Nevada Department of Wildlife

Predation Management Status Report

FY14

October 24, 2014

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Table of Contents

EXECUTIVE SUMMARY ..... **i**

PROJECT 18 ..... **1**

Predator Removal for Protection of Big Game (Unit 014)

PROJECT 21 ..... **6**

Greater Sage-grouse Protection (Statewide)

PROJECT 21 ..... **6**

Sub Project 21-02
Virginia Mountains Sage-grouse Broods (Area 2)

PROJECT 22-14 ..... **9**

Predator Removal for Protection of Mule Deer (Hunt Units 144 and 145)

PROJECT 25 ..... **10**

Coyote Mule Deer Predator-Prey Analysis (Area 16, 17)

PROJECT 29 ..... **15**

Road Carrion and Raven Population Management in High Priority Greater Sage-Grouse Habitats

PROJECT 30 ..... **15**

Landfill-Animal Pit Management for Sage-grouse

PROJECT 31 ..... **20**

Cougar-Mule Deer-Bighorn Analysis (Statewide)

PROJECT 32 ..... **20**

Ecology of Cougar and Black Bear Interactions – (Areas 19, 20, 29)

PROJECT 33 ..... **21**

Sage-grouse Nesting Habitat (Pinyon-Juniper Removal)

PROJECT 34 ..... **21**

Sage-grouse Brood Habitat (Stringer Meadow) (Area 14)

EXECUTIVE SUMMARY

The goal of the Nevada Department of Wildlife's (NDOW's) Predation Management Program is to conduct projects consistent with the terrestrial portion of the NDOW's Mission "to preserve, protect, manage and restore wildlife and its habitat for the aesthetic, scientific, educational, recreational and economic benefits to citizens of Nevada and the United States." In addition, provisions outlined in NRS 502.253 authorize the collection of a $3 fee for each big game tag application, depositing the revenue from such a fee collection into the Wildlife Fund Account and used by the NDOW to 1) manage and control predatory wildlife, 2) pay for management activities relating to the protection of non-predatory game animals and sensitive wildlife species and related wildlife habitat, 3) conduct research, as needed, to determine successful techniques for managing and controlling predatory wildlife, including studies necessary to ensure effective programs for the management and control of predatory wildlife, and 4) fund education of the general public concerning the management and control of predatory wildlife. Additional provisions of the statute include expending a portion of the money collected to enable the State Department of Agriculture and other Contractors and Grantees to develop and carry out programs designed as described above, developing and conducting predation management activities under the guidance of the Wildlife Commission, and a provision that the $3 fee monies "remain in the Wildlife Fund Account" and do not revert to State General Funds at the end of any fiscal year.

In FY2014, 10 projects were included in the planned activities, although only 8 had funding committed. In this report, predator removal for big game (Project 18) includes a final report and will not continue in FY2015; further peer-reviewed publications may be prepared based on this work. Ongoing work is described regarding greater sage grouse protection (Project 21). Mule deer fawn protection is also described, along with some recommendations for ongoing, redesigned work for FY2016 (Project 22). This report includes an update on a study on coyote ecology, which is nearing completion in August 2015 (Project 25; did not expend Predation Management Fee dollars). Ongoing work regarding carrion and landfill manipulation and study is described; assessment and redirection may be proposed in FY2016 (Projects 29 and 30). An analysis of cougar, mule deer, and bighorn sheep relationships was a project that did not receive funding (Project 31), and no work was conducted. The project on cougar, mule deer, and black bear was funded, yet little work was conducted beyond the acquisition of radiotelemetry markers (Project 32). Sage grouse nesting habitat (Project 33) and brood habitat (Project 34) both made progress, although neither expended any Predation Management Fee funding (Project 34 had no approved funding).

Total authorized budget for FY2014 was $526,360 from the Predation Management Fee Program. Total expenditures during this period was $509,156.48 (only Project 25 was specifically identifiable at $53,549.87; over the allocated Predation Management Fee budget, but this was paid from Federal Aid in Wildlife Restoration funds). This should yield a FY2014 savings of $70,753.39. Individual project accounting will resume in FY2015.

Contributors to this status report include Shawn Espinosa, Ken Gray, Kelly Horn, Pat Jackson, Kelli McKeegan, Cody Schroeder, and Brian Wakeling. Jody Wilkinson completed review and layout of this report.

PROJECT 18

Predator Removal for Protection of Big Game (Unit 014)

Background

To enhance a mule deer population in northern Washoe County, NDOW lethally removed over 1,200 carnivores in the Granite Mountain Range, Unit 014, beginning in early 2004 until June 30, 2014. Surrounding mountain ranges received no predator control during the same study period and included those portions of northern Washoe, Humboldt and Pershing Counties in Units 011–013 and 033. A limited amount of predator take did occur in the surrounding control areas which was associated with agriculture depredation, legal hunting, and poaching.

In 2010, an extensive analysis was conducted by University of Nevada Reno to identify differences in the mule deer population in Unit 014 compared to adjacent control areas Units 011–013 and 033 with different levels of predator removal. The analysis was updated in October 2014 (pending final report) with similar methodology as well as to compare before and after effects of predator control on mule deer in hunt Unit 014 and surrounding control areas.

Results

Although trends in the Unit 014 population estimate indicate a steady increase beginning at the inception of the predator removal project in 2005 to 2013 (about 67% increase), no statistical difference was attributed to this variation in population increase compared to Unit 033 (Figure 1); however, Units 011–013 combined were significantly higher than both units 033 and 014 (Figure 2). Differences in fawn production as measured by fawn:adult ratios during fall deer surveys were statistically significant between Units 011–013 compared to Unit 033, however no significant differences were detected between the treatment Unit (014) and the control Units (011–013 and 033).

The Granite Range project did produce significantly more trophy class bucks in Unit 014 than Unit 033 during the predator removal period, as indexed by the percent of 4 point or larger bucks in the fall harvest (Figure 3). However, the percent of 4 point or better in Unit 014 was not significantly different than in the Unit Group 011–013 (Figure 3). These results may indicate that predator removal for the benefit of mule deer can possibly lead to a greater percentage of older age class bucks in the population. Alternatively, since the 4 point or better metric was not significantly higher for Unit 014 than the Unit Group 011–013, other factors may have contributed to these phenomena such as hunter effort, access to high quality habitats, and conservative quotas set by the Wildlife Commission at the beginning of the project time period.

Additionally, NDOW's bighorn sheep population estimate for Unit 014 has also shown a substantial increase during the predator removal period with an observed increase of approximately 38% from 2005 to 2013 (Figure 4). The predator removal project was originally designed for the protection and enhancement of mule deer populations but NDOW believes bighorn sheep populations may have experienced some benefit from this project. Given the habitats of bighorn sheep in the Granite Range do somewhat overlap that of mule deer, and the large home range sizes of mountain lions, it is reasonable to expect that survivorship of adult bighorn sheep may have been related to the removal of large carnivores during the study period.

Some attention was given to potential effects of carnivore removal on California bighorn sheep in Unit 014. Bighorn populations increased by 75% to 200% in Units 012 and 014 respectively from 2004 to 2013. While removal of cougars and coyotes may have facilitated population growth and expansion of bighorn sheep in Unit 014, it is important to note that a rapid growth rate sometimes follows die-offs (2001 to Unit 014) and frequently follows augmentations (2004 in Unit 014) of "new" sheep populations. The simultaneous healthy bighorn sheep population increase in adjacent Unit 012 under comparatively limited carnivore removal, suggests landscape level influences such as climate, forage availability, and forage quality are also acting to facilitate increases. The recent removal of 3,017 feral horses likely had a substantive positive effect as well.

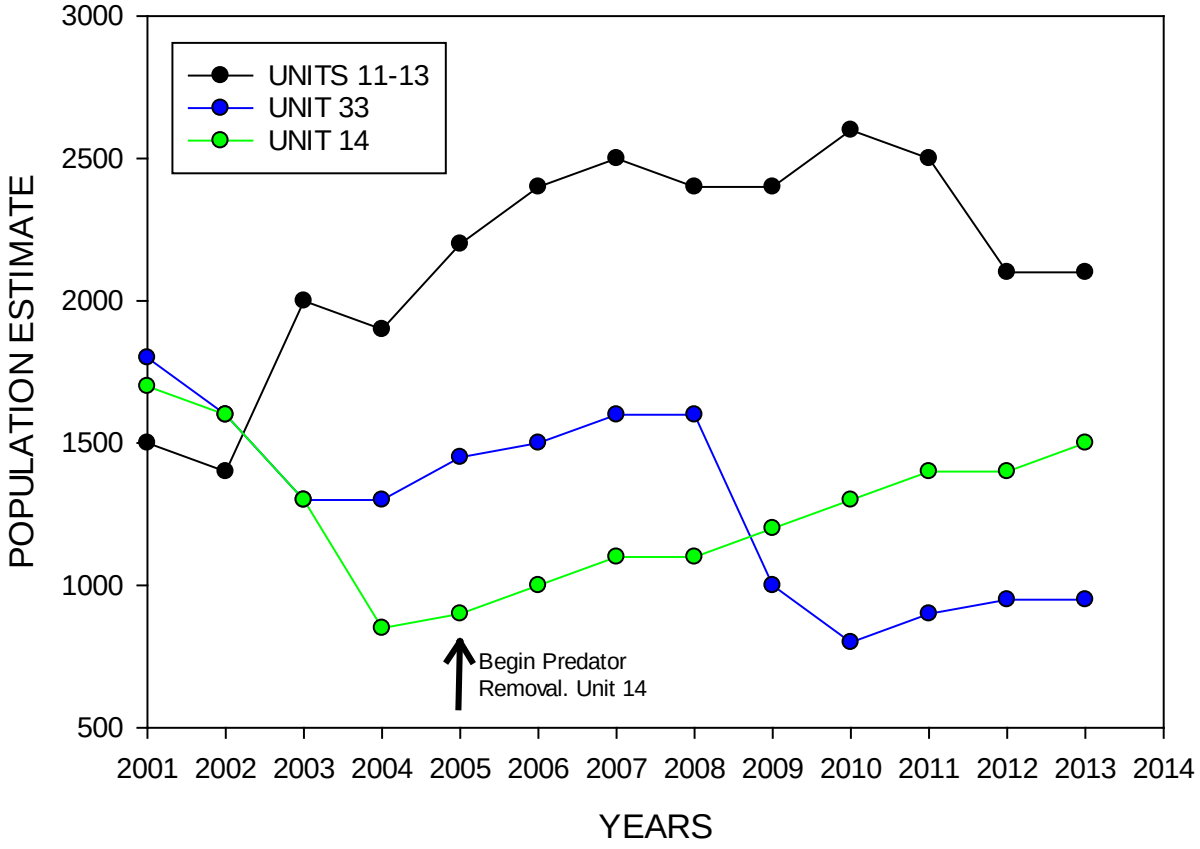

Figure 1. Mule deer population estimates by year in Hunt Unit 014 and surrounding control hunt units from 2001-2014. *Note significant changes to the 014 population model occurred during 2002-2004 which may preclude direct comparisons. Also some predator control activities began in unit 014 during 2004 not calendar year 2005 as noted on graph. Figure provided by Dr. Kelley Stewart, University of Nevada Reno.

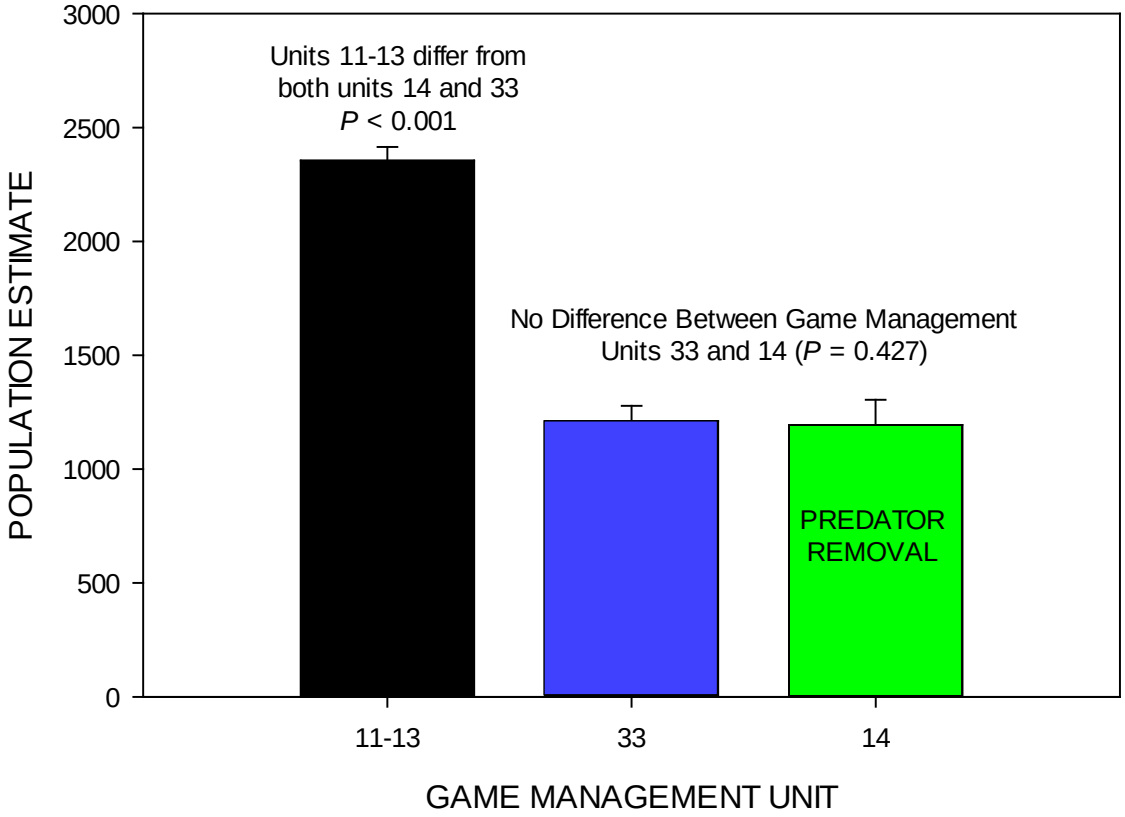

Figure 2. Results of analysis of variance for game management units for estimates of population size. Unit 14 has predator removal since 2005. Dates for these analyses include 2005 – 2013. Figure provided by Dr. Kelley Stewart, University of Nevada Reno.

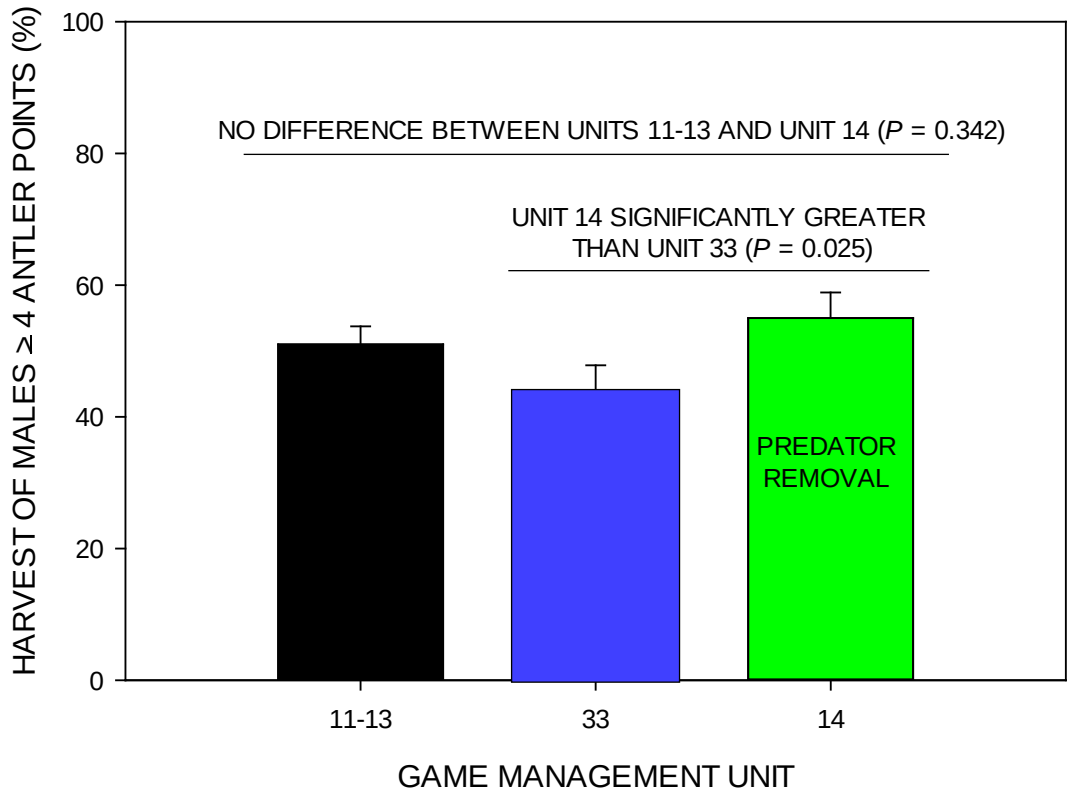

Figure 3. Results of analysis of variance for proportion of ≥ 4 point bucks in harvest. Date used for this analysis were from 2005–2013. Figure provided by Dr. Kelley Stewart, University of Nevada Reno.

Conclusions

Project 18 was designed to protect and enhance a mule deer population in northern Washoe County, Unit 014, by removing as many coyotes and mountain lions as practical, given the constraints of time and funding allocation. To that end, NDOW spent about $800,000 over a near decade-long time period to administer this predator removal program (about $80,000 per year). This program may have affected an increasing population trend in the Unit 014 mule deer population and a higher percentage of 4 point or larger bucks in the annual harvest. However, when compared to surrounding hunt units including Unit 033 and Unit Group 011–013 many of these measures of population performance were not statistically significant using an ANOVA based control treatment design. Many factors may have influenced the observed outcome in population trajectory and harvest in the hunt units used for this comparison. These factors include: 1) differences in precipitation patterns observed across northern Washoe County, 2) adjustment of population model estimates for the Unit 014 prior to the predator removal program, 3) conservatism in the hunt quota administered by the Nevada Wildlife Commission, and 4) normal stochastic variation in population dynamics that is inherent in many large ungulate populations.

This is the last report on this project as it was terminated in June 2014. Peer-refereed publications will be submitted to appropriate journals with further analyses.

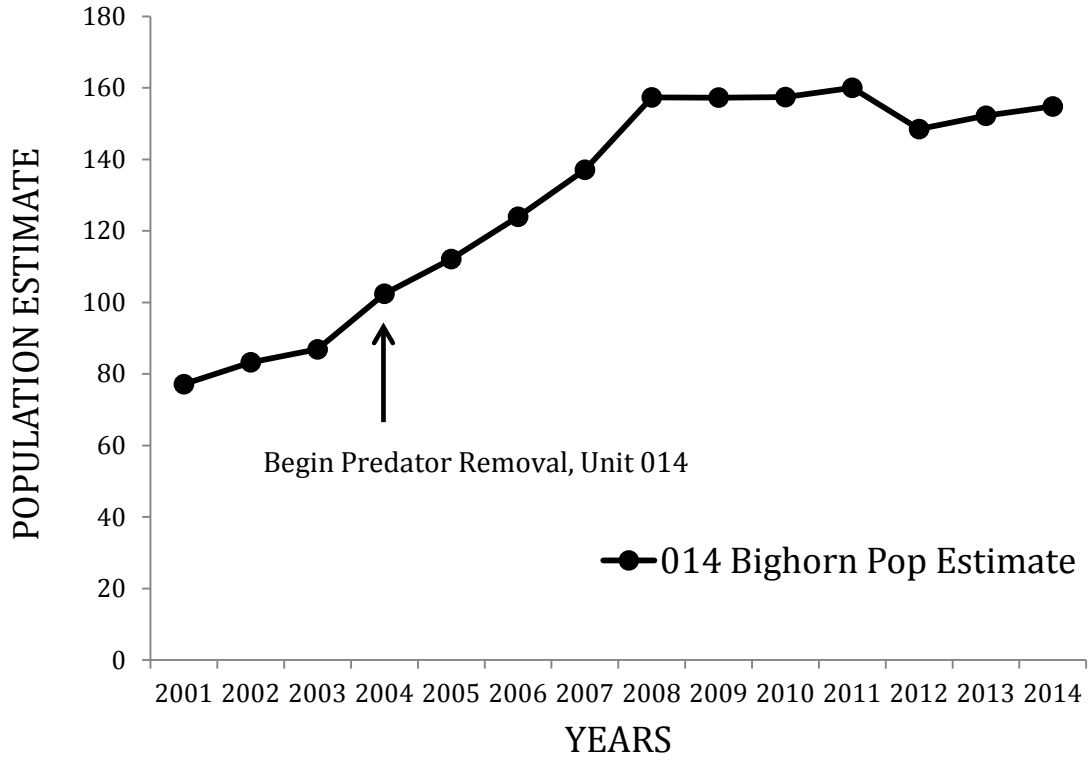

Figure 4. Bighorn sheep population estimates by year in Hunt Unit 014 from 2001–2014.

PROJECT 21

Greater Sage-grouse Protection (Statewide)

Raven control efforts to conserve greater sage-grouse commenced in early March and extended throughout May2014. The objective of this project is to increase sage-grouse nest success and recruitment. USDA Wildlife Services performed raven control work through the placement of corvicide (DCR-1339) injected chicken eggs within occupied sage-grouse habitats. The main treatment areas consisted of eastern and northeastern Nevada in situations where concentrations of ravens have been noted and where habitat has been compromised, potentially by wildfire or anthropogenic subsidies (e.g., roadkills). Another treatment area, the Virginia Mountains in western Nevada, is being used as an experimental area and details of that project are reported below (Project 21-2).

Through the efforts of Wildlife Services personnel, an estimated 2,177 ravens were removed during the spring 2014. The total number of ravens taken for both this project and the Virginia Mountains project previously mentioned was 2,500, which equals the number of ravens that NDOW can remove under the current depredation permit (#MB37116A-0). The table below summarizes where ravens were removed by area and county during the spring of 2014 (Table 1).

Table 1. Raven take by Game Management Area (GMA) and County in Nevada during FY2014.

Area	County	Ravens Removed
GMA 6	Elko	40
GMA 7	Elko	555
GMA 8	Elko	12
GMA 10	Elko	52
GMA 11	White Pine	273
GMA 22	White Pine/Lincoln	705
GMA 23	Lincoln	540
Total Raven Removal		2,177

Additionally, 11 coyotes and 8 badgers were removed at various locations, mainly in Game Management Areas 7, 22, and 23. Mammalian predators we removed using either a trap or firearm.

PROJECT 21
Sub Project 21-02

Virginia Mountains Sage-grouse Broods (Area 2)

Raven control work was initiated during March and extended throughout May 2014. This work was conducted to determine the efficacy of raven control work directly on the resident sage-grouse population within the Virginia Mountains located in southern Washoe County. Over a 2 ½ month period, USDA Wildlife Services deployed approximately 5,100 corvicide treated eggs within previously identified sage-grouse nesting habitats located around Sheep Springs, Spanish Flat, and lower Cottonwood Creek. An estimated 323 ravens were removed during the

spring months. Additional treatments are scheduled for 2015 and 2016 that will allow researchers to determine the ultimate effects of raven control on sage-grouse population performance.

Greater sage-grouse monitoring work is being conducted by the USGS – Western Ecological Research Center. Five years of baseline monitoring work have been conducted on this population to determine various vital rates and vegetative parameters in used versus random sites across multiple life phases. The information presented below provides summaries of the USGS field crew efforts from April through July 2014.

Telemetry Monitoring

USGS field crews trapped and deployed 8 VHF radio transmitters on sage-grouse during spring 2014 near Spanish Flat (7 females, 1 male). Field crews obtained 161 telemetry locations from 21 VHF marked grouse during May–July 2014.

Reproduction

USGS field crews located 11 nests, of which 7 were depredated and 4 were successful. One nest was located about 4 km from the Sheep Springs lek, the remaining 10 nests were located around Spanish Flat. The high predation rates could be due to the dry winter and spring conditions, which may have contributed to less vegetative cover for nesting sage-grouse. Of the 7 depredated nests, evidence suggested avian or mammalian predators. Four nests did not have any egg shells or fragments left at the nest. The remaining nests had eggs shells and fragments scattered around the nest area. However, without conclusive evidence that can be obtained from nest videography, we cannot confidently determine causes of failure at depredated nests.

Nest Videography

USGS research crews set up video monitoring equipment on 2 nests to record predation and nesting recess activity. One nest was depredated while being monitored. The video showed clear evidence of coyote depredation. The coyote took the eggs each individually and cached them somewhere nearby. The second nest successfully hatched 7 chicks, and the hen and her brood left the nest just 2 hours after hatching.

Brood Monitoring

Of the 9 broods monitored this season, 4 were successful and reached 50 days post-hatch. Final brood size ranged from 2 to 6 chicks. USGS research crews monitored 5 broods where the hens were never found on a nest but located later in the season with chicks. Two of these broods were unsuccessful within the first 10 days and 1 was successful 50 days post-hatch. Two broods remained about 1.5 km from Spanish flat lek. One brood, which failed on day 30, moved about 4 km from her nest. Another active brood localized near her nest location on the north end of the flat. Seven out of the 9 broods that were monitored this season congregated around Spanish Flat, where we observed 3 other broods with unmarked hens. Only 2 broods were located at Sheep Springs lek, which were unsuccessful within the first 30 days.

Habitat

USGS field crews have completed 87 microhabitat surveys. Each microhabitat survey is conducted at nest sites immediately following nest fate to better understand sage-grouse-habitat relationships. We are collecting data at 3 points for every nest, including 2 random points: 1 at a dependent random location based on nest location and 1 at an independent random location. Conducting microhabitat surveys at random points allows for the estimation differences between nesting sites and available habitat across the study area at different spatial scales.

For each successful nest, field crews collected 3 locations for each brood on a 10-day rotation. Each cycle of locations consists of 1 night location, 1 day location, and 1 dependent random location (based on day location). Habitat variables are measured at each location and also at random locations to characterize available nest and brood rearing habitat.

Raptor, Raven, and Livestock Surveys

USGS field crews conducted 314 raptor, raven, and livestock (RRHL) surveys, which will help us understand relationships between avian and livestock composition and sage-grouse population vital rates.

Mortalities

USGS field crews recovered 10 VHF collars from hens that expired. Of those collars, coordinates for 8 were provided from the aerial telemetry flight. Two were recovered from hens that had failed nests this year. One was found about 1.5 km from her nest, and the collar was sitting on top of a snowberry bush. The second hen was killed sometime between a 50-day night brood check and the subsequent check the following day. Evidence suggested mammalian depredation.

PROJECT 22-14

Predator Removal for Protection of Mule Deer (Hunt Units 144 and 145)

Although this project was approved for funding by the Wildlife Damage Management Committee for FY2014, no actual predator removal work has been conducted on this project. The study design for this project will be reconsidered before initiating carnivore removal. Previous aspects of this project directed at improving sage grouse populations be reconsidered as a separate project from 22-14.

Background

Sub Project 22-14 is an attempt to understand the complexity in managing wildlife species in a recovering sagebrush ecosystem in central Nevada. Work is currently being conducted on private lands in this area of Eureka County to restore the native sagebrush steppe ecosystem on a small scale. NDOW would also like to pursue funding other habitat projects including fire restoration and pinyon-juniper removal on public lands in strategic areas throughout the Diamond Mountain range. Thus far, nearly 800 feral horses were removed from a portion of the project area and there is work being conducted on private lands to restore water sources through targeted removal of pinyon-juniper woodlands in historical sagebrush and stringer meadow habitats. We intend through this project to implement targeted, site-specific predator removal in an attempt to illicit positive responses in mule deer and other wildlife populations over time. Improvements in fawn production and recruitment as well as the success of habitat restoration efforts will be monitored over the course of the project by NDOW and project collaborators.

NDOW will develop a plan to strategically remove coyotes and cougars from important deer habitats where predators may be having the most negative effects on deer. It should be understood that because of the dynamic nature of weather patterns, habitat conditions, and population responses that identifying specific cause-and-effect relationships of predator-prey and environmental conditions may be difficult for this project.

Recommendations

Due to questions about the original study design and data collection protocols for this project and changes in personnel within key positions at NDOW, this project should be redesigned with strong collaboration between NDOW field biologists, regional supervisors, wildlife staff biologists, and personnel conducting the carnivore work. Previous portions of this project intended to address sage grouse populations should be separated and specifically designed for that species.

Although scheduled to end in June 2015, NDOW will make recommendations regarding plans to amend work plans and continue predation management in accordance with this project within the FY2016 plan.

PROJECT 25

Coyote Mule Deer Predator-Prey Analysis (Area 16, 17)

Coyote field work began May 2011 and has continued each year from May to October in Game Management Units (GMU) 161 and 162 (Fig. 1). This work has been conducted to understand coyote diet, space use, and travel movements during the coyote denning and pup rearing seasons (April 16 to August 15; Gese 2005).

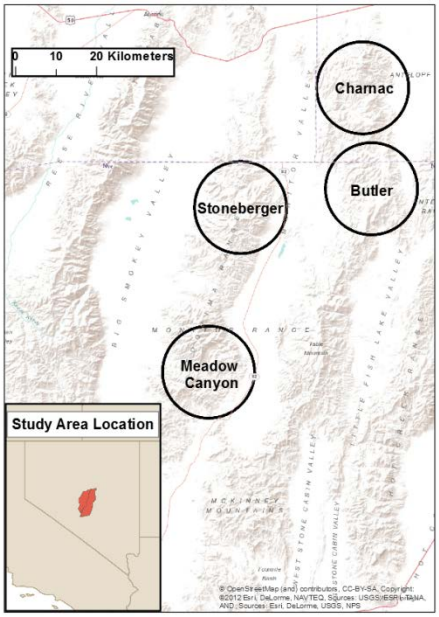

Figure 1. Map of 4 study sites in GMU 161 and 162.

Coyote Captures

Between June 2011 and September 2013, 15 coyotes have been captured with foothold traps and received GPS collars; an additional 22 coyote pups were captured and received ear tags during this same time. Beginning in winter 2012 and continuing into the early winter 2014, 10 coyotes were captured using helicopters and net guns (Fig. 2). These data will be used to learn about coyote home range size, daily, seasonal, and yearly movements, individual interactions, annual survival, microhabitat space use, and denning locations (Fig 3).

Coyote Scats

Each field season 4, 1-km transects have been walked (both ways) in each study site every 2 weeks from mid-May to mid-September. Scats were collected for coyote abundance estimates and to understand coyote diet. Saved scats will be dissected such that bones, skin, feathers, hair, insect parts, and plant parts will be identified to genus and species when possible (Kelly 1991). About 150 scats have been collected each season.

Figure 2. Example of course taken by Native Range in February 2014 during coyote captures.

Figure 3. Collared coyote killed and eaten by mountain lion.

Table 1. Variables collected to determine coyote microhabitat selection, den site, and den survey areas.

Parameter	Variable	Description
DSTEDGE*	Distance to nearest edge	Distance in meters to nearest change in habitat type. Determined from Landsat-based land use-land cover map when not measured in the field
COVERALL*	Overall vertical vegetative cover	Average percent of a 2 m high cover pole obscured from 10 meters away in each cardinal direction (Griffith and Youtie 1988). Cover pole divided in 20 1 diameter sections. Data recorded as the percentage of 1 diameter sections obscured (>50%) by vegetative or structural cover
COVER1*	Low vegetative cover	Average percent of low portion (<0.5 m) of cover pole obscured by vegetative or structural cover
COVER2*	Mid height vegetation cover	Average percent of middle portion (0.5-1.0 m) of cover pole obscured by vegetative or structural cover
COVER3*	High vegetative cover	Average percent of high portion (>1.0-2.0 m) of cover pole obscured by vegetative or structural cover
SLOPE*	Slope of site	Ocular estimate, using clinometer, of the average degrees of slope within sampled area
SHRUBCOV*	Shrub cover	Percent cover of shrub stems measured on the 3, 20 meter transects described above. Recorded as the average number of cover hits/total steps for the 3 transects. Cover hits are defined as steps that resulted in the tip of one's shoe being hidden from sight by shrub vegetation when viewed from above. Sample height range is 1.5 meters
CANCOV*	Percentage of canopy closure	Measured with densiometer at center of plots; held 55 cm from ground, facing each cardinal direction
POST*	Relative slop position	Categorical value, estimating proximity of plot in relation to position on ridge (0, 1, 2, 3, 4)
ASPECT*	Aspect of plot	Categorical value defining general direction of plot (N, NE E, SE, S, etc.) or no aspect (0)
TREES*	Trees per hectare	Woody stems with DBH > 6.4 cm at breast height within plot multiplied by whatever it takes to get to 1 hectare
MEANDIA*	Average tree diameter	Mean of woody stems with DBH > 6.4 cm at breast height within plot
LGSHRUB*	Shrubby vegetation > 1 m in height	Sum of shrub vegetation > 1 m in height
%GRASS	Percent grass cover	Average amount of % grass coverage of 9, 1 m^2 subplots
GRASSHT	Average grass height	Average height cm of grass cover within 9, 1 m^2 subplots
%FORB	Percent forb cover	Average amount of % forb coverage of 9, 1 m^2 subplots
FORBHT	Average forb height	Average height cm of forb cover within 9, 1 m subplots
%SHRUB	Percent small shrub (< 1 m) cover	Average amount of % shrub cover < 1 m in height within sample plot2
SHRUBHT	Average shrub height	Average height cm of small shrub cover within 9, 1 m^2 sub-plots
BARE	Percent bare ground	Averaged % of 9, 1 m^2 sub-plot that is composed of bare ground

*****Variables surveyed for coyote den site and area only.

Microhabitat Surveys

Thirty random locations collected between denning and pup rearing season (April 16 to August 15; Gese 2005) and 15 random locations within the minimum convex polygon will be selected for microhabitat space use analysis. All 45 locations will be visited and 20 variables will be measured at each location (Mosby et al. 2012; table 1).

Coyote Dens

Twenty coyote dens and their surrounded areas were surveyed in the 2014 field season. One den location was found with GPS collars, the other 19 dens surveyed were provided from a predator control contractor. All dens were surveyed at 3 spatial scales; den site, den area, and den environment (1 km from den; Squires et al. 2008). LANDFIRE will be used to classify habitat types in a 1 km circle surrounding each den (Rollins et al. 2006, Squires et al. 2008, Rollins 2009). LANDFIRE will be used to reclassify vegetation map into seven habitat (forest, grassland, road, sagebrush, mesic shrub-meadow, riparian and mesic-meadow) as described by Gese et al. (1996*a*, *b*). Thirteen of the 20 variables collected for microhabitat analysis will be collected at each den site and den area (table 1).

Alternate Prey Densities

Small mammals

To estimate small mammal densities a mark-recapture study involving Sherman traps during May–June and September–October of each field season has been conducted. Two trapping webs have been established in each site (Parmenter et al. 2003; Fig 4). Each small mammal trapping web has 148 traps. A total of 3,552 trap nights occur each season. An order of magnitude change was observed from spring 2012 until spring 2013. Small mammal populations have remained about the same into 2014.

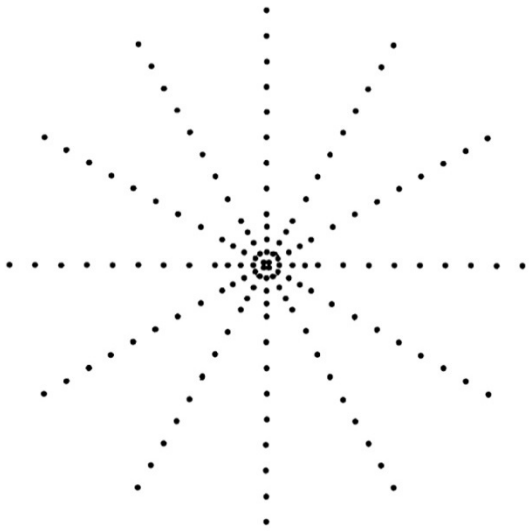

Figure 4. Aerial viewpoint of small mammal web layout.

Lagomorphs

Surveys to assess lagomorph densities were conducted twice per month corresponding with the new and full moon on roads within each study site (Smith and Nydegger 1985, Ralls and Eberhardt 1997). One technician drove 10–15 kph and surveyed for lagomorphs on the road while 2 passengers with 3 million candle power spotlights searched for lagomorph eye shine on their respective side of the vehicle. When a lagomorph was sighted, the vehicle was stopped and the distance, species, number of individuals, and UTM coordinates was recorded. Lagomorph observations have remained about the same across all seasons.

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PROJECT 29

Road Carrion and Raven Population Management in High Priority Greater Sage-Grouse Habitats

AND

PROJECT 30
Landfill-Animal Pit Management for Sage-grouse

Introduction

The greater sage-grouse (*Centrocercus urophasianus*) has been declining in population and active lek size at an average annual rate of 2% across most of its range since the 1960s (Connely et al. 2004). While many different factors may cause extreme population changes, greater sage-grouse numbers seem to be less affected by hunting or disease and most affected by lower reproductive success due to predation and habitat fragmentation. Sage-grouse behavior (e.g., lek activity, nest location) changes when their habitat diminishes or becomes fragmented. This, as well as nest-lek predation by other animals, causes a decline in population due to the sage-grouse's relatively low reproductive rate (Connely et al. 2004). The common raven (*Corvus corax*) is a known and ever-increasing predator of ground-nesting birds, and studies suggest that ravens may be key players in the decline of sage-grouse numbers (Lockyer et al. 2013). The purpose of this project is to find non-lethal approaches to controlling the raven populations in high-priority sage-grouse areas. Human-induced subsidies such as road carrion, waste, and ranching will attract ravens to a given range. By performing surveys of ravens, other birds of prey, and their nests throughout central and northern Nevada, we will be able to map concentrations and movement corridors of avian predators and how those might compare to sage-grouse ranges. We will manage carrion on specific state highways, while leaving some roads unmanaged as a control, to decide whether removing this anthropomorphic subsidy influences raven behavior and distribution. Another part of our project includes monitoring landfills and surveying any that may have a significant abundance of ravens. We would like to ensure that all animal waste and other attractants to scavengers in landfills are controlled in some way. Our hope is that reduction of man-made subsidies for predators will be a successful non-lethal strategy in helping nest success and recruitment of the greater sage-grouse.

Materials and Methods

Two technicians were hired to work on the project. The 4 main tenets of the project that we've focused on thus far are road carrion removal, raven-bird of prey-nest surveying, resource reduction at landfills, and radio telemetry tracking of ravens.

Our main focus during the past 9 months has been road carrion removal. The materials needed for road carrion removal include a shovel, a Garmin portable GPS device, field notebooks, pens, maps, a vehicle, and the safety-roadside repair equipment associated with the vehicle. Road carrion is removed by underground burial off the side of the road. Factors that affect our decision as to whether to bury road carrion include safety considerations (e.g., finding a safe place to stop, level of traffic on road), the size of the carrion, how fresh it is, and the

degree of scavenging it has already undergone. We usually bury small, fairly fresh road carrion with at least some meat left on it. We don't generally bury anything larger than a fox. However, we do record information about all the road carrion we see, regardless of size or location, and add it to the road carrion database. During the winter months, sometimes the ground is too hard to bury road carrion because of cold temperatures. If this is the case, we usually put it under some vegetation, and cover it with snow if possible.

From November through June, road carrion was removed during the daytime hours, usually between 9 a.m. and 5 p.m. That schedule changed during the summer; we remove road carrion as early as possible, usually at around 6 a.m., and we do a second route in the early evening around 4 p.m. We have done road carrion routes out of 3 locations: Reno, Elko, and Ely. We only worked in the Ely area from November through May. Since June we have just worked out of Reno and Elko. From November through May, we removed carrion from almost all well-travelled roads in northern Nevada. We removed road carrion on different roads every day, during 8-day trips when we went to Elko or Ely. We were told not to remove road carrion from 2 high traffic highways due to safety concerns: US 50 and US 93. The roads that we did remove road carrion from during that time period include:

- Reno-based roads: SR 445, SR 446, SR 447, Winnemucca Ranch road, Fish Springs road, Flanigan road, Red Rock road, SR 208, SR 338, East Walker road, and SR 359.

- Elko-based roads: SR 278, SR 225, SR 226, Owyhee road, SR 228, SR 227, SR 229, Harrison Pass road, Ruby Valley road, SR 230, Charleston-Deeth road, O'neil-Deeth road, Metropolis road, Wilkins-Montello road, SR 233, SR 232, and Alternate US 93.

- Ely-based roads: SR 278, US 6, SR 379, SR 318, Schellbourne pass road, Cherry Creek road, Cave Lake road, SR 893, SR 894, SR 487, and SR 488.

Since June, we have changed our road carrion removal strategy, based on discussion with new supervision. We now only remove road carrion from a few roads in the Elko area. These roads include: SR 225, SR 226, and SR 278. Instead of 8-day trips, we have been doing 4-day trips to Elko, and focusing solely on those roads during those 4-day trips.

Another aspect to this project has been predator and nest surveying. Materials necessary for surveying include binoculars, a spotting scope, portable GPS device, compass, bird reference books, field notebooks, and pens. From November through June, we recorded any predator or nest we saw along the roads we removed road carrion from. We also recorded the behavior of the birds we saw, the status of the nests (i.e., occupied-unoccupied, by which species), and notes on the general location and habitat.

Starting in July, we adopted a new surveying strategy: RRHL (Raptor, Raven, Horse and Livestock) point surveys. This surveying method requires us to count all the raptors, ravens, nests, horses, and livestock we see during 10-minute periods at set locations. We record information on the type of animal seen, the number of animal(s), time seen, the distance from the observer, bearing to the observer, and behavior of the animal(s). Information on weather conditions and anthropogenic subsidies is also recorded for each survey. We conduct several point surveys on both control roads that we don't remove carrion from, and roads that we do remove carrion from. Roads that we conduct point surveys on include:

- Reno-based roads: SR 447, SR 338, and SR 305 (control roads, no carrion removal)

- Elko-based roads: SR 278, SR 225, and SR 226 (treatment roads, carrion removal), and US 93 (control road, no carrion removal)

The last 2 aspects of the project have not been focused on as much thus far. Previous supervision requested that we call landfills and trash collection services across the state and conduct a survey on dead animal management at those landfills. Questions asked included:

1) Do you have standard procedures for dealing with dead animals in your jurisdiction? Y/N
2) What types of dead animals do you handle? (Pets, livestock, etc.)
3) How do you dispose of these dead animals?
4) Do you have an animal pit or any special location just for animals?
5) If so, where is it located? (In the landfill, at a different address, etc)
6) Is it covered or protected from the elements and scavengers? (Y/N)
7) If so, how is it protected?
8) Is it routinely checked/covered? How often? Daily? Once/week? Other?
9) Do you feel like you have a problem with scavengers on your site?
10) Do you keep organic waste separate from inorganic waste?

Eighteen trash collection companies and landfills were called. Answers to these questions are recorded in an electronic database. We have not done anything else relating to this aspect of the project since conducting these surveys.

Raven capture and radio-telemetry is something that we have tried to accomplish at various points since the project began in November. Materials needed for radio telemetry include radio transmitters, antennas, receivers, headphones, and batteries. Initially we constructed 8 noose carpet traps for capturing ravens. Materials needed to make these traps included chicken wire, rebar, 25-50 lb brown fishing line, leather sections, wire, pliers, scissors, and an awl. Noose carpet traps were constructed, and set out around different types of bait at various times during the spring. Types of bait used included doughnuts, chicken, ribs, steak, and pork. We also tried using fresh road carrion. Previous to setting out bait and traps, we had been trained on how to handle ravens or birds of prey if we caught one. We spent several hours monitoring whether there was any raven activity around the bait when we set it out, either with or without traps set up around it. Currently, we are planning on attempting to capture ravens with a net gun.

Results

All the data we have obtained for this project have been recorded in electronic databases, and detailed field reports. No statistical or GIS analyses have been conducted yet, but the plan is to use GIS to analyze the data. Below is a basic summary of our results thus far:

Since the start of the project in November, we have documented 426 road carrions. All of this carrion data is recorded in a database, which has details on the species, the Latin name, GPS coordinates, whether it was scavenged, and whether we buried it or not. Rabbit carrion has been the most common by far, with black-tailed jackrabbits being the most common species, followed by mountain cottontails. We have also seen quite a bit of squirrel species carrion, the majority of it during late spring and early summer. Other common species include: skunks, mule deer,

horned larks, red-tailed hawks, turkey vultures, gray foxes, kit foxes, coyotes, white-tailed jackrabbits, and great basin gopher snakes.

During the months of May and June, we noticed a substantial increase in the amount of road carrion. In winter and early spring months, it was not uncommon to not see any road carrion at all on some days, or see only 1 or 2 a day. This started changing in May, and continued into June and July. During those months, we noted several road carrions every day, sometimes up to 20 in a single day. Just recently, during August and early September, we have noticed that the amount of road carrion has gone down again.

We have noted road carrion on most of the roads we have done routes on, but there are certain roads that stand out in terms of the amount of road carrion we see on them. These roads include SR 278, SR 225, SR 226, SR 228, and SR 318. The high amount of road carrion seen on SR 225, SR 226, and SR 278 contributed to our decision to focus on those roads in the Elko area. We have also noticed that since we started doing road carrion routes in the early morning, we have seen a few more fresh, unscavenged carcasses. Most of the road carrion we see is a little bit scavenged though – it is hard to get to it before the scavengers do.

All of our surveying data is recorded in 2 databases; the first database contains all the data we recorded from November through June, and the second database contains all the data we've collected since we started doing point surveys in June. In terms of what sage grouse predator species we have seen the most, ravens are most numerous. We also have seen a lot of rough-legged hawks during the winter and spring months, and a lot of red-tailed hawks throughout the year.

One factor we have noticed that seems to correlate with the raven density in an area is the presence of ranching or farming. We have seen higher numbers of ravens in areas with extensive ranching and farming. One specific example is the difference in raven density between SR 278 and US 93. SR 278 has a lot of ranchland and farmland, especially on the northern end of the road. There are always many more ravens and birds of prey in these areas than in other areas, as is evident in our point survey results. US 93, however, doesn't have nearly as much farming or ranching, and there isn't as much raven or bird of prey activity. This could be partially because there isn't as much ranchland or farmland off of US 93, so ravens and birds of prey don't spend their time there because there aren't as many food subsidies for them.

Waste management surveys were conducted on 18 landfill and trash collection companies in Nevada. All landfills contacted reported that they had an animal pit where they buried dead animals. Most of the people we talked to from the landfills had similar answers regarding how they dealt with dead animals, probably because there are fairly strict state laws regarding how animal waste should be managed. They reported that animal pits are covered with a thick layer of dirt, ranging from 6–36 inches, depending on the landfill. The animal pits are checked routinely, ranging from daily to every time a new animal comes in.

In regards to scavenger issues, only a few landfills reported having a problem with ravens including Battle Mountain, Ely, and Hawthorne. When we have driven by several landfills, however, we have noticed higher numbers of ravens near the landfill. This is especially true for the Battle Mountain landfill, which is close to point survey locations. The last question in the survey we gave concerned whether organic and inorganic waste was separated. Most of the landfills said that their organic and inorganic waste wasn't separate. The presence of organic waste could potentially be drawing the ravens more than the dead animal pits, since the majority of the landfills reported that the pits were always covered with a thick layer of dirt to deter scavengers. It is known that ravens will eat a wide variety of food, especially in winter when

resources are scarce. A potential strategy for dealing with ravens at landfills could be to continue keeping dead animal pits inaccessible, as well as somehow preventing ravens from having access to organic waste. This could potentially reduce the raven population at landfills by reducing their access to resources.

We started baiting and monitoring raven activity at bait sites in early spring. We focused on baiting near active raven nests or areas with high raven densities. We never actually saw ravens eat the bait we put out, possibly because we were sitting in a truck somewhat nearby and the ravens were suspicious. We did find that some animal had usually eaten the bait when we checked on it the next day. Oftentimes, we thought it must have been ravens, because they had been flying around nearby the bait site while we were monitoring, but they never actually went for it while we were there.

We set up noose carpet traps with fresh road carrion as bait near an active raven nest on SR 318 at the beginning of one of our 8-day trips to Ely. We checked the trap every day, and monitored it for several hours at a time, but unfortunately to no avail. The ravens never went for the bait, it was untouched after 7 days. There may be some change in capture strategy in the future.

Conclusion

With this project we seek to identify and alleviate some of the major causes of the decline in greater sage-grouse numbers. In our surveys we have noted the areas where substantially more ravens are roosting, and we will continue to monitor these locations to determine whether road carrion management is affecting density of scavengers. Aside from road kill carcasses, we have found that extensive ranchland and landfills are also strong attractants to ravens and other birds of prey. Unfortunately, it may prove difficult to manage raven numbers in both of these habitats. This may be a topic for further research. We will continue trapping and tracking ravens with radio telemetry to study migration corridors and choice of nest location. We may discover other things that are attracting or deterring scavengers in particular areas. Sage-grouse nest monitoring with cameras and blinds can help determine the frequency of raven visits and identify nest predators.

NDOW may redirect efforts within the scope of the existing plan for FY2015 and may prepare substantial realignments for this project in the plan for FY2016 based on our findings.

Literature Cited

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Lockyer, Z. B., P. S. Coates, M. L. Casazza, S. Espinosa, and D. J. Delehanty. 2013. Greater sage-grouse nest predators in the Virginia Mountains of northwestern Nevada. Journal of Fish and Wildlife Management 4(2):242–254

PROJECT 31

Cougar-Mule Deer-Bighorn Analysis (Statewide)

No Predation Management Fee funding was expended on this project during State Fiscal Year 2014. No funding was approved for this project during this fiscal year either. No activity was undertaken on this project.

PROJECT 32

Ecology of Cougar and Black Bear Interactions – (Areas 19, 20, 29)

GPS radiotelemetry collars for 4 black bears, 6 cougars, and 5 mule deer have been purchased and are currently being tested and evaluated for effectiveness in this multi-species interaction study. Because the inter-species communicative GPS technology has never been implemented in North America, we are using extreme caution and thorough testing of radiotelemetry collars before the final deployment.

Background

The black bear population has expanded its distribution in western Nevada recently to include historical bear habitat in desert mountain ranges east of the Sierra-Carson Front (Beckmann and Berger 2003, Lackey 2004). Natural diet overlap of bears and cougars (Hornocker and Negri 2010) and the recent range expansion by bears provide an opportunity to evaluate resource partitioning in these 2 apex carnivores. Additionally, it is unknown how the expansion of 1 species (black bears) may have on the population dynamics of a competitive carnivore (cougars) and the affects these changes may have on prey species such as feral horses and mule deer. This project will study the movement patterns, inter and intra species competition, predator-prey relationships as well as aspects of human wildlife conflicts.

In cooperation with the Wildlife Conservation Society (WCS), NDOW plans to monitor black bear, cougar, and mule deer movement patterns in 3 areas of western Nevada. Through the analysis of location data, kill-site follow-up, tissue analysis, prey availability, and habitat conditions (Andreasen et al 2012), we hope to begin to understand the relationship between the 3 species including differences in seasonal diet patterns, home ranges, movement patterns, and population linkages. Over a 4-year period, NDOW biologists and researchers with WCS, plan to satellite collar 15 cougars, 15 black bears, and 30 mule deer distributed across the various study sites. Radiomarking and kill-site tracking will follow standard guidelines developed by project personnel (Beckmann and Berger 2003, Lackey 2014, Andreasen et al. In prep.). Mule deer will be monitored for changes in body condition, forage preferences, and diet quality using previously developed methods now widely used in other studies across Nevada (Schroeder et al. 2014). Habitat conditions will be monitored through collaborative field work with NDOW Habitat Division staff biologists.

Recommendations

Continue with coordination between NDOW biologists and WCS to design and implement the radiomarking efforts during winter months of 2014–2015. Fund Project 32 through FY2018. Evaluate efficacy of Project 32 annually.

Literature Cited

Andreasen, A., W. Longland, K. Stewart, and J. P. Beckmann. In prep. Characterizing mountain lion distribution and interactions with prey populations in Nevada.

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Hornocker, M. G., and S. Negri (eds). 2010. Cougar: ecology and conservation. 306pp.

Lackey, C. W. 2004. Nevada's black bear: ecology and conservation of a charismatic omnivore. Nevada Department of Wildlife. Biological Bulletin 15. 46pp.

PROJECT 33

Sage-grouse Nesting Habitat (Pinyon-Juniper Removal)

No Predation Management Fee funding was expended on this project during State Fiscal Year 2014; however, work was conducted within the 2 project areas identified within the plan. The China Camp Sage-grouse Habitat Restoration Project in Mineral County (Bi-State Sage-grouse Distinct Population Segment) is a long-standing, phased project that is nearing completion. This project represents a joint effort between the Nevada Department of Wildlife and the USDA Forest Service (USFS). Funding for this project was previously made available through the USFS for planning and clearance work and NDOW Upland Game Stamp, Habitat Conservation Fee, and the Nevada Partners in Conservation Development (NPCD) Program for implementation. The second project mentioned within the plan is the Long Doctor Habitat Enhancement project, also within the Bi-State DPS, and the initial stages of this project have also been implemented. This is also a phased project with initial funding coming from the NPCD program and Habitat Conservation Feed funds.

PROJECT 34

Sage-grouse Brood Habitat (Stringer Meadow) (Area 14)

Like Project 33, no Predation Management Fee funding was expended on this project during State Fiscal Year 2014; however, no funding was identified for the project either. This project was composed of 4 main treatment areas including the Sulphur Springs Range, eastern side of Roberts Creek Mountain, western edge of the Diamond Mountains north of Eureka, and the northern end of the Monitor Range. No treatments were conducted in these areas in FY2014.