Desert Grassland Bird Conservation: Is low winter survival driving population declines? Phase I

Final report
February 15, 2010

Rocky Mountain Bird Observatory

PO Box 1232
Brighton, CO 80601-1232
303.659.4348
www.rmbo.org

Tech. Report # **I-MXPLAT-NPS-08-02**

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 trends in bird populations 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 instill 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 throughout the Americas.

ROCKY MOUNTAIN BIRD OBSERVATORY

On behalf of RMBO, I am pleased to submit the following technical report.

Arvind Panjabi
Director, International Program

Suggested Citation:
Panjabi, Arvind and Loni Beyer. 2010. Desert Grassland Bird Conservation: Is low winter survival driving population declines? Phase I. Rocky Mountain Bird Observatory, Brighton, CO, Final report I-MXPLAT-NPS-08-02. 10 pp.

Cover Photo: Jose Luis Garcia Loya, a field biologist with The Nature Conservancy, searches for Vesper Sparrows carrying radio-transmitters at the Reserva Ecológica El Uno in Chihuahua, Mexico.

Contact Information:
Arvind Panjabi arvind.panjabi@rmbo.org
RMBO Fort Collins Office
230 Cherry Street, Suite 150
Fort Collins, CO 80521
970.482.1707

Overview

In January and February 2009, Rocky Mountain Bird Observatory (RMBO) implemented the first year of a grassland songbird research project in the Chihuahuan Desert to determine over-winter survival rates and home range use among species through use of radio-telemetry. The 2009 field season was a pilot effort focused primarily on developing and refining the technology and methods needed to capture various grassland bird species in winter and monitor their daily survival and movements. This effort was funded by the National Park Service (NPS), through agreement #H1200050003, and administered by the Desert Southwest Cooperative Ecosystem Studies Unit. In-kind support was provided by RMBO, The Nature Conservancy-Chihuahua (TNC), Universidad Autónoma de Nuevo Leon (UANL), and the Canadian Wildlife Service (CWS). This report details the field work conducted in 2009, presents some preliminary results, and describes future directions.

There were five primary objectives of this project:

> 1) determine feasibility of capture/recapture techniques for up to eight grassland bird species in winter,
>
> 2) assess use of radio-telemetry in locating, monitoring, and recapturing grassland birds in winter,
>
> 3) collect and maintain data on daily survival and movements in individual wintering grassland birds,
>
> 4) collect and maintain data on the physical condition of birds at start and end of wintering periods to asses physiological stress over the winter period across species, demographics, and external factors, and
>
> 5) collect and maintain data on potentially important habitat and landscape variables that may influence survival.

We successfully met objectives 1-3, and 5, but were unable to collect data on the physical conditions of birds at the end of the wintering period (4, in part) due to the avoidance of our nets by radio-tagged birds (see *Radio recovery*, under **Discussion** below). We did however collect physiological and demographic data at the start of our study. Winter grassland bird abundance may vary locally from year to year; we were fortunate that many grasslands birds were abundant in northern Mexico during this study as it would have been much more difficult to implement had birds been less abundant. Here we report on the results of this study in relation to the five project objectives and other desired outcomes.

Partners and contributions

The project was carried out on the Reserva Ecológica “El Uno” (El Uno), a 45,000-acre property dominated by desert grassland and shrubland owned by TNC, in the municipality of Janos in northwestern Chihuahua, Mexico. With funding from NPS, we purchased 26 radio transmitters from Advanced Telemetry Systems (ATS), 13 model 1015’s (.57 g; expected battery life=45 d), and 13 model 1035 (.74 g; expected battery life=59 d). Two ATS radio receivers (model R2000) and antennae (3-element folding Yagi) were provided by UANL. Ten 12 m mist nets, bands, and banding supplies were provided by RMBO. A 4x4 pick-up truck dedicated to this project and housing for all field personnel was provided by TNC. The project benefitted greatly from technical assistance from Dr. Stephen Davis, CWS, who participated in the first week of field work and provided guidance on focal species, capture techniques, study design, field protocols, operation of telemetry equipment, and attachment of transmitters. After the initial week of capturing and affixing transmitters to birds, the project was run by two technicians, one provided by RMBO and one provided by TNC. Some additional capture of birds and re-attachment of fallen transmitters was required throughout the study with additional help provided by additional RMBO staff on a voluntary basis.

We assembled a team of 11 field biologists to assist with the initial week of capture and banding of birds (Figure 1). This team included seven Mexican biologists from five organizations, representing non-governmental organizations, universities, and government agencies, including TNC, UANL, the Universidad Juarez del Estado de Durango (UJED), and Profauna-Coahuila (PC). Due to agency restrictions on international travel, cooperators from NPS were unable to attend as planned.

Figure 1. Grassland bird radio-telemetry crew, 2009. Back row (from left to right): Greg Levandoski (RMBO), Hugo Elizondo (UANL), Jose Hugo Martinez Guerrero (UJED), Jorge Allen Bobadilla (UANL), Javier Lombard Romero (PC), Stephen Davis (CWS), Jose Luis Garcia Loya (TNC), Martin Pereda Solis (UJED); front row (left to right): Loni Beyer (RMBO), Edhy Alvarez Garcia (PC), and Arvind Panjabi (RMBO).

Design and methodology

We selected four study sites on El Uno that were comprised mainly of grasslands with scattered mesquite (*Prosopis* sp.) and separated from each other by roughly 1-5 km. At each site we set up a line of 4-6 mist-nets in a slight semi-circle in front of some shrubs (to provide a dark background for the nets), and then using all available people, we corralled birds from roughly 100-200 m out from the nets and flushed them toward the nets as we closed in on them (Figure 2). Although we attempted this practice at all times of day, we generally had higher success in the morning and evening, when winds were calm and the sun was low in the sky.

Figure 2. Biologists corral grassland birds towards mist-nets during flush-netting.

We banded all individual birds caught, but attached transmitters only to Vesper Sparrows (*Pooecetes gramineus;* Figure 3). Our decision to focus on Vesper Sparrows was influenced by the fact that other species of interest were either too difficult to capture (e.g., Sprague's Pipit, Lark Bunting, Chestnut-collared Longspur), too uncommon (e.g., Cassin's Sparrow, Lark Sparrow), or too small for the transmitters (Savannah Sparrow, Grasshopper Sparrow, Baird's Sparrow). The Vesper Sparrow proved to be an effective focal species as they were relatively abundant, large enough to carry both types of transmitters at <4% of their body weight, relatively easy to capture, and provided an opportunity to obtain a reasonable sample size on a single species.

From 8 January to 19 February, we located radio-marked Vesper Sparrows 5-7 days per week using the receivers and antennae and recorded UTMs (NAD27 CONUS) for bird locations over four time blocks, early morning (6-9am), mid-morning (9am-noon), early afternoon (noon-3pm), and late afternoon (3pm-6pm). We rotated the order in which we visited each site, in order to obtain a roughly equal number of point locations for each bird among the four time blocks. We documented roosting areas by marking bird locations after dark.

In order to avoid influencing the movements and locations of birds, we tracked each bird from a distance using two observers. After detecting a bird, each observer recorded their own location, the bearing to the bird, and estimated its distance from the observer. We then closed in on the bird to determine its exact location, flushed it, and then estimated percent cover of bare ground, grass, and shrubs, as well as mean shrub and grass height, within a 5 m radius around the location of each bird. If the birds exact location could not be determined in the field we would triangulate it in GIS using the initial observer locations and recorded bearings.

Figure 3. A Vesper Sparrow outfitted with a radio transmitter.

Results

We banded 248 birds of ten species over the course of the project (Appendix 1). We fitted a total of 37 Vesper Sparrows, and one Cassin’s Sparrow, with radio transmitters. Proper attachment of transmitters to birds was a skill that required substantial practice and learning. Five transmitters, all from birds outfitted in the first few days of the study, fell off after 3 to 14 days (avg=6.4 d). Although the lost transmitters were retrieved and later affixed to other birds, this limited the amount of useful information we could obtain for both the birds from which they fell off, and the birds to which they were later re-attached, due to constraints of the battery life.

Home range
In total, we recorded 452 point locations for 37 individual Vesper Sparrows (avg=14.7 points/bird; min=1, max=28) over the four time blocks. We analyzed the home range data in GIS (ArcMap 9.2) by building minimum convex polygons (MCP) around the recorded locations for each radio-fitted bird. Mean MCP home range size for birds with 20 or more observations (collected over 30-44 days) was 13.33 ha (min=3.76, max=32.24 ha; SE=2.76; n=11). Mean MCP home range size for birds with 10-19 observations (collected over 13-29 days) was 9.37 ha (min=1.73, max=39.78 ha; SE=3.25; n=12).

Seventeen of the 37 radio tagged birds could not be relocated during one or more attempts, suggesting that they had either temporarily moved out of the range of the receivers, or were positioned such that their transmitter signals could not be detected (e.g., on the ground behind dense grass or shrubs). Most birds did not go undetected for more than one consecutive relocation attempt, however, one bird was not located on seven consecutive attempts, after being located 12 of the 15 previous days. It was eventually detected one last time, suggesting it may have moved its primary home range beyond the original area where it was being monitored.

Foraging sites -- Using all Vesper Sparrow foraging locations (n=452), average percent cover of bare ground at foraging sites was 24.8% ± 24.5%, grass was 53.8% ± 28.3%, and shrubs 21.4% ± 15.5%. Average height of grass and shrubs were 28.3 ± 10.3 cm and 1.3 ± 0.05 m respectively[*].

Roost sites -- We recorded 34 roosting locations for 17 individual radio-tagged Vesper Sparrows. In the dark, we were able to approach the birds closely and take GPS readings at their exact locations. Vesper Sparrows generally roosted in loose colonies, often with other radio-tagged birds, suggesting these birds may maintain the same social networks day and night. For eight birds with two to four recorded roost sites, locations varied by an average of 34 m (min=6 m, max=84 m), suggesting some plasticity in roost location. Because it was dark, we generally did not attempt to quantify habitat characteristics. At three of four sites where vegetation parameters were estimated within a five meter radius around the roosting bird, grass cover ranged from 49-79%, grass height ranged from 30-45 cm, bare ground ranged from 1-50%, shrub cover ranged from 0-20%, and shrub height ranged from 0.4 to 1.6 m. At the fourth site, grass cover was absent and shrub cover was 95% and 0.3 m high. These data, along with qualitative descriptions of roost habitat made at 13 other roost locations, suggest roost sites may vary considerably, from open grassy areas with no shrubs to areas with dense shrubs. At most sites, dense vegetation was noted, whether it was tall bunch grasses like Tobosa (*Hilaria mutica*), sprawling woody herbs like Russian thistle (*Salsola* sp.), or thorny shrubs like mesquite. Roosting birds were observed perched on the ground, amongst dense grasses, and above ground in plants like mesquite and in Russian thistle. Roost sites were located both on flat ground and on steep hillsides. For 10 of the 17 birds whose roost sites were located, roosts were within or adjacent to diurnal home ranges. The remaining 7 birds roosted 15 to 190 m away (avg=58.6 m) from the perimeter of areas used during the day.

---

[*] Averages reported with standard deviations.

Survival
Among the 37 radio-tagged Vesper Sparrows in this study, five predator-related mortalities were confirmed. All of these were second-year birds (i.e., less than one year old). In each case, the transmitter was recovered from within or adjacent to a pile of flight and body feathers, often in or under a shrub. Additionally, the elastic harnesses were intact and the knots were still tied, suggesting the transmitters did not simply fall off. Cooper's Hawks were suspected in most attacks, as they were common in the area, and were observed hunting, capturing and eating birds while perched in or under shrubs. Northern Harriers (also potential predators) were common in the area, although no predation events on small birds were observed. The predation events occurred no more than 6, 7, 16, 19, and 31 days after transmitter attachment, but the exact date of mortality is difficult to determine due to time between the last live location and transmitter recovery. It is impossible to know if these birds were more susceptible to predation because they were carrying transmitters, but radio-tagged birds were regularly seen flying without apparent difficulties.

Using all Vesper Sparrows monitored for at least one week (n=26), apparent survival was 88% during the project period, although actual survival was likely lower due to individuals included here whose fate was unknown (due to early transmitter battery failure) or which were monitored for only part of the study period (due to inclusion in the study after the initial start date). Proper estimation of survival should include censuring birds whose fate is not known (Conroy and Carroll 2009). In future analyses of survival, we will employ the Kaplan-Meier model, which allows for censuring birds with unknown fates and staggered entry of radio-tagged birds throughout the study period.

Discussion

We were able to meet four of the five stated objectives of this project during this first pilot year. The information we gathered will aid us in building more effective protocols and strategies to meet future goals. We achieved several other accomplishments beyond the original objectives, such as estimating home range size for Vesper Sparrows, determining important predators, characterizing roost sites, and providing hands-on training in bird banding and radio-telemetry for a large number of Mexican ornithologists. Nonetheless, certain technical difficulties and ecological uncertainties did lower our success in achieving all of our primary objectives

Harness attachment and predicted battery life -- Six radios had to be re-fitted onto new birds due to radios falling off the birds they were first attached to. This was a significant problem because splitting the transmitter's short battery life between two individuals resulted in an insufficient number of locations for either bird. Fallen radios were disproportionate to the beginning of the study as biologists improved their techniques with each fitted radio. We expect that this problem will be significantly reduced in future years with increased expertise. Additionally, we will weigh our efforts to re-attach transmitters based on estimated minimum remaining battery life.

In general, radio transmitter batteries did not meet factory-predicted life spans (Table 1). Average life span was 29 days for small radios (64% predicted lifespan) and 41 days for large radios (60% of predicted lifespan). Four of the 11 large radios were recovered from the field prior to the completion of their battery life, these were not included in our life span calculations. One radio was "lost" in the field due to the bird moving locations, a predator taking the radio out of range, or an early battery failure. Low ambient temperatures in the field may have contributed to a shorter than expected battery life, as temperature regularly dipped below freezing at night, although ATS personnel did not believe that low temperature would significantly reduce battery life.

Table 1: Predicted vs. actual radio transmitter battery life.

Radio model	weight (g)	Predicted battery life	Actual average battery life	SD	Min	Max	n
A1015	0.57	45 d	28.9 d	3.9	18	34	13
A1035	0.74	68 d	40.9 d	2.5	36	44	7*

*life span not determined on 4 of 11 large radios

Radio recovery -- We attempted to recapture radio-tagged birds through flush-netting before the predicted end of the battery life in order to remove transmitters and examine body condition, but none could be recaptured. These birds were apparently still "net-shy" several weeks after the initial capture and banding and thus adeptly avoided recapture. We were therefore unable to obtain data on post-study or end-of-winter physiological condition as desired. These data would have helped us determine if the radio-tagged birds gained or lost weight during the course of this study, and whether there were other adverse impacts to birds as a result of the transmitters, thus aiding interpretation of results and guidance on future directions. Nonetheless, our inability to recapture birds through our conventional capture techniques will weigh into our future decisions on whether and how to attempt to collect these data and recover transmitters.

Analytical techniques -- Our low sample sizes led us to choose minimum convex polygon (MCP) methodology as a means of home range analyses. The MCPs were a useful tool to determine a crude area that Vesper Sparrows utilize on their wintering grounds and the relative distance of roosting locations from those areas. Fixed kernel analyses are, however, the preferred method of analyzing home range use (Seaman and Powell 1996, Powell 2000, Kernohan 2001), but they require a minimum of 50 locations per animal. Minimum convex polygons tend to overestimate home range size as they are strongly influenced by locations of the outermost points, include areas that are rarely or never used, and are not capable of demonstrating how intensively different parts of the home range are used (Franzreb 2006). As the number of observations increases, MCP home range size may also increase (Franzreb 2006). Our data appear to support this notion, as MCP-calculated home range sizes increased exponentially with increasing observations (Figure 4). This was likely due to a few outlying points; most observations of each bird were made within a relatively small area.

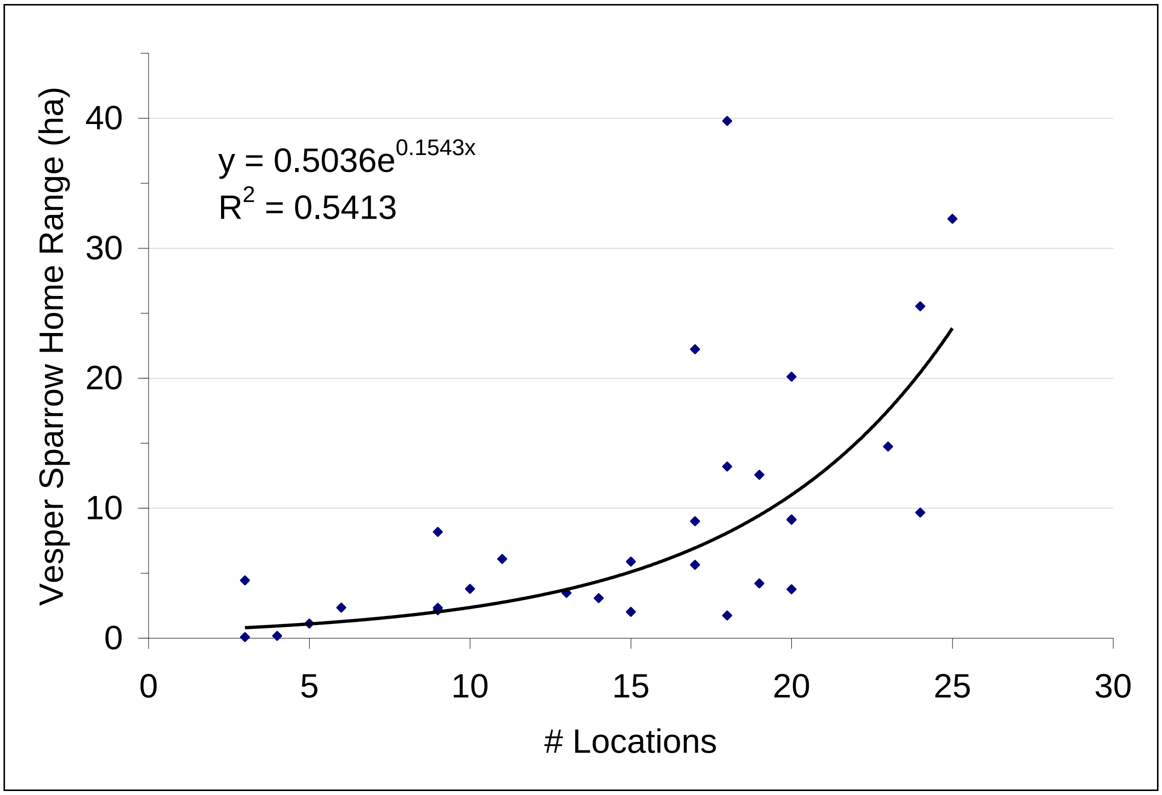

Figure 4. Relationship of the number of point observations and Vesper Sparrow home range size estimated using minimum convex polygon areas.

Our small sample size (and insufficient resources) hindered us from employing more sophisticated models in estimating survival of Vesper Sparrows during this study. In the future, we aim to utilize the Kaplan-Meier model to estimate survival, which should yield a more realistic probability of survival than the apparent survival rate presented in this report. It will also be essential to obtain samples of survival from less optimal habitats than those surveyed on the El Uno ecological reserve, as this will provide the data needed to gain insight into habitat specific survival and assess survival probabilities across desert grasslands in Mexico in relation to habitat quality.

Future directions -- For future field efforts, we aim to increase the number of radio-tagged birds, and increase the number of point locations obtained for each bird, in order to apply fixed-kernel analyses in describing home range size and use. We also aim to increase the duration for which each bird is monitored in order to input the most useful data for estimating survival using the Kaplan-Meier model. To this end, we will use only the larger transmitters with the longer battery life, deploy as many transmitters as possible at the start of the study, and exercise great care in transmitter attachment to minimize detachment during the study. We will also increase the number of roosting locations we visit and better describe the habitat variables, bird assemblages, and travel distances associated with roost sites. We plan also to introduce a comparative aspect to our study. Since the El Uno ecological reserve is an example of very lightly grazed grassland, we will need to expand efforts into intensively grazed grasslands, and increase the total number of birds carrying transmitters to 60 (ideally 30 in each type), to determine the effects of grazing related habitat quality on survival and home range size. We will continue to collect data on habitat attributes around foraging locations and randomly sample the habitat in the study area to determine if birds are specializing in certain microhabitats or using them in proportion to their availability on the landscape. Finally, we will continue to attempt to recapture radio-tagged birds to remove and recover radios and document the physiological condition of birds at the end of the study, most likely by trapping birds at roost sites or using other novel methods.

Meeting these objectives will require adding an additional two-person survey crew (plus another vehicle, two radio receivers and antennae, and additional banding supplies) to rapidly attach all transmitters at the start of the study and then monitor birds throughout the study by collecting at least two points per bird each day. Since this year's study relied on volunteers and donated equipment and vehicles, a significant increase in field and analytical efforts will require additional financial and/or in-kind resources to meet these objectives. If the redesigned study, as described above, can be successfully implemented for Vesper Sparrows, and if radio-telemetry and small battery technologies improve, we can likely extend this research to other higher-priority, but smaller, grassland species, like Baird's and Grasshopper sparrows. Winter-season capture techniques for other grassland songbirds, particularly Chestnut-collared Longspur and Sprague's Pipit, remain an obstacle for effective studies utilizing radio-telemetry, but could potentially be overcome with additional effort.

Literature Cited

Conroy, M.J. and J.P. Carroll. 2009. Estimation of survival from radiotelemetry, nesting success studies, and age distributions. In: Conroy M.J. and J.P. Carol (Eds.) Quantitative Conservation of Vertebrates, pp. 160-188. Wiley-Blackwell, USA.

Franzreb, K.E. 2006. Implications of home-range estimation in the management of red-cockaded woodpeckers in South Carolina. Forest Ecology and Management. 228: 74-284.

Kernohan, B.J., Gitzen, R.A., Millspaugh, J.J., 2001. Analysis of animal space use and movements. In: Millspaugh, J.J., Marzluff, J.M. (Eds.), Radio Tracking and Animal populations. Academic Press, San Diego.

Powell, R.A. 2000. Animal home ranges and territories and home range estimators. In: Research Techniques in Animal Ecology Controversies and Consequences (eds L. Boitani & T.K. Fuller), pp. 65–110. Columbia University Press, New York.

Seaman, E., Millspaugh, J., Kernohan, B. Brundridge, G. Raedeke, K., Gitzen, R. 1999. Effects of Sample Size on Kernel Home Range Estimates. Journal of Wildlife Management. 63(2): 739-747.

Seaman, D.E. & Powell, R.A. 1996 An evaluation of the accuracy of kernel density estimators for home range analysis. Ecology. 7: 2075–2085.

Appendix 1.
Results of grassland bird flush-netting at El Uno Ecological Reserve, Jan-Feb. 2009.*

	Number Banded							
Species	**Total**	**AHY**	**SY**	**ASY**	**Mean Fat Score**	**Mass (g)**	**Wing length (mm)**	**Tail length (mm)**
Cassin's Sparrow *Aimophila cassinii*	5	5	0	0	1.2 ± 1.6 (0, 4)	18.2 ± 0.6 (17.6, 18.7)	62.6 ± 3.1 (59, 66)	62.0 ± 5.7 (55, 69)
Baird's Sparrow *Ammodramus bairdii*	1	0	0	1	0	18.0	71.0	52.0
Grasshopper Sparrow *Ammodramus savannarum*	15	12	1	2	1 (0, 3)	16.8 ± 1.0 (15.6, 18.9)	64.1 ± 2.3 (60, 67)	45.5 ± 3.6 (39, 52)
Black-throated Sparrow *Amphispiza bilineata*	7	1	2	4	2.3 ± 1.3 (2, 4)	14.32 ± 0.7 (13.6, 14.9)	66.7 ± 2.5 (63, 69)	65.3 ± 5.3 (59, 72)
Lincoln's Sparrow *Melospiza lincolnii*	2	1	1	0	1.5 ± 0.7 (1, 2)	17.9**	60.0 ± 1.4 (59, 61)	63.0 ± 8.5 (57, 69)
Savannah Sparrow *Passerculus sandwichensis*	74	11	25	38	1.1 ± 1 (0, 3)	17.0 ± 1.2 (14.6, 19.0)	69.4 ± 2.8 (60, 77)	48.9 ± 3.9 (44, 63)
Green-tailed Towhee *Pipilo chlorurus*	1	0	0	1	3	29.4	75.0	86.0
Vesper Sparrow *Pooecetes gramineus*	79	6	61	12	0.9 ± 0.9 (0, 3)	23.4 ± 1.5 (19.9, 26.8)	80.9 ± 4.1 (68, 90)	62.0 ± 4.0 (53, 72)
Brewer's Sparrow *Spizella breweri*	64	10	40	14	0.9 ±1.0 (0, 4)	11.1 ± 0.6 (9.6, 12.3)	63.0 ± 2.6 (55, 69)	60.3 ± 3.7 (51, 68)
All species	248	46	130	72				

* Reported as averages ± standard deviations with minimum and maximum values in parenthesis.
** Only one mass taken