Comparative behavioral study of relocated and non-relocated populations of the Black-tailed prairie dog, *Cynomys ludovicianus*

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Abstract

The policy of relocating the black-tailed prairie dog, *Cynomys ludovicianus*, is becoming more popular than outright extermination. However, the effects of the relocation process on the behavior of these animals is not known. We hypothesized that relocated prairie dogs would not show behavioral differences relative to non-relocated prairie dogs. We recorded response distances to a human intruder in three prairie dog towns in Boulder, Colorado, containing non-relocated, relocated, and combined non-relocated and relocated prairie dogs. The relocated prairie dogs showed nearly twice the sensitivity to human approach as non-relocated prairie dogs. This increased sensitivity complicates management considerations of relocated populations that are subject to human traffic.

Introduction

Prairie dogs are herbivorous, territorial (Garrett and Franklin 1988), diurnal rodents that live in harem-polygynous families called coteries, several of which make up a larger colony (Hoogland 1992). The black-tailed prairie dog, *Cynomys ludovicianus*, is native to the North American short grass prairie. Since the spread of agriculture and ranching on its former range, farmers and ranchers have voiced somewhat exaggerated complaints about prairie dogs, which have resulted in intense government sponsored extermination programs (Clark 1979). Since the turn of the century, 98% of the prairie dog population in this country has disappeared (Miller, Ceballos, and Reading 1994). Prairie dogs now occupy only a small percentage of their former range: 600,000 hectares in 1960, compared to 100 million hectares in 1900 (Koford 1958; Miller et al. 1994). But even this land area is

decreasing under the relentless onslaught of human development. Through the work of several scientists, the prairie dog is now recognized as an essential part of healthy prairie ecosystems (Whickler and Deitling 1988; Miller et al. 1994; Robinette, Andelt, and Burnham 1995). Several wildlife advocacy groups such as Wild Places, Prairie Dog Rescue, Citizens Concerned for Wildlife, Loveland Prairie Dog Action, and the Humane Society, advocate methods of management less drastic than outright extermination. Black-tailed prairie dogs can be seen as ecosystem regulators since they "manipulate soil and increase plant and animal density" (Clark et al. 1982). Over 140 vertebrate species have been observed to benefit from the presence of prairie dogs (Clark et al. 1982; Miller et al. 1994). These are animals that benefit by living in areas of short vegetation, have burrows, or prey on prairie dogs (Clark et al. 1982).

Due to the pending construction of a laboratory for the National Oceanic and Atmospheric Administration (NOAA) on the US Commerce Department Station in Boulder, Colorado, the Wild Places group worked with Phyllis Gunn of the Commerce Dept. to relocate part of a prairie dog town to a protected site on the Boulder City Open Space system. After the trapping and releasing was complete, we were interested in knowing whether they would behave differently subsequent to their trapping, handling, and adjusting to a new habitat. Robinette et al. (1995) recommended releasing groups larger than 60 individuals in areas with no potential immigration "to minimize the effects of random genetic drift and inbreeding." This number was well exceeded at the release site (see Methods section).

There are many studies dealing with the genetic dynamics of prairie dog populations and the effects of reduction (Daley 1992), gene flow and dispersal (Garrett & Franklin 1988), and inbreeding (Hoogland 1992; Mills & Smouse 1994). Adams, Lengas, and Bekoff (1987) tested the differences between city and country prairie dog populations in response to human approach concluding that country dogs respond to human approach at greater distances than did city dogs. Skagen, Knight, and Orians (1991) used similar methods using human approach to study the behavior of avian scavengers. None, however, deal specifically with the effects of relocation on individual behavior. We hypothesized that relocated prairie dogs

would show no difference in human approach response distances than their non-relocated counterparts.

Methods

Study Sites

We studied three towns, designated NOAA, 51, and #3. The NOAA town consisted of prairie dogs remaining in the colony that were not moved for imminent construction. These dogs constituted our control group. The colony is bounded by facility service roads restricted to facility motor vehicles only. Pedestrians regularly use these, however, and dogs often accompany them, both on and off leash. Thus the NOAA prairie dogs are accustomed to close proximity of vehicles, humans, and curious potential predators.

The second town is on the Boulder Reservoir Open Space adjacent to north 51st Street; 83 dogs were released here onto the periphery of an existing town from 12 July to 8 October 1996. These dogs came from the 63rd St. Water Treatment Plant grounds which experienced similar traffic to that of the NOAA site. Thus the town contains non-relocated and relocated dogs, and it served as an intermediate group due to their longer adjustment time and the mixed population. To the north of the town is a model airport and flyers often "buzz" the prairie dogs for sport and have reportedly occasionally plugged burrows with newspaper to prevent their interference with the model planes. This and the occasional jogger or biker along 51st is the only human interaction the prairie dogs have had.

The dogs from NOAA were relocated onto the third site designated for this project as site #3. The city wishes to keep this location from the public due to past incidents of people dropping off privately captured prairie dogs on open space without authorization (Clint Miller, personal comment). Here, Wild Places released 117 dogs from 9 September to 6 November 1996 onto a town that was previously extirpated by plague. The prairie dogs were released in the same relative burrow positions in which they were trapped. This group constituted our experimental group.

Data Collection and Analysis

From 19 October to 20 November 1996, we collected one data set at each site once a day at varied times of the day until we had 21 sets of data for each site. We employed the methods that Adams, Lengas, and Bekoff (1987) used when studying country and city populations. Specifically, before approaching the town, we selected a focal animal which to observe. We recorded four behavioral measures as follows: 1. bark distance (BD): distance from observer to the focal animal when it emits the initial warning signal and retreats to its burrow entrance; 2. concealment distance (CD): distance from observer to the burrow when the animal conceals itself; 3. sequence time (ST): time the individual takes to perform the avoidance sequence of a. running to the burrow, b. pausing at the burrow entrance, c. flattening down inside the lip of the burrow, d. tail-wagging, e. barking, and f. concealing itself underground; 4. concealment time (CT): time from the moment that all individuals in the group conceal themselves until one reappears above ground (Adams et al. 1987). At NOAA and #3, approaches began 200m from the towns. At 51st, approaches began at the fence lines on the north and west sides and 200m from the colony edge on the south and east sides. One researcher made all approaches to control for speed, and each approach toward the focal individual began from a different direction to ensure that most members of the town were sampled.

We analyzed the data using the Analysis of Variance (ANOVA) test to see if there was a significant difference in the town members' response distances and times.

Results

We collected distance and time data until we had 21 data points for all three sites; there were several days on which the prairie dogs remained below ground due to inclement weather.

Prairie dogs at site #3 responded at the greatest distances for both distance measures. Barking and concealment distances were significantly different for each site ($P=6.4189\times10^{-10}$ and $P=2.9663\times10^{-12}$ respectively) (Figures 1 & 2). Particularly site

#3 concealment and barking distances are more than twice those of NOAA. The standard error bars of NOAA and 51st differ by 0.6 m and 4.7 m for concealment and bark distances respectively. Sequence and concealment times did not vary significantly between towns (P = 0.282 and P=0.744 respectively) (Figures 3 & 4).

Discussion

Repetitious barks are common warning signals that prairie dogs vocalize after spotting a predator which alert other dogs in the area to the presence of the intruder (Waring 1970). Response distances to human approach increased with greater numbers of relocated prairie dogs in a town. Site #3 dogs responded to at the greatest distance, NOAA dogs at the shortest, and 51st dogs at intermediate distances. This data supports the idea that relocated dogs have a greater sensitivity to humans. This sensitivity may decrease with time, but it suggests an additional factor to consider in prairie dog management. Perhaps this is one reason mortality is high in the first year after relocation such that group size should be greater than 60 when there is no potential immigration (Robinette et al. 1995) as at site #3. The greater response distances translate to greater time spent avoiding potential predators which in turn reduces the time available for finding and consuming food. As an example of human intrusion, Skagen et al. (1991) found that Bald Eagles do not scavenge salmon in areas with frequent human disturbance. Prairie dogs are not as sensitive to humans, but they may require an adjustment period during the time when relocated group is at a higher risk of dying off. It is possible however, that relocated prairie dogs would adapt quickly to human intrusion.

One factor considered when interpreting our data was the topography of the towns which may have, on occasion, altered the dogs' response distance. Some approaches involved traversing small rises. While we were usually focused on a farther individual, clearing the rise often startled nearby dogs on the other side which at times, depending on distance to the startled dog, prematurely initiated the response sequence in the focal animal. Additionally fence lines made sampling some areas of towns difficult. At site 51, the town abuts right against the road so when attempting to sample animals at the west edge of the town, we could only

begin our approach from the opposite side of the road. We were then forced to navigate the barbed wire which altered approach speed and probably our level of threat, because of having to climb the fence. Site #3 is similar on its south edge but the dogs use burrows on either side of the fence.

The mixed population of site 51 adds ambiguity to our results. These dogs' average response distance was intermediate between NOAA and #3, but the relocated dogs had been at 51st longer than those at #3. It is not clear, given the combination of the more limited prior exposure to humans of non-relocated dogs and the longer adjustment time of relocated dogs, which factor motivated their responses. A similar study over a greater time in which all town members are sampled in blocks repeatedly would give information on whether relocated dogs go through an adjustment period. These methods are sufficiently non-invasive so as to have a minimal habituation effect.

Our time measures are unlikely to be independent of our distance measures. Though bark distances were high on site #3, sequence times were correspondingly high. This is surely due to the time it took to walk the 30 m to the average concealment distance of 70 m. At shorter overall distances, the walk time is similarly shorter. Therefore sequence times could be a function of the initial distance of the intruder at which the individual dog reacts. Since the data shows that black-tailed prairie dogs show significant behavioral differences in response to relocation activities, we reject our hypothesis that prairie dogs would show no behavioral differences between non-relocated and relocated towns. Wildlife managers and advocacy groups must take into account this increased sensitivity to human traffic and, probably, to natural predators when considering possible release sites.

The prairie dog is a keystone species that plays an important role in the maintenance of biotic diversity in grasslands of the western United States, Canada, and Mexico (Miller et al. 1994). "Past methods of reducing conflict between livestock interests and prairie dogs have failed. As a result, the western Great Plains have lost biodiversity, and managers are spending increasing amounts of money and time to rescue species that depend on prairie dogs. The U.S. Government financially

subsidizes both the poisoning of the prairie dog and the preservation of species that depend on the prairie dog for survival." (Miller et al. 1994) "Without addressing the issues surrounding the destruction of the prairie dog, we will only continue to degrade the western grasslands, reduce biotic diversity, and drain government budgets." (Miller et al. 1994)

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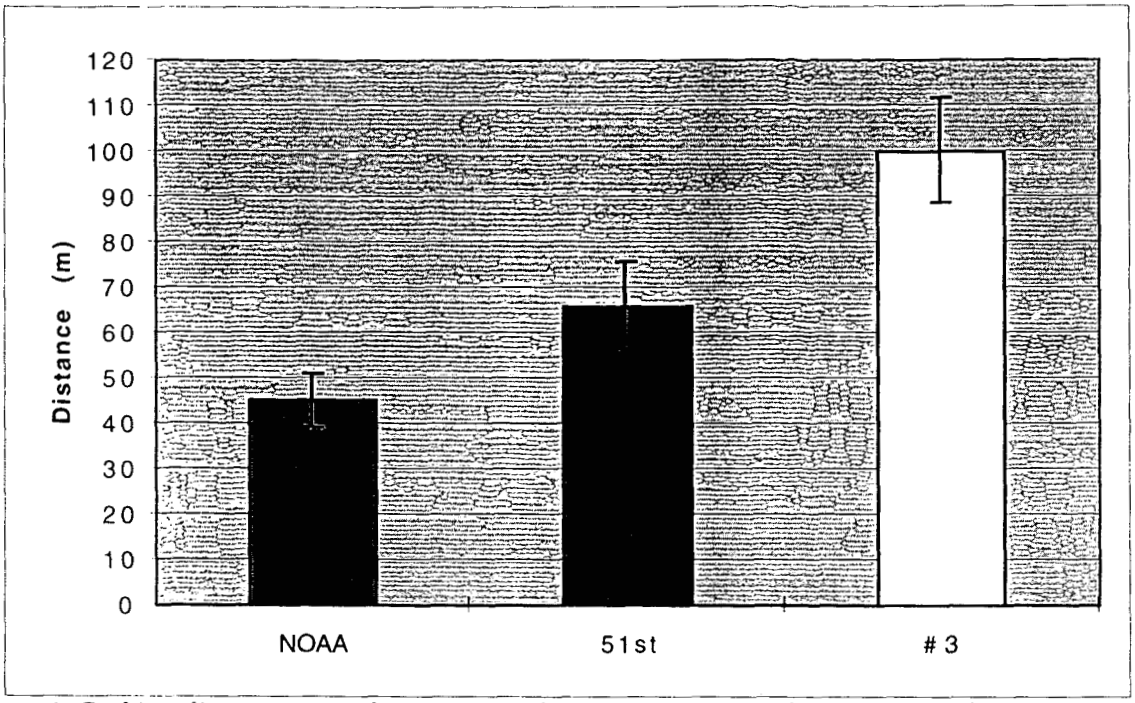

Figure 1. Barking distance means by site. Error bars show 2 standard errors. Note that site #3 values are more than twice those of NOAA. Difference of standard errors of upper NOAA and lower 51st is 4.6m

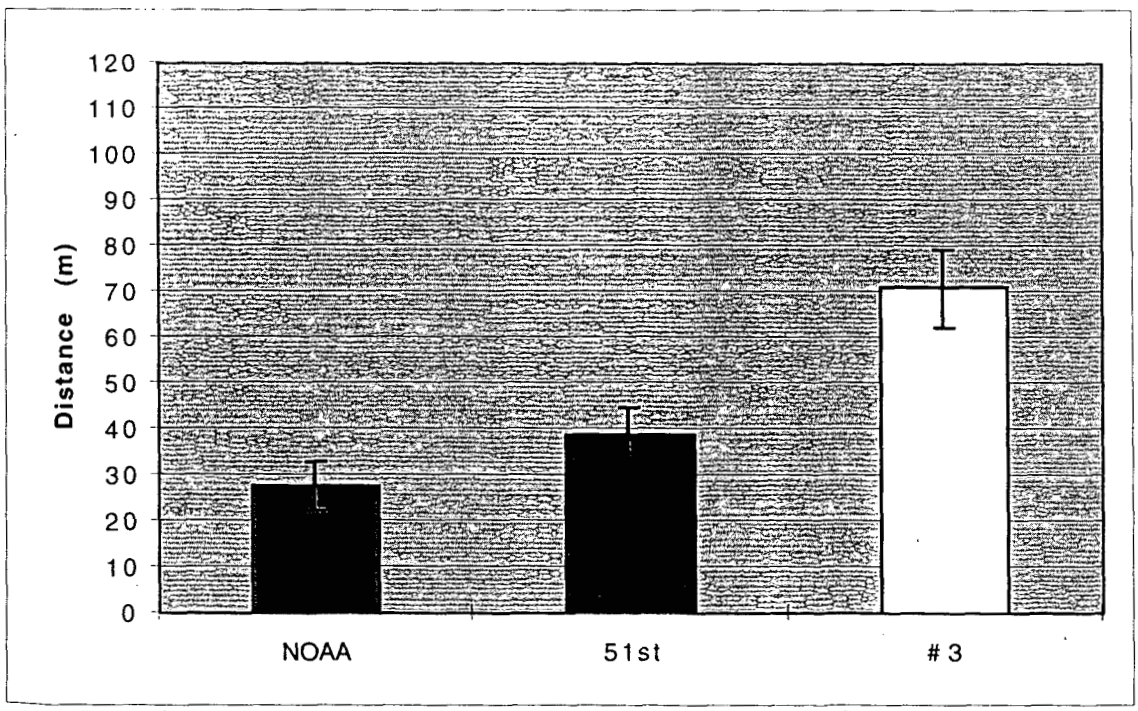

Figure 2. Concealment distance means by site. Error bars show 2 standard errors. Note, again that site #3 are more than twice those of NOAA. Difference in standard errors of upper NOAA and lower 51st is 0.5m.

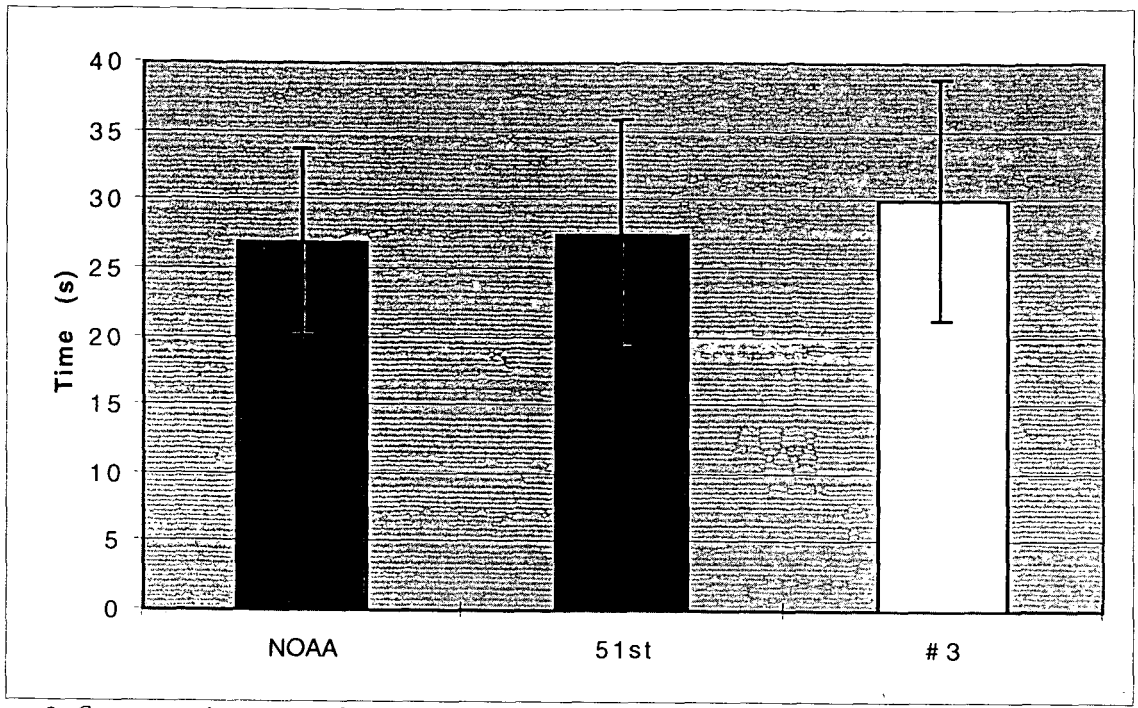

Figure 3. Sequence time means by site. Note overlap may be a function of the difference between bark and concealment distances (Figs 1 & 2) due to walking time.

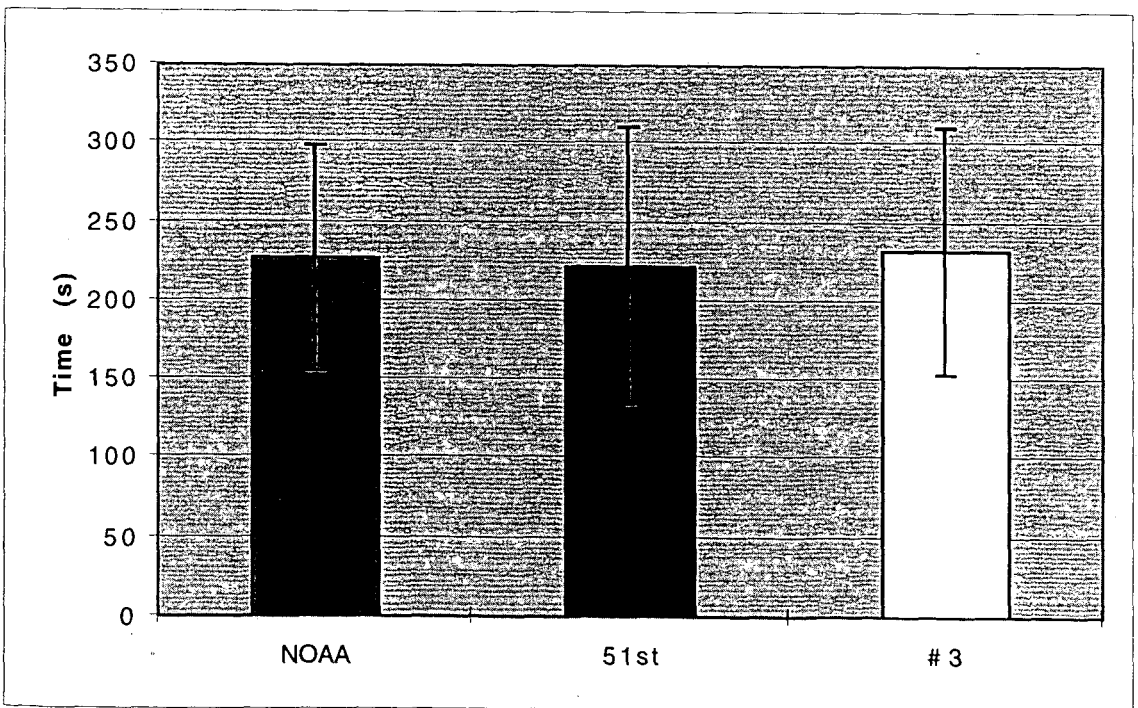

Figure 4 Concealment time means by site. Overlap may be due to the general difficulty of detection.