CALIFORNIA STATE UNIVERSITY, STANISLAUS

ENDANGERED SPECIES RECOVERY PROGRAM

SMALL MAMMAL MONITORING
BITTER CREEK NATIONAL WILDLIFE REFUGE
2016

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Introduction

Live-trapping was conducted at Bitter Creek National Wildlife Refuge (BCNWR) in 2016 as part of a newly established small mammal monitoring program. This program will track annual trends in small mammal abundance at BCNWR and assess the relationship between small mammals and vegetation characteristics, including response to cattle grazing.

Methods

Fifteen small mammal monitoring plots were established at BCNWR in 2015. These plots were paired with exiting vegetation monitoring transects to more effectively assess the response of small mammals to annual vegetation attributes. The plots were located in management units 9 Central, 9 West, 10A, 10B, and 12. The specific sites were:

10A05	10AEX	09W08
09C06	10B03	1202
09C08	10BEX	09WEX
09C09	10B06	12EX
09W01	09CEX	09W03

A Sherman aluminum box trap (7.6 cm x 9.5 cm x 30.5 cm) modified to prevent injury to long kangaroo rat tails was placed at each of 24 trap stations on a transect surrounding the vegetation monitoring plot. Each trap was provisioned with a handful (ca. 20 ml) of millet seed for bait and an unbleached paper towel or wad of cotton batting for bedding and thermal insulation. Traps were opened near dusk and checked beginning just before sunrise the next morning. All rodents captured were identified to species and marked ventrally with a non-toxic felt-tipped marker to identify recaptured animals within a

trapping session. Sex, age, weight, and reproductive status also were recorded. Animals were then released at the capture site.

Results

In 2016, trapping was conducted by ESRP and BCNWR staff during 20 September-7 October (Table 1). Trapping was conducted on 5 plots each week. Across all plots, 460 individuals were captured representing seven species: Heermann's kangaroo rat (*Dipodomys heermanni*), Giant kangaroo rat (*Dipodomys ingens*), San Joaquin pocket mouse (*Perognathus inornatus*), California pocket mouse (*Chaetodipus californicus*), deer mouse (*Peromyscus maniculatus*), Harvest mouse (*Reithrodontomys megalotis*), and California vole (*Microtus californicus*). Deer mice were the most frequently captured species (248 individuals) and were recorded on all 15 plots. For California pocket mice, 138 individuals were captured on all 15 plots, and for San Joaquin pocket mice, 13 individuals were captured on 5 plots. Forty-eight Heermann's kangaroo rats were captured on 12 plots. One endangered Giant kangaroo rat was captured on one plot. Eleven harvest mice were captured on 6 plots, and one California vole was captured on one plot.

The number of unique individuals caught on plots averaged 30.7 and ranged from 8-57 (Table 1). Capture rates on the plots averaged 0.32 individuals per trap-night and ranged from 0.08-0.59 individuals per trap-night. The number of species captured on plots averaged 3.7 and ranged from 2-5. A Shannon diversity index on plots averaged 0.92 and ranged from 0.27 to 1.43.

The mean (± SE) number of unique individuals captured was 29.1 (± 4.2) on the 10 grazed plots and 33.8 (± 6.4) on the 5 ungrazed plots. These means were not significantly different ($t_{1,8}$ = -0.62, P = 0.55). Mean residual dry matter (RDM) was 1739 (± 317) lbs/ac on grazed plots and 1527 (± 270) lbs/ac on ungrazed plots. These means also were not significantly different ($t_{1,8}$ = -0.51, P = 0.62). The relationship between capture rates and RDM was not significant ($F_{1,13}$ = 0.69, R^2 = 0.05, P = 0.42).

Discussion

Small mammal abundance was higher in 2016 (460 individuals) compared to 2015 (240 individuals). Consequently, mean capture rate was higher as well (0.32 individuals per trap-night in 2016 vs 0.18 individuals per trap-night in 2015). Diversity also was slightly higher in 2016 (0.92) compared to 2015 (0.83). Precipitation was considerably higher in during the 2015-16 growing season compared to the 2014-15 growing season, and concomitant increase in primary productivity may be responsible for the increase in rodent abundance.

A working hypothesis for habitat management at BCNWR is that the abundance of arid land rodents will increase as vegetation biomass, particularly that of non-native grasses, is reduced. The

management strategy being employed at BCNWR to reduce this biomass is grazing by cattle. Small mammal abundance actually was higher on ungrazed plots in 2016. This may be because RDM was actually lower on ungrazed plots compared to grazed plots. In essence, a grazing effect was not evident on the grazed plots. This may have been a function of the abundant precipitation during the 2015-16 growing season.

One giant kangaroo rat was captured during the 2016 monitoring session. This is notable because giant kangaroo rats are listed as both Federal and State endangered. The giant kangaroo rat is an arid land species and prefers habitat conditions characterized by low RDM (generally less than 1,000 lbs/ac). This is incongruous with the higher RDM values measured on BCNWR in 2016. However, giant kangaroo rats have increased rapidly and markedly since early 2015 due to favorable conditions in core habitat areas such as the Carrizo Plain National Monument which is located just a couple miles north of BCNWR. Giant kangaroo rats have expanded from these core areas and in 2016 were documented in several locations where they had not been observed in recent years. This expansion may explain the giant kangaroo rat capture in 2016 on BCNWR. In a previous report (*Cypher, B. L., T. L. Westall, C. L. Van Horn Job, L. R. Saslaw, E. C. Kelly, and S. E. Phillips. 2013. Small mammal surveys at Bitter Creek National Wildlife Refuge. California State University-Stanislaus, Endangered Species Recovery Program, Turlock, California*), we suggested that the potential for giant kangaroo rats to occur on BCNWR was high due to its close proximity to the Carrizo Plain core habitat area. However, we also caveated that persistence on BCNWR probably was dependent upon active vegetation management to produce favorable habitat conditions. Thus, although giant kangaroo rats appear to have expanded to BCNWR, it is possible that they might not persist there due to the high ground cover density, as reflected in the 2016 RDM values. Therefore, we recommend adjusting grazing management strategies to obtain a more profound reduction in RDM to improve habitat conditions for giant kangaroo rats and other arid land rodents.

Table 1. Small mammals captured on monitoring plots at Bitter Creek National Wildlife Refuge, 2016. Counts are numbers of unique individuals.

Plot	Dates	DIHE[1]	DIIN[2]	PEIN[3]	CHCA[4]	PEMA[5]	REME[6]	MICA[7]	Diversity Index (H')[8]	Total individuals	Trap Nights	Capture rate (ind/trap night)	RDM[9]
10A05	09-27-16 to 09-30-16	11	1	0	5	21	0	0	1.07	38	96	0.40	480.00
10AEX	09-27-16 to 09-30-16	1	0	3	20	31	2	0	1.06	57	96	0.59	1116.48
10B03	09-27-16 to 09-30-16	1	0	2	18	13	1	0	1.10	35	96	0.36	1776.00
10B06	09-27-16 to 09-30-16	1	0	0	34	12	1	0	0.75	48	96	0.50	415.68
10BEX	09-27-16 to 09-30-16	5	0	4	10	5	1	0	1.43	25	96	0.26	964.80
09C06	09-20-16 to 09-23-16	4	0	0	14	24	0	1	0.99	43	96	0.45	2112.00
09C08	09-20-16 to 09-23-16	0	0	0	9	17	4	0	0.95	30	96	0.31	2880.00
09C09	09-20-16 to 09-23-16	2	0	0	3	7	2	0	1.23	14	96	0.16	3151.68
09CEX	09-20-16 to 09-23-16	4	0	2	9	23	0	0	1.03	38	96	0.40	1567.68
09W01	09-20-16 to 09-23-16	1	0	2	3	2	0	0	1.34	8	96	0.08	976.32
09W03	10-04-16 to 10-07-16	12	0	0	1	16	0	0	0.80	29	95	0.30	1824.00
09W08	10-04-16 to 10-07-16	0	0	0	2	12	0	0	0.41	14	96	0.15	976.32
09WEX	10-04-16 to 10-07-16	0	0	0	2	23	0	0	0.27	25	96	0.26	2512.32
1202	10-04-16 to 10-07-16	3	0	0	7	22	0	0	0.81	32	96	0.33	2800.32
12EX	10-04-16 to 10-07-16	3	0	0	1	20	0	0	0.56	24	96	0.25	1471.68

[1] Heermann's kangaroo rat (*Dipodomys heermanni*)

[2] Giant kangaroo rat (*Dipodomys ingens*)

[3] San Joaquin pocket mouse (*Perognathus inornatus*)

[4] California pocket mouse (*Chaetodipus californicus*)

[5] Deer mouse (*Peromyscus maniculatus*)

[6] Harvest mouse (*Reithrodontomys megalotis*)

[7] California vole (*Microtus californicus*)

[8] Shannon diversity index: $H' = (N \log N - \sum ni \log ni)/N$

[9] Residual dry matter measured in lbs/ac