	10	0.29	2,0	5	1.01
Killdeer	*Charadrius vociferus*	10	0.29	0,5	7	1.41
Say's Phoebe	*Sayornis saya*	9	0.26	0,4	7	1.41
Western Kingbird	*Tyrannus verticalis*	9	0.26	1,2	8	1.62
Bank Swallow	*Riparia riparia*	8	0.23	0,2	3	0.61
Swainson's Hawk	*Buteo swainsoni*	8	0.23	2,1	5	1.01
House Sparrow	*Passer domesticus*	7	0.20	0,1	2	0.40
Long-billed Curlew*	*Numenius americanus*	7	0.20	2,1	4	0.81
American Robin	*Turdus migratorius*	6	0.18	2,1	4	0.81
Canada Goose	*Branta canadensis*	6	0.18	0,1	2	0.40
Greater Sage-grouse*	*Centrocercus urophasianus*	5	0.15	1,0	1	0.20
Rock Wren	*Salpinctes obsoletus*	5	0.15	3,2	5	1.01
Willet	*Tringa semipalmata*	5	0.15	1,0	4	0.81
American Kestrel	*Falco sparverius*	4	0.12	2,1	4	0.81
American Wigeon	*Mareca americana*	4	0.12	0,1	2	0.40
Grasshopper Sparrow*	*Ammodramus savannarum*	4	0.12	3,1	4	0.81
House Finch	*Haemorhous mexicanus*	4	0.12	0,1	1	0.20
Spotted Sandpiper	*Actitis macularius*	4	0.12	1,1	2	0.40
American Avocet	*Recurvirostra americana*	3	0.09	0,1	1	0.20
Gadwall	*Mareca strepera*	2	0.06	0,1	2	0.40
Gray Flycatcher	*Empidonax wrightii*	2	0.06	1,0	2	0.40
Northern Flicker	*Colaptes auratus*	2	0.06	1,1	2	0.40
Northern Pintail	*Anas acuta*	2	0.06	0,2	2	0.40
Northern Shoveler	*Spatula clypeata*	2	0.06	0,1	1	0.20
Prairie Falcon	*Falco mexicanus*	2	0.06	1,1	2	0.40
Burrowing Owl*	*Athene cunicularia*	1	0.03	0,1	1	0.20

Common Name	Scientific Name	*n*	%	Routes[1]	Stops[2]	%[3]
Cedar Waxwing	*Bombycilla cedrorum*	1	0.03	1,0	2	0.40
Chipping Sparrow	*Spizella passerina*	1	0.03	1,0	1	0.20
Cliff Swallow	*Petrochelidon pyrrhonota*	1	0.03	1,0	1	0.20
Lark Bunting	*Calamospiza melanocorys*	1	0.03	1,0	1	0.20
Lark Sparrow	*Chondestes grammacus*	1	0.03	1,0	1	0.20
Ruddy Duck	*Oxyura jamaicensis*	1	0.03	0,1	1	0.20
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	1	0.03	0,1	1	0.20

[1]The first value represents the number of remote routes at which a species was recorded, and the second value represents the number of facility routes at which a species was recorded.
[2]Number of stops at which a species was documented.
[3]Percent of stops (from a total of 495) at which a species was recorded.
*Species of Greatest Conservation Need.

The western meadowlark was the most evenly distributed species, observed at 66% (329) of the total stops made during the survey (Table 1). The horned lark is traditionally the most abundant species recorded during BBSs on the INL Site and, apart from 2013 and 2016, has been the most abundant species annually since 1998.

The Tractor Flats Route had the highest bird abundance of any route (Table 2), and consistently has had the highest abundance among remote routes since 1999, excluding 2010. Mean bird abundance on this route since 1985 was 712 individuals, which is higher than other remote routes. The bird abundance for 2019 on the Tractor Flats Route was 35% higher than the mean bird abundance since 1985. Tractor Flats Route had the highest species richness of the remote routes. The CFA and MFC Routes had highest species richness of all facility routes. The TAN Route has had the highest mean abundance at a facility since 1985 with 448 birds and CFA had the highest mean richness at a facility route since 1985 with 21 species.

Species Assemblage

Assemblages of bird species in particular habitats, within a region, provide useful insight about general ecological health of such habitats. For example, if a study area contains large shrubland and grassland habitat patches and the corresponding observations of associated bird assemblage for that habitat is low, it may indicate that the local population is experiencing a decline.

Each species of bird detected on the INL Site has been assigned to one of seven species assemblage and include:

- Shrub-Steppe/Grassland
- Sagebrush Obligate
- Raptor, Corvid and Shrike
- Shorebird
- Urban and Exotic
- Waterfowl
- Other

The most abundant species assemblage in 2019 was the shrub-steppe/grassland, representing 47% of all BBS observations (Figure 3). This assemblage normally has the highest abundance because the majority of the INL Site consists of shrub-steppe and grassland habitats. The second most abundant species assemblage was the sagebrush obligate category representing 26.3% of all observations (Figure 3). The third most abundant species assemblage was the Shorebird representing 15.6% of all observations.

Table 2. Summary numbers for each breeding bird route that was surveyed in 2019 on the Idaho National Laboratory Site.

Route	Stops	Species Richness	Mean Species Richness[1]	Abundance	Mean Abundance[2]
Remote Routes					
Lost River	50	19	17	330	428
Circular Butte	50	13	15	287	452
Kyle Canyon	50	21	23	273	404
Tractor Flats	50	26	23	959	712
Twin Buttes	50	17	21	181	439
Subtotal	**250**	**40**		**2030**	
Facility Routes					
CFA	42	22	21	259	323
INTEC	25	14	16	153	203
MFC	18	22	20	136	262
NRF	20	14	20	108	218
PBF (CITRC)	28	13	15	159	252
ATR-C	32	16	18	147	288
RWMC	20	18	19	160	174
TAN	60	15	17	273	448
Subtotal	**245**	**43**		**1395**	
Total	**495**	**53***		**3425**	

*Total number of unique species.
[1]Mean species richness 1985 - 2019
[2]Mean abundance 1985 - 2019

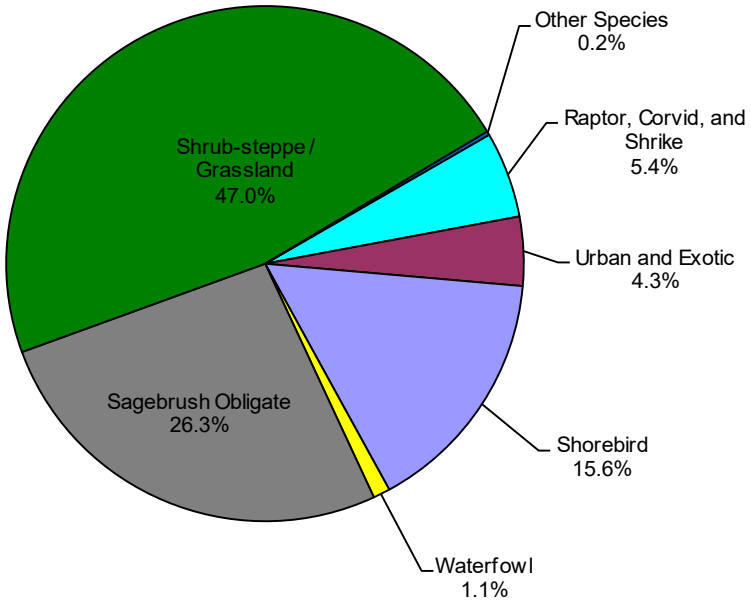

Figure 3. Summary of species assemblage for Breeding Bird Surveys of remote and facility routes on the Idaho National Laboratory Site in 2019.

Shrub-steppe/Grassland

Shrub-steppe/Grassland refers to the dominant plant types in the habitat: shrubs and grasses. Species representing the shrub-steppe/grassland assemblage have always been observed in greatest numbers in past BBSs, and they again dominated observations in 2019 (*n*= 1,610, Figure 3). Common shrub-steppe/grassland species include: horned lark, western meadowlark, brown-headed cowbird (*Molothrus ater*), vesper sparrow (*Pooecetes gramineus*)

Horned lark (*n*= 663) and western meadowlark (*n*= 806) were the most abundant species in this assemblage and were the top two most abundant species for the entire survey (Table 1). Mean bird abundance the Shrub-steppe/Grassland assemblage since 1985 is 2471 (Table 3).

Sagebrush Obligate

Table 3. 2019 Species assemblage abundance on the Idaho National Laboratory Site.

Species Assemblage	Abundance	Mean Abundance[1]
Shrub-Steppe / Grassland	1610	2471
Sagebrush Obligate	902	1505
Raptor, Corvid and Shrike	185	177
Shorebird	536	252
Urban and Exotic	148	145
Waterfowl	36	45
Other species	8	16

[1]Mean abundance 1985 - 2019

The sagebrush obligate assemblage had the second highest species abundance with 902 individuals (26.3% of total). This assemblage includes Brewer's sparrow, sagebrush sparrow, sage thrasher, and greater sage-grouse. Sage thrasher was the most abundant sagebrush obligate (*n*= 442), followed by Brewer's sparrow (*n*= 237) and sagebrush sparrow (*n*= 218). Since 1985, sage thrasher counts have fluctuated, but appear to be stable (Figure 3). Sagebrush and Brewer's sparrows, however, are at historically low levels (Figure 4). For the past eight years (since 2011), sagebrush sparrow observations ranged from 161–237, all of which were lower than the previous low count of 241 individuals recorded in 1987 (Figure 4). Brewer's sparrow observations in 2019 were 22% higher than in 2018 (Figure 4).

In many western states, sagebrush obligates are facing significant habitat loss; consequently, many populations are in decline (Knick 1999; Knick et al. 2003). On the INL Site, three large fires in 2010 and 2011 burned 29,944 ha (73,993 acres) of sagebrush-dominated communities, representing over 20% of big sagebrush communities (DOE-ID and USFWS 2014). Sharp declines in the number of observations of Brewer's and sagebrush sparrows correspond with these fires. It is unclear, however, why sage thrasher abundance has apparently not been affected. Across its range in Idaho, sage thrasher populations have declined by 1.6% per year (95% C.I. is 3.25-0.51%) between 1966 and 2013 (Sauer et al. 2014). The sharp reduction in sagebrush-dominated lands on the INL Site most likely has affected the total abundance of birds detected during these surveys. Breeding bird surveys in the western U.S. indicate that populations of Brewer's sparrows, sage thrashers, and sagebrush sparrows have all declined across their range (Knick et al. 2003; Sauer and Link 2011). Mean bird abundance in this assemblage since 1985 is 1505.

Raptor, Corvid, and Shrike

The raptor, corvid, and shrike assemblage consisted of 185 observations representing 5.4% of the total count. Among these were 10 species of raptors (i.e. eagles, hawks, falcons, and owls). Red-tailed hawk (*Buteo jamaicensis, n*= 16) and Swainson's hawk (*Buteo swainsoni, n*= 8) were the most abundant raptors observed. We observed 11 loggerhead shrikes (*Lanius ludovicianus*) in 2019, which was lower than the mean of 28 loggerhead shrikes per year (1985–2018).

The corvid family includes: the common raven (*Corvus corax*.), American crow (*Corax brachyrhynchos*), and black-billed magpie (*Pica hudsonia*). The common raven was the most abundant species within this assemblage in 2019 (*n*= 107). Raven observations have increase over the years (Figure 5). The number of birds detected in this assemblage is higher than the Mean bird abundance in the Raptor, Corvid, and Shrike assemblage since 1985 is 177.

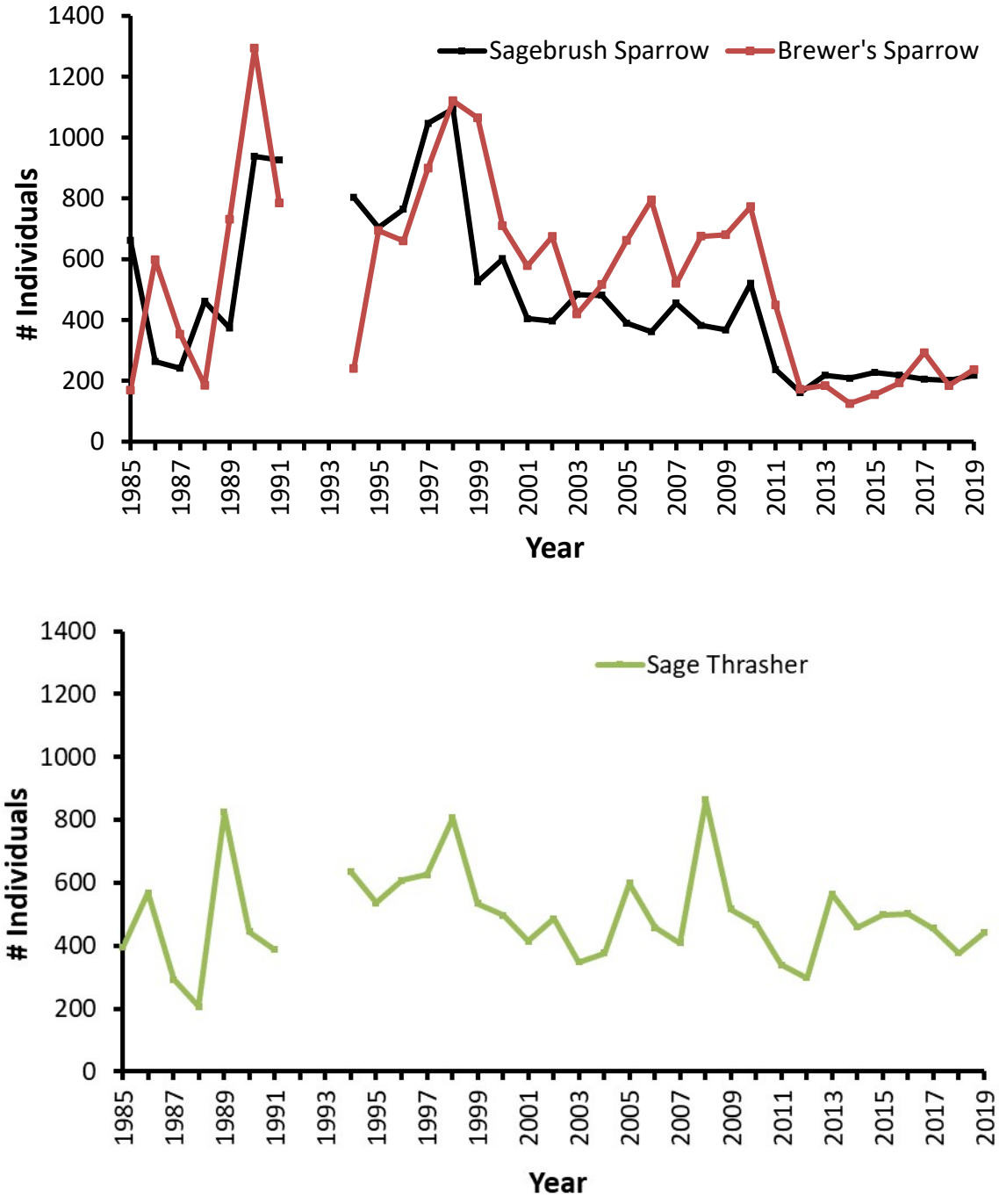

Figure 4. Trends of three sagebrush obligates recorded during Breeding Bird Surveys since 1985. Surveys were not conducted in 1992 and 1993.

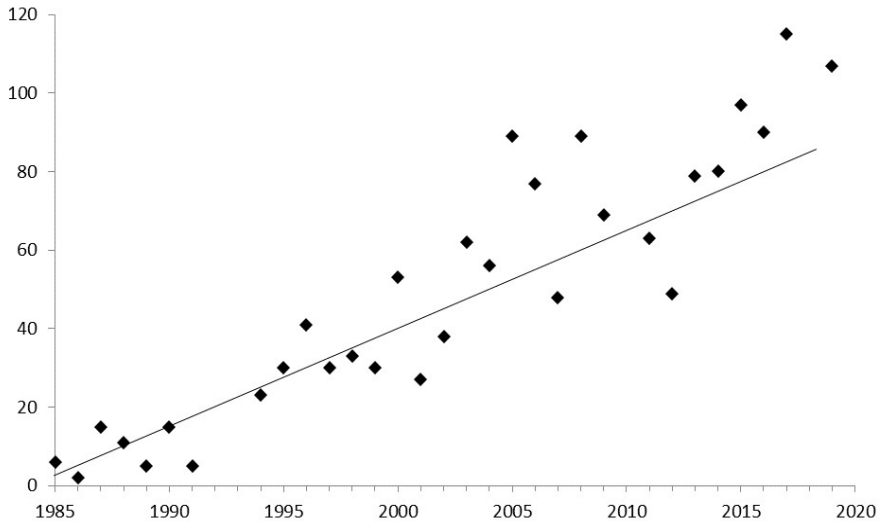

Figure 5. Common raven observations during breeding bird surveys on the INL Site 1985-2019. No surveys were conducted in 1992 and 1993, and the data point in 2010 was removed because it represented an outlier (*n*=280) caused by a single large flock flying overhead during one survey.

Shorebird

We observed 536 individuals representing six species from the shorebird assemblage, which accounted for 15.6% of the total BBS observations (Figure 3). Because standing water is rare on the INL Site, typically most observations of shorebirds occur in proximity to waste ponds near facility routes; however, they are also observed in agricultural fields along the INL Site boundary. In 2019, Franklin's gull observations (*n*= 507) comprised 95% of all shorebird observations. Most of the Franklin's gulls were observed on the Tractor Flats route, near the Circular Butte Landfill. Other shorebirds seen included: killdeer (*Charadrius vociferous, n*= 10), long-billed curlew (*Numenius americanus*, *n*= 7), willet (*Tringa semipalmatus, n*= 5), spotted sandpiper (*Actitis macularius*, *n*= 4), American avocet (*Recurvirostra americana, n*= 3). Mean shorebird abundance since 1985 is 252.

Urban and Exotic

The urban and exotic assemblage represents birds associated with urban or human-altered environments, which are most commonly found around INL Site facilities. Examples of these species include: barn swallow (*Hirundo rustica*), European starling (*Sturnus vulgaris*), Say's phoebe (*Sayornis saya*), American robin (*Turdus migratorius*). This assemblage constituted 4.3% (*n*= 148) of the total observations in 2018. The barn swallow was the most abundant species observed in this assemblage (*n*= 66), followed by European starling (*n*= 56). Mean urban and exotic bird abundance since 1985 is 145.

Waterfowl

Waterfowl are commonly observed during the BBS even though little standing water exists on the INL Site. Apart from the ephemeral Big Lost River, Big Lost River spreading area, and the Big Lost River Sinks playa, the only standing water bodies on the INL Site during these surveys are wastewater treatment ponds near facilities. These man-made ponds serve as stopover locations for migrating birds and provides nesting opportunity for some waterfowl species.

We documented 36 individuals from 7 waterfowl species: mallard (*Anas platyrhynchos, n*= 19), Canada goose (*Branta canadensis*, *n*= 6), American wigeon (*Anas americana*, *n*= 4), gadwall (*Mareca strepera*, *n*= 2), northern pintail (*Anas acuta*, *n*= 2), northern shoveler (*Spatula clypeata*, *n*= 2), ruddy duck (*Oxyura jamaicensis*, *n*= 1), representing 1.1% of total observations.

Other Birds

The bank swallow (*Riparia riparia*, *n*= 8) was the only species observed in 2019 that was not assigned to any species assemblage.

Community Diversity Index

The CFA Route had the most diverse bird community of all 13 routes (H=2.46, E_H=0.80; Table 4), followed by the MFC Route (H= 2.45, E_H= 0.79). CFA and MFC had the highest species richness (n= 22) among facility routes. Among remote routes, Kyle Canyon (H= 2.18; E_H= 0.72) had the most diverse bird community, while Circular Butte was the least diverse based on richness (n= 13). Tractor Flat was the least diverse based on H (H= 1.68).

Table 4. Values for species richness, Shannon Diversity (H), and Equitability (E_H) indices for the 2019 Idaho National Laboratory Site Breeding Bird Surveys.

Route	Species Richness	Shannon's H	Shannon's E_H
Remote Routes			
Lost River	19	1.74	0.59
Kyle Canyon	21	2.18	0.73
Circular Butte	13	1.70	0.66
Tractor Flats	26	1.68	0.52
Twin Buttes	17	2.15	0.76
Facility Routes			
CFA	22	2.46	0.80
INTEC	14	2.01	0.76
MFC	22	2.45	0.79
NRF	14	1.96	0.74
PBF (CITRC)	13	1.92	0.75
RWMC	18	2.28	0.79
ATR-C	16	1.99	0.72
TAN	15	1.70	0.63

The CFA route has been among the top three in regard to diversity ten of the past eleven years. RWMC has been among the three most diverse routes during ten of the past 13 years. During the same time, Tractor Flats has been among the top three for species richness. This information indicates that the area surrounding CFA and RWMC (building, trees, and waste-water ponds) may provide a more diverse habitat for several species of birds. Additionally, the northern stops on the Tractor Flats Route occur in the agricultural areas near State Highway 33, which likely influences the species richness in that area.

2.0 Conclusions

Two sagebrush-obligate species continue to be counted at historically low levels on INL Site routes, which is probably a consequence of losing large amounts of sagebrush-dominated communities to wildfires. Conversely, common raven observations continue to increase.

3.0 Acknowledgements

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Appendix A

Summary of Species by Route 2019

Survey Route: **Lost River**
Survey Date: **June 3, 2019**

Species	Abundance	Percentage
Western Meadowlark	148	44.85
Horned Lark	75	22.73
Brewer's Sparrow	32	9.70
Sage Thrasher	22	6.67
Sagebrush Sparrow	19	5.76
Common Raven	9	2.73
Vesper Sparrow	7	2.12
Brewer's Blackbird	3	0.91
American Robin	2	0.61
Common Nighthawk	2	0.61
Ferruginous Hawk	2	0.61
Mourning Dove	2	0.61
American Kestrel	1	0.30
Brown-headed Cowbird	1	0.30
Mallard	1	0.30
Prairie Falcon	1	0.30
Red-tailed Hawk	1	0.30
Red-winged Blackbird	1	0.30
Swainson's Hawk	1	0.30
Total Individuals	***330***	
Total Species	***19***	

Survey Route: **Circular Butte**
Survey Date: **June 17, 2019**

Species	Abundance	Percentage
Horned Lark	107	37.28
Western Meadowlark	72	25.09
Sage Thrasher	42	14.63
Brewer's Sparrow	20	6.97
Common Raven	20	6.97
Sagebrush Sparrow	17	5.92
European Starling	2	0.70
Northern Harrier	2	0.70
American Kestrel	1	0.35
Common Nighthawk	1	0.35
Grasshopper Sparrow	1	0.35
Loggerhead Shrike	1	0.35
Mourning Dove	1	0.35
Total Individuals	***287***	
Total Species	***13***	

Survey Route: **Kyle Canyon**
Survey Date: **June 13, 2019**

Species	Abundance	Percentage
Western Meadowlark	67	24.54
Sage Thrasher	43	15.75
Sagebrush Sparrow	42	15.38
Brewer's Sparrow	41	15.02
Horned Lark	33	12.09
Common Raven	10	3.66
Ferruginous Hawk	10	3.66
Mourning Dove	5	1.83
Red-tailed Hawk	4	1.47
Black-billed Magpie	3	1.10
Western Kingbird	3	1.10
Common Nighthawk	2	0.73
Gray Flycatcher	2	0.73
Chipping Sparrow	1	0.37
Cliff Swallow	1	0.37
Long-billed Curlew	1	0.37
Northern Harrier	1	0.37
Northern Flicker	1	0.37
Lark Bunting	1	0.37
Rock Wren	1	0.37
Vesper Sparrow	1	0.37
Total Individuals	***273***	
Total Species	***21***	

Survey Route: **Tractor Flats**
Survey Date: **June 5, 2019**

Species	Abundance	Percentage
Franklin's Gull	506	52.76
Western Meadowlark	156	16.27
Horned Lark	98	10.22
Brewer's Sparrow	50	5.21
Sage Thrasher	41	4.28
Common Raven	25	2.61
Sagebrush Sparrow	24	2.50
European Starling	8	0.83
Black-billed Magpie	7	0.73
Mourning Dove	6	0.63
Greater Sage-Grouse	5	0.52
Long-billed Curlew	5	0.52
Willet	5	0.52
Vesper Sparrow	4	0.42
Northern Harrier	3	0.31
Spotted Sandpiper	3	0.31
Brown-headed Cowbird	2	0.21
Common Nighthawk	2	0.21
Red-tailed Hawk	2	0.21
American Robin	1	0.10
Barn Swallow	1	0.10
Burrowing Owl	1	0.10
Cedar Waxwing	1	0.10
Grasshopper Sparrow	1	0.10
Lark Sparrow	1	0.10
Rock Wren	1	0.10
Total Individuals	***959***	
Total Species	***26***	

Survey Route: **Twin Buttes**
Survey Date: **July 1, 2019**

Species	Abundance	Percentage
Western Meadowlark	65	35.91
Horned Lark	29	16.02
Sage Thrasher	22	12.15
Common Nighthawk	11	6.08
Common Raven	9	4.97
Brown-headed Cowbird	8	4.42
Sagebrush Sparrow	8	4.42
Mourning Dove	5	2.76
Swainson's Hawk	5	2.76
Vesper Sparrow	5	2.76
Brewer's Sparrow	3	1.66
Loggerhead Shrike	3	1.66
Northern Harrier	3	1.66
Ferruginous Hawk	2	1.10
Grasshopper Sparrow	1	0.55
Red-tailed Hawk	1	0.55
Rock Wren	1	0.55
Total Individuals	***181***	
Total Species	***17***	

Survey Route: **CFA**
Survey Date: **June 14, 2019**

Species	Abundance	Percentage
Western Meadowlark	62	23.94
Horned Lark	42	16.22
Sage Thrasher	41	15.83
European Starling	21	8.11
Sagebrush Sparrow	15	5.79
Barn Swallow	12	4.63
Brewer's Sparrow	9	3.47
Common Nighthawk	7	2.70
House Sparrow	7	2.70
Common Raven	5	1.93
Say's Phoebe	5	1.93
Western Kingbird	5	1.93
Brewer's Blackbird	4	1.54
House Finch	4	1.54
Loggerhead Shrike	4	1.54
Mourning Dove	4	1.54
American Robin	3	1.16
American Kestrel	2	0.77
Killdeer	2	0.77
Red-tailed Hawk	2	0.77
Swainson's Hawk	2	0.77
Rock Wren	1	0.39
Total Individuals	***259***	
Total Species	***22***	

Survey Route: **INTEC**
Survey Date: **June 11, 2019**

Species	Abundance	Percentage
Sage Thrasher	40	26.14
Western Meadowlark	40	26.14
Horned Lark	24	15.69
Brewer's Sparrow	14	9.15
Sagebrush Sparrow	12	7.84
Barn Swallow	4	2.61
Brewer's Blackbird	4	2.61
Common Raven	4	2.61
Brown-headed Cowbird	3	1.96
Mallard	3	1.96
Common Nighthawk	2	1.31
Bank Swallow	1	0.65
European Starling	1	0.65
Vesper Sparrow	1	0.65
Total Individuals	***153***	
Total Species	***14***	

Survey Route: **MFC**
Survey Date: **May 31, 2019**

Species	Abundance	Percentage
Western Meadowlark	40	29.41
Horned Lark	16	11.76
Barn Swallow	15	11.03
Sage Thrasher	11	8.09
Mallard	10	7.35
Bank Swallow	7	5.15
European Starling	7	5.15
Brewer's Blackbird	4	2.94
Red-winged Blackbird	4	2.94
American Wigeon	4	2.94
Common Raven	3	2.21
Brewer's Sparrow	2	1.47
Gadwall	2	1.47
Killdeer	2	1.47
Northern Shoveler	2	1.47
Long-billed Curlew	1	0.74
Northern Flicker	1	0.74
Northern Pintail	1	0.74
Prairie Falcon	1	0.74
Sagebrush Sparrow	1	0.74
Vesper Sparrow	1	0.74
Yellow-headed Blackbird	1	0.74
Total Individuals	***136***	
Total Species	***22***	

Survey Route: **NRF**
Survey Date: **June 11, 2019**

Species	Abundance	Percentage
Horned Lark	30	27.78
Western Meadowlark	30	27.78
Sage Thrasher	17	15.74
Brewer's Sparrow	8	7.41
Sagebrush Sparrow	7	6.48
American Avocet	3	2.78
Barn Swallow	3	2.78
Mallard	3	2.78
Common Raven	2	1.85
Brewer's Blackbird	1	0.93
Common Nighthawk	1	0.93
Killdeer	1	0.93
Say's Phoebe	1	0.93
Vesper Sparrow	1	0.93
Total Individuals	***108***	
Total Species	***14***	

Survey Route: **PBF (CITRC)**
Survey Date: **June 25, 2019**

Species	Abundance	Percentage
Horned Lark	47	29.56
Western Meadowlark	35	22.01
Sage Thrasher	23	14.47
Brewer's Sparrow	20	12.58
Sagebrush Sparrow	17	10.69
Vesper Sparrow	5	3.14
Killdeer	3	1.89
Barn Swallow	2	1.26
Mourning Dove	2	1.26
Say's Phoebe	2	1.26
Brewer's Blackbird	1	0.63
Loggerhead Shrike	1	0.63
Northern Harrier	1	0.63
Total Individuals	***159***	
Total Species	***13***	

Survey Route: **ATR-C**
Survey Date: **June 10, 2019**

Species	Abundance	Percentage
Western Meadowlark	51	34.69
Sage Thrasher	31	21.09
European Starling	17	11.56
Horned Lark	15	10.20
Brewer's Sparrow	9	6.12
Vesper Sparrow	7	4.76
Common Raven	4	2.72
Red-tailed Hawk	4	2.72
Brown-headed Cowbird	2	1.36
Barn Swallow	1	0.68
Brewer's Blackbird	1	0.68
Franklin's Gull	1	0.68
Loggerhead Shrike	1	0.68
Mourning Dove	1	0.68
Northern Pintail	1	0.68
Sagebrush Sparrow	1	0.68
Total Individuals	***147***	
Total Species	***16***	

Survey Route: **RWMC**
Survey Date: **May 30, 2019**

Species	Abundance	Percentage
Western Meadowlark	34	21.25
Sage Thrasher	31	19.38
Barn Swallow	25	15.63
Horned Lark	16	10.00
Brewer's Sparrow	13	8.13
Sagebrush Sparrow	12	7.50
Canada Goose	6	3.75
Red-winged Blackbird	6	3.75
Common Raven	4	2.50
Brewer's Blackbird	3	1.88
Killdeer	2	1.25
Mallard	2	1.25
Loggerhead Shrike	1	0.63
Mourning Dove	1	0.63
Rock Wren	1	0.63
Ruddy Duck	1	0.63
Say's Phoebe	1	0.63
Spotted Sandpiper	1	0.63
Total Individuals	***160***	
Total Species	***18***	

Survey Route: **TAN**
Survey Date: **June 19, 2019**

Species	Abundance	Percentage
Horned Lark	101	37.00
Sage Thrasher	78	28.57
Sagebrush Sparrow	43	15.75
Brewer's Sparrow	16	5.86
Common Raven	12	4.40
Mourning Dove	6	2.20
Western Meadowlark	6	2.20
Barn Swallow	3	1.10
Red-tailed Hawk	2	0.73
Common Nighthawk	1	0.37
Ferruginous Hawk	1	0.37
Grasshopper Sparrow	1	0.37
Northern Harrier	1	0.37
Vesper Sparrow	1	0.37
Western Kingbird	1	0.37
Total Individuals	***273***	
Total Species	***15***	