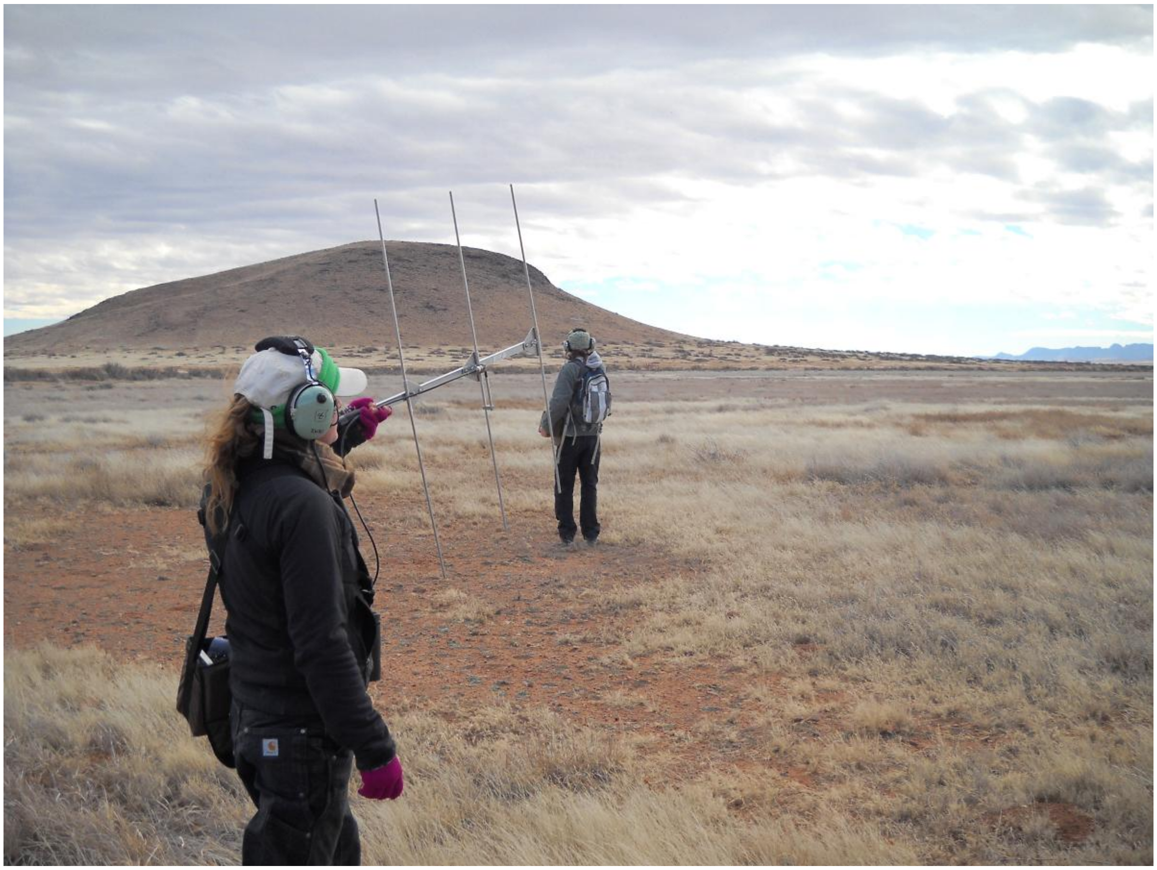
Desert Grassland Bird Conservation: Is Low Winter Survival Driving Population Declines? Phase II



Annual Report
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ROCKY MOUNTAIN BIRD OBSERVATORY

Mission*: To conserve birds and their habitats*

Vision*: Native bird populations are sustained in healthy ecosystems*

Core Values*: (Our goals for achieving our mission)*
1. ***Science*** *provides the foundation for effective bird conservation.*
2. ***Education*** *is critical to the success of bird conservation.*
3. ***Stewardship*** *of birds and their habitats is a shared responsibility.*

RMBO accomplishes its mission by:
- ***Monitoring*** *long-term bird population trends to provide a scientific foundation for conservation action.*

- ***Researching*** *bird ecology and population response to anthropogenic and natural processes to evaluate and adjust management and conservation strategies using the best available science.*

- ***Educating*** *people of all ages through active, experiential programs that create an awareness and appreciation for birds.*

- ***Fostering*** *good stewardship on private and public lands through voluntary, cooperative partnerships that create win-win situations for wildlife and people.*

- ***Partnering*** *with state and federal natural resource agencies, private citizens, schools, universities, and other non-governmental organizations to build synergy and consensus for bird conservation.*

- ***Sharing*** *the latest information on bird populations, land management and conservation practices to create informed publics.*

- ***Delivering*** *bird conservation at biologically relevant scales by working across political and jurisdictional boundaries in western North America.*

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Cover Photo: RMBO interns, Rachel Frieze and Scott Havill, scan for radio-tagged Vesper Sparrows on the Reserva Ecológica El Uno Chihuahua, Mexico. Photograph by Loni Beyer 2010.

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EXECUTIVE SUMMARY

Grassland birds have declined more than any other guild of North American birds, but the factors driving these declines are poorly understood. Migratory species spend up to 4 months or more on their winter territories, yet it is largely unknown what processes limit survival there. Our research addresses this information gap by investigating overwinter survivorship, home range size, and habitat use through use of radio telemetry studies during January and February 2010. This report summarizes phase II of *Desert Grassland Bird Conservation: Is Low Winter Survival Driving Population Declines?*

This project was conducted on The Nature Conservancy land at the Reserva Ecológica El Uno (REEU) near Janos, Chihuahua, Mexico. We established three study sites >2 km apart, each differing in habitat structure. Thirty-two Mexican and American biologists from nine different organizations assisted in the 2010 netting and banding efforts. All avian species captured were banded, and over 20 Vesper Sparrows at each study site were outfitted with radio transmitters. We placed 0.70 g transmitters on birds weighing > 21g and 0.58 g transmitters on birds weighing <21 g to ensure that the total weight of the transmitter and harness did not exceed 4% of each bird's body weight. We marked avian foraging locations twice a day and marked night roost locations at least twice at each site over the duration of the study. We conducted vegetation surveys at all marked locations, and 100 random vegetation surveys per site within the core use areas. Additionally we conducted line transects surveys to determine the relative abundance of Vesper Sparrows and predatory birds at each site.

We banded 363 birds of 19 species, and recaptured two Vesper Sparrows and a Brewer's Sparrow originally banded at the same site in 2009. We affixed radio transmitters to 69 Vesper Sparrows, marked 2651 foraging locations and 76 night roost locations over 47 days. We observed a 52% apparent survival rate among all sparrows with known fates (n=54), with all mortalities attributed to predation. Vesper Sparrow predators included shrikes (n=3), raptors (n=11), owls (n=1), and mammals (n=5). We were unable to determine the type of predator for six predatory events. At least two of 13 missing birds were transmitter failures and five are presumed early battery death (0.58g radios with a shorter battery lifespan). At the end of the study, we recaptured four Vesper Sparrows to remove their transmitters. All birds were in apparent good health and did not suffer any visible negative effects of the telemetry equipment.

We completed 23.2 total kilometers of line transect surveys detecting 14.5 Vesper Sparrows/km and 1.7 predatory birds/km across all sites. Loggerhead Shrike was the most common avian predator (n=25) followed by Northern Harrier (n=7).

We successfully collected over 50 foraging locations per bird - the recommended value for fixed-kernel home range estimates (Seaman and Powell 1996; Seaman, Millspaugh et al. 1999) - for 33 of the 69 transmitter birds. For the final report of this study we plan to analyze how differences in vegetation, predatory pressures, and home range size influence wintering survivorship. Additionally, we will examine Vesper Sparrow habitat selection and explore how habitat structure, age class, Vesper Sparrow density, home range size, flocking behavior, predator density, climate and other factors influence survival rates.

ACKNOWLEDGEMENTS

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We are grateful to RMBO volunteer interns Apple Wood, Rachel Frieze, Emily Strelow, and Scott Havill, for their diligence and hard work in the field, as well as Greg Levandoski for his field and technical assistance.

We would like to thank the 32 attendees of the fourth annual Chihuahuan grassland wintering bird monitoring workshop who aided in our avian capture efforts. Participants include Juan Manuel Cardenas Villanueva , Rodolfo Garcia Morales, Jaime Hernández Martinez, and Alicia Zarate Martinez of The National Commission of Natural Protected Areas (CONANP); Jorge Carranza and Daniel Toyos of Biodiversity and Development in Harmony (BIDA), Edhy Franscisco Álvarez García and Javier Lombard Romero of Profauna-Coahuila, Miguel Angel Grageda Garcia and Javier Saúl Garcia of Sul Ross State University (SRSU), Irene Ruvalcaba Ortega, Mario Alberto Guerrero Madriles, Jorge Allen Bobadilla, Angel Medina Lira, Hugo Enrique Elizondo Alejo, Gustavo Fernández, Ricardo Canales and Cecilio Perez Rangel of the University of Nuevo León (UANL); Martin Pereda Solis and Jose Hugo Martinez Guerrero of the University Juarez of Durango (UJED); Bryan Sharp from Durango; Ana Laura Nolasco Vélez from the National Autonomous University of Mexico (UNAM); and Wendy Willis and Andrew Tillinghast of the Rocky Mountain Bird Observatory (RMBO).

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INTRODUCTION

Grassland birds have declined more than any other guild of North American birds (Smith and Lomolino 2004), but the factors driving these declines are poorly understood. For most migratory grassland species, we do not know whether populations are being limited on the breeding or wintering grounds, or in between. Understanding the causes of population change is critical to conserving and restoring declining grasslands birds as it allows managers and conservationists to identify key habitats and seasons in which corrective actions are needed.

Overwinter survival is a key demographic rate that affects the size of migratory populations returning north to breed in spring. Knowledge of this rate, and the factors that influence it, is needed to determine if populations are being significantly limited in winter and what actions might be needed to increase survival. Increasing overwinter survival could play an important role in strategies to conserve North American grasslands birds.

We aimed to determine survival rates, home range size, and habitat use of wintering Vesper Sparrows (*Pooecetes gramineus*) in desert grasslands in the Chihuahuan desert region. Vesper Sparrow is a declining migratory grassland bird that breeds mainly in western North America and winters in grasslands, shrublands, and similar habitats across the southwestern USA and Mexico. Reasons for their decline are poorly understood and very little is known about their wintering ecology (Jones and Cornely 2002). Vesper Sparrows are one of the more common sparrows in Chihuahuan grasslands, relatively easily captured, and large enough to carry a radio-transmitter that lasts between 28 to 40 days (Panjabi and Beyer 2009). They are thus an ideal study subject for our research project *Desert Grassland Bird Conservation: Is Low Winter Survival Driving Population Declines?* This interim report summarizes activities and data collected under Phase II during January and February of 2010.

DESIGN AND METHODOLOGY

Study Area

We conducted our research at the Reserva Ecológica El Uno (REEU) near Janos, Chihuahua, Mexico. The reserve, owned and operated by The Nature Conservancy (TNC), spans 45,500 acres of desert grassland and shrubland within a 1.2 million acre federally-protected biosphere reserve.

Because of a dry summer and fall in 2009, range conditions in early January 2010 were poor in the Janos valley, with little standing grass cover available on most ranchlands. Vesper Sparrows were virtually absent on ejidos (communal lands) and private ranches adjacent to REEU. Numbers of Vesper Sparrows on REEU were lower than in 2009, but still some small populations were present in a few areas. Although our intention was to compare survival across properties with contrasting management regimes, we were not able to locate any Vesper Sparrow populations on sites adjacent and near to REEU. For this reason we focused our research at three sites within REEU, all at least two kilometers apart. These three sites supported the only significant populations of Vesper Sparrows we encountered in three days of scouting on and off of REEU.

The three study sites varied in vegetation structure (Table 1), but were similar in species composition. Grasses were primarily a mix of *Aristida*, *Panicum*, and *Bouteloua* species. Shrubs were predominately *Prosopis* species however *Ephedra* and *Mimosa* species were also present. El Papalote (PAPA) and Los Ratones (LORA) were sites used in our 2009 pilot study, are lightly grazed, and comprised of grasslands with scattered shrubs. PAPA has an active water tank and watering trough frequented by 23 bison introduced to the reserve in November of 2009. LORA harbors a narrow mesquite corridor that runs north-south for approximately one kilometer. Los Corrales (CORR), the third site, consists of mesquite shrubland interspersed by patches of grass and an occasionally-active cattle loading corral with a stock tank and abandoned outbuildings.

Table 1. Vegetation characteristics collected from random circular plots (5m radius) at three study sites, standard error (SE) presented. REEU, Chihuahua, Mexico 2010.

	Los Corrales (n=100)		Los Ratones (n=100)		El Papalote (n=97)	
	Average	SE	Average	SE	Average	SE
Shrub Height (m)	0.8	0.1	0.7	0.1	0.4	0.0
Grass Height (cm)	19.6	1.4	27.5	1.3	24.2	1.5
% Shrub	14.5	1.5	5.0	0.9	4.1	0.6
% Grass	27.1	3.2	65.3	2.6	42.1	2.8
% Bare Ground	39.3	2.8	14.9	1.9	26.0	2.0
% Forbs	6.4	0.8	4.0	0.7	17.9	1.7
% Salsola	5.7	0.7	3.6	0.7	0.4	0.1
% Other	6.2	0.5	5.9	0.6	9.8	0.9

Equipment and Crew

This year RMBO coordinated its fourth annual Chihuahuan grassland wintering bird monitoring workshop to coincide with the start of our over-winter survival research in order to gain valuable assistance from a large group of volunteers in flush-netting, and provide value-added training for grassland bird surveyors. Thirty-two Mexican and American biologists (Figure 1) assisted in the 2010 netting and banding efforts. Participating organizations included: The Nature Conservancy, The National Commission of Natural Protected Areas (CONANP), Biodiversity and Development in Harmony (BIDA), Profauna-Coahuila, Sul Ross State University (SRSU), University of Nuevo León (UANL), University Juarez of Durango (UJED), and the National Autonomous University of Mexico (UNAM). After the initial week of capturing and affixing transmitters to birds, the project was run by two technicians, four interns, and two volunteers.

Figure 1. Partners and participants of the avian banding and monitoring workshop. Reserve Ecológica El Uno, Chihuahua, Mexico 2010. Photo by Arvind Panjabi.

Bird capture and Radio Telemetry

From January 4th – 16th 2010 we worked in two groups of 12-20 people to capture, band, examine, and affix radio transmitters to Vesper Sparrows at our three study sites. Most Vesper Sparrows were captured and outfitted during the first 5 days of the study, but some additional capture was required to re-attach recovered transmitters from predated birds during this period. To capture birds at each site we set up a line of 4-10 mist nets, generally with shrubs just in front and behind the mist nets. This aided in capture by making the nets less visible and by providing perches and escape destinations that were attractive to Vesper Sparrows. Using all available people, we slowly corralled birds from roughly 150-300 m away and flushed them toward the nets as we closed in on them. We banded all species captured; we attached 0.70g transmitters to Vesper Sparrows with a total body weight > 21g, and 0.58g transmitters to Vesper Sparrows ≤21g, so that the total weight of the transmitters and harness did not exceed 4% of each bird's body weight. Transmitters were placed over the rump with a leg-loop harness made of beading elastic (Rappole and Tipton 1991) (Figure 2).

During banding operations we used 12 m mist nets, banding supplies, and six GPS units (Garmin eTrex Legend). We used 60 Advanced Telemetry Systems (ATS) transmitters; 8 model A1025's (0.58g) with an expected battery life of 28.9 days, and 52 A1035's (0.70 g) with an expected battery life of 40.9 days (Panjabi and Beyer 2009). We used four ATS radio receivers (model R2000) with headphones (David Clark model H10-00-4) and antennae (3-element folding Yagi).

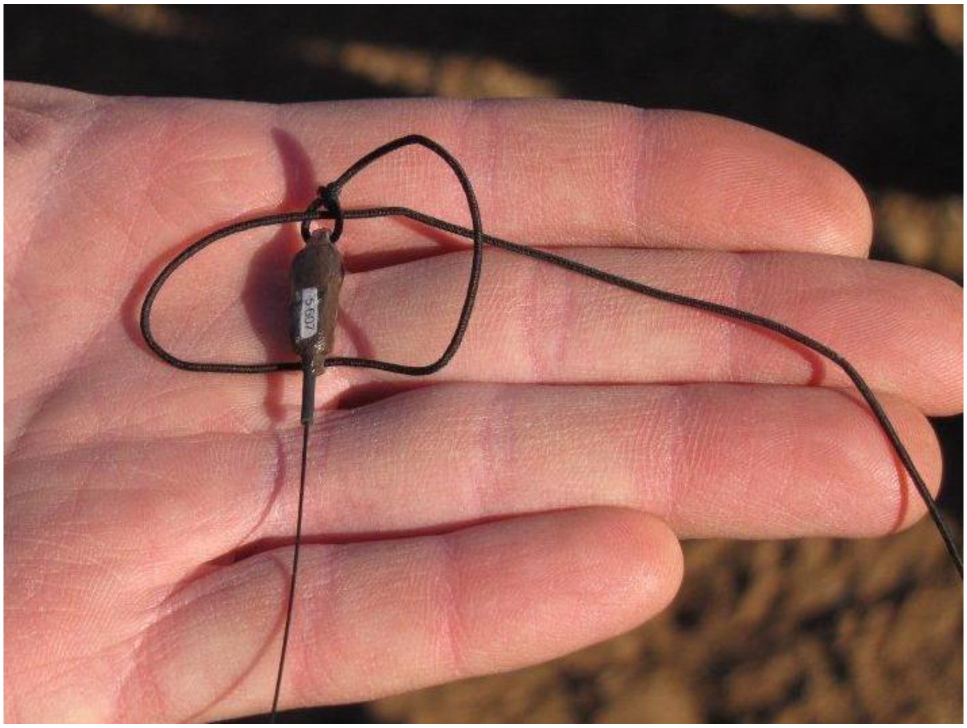

Figure 2. A radio transmitter and harness weighing approximately 0.7 grams.
Photograph by Jose Hugo Martinez Guerrero.

Two teams of two observers each marked locations of each radio-tagged bird twice daily. Teams triangulated each bird's exact location by first scanning for the general location of the bird then spreading out to form an approximate 90-degree angle. Once each observer determined the direction to the transmitter bird they walked towards the bird's signal until they met. If more than one radio-tagged bird appeared to be flocking together, both observers switched between all possible transmitter frequencies during triangulation. Frequencies that exhibited the same signal strength and direction for both observers were determined to be at the same location. Once the exact location was established one observer conducted vegetation surveys while the other verified the target bird(s) were alive and moving.

We marked each avian location with GPS units and recorded the time of day, how the bird was detected (visually or by signal only), flock size, bird location (in a shrub, in the grass, on bare ground, or other), and bird status (alive, dead, predated, fallen transmitter or uncertain fate). If a bird's signal was unable to be detected, we continued to scan for its signal at least once each site visit through the entire course of the study. An extended effort was made to find these missing birds at least twice over the season by scanning for their signals in the surrounding habitats, from hilltops and between sites. When transmitters were recovered in the field we assessed the transmitter and immediate area for signs of predation such as blood on the transmitter and harness, Vesper Sparrow remains, predator feces, or transmitter damage. We attempted to identify whether the predator was avian or mammalian by assessing the remains and immediate area to where the transmitter was recovered. Avian predators remove feathers from their prey before consumption so that transmitters from predated birds are located among non-masticated feathers. Shrikes often impale body parts or leave the transmitters hanging on barbed wire fences or spines of vegetation. Mammalian predators leave signs of mastication on the transmitter and/or feathers. Mammalian predators may also cache their prey underground (foxes and bobcats), and may take them back to their dens and burrows (ferrets and rats).

In February we conducted surveys after dark to determine Vesper Sparrow roosting locations. For these surveys, triangulation was not possible due to lack of visibility, nor was it necessary as roosting birds generally do not flush easily. Observers located roosting transmitter birds by following signals until they approached to within 5 meters of that bird. We marked locations with GPS units and recorded the date, time, and noted any behaviors that were possible to discern in the dark.

On February 26th we employed the same flush-netting techniques to attempt to recapture birds with radio transmitters. We closely examined all recaptured transmitter birds for overall health and any sign of ill-effects from the transmitter (rubbing or chaffing); we removed transmitters prior to release.

Vegetation Surveys

During mid February we conducted vegetation surveys at 100 random locations at each of the three study sites. Immediately after marking each Vesper Sparrow foraging location, we conducted vegetation surveys within a five-meter radius, centered at the marked location. We returned to roost locations during the day and conducted vegetation surveys within both a five and a ten-meter radius to account for any uncertainty in the location of the roosting birds and in GPS accuracy. Prior to initiation of field surveys, each observer measured the location of 0.5m, 1m, and 1.5m relative to their own bodies in order to accurately estimate shrub and grass heights. At all vegetation plots we estimated percent cover of shrubs, grasses, forbs, tumbleweed (*Salsola* sp.), and “other” (litter, rock, animal excrement, woody vegetation, etc.). We also recorded the presence of prairie dog (*Cynomys ludovicianus*) colonies and kangaroo rat (*Dipodomys*) mounds and noted any other significant structures or plant/animal communities that may affect sparrow habitat use, such as halophytic grasses or the presence of water troughs.

We selected random locations by plotting all marked locations of birds in ArcMap GIS 9.1 to delineate each study site. We determined core habitat using Hawth’s Tools Fixed Kernel Density Estimator (FKE) set at 90-percent probability of occurrence. We generated random points within 90-percent probability polygons using Hawth’s Tools Random Point Generation. We assigned UTM coordinates to the random points and navigated to them with GPS units.

Line Transects

We conducted line transect surveys twice at each site to determine Vesper Sparrow and avian predator densities following standard distance sampling protocol (Buckland 2001). Transects ran parallel to each other and were separated by 75 meters. Transects varied in direction between the two sampling visits for more complete coverage. We conducted surveys in February; at Los Corrales on the 8th and 14th, Los Ratones on the 9th and 13th, and El Papalote on the 6th and 12th. We created systematic random line transects tailored to the core habitat of each site using FKE and Generate Regular Point in Hawth’s Tools ArcMap GIS. The same two observers conducted the line transects surveys to minimize variation in the data due to observer differences.

Observers recorded all observations of Vesper Sparrows and predatory birds (Loggerhead Shrikes and raptors). Additionally, we noted if any mammalian predators were present during transect surveys. We used laser distance meters to measure distances to each avian observation from the transect line

PRELIMINARY RESULTS

We banded 363 birds of 19 species (Table 2). We recaptured two Vesper Sparrows and a Brewer's Sparrow at PAPA that were originally banded at the same site in 2009. We affixed radio transmitters to 69 Vesper Sparrows, marked 2651 foraging locations and 76 night roost locations for these birds over 47 days, and completed vegetation surveys at each foraging and roosting location.

We estimated an apparent survival rate of 52% during the study period. Of the 69 transmitter birds, 28 survived, at least 26 were predated, two had uncertain fates (due to no obvious evidence of predation or harness failure at time of recovery) and 13 birds went missing (transmitter signal was undetectable) during the study (due either to equipment failure or birds moving, or being carried, out of range of our receivers) (Table 3). Six of these missing birds were carrying small transmitters with shorter expected battery life; we presume that their batteries stopped working as they all went missing within ten days of each other and their disappearances were preceded by weaker signal strength.

After ten days of bird #1846 going undetected we recovered it's transmitter over three kilometers from its original capture location. The transmitter was found next to a small bird skull; the feces of a large bird and a mammal were present. The recovery location of this transmitter was in a shrub dominated habitat with mesquite averaging two meters in height and only sparse grasses, not indicative of typical Vesper Sparrow habitat. It is very likely that this bird was predated and carried away from its wintering territory, out of range of our radio receivers.

Eight transmitter birds went missing for at least one day. These birds were likely either foraging in areas out of range of our receivers, or were obscured by thick vegetation or other obstructions, as they were later detected back within their regular foraging areas for the remainder of the study. Four transmitter birds shifted their foraging territory to more than one kilometer from their original capture location over the duration of the study. The remaining birds remained within a kilometer from their capture location for the entire study period.

Equipment failure accounted for at least one missing bird, and probably many of the other birds with unknown fates. On February 25th we recaptured Vesper Sparrow #1825 which had been affixed with a radio-transmitter on Jan. 6th at the same site. We had not detected this individual since January 31st. Another probable transmitter failure was discovered on February 7th when two observers had a visual on a transmitter bird in LORA, but the frequency signal could not be detected in the receiver. This bird was likely Vesper Sparrow #1111 or #1135, both which had gone "missing" three weeks prior.

Of the 26 confirmed predations, 15 were attributed to avian predators including three confirmed Loggerhead Shrike predations and one transmitter recovered in an owl pellet (presumably from a

Short-eared Owl based on location). We dug up one intact sparrow body and transmitter from 4-6 inches underground and another beneath 4-6 inches of litter, both presumably cached by a Bobcat or a Kit Fox. We recovered the remains of one transmitter bird from a pack-rat nest and two transmitters with sparrow remains from within kangaroo rat burrows up to one foot below ground. The factors responsible for the death of these birds, and how they ended up in the rodent dens, are not known. We were unable to determine the type of predator for the remaining six predated birds.

In February we completed over 23.2 total kilometers of line transect surveys across all three study sites, detecting 14.5 Vesper Sparrows/km and 1.7 predatory birds/km on average across the sites (Table 4). Loggerhead Shrike was the most common avian predator (n=25) followed by Northern Harrier (n=7). Coyotes frequented all study sites, but were only observed during surveys at PAPA. One bobcat was observed at CORR outside of the survey period.

On February 26th we recaptured four transmitter birds, two at PAPA and two at CORR (Figure 3). The recaptured sparrows showed no signs of ill effects, such as rubbing or chaffing, due to the transmitter and harness. One bird decreased in weight and fat, the remaining birds increased or maintained the same fat and weight from the beginning of the study (Table 5).

Figure 3. RMBO biologist, Loni Beyer, checks health of a recaptured Vesper Sparrow carrying a radio transmitter at the Reserva Ecologica El Uno, Chihuahua, Mexico, in 2010. Photograph by Apple Wood.

Table 2. Number of birds captured and banded (n); averages given with standard error (SE), minimum (Min) and maximum (Max) measurements. REEU, Chihuahua, Mexico 2010.

		Wing Chord (mm)				Tail Length (mm)				Weight (g)				Fat Score (0-5)			
Species	#	Average	SE	Min	Max	Average	SE	Min	Max	Average	SE	Min	Max	Average	SE	Min	Max
Brewer's Sparrow	137	62.1	0.2	52	72	61.6	0.3	51	72	11.1	0.1	9.3	15.5	0.6	0.1	0	2
Savannah Sparrow	6	71	0.9	69	73	50.5	0.9	48	52	17.4	0.8	16.2	19.6	0.8	0.5	0	3
Black-throated Sparrow	35	64.8	0.5	58	70	61.5	0.5	56	66	13.8	0.3	10.5	21.2	0.9	0.2	0	3
Cassin's Sparrow	1	64.0	0.0	64	64	63.0	0.0	63	63	18.8	0.0	18.8	18.8	0.0	0.0	0	0
Grasshopper Sparrow	13	63.5	0.7	59	67	45.7	2.2	20	51	16.6	0.4	14.3	18.9	0.7	0.2	0	2
Lincoln's Sparrow	1	65.0	0.0	65	65	61.0	0.0	61	61					0.0	0.0	0	0
Vesper Sparrow	104	80.8	0.4	59	89	63.5	0.4	53	76	23.5	0.2	18.9	27.1	0.6	0.1	0	2
Sage Sparrow	2	74.5	0.4	74	75	71	0.8	70	72	19.4	0.5	18.7	20	1.5	1.5	0	3
Chipping Sparrow	1	71.0	0.0	71	71	63.0	0.0	63	63	13.0	0.0	13	13	0.0	0.0	0	0
Gamble's White-crowned Sparrow	27	73.4	0.9	54	79	70.0	0.6	63	78	23.5	0.3	20.4	26.2	1.1	0.2	0	3
White-crowned Sparrow	19	73.8	0.8	67	82	70.6	0.9	63	79	23.1	0.8	13.1	27.3	0.8	0.2	0	2
Cactus Wren	6	82.5	0.7	81	85	81.5	1.6	79	89	43.1	0.9	41.1	45.8	1.4	0.4	0	2
Eastern Meadowlark	3	117.7	4.1	110	124	69.7	1.5	67	72	112.8	3.7	105	117	0.7	0.3	0	1
Western Meadowlark	2	108.5	0.5	108	109	67.5	0.5	67	68	85.7	0.7	85	86.4	0.0	0.0	0	0
Verdin	1	50.0	0.0	50	50					6.8	0.0	6.8	6.8	1.0	0.0	1	1
Bewick's Wren	3	54.3	1.3	53	57	57.7	1.5	55	60	9.5	0.5	8.8	10.5	1.7	0.3	1	2
Loggerhead Shrike	1	103.0	0.0	103	103	105.0	0.0	105	105	48.3	0.0	48.3	48.3	0.0	0.0	0	0
Curve-billed Thrasher	1	111.0	0.0	111	111	114.0	0.0	114	114	92.1	0.0	92.1	92.1	4.0	0.0	4	4
Sage Thrasher	2	100.0	1.0	99	101	89.5	0.5	89	90	44.0	1.4	42.6	45.4	3.0	0.0	3	3
American Kestrel	1	192.0	0.0	192	192	122.0	0.0	122	122	115.0	0.0	115	115	0.0	0.0	0	0

Table 3. Total number of marked locations, minimum days survived, and fates of 69 radio tagged sparrows. Fate: missing (M) n=13, Predated (P) n=26, survived (S) n=28, uncertain fate (U) n=2. REEU Chihuahua, Mexico 2010.

Los Corrales				**Los Ratones**				**El Papalote**			
Band No.	Fate	No. Marked Locations	Min. Survival Days	Band No.	Fate	No. Marked Locations	Min. Survival Days	Band No.	Fate	No. Marked Locations	Min. Survival Days
1817	M	0	0	1135	M	12	9	9267	M	35	26
1120	M	16	17	1111	M	15	11	4615	M	50	34
1826	M	17	15	1109	M	55	37	1107	M	57	41
1823	M	18	15	1805	P	2	5	4619	P	2	3
1824	M	37	34	1144	P	8	5	4618	P	3	3
1125	M	50	37	1846	P	9	8	4606	P	9	8
1829	M	59	41	1143	P	16	14	1106	P	19	14
1119	P	0	0	1113	P	17	13	4612	P	24	22
1818	P	0	0	1803	P	20	22	1102	P	27	24
1821	P	1	2	1112	P	28	24	4610	P	30	25
1122	P	3	3	1848	S	55	44	4603	P	31	26
1123	P	7	5	4630	S	61	40	1103	P	41	31
1814	P	17	17	1140	S	64	44	4607	P	58	41
1822	P	17	15	1138	S	64	44	4601	S	65	50
1126	P	23	22	1136	S	68	44	4614	S	68	49
1819	P	27	26	1831	S	70	49	1108	S	68	49
1825	S	24	51	1833	S	71	49	4609	S	70	49
1820	S	64	50	1830	S	72	49	4611	S	70	49
1809	S	65	51	1806	S	73	51	4616	S	70	50
1121	S	65	47	1804	U	9	11	4608	S	71	51
1118	S	66	48					4604	S	71	50
1124	S	66	47					1105	S	73	49
1808	S	66	50					4605	S	73	50
1816	S	67	50					4602	U	9	8
1811	S	69	50								

Table 4. Number of Vesper Sparrows and predatory birds detected per kilometer during line transect surveys at three study sites, REEU Chihuahua, Mexico 2010.

	Los Corrales		Los Ratones		El Papalote		Cumulative Total
Species	n	n/km	n	n/km	n	n/km	n/km
Vesper Sparrow	73	8.1	46	6.5	223	29.4	14.48
Loggerhead Shrike	11	1.2	5	0.7	9	1.2	1.06
Northern Harrier	7	0.8					0.30
Bald Eagle					1	0.1	0.04
Red-tailed Hawk	3	0.3					0.13
American Kestrel					1	0.1	0.04
Merlin	1	0.1					0.04
Prairie Falcon					1	0.1	0.04
Burrowing Owl			2	0.3			0.08
Total Bird Detections	95		53		235		383
Total Transect Effort (km)	9.0		7.0		7.6		23.6

Table 5. Fat scores and weights of four recaptured Vesper Sparrows with radio transmitters at the beginning and end of the study.

	Fat Score (1-5)		Weight (g)	
Bird#	Initial	Final	Initial	Final
4608	2	0	23.5	22.3
4616	2	1	23.7	-
1118	0	1	22.3	22.8
1825	0	1	23.4	23.6

DISCUSSION

Among all wintering Vesper Sparrows with known fates (N=54), we observed a 52% apparent survival rate. This rate of survival was substantially lower than the apparent rate observed in 2009 (88%) during our pilot research. Climatic conditions prior to the two winters were considerably different, with relative wet conditions preceding the 2009 study, and relatively dry conditions preceding the 2010 study. As a result of the poor range conditions in early 2010, the population of wintering Vesper Sparrows was considerably smaller than that during this same time in 2009. Predator density, particularly of Loggerheads Shrikes, did not appear to be significantly different in the two years, perhaps leading to greater predation pressure on the wintering sparrow population.

Our findings suggests that predation plays a significant role in regulating population size in the winter, as 26 of 28 known mortalities were determined to be predator-related. Vesper Sparrows undergo predatory pressures from a variety of both avian and mammalian species. Los Corrales had the greatest number of predators (n=22) during line transect surveys, followed by PAPA (n=12, and LORA (n=5). Over half of predatory events were attributed to avian species. Loggerhead Shrikes were the most prevalent predator, and were regularly observed actively hunting sparrows within our study sites. Avian prey are not widely recognized as the most common part of shrike diets (Atkinson and Cade 1993) however shrikes likely pursue avian prey more frequently when other food sources are low. It is likely that many of the shrikes observed in our study sites were resident birds as they are common year-round on REEU and in the Janos region.

Predator-prey relationships are often density dependant where both the success of the predator and survival of the prey are subject to optimal density thresholds (Brunton 1999; Enstipp, Grémillet et al. 2007). Our survivorship data paired with our observations of lower avian abundance this year cause us to question whether drought conditions can lead to higher predatory pressures on the wintering grassland birds on REEU. Grassland bird density and distribution shift from year to year in response to precipitation levels which directly influence the availability of seeds for forage and protective vegetative cover from predators (Macias-Duarte, Montoya et al. 2009). If resident predators don't generally relocate to follow the nomadic tendencies of grassland sparrows, it is possible that predation pressures on any remaining wintering sparrows would increase. This appeared to reflect the situation on REUU. Resident predators may have an advantage over non-resident passerine prey (Flaxman and Lou 2009; Millon, Nielsen et al. 2009). A high predation rate, as seen this year, suggests that as the winter season progresses sparrow populations shrink. Among other things, this has implications for timing of winter population monitoring.

Of interest was the recovery of Vesper Sparrows with radio transmitters from kangaroo rat and pack rat burrows. We are unsure if these rats were responsible for the predation or if they were merely scavenging the kills of other predators. It is also possible there was another predator utilizing kangaroo rat burrows, although the instability of the soil would make it difficult for any larger animals to utilize these burrows. We often observed Vesper Sparrows taking refuge from inclement weather on the lee side of kangaroo rat mounds, foraging on top of the mounds, and entering and exiting from burrows. Kangaroo rats could conceivably catch sparrows when they are roosting or vulnerable, but Kangaroo rat feeding behavior is not known to include avian predation (Nagy and Gruchacz 1994; Tracy and Walsberg 2002). Further research is need to identify all avian predators in grasslands.

While we had hoped to conduct surveys of Vesper Sparrow and predator abundance at both the start and end of our study, weather-related setbacks in January delayed line transect surveys in the early season when sparrow populations were likely greater. In future studies we will attempt to measure abundance at the beginning and end of the study period to provide better insight into winter population dynamics.

We were not able to access CORR site for a total of five days due to impassible roads after weather events. Although our effort was reduced we were usually able to walk into to PAPA and LORA during these times leading to a greater overall effort at those sites than at CORR. Five transmitter birds went missing and six were found predated immediately following one of three large rain storms, suggesting that winter storms may either increase mortalities, cause sparrows to shift their winter territories, or cause transmitter failure.

Future Analyses

We successfully collected over 50 foraging locations -the recommended value for fixed-kernel home range estimates (Seaman and Powell 1996; Seaman, Millspaugh et al. 1999)- for 33 of the 69 transmitter birds. We plan to use these data to estimate winter home range sizes of Vesper Sparrows, and together with all observations, determine the optimal number of locations needed to adequately assess home-range size and use.

We plan to analyze vegetation data and Vesper Sparrow and predator density data, to assess differences in among the study sites. These parameters will then be used as covariates in our analyses of survival, which will also include the influence of age class (second year vs. after second year), home range size, flocking behavior, and climatic variables. We will attempt to determine Vesper Sparrow foraging micro-habitat selection through comparisons of observed vs. expected use of vegetation conditions. We also plan to characterize night roosting behavior and habitat.

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