

SMALL GRANT PROGRAM

UTILIZATION OF SCENT-STATION SURVEYS  
TO DETERMINE THE RESPONSE OF PREDATORS  
TO RECREATION ON HEIL RANCH



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Cover Photo: Mountain lion (*Felis concolor*) track, by Bill Given

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## ABSTRACT

Boulder County Parks and Open Space (BCPOS) management plans to seek a balance between recreation and the protection of wildlife habitats and other natural resources. Determining the response of predators to recreational activities is difficult due to the secretive nature and vast area used by most predators. The scent-station survey method has been widely used to detect predators and to estimate trends in carnivore abundance. During the 2000 field season scent-station surveys were conducted at carefully selected control (non-recreational) and experimental (recreational) sites on the Heil Ranch Open Space. Abundance indices have been developed for each species of predator in the area from the data collected. During this first field season only one site (out of six) had recreation while two other sites were under trail construction thus data collection during future field seasons will be necessary to study the effects of recreation to this baseline year. Comparison of the indices will demonstrate if there is a response by different species in the use of areas containing recreation. The development of abundance indices also provides a useful measure to evaluate the effects of future management practices.

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## INTRODUCTION

This study applied a widely accepted and cost effective method for evaluating predatory species to a new and important function, use of habitat in relation to recreational use. The objectives of this study were to establish a baseline toward determining what response predators have to recreation on the Heil Ranch Open Space property and to develop relative abundance indices for predatory species. The study was designed to detect the presence of predator species in areas with and without recreational use.

By determining a response of predators to recreational use Boulder County Parks and Open Space (BCPOS) will be able to make more informed decisions for both current and future recreational activities in relation to desired management of predatory species. Further, the development of abundance indices provides BCPOS managers with a tool to track population trends for individual predatory species and a useful measure to evaluate the effects of future management practices upon predators.

### *Literature Review*

Recreational activities are widespread, yet our understanding of their effects on wildlife is rudimentary. Although numerous studies of recreational impacts have been conducted, the knowledge gained is disparate and seldom definitive (Knight and Gutzwiller 1995). Numerous research papers have been published on the response of birds and ungulate species to recreation, however predators tend to be more difficult to study. Most available literature regarding predators and recreation focus on bears, as well as mountain lions and wolves to a lesser extent. Virtually all of these papers were

comprised of anecdotal material or information derived through the use of radio-collared subjects. There was no published literature focused on the response of mesopredators to recreation. However, there is a large amount of literature that suggests that scent-stations can be utilized to detect carnivores and estimate relative abundances for many species, including all those known to occur in Boulder County. The attached references section lists the literature and papers reviewed to develop this study and will be appropriately referenced throughout the methods section.

## **METHODS**

Scent-station surveys were conducted to record the presence of predators during the 2000 field season. Six scent-station survey sites were established in consultation with BCPOS staff to represent the habitat of the Heil Ranch in three control (non-recreational) and three experimental (recreational) sites. Each scent-station survey site contained one scent-station line consisting of nine stations. Each station consisted of approximately one square meter of backyard sand that is raked smooth before being baited and each station is spaced approximately .32 km apart (Connor et al. 1983) (Nottingham et al. 1989). Due to topography and field conditions some stations are somewhat closer but in the 2000 field season no repeat visits occurred so stations all appear to be adequately spaced (Given 2000). Stations were baited with one fatty acid scent (FAS) tablet, a commercially available predator scent attractant manufactured by the U.S. Department of Agriculture. One FAS tablet was placed in the center of the station during the day and checked for visitation the following day with a visit defined as one track or more of a

species/station (Connor et al. 1983). Tracks were measured and identified using *Tracking Mammals* by James Halfpenny as a definitive reference. Each line was operated for one night/month from July through October (Brady 1981) (Roughton and Sweeny 1982). Other methods were attempted during May and June that were unsuccessful. The study began in May using track plates sooted with an acetylene torch, however, a mechanical accident with the torch rendered the May survey inoperable and it was hence decided that the fire danger of the method was not advisable for this study. In June the same methods were used but instead of sand a sifted limestone substrate was used as the tracking medium. The limestone proved to be an ineffective medium rendering the June sample as unusable.

The relative abundance index for each species is calculated as: total visits by a species divided by the total operative station nights times 1,000 (index = total visits by a species/total operative station nights X 1,000) as developed by Linhart and Knowlton (1975) and widely accepted as the standard for calculating scent-station abundance indices. Comparisons of future data among indices will be performed using the Wilcoxon Signed Rank test for paired samples (Travaini et al. 1996) and chi-squared goodness-of-fits tests to compare field data to expected values.

## RESULTS

Eight species (including feral cat) of predators were detected on the Heil Ranch through this study. The results for each species are detailed by three calculations. First is the relative abundance index for the Heil Ranch (labeled as Heil Ranch Abundance)

calculated as: total visits by a species divided by the total operative station nights times 1,000 (index = total visits by a species/total operative station nights X 1,000). Second is the relative abundance index for the control sites (labeled as Non-Recreation Abundance) calculated as total visits by a species on control transects divided by the total operative control station nights times 1,000 (index = total visits by a species to control stations/total operative control station nights X 1,000). Third is the relative abundance index for the experimental sites (labeled as Recreation Abundance) calculated as total visits by a species on experimental transects divided by the total operative experimental station nights times 1,000 (index = total visits by a species to experimental stations/total operative experimental station nights X 1,000). The abundance results by species are as follows:

Coyote (*Canis latrans*)

Heil Ranch Abundance = 28.04 (6 visits/216 operative stations X 1000)

Non-Recreation Abundance = 46.30 (5 visits/108 operative stations X 1000)

Recreation Abundance = 9.26 (1 visit/108 operative stations X 1000)

Red fox (*Vulpes vulpes*)

Heil Ranch Abundance = 4.63 (1 visit/216 operative stations X 1000)

Non-Recreation Abundance = 9.26 (1 visit/108 operative stations X 1000)

Recreation Abundance = 0.00 (0 visits/108 operative stations X 1000)

Gray fox (*Urocyon cinereoargenteus*)

Heil Ranch Abundance = 37.04 (8 visits/216 operative stations X 1000)

Non-Recreation Abundance = 64.81 (7 visits/108 operative stations X 1000)

Recreation Abundance = 9.26 (1 visit/108 operative stations X 1000)

Black bear (*Ursus americanus*)

Heil Ranch Abundance = 9.26 (2 visits/216 operative stations X 1000)

Non-Recreation Abundance = 18.52 (2 visits/108 operative stations X 1000)

Recreation Abundance = 0.00 (0 visits/108 operative stations X 1000)

Long-tailed and Short-tailed weasel (*Mustela frenata or erminea*)

Heil Ranch Abundance = 60.19 (13 visits/216 operative stations X 1000)

Non-Recreation Abundance = 74.07 (8 visits/108 operative stations X 1000)

Recreation Abundance = 46.30 (5 visits/108 operative stations X 1000)

Mountain lion (*Felis concolor*)

Heil Ranch Abundance = 4.63 (1 visit/216 operative stations X 1000)

Non-Recreation Abundance = 9.26 (1 visit/108 operative stations X 1000)

Recreation Abundance = 0.00 (0 visits/108 operative stations X 1000)

Bobcat (*Lynx rufus*)

Heil Ranch Abundance = 13.89 (3 visits/216 operative stations X 1000)

Non-Recreation Abundance = 0.00 (0 visits/108 operative stations X 1000)

Recreation Abundance = 27.78 (3 visits/108 operative stations X 1000)

Feral cat (*Felis catus*)

Heil Ranch Abundance = 4.63 (1 visit/216 operative stations X 1000)

Non-Recreation Abundance = 9.26 (1 visit/108 operative stations X 1000)

Recreation Abundance = 0.00 (0 visits/108 operative stations X 1000)

## DISCUSSION OF RESULTS

Results of this study are discussed by species accounts, as non-recreation vs. recreation areas, and a review of how the results may apply to natural resource and visitor management of the Heil Ranch.

### Species Accounts

Seven naturally occurring predators and one feral species were detected utilizing the scent-station method. As expected weasels and canids were the most numerous by detection, while the felids and bears that normally require much larger ranges were found to be present but with much less frequency. Interestingly, raccoons and skunks were not detected in this study. A brief synopsis for each species detected will follow, including population estimates based on research of home ranges. It should be noted that the entire acreage of the Heil Ranch may not provide appropriate habitat and there are many other variable factors so such estimates should be considered loose guidelines, with very detailed research required to refine such population estimates.

Coyote (*Canis latrans*)

Coyotes were observed on the Heil Ranch several times and both tracks and scat were frequently sighted. Home ranges are known to vary widely for coyotes from as little

as 4 to 5 square kilometers to as large as 143 square kilometers (Voigt and Berg 1987). Mean annual home range in southeastern Colorado was 11.3 square kilometers for residents (Gese et al. 1988). Based on the Colorado data, and depending on ranges falling partially on adjacent lands the Heil Ranch probably supports two to three pairs of coyotes, their associated offspring until dispersal and occasional transient individuals. More than 80% of the coyotes detected in the study were in the control (non-recreation) areas. However, sign was frequently found within the experimental areas including often on the existing recreation trail. This may suggest that the coyote are more cautious in the area frequented by people because physical evidence indicated the presence of coyotes along the experimental transects numerous times yet only one visit was recorded.

#### Red fox (*Vulpes vulpes*)

Only once was a red fox detected on the Heil Ranch. Coyotes may partially restrict populations of red foxes through direct predation or competition for food (Linhart and Robinson 1972, Sargeant 1982). As discussed above coyotes are definitely present throughout the Heil Ranch and this may be limiting the presence of red foxes.

#### Gray fox (*Urocyon cinereoargenteus*)

The gray fox was the second most abundant predator in the study to the weasels. Home ranges averaged 30 to 200 ha in Utah (Trapp 1978). Exclusive areas of occupancy are established and dens are thought to often be in the vicinity of water. Based on the Utah home range data the Heil Ranch could likely carry ten or more gray foxes and their associated young. Seven of eight detected visits occurred in the control (non-recreation) areas indicating a strong preference for less disturbance.

Black bear (*Ursus americanus*)

Tracks and scat demonstrated the presence of a black bear in Plummey Canyon from April through to at least mid-November. Twice (July and August) the bear visited scent-stations. The large size of the tracks and the late denning activity indicate that a boar was using the area. The annual home range of a male in Colorado varied from 31 to 145 square kilometers (Beck 1991). Ranges will sometimes have some overlap but it is unlikely that the Heil Ranch supports more than one boar and one sow with her young.

Long-tailed and Short-tailed weasel (*Mustela frenata* or *erminea*)

Utilizing more sophisticated tracking methods, such as stride and straddle measurements these two species can be differentiated, however, reliable measurements require good trails rather than just the random tracks often found at scent-stations so tracks were simply recorded as weasel. The weasels were the most common species recorded in the study and they visited stations frequently at both the control and experimental transects. Forest thinning efforts and trail building resulted in numerous wood piles throughout the experimental transects under trail construction, perhaps creating enhanced microhabitats for weasels. Home ranges for both weasels range anywhere from 10 to 25 ha (Fitzgerald, Meaney, and Armstrong, 1994). Based on those range estimates there could be anywhere from 80 to 200 individual weasels on the Heil Ranch.

Mountain lion (*Felis concolor*)

Mountain lions have a behavioral intolerance of their own and require large home ranges with maximum density estimated to be one lion per 25 to 50 square kilometers

(Currier 1976). Depending on how territories fall within adjacent lands the Heil Ranch probably falls within the home range of one to two males perhaps overlapping with one to two females and there may be an occasional transient on the move through. With only one detection during the study no behavioral preferences can be inferred.

#### Bobcat (*Lynx rufus*)

Home ranges in the West vary from 22 to over 80 square kilometers for males and 8 to 27 square kilometers for females (McCord and Cardoza 1982, Rolley 1987). Based on these ranges the Heil Ranch probably supports one to two males and one to three females and their associated young. Bobcats registered three times all at the same scent-station. The station was in a recreational area along the road portion used for the loop hike, however, there was a steep embankment and a dry wash between the station and the road. Current recreation would appear to be compatible with at least one secretive bobcats use of the area.

#### Feral cat (*Felis catus*)

One feral cat (small black cat) was observed on the property in the vicinity of a scent-station that registered a feral cat a couple of weeks earlier. Ranches and large acre properties commonly have outdoor cats and it is not uncommon for such cats to disappear to adjacent lands.

#### **Utilization of Non-Recreation areas vs. Recreation areas**

In this baseline year only one of the six study areas was being utilized for recreation (limited to hiking with no dogs). However, the other two experimental

transects were in areas under trail construction through most of the field season, a process that seemed very disruptive with chainsaws, tractors/vehicles, and numerous people at times. Based on only one field season of data it is impossible to determine how trail construction compares with recreation as a disruption. Further, one field season of data is not sufficient to draw any conclusions regarding the response of predators to recreation. It is possible to make observations based on the first year results, which support that there is a response to recreation (or more correctly in this year disturbance as trail construction was two-thirds of the experimental study areas). Seven of the eight species (including feral cat) were detected more often in the non-recreation (control) study areas, including six of them occurring greater than 83% of the time in the non-recreation area. The seventh species (the weasels), which maintain the smallest home ranges of any of the predators and thus could be predicted to be least effected by recreation were detected 61.5% in the non-recreation area. The bobcat was the only species found more often within the recreation (experimental) study areas, with all three detections located at the same station. The station was located about 25 meters to the side of the road that is used as part of the hiking loop trail. Overall 71.4% of predators detected during the study occurred in the non-recreational (control) areas suggesting that there is indeed a response by predators to favor areas that are not utilized for recreation.

#### **Application to Natural Resource and Visitor Management**

Based on the very limited one year of data, it would appear that if it is desired to manage for the benefit of predators it is important to restrict recreation as much as

possible. The presence of diverse predators indicates that recreation on the Heil Ranch has certainly not excluded predators from utilizing the property, but the initial data does suggest that predators have an aversion to recreation areas. Concentrating recreation to avoid fragmentation of habitat would be the recommended approach to manage for predators while still providing recreational opportunities for the public. Such an approach may make recreated areas even less functional for predators but it would maintain the largest possible acreages for undisturbed wildlife use. Thus, three recreation trails in close proximity to each other would provide less disturbance and maintain more useable habitat for predators than three separate trails scattered throughout a property (assuming similar habitat values and the same trail lengths).

Another valuable application would be to utilize scent-stations prior to opening an area to recreation to pinpoint use by predators. In the case of this past field season at the Heil Ranch it was easy to pinpoint the favored area for a black bear and a bobcat. In such cases it would be easy to select trail locations that avoid such hotspots and thus not displace a resident predator from a favored location.

Again, it is important to emphasize that this study is developed to compare trends across years, and in particular as recreation at the Heil Ranch expands in the next year. It is difficult to make conclusive recommendations based on only one year of data and therefore all such recommendations are made cautiously using the best data available with an emphasis that further research is necessary to make more meaningful determinations.

## CONCLUSION

Utilizing the scent-station methodology to detect predators during the 2000 field season appears to have been very successful. Species were detected in frequencies that are consistent with their expected abundances, such as based on population density research weasels should have been the most common species followed by gray foxes and then coyotes while black bears and mountain lions should be considerably less abundant. The relative abundance indices developed in this study found that species did in fact occur in the abundance order that would have been expected based on known research thus lending validity to this method as a measure of predator abundance.

First year data supports the hypothesis that predators do respond to recreation by either favoring less disturbed areas and/or altering their behavior within recreated areas (note: for this study trail construction was a disturbance in 2 of 3 experimental sites while only one was actually being recreated). Seven of eight species were detected more often in the control areas of the Heil Ranch, with six of those occurring at least 83% in the control areas demonstrating a clear pattern of preference toward the non-recreational areas. Anecdotal evidence on coyotes suggests that the species may utilize all areas but may behave somewhat differently in the recreated areas. This was evidenced by numerous observations of sign (tracks and scat) in the recreated area but yet only one detected visit versus five visits in the non-recreated areas. Perhaps, some species are more cautious in the recreated areas and are thus harder to detect, although such a change in behavior would still be an important response to recreation.

It is clear that one year of data at the Heil Ranch does not provide the statistical power to suggest any definitive results as to predator abundances. Further it is important to have additional years to examine how predators respond to new recreational opportunities that will begin in 2001. The results of this baseline study though do indicate that the methodology is properly designed to both establish predator abundance indices and to determine a response of predators to recreation. This limited data set has resulted in relative abundance indices that are consistent with expected predator abundances and has supported the hypothesis that predators do respond to recreation. Continued data collection over a prolonged time period (3-5 years, longer the better) is recommended to refine relative abundance indices and to more fully determine the response of predators to recreation.

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