

Nevada Department of Wildlife

PREDATION MANAGEMENT PLAN



PHOTO BY: KEVIN C. LANSFORD

FISCAL YEAR 2010



August 2009

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Nevada Predation Management Plan

Fiscal Year 2010

July 1, 2009 - June 30, 2010

The goal of the Nevada Predation Management Program is to initiate projects that have the greatest potential to produce the intended results based on the best available information and carried out in the most appropriate manner.

NDOW maintains the philosophy that predation management is a valuable management tool. It is a tool to be applied by itself, or ideally in conjunction with other management techniques. The sole intention is to lessen the impacts of predation on identified populations that are being additively impacted by specific predators. As with any management strategy, predation management should be applied on a location specific, case-by-case basis, with clear goals, and based on the best available information. It should be applied in the proper intensity and at a focused scale. Equally important, after management is initiated, projects should be monitored to determine whether the desired results are achieved. The analysis of these projects will lead to better applications on future projects.

The 2010 Predation Management Plan (PMP) provides a brief description and synopsis of the FY 2009 and 2010 predation management projects. "All intrastate boundaries of wildlife damage management projects are to be taken as flexible boundaries, and any damage control personnel may operate freely in adjacent areas if, in their professional opinion, the animals determined to be causing damage in the target project area are located in such an adjacent area." A history of the Projects through 2006 can be found in the NDOW document entitled: *A Program Overview - Nevada Predator Management Plan - A Report to the Nevada Board of Wildlife Commissioners' Wildlife Damage Management Committee*. This report was prepared by NDOW to describe the history of the Predator Management Program, including description of management applications, a documentation of deliverables, an accounting of budget commitments and analysis of project goal-completion. This document was provided to the Commission's Wildlife Damage Management Committee in 2006 and is available online at www.ndow.org.

FY 2009 Project Status Reports and FY 2010 Projects

Project 6A: Protection of Desert Bighorn Sheep: Delamar Mountains

Project Inception and Current Status: 2002, and approved through 2010.

Budget: \$17,422

Project Area: Delamar Mountains, North & South Pahroc Ranges and Hiko Range.

Predator Control Action: USDA-APHIS-Wildlife Services (WS) hunts mountain lions using dogs and other control tools such as a call box and snares. Bobcats and coyotes are targeted on a case-by-case basis using calling, shooting, leghold traps, aerial hunting and snares, to remove offending animals.

Control Period: September – March for lions, as needed for bobcats and coyotes.

FY2009 Projected Expenditures: WS-Nevada had an approved budget of \$15,000 to conduct mountain lion removal within the Delamar Mountains during FY2010. Included in this amount is the authorization for additional coyote and bobcat work as needed that may include aerial hunting time.

FY2008 Summary of Control Activities: In FY 2009 an additional 100+ bighorn sheep were augmented into the Delamars. Shortly after the release, mortality signals on two GPS collars were received. Initial investigation of the carcasses indicated the predation was by coyotes. This adds to the list of mountain lions and bobcats as confirmed bighorn sheep predators in the Delamar Range. Aerial hunting of coyotes in the immediate vicinity was accomplished and resulted in the removal of eight coyotes from the area. Wildlife Service's contracted a helicopter to return to the area in May. Eight more coyotes (16 total) were removed from in and around bighorn sheep herds and the vicinity of the original predation.

Subsequent to the coyote predation was two bighorn sheep mortalities from mountain lion predation. In FY2008 the lion specialist assigned to the project had trailed one of the lions but never was able to capture it. In FY 2009, the area biologist placed trail cameras at several waterholes and caught two lions on film utilizing the area. The Wildlife Services Lion Specialist began trailing the cats again in December FY 2009 and captured the two on 12-16 and 12-22. One female and one male were removed with estimated ages of 7.5 and 4.5 years old, respectively. To date no new lion predation has been confirmed. Overall, six lions have been removed from the project since inception.

FY2008 Summary of Measured Outcomes:

The Delamar Bighorn population continues to show indications that the release of over 250 bighorns in the past and the installation of seven water developments, may turn it into one of the largest populations of desert bighorn sheep in the State. The following table shows survey results from 2001-2008.

<i>Year</i>	<i>Rams</i>	<i>Ewes</i>	<i>Lambs</i>	<i>Total</i>
2001	16	17	5	38
2002	3	15	3	21
2003	7	12	2	21
2004	5	15	5	25
2005	5	19	3	27
2006	5	7	1	13
2007	7	12	5	24
2008	23	78	29	130

Conclusion:

Six lions, two bobcats and 16 coyotes have been removed to date. The initial large tom that was removed in 2002, the lion removed in 2006 and the two lions removed in 2009 were all associated with bighorn sheep mortalities. It has been surmised that bobcat predation has had a potentially larger impact than originally thought. This was founded on the fact that at least two previous kills were identified as bobcat predation. This can also be said of coyotes after the predation of two bighorn sheep due to coyote after the FY 2009 augmentation.

A large portion of the Delamar Mountain Range was declared wilderness in the Lincoln County Lands Act of 2004 and is now Designated Wilderness Area. Access for trappers was severely reduced, which may result in higher bobcat and coyote densities than adjacent areas where trappers have good access. The project is designed to mitigate bighorn losses to predation until such time that the herd has reached a threshold level where such losses are overcome by recruitment.

The project has resulted in important information concerning lion use patterns, season of use, general densities, as well as pinpointing windows when lions and bighorn sheep overlap providing the opportunity for a more surgical approach to lion removal. Most known lion predation incidents have occurred from October through March. This, in turn, has lead to a better understanding of how to more efficiently and effectively allocate personnel as well as resources.

Bobcats and coyotes are known predators of large ungulates. Recently augmented or introduced bighorns are also known to be more vulnerable to predation. Since both of the confirmed bobcat and coyote predation occurred on recently augmented and collared sheep within weeks of release, the extent this is true has been confirmed. It also begs the question, how much predation is actually occurring since only a small portion of sheep are collared.

Project 14: Wilson Creek-White Rock Coyote Control to Enhance Deer Fawn Production.

Project Inception: FY 2004

Project Conclusion: FY 2009

Project Area: Unit 231

Summary of Control Activities:

Wildlife Service's has reported the removal of 1,143 coyotes over the course of the six year project from aerial hunting and ground trapping.

Tooth Analysis Update:

Included in this report are maps indicating coyote take and associated ages from the tooth analysis. Results from the final year of tooth age analysis will not be known until spring of 2010. Initial results from the completed five years (Map on Page 9) are that reduction in the overall age structure of coyotes from within the treatment areas has occurred. The age structure is indicative of several factors that relate directly to goals of the project. Older age class coyotes that are territorial are generally responsible for the majority of predation occurring within their ranges, especially when they are paired and have offspring. The younger age class is represented mostly by dispersers and transient coyotes not as familiar with that particular environment making them less effective predators. Coyote pairs with pups are recognized in the literature as the most prolific killers. Those established pairs are representatives of an older age class of coyotes. As those are removed a younger age class moves in and initially may be less effective at predating animals such as fawns.

Conclusion:

Direct comparisons to adjacent areas is not always an effective tool for assessing if the project has reached it goals of improved fawn survival and ultimately fawn recruitment. As with Project 17, the area 10 deer project in Elko County, statistical analysis of the project revealed that no significant difference exists between pre and post treatment in fawn to doe ratios. However, the empirical data suggests that during several years of the project, fawn to doe ratios exceeded the State average and historic levels for those areas. The inflated winter fawn ratios resulted in increased recruitment during the spring surveys. This can be attributed to multiple factors including improved climatic conditions, water developments and many habitat restoration efforts over the years as well as predation management.

RECOMMENDATION:

It is recommended that aerial hunting continue on this project. Specific winter and summer ranges will be identified for control actions. While no boundaries should inhibit control activities, specific areas should be recognized and identified as areas where control efforts should focus.

Project 15: Horse and Cattle Camp Loop, Schell Creek Range

Project Inception: FY 2004

Project Conclusion: FY 2009

Project Area: Northern Unit 222

Summary of Control Activities: Wildlife Service's has reported the removal of 565 coyotes over the course of the six year project from aerial hunting and ground trapping. Two mountain lions were also removed incidentally using equipment placed for coyotes.

Tooth Analysis Update: Same as for Project 14.

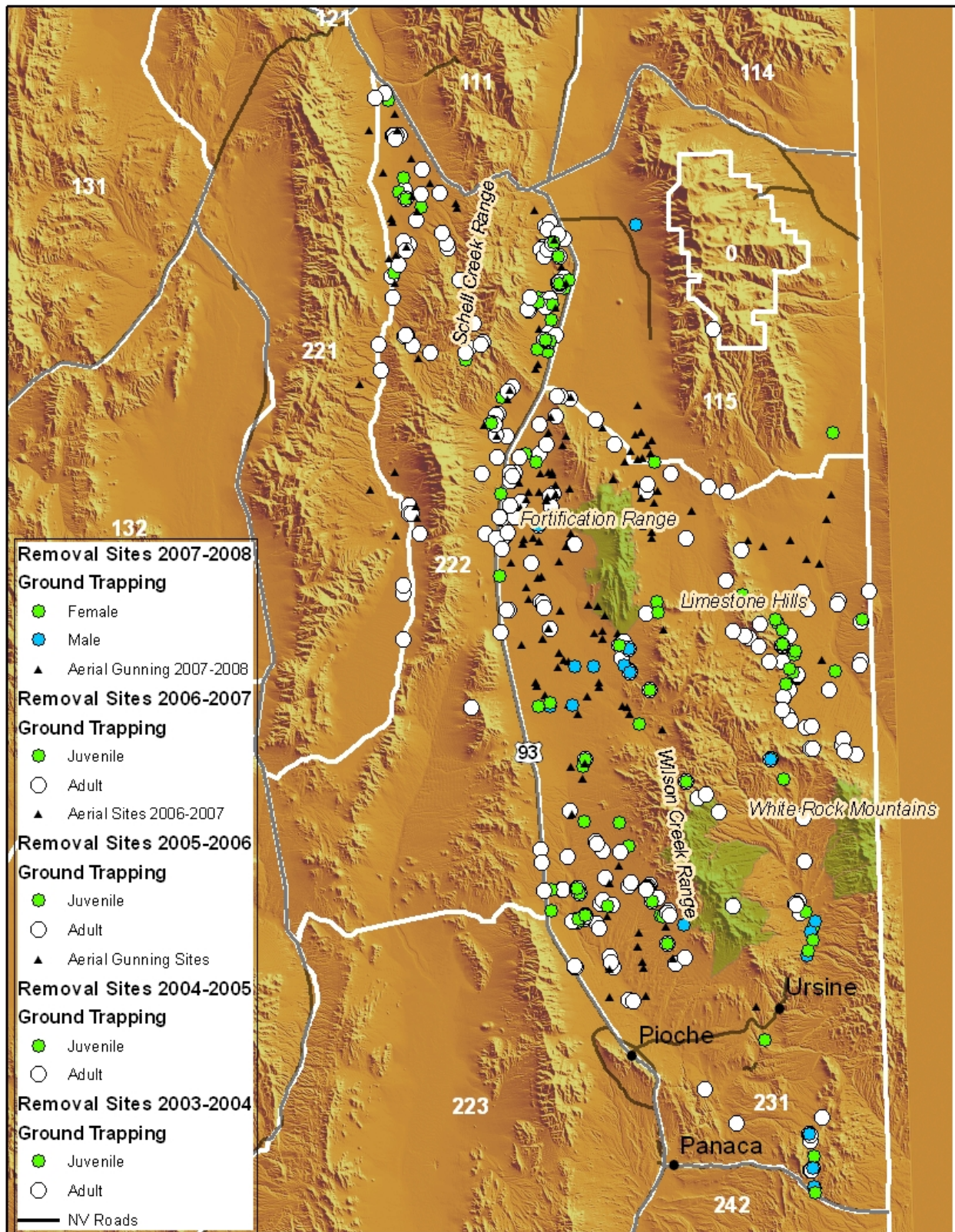
FY2009 Summary of Measured Outcomes:

Conclusion:

Direct comparisons to adjacent areas is not always an effective tool for assessing if the project has reached it goals of improved fawn survival and ultimately fawn recruitment. As with Project 17, the area 10 deer project in Elko County, statistical analysis of the project revealed that no significant difference exists between pre and post treatment in fawn to doe ratios. However, empirical evidence suggests that during several years of the project, fawn to doe ratios far exceeded the State average and historic levels. The inflated winter fawn ratios resulted in increased recruitment during the spring surveys. These results can be partly attributed to multiple factors including improved climatic conditions, water developments and many habitat restoration efforts over the years as well as predation management.

RECOMMENDATION:

It is recommended that aerial hunting continue on this project. Specific winter and summer ranges will be identified for control actions. While no perimeter should inhibit control activities, specific areas should be recognized and identified as areas where control efforts should focus.



Project 17: Elko County Deer & Elk

Project Inception: FY 2005

Project Conclusion: FY 2009

Project Area: Units 101, 105 and 107.

FY2009 Summary of Control Activities: Total predators removed during the project were 2,340 coyotes and 12 mountain lions. Coyote age analysis was not attempted for this project, but there have been some interesting findings. Three coyotes were estimated at over 10 years of age. One was a female estimated at 10 years old: she was captured in February 2007 with 13 fetuses in her uterus.

FY2009 Summary of Measured Outcomes: NDOW was able to gather post-season and spring mule deer composition data during the report period for the project area and for the control area. These are reported as follows:

Table 1. Observed Fawn/Adult Ratios for Project 17 Treatment & Control Areas								
Survey	Unit Group:	1989-1994	1995-2004	2004	2005	2006	2007	2008
Post-season	101, 105, 107	50	46	45	34	40	39	na
	102, 103, 104 & 108	50	46	40	29	39	38	na
Spring*	101, 105, 107	34	33	39	28	39	25	19
	102, 103, 104 & 108	34	36	40	30	31	22	20

* Results reported for “Spring” surveys are from survey activities conducted in the Spring following the corresponding “Post-Season” survey and therefore are actually conducted in the subsequent calendar year, one year greater than the year in the column heading.

Table 2. Area 10 Elk Estimates & Survey Findings							
	2002	2003	2004	2005	2006	2007	2008
Pop. Estimate	180	170	160	160	190	220	200
Calves/100♀	31	26	12	24	25	46	28

Conclusion:

Based on statistical analysis, it is not recommended this project be continued at the current level. Management Area 10 will be included in Project 22. Specific winter and summer ranges will be identified for control actions. While no boundary should inhibit control activities, specific areas should be recognized and identified as areas where control efforts should focus.

Project 18: Washoe County Deer

Project Inception: FY 2005

Project Conclusion: FY 2009 (5 year project)

Project Area: Treatment Area: Granite Range, Washoe County.

Control Area: Balance of northern Washoe County and the Sheldon NWR.

Target Predators: Coyotes and Mountain Lions.

Control Period: Year-round.

Summary of Project Deer Actions: 24 mule deer were captured and collared in December 2004. FY2005 monitoring was as follows:

- A ground monitoring effort occurred on July 1, 2005 (1st day of FY2009) and was closely followed by an aerial follow up on July 8th. Aerial surveys found all instrumented animals alive.
- During the 2005 hunting season, one of the marked bucks was legally harvested by a Unit 014 tag holder. Findings thus far indicate that deer movements within the Granite Range are not very extensive.
- On June 21, 2009 NDOW personnel conducted another telemetry monitoring flight using the NDOW fixed wing Cessna. Of the original 24 installed transmitters a total of nine frequencies remained active and two of these were pulsing in the mortality mode. The latter instruments were located from the air in remote areas. Several attempts were made in the early summer to locate them from the ground. The newly acquired UTM locations will help to direct biologists into the remote areas where the transmitters are located. The other seven transmitters were functioning in the live mode. The instrumented deer have been monitored on a regular basis over an 18-month period. The battery life on the ear tag transmitters is generally 15 to 16 months.

FY2010 Projected Expenditures: WS-Nevada had proposed a budget authorization in the amount of \$103,945 to conduct coyote and mountain lion removal within the treatment area during FY2009. NDOW had anticipated expending monies toward this project during the report period for the monitoring of the collared deer and intend to keep the monitoring up even though most of the collars are now not functioning. Several aerial telemetry flights and a number of ground monitoring efforts ensued last year.

FY2009 Summary of Control Activities: A total of 771 coyotes and 22 mountain lions have been removed since project inception.

Tooth Analysis Update: FY 2008 tooth analysis data will be available sometime after August 2009. Complete results will be presented much like the results on Projects 14 and 15.

FY2009 Summary of Measured Outcomes:

Table 1. Observed Fawn/Adult Ratios for Unit 014 and Adjacent Unit Groups

Survey Type:	Unit Group:	Averages:			2004-05	2005-06	2006-07	2007-08	2008-09
		1989-1994	1995-2004	2000-2004					
Post-season	014	30	45	37	38	52	50	44	43
	Washoe	31	39	33	56	47	46	29	38
	033	25	48	50	56	57	41	43	36
Spring	014	18	36	32	44	65	51	32	42
	Washoe	19	31	30	48	60	44	28*	38
	033	17	37	33	44	58	52	26*	34

* Due to a maintenance issue with one of the NDOW helicopters, the 2007-08 spring data was collected from the ground and resulted in a reduced number of animals classified and smaller sample sizes. Some of the data may be inadequate to assess accurate recruitment rates.

Conclusion:

The winter of 2008-09 was mild and with little snowfall. The lack of significant snowmelt and runoff is expected to impact the amount of water available during the 2009 summer months. However, the significant amount of moisture received during April, May and the first two weeks of June have been well above average. Habitat conditions have improved at least in the short-term due to the increased moisture.

Mule deer survival over the winter was high in 2008-09 in all hunt units within Washoe and western Humboldt County. Due to the extremely mild conditions and lack of any significant snow accumulations, mule deer were scattered out over much broader areas and were not forced to concentrate on their typical lower elevation winter ranges. This enabled the deer to search out areas with better quality forage for much of the winter.

The 2009 post-season (fall) fawn ratios were generally similar to the previous year but lower than what was observed in both 2006 and 2007. The lower post-season fawn ratios observed throughout Washoe and western Humboldt Counties the past two years are related to the poor habitat conditions brought on by the consecutive dry years.

The spring fawns to 100 adult ratios were higher in all units when compared with 2007-08. Ratios increased between 8 and 10 fawns per 100 adults in all hunt units from what was observed in 2008. However, this year's recruitment ratios were much lower than those observed in 2005-06 and 2006-07.

In 2009, unit 014 had the highest 2009 spring fawn ratio at 42 fawns per 100 adults. The remainder of Washoe County had a combined average fawn ratio of 38 fawns per 100 adults and ratios ranged between a low of 33 fawns per 100 adults in hunt unit 012 to 40.5 fawns per 100 adults in hunt unit 011. The Sheldon, where habitat conditions have been very poor due to the three consecutive years of drought was lower at 34 fawns per 100 adults.

The large number of lions taken from the Granite Range over the past few years indicates that as we remove lions other transient lions continue to move back into the unit from surrounding areas.

Recommendation for FY2009: Continue with Project 18.

Proposed Budget for FY 2009: WS - \$108,674; NDOW- \$10,000

Project 19: Winters Creek/Marble Canyon Emergency Wildfire Project

Project Inception: 2006

Project Conclusion: 2009

Project Area: Elko County – Management Areas 6 and Area 7.

Target Predators: Coyotes and ravens concentrating in and around unburned habitat within and in the vicinity of the Winters, Susie, Basco Flat, Marble Canyon and other summer 2006 and 2007 wildfires.

Summary of Control Activities: Wildlife Service's has removed 694 coyotes by aerial hunting to date on this project. A map was produced to illuminate the clusters of predators repeatedly removed from specific areas. Ravens were removed in close association to two known sage grouse leks in the Willow Creek Reservoir and St. John areas. Approximately 305 ravens were removed during three years of DRC-1339 projects.

Conclusion:

The project was not designed or intended to be analyzed. After the catastrophic fires occurred in 2006 and 2007, the decision to initiate predation management was under the auspice that remaining habitats would be predator pits and sinks for remaining wildlife.

Recommendation:

It is recommended that aerial hunting continue on this project. The aerial hunting will be rolled into Project 22. Specific winter and summer ranges will be identified for control actions. While no perimeter should inhibit control activities, specific areas should be recognized and identified as areas where control efforts should focus.

Project 20: Virginia Mountains BHS

Project Inception: 2008

Project Conclusion: Not determined.

Project Area: Washoe County, Unit 022.

Target Predator: Mountain Lions

FY2009 Projected Expenditures: A total budget request of \$5,000 for Wildlife Services to perform control work as needed and as available.

Summary of Control Activities: Wildlife Services Lion Specialist initiated control activities in January 2008. Almost immediately a female with 3 kittens was located and removed within the same range the sheep were occupying. It is well known and documented that female lions with kittens are the most prolific killers. Removing that specific situation was important. In February of 2008 another lion was removed within the sheep's range, again a female.

Recommendation: The recommendation is to continue to target mountain lions preying on populations of recently introduced, augmented, underachieving herds, or herds where lion predation is identified as excessive on bighorn sheep.

Proposed Budget for FY 2009: WS - \$5,807; NDOW- \$4,500

Project 21a: Elko and Lincoln County Sage Grouse

Project Inception: 2008

Project Conclusion: Not determined.

Project Area: Twenty two leks in Elko and Lincoln Counties.

Target Predator: Ravens

Predator Control Action: The USDA/APHIS Wildlife Services will remove ravens using DRC-1339.

Control Period: March-May.

FY2009 Projected Expenditures: Although \$20,000 was designated for emergency projects, that money was not expended on this project due to Wildlife Service's aerial program having down time due to a pilot leaving. Those savings allowed for this project to be funded from the base budget. It was estimated that it cost Wildlife Service's \$12,000 to treat these 22 locations, including re-treatments.

Raven counts started on 2/19/09 for the protection of sage grouse in Eastern Nevada. Raven control activities started on 3/12/09. For the second year, NDOW biologists pre-selected 20 sage grouse leks based on the number of sage grouse at each lek, the number of ravens observed at the leks and leks associated with sage grouse nesting areas with low production. All 20 leks were located in Elko and Lincoln Counties. Six leks were Elko County 14 were in Lincoln County. Additional leks were selected by NDOW biologists in Elko County but were not treated due to lack of available Wildlife Services personnel. Additionally, two locations were treated in Lincoln County. Both areas, White Rock and Table Mountain were selected by NDOW staff as important sage grouse nesting areas.

Ravens are known predators of sage grouse nests and chicks. USDA-APHIS-Wildlife Services was requested by NDOW to help reduce impacts caused by raven predation in designated areas utilizing DRC-1339 egg baits.

This year some pre-treatment raven counts were conducted and recorded with the associated leks. Due to weather conditions and logistics, not all leks had pre-treatment raven counts completed. Wildlife Services observations indicate that ravens tend to move into the treatment areas later in the season. This may account for the low pre-treatment counts and the fluctuation in raven numbers.

Control activities began on 3/12/09 and ended on 7/2/09. The following is a summary of activities.

Lincoln County:

Little Spring Valley

- 1) Little Spring Valley 1 Lek- Pre-treatment raven counts were conducted on 2/19/09. Ten ravens were observed. First treated on 3/12/09, 30 ravens observed and 40 egg baits placed. Fifteen ravens estimated removed. Re-treated on 3/19/09, 30 ravens observed and 20 egg baits placed. Five ravens estimated removed. Re-treated on 4/14/09, 25 ravens observed and 30 eggs placed. Ten ravens estimated removed. Re-treated on 4/29/09, 20 ravens observed and 20 eggs placed. Four ravens estimated removed. Re-treated on 5/28/09, 15 ravens observed and 30 eggs placed. Ten ravens estimated removed.
- 2) Whittemore Lek- Pre-treatment raven counts were conducted on 2/19/09. Eight ravens were observed. First treated on 3/12/09, 10 ravens observed and 30 egg baits placed. Five ravens estimated removed. Re-treated on 3/19/09, 15 ravens observed and 20 egg baits placed. Five ravens estimated removed. Re-treated on 4/14/09, 25 ravens observed and 30 eggs placed. Ten ravens estimated removed. Re-treated on 4/29/09, 20 ravens observed and 20 eggs placed. Four ravens estimated removed. No ravens were observed on 5/28/09.
- 3) Fogliani Lek- Pre-treatment raven counts were conducted on 2/19/09. Ten ravens were observed. First treated on 3/12/09, 20 ravens observed and 30 egg baits placed. Five ravens estimated removed. Re-treated on 3/19/09, 10 ravens observed and 20 egg baits placed. Five ravens estimated removed. Re-treated on 4/14/09, 25 ravens observed and 30 eggs placed. Ten ravens estimated removed. Re-treated on 4/29/09, 20 ravens observed and 20 eggs placed. 4 ravens estimated removed. No ravens were observed on 5/28/09.

South Lake Valley

- 1) Eight Mile Lek- First treated on 3/13/09, 50 ravens observed and 70 egg baits placed. Fifteen ravens estimated removed. Raven counts and egg take observed on 3/16/09, all eggs consumed or gone and very few ravens observed. Re-treated on 3/18/09, 15 ravens observed and 30 egg baits placed. Eight ravens estimated removed. Re-treated on 3/24/09, 20 ravens observed and 25 eggs placed. Ten ravens estimated removed.
- 2) Benchland Lek- First treated on 3/13/09, 83 ravens observed and 70 egg baits placed. Twenty ravens estimated removed. Raven counts and egg take observed on 3/16/09, all eggs consumed or gone and very few ravens observed. Re-treated on 3/18/09, 10 ravens observed and 30 egg baits placed. Seven ravens estimated removed. Re-treated on 3/24/09, 20 ravens observed and 25 eggs placed. Five ravens estimated removed.

North Lake Valley

- 1) Tub Peak Hills1 Lek- Pre-treatment raven counts were conducted on 2/19/09. No ravens were observed. First treated on 3/24/09, 5 ravens observed and 11 egg baits placed. Three ravens estimated removed. Re-treated on 4/23/09, more than 100 ravens observed on a nearby farm and 30 eggs placed. Seven ravens estimated removed.

- 2) Tub Peak Hills 2 Lek- Pre-treatment raven counts were conducted on 2/19/09. Ten ravens were observed. First treated on 3/24/09, 10 ravens observed and 20 egg baits placed. Five ravens estimated removed. Re-treated on 4/23/09, more than 100 ravens observed on a nearby farm and 30 eggs placed. Seven ravens estimated removed.
- 3) Tub Peaks Hills 3 Lek- Pre-treatment raven counts were conducted on 2/19/09. Seventeen ravens were observed. First treated on 3/24/09, 7 ravens observed and 9 egg baits placed. Two ravens estimated removed. Re-treated on 4/23/09, more than 100 ravens observed on a nearby farm and 10 eggs placed. Three ravens estimated removed.

With the assistance of NDOW biologist Mike Scott, permission was obtained to place eggs on a farm adjacent to all three Tub Peaks Hills leks. On 4/29/09, 400 ravens were observed and 180 eggs were placed. Forty eight ravens were estimated removed. On 5/1/09 an addition 180 eggs were placed and 45 ravens were estimated removed. On 5/6/09, 90 more eggs were placed and an estimated 25 ravens were removed.

Hamlin Valley

- 1) North Hamlin Well Lek- Pre-treatment raven counts were conducted on 2/19/09. Six ravens were observed. First treated on 4/23/09, 6 ravens observed and 10 eggs placed. Three ravens estimated removed. Re-treated on 5/28/09, 10 ravens observed and 30 eggs placed. Five ravens estimated removed.
- 2) Rosencrans Knolls 1 Lek- Pre-treatment raven counts were conducted on 2/19/09. No ravens were observed. No ravens observed on 4/23/09. On 5/20/09 while conducting coyote control with a helicopter, numerous ravens were observed. On 5/28/09, 30 ravens were observed and 45 eggs were placed. Ten ravens estimated removed.
- 3) Rosencrans Knolls 2 Lek- Pre-treatment raven counts were conducted on 2/19/09. Fourteen ravens were observed. No ravens observed on 4/23/09. On 5/20/09 while conducting coyote control with a helicopter, numerous ravens were observed. On 5/28/09, 30 ravens were observed and 45 eggs were placed. Ten ravens estimated removed.

South Spring Valley

- 1) South Spring Valley 1 Lek- Did not treat this lek after NDOW reported no sage grouse observed.

Cave Valley

- 1) Gardner Ranch Lek- Pre-treatment raven counts were conducted on 3/13/09. Nine ravens were observed. First treated on 3/18/09, 7 ravens observed and 30 egg baits placed. Five ravens estimated removed. Re-treated on 4/14/09, 15 ravens observed and 20 eggs placed. Five ravens estimated removed. Re-treated on 4/21/09, 10 ravens observed and 30 eggs placed. Ten ravens estimated removed. Re-treated on 5/13/09, 20 ravens observed and 45 eggs placed. Fifteen ravens estimated removed.

- 2) Patterson Pass 1 Lek- First treated on 3/18/09, 7 ravens observed and 30 egg baits placed. Ten ravens estimated removed. Re-treated on 4/14/09, 15 ravens observed and 20 eggs placed. Five ravens estimated removed. Re-treated on 4/21/09, 10 ravens observed and 30 eggs placed. Five ravens estimated removed. Re-treated on 4/29/09, 20 ravens observed and 45 eggs placed. Ten ravens estimated removed.

White Rock/Table Mountain

- 1) At the request of NDOW Biologist, both White Rock and Table Mountain areas were treated. Both areas are important sage grouse nesting locations. On 6/23/09, both locations were treated. Seventy five ravens were observed, 150 egg baits were placed and an estimated 60 ravens were removed.

Elko County:

Harris Lek Complex- Treated on 4/9/09, 30 ravens observed and 100 egg baits placed. Twenty five ravens estimated removed

Barry's Lek Complex- Treated on 4/9/09, 50 ravens observed and 100 egg baits placed. Twenty five ravens estimated removed.

West Basin Lek Complex- First treated on 4/9/08, 75 ravens, observed and 100 egg baits placed. Twenty five ravens estimated removed. Re-treated on 6/19/09, 100 ravens observed and 80 egg baits placed. Twenty five ravens estimated removed. Re-treated on 7/2/09, 150 ravens observed (three miles west of the leks), 60 egg baits placed and 20 ravens estimated removed. On several occasions, 400-500 ravens were observed about ten miles east of West Basin Lek Complex but were not treated due to the distance from the leks.

Willow Creek Lek- First treated on 5/15/09, 60 ravens observed and 60 egg baits placed. Twenty five ravens estimated removed. Re-treated on 5/22/09, 20 ravens observed and 40 eggs placed. Ten ravens estimated removed.

St. Johns Lek- First treated on 5/15/09, 45 ravens observed and 40 egg baits placed. Ten ravens estimated removed. Re-treated on 5/22/09, 10 ravens observed and 20 eggs placed. Five ravens estimated removed.

Death Creek Lek- Treated on 6/19/09. Seven ravens observed and 20 eggs placed. Five estimated removed.

Conclusion: FY2009

A total of 2300 treated eggs were placed. An estimated 630 ravens were removed. Both Wildlife Services and NDOW's observations indicated a dramatic reduction in raven numbers in and around the treatment areas. Wildlife Services observations indicate that a 90% or higher reduction in localized raven numbers can be achieved.

FY 2008

A total of 2436 treated eggs were placed. An estimated 925 ravens were removed. Both Wildlife Services and NDOW's observations indicated a dramatic reduction in raven numbers in and around the treatment areas.

Recommendation for FY2009: Continue with Project (21a).

Proposed Budget for FY 2009: WS – estimated \$13,938.

Project 21b: Overton WMA Turkey

Project Inception: 2008

Project Conclusion: Not determined.

Project Area: Overton Wildlife Management Area

Target Predator: Ravens

Predator Control Action: The USDA/APHIS Wildlife Services will remove ravens using DRC-1339.

Control Period: March-June.

Desired Results: Nest success of turkeys should increase from the suppression of ravens.

FY2009 Projected Expenditures: \$2,000.

Conclusion: In the past raven control efforts on Overton and Kirch WMA's have been successful in producing clutches of waterfowl as well as turkeys. After several years of no turkey poult production it was hypothesized that raven predation was the problem. This was based on observations of ravens preying on other nesting birds nest in the WMA. Observational data expressed from WMA management is that production was up after raven reductions.

Recommendation for FY2009: Continue with Project as needed.

Proposed Budget for FY 2009: WS – estimated \$2,323

Project 22: Statewide Deer and Multi Species Enhancement Project

Project Inception: FY 2010

Project Conclusion: Undetermined.

Project Expenditures: WS \$145,187; NDOW \$6,500.

Project Areas: Based on current information in regards to big game species. Areas will be selected on several criteria. Those will include but not be limited to:

1. Mule deer herds below carrying capacity, below long term averages (post-season) for fawn: doe ratios and areas where recruitment is below long term averages (spring).
2. Areas where multi big game species exist.
3. Areas where long term habitat improvements are under way.
4. Areas where recent augmentations or reintroductions are planned.
5. Areas where other big game species are below carrying capacity, under long term averages for adult female: offspring ratios and areas where recruitment is below long term averages.

Areas for Consideration: Specific winter and/or summer ranges in Areas 1, 3, 6, 7, 10, 11, 14, 17, 22, 23, and 24.

This proposal is for the perpetuation of Wildlife Service's aerial hunting program to control predatory animals for game species enhancement. Selective and timely control in designated areas based on aforementioned criteria will focus the effort in critical seasonal ranges. The funding will be applied to either existing, or proposed projects. The timing of the control work will be in accordance with the individual projects criteria, but should occur mainly on critical winter range and summer fawning areas. Wildlife Services will have the ability to utilize the funding for either fixed wing or helicopter services. The proportion of use will be determined project by project.

The funding amount proposed in the 2010 budget is \$145,187 and should annually be in the range of 25% of the overall control work budget. Fixed wing costs are \$175/hour. Helicopter use varies by type of aircraft is estimated between \$600 to \$850/hour plus expenses.

Project 23: Mason Valley Pheasant

Project Inception: 2010

Projected Budget: \$9,872.

Project Description:

This year the Mason Valley Wildlife Management Area has initiated a ring-necked pheasant program incorporating two surrogate incubator boxes designed to raise pheasant chicks for a period of four weeks, at which time they will be released onto the WMA. The action is to augment the existing wild population of ring neck pheasants. A total of 260 birds will be released onto the area this year, with another 260 slated for next year. It is anticipated that a fairly high number of these birds will be lost due to predation.

Target Predators:

Coyotes, raccoons, skunks, badgers, and ravens.

Wildlife Services Field Specialist Position

Projected Budget: \$98,727.

Description:

The position(s) allows the flexibility to adaptively manage the needs of multiple projects. Wildlife Services is authorized to expend up to \$85,000 to facilitate personnel needs to cover ground crew for aerial operations, ground trapping, raven control, and other duties as required.

Project 24: Predation Management Brochure and Public Outreach

Project Inception: FY 2010

Project Expenditures: \$5,000

Proposal:

The predator brochure would provide general information about how to reduce losses to livestock, pets or property by taking actions around the property. It would also provide guidance on who to call for specific problems. The brochure would address the problems associated with lions, bobcats, coyotes, and bears.

The brochure would be reviewed by and shared with other control agencies such as APHIS, and county animal control agencies, and county public safety agencies.

This tri-fold brochure will provide simple and direct answers to the questions we often receive from the public about how to deal with problems with predators. An estimated 20,000 brochures will be printed. The brochure will be promoted through radio and television segments and a press release to print media.

The brochure will be distributed in NDOW lobbies statewide, on the agency web site, and through wardens and staff at outdoor events and conventions. It will also be provided to Chambers of Commerce. A portion of the costs will cover inclusion in Chamber of Commerce mailings, which costs \$1,000.

Video public service announcements (psas) would cover the same information, presented to television stations with a request for free airing. Video production and duplication costs are estimated to cost \$2,500. The video psas would be sent to television stations statewide, and also to local Cable television stations in a ready to use format.

This project is directly related to Commission Policy regarding wildlife and damage control. It is directed by both the NDOW Comprehensive Strategic Plan and the Conservation Education Division Strategic Plan.

Project 25: Proposal for Area 16 Deer/Predator Project

Project Initiation: FY 2010

Project Conclusion: FY 2015-2017

Project Expenditures: Approved for \$25,000 and contingent upon additional funding from other sources.

Project Activities: After initial year when removal efforts are implemented, aerial hunting of the project will be in conjunction with Project 23. The Wildlife Specialist assigned to the project will coordinate removal activities with USU.

Project Criteria: Area 16 is located mostly in Nye County in central Nevada. The fawn ratios in the fall and in the spring have been some of the lower numbers in the State in recent history rarely having spring fawn: adult ratios over 30:100. The Area provides over 300 tags for deer hunters. The Management Area is also provides habitat for elk, bighorn sheep and antelope. The deer herds are not as migratory as many in the State. Unit 162 also contains one of the most important source stocks for Nelson (Desert bighorn sheep in the State.

Impact of coyote removal on mule deer in Nevada

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INTRODUCTION

Mule deer (*Odocoileus hemionus*) populations throughout the western United States have declined in recent decades (Fuller 1988, Ballard et al. 2001, Gill 2001). Factors identified as potential contributors to these declines include severe winters, drought, habitat loss or alteration, competition with elk (*Cervus elephus*), and fawn predation (deVos et al. 2003).

Coyotes (*Canis latrans*) are known predators of mule deer fawns, and there have been numerous observations of confrontations between mule deer and coyotes have been noted (Alldredge and Arthur 1980, Truett 1980, Wenger 1981, Lingle and Pellis 2002). To what extent coyote predation limits mule deer survival or recruitment remains unclear Connolly (1978) reviewed articles addressing the effects of predation on native ungulates. He found 31 studies that indicated predation was a limiting factor, and 27 that did not. He drew no definitive conclusion on the effects of predation on ungulates, although he suggested predation could have an important effect on ungulate numbers if coupled with inclement weather, disease, or habitat change.

Since Connolly's review, coyote populations have increased in many parts of the West following the ban on the use of most toxicants during the 1970s and the reduced hunting and trapping of coyotes after fur prices declined (Nowak 1978, Sterner and Shumake 1978, Hamlin 1997).. Concomitantly, there was a widespread decline in mule deer populations that motivated state wildlife agencies to re-examine factors limiting mule deer populations. Predator control activities in the United States are often

conducted by United States Department of Agriculture's Wildlife Services (WS) primarily to protect livestock from predators, especially coyotes (Conover 2002). There are two different ways that coyote control could influence mule deer densities. The first is that coyote control increases the survival of fawns, causing ungulate populations to grow internally due to higher local recruitment (Teer et al. 1991; Ballard et al. 2001, 2003; Phillips and White 2003). The second is that ungulates try to avoid encounters with predators and will move to areas where such encounters are less common (Altendorf et al. 2001, Ripple and Beschta 2004, Harrington and Conover 2007).

Unfortunately, most studies examining the effects of predator control on native ungulates are conducted over short time periods and conducted in areas < 1,000 km² (Ballard et al. 2001, 2003). To date only 2 large-scale predator control studies have been conducted. Harrington and Conover (2007) conducted a study in Utah and Colorado that encompassed an area >1,900 km². They did not find a relationship between coyote removal and fawn:doe ratios, but found a correlation between the level of coyote removal and densities of pronghorn and mule deer. The other study was conducted by Hurley and Zager (2007) on mule deer in southeast Idaho. They found that coyote removal did not increase fawn or adult survival during winter, and that coyote removal did not increase the population growth rate. Nonetheless, coyote removal increased fawn survival under some conditions and had a positive, but weak, effect on fawn:doe ratios.

There is a clear need to determine why predator control has a positive benefit on mule deer recruitment and densities in some cases but not in others. I propose to study the effectiveness of predator control to enhance deer recruitment and densities over a seven-year period. I will conduct these studies at three different study areas allowing natural variation in weather and range conditions, as well as densities of deer, predator, and alternate prey. Additionally, coyotes will be removed in some areas but not others. One objectives of my research will be to determine if coyotes are decreasing fawn survival. I will also determine under what conditions coyote removal improves fawn survival and deer densities. Finally, results from this research have the potential to help managers decide if and when coyote removal should be used to increase mule deer populations.

Methods

Study area

This study will take place in Management Area 16, specifically 162 or 163, where mule deer populations migrate short distances between their winter and summer range. Populations will be far enough apart that they are independent from each other. Ideally, I will study three deer populations that occupy linear mountain ranges. The area occupied by each population will be divided into two sections so that coyote populations can be controlled in one section but not the other.

This study will take place over seven years and three study areas providing a sample size of 21 site-years. A large sample size is needed to ascertain how variation in weather, range conditions, and alternate prey densities impact the effectiveness of predator removal on mule deer recruitment and densities. My aim is to be able to predict by the end of the study where and under what conditions predator removal has a beneficial effect on mule deer recruitment.

During the first year of the study, there will be no predator removal in any of the study areas so that I can collect pretreatment or base-line data. Starting in the second year, one section of study areas 1 and 2 will be subject to predator removal (Table 1). During the third year, predator control in study area 1 will be switched between the two sections; in study area 2, there will be no predator removal; and in study area 3, one section will receive predator control. This pattern of alternating predator removal and no removal will continue throughout the seven-year study (Table 1).

Coyote removal

USDA Wildlife Services (WS) will conduct coyote control in those study sections and during those years that are scheduled for predator removal (Table 1). Coyotes will be removed during winter using aerial gunning. Coyotes will also be removed using a combination of ground techniques (i.e., trapping, snaring, M-44s, and calling-and-shooting) during spring and early summer while the fawns are still small enough to be vulnerable to coyotes.

Wildlife Services will provide me with the number of coyotes taken, the method of take, and either the coyote's carcass or the GPS coordinates of the carcass so that it can be retrieved. They will also provide me with 3 measurements of their control effort: hours spent aerial gunning, hours spent removing coyotes using ground techniques, and total hours worked (aerial hunting and ground techniques combined) for each section where coyotes were controlled.

I will ascertain for each coyote carcass its cause of death, prior injuries, disease, parasites, age, sex, size, mass, body condition, percent body fat, and reproductive status. I will collect and weight the contents of its digestive system and analyze the contents to determine the coyote's diet.

Coyote surveys

Coyote relative abundance will be estimated for all six section annually using coyote scat surveys (Knowlton, 1984). I will place a 1-km transect along a dirt road within the boundaries of each section. Transects will be walked once in each direction to avoid missing scats and all scats will be collected, counted and frozen. Numbers of scats counted will be standardized by the number of days between surveys and transect length. I will sample all section once every 14 days from June–August. Frozen scats will be dried, weighed, and any hair or feathers within them will be removed and identified to species. These scat data will be used to determine the percent occurrence of different prey species in scat samples.

In all sections, I will conduct an aerial survey of coyotes during the winter. In sections scheduled for predator removal, this count will be made during the same flights used to remove coyotes. Data from these counts in each section will be standardized into coyotes seen per hour searched and coyotes seen per km². I will also record any coyotes observed in the study areas during our year-round activities.

Coyote scat and aerial surveys will provide a measure of relative coyote abundance and how it varies among sections within the same year and within the same section among years. To determine how these measures of relative coyote abundance compare to actual coyote densities, I plan to conduct a classical mark-recapture study in the two sections each year where coyotes are scheduled for removal (Table 1). I intend

to capture live coyotes in the fall using neck snares with deer stops so that the coyotes are held but not strangled (Frey and Conover 2007), and leg-hold traps with tranquilizer tablets to sedate the coyote and a radio transmitter that send a signal when the trap has snapped. Trapped coyotes will be aged, sexed, weighed, tattooed, and checked for injuries; blood also will be drawn. Before being released at the capture site, the coyote will be fitted with a radio-collar so that it can be detected at a distance. During the winter when coyotes are surveyed from the air, all coyotes that are observed or shot in the two removal sections will be checked with a radio receiver to determine if they are wearing a radio collar. All coyote carcasses also will be retrieved and checked for a radio collar or a tattoo to determine if the coyote had earlier been marked. I will determine the density of coyotes in the sections by comparing the number of coyotes that have been marked, the number of coyote carcasses collected, and the proportion of carcasses that were marked.

In all sections, I will search for coyote hunters and ask them to report to me the number of coyotes they have shot or will shoot in any of my study areas, where the coyotes were shot, and how many had a radio collar. I will also ask them for the names and phone numbers of any other people they know that hunt coyotes in the area. I will then contact these potential hunters. Additionally, I will place infra-red video-cameras by ungulate or livestock carcasses in the two removal sections and record the number of coyotes with and without radio collars that visit each carcass over the period of a week.

Radio-collared coyotes will be tracked weekly throughout the year and their position will be determined through triangulation. These data will be used to determine the use of space by coyotes and their home range size.

Ungulate surveys

Ungulate counts will be conducted using the methods of Connolly (1981), Lopez et al. (2004), and Harrington and Conover (2007). Each section will be surveyed once every 2 weeks in from June until October. One transect will be placed in the middle of each section along roads located in areas where ungulates were known to inhabit during the summer and fall. Transect length will vary from 15 to 30 km depending upon availability of roads. Once set, the location of transects will not be changed, and all will be surveyed by the same person to avoid inter-observer biases. Surveys will be conducted using a motor vehicle traveling 25 km/hr during the first two hours after sunrise or the last two hours prior to sunset. All ungulates observed during the surveys will be identified to species, sex, and age (fawn, adult). Surrounding vegetation height, the ungulate's perpendicular distance to the transect and group size will be recorded for all observations. I will estimate fawn survival for each section by calculating fawn:doe ratios from my survey data (Harrington and Conover 2007). Ungulate abundance indices for each site will be calculated as the number of ungulates seen per km of transect. Other observations recorded for each ungulate group sighted include the number of ungulate yearling males, time of day, odometer reading, habitat type, and side of road. I will measure temperature, wind speed, amount of cloud cover, and weather periodically throughout the survey.

I will use the program DISTANCE to model deer detection functions and to estimate mule deer densities (Thomas et al. 2006). Information provided in Buckland et

al. (2001), Buckland et al. (2004), and Thomas et al. (2006) will be used to determine appropriate detection functions during modeling and in the model selection process.

During the deer hunting season (bow, rifle, or muzzle-loader), I will contact hunters by leaving a questionnaire on their parked vehicles, waiting for their return, or visiting them in their camps. I will measure hunter success, number of hours spent hunting in each section, and the numbers of bucks, does, or coyotes they observed. All dead deer shot by hunters and all deer carcasses found will be sexed; weighed; aged; and checked for condition (body fat), any obvious wounds, diseases or parasites. Blood also will be drawn from each deer.

Alternate prey surveys

I will analyze hair samples from coyote scat and the stomach contents of coyote carcasses obtained throughout the year to determine their diet. I will survey all foods that coyotes consume regularly to track their abundance over time. Elsewhere, lagomorphs are the primary prey of coyotes, and I suspect that will also be true for my study sites. I will conduct lagomorphs spotlight surveys using the methods of Calley and Morley (2002). I will drive at 10-20 km/hour along the same transects used for deer surveys. Lagomorph surveys will be conducted two hours after sunset until two hours before sunrise with five nights of the new moon because lagomorphs are more active on dark nights than when the moon is full (Kline 1965, Fafarman and Whyte 1979).

. Whenever I spot a lagomorph, I will record the time, odometer reading, GPS location, and perpendicular distance from the transect. These data will be used to determine abundance indices (lagomorph/km of transect) for each section.

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Budget Detail by Project

Project 6a: Delamar Bighorn Sheep	2009	2010
GSA Vehicle	\$5,000	\$5,000
Dog & Horse	\$4,000	\$4,000
Supplies/Aerial Hunt	\$3,500	\$3,500
Camp Rate	\$2,500	\$2,500
Admin Overhead (16.15%)	\$2,475	\$2,422
TOTAL WS Budget for FY 2010	\$17,475	\$17,422

Project 18: Washoe County Deer Project WILDLIFE SERVICES					
BUDGET ITEM	FY06	FY07	FY08	FY09	FY10
	Actual	Actual	Actual	Projected	Projected
Salary/Benefits	\$12,465	\$16,896	\$50,335	\$54,362	\$57,080
APHIS Vehicle	\$2,813	\$3,801	\$13,925	\$15,039	\$16,000
Camp & ATV Hire	\$1,506	\$1,007	\$8,782	\$9,484	\$9,484
Aerial Hunting	\$4,755	\$5,715	\$9,000	\$10,500	\$10,500
Supplies	\$99	\$85	\$200	\$216	\$500
Administration	\$4,328	\$4,442	\$13,282	\$14,344	\$15,110
TOTAL	\$25,966	\$31,946	\$95,525	\$103,945	\$108,674
NDOW Surveys	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000

Project 20: Virginia Mountains BHS WILDLIFE SERVICES	
YEAR	BUDGET
FY 2010	\$5,000
Administrative Overhead	807
TOTAL WS Budget for FY 2010	\$5,807
NDOW Surveys	\$4,500

Project 21a & b: Raven Control	2010
GSA Vehicle	\$5,000
Salary and Benefits	\$5,000
Supplies	\$3,000
Camp Rate/Per Diem	\$2,000
Admin Overhead	\$2,475
TOTAL WS Budget for FY 2010	\$17,475

Project 22: Multi-Species	2010
Aerial Hunting	\$125,000
Admin Overhead	\$20,187
TOTAL WS Budget for FY 2010	\$145,187
NDOW Surveys	\$6,500

Project 23: Mason Valley Pheasant	2010
Aerial Hunting	\$2,000
Salary	\$6,000
Supplies	\$500
Admin Overhead	\$1,372
TOTAL WS Budget for FY 2010	\$9,872

Project 24: Predator Brochure	\$5,000
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Wildlife Services Specialist	2010
Funding Available for Position(s)	\$85,000
Admin Overhead	\$13,727
TOTAL WS Budget for FY 2010	\$98,727

PREDATION MANAGEMENT PROGRAM BUDGET <i>DRAFT</i> FY 2010				
<i>ESTIMATED July 1, 2009 Beginning Balance</i>				\$632,839
Item	Unit	Day	Cost 2010	TOTALS
Wildlife Services Approved Projects:				
Project 6B - Delamar BHS			\$15,000	
Project 18 - Granite Range Deer			\$93,564	
Project 20 - Virginia Mtns. BHS			\$5,000	
Projects 21a & b Sage Grouse/Upland			\$15,000	
Project 22 Multi Species			\$125,000	
Project 23 Mason Valley			\$8,500	
WS Specialist			\$85,000	
Administrative Overhead (16.15%)			\$56,100	
			\$403,164	\$403,164
Emergency Fund for Emergent Projects:				\$20,000
NDOW Budget: Salary				
	*Productive Hrly Rt.			
Game Bureau Chief	\$62.61	10	\$5,008	
Staff Biologist	\$54.02	145	\$62,663	
Field Biologists	\$48.83	25	\$9,766	
Administrative Assistants	\$35.65	3	\$856	
TOTAL			\$78,293	
Operating				
Additional Flight Surveys	\$21,000			
Project 24 Predator Brochure	\$5,000			
Project 25 Area 6 Predator Study	\$25,000			
				\$51,000
Out-of-State Travel				
Vertebrate Pest Conference 2010				\$1,200
In-State Travel				
Mileage (Vehicle use)	\$0.585	4,500	\$2,633	
Fixed Costs (Uniforms etc.)			\$200	
				NDOW: \$134,166
TOTAL ESTIMATED FY2010 PROGRAM EXPENDITURES:				\$557,330
REVENUE 2009:				
	Fees collected from Tag Applications*:			\$395,502 (projected)
	Donations through Tag Application processes:			\$15,498 (projected)
June 30, 2010 Ending Balance (Carry Forward to FY2011): <i>ESTM.</i>				\$75,509

* Application processes are 2008 Fall Turkey, 2009 Spring Turkey, 2009 Guided Deer, 2009 Main Big Game, 2008 Second Big Game, 2008 first come first serve Big Game, and 2008 and 09 Mountain Lion Tags.

* PRODUCTIVE HOURLY RATE IS A CALCULATION FOR THE COST ASSOCIATED TO FULLY FUND PERSONNEL WHICH INCLUDES SALARY/BENEFITS/LEAVE AND OTHER RELATED EXPENSES.

FY 2009 Expenditures and Estimated FY 2010 Starting Balance	
Starting Balance for FY2009.	\$622,627.00
NDOW Expenditures to date.	-\$71,457.00
WS FY 2009 July-May Expenditures.	-\$329,331.00
<i>Estimated</i> Carry-Forward to FY2010.	\$241,282.00
\$3 Fee Collected in FY2009 for FY2010 to date.	\$395,502.00
Predator Donations Collected in FY2009 for FY2010 to date.	\$15,498.00
Estimated Starting Balance for FY 2010.	\$632,839.00