Results of 2012 Breeding Season Surveys for Burrowing Owls along established Point-Count Routes within the BLM Shoshone Field Office

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ABSTRACT: The Idaho Bird Observatory conducted breeding season surveys for Burrowing Owls along previously-established survey routes (Belthoff and Boves 2005) across the Bureau of Land Management (BLM) Shoshone Field Office (SFO) in south-central Idaho from late-April to mid-July 2012. Survey routes were established and surveyed by Belthoff and Boves (2005) in response to concerns that the number of Burrowing Owls breeding within the study area had declined markedly since 1976-1983 (Rich 1985, Red Willow Research 2004). We used a standardized survey protocol consisting of silent listening and call playback at 32 survey routes consisting of 10 survey points each. We surveyed each route three times during the 2012 season. In addition, we attempted to find occupied nest burrows whenever possible. We also recorded incidental observations of Burrowing Owls and other species of concern to the BLM. In this report, we present 2012 findings and also compare results to historic 2005 and 2008 results. During 2012 surveys, we detected a total of 36 adult Burrowing Owls and also observed 19 juvenile (young-of-the-year) owls. We detected Burrowing Owls on 14 of the 32 routes (43.8%), including 40% (10 of 25) of *systematic* routes and 57.1% (4 of 7) of *supplemental* routes. We located a total 12 occupied nest burrows during 2012. Survey efforts in 2008 and 2012 have resulted in relatively comparable numbers of owl detections and nesting owls, although fewer owls were detected during 2012 surveys. Also, we detected owls on fewer transects in 2012 (14) than were detected in 2008 (20).

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INTRODUCTION

The Burrowing Owl (*Athene cunicularia*) inhabits grassland, prairie, and open sage habitats (Poulin et al. 2011). Throughout most of their range, Burrowing Owls utilize the unoccupied burrows of Prairie Dogs (*Cynomys* spp.) for nesting (Poulin et al. 2011). Because Prairie Dogs are absent from our study area in south-central Idaho, Burrowing Owls largely depend on the unoccupied burrows of American Badgers (*Taxidea taxus*) and/or natural openings in areas of lava outcrops.

Throughout their range, populations of Burrowing Owls have declined. The species is classified as Endangered in Canada, is a species with Special Protection in Mexico, and is a "Special Status" species in at least 9 western states (Poulin et al. 2011). In Idaho, the species is currently listed as a 'Species of Greatest Conservation Need' by Idaho Department of Fish and Game, a 'Watch List species' by the Bureau of Land Management, and as a 'Bird Species of Conservation Concern' by the U.S. Fish and Wildlife Service.

Burrowing Owls were intensively studied from 1976-1983 in south-central Idaho, primarily within the Shoshone Field Office (SFO) of the Bureau of Land Management (BLM), during which time 242 nest sites were located (Rich 1985). In 2003, the Shoshone Field Office began an effort to assess current Burrowing Owl populations and compare to historic data. Red Willow Research (2004) attempted to revisit the historically-used sites documented by Rich (1985) to determine if Burrowing Owls were continuing to use these sites. Only four of the 225 historical nest sites revisited were occupied in 2003 (Red Willow Research 2004). They did locate an additional eight new nest sites within the SFO but, of the 12 nest sites monitored in 2003, only three fledged young (Red Willow Research 2004). Whereas these data could suggest a substantial population decline as well as lowered reproductive success relative to historic data, this study did not address the potential for nesting sites to have shifted over two decades – a prospect that is quite likely in a species that depends on burrows for nesting, many of which could erode/collapse over time while others are created. Thus, a more systematic survey effort was deemed necessary to better gauge the current status of Burrowing Owls.

In 2005, under the guidance of the BLM SFO, Belthoff and Boves (2005) established 32 survey routes on public lands across the SFO within potentially suitable Burrowing Owl habitat. They conducted surveys on all 32 routes following a standardized listening and call broadcast survey protocol designed specifically for detecting Burrowing Owls (Conway and Simon 2003). The BLM Shoshone Field Office has established a goal of repeating these surveys on three-to-five year intervals. Surveys were repeated three years later in 2008, and again in 2012. Here, we report the results of 2012 breeding season surveys and compare 2012 results with 2005 and 2008 (Belthoff and Boves 2005, Carlisle and Kaltenecker 2012).

METHODS

Study Area

The survey routes established by Belthoff and Boves (2005) are spread across five counties (Blaine, Gooding, Jerome, Lincoln, and Minidoka) in south-central Idaho and follow paved, gravel, or two-track roads (Figure 1; see also Appendix A in Belthoff and Boves 2005). Habitats along survey routes are comprised primarily of shrubsteppe and disturbed/rehabilitated grassland, and lava outcrops are common in some areas. Though all survey routes were established on public lands, irrigated agriculture occurs on private lands adjacent to some routes (Appendix 1). Of the 32 routes established by Belthoff and Boves (2005), 25 "systematic" routes were placed without respect to historical breeding locations and seven routes (4, 6, 7, 22, 23, 30, 33) are "supplemental" routes placed in areas of higher concentrations of historical breeding locations based on Rich (1985). See Belthoff and Boves (2005) for further discussion of the rationale behind establishment of ***systematic*** (n=25) and ***supplementary*** routes (n = 7).

Survey Methods

The following methodology is drawn extensively from Conway and Simon (2003) and Belthoff and Boves (2005). Survey routes are approximately 7.2 km (4.5 mi) in length and include 10 survey points separated by ≥ 0.8km (0.5 mi). Following Conway and Simon (2003) and Belthoff and Boves (2005), we visited each survey route 3 times to maximize detection probability. We conducted surveys between late April (pre-incubation to incubation periods) and mid-July (nestling period) 2012, with visits to each route separated by two to

three weeks (Table 1). We conducted surveys from 1700 hr until approximately 0.5 hr after sunset, and in a few cases (see Table 1) surveys were conducted from 0600 hr until 1100 hr, as per Conway and Simon (2003). The standardized protocol at each survey point included an initial 3-min passive observation segment followed by a 3-min call-broadcast segment (Conway and Simon 2003). For the 3-min call-broadcast segment, we broadcast a series of 30 sec call broadcasts (*coo-coo* call and alarm call broadcast using a Foxpro digital caller) interspersed with 30 sec of silence. During each point-count survey, the observer thoroughly scanned the surrounding area, both with binoculars and naked-eye, and listened for Burrowing Owl vocalizations during the entire 6-min survey. For each point-count location, we recorded the number of adult and juvenile owls as well as the number and location of presumed nest sites. On subsequent visits, we monitored nests from a distance with binoculars and, if necessary, by approaching more closely in order to determine nest status. Following Belthoff and Boves (2005), we considered a nest successful we observed fledglings or if nestlings reached approximately 80% of fledging age and if we found no obvious signs of predation on subsequent visits.

Belthoff and Boves (2005) categorized dominant cover types at each point-count location and noted other landscape features pertinent to Burrowing Owls. In 2012, we collected similar data.

RESULTS

Survey Results

We surveyed each route three times between 28 April and 12 July 2012 (Table 1). Over the three surveys combined, we detected 55 Burrowing Owls (36 adults and 19 juveniles). We detected Burrowing Owls on 14 of the 32 routes (43.8%), including 40% (10 of 25) of *systematic* routes and 57.1% (4 of 7) of *supplemental* routes. We recorded the greatest number of Burrowing Owls on Routes 7 (supplemental), 25 (systematic), and 30 (supplemental; n = 8, 8, and 14 respectively). Although we detected owls on a higher proportion of supplemental routes (57.1%) than systematic routes (40.0%), our detection frequency was not different between route type (Chi-square contingency analysis to test for independence: P = 0.86). Moreover, although we detected a higher number of owls along

supplemental (1.86 ± 0.67 owls per route) than *systematic* (0.92 ± 0.27) routes, the difference was not significant (P = 0.14).

Burrowing Owls were detected at 33 (10.3%) of the 320 survey points (Table 2). We detected owls at 17 (6.8%) of 250 points along *systematic* routes, and at 16 of 70 (22.9%) points along *supplemental* routes. Belthoff and Boves (2005) noted that owl detections were frequently clustered (multiple owls detected along single transect), but Carlisle and Kaltenecker (2012) found single owls on 10 of 20 (50%) transects in 2008. In 2012 we only had single owl detections on 3 of 14 (21%) transects (Table 2). 2012 results aligned more with 2005 in that owl detections were frequently clustered (11 of 14 transects; 73%).

The proportion of owls detected prior to playback (during the initial 3 min listening period) versus after the beginning of call broadcasts was different in 2012 than both 2005 and 2008. In 2005 and 2008 the majority of owls (73.1% and 77.1 % respectively) were detected *during* playback broadcast, but in 2012 most of the owls were detected *prior* to the playback broadcast period (66.6% detected before call playback).

Occupied Nests

We located 11 occupied burrows during 2012 (Table 3). Three of the 11 nests found during surveys occurred along *supplemental* routes; 5 were found along *systematic* routes, while the remaining 3 were located incidentally between survey routes (Table 3).

Figure 1. Location of the 32 point-count survey routes established on the BLM Shoshone Field Office by Belthoff and Boves (2005) and re-surveyed by the Idaho Bird Observatory – Boise State University in 2008 and 2012.

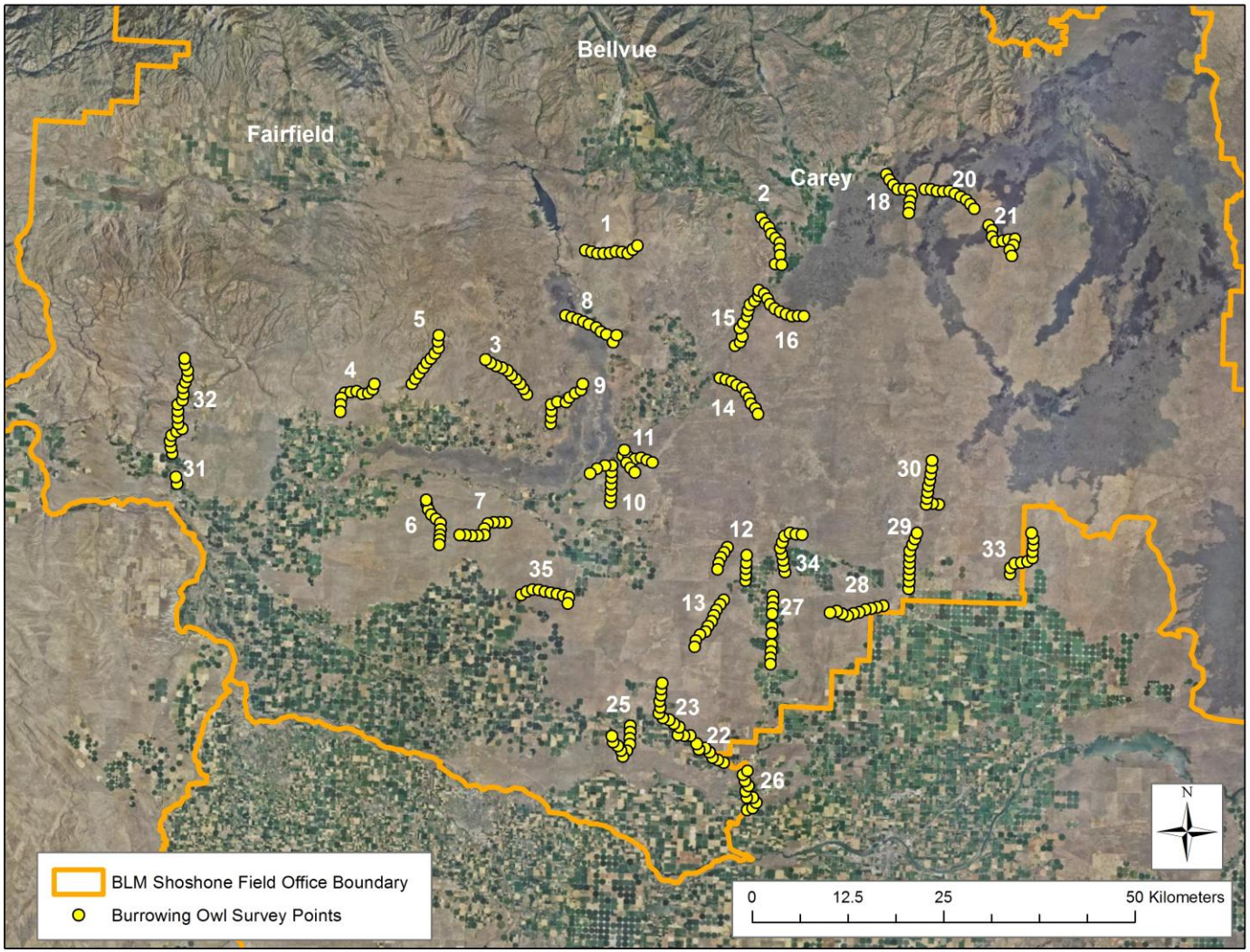

Table 1. Survey routes, UTMs of the 1st survey point within each route, Township/Ranges, and dates of surveys for established Burrowing Owl point-count routes within the BLM Shoshone Field Office, 2012.

Removed due to sensitive location information.

Table 2. Comparison of Burrowing Owls detected during 2005, 2008, and 2012 breeding seasons on established point-count survey routes within the BLM Shoshone Field Office. "Juv" = nestlings detected. 2005 results from Belthoff and Boves (2005) and 2008 results from Carlisle and Kaltenecker (2012). **Note – the subtotal for each route accounts for repeat detections of presumably the same individual.**

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
1	3	2	10-Jun	-	1	-
	5	1	21-May	-	2	-
	5	2	10-Jun	-	2	-
	5	3	1-Jul	-	2	-
	7	1	15-May	-	-	1
	9	1	7-May	2	-	-
	9	2	30-May	1	-	-
	10	3	21-Jun	1	-	-
	10	1	21-May	-	1	-
			Route 1 Subtotal	**3**	**4**	**1**
3	4	1	21-May	-	2	-
	5	1	21-May	-	1	-
	6	1	21-May	-	2	-
	10	1	21-May	-	1	-
			Route 3 Subtotal	**0**	**6**	**0**
4	1	1	23-May	-	1	-
	1	1	12-May	-	-	2*
	1	2	3-Jun	-	2	-
	1	2	1-June	-	-	1*
	1	3	25-Jun	-	1	-
	1	3	25-Jun	-	-	2*
	2	1	23-May	-	1	-
	2	1	12-May	-	-	1*
	4	2	3-Jun	-	1	-
	5	1	23-May	-	1	-
	5	2	3-Jun	-	1	-
	6	1	17-May	2	-	-
	7	1	17-May	1	-	-
	7	2	1-Jun	1	-	-
	7	2	3-Jun	-	1	-
	8	1	23-May	-	1	-
	9	1	23-May	-	2	-

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
	9	2	3-Jun	-	1	-
	10	1	12-May	-	-	1
			Route 4 Subtotal	**3**	**9**	**3**
5	4	1	23-May	-	1	-
			Route 5 Subtotal	**0**	**1**	**0**
6	2	3	27-Jun	-	-	1
	6	1	23-May	-	1*	-
	7	1	23-May	-	1*	-
	7	1	1-May	-	-	2*
	8	2	31-May	-	-	1*
			Route 6 Subtotal	**0**	**1**	**3**
7	1	3	27-Jun	-	-	1*
	2	1	4-May	1	-	-
	2	1	1-May	-	-	1*
	2	2	28-May	2	-	-
	2	3	16-Jun	2 (+1 Juv)	-	-
	2	3	27-May	-	-	1*
	3	1	4-May	1	-	-
	4	3	16-Jun	2	-	-
	4	1	23-May	-	1	-
	6	1	4-May	2	-	-
	6	2	28-May	1	-	-
	6	3	16-Jun	1	-	-
	7	1	1-May	-	-	2
	7	3	27-Jun	-	-	2 (+5 Juv)
	10	1	4-May	1	-	-
			Route 7 Subtotal	**8 (+1 Juv)**	**1**	**3 (+5 Juv)**
9	4	1	21-May	-	1	-
			Route 9 Subtotal	**0**	**1**	**0**
10	1	1	4-May	1	-	-
	1	3	15-Jun	1	-	-
	2	1	4-May	2	-	-
	2	2	28-May	1	-	-
	2	3	15-Jun	2	-	-

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
	3	1	4-May	2	-	-
	4	1	2-May	-	-	1
	4	2	8-Jun	-	-	2
	4	3	26-Jun	-	-	1
	5	1	4-May	1	-	-
	5	3	15-Jun	2	-	-
	5	1	22-May	-	1	-
	6	1	4-May	2	-	-
	6	3	15-Jun	1	-	-
			Route 10 Subtotal	**9**	**1**	**2**
11	9	1	22-May	-	1	-
			Route 11 Subtotal	**0**	**1**	**0**
13	1	1	22-May	-	1	-
	3	2	17-Jun	-	2	-
	5	1	22-May	-	1	-
	6	2	22-Jun	-	-	1*
	8	2	22-Jun	-	-	1*
			Route 13 Subtotal	**0**	**4**	**1**
14	6	1	19-May	1	-	-
	8	1	24-May	-	-	-
			Route 14 Subtotal	**1**	**0**	**0**
15	9	1	14-Jun	1	-	-
			Route 15 Subtotal	**1**	**0**	**0**
16	3	3	28-Jun	-	-	1
	6	1	26-May	-	-	1
	8	1	24-May	-	1	-
	10	2	14-Jun	-	-	1
			Route 16 Subtotal	**-**	**1**	**3**
20	10	1	18-May	-	1	-
			Route 20 Subtotal	**-**	**1**	**0**
21	7	3	28-Jun	1	-	-
	9	1	18-May	1	-	-

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
	9	2	6-Jun	2	-	-
	9	3	29-Jun	-	-	-
	10	1	18-May	1	-	-
			Route 21 Subtotal	**4**	**0**	**0**
22	1	2	19-Jun	-	1	-
	2	1	8-May	1	-	-
	2	3	25-Jun	1	-	-
	2	1	25-May	-	1	-
	2	2	19-Jun	-	2	-
	2	3	10-Jul	-	2 (+2 juv)	-
	3	1	25-May	-	2	-
	3	2	19-Jun	-	2	-
	3	3	10-Jul	-	2 (+3 juv)	-
	4	1	8-May	1	-	-
	8	1	25-May	-	1	-
			Route 22 Subtotal	**2**	**6 (+5 juv)**	**0**
23	4	1	8-May	3	-	-
	4	2	10-Jun	1	-	-
	4	3	26-Jun	2	-	-
	4	1	25-May	-	1	-
	4	2	18-Jun	-	1	-
			Route 23 Subtotal	**3**	**1**	**0**
25	3	1	29-Apr	-	-	2*
	4	1	15-May	2	-	
	4	1	25-May	-	2	
	4	1	29-Apr	-	-	3*
	4	2	31-May	1	-	
	4	2	30-May	-	-	1*
	4	3	26-Jun	2 (+5 Juv)	-	
	4	3	8-Jul	-	2	
	4	3	12-Jul	-	-	2* (+4 Juv)
	5	1	29-Apr	-	-	1
	5	3	12-Jul	-	-	1*
	8	1	15-May	1	-	-
			Route 25 Subtotal	**3 (+5 Juv)**	**2**	**4 (+4 Juv)**

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
26	4	1	25-May	-	2	-
	5	1	25-May	-	3	-
	5	2	19-Jun	-	5	-
	5	3	10-Jul	-	5 (+5 Juv)	-
	9	1	25-May	-	2	-
			Route 26 Subtotal	**0**	**9 (+5 Juv)**	**0**
27	8	1	19-May	-	2	-
	9	1	19-May	-	1	-
	9	1	14-May	-	-	2
			Route 27 Subtotal	**0**	**3**	**2**
28	2	1	6-May	1	-	-
	2	2	22-May	2	-	-
	2	2	10-Jun	-	-	2
	7	2	10-Jun	-	-	2
			Route 28 Subtotal	**2**	**0**	**4**
29	6	1	24-May	-	-	1
	5	2	10-Jun	-	-	1
	6	2	10-Jun	-	-	2
	6	3	10-Jun	-	-	2
			Route 29 Subtotal	**2**	**0**	**3**
30	1	2	21-Jun	-	-	1
	2	2	21-Jun	-	-	1*
	3	2	21-Jun	-	-	1*
	3	3	9-Jul	-	-	1*
	4	3	9-Jul	-	-	1*
	5	2	21-Jun	-	-	1**
	6	2	21-Jun	-	-	1**
	7	2	21-Jun	-	-	1***
	7	3	9-Jul	-	-	1 (+10 Juv)***
	8	2	21-Jun	-	-	1***
	8	3	9-Jul	-	-	1***
			Route 30 Subtotal	**2**	**0**	**4 (+10 Juv)**

Route	Point	Visit	Date	2005 Results	2008 Results	2012 Results
31	9	1	13-May	-	1	-
	9	1	29-Apr	-	-	1
	9	3	1-Jul	-	-	1
			Route 31 Subtotal	**0**	**1**	**1**
33	1	1	18-May	-	1	-
			Route 33 Subtotal	**0**	**1**	**0**
34	9	2	7-Jun	2	-	-
	9	3	27-Jun	2	-	-
	9	1	19-May	-	2	-
	9	1	27-May	-	-	2
	9	3	10-Jul	-	-	1
	10	2	7-Jun	1	-	-
	10	3	27-Jun	1	-	-
	10	1	19-May	-	2	-
			Route 34 Subtotal	**3**	**4**	**2**
			GRAND TOTAL	**42 (+6 Juv)**	**58 (+10 Juv)**	**36 (+19 Juv)**

* same male owl at pts 6 & 7 in 2008

* and ** presumed same owls in 2012

Table 3. Location information and outcomes of Burrowing Owl nests found during the 2012 breeding season, BLM Shoshone Field Office.

Removed due to sensitive location information.

Passive Detection of Landbird Species of Concern

Though late afternoon is not the best time of day for detecting other landbird species, we also recorded presence of a suite of grassland and/or shrub-steppe dependent species as well as raptors. Species noted included: Greater Sage-grouse; Long-billed Curlew; Loggerhead Shrike; Sage Thrasher; Brewer's, Sage, Lark, and Grasshopper sparrows; and all raptor species detected. Note that effort was not standardized within or among transects or visits; thus, the results presented below are only a preliminary effort at examining the distribution of these species in the Shoshone field office.

Only three **Greater Sage-grouse** were detected: 2 males between points 20-10 and 21-1 (sage-grouse were located near this same point in 2008), and one female between points 14-09 and 14-10. **Long-billed Curlews** were detected along transects 4, 6, 7, 9, 23, 26, 27, 33 and 35. **Loggerhead Shrikes** were commonly detected along transects 8, 11, 12, 18, 20, 21, 26, 28, 29, and 33. **Sage Thrashers** were commonly detected along transects 3, 4, 5, 9, 11, 12, 14, 15, 21, 29, and 32. **Brewer's Sparrows** were commonly recorded at transects 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16, 18, 20, 21, 27, 28, 31, and 32. **Sage Sparrows** were uncommon and were detected at only four points 5-5, 18-10, 26-4, and 30-4. **Lark Sparrows** were relatively widespread and were detected along transects 1, 2, 3, 4, 5, 6, 8, 9, 14, 23, 31, and 32. **Grasshopper Sparrows** were common in grassland areas along transects 14, 22, 23, and 35. Among raptors, **Northern Harriers** were widespread and observed along transects 2, 6, 10, 12, 15, 22, 23, 25, 26, 28, 29, 31, and 32. **Swainson's Hawks** were seen along transects 3, 14, 22, 25, 26, 29, 31, 32, and 33**. Short-eared Owls** were commonly observed along transects 26, 27, 28, 29, 30, 31, and 32. **Prairie Falcons** were observed along transects 1 and 33, and **Golden Eagles** were detected along transects 1 and 32.

DISCUSSION

Because of population declines, many land and resource management agencies have classified Burrowing Owls as special status species (Klute et al. 2003, IDFG 2005). Throughout their range, but specifically in Idaho, studies assessing long-term changes in Burrowing Owl populations are needed. In south-central Idaho, Belthoff and Boves (2005) established 32 permanent Burrowing Owl point-count survey routes within public lands administered by BLM

Shoshone Field Office. We repeated this survey protocol at these established routes during 2008 and 2012.

2008 vs. 2012 Data

In 2012, we detected fewer owls (36 adults and 19 juveniles) along survey routes than were detected in 2008 (58 adults and 10 juveniles; Carlisle and Kaltenecker 2012). Some survey routes contained owls in both years (transects 1, 4, 6, 7, 10, 13, 16, 25, 27, 31 and 34), whereas other routes (transects 28, 29, and 30) had owls in 2012 and not 2008. We also found that some transects that supported multiple owls in 2008 supported fewer in 2012 (e.g., routes 1, 3, 4, 13, 22, and 26) whereas others showed dramatic increases in 2012 compared to 2008 (e.g., routes 7, 25, and 30). Thus, there were shifts in occurrence/abundance and/or distribution patterns between 2008 and 2012. Suitable nesting burrows are relatively lacking throughout the study area since there is a lack of ground squirrels and prairie dogs. Mound burrows that are available in any given year depend on the population size and distribution of the primary burrow-excavating species in the study area (American badger). For example, if badger numbers are low and/or their distribution shifts within the study area, this is likely to impact where Burrowing Owls are able to find burrows that have not caved in. Refer to Carlisle and Kaltenecker (2012) for a discussion and comparison of other historical data in the BLM Shoshone Field Office including historical data from Rich (1985) and Red Willow Research (2004).

Detection of Burrowing Owls Before and After Playback

The survey protocol included a 3-min silent listening period and a 3-min broadcast period. During the broadcast period, owl vocalizations were broadcast for 30-seconds at a time. In 2008 we detected the majority (77.1%) of Burrowing Owls *after* beginning the broadcast. In 2012, 73% of our detections occurred *before* the broadcast period. Though this interesting result is difficult to explain with certainty, observer experience could possibly play a role.

Vegetation along Transects

There were no major differences in vegetation along transects between 2008 and 2012. Refer to Appendix 1 in Carlisle and Kaltenecker (2012) for full vegetation descriptions for each transect and point.

Systematic vs. Supplemental Routes

Belthoff and Boves (2005) placed *supplemental* routes in areas of high historical breeding based on Rich (1985). Both the mean number of owls detected and the frequency of detections have been higher in the *supplemental* routes in all years surveyed and suggest that a higher density of owls occur along these routes than along systematic routes.

Management Considerations

Because evidence supports an apparent population decline of Burrowing Owls within south-central Idaho (Red Willow Reseach 2003; Belthoff and Boves 2005; this study), and because Burrowing Owls are considered a watch species by the BLM and a Species of Greatest Conservation Need in Idaho (IDFG 2005), Belthoff and Boves (2005) suggested several management recommendations that we also support and paraphrase here.

(1) Repeat Burrowing Owl point-count surveys at least once every 5 years to document future population trends. An additional option could be a more intensive nest-monitoring effort (which could include monitoring historic nest sites from this and prior studies; e.g., Rich 1984, Red Willow Research 2004, Belthoff and Boves 2005).

(2) Protect occupied nesting burrows and the areas around them from disturbance and destruction (because Burrowing Owls exhibit some fidelity to previous nest sites - see Rich 1984, Belthoff and Smith 2003).

(3) Provide artificial burrows in areas where soils will allow (i.e., in areas without lava). Burrowing Owls readily use artificial burrows, which last longer and provide more security than mound burrows (Rich 1984). We agree with Belthoff and Boves (2005) in that underground burrows were lacking in many areas where general habitat characteristics seemed appropriate. Thus, availability of suitable nest sites might be limiting Burrowing Owl populations within the Shoshone Field Office. See Belthoff and Boves (2005) for more details.

Despite little change in the number of owls detected when comparing 2008 surveys to those conducted in 2012, results do indicate that Burrowing Owl populations within the BLM

Shoshone Field Office have declined since Rich's (1985) original work during 1976-1983. Because methods used in this study and by Belthoff and Boves (2005) only assess distribution and abundance, we cannot speculate about the possible causes of the decline of Burrowing Owls. Red Willow Research (2004) presented several hypotheses and, like Belthoff and Boves (2005), we agree that testing these hypotheses in future studies may be warranted. The BLM Shoshone field office plans to repeat this survey protocol every three to five years to track Burrowing Owl population trajectories in the study area. Considering that Burrowing Owls are often found in association with agriculture, it would be interesting to compare the current versus former extent of irrigated agriculture within the study area (which might be possible with a GIS analysis using historic data).

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