

# 2015 Breeding Bird Surveys on the Idaho National Laboratory Site

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## EXECUTIVE SUMMARY

Breeding bird surveys (BBSs) have been conducted annually since 1985 (no surveys were conducted in 1992 and 1993) to monitor bird populations on the Idaho National Laboratory (INL) Site. In 2015, we conducted surveys from May 29 to June 30 along 13 established routes, five of which are part of a nationwide survey administered by the U.S. Geological Survey (USGS) and eight of which border INL Site facilities. We documented 3,503 birds from 52 species during those surveys. Bird abundance was less than the 1985-2014 average of 4,748 birds, and the number of species (i.e., species richness) was lower than the 28-year average of 56.

Compared with past surveys, we observed similar patterns of bird abundance among those species that are typically the most numerous. In 2015, the six species that were documented in greatest abundance were horned lark (*Eremophila alpestris*,  $n = 897$ ), western meadowlark (*Sturnella neglecta*,  $n = 667$ ), sage thrasher (*Oreoscoptes montanus*,  $n = 499$ ), mourning dove (*Zenaida macroura*,  $n = 296$ ), sagebrush sparrow (*Artemisiospiza nevadensis*,  $n = 227$ ), and Brewer's sparrow (*Spizella breweri*,  $n = 154$ ). With the exception of the mourning dove, these species have been the five most abundant 23 times during the past 29 years of surveys, and in the remaining six years they were among the six most abundant species.

Investigators observed two species that were previously not recorded during the INL surveys: one unidentified hummingbird and one peregrine falcon (*Falco peregrinus*). Additionally, we observed a great blue heron (*Ardea herodias*), which had been recorded in 2 of the past 28 years.

Species observed during the 2015 BBS that are considered by the Idaho Department of Fish and Game as species of conservation concern included the Franklin's gull (*Larus pipixcan*,  $n = 76$ ), grasshopper sparrow (*Ammodramus savannarum*,  $n = 6$ ), ferruginous hawk (*Buteo regalis*,  $n = 15$ ), long-billed curlew (*Numenius americanus*,  $n = 7$ ), peregrine falcon (*Falco peregrinus*,  $n = 1$ ), greater sage-grouse (*Centrocercus urophasianus*,  $n = 1$ ), and burrowing owl (*Athene cunicularia*,  $n = 1$ ).

We noted two negative trends regarding sagebrush specialist species. Brewer's sparrow and sagebrush sparrow (both specialists) have been at historically low levels since 2011. We attribute this decline to the loss of sagebrush habitats during large fires in 2010 and 2011. Conversely, the common raven, which preys on sage-grouse eggs (another sagebrush specialist), continues to trend upward and was observed in 2015 at higher levels than in any other INL Site breeding bird survey, except 2010.

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## ACRONYMS

ATRC	Advanced Test Reactor Complex
BBS	Breeding Bird Survey
CFA	Central Facilities Area
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).

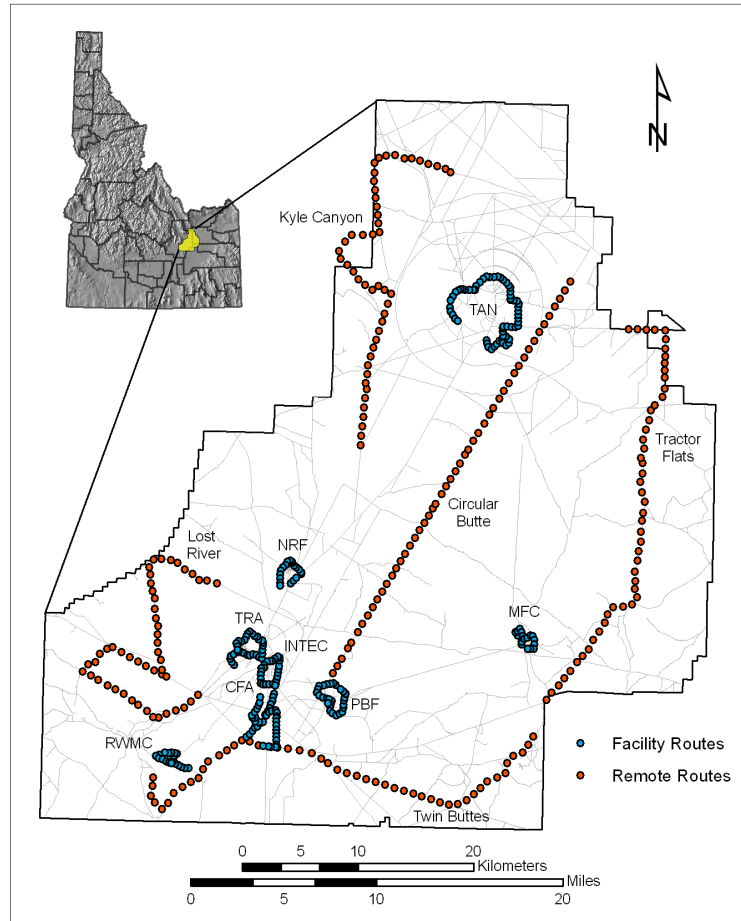
BBS data provide long-term species abundance and distribution trends for > 420 species of birds across a broad-geographic scale (Sauer and Link 2011). These data have been used to estimate population changes for hundreds of bird species, and they are the primary source for regional conservation programs 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).

The Idaho National Laboratory (INL) Site has five permanent, official BBS routes originally established in 1985 (hereafter referred to as remote routes) and eight additional survey routes near INL Site facilities (hereafter referred to as facility routes) (Figure 1). Facility routes were developed to monitor birds near the highest human activity centers on the INL Site. The annual BBS provides land managers information regarding trends in abundance of breeding birds, which may be useful as they consider new activities and comply with the National Environmental Protection Act. This report summarizes the results from the 2015 BBS and compares current species abundance with long-term averages.

### 1.1 STUDY AREA

The INL Site encompasses almost 900 mi<sup>2</sup> (2,330 km<sup>2</sup>) 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 2013). The INL Site has also been recognized as a Global Important Bird Area by the National Audubon Society.

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. Location of 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.**

In general, the INL Site is located in a semi-arid desert that experiences hot, dry summers and cold winters. Annual precipitation on the INL Site averages 8 inches (20 cm), with peak precipitation commonly occurring in spring. The geology is dominated by Quaternary basalt lava flows producing 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 flood plain 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. (2011).

Little surface water exists during spring and summer on the INL Site. 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 drains into an ephemeral wetland known as the Big Lost River Sinks. This ephemeral wetland provides 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 aquatic habitat for migrating 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 29 to June 30, 2015, consisting of five official USGS BBS routes and eight facility routes that were developed specifically for the INL Site (Figure 1). Each remote survey route is 24.5 miles (39.2 km) with 50 sampling points systematically spaced every 0.5 mile (0.8 km). Facility routes vary in length between 3.6 miles (5.8 km) and 11.9 miles (19.2 km), depending on the size of the facility. Sampling points along facility routes are separated by approximately 0.2 mile (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 or heard within a quarter-mile radius 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. Each route was only surveyed when weather conditions were appropriate (e.g., no heavy rain or strong wind). These surveys began one-half hour before sunrise and continued for up to 6 hours until the route was completed. The number of vehicles that passed observers during the 3-minute sampling period was recorded on all remote routes. Also, observers noted whether background noise interfered with audible detection of birds.

We used Spearman rank correlation coefficient (Zar 1984) to investigate relationships between bird abundance and both mean temperature and total precipitation in June since 1985. Weather data were recorded at the Central Facilities Area (CFA) and are available at <http://niwc.noaa.inel.gov/climate.htm>. Statistical significance was calculated using a two-tailed test with  $\alpha = 0.05$ .

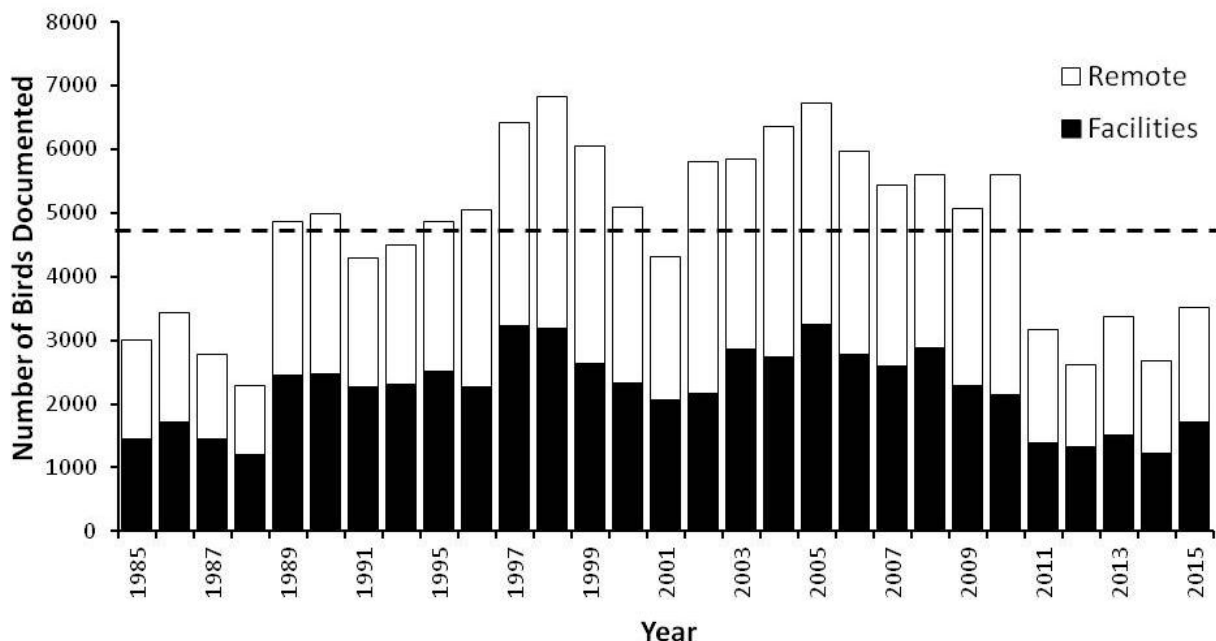
Shannon's  $H$  and  $E_H$  were calculated for all BBS routes to show the species diversity, species abundance, measure of evenness, and compared with standard species richness information documented in past reports. We assumed that data obtained from each survey route was an accurate representation of the local bird community.

## 1.3 RESULTS AND DISCUSSION

### Summary Statistics

We documented 3,503 birds from 52 species during the 2015 surveys (Appendix A), which was lower than the average of 4,748 birds from 56 species (1985-2014) (Figure 2). The 2015 count is

the highest since 2010, though it remains just over half the observations in the two years of highest counts (1998 and 2005)(Table 1).



**Figure 2. Number of birds observed during Breeding Bird Surveys on the Idaho National Laboratory Site. The dashed line indicates the mean number of birds observed from 1985 to 2014. No BBSs were conducted on the INL Site in 1992 or 1993.**

The six most abundant birds we observed were horned lark (*Eremophila alpestris*) ( $n = 897$ ), western meadowlark (*Sturnella neglecta*,  $n = 667$ ), sage thrasher (*Oreoscoptes montanus*,  $n = 499$ ), mourning dove (*Zenaida macroura*,  $n = 296$ ), sagebrush sparrow (*Artemisiospiza nevadensis*,  $n = 227$ ), and Brewer's sparrow (*Spizella breweri*,  $n = 154$ ). These six species comprised  $> 78\%$  of all observations and each was observed on every remote route (Table 2, Appendix A). With the exception of the mourning dove, these species have been the five most abundant in 23 of the 29 years of INL Site BBS (in the other years they were among the six most abundant species).

One of every four observations was of a horned lark (Table 2). This species was observed at 65.9% (326) of the total stops made during the survey. The horned lark is the most abundant species recorded during historic BBSs on the INL Site, and has been the most abundant species annually since 1998, with the exception of 2013.

The Tractor Flats Route had the highest species richness and the highest bird abundance of all routes (Table 1). Among remote routes, Tractor Flats consistently has had the highest abundance since 1999, excluding 2010. The mean bird abundance of this route since 1985 is 683 individuals, which is higher than other remote routes. For facility routes PBF had the highest abundance and CFA had highest species richness. The TAN Route has had the highest mean abundance at a facility since 1985 with 479 birds and NRF and CFA have had the highest mean richness since 1985 with 21 species.



**Table 1. Number of stops surveyed, species richness, and bird abundance in 2015 for Breeding Bird Survey routes on the Idaho National Laboratory Site.**

<b>Route</b>	<b>Stops</b>	<b># Species</b>	<b>Abundance</b>
Remote Routes			
Lost River	50	13	303
Circular Butte	50	15	365
Kyle Canyon	50	20	317
Tractor Flats	50	27	588
Twin Buttes	50	17	223
<b>Subtotal</b>	<b>250</b>	<b>40*</b>	<b>1796</b>
Facility Routes			
CFA	42	22	236
INTEC	25	13	156
MFC	18	18	165
NRF	20	16	258
PBF	28	11	280
ATRC	32	14	202
RWMC	20	16	197
TAN	60	17	213
<b>Subtotal</b>	<b>245</b>	<b>38*</b>	<b>1707</b>
<b>Total</b>	<b>495</b>	<b>52</b>	<b>3503</b>

\*Combined number of unique species.

### **Rare Observations and Species of Special Concern**

Six species were observed during the 2015 BBS that are considered Species of Greatest Conservation Need by the Idaho Department of Fish and Game (2013). These included the Franklin's gull (*Larus pipixcan*,  $n = 76$ ), ferruginous hawk (*Buteo regalis*,  $n = 15$ ), long-billed curlew (*Numenius americanus*,  $n = 7$ ), grasshopper sparrow (*Ammodramus savannarum*,  $n = 6$ ), greater sage-grouse (*Centrocercus urophasianus*,  $n = 1$ ), and burrowing owl (*Athene cunicularia*,  $n = 1$ ).

### **Species Assemblage Summary**

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 shrub-land and grassland habitat patches and the corresponding observations of bird assemblages are low in those areas, this may indicate that the local population is experiencing declines.

**Table 2. Summary of species from 13 routes, sorted by abundance, that were observed during the 2015 Breeding Bird Survey on the Idaho National Laboratory Site.**

Common Name	Scientific Name	n	%	Routes <sup>1</sup>	Stops <sup>2</sup>	% <sup>3</sup>
Horned Lark	<i>Eremophila alpestris</i>	897	25.61	5,8	326	65.86
Western Meadowlark	<i>Sturnella neglecta</i>	667	19.04	5,7	300	60.61
Sage Thrasher	<i>Oreoscoptes montanus</i>	499	14.24	5,8	288	58.18
Mourning Dove	<i>Zenaida macroura</i>	296	8.45	5,8	106	21.41
Sagebrush Sparrow	<i>Artemisospiza nevadensis</i>	227	6.48	5,8	150	30.30
Brewer's Sparrow	<i>Spizella breweri</i>	154	4.40	5,8	95	19.19
Barn Swallow	<i>Hirundo rustica</i>	114	3.25	1,8	29	5.86
Common Raven	<i>Corvus corax</i>	97	2.77	5,8	71	14.34
Franklin's Gull	<i>Larus pipixcan</i>	76	2.17	3,2	9	1.82
Vesper Sparrow	<i>Poocetes gramineus</i>	71	2.03	5,6	49	9.90
American Crow	<i>Corvus brachyrhynchos</i>	66	1.88	1,0	2	0.40
Willet	<i>Catoptrophorus semipalmatus</i>	30	0.86	0,1	1	0.20
Common Nighthawk	<i>Chordeiles minor</i>	29	0.83	4,3	24	4.85
European Starling	<i>Sturnus vulgaris</i>	24	0.69	3,6	14	2.83
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	23	0.66	1,6	14	2.83
Cliff Swallow	<i>Hirundo pyrrhonota</i>	23	0.66	1,3	8	1.62
Brown-headed Cowbird	<i>Molothrus ater</i>	20	0.57	2,3	9	1.82
Loggerhead Shrike	<i>Lanius ludovicianus</i>	17	0.49	2,2	9	1.82
Black-billed Magpie	<i>Pica pica</i>	16	0.46	2,0	6	1.21
American Robin	<i>Turdus migratorius</i>	15	0.43	1,3	9	1.82
Ferruginous Hawk	<i>Buteo regalis</i>	15	0.43	2,1	9	1.82
Killdeer	<i>Charadrius vociferus</i>	15	0.43	0,4	9	1.82
Western Kingbird	<i>Tyrannus verticalis</i>	12	0.34	2,4	10	2.02
Swainson's Hawk	<i>Buteo swainsoni</i>	11	0.31	3,1	10	2.02
Rock Wren	<i>Salpinctes obsoletus</i>	10	0.29	1,4	9	1.82
Red-tailed Hawk	<i>Buteo jamaicensis</i>	9	0.26	5,1	8	1.62
Long-billed Curlew	<i>Numenius americanus</i>	7	0.20	1,0	3	0.61
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	6	0.17	2,1	5	1.01
Northern Harrier	<i>Circus cyaneus</i>	6	0.17	4,1	6	1.21
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	6	0.17	0,1	3	0.61
House Finch	<i>Carpodacus mexicanus</i>	4	0.11	0,2	4	0.81
Mallard	<i>Anas platyrhynchos</i>	4	0.11	0,2	2	0.40
Northern Shoveler	<i>Anas clypeata</i>	4	0.11	0,1	1	0.20
House Sparrow	<i>Passer domesticus</i>	3	0.09	1,0	3	0.61
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	3	0.09	0,1	1	0.20
Say's Phoebe	<i>Sayornis saya</i>	3	0.09	1,1	3	0.61
American Coot	<i>Fulica americana</i>	2	0.06	0,1	1	0.20
American Kestrel	<i>Falco sparverius</i>	2	0.06	0,1	1	0.20
Eastern Kingbird	<i>Tyrannus tyrannus</i>	2	0.06	1,0	2	0.40
Gray Flycatcher	<i>Empidonax wrightii</i>	2	0.06	1,0	1	0.20
Mountain Bluebird	<i>Sialia currucoides</i>	2	0.06	1,0	1	0.20
Rock Pigeon	<i>Columba livia</i>	2	0.06	1,0	1	0.20
Prairie Falcon	<i>Falco mexicanus</i>	2	0.06	1,1	2	0.40
Western Tanager	<i>Piranga ludoviciana</i>	2	0.06	1,0	2	0.40
Burrowing Owl	<i>Athene cunicularia</i>	1	0.03	1,0	1	0.20
Great Blue Heron	<i>Ardea herodias</i>	1	0.03	0,1	1	0.20

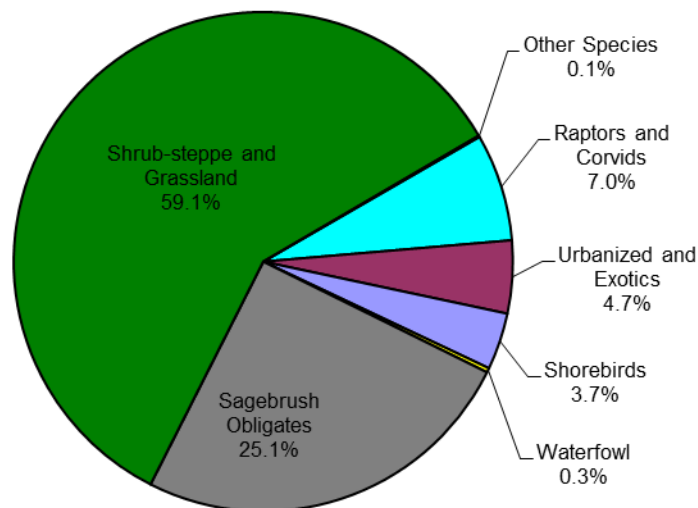
Common Name	Scientific Name	n	%	Routes <sup>1</sup>	Stops <sup>2</sup>	% <sup>3</sup>
Great Horned Owl	<i>Bubo virginianus</i>	1	0.03	0,1	1	0.20
Greater Sage Grouse	<i>Centrocercus urophasianus</i>	1	0.03	1,0	1	0.20
Lark Sparrow	<i>Chondestes grammacus</i>	1	0.03	1,0	1	0.20
Lark Bunting	<i>Calamospiza melanocorys</i>	1	0.03	1,0	1	0.20
Peregrine Falcon	<i>Falco peregrinus</i>	1	0.03	0,1	1	0.20
Unknown Hummingbird		1	0.03	1,0	1	0.20

<sup>1</sup>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.

<sup>2</sup>Number of stops at which a species was documented.

<sup>3</sup>Percent of stops (from a total of 495) at which a species was recorded.

The most dominant species assemblage on the INL Site was the shrub-steppe/grassland category, representing nearly 59.1% of all BBS observations (Figure 3). The shrub-steppe/grassland bird assemblage consistently has the highest bird abundance because the majority of the INL Site consists of shrub-steppe and grassland habitats. The second most abundant species assemblage was sagebrush obligates representing 25.1% of all observations (Figure 3). In the past seven years the abundance of species in this category has averaged 28% (range = 25% to 35%). As indicated earlier, recent fires on the INL Site have reduced the amount of sagebrush habitat. Such reduction in sagebrush most likely has affected the abundance of sagebrush-obligate species. Further analyses needs to be conducted to verify this relationship.



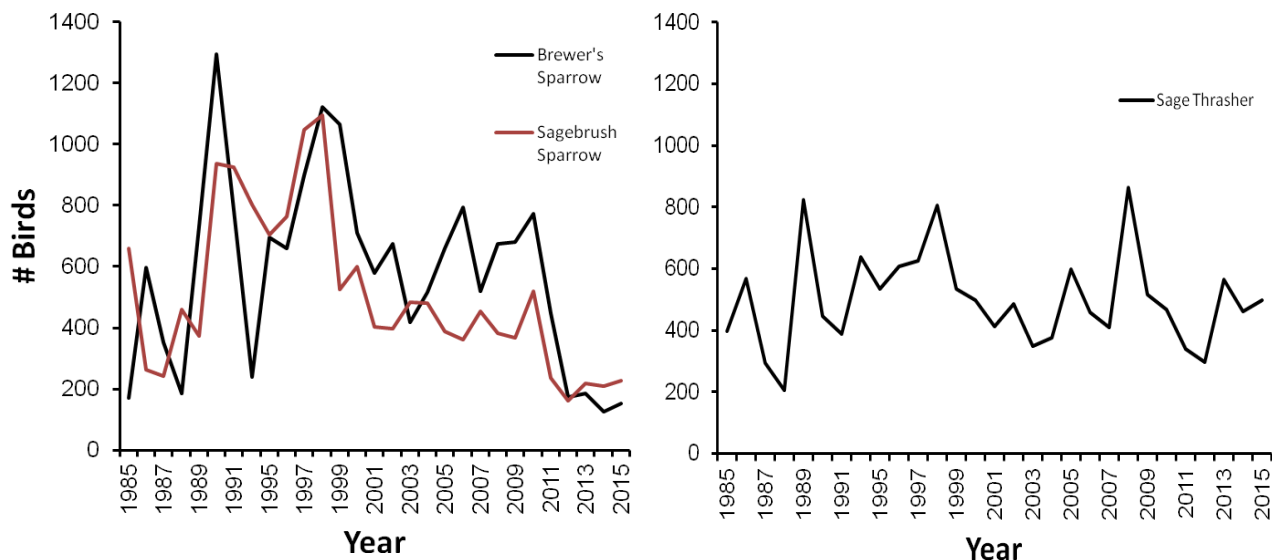
**Figure 3. Summary of species assemblage for Breeding Bird Surveys of remote and facility routes on the Idaho National Laboratory Site in 2015.**

## Shrub-steppe/Grassland

Species representing the shrub-steppe/grassland assemblage have always been observed in the greatest number in past BBSs, and they dominated observations in 2015 with 2,071 individuals (59.1%). Common shrub-steppe/grassland species include horned lark, western meadowlark, brown-headed cowbird (*Molothrus ater*), and vesper sparrow (*Pooecetes gramineus*). Western meadowlark ( $n = 667$ ) and horned lark ( $n = 897$ ) were the most abundant species in this assemblage, and were ranked as the top two most abundant species for the entire survey (Table 2). Annual horned lark observations between 2002 and 2014 have averaged 1,365 birds, whereas the average number observed between 1985 and 2001 was 699 birds. We suspect that the high abundance of horned lark in recent years is a response to wildfires that have converted shrub-dominated habitat into grassland communities. Further investigation of this hypothesis may provide useful insight into the effects of wildfire on passerine bird communities.

## Sagebrush Obligates

The sagebrush obligate assemblage had the second highest species abundance with 881 individuals (25.1% of total). This assemblage includes Brewer's sparrow, sagebrush sparrow, sage thrasher, and greater sage-grouse. Sage thrasher was the most abundant sagebrush obligate ( $n=499$ ), followed by sagebrush sparrow ( $n=227$ ) and Brewer's sparrow ( $n=154$ ). Since 1985, sage thrasher counts have fluctuated, but appear to be stable. Sagebrush and Brewer's sparrows, however, are at historically low levels (Figure 4). Since 2011, sagebrush sparrow observations ranged from 161–237, all of which are lower than the previous low count of 241 individuals recorded in 1987. Brewer's sparrow observations in 2014 and 2015 were the lowest recorded since 1985, and four of the lowest six counts have occurred since 2012.



**Figure 4. Trends of three sagebrush obligates observed during Breeding Bird Surveys since 1985.**

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

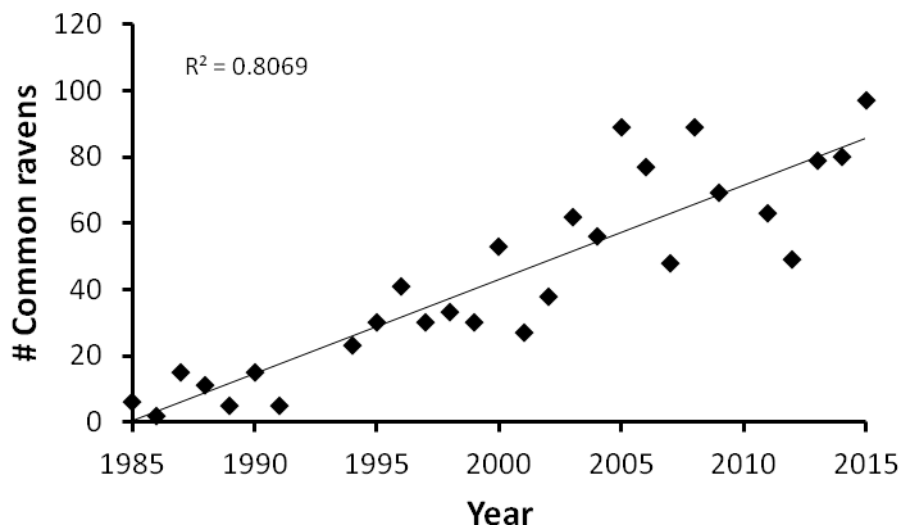
declines in the number of observations of Brewer's and sagebrush sparrows correspond with these fires. It is not clear, however, why sage thrasher abundance has apparently not been affected.

Surveys in the western U.S. indicate that populations of horned larks, western meadowlarks, Brewer's sparrows, and sagebrush sparrows have all declined across their range (Knick et al. 2003; Sauer and Link 2011). As sagebrush obligates are experiencing population declines from habitat loss and disturbance (Knick et al. 2003), it is encouraging to see the relatively high abundance of these species each year on the INL Site. Recent fires on the INL Site, however, have reduced the amount of sagebrush habitat. Such reduction in habitat most likely has affected the total abundance of birds, including sagebrush obligates in this area.

### Raptors, Corvids, and Shrikes

The raptor and corvid assemblage consisted of 244 observations representing 7.0% of the total count. Among these were nine species of raptors (eagles, hawks, falcons, and owls). Ferruginous hawk (*Buteo regalis*) was the most abundant raptor with 15 individuals observed. Observations that were notable in 2015 included 17 loggerhead shrikes (*Lanius ludovicianus*), which was substantially lower than the average of 31 loggerhead shrikes per year between 1985 and 2014.

The corvid family includes ravens (*Corvus* spp.), crows (*C. spp.*), and magpies (*Pica* spp.). The common raven (*C. corax*) was the most abundant species within this assemblage in 2015 ( $n=97$ ). The number of common ravens observed in 2015 was higher than any other year except 2010 (Figure 5) (data from 2010 was excluded as an outlier because 280 ravens were observed, mostly in a single, large flock). Though native to Idaho, the common raven is an effective nest predator



**Figure 5. Common raven observations during breeding bird surveys on the INL Site 1985-2015. 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.**

of sage-grouse, and DOE is concerned about the potential impact common ravens may have on nesting sage-grouse (DOE and USFWS 2014). There is some evidence that territory-holding

mated pairs may be primarily responsible for sage-grouse nest predation, rather than non-territorial juvenile flocks (Bui et al 2010). It is unclear how many common ravens observed during the breeding bird survey are mated pairs and how many are unmated, so the trend reported here may not be a good indicator of the level of nest predation risk to sage-grouse.

### **Urbanized and Exotics**

The urbanized and exotics assemblage represents birds associated with urban or human-altered environments, which are most commonly found around INL Site facilities. Examples of these species include European starling (*Sturnus vulgaris*), rock dove (*Columba livia*), and American robin (*Turdus migratorius*). This assemblage constituted 4.7% ( $n = 165$ ) of the total observations in 2015. The barn swallow (*Hirundo rustica*) was the most abundant species observed in this assemblage (114 individuals), followed by European starling (24 individuals).

### **Waterfowl**

Waterfowl are commonly observed during the BBS even though little standing water exists on the INL Site. With the exception of the ephemeral Big Lost River and the Big Lost River Sinks Wetland, the only standing water bodies on the INL Site are wastewater treatment ponds near facilities. These man-made ponds serve as stopover locations for migrating birds and a number of different species have been observed using these areas since 1985.

We documented 10 individuals from three waterfowl species, Northern Shoveler (*Anas clypeata*,  $n = 4$ ), Mallard (*Anas platyrhynchos*,  $n = 4$ ), and American coot (*Fulica americana*,  $n = 2$ ) representing 0.3% of total observations. As in past years, these three species have been observed along the facility routes.

### **Shorebirds**

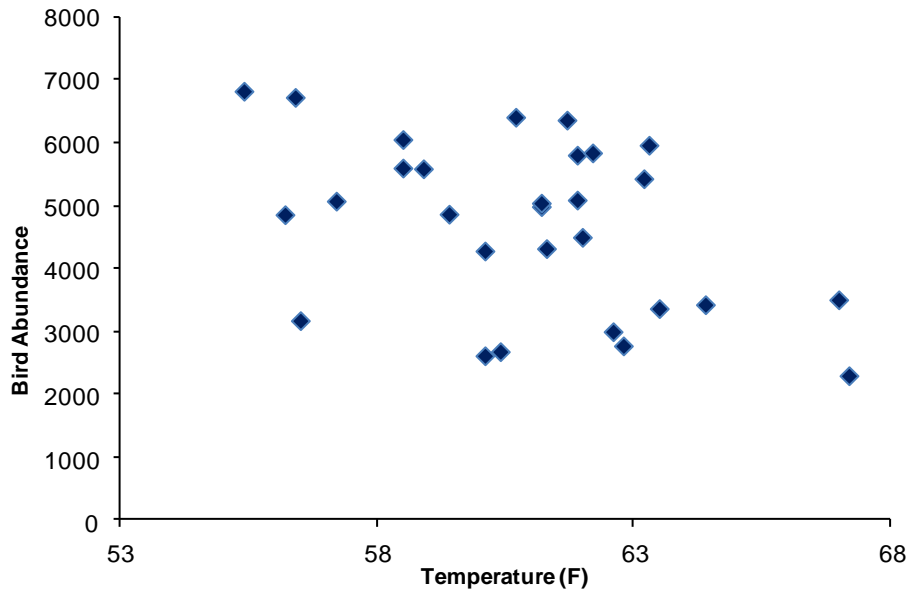
We observed 129 individuals representing five species from the shorebird assemblage, which accounted for 3.7% of the total BBS observations. Because standing water is rare on the INL Site, most observations of shorebirds occurred in proximity to waste ponds near facility routes. Franklin's gull ( $n = 76$ ), killdeer (*Charadrius vociferous*,  $n = 15$ ), willet (*Catoptrophorus semipalmatus*,  $n = 15$ ), long-billed curlew (*Numenius americanus*,  $n = 7$ ), and great blue heron (*Ardea herodias*  $n = 1$ ) comprised all observations.

### **Other Birds**

Two bird species that were not assigned to any species assemblage were observed in 2015. These species were the western tanager (*Piranga ludoviciana*,  $n = 2$ ) and an unknown hummingbird ( $n = 1$ ).

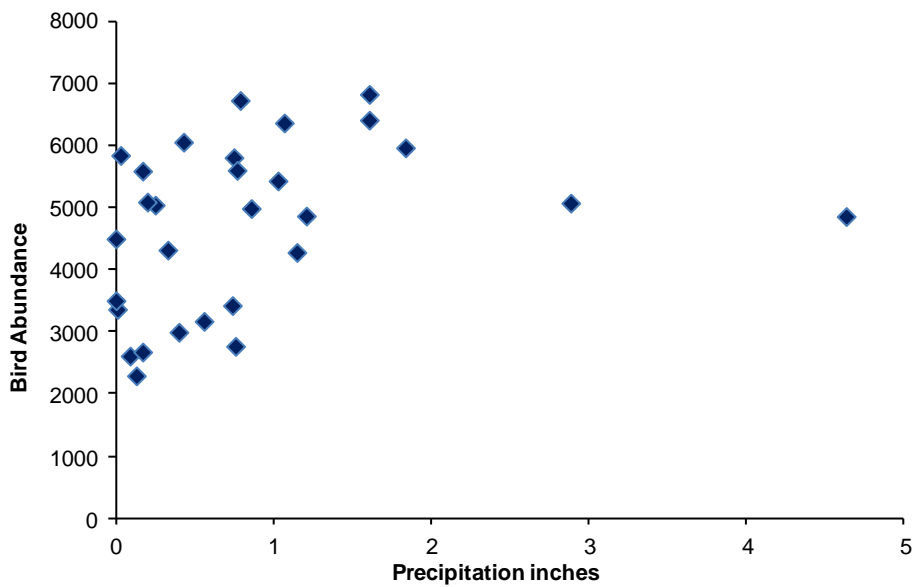
### **Bird Abundance Correlation**

Bird abundance was negatively correlated, though not significantly ( $r_s = -0.34$ ,  $n = 29$ ,  $P = 0.07$ ), with mean June temperature (Figure 6). This trend is consistent with previous findings from BBSs on the INL Site (Belthoff et al. 1998, Belthoff and Ellsworth 1999) and suggests that June temperature may be an important consideration when interpreting BBS results. We recommend that future data analyses use multivariate techniques to test for strength of each independent variable (i.e., temperature, date of survey, or observer) that could influence bird abundance.



**Figure 6. Relationship between total bird abundance at the Idaho National Laboratory Site and the average June temperature recorded at the Central Facilities Area from 1985 to 2015.**

Bird abundance was significantly correlated with total precipitation in June ( $r_{sc} = 0.46$ ,  $n = 29$ ,  $P = 0.01$ ; Figure 7). These results also support previous analyses (Bethoff and Ellsworth 1999). Therefore, precipitation is an important variable to be considered when interpreting changes in annual BBS abundance.



**Figure 7. Relationship between bird abundance at the Idaho National Laboratory Site and total June precipitation recorded at the Central Facilities Area from 1985 to 2015.**

### Community Diversity Index

Based on both of Shannon's measures of diversity, the CFA Route had the most diverse bird community of all 13 routes ( $H = 2.36$ ,  $E_H = 0.76$ ; Table 3), followed by the Kyle Canyon Route ( $H = 2.24$ ,  $E_H = 0.75$ ). Tractor Flats had the highest species richness ( $n = 27$ ). Kyle Canyon had the most diverse bird community among remote routes based on both of Shannon's indicators. The PBF Route had the lowest diversity among facility routes based on Shannon's measures of diversity ( $H = 1.69$ ;  $E_H = 0.71$ ), and Lost River was the least diverse among remote routes based on richness and  $H$  ( $n = 13$ ;  $H = 1.74$ ). Overall, PBF was the least diverse of all routes.

Over the past seven years, CFA is the only route that has been among the top three in regards to diversity each year. RWMC has been among the three most diverse during six of the past nine years. During the same time, Tractor Flats has had the highest or second highest species richness. This information indicates that the area surrounding CFA and RWMC (building, trees, and waste-water ponds) may provide unique 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 total number of unique birds that are detected in that area.

**Table 3. Values for species richness, Shannon Diversity ( $H$ ), and Equitability ( $E_H$ ) indices for the 2015 Idaho National Laboratory Site Breeding Bird Surveys.**

Route	Species Richness	Shannon's $H$	Shannon's $E_H$
Remote Routes			
Twin Buttes	17	2.16	0.76
Kyle Canyon	20	2.24	0.75
Tractor Flats	27	2.30	0.70
Circular Butte	15	1.82	0.67
Lost River	13	1.74	0.68
Facility Routes			
INTEC	13	2.10	0.82
NRF	16	2.15	0.78
CFA	22	2.36	0.76
RWMC	16	2.09	0.75
ATRC	14	1.90	0.72
PBF	11	1.69	0.71
MFC	18	1.99	0.69
TAN	17	1.85	0.65

## 2.0 CONCLUSION

As in most previous years, birds belonging to shrub-steppe and grassland community assemblages dominated observations on the INL Site in 2015. However, the total number of birds observed ( $n = 3,503$ ) and species richness ( $n = 52$ ) across all routes was lower than average ( $\bar{x} = 4,748$ ;  $\bar{x} = 56$ ). Though only correlative, historically low observations of Brewer's and sagebrush sparrows since 2011 suggest that large-scale wildland fire has had at least a temporary



negative impact on these sagebrush-obligate passerines. Furthermore, though the BBS is not designed to accurately survey greater sage-grouse, the continually increasing number of common ravens observed during BBSs indicates that the risk of predation may be increasing.

Following patterns of abundance from most of the previous BBSs on the INL Site, the horned lark was the most abundant species, followed by western meadowlark, mourning dove, sage thrasher, sagebrush sparrow, and Brewer's sparrow. These species have been consistently among the most abundant species each year of the BBS.

### 3.0 ACKNOWLEDGEMENTS

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## **Appendix A**

### **SUMMARY OF SPECIES BY ROUTE 2015**

Survey Route: <b>RWMC</b>		
Survey Date: <b>May 29, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Mourning Dove	69	35.03
Western Meadowlark	32	16.24
Horned Lark	25	12.69
Sage Thrasher	20	10.15
Brewer's Sparrow	11	5.58
Sagebrush Sparrow	7	3.55
Barn Swallow	6	3.05
Brown-headed Cowbird	6	3.05
Rock Wren	5	2.54
Northern Shoveler	4	2.03
European Starling	3	1.52
Killdeer	3	1.52
Red-winged Blackbird	3	1.52
Common Raven	1	0.51
Mallard	1	0.51
Western Kingbird	1	0.51
<b>Total Individuals</b>		
	<b>197</b>	
<b>Total Species</b>		
	<b>16</b>	

Survey Route: <b>Lost River</b>		
Survey Date: <b>June 1, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	104	34.32
Western Meadowlark	92	30.36
Sage Thrasher	35	11.55
Sagebrush Sparrow	22	7.26
Brewer's Sparrow	18	5.94
Common Raven	14	4.62
Mourning Dove	6	1.98
Vesper Sparrow	6	1.98
Red-tailed Hawk	2	0.66
American Robin	1	0.33
Greater Sage-Grouse	1	0.33
Northern Harrier	1	0.33
Say's Phoebe	1	0.33
<b>Total Individuals</b>		
	<b>303</b>	
<b>Total Species</b>		
	<b>13</b>	

Survey Route: <b>RTC</b>		
Survey Date: <b>June 3, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	68	33.66
Western Meadowlark	50	24.75
Sage Thrasher	24	11.88
Brewer's Sparrow	20	9.90
Vesper Sparrow	12	5.94
Barn Swallow	8	3.96
Common Raven	7	3.47
American Robin	3	1.49
Mourning Dove	3	1.49
Brewer's Blackbird	2	0.99
Sagebrush Sparrow	2	0.99
Cliff Swallow	1	0.50
Franklin's Gull	1	0.50
Rock Wren	1	0.50
<b>Total Individuals</b>		
	<b>202</b>	
<b>Total Species</b>		
	<b>14</b>	

Survey Route: <b>Tractor Flats</b>		
Survey Date: <b>June 5, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Western Meadowlark	146	24.83
Horned Lark	133	22.62
American Crow	66	11.22
Sage Thrasher	40	6.80
Franklin's Gull	39	6.63
Mourning Dove	35	5.95
Sagebrush Sparrow	27	4.59
Brewer's Sparrow	26	4.42
Common Raven	26	4.42
Black-billed Magpie	12	2.04
Long-billed Curlew	7	1.19
Vesper Sparrow	5	0.85
Barn Swallow	3	0.51
House Sparrow	3	0.51
Northern Harrier	3	0.51
Brown-headed Cowbird	2	0.34
Common Nighthawk	2	0.34
Eastern Kingbird	2	0.34
Red-tailed Hawk	2	0.34
Rock Pigeon	2	0.34
Brewer's Blackbird	1	0.17
Cliff Swallow	1	0.17
European Starling	1	0.17
Grasshopper Sparrow	1	0.17
Prairie Falcon	1	0.17
Swainson's Hawk	1	0.17
Western Kingbird	1	0.17
<b>Total Individuals</b>		
	<b>588</b>	
<b>Total Species</b>		
	<b>27</b>	

Survey Route: <b>Circular Butte</b>		
Survey Date: <b>June 8, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	139	38.08
Western Meadowlark	89	24.38
Sage Thrasher	37	10.14
Franklin's Gull	30	8.22
Sagebrush Sparrow	22	6.03
Brewer's Sparrow	16	4.38
Common Raven	13	3.56
Mourning Dove	6	1.64
Vesper Sparrow	4	1.10
Grasshopper Sparrow	3	0.82
Common Nighthawk	2	0.55
Ferruginous Hawk	1	0.27
Lark Bunting	1	0.27
Northern Harrier	1	0.27
Red-tailed Hawk	1	0.27
<b>Total Individuals</b>		
	<b>365</b>	
<b>Total Species</b>		
	<b>15</b>	

Survey Route: <b>MFC</b>		
Survey Date: <b>June 9, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	53	32.12
Western Meadowlark	52	31.52
Sage Thrasher	11	6.67
Barn Swallow	9	5.45
Brewer's Blackbird	9	5.45
Yellow-headed Blackbird	6	3.64
Brewer's Sparrow	4	2.42
Common Raven	3	1.82
Mallard	3	1.82
Sagebrush Sparrow	3	1.82
American Coot	2	1.21
Killdeer	2	1.21
Mourning Dove	2	1.21
Western Kingbird	2	1.21
American Robin	1	0.61
Brown-headed Cowbird	1	0.61
European Starling	1	0.61
House Finch	1	0.61
<b>Total Individuals</b>		
	<b>165</b>	
<b>Total Species</b>		
	<b>18</b>	



Survey Route: <b>Kyle Canyon</b>		
Survey Date: <b>June 17, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Sage Thrasher	73	23.03
Western Meadowlark	64	20.19
Horned Lark	49	15.46
Sagebrush Sparrow	40	12.62
Mourning Dove	27	8.52
Ferruginous Hawk	13	4.10
Common Raven	10	3.15
Brewer's Sparrow	7	2.21
Common Nighthawk	5	1.58
Black-billed Magpie	4	1.26
Franklin's Gull	4	1.26
Vesper Sparrow	4	1.26
Loggerhead Shrike	3	0.95
Swainson's Hawk	3	0.95
Western Kingbird	3	0.95
Gray Flycatcher	2	0.63
Rock Wren	2	0.63
Western Tanager	2	0.63
Lark Sparrow	1	0.32
Red-tailed Hawk	1	0.32
<b>Total Individuals</b>		
	<b>317</b>	
<b>Total Species</b>		
	<b>20</b>	

Survey Route: <b>CFA</b>		
Survey Date: <b>June 19, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Western Meadowlark	64	27.12
Sage Thrasher	47	19.92
Horned Lark	31	13.14
European Starling	16	6.78
Sagebrush Sparrow	11	4.66
American Robin	10	4.24
Brewer's Sparrow	9	3.81
Barn Swallow	6	2.54
Brewer's Blackbird	6	2.54
Common Raven	6	2.54
Killdeer	6	2.54
Mourning Dove	4	1.69
Cliff Swallow	3	1.27
Common Nighthawk	3	1.27
House Finch	3	1.27
Western Kingbird	3	1.27
American Kestrel	2	0.85
Say's Phoebe	2	0.85
Great Horned Owl	1	0.42
Great Blue Heron	1	0.42
Rock Wren	1	0.42
Vesper Sparrow	1	0.42
<b>Total Individuals</b>		
	<b>236</b>	
<b>Total Species</b>		
	<b>22</b>	

Survey Route: <b>INTEC</b>		
Survey Date: <b>June 23, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	39	25.00
Sage Thrasher	33	21.15
Brewer's Sparrow	20	12.82
Cliff Swallow	18	11.54
Western Meadowlark	14	8.97
Barn Swallow	11	7.05
Sagebrush Sparrow	8	5.13
Common Raven	3	1.92
European Starling	3	1.92
Brewer's Blackbird	2	1.28
Loggerhead Shrike	2	1.28
Vesper Sparrow	2	1.28
Mourning Dove	1	0.64
<b>Total Individuals</b>		
	<b>156</b>	
<b>Total Species</b>		
	<b>13</b>	

Survey Route: <b>TAN</b>		
Survey Date: <b>June 25, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	75	35.21
Sagebrush Sparrow	45	21.13
Sage Thrasher	43	20.19
Mourning Dove	15	7.04
Vesper Sparrow	13	6.10
Common Nighthawk	5	2.35
Brewer's Sparrow	2	0.94
Brown-headed Cowbird	2	0.94
Grasshopper Sparrow	2	0.94
Swainson's Hawk	2	0.94
Franklin's Gull	2	0.94
Brewer's Blackbird	2	0.94
Barn Swallow	1	0.47
Common Raven	1	0.47
Ferruginous Hawk	1	0.47
Red-tailed Hawk	1	0.47
Western Kingbird	1	0.47
<b>Total Individuals</b>		
	<b>213</b>	
<b>Total Species</b>		
	<b>17</b>	

Survey Route: <b>PBF</b>		
Survey Date: <b>June 26, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Mourning Dove	105	37.50
Horned Lark	61	21.79
Sage Thrasher	57	20.36
Western Meadowlark	17	6.07
Sagebrush Sparrow	16	5.71
Brewer's Sparrow	10	3.57
Vesper Sparrow	7	2.50
Common Raven	3	1.07
Barn Swallow	2	0.71
Loggerhead Shrike	1	0.36
Northern Harrier	1	0.36
<b>Total Individuals</b>		
	<b>280</b>	
<b>Total Species</b>		
	<b>11</b>	

Survey Route: <b>Twin Buttes</b>		
Survey Date: <b>June 29, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Horned Lark	74	33.18
Sage Thrasher	36	16.14
Western Meadowlark	31	13.90
Mourning Dove	13	5.83
Sagebrush Sparrow	12	5.38
Loggerhead Shrike	11	4.93
Vesper Sparrow	11	4.93
Brown-headed Cowbird	9	4.04
Common Raven	7	3.14
Swainson's Hawk	5	2.24
Common Nighthawk	5	2.24
Brewer's Sparrow	2	0.90
Mountain Bluebird	2	0.90
Red-tailed Hawk	2	0.90
Burrowing Owl	1	0.45
Unknown Hummingbird	1	0.45
Western Kingbird	1	0.45
<b>Total Individuals</b>		
	<b>223</b>	
<b>Total Species</b>		
	<b>17</b>	

Survey Route: <b>NRF</b>		
Survey Date: <b>June 30, 2015</b>		
<b>Species</b>	<b>Abundance</b>	<b>Percentage</b>
Barn Swallow	68	26.36
Horned Lark	46	17.83
Sage Thrasher	43	16.67
Willet	30	11.63
Western Meadowlark	16	6.20
Sagebrush Sparrow	12	4.65
Mourning Dove	10	3.88
Brewer's Sparrow	9	3.49
Common Nighthawk	7	2.71
Vesper Sparrow	6	2.33
Killdeer	4	1.55
Common Raven	3	1.16
Brewer's Blackbird	1	0.39
Prairie Falcon	1	0.39
Peregrine Falcon	1	0.39
Rock Wren	1	0.39
<b>Total Individuals</b>		
	<b>258</b>	
<b>Total Species</b>		
	<b>16</b>	