2014 Boulder Reservoir Small Mammal Survey

Parks and Recreation Department

City of Boulder, Colorado

prepared for:

Nicholas DiFrank
Landscape Designer II
City of Boulder - Parks Planning Group

prepared by:

Wildlife Specialties LLC
PO Box 1231, Lyons, CO 80540

September 2014

Table of Contents

Section / Title **Page**

1.0 Introduction 1
2.0 Methods 1
3.0 Results 1
4.0 Discussion 5
5.0 References 7

List of Figures

Number / Title **Page**

Figure 1. 2014 Small Mammal Survey Transect Locations 2
Figure 2. 2014 Small Mammal Capture Locations 4

List of Tables

Number / Title **Page**

Table 1. 2014 Small Mammal 600 Trap-night Results 3
Table 2. 2014 Small Mammal Capture Location Characteristics 3

1.0 Introduction

The City of Boulder, Colorado Parks and Recreation Department contracted Wildlife Specialties LLC to conduct a small mammal survey in 2014 to complement surveys conducted at Boulder Reservoir in 2013. The goal was to develop an assessment of the species richness and composition of small mammals over a two-year period to investigate population trends. It is important to note that the summer of 2012 was one of the hottest and driest years recorded in Boulder and that the plant community suffered from the heat and lack of moisture, resulting in a decreased food source and reduced cover for hiding and thermal cover. The 2013 surveys reflected the impact to the vegetation, and very few animals were captured (16 total captures of one species). In September of 2013, Boulder County received a large amount of rainfall (greater than 30 inches in some areas) and the vegetation quickly began to rebound and flourish. As a result, areas that had very little cover in 2013 had plant growth close to three feet in height in 2014, greatly improving habitat conditions for small mammals.

2.0 Methods

Fifty Sherman small mammal live traps were placed at the same locations in 2014 that were used in 2013 (Figure 1) for a total of 600 trap-nights (1 trap out for 1 night equals 1 trap-night). Traps were baited with the same bait used in 2013 (molasses sweetened grain mixture) to allow for identical sampling methods. Traps were placed in the evening and checked the following morning between approximately 0600 – 0800 hours.

Photo 1. Small area clipped for identification.

Four hundred of the trap nights occurred with the traps available at one location for one night only; two hundred trap nights occurred with the trap at one location for two nights. When traps are left in one location for more than one night small mammals can and do develop an affinity for the traps and will return to that location, resulting in repeated captures of one individual and potentially causing an inaccurate account of number of individuals captured. Since traps were available for consecutive trap nights at the two locations, individuals captured on day one were marked by clipping the guard hairs from a small area of the back (Photo 1) to identify them if they were caught on day two, allowing for an accurate accounting of the number of individuals captured.

3.0 Results

The 2014 600 trap-night survey resulted in a total of 49 captures representing three species (Table 1) with no recaptures of marked individuals. The overall capture rate was 8.12 percent; up from the 2.66 percent capture rate recorded in 2013. Trap availability was 98 percent; of the 600 total trap nights, traps were available for 588 trap nights (twelve [2% of total trap nights] were not available because they were recorded as 'closed/empty'). Traps identified as 'closed/empty' were often found away from the original trap location with the batting removed, and based on physical evidence, were the result of raccoons (*Procyon lotor*) or coyotes (*Canis latrans*) tampering with the

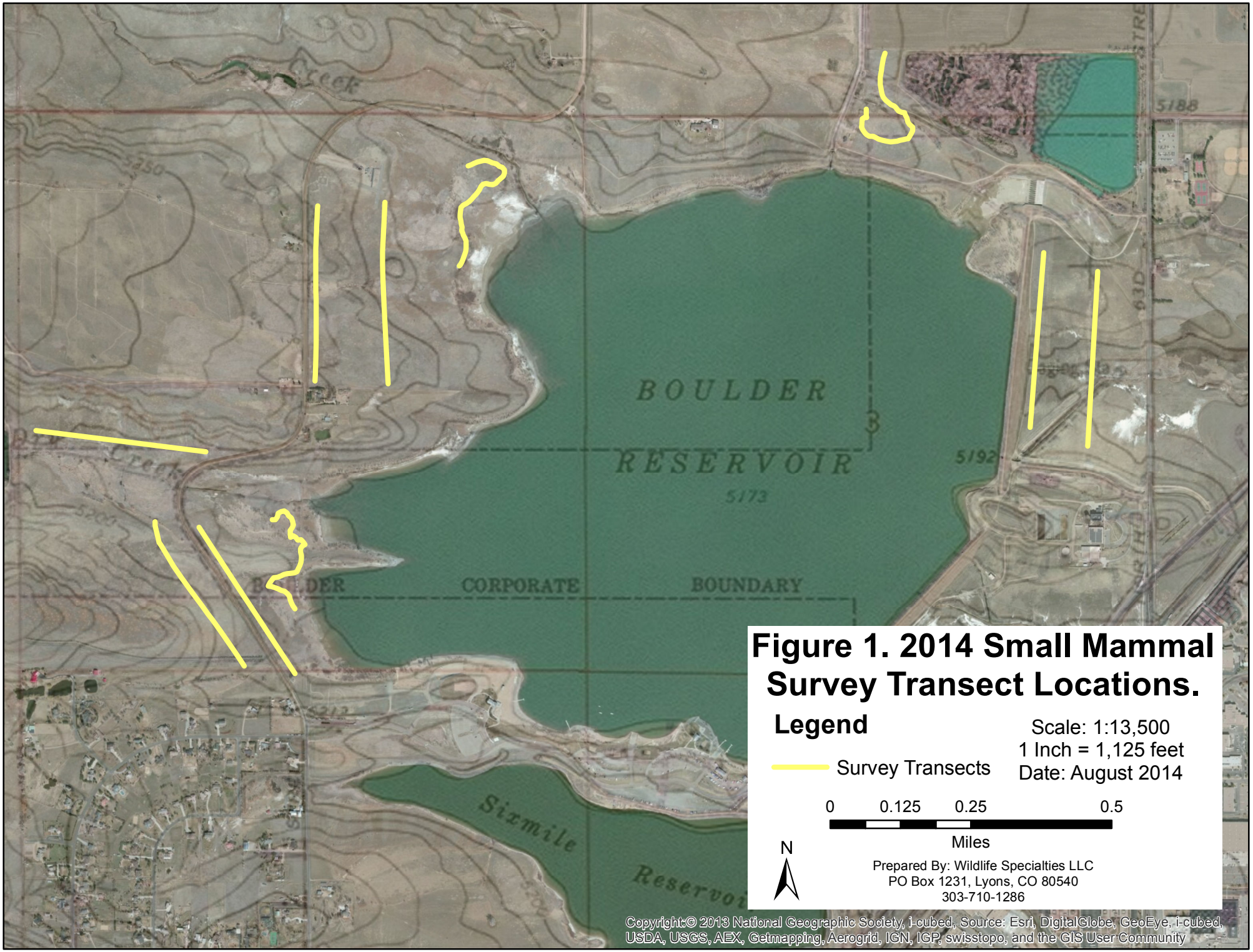

Figure 1. 2014 Small Mammal Survey Transect Locations.

traps. In traps that had consecutive trap nights at one location, captures were 41% greater on night two than night one.

Captures were recorded at all transects (Figure 2), excluding the Coot Lake west transect where no captures occurred in both 2013 and 2014. Seventy three percent (n = 36) of the total captures occurred in areas with vegetation that was at least six inches in height, and as tall as three feet in some areas; the remaining captures were in areas with very short vegetation dominated by field bindweed (*Convolvulus arvensis*) (Table 2). Thirty percent (n = 15) of all captures occurred in areas in which black-tailed prairie dogs were active (Table 2). Deer mice were the only species captured in active prairie dog colonies.

Table 1. 2014 Small Mammal 600 Trap-night Results

Species*	No. of Individuals Captured	% Total Captures
Meadow Vole (*Microtus pennsylvanicus)*	5	10.4
Western Harvest Mouse (*Reithrodontomys megalotis)*	2	4.1
Deer Mouse (*Peromyscus maniculatus)*	42	85.5
* Species listed phylogenetically.		

Table 2. 2014 Small Mammal Capture Location Characteristics

Species*	Vegetation Height	Prairie Dogs Present Y/N
Meadow Vole (*Microtus pennsylvanicus)*	All captures in areas with vegetation greater than 6 inches.	N
Western Harvest Mouse (*Reithrodontomys megalotis)*	All captures in areas with vegetation greater than 6 inches.	N
Deer Mouse (*Peromyscus maniculatus)*	69% of captures (n = 29) where vegetation greater than 6 inches; 13 captures (31%) in areas with vegetation less than 6 inches.	64% (n = 27) of captures in areas where prairie dogs were not present.
* Species listed phylogenetically.		

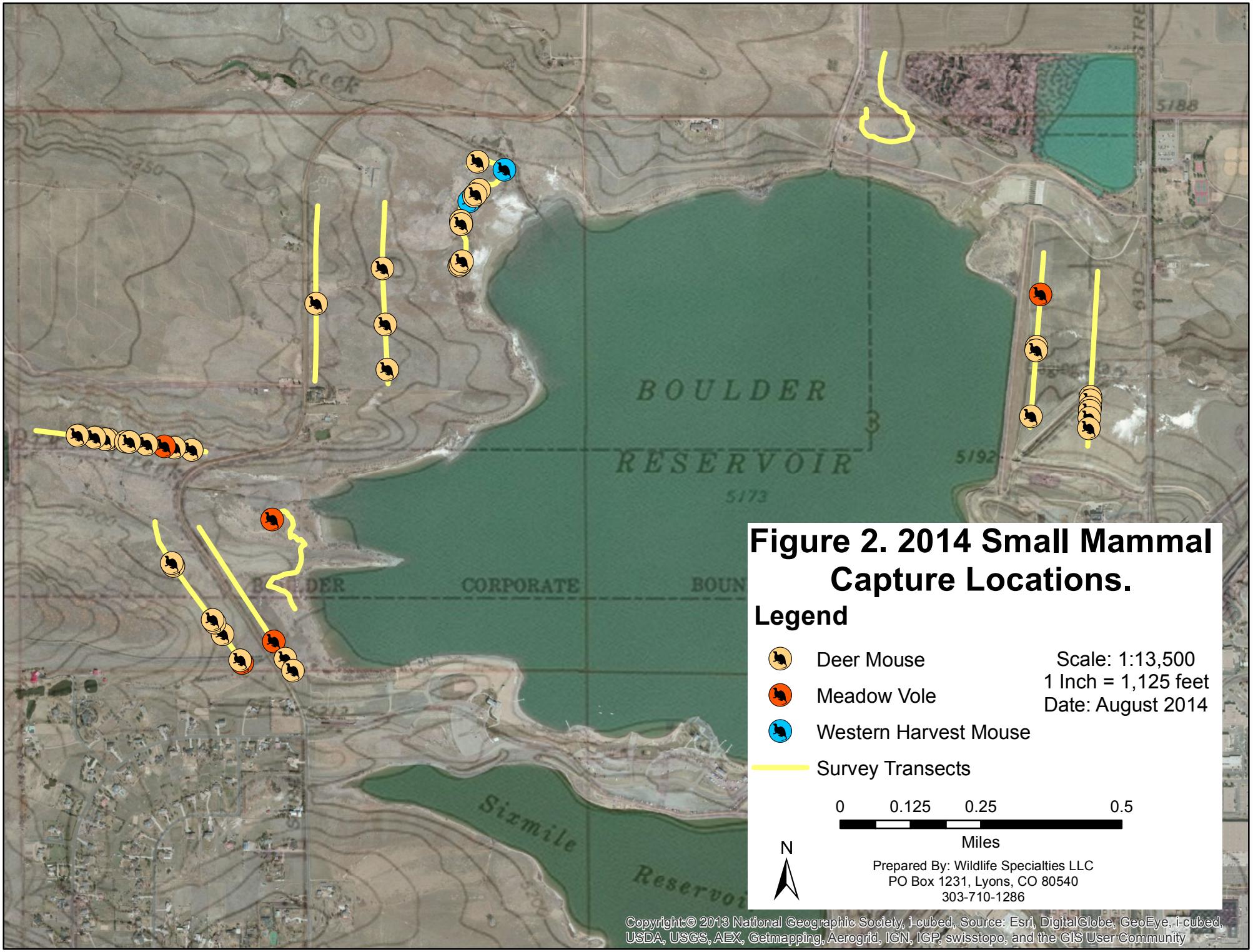

Figure 2. 2014 Small Mammal Capture Locations.

The number of species in a community is referred to as species richness, and the relative abundance of rare or common species is evenness. Both species richness and relative abundance are important. For example, two communities may both contain the same number of species, but one community may be dominated by one species while the other community may contain large numbers of all species. Communities dominated by one or a few species have a low evenness, while those that have a more even distribution of species have high evenness. Therefore, species diversity includes both richness and evenness. Communities with a large number of species that are evenly distributed are the most diverse and communities with few species that are dominated by one species are the least diverse.

The Simpson's Diversity Index (Equation 1) takes into account both species richness and evenness. Thus, for a given evenness, diversity increases with species richness; similarly, for a given species richness, diversity will increase with evenness. The Simpson's Diversity Index produces a value between 0 and 1; values around 1 have high diversity (even composition of each species) and values around 0 have low diversity.

$$\text{Eq. 1: } D = (\sum n\,(n-1))/(N(N-1))$$

(Where N = the total number of individuals of all species)

Using the data provided in Table 1, the 2014 Simpson's Diversity Index equals 0.74149, a vast change from the 2013 value of 0 (zero). This increase in diversity is attributable to the threefold increase in both total number of individuals captured (16 in 2013, 49 in 2014) and number of species captured (1 species in 2013, 3 in 2014). This value also reflects the low species diversity recorded and demonstrated by the dominance of deer mice captured and the low number of other species captured.

4.0 Discussion

The 2014 survey resulted in an increase in the number of individuals and individuals captured over 2013. The overall capture rate of 8.12 percent is an increase over 2013, but it still suggests that there are very low numbers of small mammals in the areas surveyed. By comparison, at the Wernimont Ponds Regional Detention Facility in Loveland, an area that has been restored to a diverse native plant community with very few weeds, no prairie dogs, and an average plant height greater than 6 inches, a 50 trap-night survey resulted in the capture of 12 individuals representing four species. At Wernimont Ponds trap availability was 74 percent (12 tampered with by raccoons) and the overall capture rate was 31.57 percent. Fifty percent of all captures were meadow voles.

The following factors, singularly or in combination, could be contributing to the current low small mammal species richness and diversity:

- Drought and other environmental conditions can suppress small mammal populations. In 2012 the entirety of Colorado, for the first time in recorded history, was under severe drought conditions. Record high temperatures were recorded early in the growing season and the continued heat throughout the summer led to a reduction in biomass. Although the drought was less severe during the 2013 survey season, the effects (reduced seed production, a decrease in suitable habitat, etc.) of the 2012 drought likely influenced the 2013 survey results. Rains in September of 2013 resulted in a burst of growth in the fall which was helped by a wet 2014 spring and summer – resulting in vigorous plant growth.

- Recreation and dogs could be impacting the small mammal community near Coot Lake where zero captures occurred in 2013 and 2014. Studies (Johnson 2000; Meaney et al. 2002; Lenth et al. 2006) have shown that small mammal species richness and diversity are influenced by recreation (including the physical impacts of trails) and dogs. Dogs were observed in most areas (except within the wetland enclosure at Coot Lake) near Coot Lake – often with no owner seen within the immediate area of the dog. The physical direct loss of habitat (trails), the fragmentation of habitat associated with trails, and the presence of canines could be impacting small mammal populations in the areas near Coot Lake.

- Populations of small mammals fluctuate more or less regularly (Boonstra et al. 1998). Voles, a group of small mammals common throughout the Front Range, have fluctuations on an average of every 3-5 years (Boonstra et al. 1998). Schramm et al. (1990) reported high numbers of voles within their study area prior to a drought, no voles during the drought, and rare in the post-drought period. The zero capture of voles during the 2013 trapping period could be a relic of 2012's drought, and the low number of captures in 2014 could be the beginning of an upward trending population.

- Cover height and density can be important in small mammal population regulation. Oftedahl (1976) reported overgrazed areas with short vegetation and bare ground favored the deer mouse and areas that were not overgrazed had a greater occurrence of voles (Microtus spp. – Oftedahl 1976). In 2013, most of the surveyed areas had minimal cover; in 2014 areas that had minimal cover in 2013 often had tall, dense cover that provided food and thermal and hiding cover. All captures of voles in 2014 occurred in areas with dense vegetation that was greater than 6 inches in height.

- All but one transect (west of Coot Lake) was influenced by the presence of prairie dogs, and there are varying reports of the effects of prairie dogs on faunal diversity. Recently, Cully et al. (2010) reported small mammal species richness and evenness are less variable within colonies, and Pruett et al. (2010) reported species diversity and evenness greater in areas outside of colonies. This decrease in species richness and evenness within colonies could be in part a result of the change in plant species composition (often towards a non-native invasive community) and a suppression of plant cover by prairie dogs (Baker et al. 2013). The survey results from both 2013 and 2014 suggest greater species richness and diversity, and total number of individuals, in areas not dominated by prairie dogs.

5.0 References

Baker, B. W., Augustine, D. J., Sedgwick, J. A., and B. C. Lubow. 2013. Ecosystem engineering varies spatially: a test of the vegetation modification paradigm for prairie dogs. Ecography 36(2):230–239.

Boonstra, R., C. J. Krebs, and N. C. Stenseth. 1998. Population cycles in small mammals: The problem of explaining the low phase. Ecology 79(5):1479-1488.

Cully, J. F., Collinge, S. K., VanNimwegen, R. E., Ray, C., Johnson, W. C., Thiagarajan, B., Conlin, D. B., and B. E. Holmes. 2010. Spatial variation in keystone effects: small mammal diversity associated with black-tailed prairie dog colonies. Ecography 33(4):667–677.

Johnson, W. 2000. Effects of recreational trails on small mammals. University of Colorado.

Lenth, B., Brennan, M., and R.L. Knight. 2006. The effects of dogs on wildlife communities. Final research repoprt submitted to Boulder County Open Space and Mountain Parks.

Meaney, C.A., A.K. Ruggles, N.W. Clippinger, and B.C. Lubow. 2002. The impact of recreational trails and grazing on small mammals in the Colorado Piedmont. Prairie Naturalist 34(3/4) 115-136.

Oftedahl, L. O. 1976. Small mammal habitat modification in Northeastern Colorado. Technical Report No. 301. Grassland Biome, U.S. Internation Biological Program.

Pruett, A. L., Boal, C. W., Wallace, M. C., Whitlaw, H. A., J. D. Ray. 2010. Small Mammals Associated with Colonies of Black-Tailed Prairie Dogs (Cynomys ludovicianus) in the Southern High Plains. The Southwestern Naturalist 55(1):50-56.

Schramm, P., D.B. Dunn, and L. Nachowicz. 1990. The drought and post-drought abundance and habitat distribution of small mammal species in burned and unburned restored tallgrass prairie. Proceedings of the Twelfth North American Prairie Conference. Pp. 55-60.