Committee Members: Commissioner Johnston (Chair), Commissioner Almberg, Commissioner Hubbs, Commissioner Barnes, Tom Cassinelli

Staff to the Committee: Pat Jackson

Nevada Board of Wildlife Commissioners
Wildlife Damage Management Committee
Nevada Department of Wildlife
Las Vegas, NV 89108

Thursday, March 23, 2017 / 6:00 p.m.

Minutes

1. Call to Order – Chairman Johnston

Meeting called to order at 6:04 p.m.

In attendance:

Commissioner Brad Johnston
Commissioner Jon Almberg
Commissioner Tom Barnes
Committee Member Tom Cassinelli
Brian Wakeling, Nevada Department of Wildlife

Absent:

Commissioner Kerstan Hubbs

Others Present:

Fred Voltz
Janna Wright

2. Approval of Agenda

Commissioner Almberg moved to approve agenda. Mr. Cassinelli seconded the motion. The motion passed.

3. Approval of Minutes (March 23, 2016)

Mr. Cassinelli moved to approve the minutes. Chair Johnston seconded the motion. Commissioner Almberg abstained. The motion passed.

4. Report on DRAFT FY 2018 Predator Management Plan – Predator Management Staff Specialist Pat Jackson, Nevada Department of Wildlife (NDOW)

Chief Brian Wakeling presented the DRAFT FY 2018 Predator Management Plan (Attachment A) on behalf of Staff Specialist Jackson, who was unavoidably absent. The NDOW took into consideration feedback from the February 2017 Commission Meeting and made subsequent changes to the DRAFT FY 2018 Predator Management Plan (Attachment A). The NDOW also reviewed comments from the Predatory Animal and Rodent Committee (PARC) from its February 15, 2017 meeting. The PARC submitted its written comments (Attachment B) regarding the DRAFT FY 2018 Predator Management Plan on March 23, 2017.

Chief Wakeling addressed the Committee's desire to measure the DRAFT FY 2018 Predator Management Plan (Attachment A) against the performance of the FY 2017 year. Since FY 2017 is not finished yet, the FY 2017 Predation Management Status Report is unavailable. Chief Wakeling offered the FY 2016 Predation Management Status Report (Attachment C) as reference

for assessing performance while considering the FY 2018 Predator Management Plan (Attachment A).

Chief Wakeling stated that the NDOW had taken into consideration comments from the Commission, PARC, and the public and had made appropriate changes to the FY 2018 Predator Management Plan (Attachment A). Such changes primarily addressed reporting, especially under what conditions a project may be determined as complete. Chief Wakeling highlighted several projects where wording and description had been added for emphasis and clarity.

The Committee discussed PARC's comments on specific projects (Attachment B), particularly regarding comment number 2, regarding Project 22-074. The PARC's recommendation is that Project 22-074 be defunded and suspended. Chair Johnston enquired on NDOW's stance on PARC's comment (Attachment B). Chief Wakeling stated the NDOW disagrees with PARC. The NDOW is not actively removing mountain lions because the bighorn sheep population is above the lethal removal threshold, but has chosen to continue to monitor the bighorn sheep population to ensure that it does not drop below that threshold. The NDOW biologists feel the population is currently stable, but needs monitoring as even limited predation would make the population trend downwards. The NDOW feels there is merit in Project 22-074 because it allows for a more measured response.

Chair Johnston asked Chief Wakeling about PARC's comments on specific projects number 1, regarding Project 22-01 (Attachment B). Chair Johnston asked if the NDOW had an opinion on PARC's suggestion that the word "coyote" be added to the text so that the project would become a mountain lion and a coyote removal project. Chief Wakeling stated the NDOW does not often see coyote predation on bighorn sheep and that adding the word "coyote" would create a small burden for no benefit as mountains lions are the predominant issue faced by the bighorn population.

Commissioner Almberg asked if the budget of Project 22-074 included removal, or if it was only to pay for monitoring. Chief Wakeling answered the budget includes acquisition and deployment of radio collars, as well as any necessary removal the NDOW may need. Discussion continued regarding Project 37 funds.

Commissioner Barnes asked if Chief Wakeling could interpret what PARC's issue was pertaining to Project 22-074. Chief Wakeling stated that PARC Committee Member Gardner had presented in the PARC meeting that no lions were removed in 2016 and it was stated in the plan that it is the biologist's belief that mountain lion predation is not a threat to that bighorn sheep population. Based on this information, Mr. Gardner had questioned the necessity of Project 22-074. The Committee discussed Project 37 funds. Chief Wakeling reiterated that it is NDOW's intention to deploy radio collars on the bighorn sheep in effort to monitor the population and so be more responsive.

Commissioner Barnes commented on the value of collaring and tracking the data from the bighorn sheep during predator control work. Chair Johnston concurred. Chief Wakeling agreed there was importance and value in the NDOW being able to make appropriate and flexible responses to various situations.

Chair Johnston opened the agenda item to public comment.

Fred Voltz stated there are three missing metrics for the lethal projects: reporting of dead body counts for the targeted species, the subsequent predator population numbers in targeted project areas one or more years into the future, and an estimated and actual cost per dead predator based on the targeted deaths.

Janna Wright stated it appeared there should be more comments in the plan so one did not have

to go back to the FY 2016 Predation Management Status Report (Attachment C) to see what was happening now. She would like to see a running total of the money spent on projects that go from year to year and more detail in the plans and the reports that show number of collars, number of lions removed, and numbers of coyotes removed. She would like to see the plan display project start and end dates.

Chair Johnston acknowledged the public's desire for more information and reporting data, but stated he did not want the Predator Plan to become burdened with waiting for the previous year's report. After hearing the NDOW's view, Chair Johnston did not believe PARC's suggestion of adding the word "coyotes" should be adopted. Chair Johnston commented on the remainder of PARC's suggestions.

Commissioner Barnes concurred with Chair Johnston regarding Project 37. Commissioner Almberg concurred as well.

Chief Wakeling stated NDOW wanted Projects 37 and 38 to be used for handling situations where NDOW does not anticipate a problem, but one does occur. By keeping Project 22-074 viable, NDOW can respond appropriately and transparently and NDOW can track the removals and other actions taken on a project on project basis, versus in a generalized way.

Commissioner Almberg agreed with Chief Wakeling's statement.

Chair Johnston motioned that the Committee recommend the Commission approve the DRAFT FY 2018 Predator Management Plan with the following changes: inclusion of Table 3, Project 38, which is missing from the document all together; increasing the budget on Project 37 and Project 38 from $125,000 to $175,000; including in Project 40 the baseline data from Management Area 14 and having NDOW specify the target or goal of fawn-doe ratio.

Commissioner Almberg seconded the motion. The motion passed.

5. Public Comment Period

Meeting adjourned at 6:38 p.m.

Attachment A

Draft 1

Nevada Department of Wildlife
Predator Management Plan
Fiscal Year 2018

1 July 2017 to 30 June 2018

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STATE OF NEVADA

Brian Sandoval, Governor

Nevada Department of Wildlife

Tony Wasley, Director

Jack Robb, Deputy Director
Liz O'Brien, Deputy Director
Brian F. Wakeling, Game Division Administrator

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Introduction

The goal of the Nevada Department of Wildlife's (NDOW's) Predator Management Program is to conduct projects consistent with the terrestrial portion of 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." Provisions outlined in NRS 502.253 authorize the collection of a $3 fee for each big game tag application, deposition of the revenue from such a fee collection into the Wildlife Fund Account, and use by NDOW to 1) develop and implement an annual program for the management and control of predatory wildlife, 2) conduct wildlife management activities relating to the protection of nonpredatory game animals and sensitive wildlife species, and 3) conduct research necessary to determine successful techniques for managing and controlling predatory wildlife. This statute also allows for: the expenditure of 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 predator management activities under the guidance of the Nevada Board of Wildlife Commissioners; and provide that unspent monies remain in the Wildlife Fund Account and do not revert to State General Funds at the end of any fiscal year.

NDOW maintains a philosophy that predator management is a tool to be applied deliberately and strategically. Predator management may include lethal removal of predators or corvids, nonlethal management of predator or corvid populations, habitat management to promote more robust prey populations which are better able to sustain predation, monitoring and modeling select predator populations, managing for healthy predator populations, and public education, although not all of these aspects are currently eligible for funding through predator fee dollars. NDOW intends to use predator management on a case-by-case basis, with clear goals, and based on an objective scientific analysis of available data. To be effective, predator management should be applied with proper intensity and at a focused scale. Equally important, when possible projects should be monitored to determine whether desired results are achieved. This approach is supported by the scientific literature on predation management. NDOW is committed to using all available tools and the most up-to-date science, including strategic use of predator management, to preserve our wildlife heritage for the long term.

NDOW is a state agency that must balance the biological needs of wildlife, statutory mandates, and social desires of the public. In the 2015 legislative session, Assembly Bill 78 was adopted which in part amended NRS 502.253 (4) (b) to read: [The Department] "Shall not adopt any program for the management and control of predatory wildlife developed pursuant to this section that provides for the expenditure of less than 80 percent of the amount of money collected pursuant to subsection 1 in the most recent fiscal year for which the Department has complete information for the purposes of lethal management and control of predatory wildlife." NDOW intends to comply with statute and apply the tools of scientific predation management in biologically sound, socially responsible means.

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Budget Summary

Fiscal year 2017 predator fee revenues will be available February 1, 2017. The Department expects to need to allocated approximately $470,000 on lethal removal to meet the requirements set forth by Assembly Bill 78. Proposed predator projects for fiscal year 2018 include $719,000 for lethal work, these funds include fiscal year 2017 revenues and previous fiscal years surpluses. Over $500,000 in predator fee revenues are left over from previous fiscal years; it is the Department's goal to reduce this surplus.

Map Note

Maps for each project may be found in the last page of this document.

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TYPES OF PROJECTS

Below are the three categories of projects in the predator management plan. Some projects have aspects of multiple types within a single activity or action. The project types are listed throughout this document.

1. **Implementation**: The primary objective is to implement management of predators through lethal or non-lethal means. NDOW will collaborate with USDA Wildlife Services and private contractors to conduct lethal and non-lethal management of predators. Identifying and monitoring a response variable is not a primary objective for implementation.
2. **Experimental Management**: The primary objectives are management of predators through lethal or non-lethal means and to learn the effects of a novel management technique. NDOW will collaborate with USDA Wildlife Services, private contractors, and other wildlife professionals to conduct lethal or non-lethal management of predators and will put forethought into project design. Response variables will be identified and data will be collected to determine project effectiveness. Expected outcomes will include project effectiveness, agency reports, and possible peer-reviewed publications.
3. **Experimentation**: The primary objective is for increasing knowledge of predators in Nevada. NDOW may collaborate with other wildlife professionals to study and learn about predators of Nevada. Expected outcomes will include agency reports, peer-reviewed publications, and information on how to better manage Nevada's predators.

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LEVELS OF MONITORING

Below are the three levels of monitoring outlined in the predator management plan. The level of monitoring for each project is identified within the project description.

1. **Standard Monitoring**: The primary objective of standard monitoring is to use existing survey protocols to evaluate the response of game species or sensitive wildlife to lethal or non-lethal management of predators. NDOW conducts annual and biannual surveys to evaluate trend and composition of game species or sensitive wildlife and to inform the season and quota-setting process. Composition surveys will yield response variables such as recruitment of juveniles into the adult population and will be compared to published benchmarks of productivity in the management area of interest, to neighboring areas not receiving predator management, or in the same area before treatment began. Standard monitoring represents no change to existing monitoring efforts. Expected outcomes include an indication of project effectiveness and agency reports.
2. **Intermediate Monitoring**: The primary objective of intermediate monitoring is to apply a specific monitoring plan designed to evaluate the response of game species or sensitive wildlife to lethal or non-lethal management of predators. NDOW may collaborate with other wildlife professionals to identify reference and treatment areas or evaluate productivity of game species or sensitive wildlife before, during, and after implementation to determine effectiveness of predator management. Composition surveys may be modified to thoroughly evaluate productivity in the reference and treatment areas and to better accommodate annual variation in survey conditions. Expected outcomes will include an indication of project effectiveness, agency reports, and possible peer-reviewed publications.
3. **Rigorous Monitoring**: The primary objective of rigorous monitoring is to evaluate several response variables known to affect productivity of game species or sensitive wildlife and to determine the relative influence of those variables when measuring the response to lethal or non-lethal management of predators. NDOW may collaborate with other wildlife professionals to identify the requirements of rigorous monitoring and to further evaluate factors influencing productivity of game species or sensitive wildlife such as survival of juveniles, body condition of adults, or habitat productivity. Rigorous monitoring efforts will help to disentangle biotic and abiotic conditions that may influence productivity of game species or sensitive wildlife from the effects of lethal or non-lethal management of predators. Expected outcomes will include agency reports, peer-reviewed publications, and information on how to better manage Nevada's wildlife.

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FY 2018 PROJECTS RECOMMENDED FOR CONTINUATION

Project 21: Greater Sage-Grouse Protection (Common Raven Removal)

Justification	This project proposes to lethally remove common ravens from known Greater Sage-grouse habitat, common raven predation on Greater Sage-grouse nests and broods can limit population growth. Common ravens will be removed around known Greater Sage-grouse leks because most nest sites are located within 4 km of a lek. Common ravens will be removed in areas of known greater abundance to benefit sensitive populations of Greater Sage-grouse.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard to intermediate
Potentially Affected Species	Common raven, Greater Sage-grouse
Span More Than One Fiscal Year	Yes
Project Area	Elko, Eureka, Humboldt, Lander, Lincoln, Lyon, Washoe, and White Pine counties.
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for Greater Sage-grouse, their populations can be suppressed by abiotic factors such as dry climate and loss of quality habitat. Increases in predator numbers can also cause decreases in Greater Sage-grouse populations; common raven abundance has increased throughout their native ranges, with increases as much as 1,500% in some areas (Boarman 1993, Coates et al. 2007, 2014, Sauer et al. 2011). Under these circumstances, common raven predation can have a negative influence of Greater Sage-grouse nesting success, recruitment, and population trend (Coates and Delehanty 2010).
Response Variable	Common raven point counts may be conducted before, during, and after removal to detect changes in common raven densities.

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Project Goals	1. Reduce common raven populations in high abundance areas that overlap sensitive Greater Sage-grouse populations identified by NDOW and USDA Wildlife Services wildlife biologists. 2. Increase populations of Greater Sage-grouse in specific areas where deemed feasible.
Habitat Conditions	Areas of common raven removal will be within or in close proximity to Greater Sage-grouse leks, nesting habitat, and brood-rearing habitat. Persistent drought throughout Nevada has reduced herbaceous cover, along with nesting and brood rearing habitat; these effects are exacerbated by wildfire and the invasion of cheatgrass. Transmission lines, substations, and nearby agriculture production often attract common ravens which may threaten nearby Greater Sage-grouse populations.
Comments from FY 2017 Predator Report	None
Methods	*Lethal Removal* Chicken eggs treated with corvicide (DRC-1339) will be deployed to remove common ravens (Coates et al. 2007). To reduce non-target species exposure, no eggs will be left in the environment for over 96 hours. No leftover eggs will be used on subsequent treatments. All remaining eggs and any dead common ravens found will be collected and disposed of properly as per DRC-1339 protocol. Common raven take will be estimated at 1 common raven per 11 eggs gone (Coates et al. 2007). DRC-1339 is effective only on corvids and most mammals and other birds are not susceptible to the specific effects from this agent. *Monitoring* Point counts for common ravens will be conducted from March through July of each year, which corresponds with Greater Sage-grouse nesting and brood-rearing season. Surveys will be similar to Ralph et al. (1995): lasting 10 minutes; conducted between sunrise and 1400 hrs; conducted under favorable weather conditions; and stratified randomly across study areas (Luginbuhl et al. 2001, Coates et al. 2014).
Anticipated Result	The removal of common ravens is intended to result in long-term protection for Greater Sage-grouse populations through increases in nest success, brood survival, and recruitment.
Project Direction	Fund Project 21. Evaluate efficacy of Project 21 annually.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$100,000	N/A	$100,000

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Project 21-02: Common Raven Removal to Enhance Greater Sage-Grouse Nest Success

Justification	Common ravens are a leading nest and brood predator for Greater Sage-grouse and reducing common raven abundance can influence Greater Sage-grouse nest success and brood survival (Coates and Delehanty 2010). This project will lethally remove common ravens in habitats surrounding known Greater Sage-grouse leks and nesting habitats to enhance nesting success and brood survival.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Implementation and Experimental Management
Monitoring Level	Intermediate
Potentially Affected Species	Common raven, Greater Sage-grouse
Span More Than One Fiscal Year	Yes, depending on outcomes associated with Greater Sage-grouse response. The scope and location of this project may be modified in future years.
Project Area	Unit 02
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for Greater Sage-grouse, their populations can be suppressed by abiotic factors such as dry climate and loss of quality habitat. Increases in predator numbers can also cause decreases in Greater Sage-grouse populations; common raven abundance has increased throughout their native ranges, with increases as much as 1,500% in some areas (Boarman 1993, Coates et al. 2007, 2014, Sauer et al. 2011). Under these circumstances, common raven predation can have a negative influence of Greater Sage-grouse nesting success, recruitment, and population trend (Coates and Delehanty 2010).
Response Variable	The response variables will be nest success and brood survival of Greater Sage-grouse within treated areas before and after treatment. This monitoring will not be paid for with $3 predator fees.
Project Goal	1. Increase populations of Greater Sage-grouse through improved nest success and brood survival in treated areas. 2. Determine common raven removal effort needed to reduce raven densities to a level they are not detrimental to Greater Sage-grouse nest success.

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Habitat Conditions	Areas of common raven removal will be within or in close proximity to Greater Sage-grouse leks, nesting habitat, and brood-rearing habitat. Persistent drought throughout Nevada has reduced herbaceous cover, along with nesting and brood rearing habitat; these effects are exacerbated by wildfire and the invasion of cheatgrass. Transmission lines, substations, and nearby agriculture production often attract common ravens which may threaten nearby Greater Sage-grouse populations.
Comments from FY 2016 Predator Report	None
Methods	*Lethal Removal* Chicken eggs treated with avicide (DRC-1339) will be deployed to remove common ravens (Coates et al. 2007). To reduce non-target species exposure, no eggs will be left in the environment for over 96 hours. No leftover eggs will be used on subsequent treatments. All remaining eggs and any dead common ravens found will be collected and disposed of properly as per avicide protocol. Common raven take will be estimated at 1 common raven per 11 eggs gone (Coates et al. 2007). DRC-1339 is effective only on corvids and most mammals and other birds are not susceptible to the specific effects from this agent.
Anticipated Result	The removal of common ravens is intended to result in long-term protection for Greater Sage-grouse populations through increases in nest success, brood survival, and recruitment.
Project Direction	Fund project 21-02 through FY 2019.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$25,000	N/A	$25,000

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Project 22-01: Mountain Lion Removal to Protect California Bighorn Sheep

Justification	California bighorn sheep populations have been reintroduced in northwestern Nevada; mountain lion predation can be a significant source of mortality that may threaten this population's viability. Area 01 is in close proximity to the Sheldon National Wildlife Refuge, California, and Oregon; all three may act as a source for mountain lions. Mountain lions will be removed proactively by USDA Wildlife Services and private contractors until the local bighorn sheep population reaches the population objective.
Project Manager	Chris Hampson, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard to intermediate
Potentially Affected Species	California bighorn sheep, mountain lion, mule deer
Span More Than One Fiscal Year	Yes
Project Area	Units 011 and 013
Limiting Factor Statement	Mountain lions are known predators of bighorn sheep (Rominger et al. 2004). Though predation is a naturally occurring phenomenon for bighorn sheep and other big game, their populations can be lowed or suppressed by abiotic factors such as dry climate and loss of quality habitat. Mitigating abiotic factors by removing predators is imperative for some bighorn sheep populations to stabilize (Rominger 2007).
Response Variable	The response variable will be the number of radio marked bighorn sheep killed by mountain lions.
Project Goal	Remove mountain lions to proactively protect reintroduced California bighorn sheep.
Habitat Conditions	Persistent drought combined with fires and human disturbances throughout Nevada have reduced herbaceous cover, lambing, and browsing habitat. These effects may also be suppressing bighorn populations below carrying capacity or preventing them from reaching self-sustaining levels. Currently, several collaborations between the Bureau of Land Management and NDOW to remove pinyon-juniper are scheduled. These removals are intended to improve bighorn

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	sheep habitat, improve access to water sources, and to remove habitat that is ideal for mountain lions to focus on bighorn sheep.
Comments from FY 2016 Predator Report	None
Methods	NDOW biologists, USDA Wildlife Services, and private contractors will collaborate to identify current and future California bighorn sheep locations and determine the best methods to reduce California bighorn sheep mortality. Traps, snares, baits, call boxes, and hounds will be used to proactively capture mountain lions as they immigrate into the defined sensitive areas.
Population Estimate	The population estimate for California Bighorn sheep is 40-50 individuals for area 011 and 40-50 individuals in area 013
Anticipated Result	Decrease or prevent predation from mountain lions for all age classes of reintroduced California bighorn sheep, resulting in an established, viable population.
Project Direction	Fund project 22-01. Monitor population. Cease proactive removal efforts after the local bighorn sheep population reaches 60 in each area (011 and 013; table 1).

Table 1. Population numbers to be used to redirect focus of project.

Action	Bighorn Sheep Population
Monitor bighorn population, conduct removal on case by case basis	> 80
Remove mountain lions that consume bighorn sheep*	60 - 80
Remove all mountain lions in area	< 60

*Indicates need for monitoring local mountain lion population.

Budget

$3 Predator Fee	Pittman-Robertson	Total
$90,000	N/A	$90,000

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Project 22-074: Monitor Rocky Mountain Bighorn Sheep for Mountain Lion Predation

Justification	Rocky Mountain bighorn sheep populations have been established in portions of Nevada, but mountain lion predation can be a significant source for mortality that may threaten the population's viability. One collared bighorn sheep has been killed by mountain lions in the past year, it is the area biologists belief mountain lion predation is not a current threat to the local bighorn sheep population.
Project Manager	Kari Huebner and Scott Roberts, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard to intermediate
Potentially Affected Species	Rocky Mountain bighorn sheep, mountain lion
Span More Than One Fiscal Year	Yes
Project Area	Unit 074
Limiting Factor Statement	Mountain lions are known predators of bighorn sheep (Rominger et al. 2004). Though predation is a naturally occurring phenomenon for bighorn sheep and other big game, their populations can be lowed or suppressed by abiotic factors such as dry climate and loss of quality habitat. Mitigating abiotic factors by removing predators is imperative for some bighorn sheep populations to stabilize (Rominger 2007).
Response Variable	The response variable will be the number of radio marked bighorn sheep killed by mountain lions.
Project Goal	Bighorn sheep populations will be monitored on a continual basis and predator control will be implemented as deemed necessary at the discretion of the Area Biologist.
Habitat Conditions	Persistent drought combined with fires and human disturbances throughout Nevada have reduced herbaceous cover, lambing, and browsing habitat. These effects may also be suppressing bighorn populations below carrying capacity or preventing them from reaching self-sustaining levels. Currently, several collaborations between the Bureau of Land Management and NDOW to remove pinyon-juniper are scheduled. These removals are intended to improve bighorn sheep habitat, improve access to water sources, and to remove habitat that is ideal for mountain lions to focus on bighorn sheep.

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Comments from FY 2016 Predator Report	None
Methods	NDOW biologists will identify current and future Rocky Mountain bighorn sheep locations and determine the best methods to monitor this population. Additional GPS collars will be purchased and deployed to monitor the bighorn sheep population. If mountain lion predation is identified as an issue, then traps, snares, baits, call boxes, and hounds will be used to lethally remove mountain lions from the area.
Population Estimate	The population estimate for Rocky Mountain Bighorn sheep is approximately 15 individuals in area 074.
Anticipated Results	1. Monitor the population of Rocky Mountain bighorn sheep. 2. If mountain lion predation is identified as an issue, conduct lethal removal.
Project Direction	Fund project 22-074. Monitor population. Begin mountain lion removal efforts if mountain lion predation is detected (table 2). Evaluate efficacy of project 22-074 annually.

Table 2. Population numbers to be used to redirect focus of project.

Action	Bighorn Sheep Population
Monitor bighorn population, conduct removal on case by case basis	> 15
Remove mountain lions that consume bighorn sheep*	10 - 15
Remove all mountain lions in area	< 10

*Indicates need for monitoring local mountain lion population.

Budget

$3 Predator Fee	Pittman-Robertson	Total
$90,000	N/A	$90,000

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Project 32: Mountain Lion, Black Bear, and Mule Deer Interactions

Justification	Black bears are expanding numerically and geographically, and in so doing they are recolonizing historic ranges in Nevada. It is imperative to understand to what extent this increasing distribution is affected by their interactions with mountain lions. Black bear interactions with mountain lions at kill sites could potentially have effects on mule deer populations, and possible implications on livestock husbandry practices.
Project Manager	Jon Beckmann, Wildlife Conservation Society
Project Type	Experimentation
Monitoring Level	Rigorous
Potentially Affected Species	Mule deer, mountain lion, black bear
Span More Than One Fiscal Year	Yes
Project Area	Units 014, 015, 021, 192, 194, 195, 196, 201, 202, 203, 204, 291
Limiting Factor Statement	Black bears have recently expanded their distribution in western Nevada to include historical bear habitat in desert mountain ranges east of the Sierra Nevada and Carson Front (Beckmann and Berger 2003, Lackey et al. 2013). Additionally, recent findings have shown 50% of mountain lion killed deer are scavenged by black bears during summer months (Andreasen 2014, unpublished data). The current recolonization of historical bear habitat provides a unique opportunity to determine if these interactions between black bears and mountain lions are subsidizing the bear population increase.
Response Variable	No response variable will be collected, this is an experimentation project.
Project Goals	1. Increase understanding of apex predator resource partitioning, competition, and commensalism in desert ranges where black bears have established territories recently that overlap those of mountain lions. 2. Determine if mountain lion predation rates on mule deer increase in areas occupied by black bears. 3. Determine if mountain lion conflicts with humans increase where black bears are present (i.e., prey switching to less energetically expensive prey such as domestic livestock).

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Habitat Conditions	The study area consists of mountain ranges and associated basins that are characterized by steep topography with high granite peaks and deep canyons. Mountain ranges are separated by desert basins that range from 15–64 km across (Grayson 1993). These basins are often large expanses of unsuitable habitat (e.g., large areas of sagebrush) that bears and mountain lions do not use as primary habitat.
Comments from FY 2016 Predator Report	None
Methods	A minimum of 18 black bears and 18 mountain lions, will be captured and fitted with Vectronic brand GPS PLUS collars with proximity sensors to assess behavioral responses of each species upon close interaction. We will attempt to maintain sample sizes of six bears and six mountain lions collared in each of our three study areas for five years. To further maximize probability of recording predator-predator interactions, we will monitor kill sites of collared mountain lions with real-time trail cameras and target black bears scavenging from mountain lion kills for collaring with GPS proximity collars. Sixty mule deer will be fitted with Vectronic brand GPS PLUS Vertex Survey collars to monitor daily survival of individuals and to estimate annual adult doe survival in each study area, this will be funded from a source other than predator fee funds.
Anticipated Results	1. Improved understanding of mountain lion and bear dietary preference, dietary overlap and prey switching capabilities will provide insight for better big game population management. 2. Targeted predator population management could improve attendant big game population management which has implications for big game tag allocation. 3. Mountain lion subsidies may increase black bear recolonization eastward into Nevada, which could have direct implications on future management decisions. 4. Use field-based, scientific data to understand, predict, and potentially mitigate, changes in human-mountain lion conflict where bears are re-establishing historic ranges.
Project Direction	Fund Project 32 through FY 2020.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$40,000	$120,000	$160,000

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Project 37: Big Game Protection-Mountain Lions

Justification	Predation issues frequently arise in a very short timeframe. These issues often occur within a fiscal year. By the time a project can be drafted, approved, and implemented, it may be too late to prevent or mitigate the predation issue. Removing mountain lions that prey on sensitive game populations quickly is a required tool to manage big game populations statewide.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard to intermediate
Potentially Affected Species	Mountain lion, mule deer, bighorn sheep, antelope
Span More Than One Fiscal Year	Yes
Project Area	Statewide
Limiting Factor Statement	Mountain lions are known predators of bighorn sheep and other big game species (Rominger et al. 2004). Though predation is a naturally occurring phenomenon for bighorn sheep and other big game, their populations can be lowered or suppressed by abiotic factors such as dry climate and loss of quality habitat. Mitigating abiotic factors by removing predators is imperative for some bighorn sheep populations to stabilize (Rominger 2007).
Response Variable	Response variables may include reduction of prey taken by mountain lions, removal of a mountain lion that was documented consuming the concerned big game species, or a reduction in mountain lion sign. Because of the quick nature of the project, there may be times when no response variable will be measured.
Project Goal	Remove specific, problematic mountain lions to benefit game species.
Habitat Conditions	Persistent drought combined with fires and human disturbances throughout Nevada have reduced herbaceous cover, lambing, and browsing habitat. These effects may have reduced mule deer and other big game populations below carrying capacity. These effects may also be suppressing mule deer or big game populations below carrying capacity (Ballard et al. 2001).
Comments from FY 2016 Predator Report	None

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Methods	NDOW will specify locations of mountain lions that may be influencing local declines of sensitive game populations. Locations will be determined with GPS collar points, trail cameras, and discovered mountain lion kill sites. Removal efforts will be implemented when indices levels are reached, these include low annual adult survival rates, poor fall young:female ratios, spring young:female ratios, and low adult female annual survival rates (table 3). Depending on the indices identified, standard to intermediate levels of monitoring will be implemented to determine the need for or effect of predator removal. These additional monitoring efforts may be conducted by NDOW employees, USDA Wildlife Services, or private contractors.
Anticipated Results	1. Lethal removal of individual, problematic mountain lions will provide a precise tool, protecting reintroduced and sensitive big game populations. 2. Implementation will occur in association with game populations that are sensitive (e.g., small in size, limited in distribution, in decline) and may benefit from rapid intervention from specific predation scenarios.
Project Direction	Fund Project 37.

Table 3. Indices used to initiate predator removal.

Species	Annual Adult Survival Rates	Fall Young: Female Ratios	Spring Young: Female Ratios	Adult Female Annual Survival Rates
California Bighorn Sheep	< 90%	< 40:100	--	--
Rocky Mountain Bighorn Sheep	< 90%	< 40:100	--	--
Desert Bighorn Sheep	< 90%	< 30:100	--	--
Mule Deer	--	--	< 35:100	< 80%
Pronghorn	< 90%	< 40:100	--	--

Budget

$3 Predator Fee	Pittman-Robertson	Total
$125,000	N/A	$125,000

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Project 38: Big Game Protection-Coyotes

Justification	Predation issues frequently arise in a very short timeframe. These occurrences often occur within a fiscal year, therefore by the time a project can be drafted, approved, and implemented, to prevent or mitigate the predation issue, it may be too late. Removing problematic coyotes quickly is a required tool to manage big game populations statewide.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard to intermediate
Potentially Affected Species	Coyote, mule deer, antelope, Greater Sage-grouse
Span More Than One Fiscal Year	Yes
Project Area	Statewide
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for mule deer and other big game, their populations can be lowered or suppressed by abiotic factors such as dry climate and loss of quality habitat Predation from coyotes may further suppress these populations (Ballard et al. 2001).
Response Variable	Response variables may include reduction of prey taken by coyotes, removal of a coyote that was documented consuming the concerned big game species, or a reduction in coyote sign. Because of the quick nature of the project, there may be times when no response variable will be measured.
Project Goal	Conduct focused coyote removal to protect game species.
Habitat Conditions	Persistent drought combined with fires and human disturbances throughout Nevada have reduced herbaceous cover, lambing, and browsing habitat. These effects may have reduced mule deer and other big game populations below carrying capacity. These effects may also be suppressing mule deer or big game populations below carrying capacity (Ballard et al. 2001).
Comments from FY 2016 Predator Report	None
Methods	USDA Wildlife Services and private contractors, working under direction of NDOW, will use foothold traps, snares, fixed-wing aircraft and helicopters for

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	aerial gunning, calling and gunning from the ground to remove coyotes in sensitive areas during certain times of the year. Work will be implemented when indices levels are reached, these include low annual adult survival rates, poor fall young:female ratios, poor spring young:female ratios, and low adult female annual survival rates (table 3). Depending on the indices identified, standard to intermediate levels of monitoring will be implemented to determine the need for or effect of predator removal. These additional monitoring efforts may be conducted by NDOW employees, USDA Wildlife Services, or private contractors.
Anticipated Results	1. Removal of coyotes in winter range and fawning and lambing areas in certain situations will provide a valuable tool for managers. 2. Implementation will occur during times and locations where sensitive game species are adversely affected (e.g., local decline, reduced recruitment) based on the best available biological information.
Project Direction	Fund Project 38.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$125,000	N/A	$125,000

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Project 40: Coyote Removal to Complement Multi-faceted Management in Eureka County

Justification	Continuing predator removal will complement previous coyote removal, feral horse removal, and habitat restoration to benefit mule deer populations.
Project Manager	Clint Garrett, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard
Potentially Affected Species	Coyote, Greater Sage-grouse, mule deer
Span More Than One Fiscal Year	Yes
Project Area	Unit 144
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for mule deer and other big game, their populations can be lowed or suppressed by abiotic factors such as dry climate and loss of quality habitat, these populations can be continued to be suppressed by predation from coyotes (Ballard et al. 2001).
Response Variable	The response variable will be the fawn to doe ratios in the Diamond Mountains. This ratio will be observed throughout the life of the project.
Project Goal	To increase mule deer and Greater Sage-grouse populations by removing coyotes.
Habitat Conditions	Persistent drought combined with fires and human disturbances throughout Nevada have reduced herbaceous cover, fawning, and browsing habitat. These effects may have reduced mule deer below carrying capacity. These effects may also be suppressing mule deer below carrying capacity (Ballard et al. 2001).
Comments from FY 2016 Predator Report	None
Information from Eureka County	Pinyon juniper removal occurred in 2013, 2014, and 2015 with more to be completed in 2016 within the Diamond Mountains.
Methods	USDA Wildlife Services and private contractors working under direction of NDOW and Eureka County, will use foothold traps, snares, fixed-wing aircraft and helicopters for aerial gunning, and calling and gunning from the ground to

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	remove coyotes in sensitive areas during certain times of the year.
Anticipated Result	Coyote removal will complement feral horse removal already conducted by the BLM, habitat improvement conducted by Eureka County, private coyote removal funded by Eureka County, and Wildlife Service coyote removal funded through Wildlife Heritage funds in 2011 and 2012.
Project Direction	Fund Project 40. Evaluate efficacy of Project 40 annually.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$100,000	N/A	$100,000

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Project 41: Increasing Understanding of Common Raven Densities and Space Use in Nevada

Justification	Common ravens are the primary predator of Greater Sage-grouse nests and chicks (Coates and Delehanty 2010). Their populations have increased dramatically in Nevada, primarily due to human subsidies (Boarman 1993, Sauer et al. 2011). Understanding common raven density, distribution, and subsidy use will allow for intelligent management decisions to be made to reduce or alter common raven densities in Nevada. These efforts are intended to benefit Greater Sage-grouse, though desert tortoise may also benefit from this project.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Experimentation
Monitoring Level	Rigorous
Potentially Affected Species	Greater Sage-grouse, common raven, desert tortoise
Span More Than One Fiscal Year	Yes
Project Area	Statewide
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for Greater Sage-grouse, their populations can be suppressed by abiotic factors such as dry climate and loss of quality habitat. Increases in predator numbers can also cause decreases in Greater Sage-grouse populations; common raven abundance has increased throughout their native ranges, with increases as much as 1,500% in some areas (Boarman 1993, Coates et al. 2007, Sauer et al. 2011). Under these circumstances, common raven predation can have a negative influence of Greater Sage-grouse nesting success, recruitment, and population trend (Coates and Delehanty 2010). Common raven predation has also been documented to negatively impact desert tortoise populations (Boarman 1993, Kristan and Boarman 2003)
Response Variable	No response variable will be collected, this is an experimentation project.
Project Goals	1. Increase understanding of common raven density, distribution, and subsidy use to maximize common raven management effectiveness. 2. Develop a protocol to estimate common raven populations in Greater Sage-grouse habitat, and monitor these populations. 3. Increase the understanding of how human subsidies affect common raven movements and space use, particularly near Greater Sage-grouse leks and nesting areas. 4. Develop a resource selection function model to identify landscape features that influence common raven abundance and that may be used in conjunction with Greater Sage-grouse priority habitat maps to locate sites where lethal treatments of

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	common ravens may be applied with the greatest efficacy and efficiency.
Habitat Conditions	Persistent drought throughout Nevada has reduced herbaceous cover, along with nesting and brood rearing habitat; these impacts are exacerbated through wildfire and the invasion of cheatgrass. Transmission lines, substations, and nearby agriculture production also threaten Greater Sage-grouse habitat.
Comments from FY 2016 Predator Report	None
Methods	*Population monitoring and space use* Point counts for common ravens will be conducted from March through July of each year, which corresponds with Greater Sage-grouse nesting and brood-rearing season. Surveys will be similar to Ralph et al. (1995): lasting 10 minutes; conducted between sunrise and 1400; conducted under favorable weather conditions; and stratified randomly across study areas (Luginbuhl et al. 2001, Coates et al. 2014). ARGOS backpack transmitters will be deployed to monitor common raven space use and space use. *Development of Resource Selection Function (RSF)* An RSF will be developed using data on landscape features collected in habitats with varying observed abundance indices for common ravens. The abundance indices collected will include common raven point count and Greater Sage-grouse point counts. The landscape features that will be entered into the model will include 1 meter resolution digital elevation models and fire regime. The RSF for common ravens will be overlaid on polygons that feature Greater Sage-grouse priority habitats. Identifying habitats likely to support high numbers of common ravens where Greater Sage-grouse conservation is of highest priority will provide future locations where common raven removal may be warranted, land use activities may be modified, or more intensive Greater Sage-grouse monitoring may be focused. *Utility line surveys* Various utility lines will be identified in and near Greater Sage-grouse habitat from February until June of each year, which corresponds with common raven nesting and brood rearing. Surveys will be conducted from OHV vehicles, variables including utility pole type, cross arm type, utility pole height, insulator position, perch deterrent effectiveness, and proximity to Greater Sage-grouse habitat will be recorded.
Anticipated Results	1. Develop a protocol to estimate common raven populations in Greater Sage-grouse habitat, and monitor these populations.

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	2. Increase the understanding of common raven density and distribution in the state of Nevada, and how human subsidies increase common raven density and distribution. 3. Determine what common raven removal location will provide the greatest benefit to Greater Sage-grouse. Determine what time of the year is the optimal time to conduct common raven removal to optimize benefit to Greater Sage-grouse.
Project Direction	Fund Project 41. Evaluate efficacy of Project 41 annually.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$100,000	$300,000	$400,000

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Project 42: Assessing Mountain Lion Harvest in Nevada

Justification	Nevada Department of Wildlife has a yearlong mountain lion hunting season limited by harvest quotas, although mountain lion are also lethally removal for livestock depredation and to limit predation on specific wildlife populations. Statewide annual adult female harvest is ≤35%, which indicates that statewide harvests are unlikely to be reducing statewide mountain lion population abundance (Anderson and Lindzey 2005). Nevertheless, regional area harvests may be greater and can be more difficult to assess the effects due to small sample sizes. Conversely, current NDOW mountain lion removal projects may not be sufficiently intensive to reduce local mountain lion populations to attain reduced predation on prey populations. Improved understanding of mountain lion population dynamics in Nevada would allow for better informed management.
Project Manager	Pat Jackson, Nevada Department of Wildlife
Project Type	Experimentation
Monitoring Level	Rigorous
Potentially Affected Species	Mountain lion, mule deer, bighorn sheep, elk
Span More Than One Fiscal Year	Yes
Project Area	Statewide
Limiting Factor Statement	Habitat and prey availability likely limit mountain lion populations in the state of Nevada.
Response Variable	No response variable will be collected, this is an experimentation project.
Project Goals	1. Develop a population model that incorporates NDOW mountain lion harvest data to predict the number of mountain lions that must be removed to reach desired goals in mountain lion removal projects. 2. Identify limitations and gaps in the existing demographic data for mountain lions that precludes a more complete understanding of mountain lion population dynamics and limits NDOW's management ability with the greatest efficacy and efficiency.
Habitat Conditions	This work would not be conducted in the field, but would rely on statewide harvest data collected over time to include periods of normal and less-than-normal precipitation. Due to the span of the state data collection, habitat during the period of inference would also span a wide variety of conditions and vegetative communities.

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Comments from FY 2016 Predator Report	None
Methods	A private contractor will use existing mountain lion harvest data collected by NDOW biologists to develop a harvest model. The modeling approach will involve Integrated Population Modeling (IPM) which brings together different sources of data to model wildlife population dynamics (Abadi et al. 2010, Fieberg et al. 2010). With IPM, generally a joint analysis is conducted in which population abundance is estimated from survey or other count data, and demographic parameters are estimated from data from marked individuals (Chandler and Clark 2014). Age-at-harvest data can be used in combination with other data, such as telemetry, mark-recapture, food availability, and home range size to allow for improved modeling of abundance and population dynamics relative to using harvest data alone (Fieberg et al. 2010). Depending on available data, the contractor will build a count-based or structured demographic model (Morris and Doak 2002) for mountain lions in Nevada. The model (s) will provide estimates of population growth, age and sex structure, and population abundance relative to different levels of harvest.
Anticipated Results	1. Estimate statewide population dynamics, age structure, and sex structure of mountain lions in the state of Nevada with existing NDOW data. 2. Recommend additional data that could be collected to improve the model and reduce uncertainty in model results in the future.
Project Direction	Fund Project 42 through FY 2019.

$3 Predator Fee	**Pittman-Robertson**	**Total**
$2,500	$7,500	$10,000

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Project 43: Mesopredator removal to protect waterfowl, turkeys, and pheasants on Wildlife Management Areas

Justification	Mesopredators including coyotes, striped skunks, and raccoons often consume waterfowl, pheasant, and turkey eggs. Consuming these eggs may limit fowl species population growth, and could be causing a declines on Overton and Mason Valley Wildlife Management Areas.
Project Manager	Isaac Metcalf and Bennie Vann, Nevada Department of Wildlife
Project Type	Implementation
Monitoring Level	Standard
Potentially Affected Species	Assorted waterfowl, turkey, pheasant, coyote, striped skunk, raccoon
Span More Than One Fiscal Year	Yes
Project Area	Overton and Mason Valley Wildlife Management Areas
Limiting Factor Statement	Though predation is a naturally occurring phenomenon for waterfowl, turkeys, and pheasants, their populations can be lowed or suppressed by abiotic factors such as dry climate and loss of quality habitat.
Response Variable	The response variable for waterfowl, turkeys, and pheasants will be the number of females with clutches, and the number of young per clutch.
Project Goals	To increase clutch size and survival of waterfowl, turkeys, and pheasants on Overton and Mason Valley WMAs.
Habitat Conditions	Persistent drought throughout Nevada has reduced herbaceous cover, nesting, and browsing habitat.
Comments from FY 2016 Predator Report	None
Methods	USDA Wildlife Services and private contractors working under direction of NDOW, will use foothold traps, snares, calling and gunning from the ground to remove coyotes, striped skunks, and raccoons during waterfowl, turkey, and pheasant nesting seasons.
Anticipated Results	1. Increase the number of female turkeys, waterfowl, and pheasants that successful raise clutches. 2. Increase the number female turkeys, waterfowl, and pheasants that have

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	clutches
Project Direction	Fund Project 43 through FY 2019.

Budget

$3 Predator Fee	**Pittman-Robertson**	**Total**
$50,000	N/A	$50,000

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Overall FY 2018 Budget

Project	Predator Fee	PR Funds	Total
Department of Agriculture Administrative Support Transfer[a]	$14,000	N/A	$14,000
Project 21: Greater Sage-Grouse Protection (Common Raven Removal)	$100,000	N/A	$100,000
Project 21-02: Common Raven Removal to Enhance Greater Sage-Grouse Nest	$25,000	N/A	$25,000
Project 22-01: Mountain Lion Monitoring and Removal to Protect California Bighorn Sheep	$90,000	N/A	$90,000
Project 22-074: Mountain Lion Removal for the Protection of Rocky Mountain Bighorn Sheep	$90,000	N/A	$90,000
Project 32: Mountain Lion, Black Bear, and Mule Deer Interactions	$40,000	$120,000	$160,000
Project 37: Big Game Protection-Mountain Lions	$125,000	N/A	$125,000
Project 38: Big Game Protection-Coyotes	$125,000	N/A	$125,000
Project 40: Coyote Removal to Complement Multi-faceted Management in Eureka County	$100,000	N/A	$100,000
Project 41: Increasing Understanding of Common Raven Densities and Space Use in Nevada	$100,000	$300,000	$400,000
Project 42: Assessing Mountain Lion Harvest in Nevada	$2,500	$7,500	$10,000
Project 43: Mesopredator Removal to Protect Waterfowl, Turkeys, and Pheasants on Wildlife Management Areas	$50,000	N/A	$50,000
Total[b]	**$861,500**	**$427,500**	**$1,289,000**

[a] This transfer of $3 predator fees for administrative support to the Department of Agriculture partially funds state personnel that conduct work for the benefit of wildlife at the direction of USDA Wildlife Services (e.g., mountain lion removal to benefit wildlife).
[b] The projects that contain lethal removal as a primary aspect, making them ineligible for Federal Aid funding.

Expected Revenues and Beginning Balance of Predator Fee

	FY 2015 Actual	FY 2016 Actual	FY 2017 Estimated	FY 2018 Projected
Beginning balance	$380,038	$544,631	$591,382	$326,194
Revenues	$574,312	$595,107	$574,312	*******
Plan Budget	$338,000	$556,000	$839,500	$839,500
Expenditures	$409,719	$548,356	--	--
Ending balance	$544,631	$591,382	$326,194	*******

*******Figures will be available after February 1, 2017.

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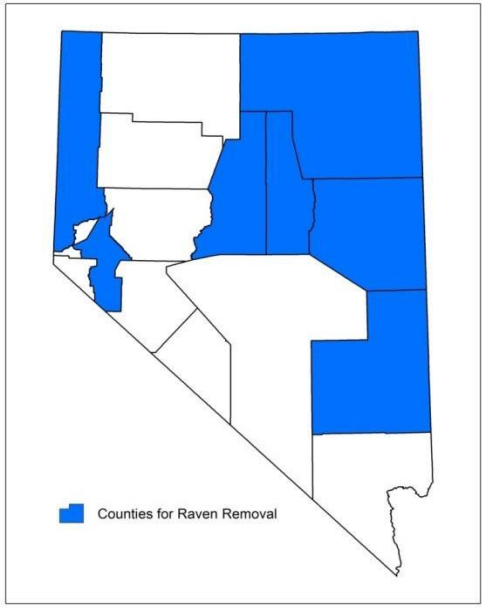
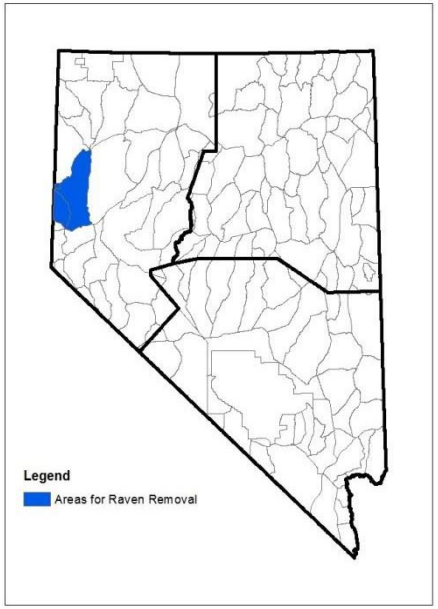
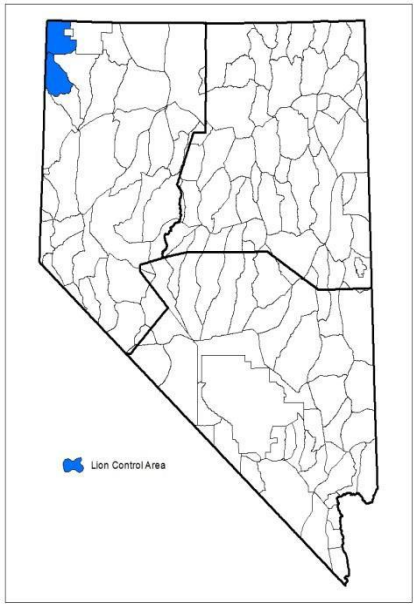


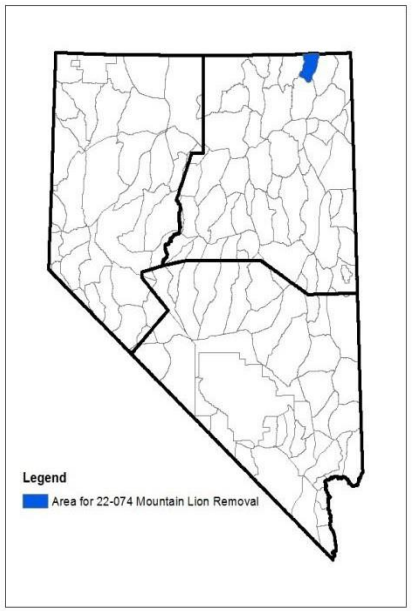
Project 21 Map



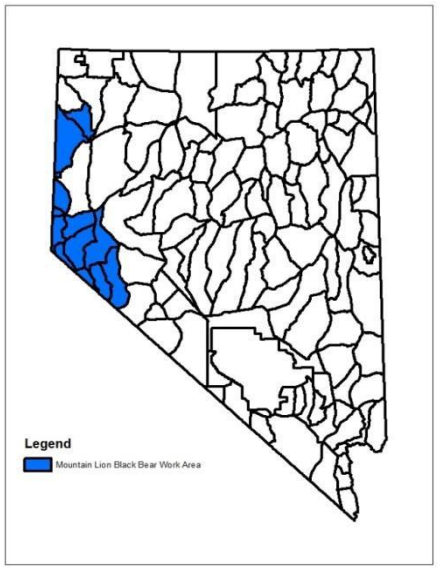
Project 21-02 Map



Project 22-01 Map

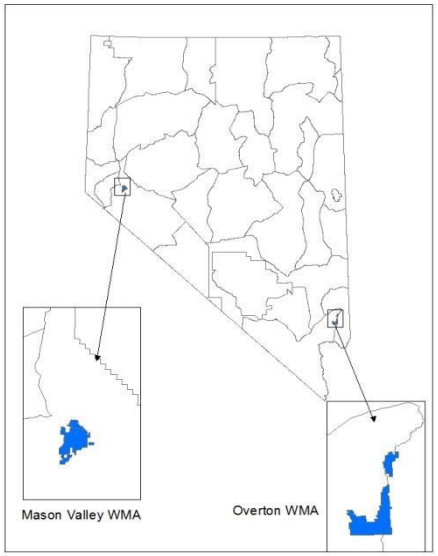


Project 22-074 Map



Project 32 Map

Project 40 Map



Project 43 Map

Attachment B

BRIAN SANDOVAL
Governor

STATE OF NEVADA

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Director

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March 23, 2017

PARC Comments on NDOWs FY2018 Predator Management Plan

PARC recommends:

1. Overall NDOW needs to develop specific goals (i.e. brood size / fawn to doe ratio) for the predator management plans. PARC would also like to see accounting from NDOW to verify where the predator funds are being spent.
2. Because of the nature of predator management and how employees, equipment, and aircraft need to be planned for, PARC recommends NDOW complete the 80% lethal removal budget as close to July 1st as possible. That gives WS and contractors the time necessary to plan to do this correctly. Specifics of who, when, where and how much should be included.
3. PARC recommends NDOW provide more specific information on the budget including past balances, carry over amounts, and specific fiscal information regarding expenditures for project staff.
4. PARC recommends the budget should include more information. In past predator management plans the budget included past balances, carry over amounts, and new money. Also included was how much was spent by NDOW, WS, and contractors.
5. PARC recommends NDOW should develop specific goals and objectives for projects. The goal could be to increase fawn/doe ratios for mule deer or antelope. Or the goal could be an increase in population level. For sage-grouse (since nest success data is very difficult to get) we could have a goal of reducing raven densities around sage-grouse leks during the nesting season. Since translocating bighorn sheep is very expensive and some populations are very low the goal for bighorn sheep projects could be zero depredations.
6. PARC recommends NDOW include more information on the resource being protected whether that be mule deer, antelope, bighorn sheep, sage-grouse or any other natural resource. **NDOW should convey to the public why these resources are important and valuable and why we are protecting them from excessive predation.**

PARC comments on specific projects:

1. Project 22-01 should have “Coyote” added – to become Mountain Lion and Coyote removal project.

2. Project 22-74 be defunded completely and suspended.

3. Project 37 should support the aspect of using funds instead of losing it to roll over.

4. Project 37 and 38 should have increased funding by equally distributing the funds originally in 22-047 (recommended for defunding). $50,000 from 22-047 be split equally to Project 37 and 38.

5. Project 40 be left at the original $100,000.

Attachment C

Nevada Department of Wildlife

Predation Management Status Report

FY2016

October 26, 2016

State of Nevada

Brian Sandoval, Governor

Department of Wildlife

Tony Wasley, Director

Game Division

Brian F. Wakeling, Chief

Board of Wildlife Commissioners

Grant Wallace, Chairman	Dyer
Brad Johnston, Vice Chairman	Yerington
Jon Almberg	Ely
Tom Barnes	Jiggs
Jeremy Drew	Minden
Kerstan Hubbs	Las Vegas
David McNinch	Reno
Paul Valentine	Las Vegas
Bill Young	Las Vegas

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EXECUTIVE SUMMARY

The goal of the Nevada Department of Wildlife's (NDOW's) Predator Management Program is to conduct projects consistent with the terrestrial portion of 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." Provisions outlined in NRS 502.253 authorize the collection of a $3 fee for each big game tag application, deposition of the revenue from such a fee collection into the Wildlife Fund Account, and use by NDOW to 1) develop and implement an annual program for the management and control of predatory wildlife, 2) conduct wildlife management activities relating to the protection of nonpredatory game animals and sensitive wildlife species, and 3) conduct research necessary to determine successful techniques for managing and controlling predatory wildlife. This statute also allows for: the expenditure of 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 predator management activities under the guidance of the Nevada Board of Wildlife Commissioners; and provide that unspent monies remain in the Wildlife Fund Account and do not revert to State General Funds at the end of any fiscal year.

NDOW maintains a philosophy that predator management is a tool to be applied deliberately and strategically. Predator management may include lethal removal of predators or corvids, non-lethal management of predator or corvid populations, habitat management to promote more robust prey populations which are better able to sustain predation, monitoring and modeling select predator populations, managing for healthy predator populations, and public education, although not all of these aspects are currently eligible for funding through predator fee dollars. NDOW intends to use predator management on a case-by-case basis, with clear goals, and based on an objective scientific analysis of available data. To be effective, predator management should be applied with proper intensity and at a focused scale. Equally important, when possible projects should be monitored to determine whether desired results are achieved. This approach is supported by the scientific literature on predation management. NDOW is committed to using all available tools and the most up-to-date science, including strategic use of predator management, to preserve our wildlife heritage for the long term.

In FY2016, 11 projects were included in the planned activities, with each project having committed funding. Included in NDOW's ongoing work is greater sage-grouse protection (Project 21 and subproject 21-02), mule deer fawn and bighorn sheep protection and recommendations for continuing redesigned work for FY2016 (Project 22-01, 22-074, 37, 38, and 40).

This report includes a report written by Wildlife Conservation Society on mountain lion, mule deer, and black bear is included (Project 32). A report on red fox genetics by written UC Davis is included (Project 35).

The planned budget for FY2016 was $556,000 from the Predation Management Fee Program. The expenditures were $675,525 with $169,400 of expenditures coming from Federal Aid in Wildlife Restoration funds.

Contributors to this status report include, Chris Hampson, Kari Huebner, Matt Jeffress, Mike Podborny, Katie Anderle, Pete Coates, Cody McKee, Shawn Espinosa, Pat Jackson, Jon Beckmann, Benjamin Sacks, and Brian Wakeling.

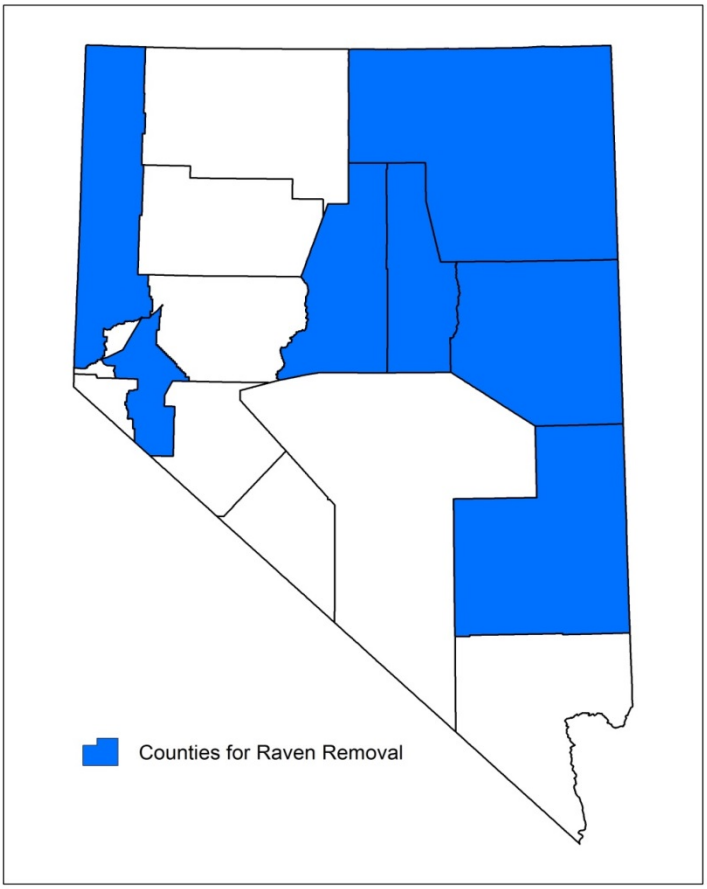
Project 21 Greater Sage-grouse Projection (Statewide)

Raven control efforts to conserve greater sage-grouse commenced in early March and extended throughout May 2016. The objective of this project is to increase greater sage-grouse nest success and recruitment. USDA Wildlife Services (USDA WS) performed raven control work through the placement of corvicide (DCR-1339) injected chicken eggs within occupied greater 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. landfills and transfer stations). Another treatment area, the Virginia Mountains in western Nevada, is being used as an experimental area and details of that project are reported below (subproject 21-02).

Through the efforts of USDA WS personnel, an estimated 2,319 ravens were removed during spring 2016. The total number of ravens taken for project 21 and the Virginia Mountains (subproject 21-02) was 2,500, which is the maximum that NDOW can remove under the current USFWS depredation permit (#MB37116A-0). Ravens were removed in 11 game management areas during the spring of 2016.

Raven take by Management Area (MA) FY2016.

Area	Ravens Removed
MA 3	456
MA 6	69
MA 7	367
MA 8	45
MA 10	87
MA 11	275
MA 14	32
MA 15	165
MA 20	42
MA 22	194
MA 23	587
Total Ravens	2,319

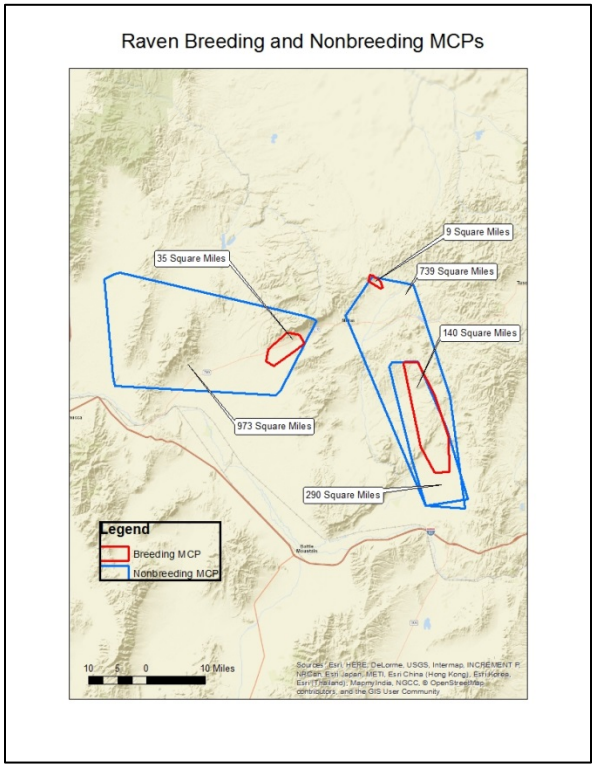


Raven Transmitters

In an effort to increase understanding of common ravens throughout the state of Nevada, test two comparable raven transmitters, and meet part of the non-lethal requirements in the USFWS depredation permit (#MB37116A-0), 5 ARGOS transmitters and 2 GSM transmitters were purchased to be deployed on common ravens.

In November 2015, NDOW field technicians captured six common ravens in and near Midas, NV. One bird was captured on November 18, 2015, approximately 15 miles SW of Midas. Three birds were captured at the Hollister Mine on November 20, 2015, with a fourth bird caught there on November 21, 2015. The last bird was captured at the Midas BLM Fire Station on November 23, 2015. Two of the birds captured at the Hollister Mine were outfitted with Northstar GSM transmitters while the remaining four birds were outfitted with ARGOS transmitters. One ARGOs transmitter did not stay on the bird and failed to provide any informative data on its movements. Based upon the data received from the remaining five devices, four of the birds were resident adults that stayed within the general area where they were captured, while the fifth bird didn't show any evidence of territorial fidelity. Two birds captured on November 20, 2015 appeared to be a mated pair that bred near the Hollister Mine. The male was fitted with an ARGOS device while the female was fitted with a GSM.

The failure rate of the GSM transmitters was 100%. Both devices stopped transmitting according to their predefined data collection schedule after November 30, 2015, while transmitting intermittently until June and August, respectively. This poor performance may have been due to the transmitters not receiving sufficient sunlight to charge their batteries, but the ARGOS devices, which were similar-sized and attached in the same manner worked as expected. The Northstar GSM devices may not be suitable for placing on common ravens.



Minimum convex polygons for territorial ravens.

Raven Enclosure

In an effort to remove a subsidy from common ravens and meet part of the non-lethal requirements in the USFWS depredation permit (#MB37116A-0), an exclosure around the Midas transfer station was completed during FY2016.

Unfinished exclosure at Midas transfer station.

Finished exclosure at Midas transfer station.

$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
$78,000	N/A	$51,815	$0	$44,304	$10,091	**$106,211**

Subproject 21-02 Virginia Mountains Sage-grouse Nests

Work was initiated during March and extended throughout May 2016 to determine the efficacy of raven control on the resident greater sage-grouse population within the Virginia Mountains located in southern Washoe County. Over a 2.5 month period, USDA WS deployed corvicide treated eggs within previously identified greater sage-grouse nesting habitats located around Sheep Springs, Spanish Flat, and lower Cottonwood Creek. An estimated 181 ravens were removed during the spring months.

Greater sage-grouse monitoring work is being conducted by the USGS Western Ecological Research Center. Seven 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 March through July 2016.

Telemetry Monitoring

USGS field crews trapped and deployed 13 VHF radio transmitters on female greater sage-grouse during spring 2016 near Spanish Flat and Sheep Springs. Field crews obtained 236 telemetry locations from 37 VHF marked greater sage-grouse during March–July 2016. Relocations extended from the California border near State Line Peak in the Fort Sage Mountains in the west, to Tule Ridge in the east, and as far south as the Dogskin Mountains.

Reproduction

USGS field crews located 15 nests, of which 4 failed and 11 were successful. Eight nests were within approximately seven km of Spanish Flat, four were within five km of Sheep Springs lek, and the remaining three were near West Cottonwood lek. The first nest was observed on 16 April, and the final successful nest hatched on 9 June. Of the 4 failed nests, two were abandoned and two were depredated. Of the two nests classified as depredations, one nest appeared to be depredated by ravens and the second was likely depredated by coyotes.

Nest Videography

USGS research crews set up video monitoring equipment on seven nests to record predation and nesting recess activity. Of these, six nests hatched, and one was abandoned. The female that abandoned was observed leaving the nest several times, in addition to normal recess activity, for extended periods until she eventually did not return to the nest over a week later.

Brood Monitoring

For each successful nest, USGS field crews collected a series of locations to track movement and space use of the female and her brood. Crews obtained a daytime location every 10 days and continued to track broods for 50 days post-hatch. In addition to our 11 successful nests we found one brood-rearing female who was not found on nest, bringing the total to 12 monitored broods, of which nine failed, two were successful, and one was of unknown status. Brood fates are as follows: three females lost their brood in the first 10 days; two females lost their broods between 10 and 20 days; one female was killed and lost her brood between 10 and 20 days; one female lost her brood between 10 and 40 days; two females were killed and their broods failed between 20 and 30 days; two females have successfully reared their broods to the 50 days post-hatch; and

we have not been able to monitor the remaining female and her brood as we have lost her signal and therefore cannot determine brood fate.

Habitat

USGS field crews completed 79 microhabitat surveys (45 at nest sites and 34 and brood locations). Each microhabitat survey is conducted at nest sites immediately following nest fate to better understand greater sage-grouse-habitat relationships. Crews collected data at three points for every nest, including two random points: one at a dependent random location based on nest location and one at an independent random location (generated randomly throughout the study area). 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 three locations for each brood on a 10-day rotation. Each cycle of locations consists of one day location and one 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 319 raptor, raven, and livestock (RRHL) surveys. These surveys help identify avian predator composition and the relationship between predators and greater sage-grouse population dynamics. Surveys are completed after each lek count, and at telemetry locations, nest sites, brood locations, and random points.

Mortalities

USGS crews recovered the remains of 13 marked birds since the beginning of field operations in March. A GPS data logger was among the mortalities; data recovered on this unit will assist in a graduate student's thesis. Perhaps the most notable of the mortalities are the three females who were killed during the brood-rearing period. The fatalities are as follows: one female was found in a Golden Eagle nest; the second appeared to be due to a raptor, as all feathers were plucked; the third possessed chew marks on some of the feathers as well as her collar, indicating a mammalian predator.

USGS Raven Modeling Report

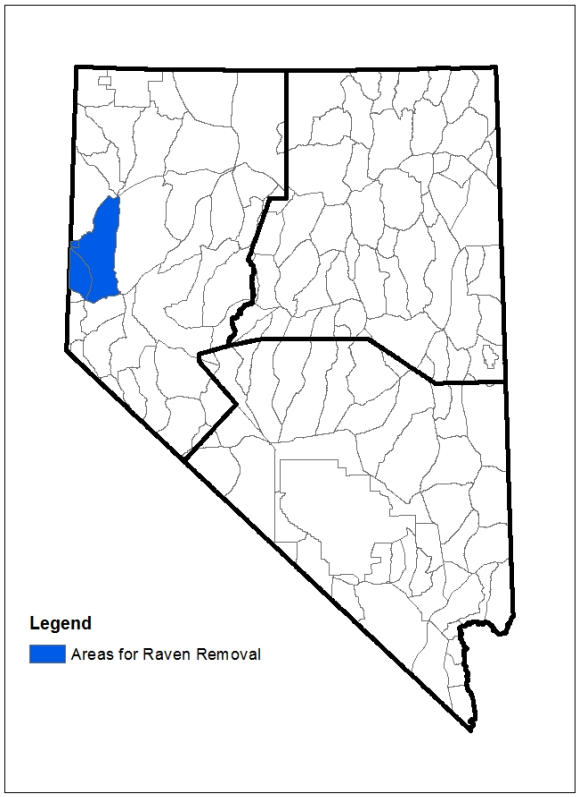
The USGS has provided a summary report (see appendix) for raven modeling conducted in the Virginia Mountains. The USGS states:

"This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government may be held liable for any damages resulting from the authorized or unauthorized use of the information."

$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
$50,000	N/A	$20,895	$0	$24,211	$10,091	**$55,197**

State Funds*	PR Funds*
$17,491	$52,472

*These funds were not from $3 predator fee.



Project 22 Mule Deer-Game Enhancement

In 2009, Project 22 was initiated statewide to provide flexibility and opportunity to respond quickly to conditions on the ground that biologists believe could be adversely affecting population trajectory of specific mule deer herds and other big game populations.

NDOW funds USDA WS and private contractors to remove predators given the constraints of weather, time, and available funding using aerial gunning, hounds, calling, call boxes, shooting, foot-hold traps, and snares to accomplish the treatment. Selective and timely management work focused on critical seasonal big game ranges. The timing of management work will be in accordance with individual project criteria, but occur primarily on critical winter ranges and summer fawning areas or in release-augmentation areas.

$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
Project 22	$0	N/A	$8,264	$0	$0	$10,091

Subproject 22-01 Mountain Lion Removal to Protect California Bighorn Sheep

Attempts have been made to establish a California bighorn sheep population in Area 01. Significant levels of mountain lion-induced mortality have been observed. California bighorn sheep populations may require a reduction in mountain lion densities to reach population viability.

Between July 1, 2015 and June 30, 2016, 11 mountain lions were removed by USDA WS. Six mountain lions were removed in Unit 011, the other five were removed in Unit 013.

California Bighorn Herd Health (Biologist III Chris Hampson)
Unit 011 – Massacre Rim and Coleman Rim Herds
One of the two remaining collared ewes from the bighorn releases on the Massacre Rim died during the winter of 2015-2016. The ewe was part of a small group (5 to 6 animals) of sheep that had moved west across the flat to the Southwestern corner of the Vya Rim during December of 2014. The sheep were believed to have been pushed to the west due to excessive lion pressure on the Massacre Rim. The sheep moved west to the SE corner of the Vya Rim during the same period of time when 5 collared bighorn were killed by lions.

The collared ewe is thought to have died during the harsh winter of 2015-2016 that produced up to 5 feet of snow along the Vya Rim. The small group of sheep had lived in this area since December 2014. Biologists were forced to use snowshoes to access the mid-elevation rocky escarpment where the bighorn ewe died. The telemetry collar was removed from the carcass and several samples (lung, liver, and head) were also taken for lab analysis and examination by the NDOW Veterinarian. It appeared that the ewe died of exposure due to the heavy snowfall and cold temperatures. The ewe carcass was found in an exposed area just outside and a few feet away from a large juniper tree. The other sheep in the immediate area appeared to be healthy and bolted quickly away from biologists when approached.

The remaining collared ewe from the Massacre Rim remains alive on the southern end of the Massacre Rim near Big Point. This group of sheep has consistently remained on the southern end of the Rim, but on occasion (once every couple of months) the sheep have moved as much as 6 miles to the north along the top of the Massacre Rim. However, the bulk of the telemetry data shows that the sheep spend a majority of their time near the release site at Big Point on the southern portion of the Rim.

A recent observation from late July 2016, observed 20 bighorn near the big game guzzler on the south end of the Coleman Rim. All sheep looked healthy and appeared to be in good condition. One ewe had a colored ear tag from a recent release in the area.

Unit 013 – Hays Canyon Range
One of the five collared sheep from the Hays Canyon bighorn population died during the winter of 2015-2016. Biologists investigated the kill site with Wildlife Services personnel and determined that the young ram was chased down and killed by what appeared to be a pack of 3 to 4 coyotes. The ram was killed at the release site in Hays Canyon. The area of the kill site had 2 to 3 inches of snow which helped biologists understand what occurred and how the animal was

killed. Skeletal remains were all that was left of the scavenged carcass even though biologists were on the scene within one to two days following the kill. Biologists brought the head of the ram to the NDOW veterinarian for sampling and examination.

Numerous reports and sightings of bighorn within Hays Canyon have been reported and observed by NDOW biologists and BLM personnel over the past year. All indications are that the small herd is healthy and doing well. Field investigations located an old lamb carcass to the north of Hays Canyon but no cause of death could be determined due to the length of time since the lamb had died. One old lion track was observed in the canyon but was believed to be more recent than the lamb kill. Information was passed on to Wildlife Services personnel.

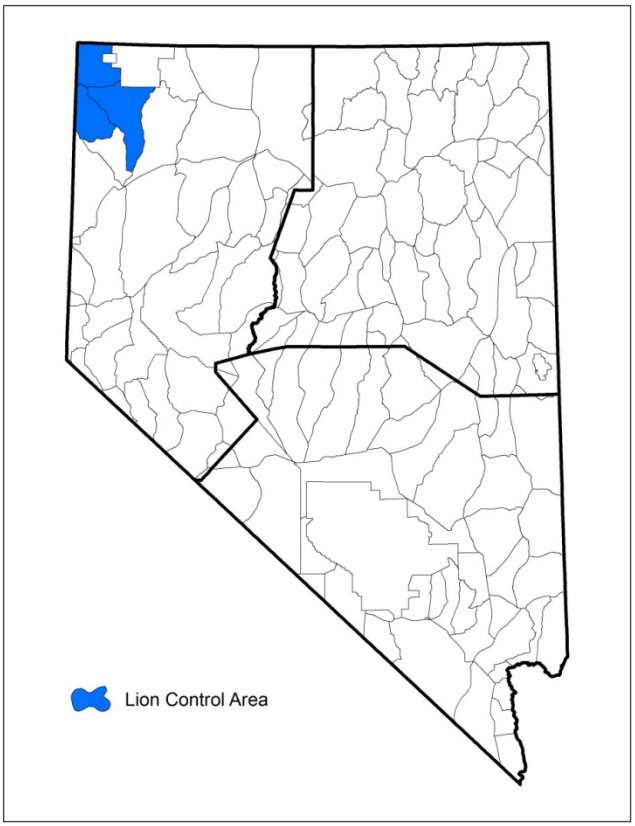
One 3 year-old collared bighorn ram was killed during the winter of 2015-2016. The ram was killed by a pack of coyotes on the north side of Hays Canyon. Tracks in the fresh snow provided good information to the biologist investigating the kill. The three other collared bighorn sheep are alive and well within the Hays Canyon Range. Telemetry data indicates that the Hays Canyon sheep have established themselves within the excellent sheep habitat between Hays Canyon and Little Hat Mountain.

In 2016-2017, Nevada Department of Wildlife biologists and staff are planning on increasing the number of bighorn that are collared within hunt Units 011 and 013. A capture is planned for the fall/winter of 2016-2017 to attach 10 more telemetry collars to bighorn that live within the 22-01 project area. This will enable biologists and staff to increase the amount of monitoring data collected for this project and will allow Wildlife Services to be better able to respond to any lion predation issues.

NDOW continues to monitor the sheep populations along the Massacre Rim and in Hays Canyon from both the air and the ground. The increased number of telemetry collars planned for this coming year will help NDOW to monitor the health and well-being of the sheep populations within project 22-01over the next few years.

NDOW continues to monitor the bighorn sheep populations along the Massacre Rim and in Hays Canyon. The most recent aerial survey located 34 bighorn sheep within the control areas of the Hays Canyon Range, Massacre Rim and Coleman Rim. Additional bighorn sheep have been observed from the ground. NDOW currently has 6 satellite telemetry collars functioning within the project area. Two are from the recent release on Massacre Rim and four are on bighorn sheep within the Hays Canyon Range. The telemetry collars help monitor the health and well-being of the bighorn sheep populations within subproject 22-01.

$3 Planned Expenditures	**P-R Planned Expenditures**	**Wildlife Services Expenditures**	**NDOW Lethal Expenditures**	**NDOW Non-Lethal Expenditures**	**NDOW Salary, Travel, and Office**	**Total**
$45,000	N/A	$54,094	$0	$0	$10,091	**$64,185**


Lion Control Area

Subproject 22-074 Mountain Lion Removal and Diet Analysis for the Protection of Rocky Mountain Bighorn Sheep

Area 074 Rocky Mountain bighorn sheep herd experienced a die-off in 1999. Two years following the die-off, the lamb recruitment was low, remaining consistent with typical bighorn sheep die-offs. Since then the average lamb recruitment has been 48 lambs:100 ewes. This level of recruitment should have resulted in an increasing bighorn sheep herd; however the expected population rebound has not occurred.

The Contact Area is a major deer winter range. It is possible that mountain lions following the deer herd from summer range in the Jarbidge Mountains to winter range switch their diet to bighorn sheep when deer return to their summer range. Some mountain lions may be staying in the area on a year-round basis with their primary food source being Rocky Mountain bighorn sheep.

A contract was formed with Currant Creek Outfitters to conduct mountain lion removal in 074. Work ranged from March 23, 2016 until May 24, 2016. No mountain lions were removed. Current Creek Outfitters submitted an "Annual Predator Management Project Reporting Form", it can be found in the appendix of this document.

USDA Wildlife Services was scheduled to also begin work removing mountain lions in 074. Upon learning of the presence of a private contractor, USDA WS informed NDOW that due to a directive they could not also work the area while a private contractor was present.

Diet Analysis

USDA Wildlife Services collected tissue, blood, fur, and whiskers from each mountain lion removed in the field during FY2015. Blood was spun in a centrifuge to separate out serum. Samples were frozen and transported to the Nevada Stable Isotopes Lab at the University of Nevada, Reno. All samples were processed and are presented below. A change to the scope of this project precluded the collection of prey samples. No inference can be made on mountain lion diet without concurrent analysis of prey.

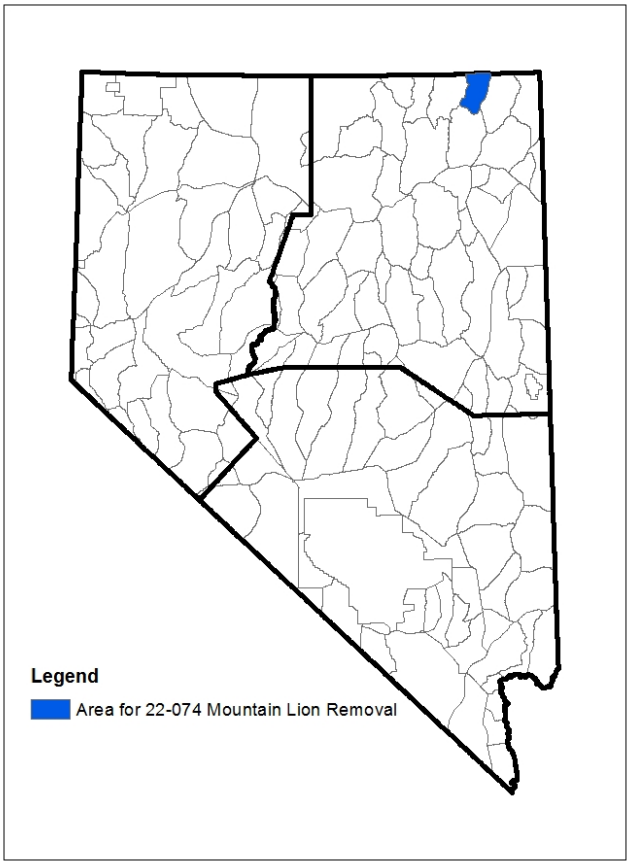
Table of carbon and nitrogen weights of mountain lion tissue, whisker, fur, blood, and serum samples.

Sample	**$d^{15}N$ (‰ vs. air)**	**wt.% N**	**$d^{13}C$ (‰ vs. VPDB)**	**wt.% C**
Lion1 fur	9.3	15.3	-21.9	45.6
Lion2 fur	9.3	15.4	-21.4	45.2
Lion3 fur	8.0	15.4	-21.9	45.5
Lion1 whisker	9.3	16.4	-21.6	47.4
Lion2 whisker	9.2	16.0	-21.4	47.0
Lion3 whisker	7.8	16.3	-21.6	47.9
Lion1 blood	8.4	15.3	-23.0	51.4
Lion2 blood	8.5	16.0	-22.7	52.5
Lion3 blood	8.3	15.4	-22.5	52.1
Lion1 muscle	9.6	15.1	-23.4	49.4
Lion2 muscle	8.7	15.4	-22.7	49.8
Lion3 muscle	8.7	15.1	-22.9	49.9
Lion1 serum	9.6	12.7	-22.8	47.4
Lion2 serum	9.2	12.7	-22.4	43.4
Lion3 serum	10.1	13.5	-22.4	49.0

Bighorn Sheep Herd Health (Biologist III Kari Huebner)

The population is estimated to be less than 15 animals. Herd surveys will be conducted in October 2016. One ram and four ewes are currently collared and still alive. In addition to the five collared bighorn there are four unmarked ewes and five unmarked rams. As of August 2016, there was only one observed lamb. Recruitment still remains an issue. A minimum of two lambs were born in the spring of 2016 but did not survive past weaning.

$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
$45,000	N/A	$4,240	$25,000	$575	$10,091	**$39,907**



Subproject 22-16 Coyote Den Density Effects on Mule Deer Fawns and Other Wildlife Species

Subproject 22-16 was an attempt to understand the complexity in managing wildlife species in a recovering sagebrush ecosystem in central Nevada. Because of coyote denning work conducted by a private wildlife removal specialist in Area 14, it was decided the Diamond Mountains were not the ideal location for an experiment. The area was changed to Area 16.

To determine the occupancy of coyote dens, coyotes, predators, and other wildlife species in the Monitor Mountains, 120 trail cameras were purchased. A grid was created in ArcMap, identifying 113 locations for camera placement within the Monitor Mountains. Technicians deployed trail cameras in January, and were able to deploy 37 until project 22-16 was terminated. All field work was immediately suspended to minimize cost.

$3 Planned Expenditures	**P-R Planned Expenditures**	**Wildlife Services Expenditures**	**NDOW Lethal Expenditures**	**NDOW Non-Lethal Expenditures**	**NDOW Salary, Travel, and Office**	**Total**
$40,000	$120,000	$0	$0	$68,844	$10,091	**$78,935**

Project 32 Mountain Lion, Black Bear and Mule Deer Interactions

Report by Dr. Jon Beckmann
Project Title: "Re-colonization of Large Carnivores and Resulting Species Interactions: Effects on Predation Behavior and Implications for Prey"

PIs: Dr. Jon Beckmann, Dr. Alyson Andreasen, Carl Lackey, Cody Schroeder, and Pat Jackson

Introduction

As with many areas in western North America, changes in species composition and predator-prey interactions occurred throughout the Great Basin upon arrival of settlers. In the Great Basin of Nevada, shifts in vegetation structure and composition occurred, with an expansion of browse at the expense of graze-land, largely thought to be due to grazing of vast numbers of livestock (Gruell and Swanson 2012). While these post-settlement disturbances had a drastic negative effect on bighorn sheep (*Ovis canadensis*) and pronghorn (*Antilocapra americana*) populations, mule deer (*Odocoileus hemionus*) responded favorably to the expanding browse and populations increased, presumably followed by increased numbers of mountain lions in the Great Basin (Berger and Wehausen 1991; Gruell and Swanson 2012; Woolstenhulme 2005). During the same time, black bears (*Ursus americanus)* and grizzly bears (*Ursus arctos*) were extirpated in the Great Basin of Nevada through targeted removals due to conflicts with humans, their livestock, and changes in land use patterns over the past century (Lackey et al. 2013). However, black bears have begun to re-colonize historic ranges in the Great Basin (Lackey et al. 2013). An on-going, long-term study on black bears in Nevada conducted by Jon Beckmann of WCS in partnership with Carl Lackey of NDOW demonstrated the success of black bear re-colonization in Great Basin ranges. Mountain lions (*Puma concolor*) have been the apex predator in the Great Basin for the past 80 or more years in the absence of bears and their primary prey, mule deer, now an important game species in Nevada, are in decline across the West (Robinson et al. 2002). Our data from an on-going, multi-year study on mountain lions in the western Great Basin and eastern Sierra Nevada range indicate that mountain lions and bears have frequent interactions at mountain lion kill sites where black bears take over and scavenge prey carcasses from mountain lions (Fig. 1). We anticipate that under certain conditions these competitive interactions between black bears and mountain lions may have non-negligible effects on mountain lion predation behavior potentially resulting in increased human-mountain lion conflicts and impacts on mule deer populations, while simultaneously facilitating recolonization of black bears into historic ranges.

The Great Basin of Nevada, where we recently documented the recolonization of black bears into historic ranges (Beckmann and Lackey 2008; Lackey et al. 2013), is comprised of over 80 percent public land, with multiple land uses including grazing allotments, hunting, trapping, and outdoor recreation, and thus provides an ideal study system to test predictions pertaining to carnivore re-colonization, conflict, and impact on prey populations in working landscapes.

This research is 1) identifying factors important in the restoration/natural re-colonization of black bears into historic ranges and important habitat for black bears and mountain lions across Nevada will be identified. In addition, this research 2) addresses problems of wildlife management and habitat to administer wildlife resources more efficiently, including understanding potential for

and predicting increased human-carnivore conflicts across the landscape thus being better able to mitigate for these potential conflicts associated with expanding black bear populations into historic Great Basin habitat. This research is allowing us to 3) obtain data that can be used by the Nevada Department of Wildlife to guide and direct regulation of hunting. For example, understanding how interactions between mountain lions and black bears affect population dynamics of each other or mule deer is important for sustainable use (i.e., sport harvest) for all three of these big game species in Nevada. For instance, scavenging by bears may affect reproductive output, survival, and recruitment of mountain lions and is important to understand since these populations will likely be different (i.e., lower) than models based on prey availability or harvest statistics alone would predict, particularly in fragmented habitat. Further, black bears that are re-colonizing historic ranges may substantially alter predator-prey dynamics (indirectly through competitive interactions with mountain lions), effectively acting as a second predator on mule deer populations; an important consideration because mule deer are in decline in several areas throughout Nevada and are an important big game species.

Progress Update

Captures and proximity collars

We have collared an additional five female mountain lions and one male lion with GPS PLUS Proximity collars; four lions in the Carson Range and two in the Pine Nut Range. Most additional mountain lion captures will occur during the coming winter. We also deployed GPS PLUS Proximity collars on 10 of 13 additional bears captured during June 2016. Of those 10 bears, their capture locations were split approximately evenly between the Carson Range and the Pine Nut Range. These 10 collared bears are in addition to six bears we collared in the second half of 2015. Of those six, three are in the Carson Range and three are in the Pine Nuts with all bears overlapping at least one of the collared lions' home range. During the past year, the GPS PLUS Proximity collars were successful in acquiring data on black bear-mountain lion interactions (see Fig. 2 as a 2016 example), linked successfully and functioned as planned when animals were within 200 meters generating these data important to addressing the questions in this project.

This project is providing a unique opportunity to combine the efforts of long-term studies being conducted on black bears and mountain lions in the western Great Basin of Nevada where black bears are naturally re-colonizing historic ranges.

Locating and analyzing kill sites by lions and interactions with bears

We are currently in the midst of the summer/fall field season where we are estimating mountain lion kill rates and prey selection across the study area by identifying GPS clusters made by collared mountain lions and investigating those clusters on the ground during months when bears are active. We are on pace to collect direct field data from >100 kill sites again in 2016, although the final number will be known at the end of the field season in Sept/Oct 2016. As a reference, during summer 2015 field crews from NDOW and WCS identified an additional 400 sites by mountain lions using GPS cluster analyses and collected direct field data from 156 kill sites. These data continue to be used to estimate kill rates, prey species and level of bear-lion interactions across varying levels of bear densities in the study area. These data are in addition to our already existing dataset consisting of kills made by 21 collared mountain lions in Nevada.

Creating Habitat Maps for bears using Resource Selection Function (RSF) Models
Using 20,000+ location data points from GPS collars that were attached to 7 male and 17 female black bears in backcountry regions of the Carson and Pinenut Mountain Ranges or at the urban-wildland interface, we modelled and mapped core habitat areas for both male and female black bears using Resource Selection Function (RSF) Models. Only adult animals were collared. GPS collars were set up to transmit location signals approximately every 4 hours and emit a mortality signal when an animal did not move for 48 hours.

We generated nine spatial data layers in a GIS (ESRI ArcMap 10.2.2) representing environmental features and the anthropogenic landscape in the study site. Although certain anthropogenic variables are often found in similar studies of wide-ranging large carnivores, such as distance to road and urban centers, we also used parameters that are specific to this landscape with biological support for their impact to large carnivore behavioral ecology, such as distance to recreation site, distance to trail, distance to railway, and human population density. We developed resource selection function (RSF) models for two levels of spatial analysis using coarse and fine scale landscape parameters (Fig. 3). The RSF analysis allowed us to estimate and map probability of habitat selection/use across the study site, allowing for predictions of habitat 'hotspots' for black bears as the population continues to expand and colonize new areas. Additionally, these models are scalable such that models/maps can be zoomed into specific areas of interest for assessing habitat selection probabilities. These models and resulting maps will also help in black bear management by NDOW now and in the future and our assessments of black bear and mountain lion interactions during this on-going project.

To-date this project is successfully moving forward in all aspects. This success is demonstrated by the number of successful collaring events of both bears and lions during the time period of this report and by the successful collection of data on mountain lion kill rates, prey selection, interaction rates with bears, etc. These data are critical to managing both bear and lion populations in the Great Basin and Sierra Nevada, especially given the changes in the bear population and distribution and the expanding human population in the region.

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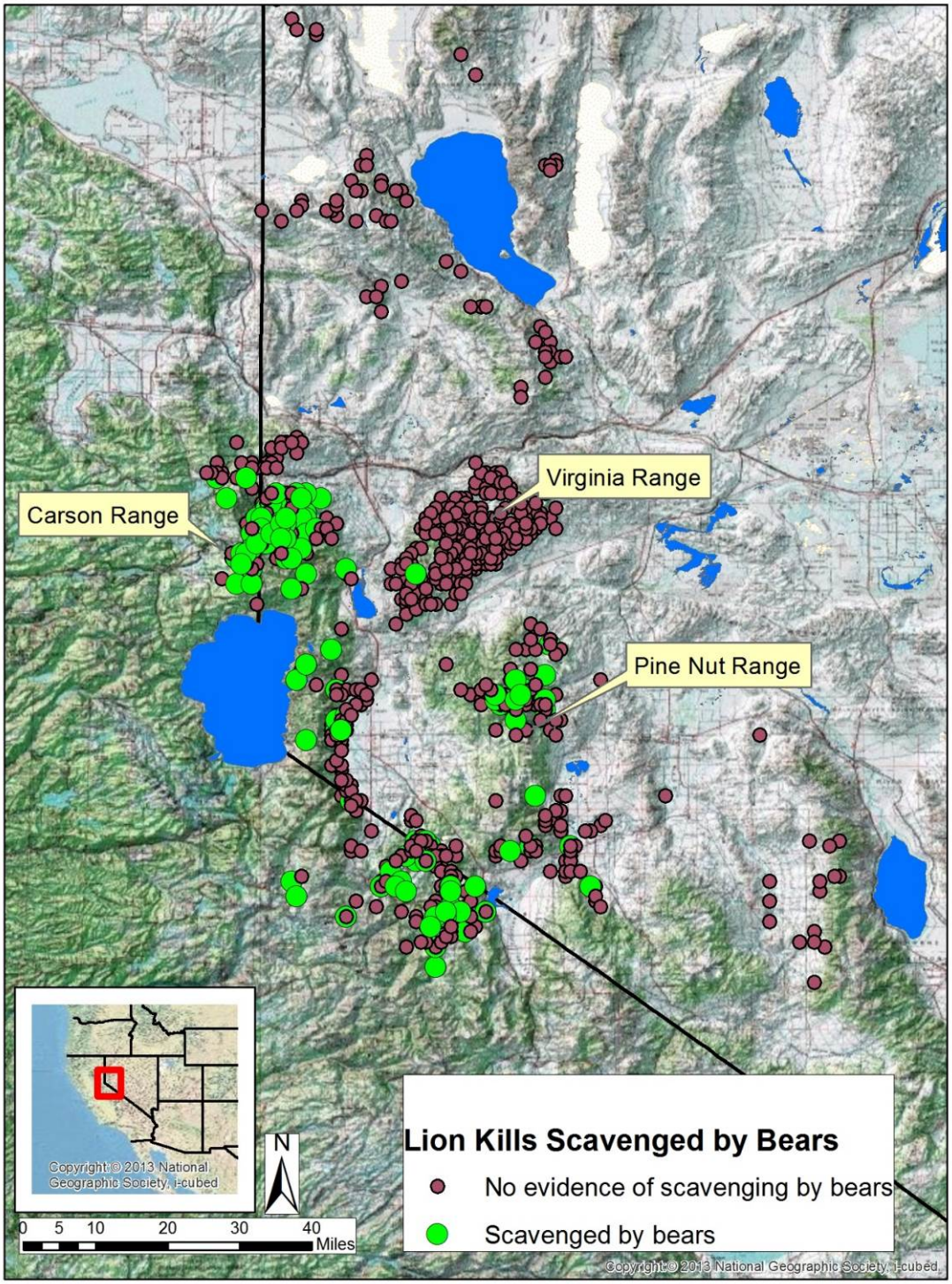

Figure 1. Example of mountain lion kills (n = 803), including kills where scavenging by black bears was recorded in the Carson Range (bears = high density), Pine Nut Range (bears = moderate density), and Virginia Range (bears = low density).

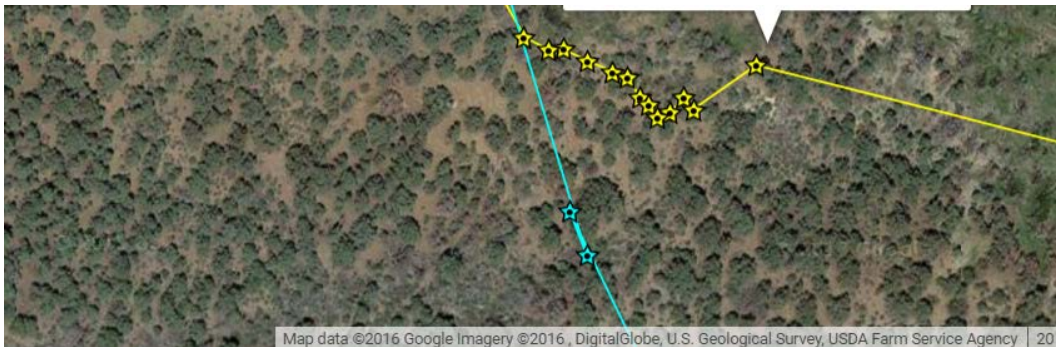

Figure 2. Example of a black bear (blue locations) and mountain lion (yellow locations) interaction in 2016 as revealed by data from GPS proximity collars. Captured black bears and mountain lions were fitted with Vectronic brand GPS PLUS collars with Proximity sensors to assess behavioral responses of each species upon close interaction. Collars were programmed to take 1 fix every 15 seconds when a collared bear and collared mountain lion are within 200 meters of each other.

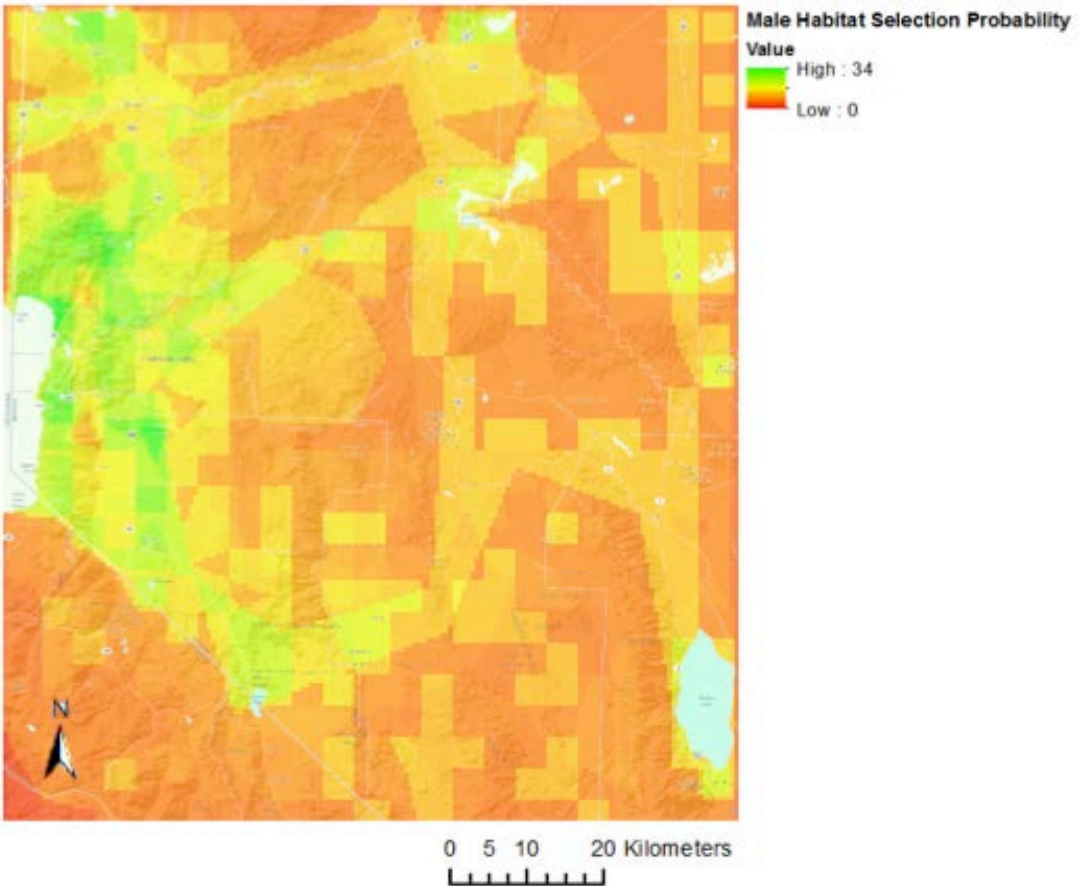

Figure 3. Model results of resource selection probability function (RSPF) displaying male black bear habitat selection in the western Great Basin (WGB) based on average habitat selection probability for all significant landscape variables.

Project 35 Using Genetic Testing To Identify Origin of Red Fox

Report by Benjamin N. Sacks

Objectives of the project are to determine (1) the distribution of native vs. nonnative red fox ancestry, (2) zones and extent of hybridization, and (3) geographic sources of nonnative ancestry.

In total, we collected 241 scats primarily at higher elevations of Great Basin mountain ranges and 52 tissue samples from trappers and road kills primarily at lower elevations during the reporting period. These samples were analyzed in conjunction with reference samples from neighboring states collected for related projects. Scats were collected predominantly from mid-to-high elevations areas of 7 Nevada mountain ranges—Ruby, East Humboldt, Snake, Toiyabe, Toquima, Schell Creek, and Monitor—only if they appeared to be from a canid and in the size range consistent with fox. Nevertheless, only a third of the samples were from red fox, whereas more than half were from coyotes (Table 1). The total number of scats collected in each of these mountain ranges served as a rough index of search effort. The proportion of these scats that were from red fox varied substantially among mountain ranges (Fig. 1). The Snake Range contained the highest relative abundance of red fox scats, followed by the Ruby and Toquima Ranges, whereas the Monitor Range only yielded a single red fox scat of 11 total. Most notably, out of 59 scats collected over a relatively broad spatial extent in the Toiyabe range, not a single red fox scat was recovered. Thus, the distribution of red foxes among the Great Basin ranges appears to be heterogeneous.

Using the red fox scat DNA sequences, and those from the tissue samples collected from trappers, we mapped the distribution of native and nonnative red fox mitochondrial haplotypes (Fig. 2). Haplotypes were strictly native from the Schell Creek Range, southern Snake Range, and the Monitor Range (a single sample), whereas both native and nonnative haplotypes occurred in the Ruby, Toquima, and Independence Ranges. The northern Snake Range had 3 foxes with nonnative haplotypes. The nonnative G haplotype was restricted to the northeastern-most portion of the state, whereas the nonnative O haplotype occurred furthest south. A single F or F5 haplotype was found in the Independence Range. This sample will need to be further resolved to determine if it was an F5, which has been previously found only in Utah, and would suggest origins from the east.

Table 1. List of species sampled based on sequences of 241 scats collected in northwestern Nevada, July 1, 2014–October 27, 2015.

Species	No. scats
Red fox	66
Coyote	108
Gray Fox	20
Kit Fox	2
Long Tailed Weasel	2
Bobcat	1
Yellow Bellied Marmot	1
No DNA Successfully Extracted	41
Total	241

To gain information on nuclear genetic ancestry and admixture, we genotyped red fox samples at 27 microsatellite loci. Preliminary analyses using these data indicate that the admixture patterns among multiple native and nonnative source populations are complex and cannot be clearly elucidated without additional samples and analyses. Nevertheless, some patterns were apparent based on an admixture analysis conducted in program Structure using reference data from known nonnative and presumptive native populations to assign the unknown genotypes from high elevation scat samples (Fig. 3).

Most notable, although admixture with nonnative red foxes appears to have significantly influenced the genetics of central Nevada red foxes at all elevations, those samples from high elevations of some of the northeastern Nevada red fox populations appear to potentially reflect relictual native populations. None of the Nevada red foxes assigned primarily as nonnative (yellow), although foxes from a litter sampled at low elevation in Garrison, UT, directly adjacent to the Snake Range, NV assigned as nonnative. Most red foxes sampled from the Snake Range clustered together as distinct from all but some in the Wasatch Range of UT (purple). Foxes from the northern portion of the East Humboldt Range and from Schell Creek Range assigned with Idaho Rocky Mountain foxes (blue). High elevation fox scats from the southern end of the Ruby Mountains, the Toquima Range, and a single sample from the Snake Range, along those trapped in the Independence Range and at the base of the Ruby/East Humboldt Ranges all composed a distinct genetic cluster (red). Consistent with the finding of nonnative mitochondrial haplotypes in north Snake and Toquima Ranges, some scats assigned to multiple clusters (i.e., suggesting admixture, white). Although tempting to attribute the red genetic cluster to a native Nevada Great Basin population, the notable abundance of nonnative mitochondrial haplotypes (Fig. 2) from the Independence Range and south and low-elevation Ruby Mountains suggest the alternative possibility that the red cluster reflects a native/nonnative hybrid swarm.

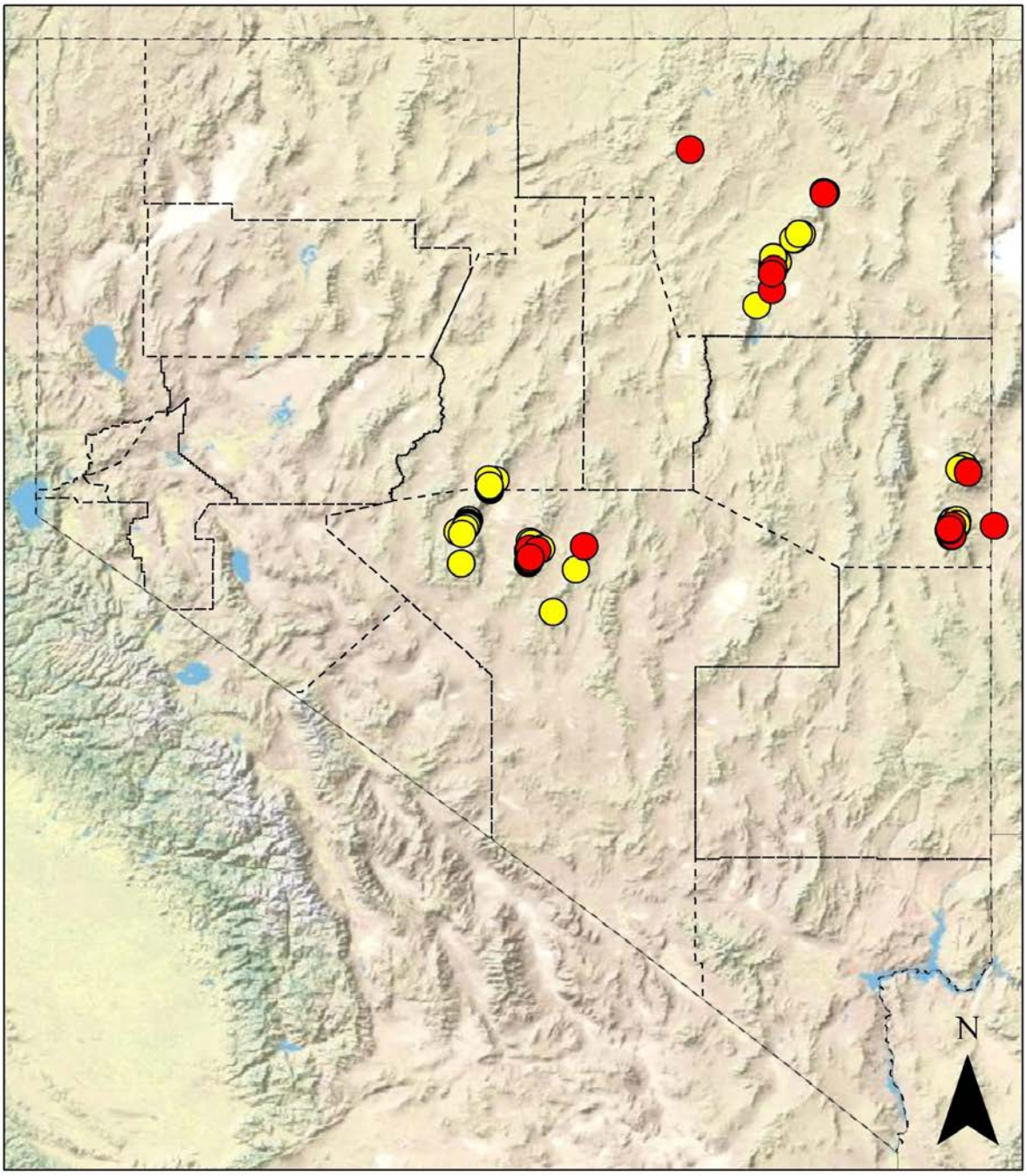

Figure 1. Distribution of 200 scats (of 241 collected) that were successfully sequenced and species-typed primarily among 5 Great Basin Mountain Ranges in Nevada, July 1, 2014–October 27, 2015, illustrating heterogeneous distribution of red foxes among mountain ranges.

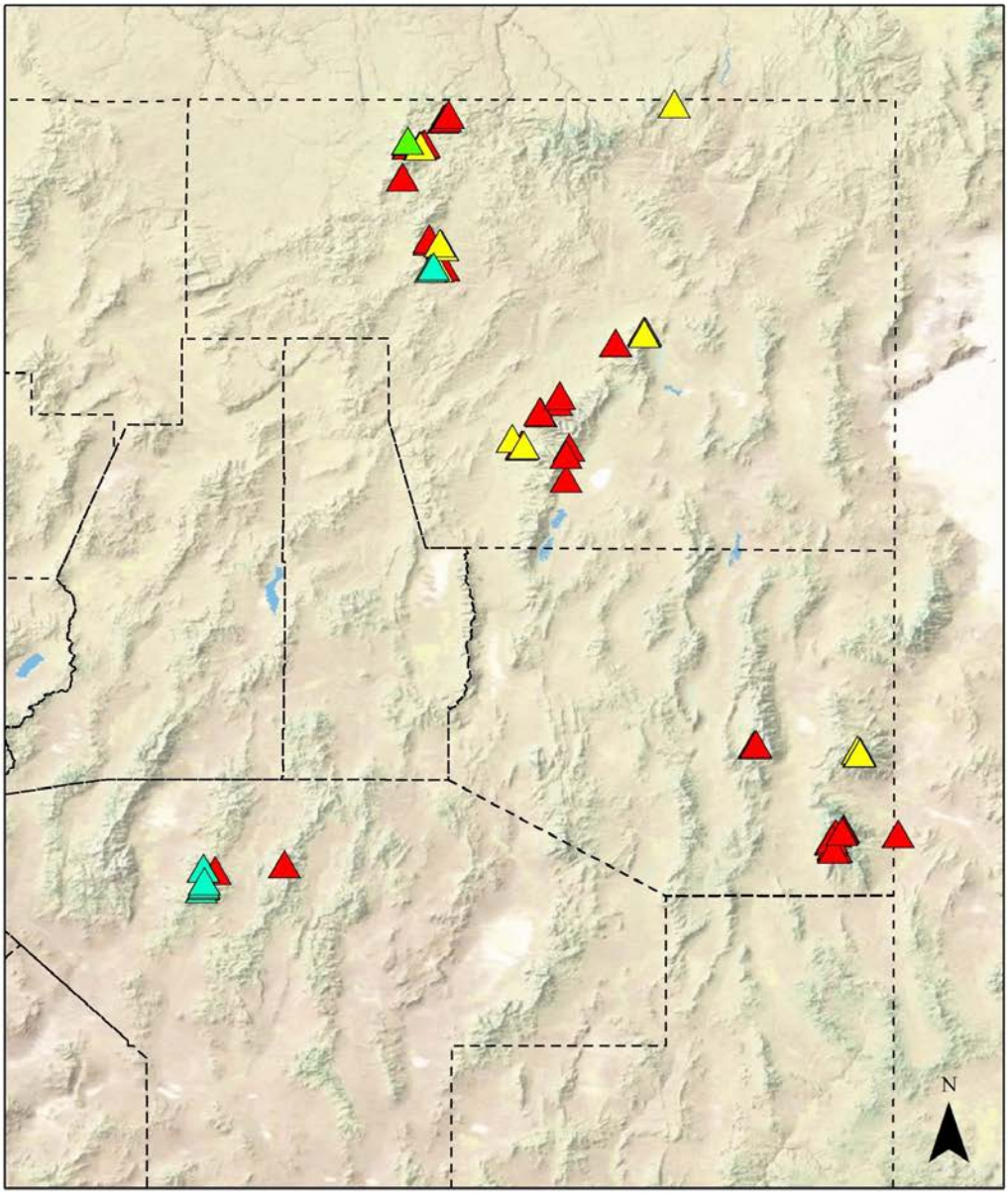

Figure 2. Distribution of native (red) and nonnative (yellow, blue, green) red fox mitochondrial DNA haplotypes in 97 scat and tissue samples collected primarily during July 1, 2013–October 27, 2015, from northeastern Nevada.

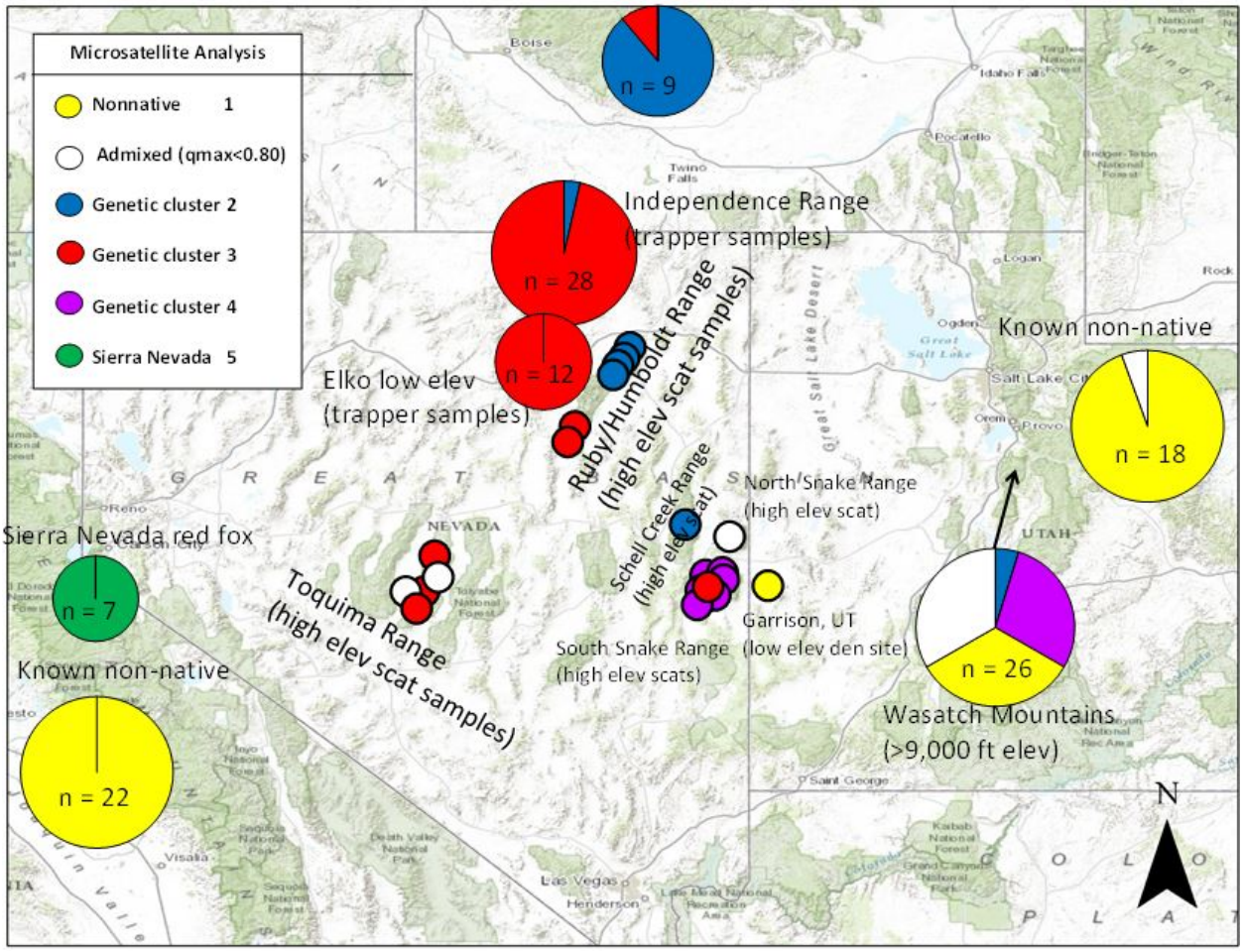

Figure 3. Distribution of red fox microsatellite genotypes colored according to genetic assignment in program Structure. Samples from high-elevation sites in Nevada (small circles) were treated as "unknowns" and assigned relative to 4 nonnative and potentially native reference samples (represented by pie charts) from Utah, California, Nevada (low elevation), and Idaho. Although reference samples were weighted by priors based on their sample population, posterior assignments of these samples in many cases differed from priors (e.g., Wasatch Mountains, which appeared highly affected by nonnative admixture).

$3 Planned Expenditures	**P-R Planned Expenditures**	**Wildlife Services Expenditures**	**NDOW Lethal Expenditures**	**NDOW Non-Lethal Expenditures**	**NDOW Salary, Travel, and Office**	**Total**
$2,500	$7,500	$0	$0	$9,750	$0	**$9,750**

Project 37 Big Game Protection-Mountain Lions

In some circumstances, culling of top predators is beneficial for protection of newly translocated big-game populations, small and isolated big-game populations, or big-game populations held below carrying capacity by predation (Hayes et al. 2003, Rominger et al. 2004, McKinney et al. 2006). The geographic range of mountain lions is larger than any big-game mammal in North and South America (Logan and Sweanor 2000), and specific areas may benefit from removal efforts that may target more than a single mountain lion.

A contract was formed with Canyon's West Guide Service to conduct mountain lion removal in the Snowstorm Mountains. Removal was conducted from March 30, 2016 until June 30, 2016. Two mountain lions were removed. Canyon's West Guide Service submitted an "Annual Predator Management Project Reporting Form", which can be found in the appendix of this document.

An underperforming population of bighorn sheep currently exists in Unit 115. In response, USDA WS removed two mountain lions in Unit 115 for the protection of bighorn sheep.

Snowstorm Bighorn Sheep Herd Health (Biologist III Matt Jeffress)
A combination of fall and winter surveys in 2015 documented a total of 38 California bighorn occupying the Snowstorms; yielding ratios of 48 rams:100 ewes:4 lambs. The year 2015 marked the second year of recruitment with 10-yearling California bighorn observed in May 2015. A combination of marked animals well distributed throughout occupied range, weeklong spring and summer ground surveys and a December/January trap-and-collaring event has resulted in a reliable estimate of the current population at 40 adults. Habitat Range conditions remain fair in the peripheral low elevations surrounding the Snowstorms. Due to the resiliency of the mid to upper elevations of the Snowstorm Range, much of the year-round California bighorn habitat remains in good to excellent condition.

As part of a greater effort to understand the dynamics of post die-off survivors in bighorn populations and how pathogens within surviving populations affect lamb recruitment, Washington State University, Idaho Fish and Game and South Dakota State University embarked on a study entitled "Investigating the Role of Super-Shedders in Respiratory Disease Persistence and Transmission in Bighorn Sheep." As part of the study, in late 2014 the Nevada Department of Wildlife gifted 11 California bighorn to South Dakota State University. The project has evolved into a field experiment looking at the effects of removing super-shedder ewes from the Snowstorm herd. In late 2015 and early 2016 the 25 remaining ewes on the Snowstorms were caught and sampled with all remaining unmarked ewes being collared using a combination of conventional vhf and satellite collars. The marked animals will allow the Nevada Department of Wildlife (NDOW) to continue monitoring Snowstorm California bighorn sheep in order to assess future performance as it relates to the removal of potential super-shedders and the amount of time elapsed since the initial die-off. Ten of the 25 sampled ewes were confirmed to be shedding *Mycoplasma ovipneumoniae* (*hereafter,* M. ovi) during the last round of sampling. These 10 ewes will be resampled in late 2016 and any ewe that is found to be shedding M. ovi during 2 consecutive sampling efforts will be removed from the population and donated to a research facility. Recruitment values will be collected for the next 5 years and these data, coupled with

pathogen samples collected in 2011, 2012 and 2014, will guide future management of the Snowstorm herd.

Due to the lack of recruitment between 2011 and 2014 this herd has continued to decline since the initial die-off in 2011. This herd declined from 160 in early 2011 to approximately 65 by 2012. It has further declined to approximately 40 animals in 2016. We acknowledge limited bighorn mortalities attributed to mountain lions have always occurred in the Snowstorms but never affected the herd sustainability. As part of the experiment, NDOW and NGO's have dedicated a great deal of time and funding to capturing and collaring animals, pathogen testing, and tracking interactions among subherds to identify "supper shedders". In early 2016 we detected a few of our collared animals killed by mountain lions. As part of the experiment, we are attempting to protect bighorn in which M. ovi is not detected and to cull those that are identified as "super shedders". Unfortunately, lion predation is occurring on animals that have cleared the pathogen analysis. Those predation events impact our research results and compromise the ability for the bighorn herd to recover if we are successful in identifying and removing the "super shedders".

Biologists have not documented mortalities of adult bighorn since the removal of 2 lions by contract hunter Dave Gowan this spring. Tracks of a single lion were observed in Kelly Creek in late May and it is believed this lion was not removed as part of the lion removal project. NDOW estimates a minimum of one lion remain on the Snowstorm Range. NDOW is hopeful continued lethal removal of lions through a combination of contract and sport harvest will greatly reduce or eliminate lion predation of bighorn in the Snowstorm Mountains for the duration of the "super shedder" study.

$3 Planned Expenditures	**P-R Planned Expenditures**	**Wildlife Services Expenditures**	**NDOW Lethal Expenditures**	**NDOW Non-Lethal Expenditures**	**NDOW Salary, Travel, and Office**	**Total**
$90,000	N/A	$8,570	$18,100	$0	$10,091	**$36,761**

Project 38 Big Game Protection-Coyotes

Coyotes face an increase in caloric need when raising pups, both through an increase in parent energetic output and feeding growing pups. Parent coyotes have been found to be exclusively responsible for domestic sheep predation. Removing coyote pups from dens or preventing parents from breeding has been demonstrated to reduce predation on domestic livestock (Till and Knowlton 1983, Sacks et al. 1999, Seidler et al. 2014). Parent coyotes and their pups may consume a drastically different diet than their non-parent counterparts at the same time of year; this difference in diet likely requires larger prey, including mule deer fawns. Removing coyotes may increase mule deer fawn and other wildlife species reproductive output.

Upon approval of project 38, Area game biologists with pronghorn management responsibilities were asked whether or not their pronghorn herds may be underperforming due to coyote predation. Areas where predation by coyotes could be a factor limiting pronghorn populations received removal efforts from USDA Wildlife Services. From January through June USDA Wildlife Services conducted coyote removal, primarily with a fixed with helicopter for the benefit of pronghorn. A total of 417 coyotes were removed.

Area	Coyotes Removed
GMA 1	36
GMA 7	71
GMA 10	90
GMA 11	3
GMA 63	63
GMA 22	44
GMA 23	110
Total	417

$3 Planned Expenditures	**P-R Planned Expenditures**	**Wildlife Services Expenditures**	**NDOW Lethal Expenditures**	**NDOW Non-Lethal Expenditures**	**NDOW Salary, Travel, and Office**	**Total**
$90,000	N/A	$97,794	$0	$0	$10,091	**$107,885**

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Project 39 Predator Education

Due to the Assembly Bill 78, use of the $3 predator fee for predator education was no longer permitted. No funds were spent on this project.

$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
$1,500	$4,500	$0	$0	$0	$0	**$0**

Project 40 Coyote Removal to Complement Multi-faceted Management in Eureka County

Mule deer populations in Diamond Mountains in Eureka County are believed to be underperforming due to competition with feral equids, pinyon-juniper expansion, and predation. To alleviate pressure on resources, the BLM conducted a feral horse round-up in the Diamond Mountains in January 2013, removing 792 horses. Eureka County and the Eureka County Advisory Board to Manage Wildlife directed the removal of pinyon and juniper trees on private range lands in the Diamonds and Roberts Mountains in 2008, 2009, and 2011. Wildlife Services removed coyotes in the area in 2011 and 2012. A private contractor removed coyotes in 2014. On-going removal of coyotes may assist mule deer population recovery.

From January until June USDA WS conducted aerial gunning of coyotes in the Diamond Mountains, removing a total of 515 coyotes.

114 Deer Herd Health (Biologist III Mike Podborny)

The spring fawn to adult doe ratio, recruitment, was very low in the springs of 2005, 2008 and 2009 and range from 18, 19, and 21 fawns per100 adults, respectively. These are the three lowest recruitment rates since helicopter surveys began in 1977 and indicate a declining population. Drought conditions existed during this time but the population did not rebound as exhibited by adjacent populations in the years following drought. The spring fawn ratios improved from 2010 to 2012 with a slight decline in 2013. Recruitment rates increased again in 2014 to 38 fawns:100 adults and 44 fawns:100 adults in 2015 both indicating growth in the population. The 2016 ratio of 37 fawns:100 adults followed a severe winter and was above all surrounding deer populations. Based on spring recruitment rates, the Unit 114 deer population has been improving since 2009.

Overall Budget

Project	$3 Planned Expenditures	P-R Planned Expenditures	Wildlife Services Expenditures	NDOW Lethal Expenditures	NDOW Non-Lethal Expenditures	NDOW Salary, Travel, and Office	Total
Project 21	$78,000	N/A	$51,815	$0	$44,304	$10,091	**$106,211**
Project 21-02	$50,000	N/A	$20,895	$0	$24,211	$10,091	**$55,197**
Project 22	$0	N/A	$8,264	$0	$0	$10,091	**$18,355**
Project 22-01	$45,000	N/A	$54,094	$0	$0	$10,091	**$64,185**
Project 22-16	$40,000	$120,000	$0	$0	$68,844	$10,091	**$78,935**
Project 22-074	$45,000	N/A	$4,240	$25,000	$575	$10,091	**$39,907**
Project 32	$40,000	$120,000	$0	$0	$90,806	$10,091	**$100,897**
Project 35	$2,500	$7,500	$0	$0	$9,750	$0	**$9,750**
Project 37	$90,000	N/A	$8,570	$18,100	$0	$10,091	**$36,761**
Project 38	$90,000	N/A	$97,794	$0	$0	$10,091	**$107,885**
Project 39	$1,500	$4,500	$0	$0	$0	$0	**$0**
Project 40	$60,000	N/A	$36,402	$0	$0	$10,091	**$46,494**
USU Contract Obligations[b]	$0	$0	$0	$0	$10,948	$0	**$10,948**
Total[c]	**$556,000**	**$252,000**	**$296,075**	**$43,100**	**$249,437**	**$100,914**	**$675,525**

[a]This transfer of $3 predator fees for administrative support to the Department of Agriculture partially funds state personnel that conduct work for the benefit of wildlife at the direction of USDA WS (e.g., mountain lion removal to benefit wildlife).
[b]Amount covers final bill payed to Utah State University for project 25.
[c]Nevada Department of Wildlife spent $312,175 on lethal predator removal during FY2016. This accounted for 54.7% of FY2014 revenues.

Expected Revenues and Beginning Balance of Predator Fee

	FY 2014 Audited[a]	FY 2015 Actual	FY 2016 Actual	FY 2017 Projected
Beginning balance	$377, 674	$380,038	$544,631	$591,382
Revenues	$570,368	$574,312	$595,107	$574,312
Plan Budget	$526,360	$338,000	$556,000	$839,500
Expenditures	$568,004	$409,719	$548,356	--
Ending balance	$380,038	$544,631	$591,382	$326,194

[a]All actual and audited amounts are from the State Accounting System. Estimated revenues are projections based on recent receipts and budget expenditures are derived from the Predator Management Plan