Nevada Department of Wildlife

A PROGRAM OVERVIEW
NEVADA PREDATOR MANAGEMENT PLAN

A Report to the Nevada Board of Wildlife Commissioners'
WILDLIFE DAMAGE MANAGEMENT COMMITTEE

August 4, 2006
Compiled by
Craig Mortimore
Game Bureau Staff Biologist

DEPARTMENT OF WILDLIFE
Douglas E. Hunt, Acting Director

GAME BUREAU
Russ Mason, PhD, Chief

Nevada Board of Wildlife Commissioners

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FINAL – 8/04/06

A PROGRAM OVERVIEW

NEVADA PREDATION MANAGEMENT PLAN

Prepared by the Nevada Department of Wildlife
Preliminary Report - March 30, 2006

This document has been compiled to provide the reader with a succinct examination of projects conducted through the agency's *Predator Management Plans* beginning in Fiscal Year 2003 (July 1, 2002 – June 30, 2003) through the present time. On August 10, 2002 the Nevada Board of Wildlife Commissioners (Commission) approved the FY2003 *Predator Management Plan*, the first to derive budget support through a fund created by the Nevada State Legislature.

Background

The relationship between predator and prey is consistent throughout nature – it is the most basic of ecological principles. Such relationships are essential to the evolution of species. These inveterate associations contribute to behavioral and physical adaptations that improve the ability for predators to effectively catch and kill prey while simultaneously improving the ability of prey to elude predation. These natural systems can be manipulated through human intervention for the purpose of creating a result that benefits humans. In this regard, predator control has probably been employed as a management tool throughout human history. In ancient through modern times, control measures have been implemented to protect livestock and affect human security. Even more recently, targeted predator control actions have been devised with the intent of protecting imperiled wildlife populations or as an action to increase the production and survival of wildlife species that mankind utilizes for sustenance or recreation.

Beginning in FY2000, the Nevada Department of Wildlife (NDOW) conducted predator control activities though a funding source entirely supported through donations by big game tag applicants. Prior to that predator control projects were funded through any number of non-dedicated budget categories, through cooperation with other agencies, most prominently Wildlife Services (WS), or through donations. During the 71st Session of the Nevada Legislature, Assembly Bill 291 was enacted, creating a funding mechanism generated through a tag application surcharge of three dollars per tag. This fee was first applied to applications for the 2002-03 hunting season, which was within FY2003. This revenue plus donations voluntarily provided by tag applicants are combined to fund projects within the program. The program established four expenditure categories:

1. Programs for the management & control of injurious predatory wildlife.
2. Wildlife management activities relating to the protection of non-predatory game animals, sensitive wildlife species and related wildlife habitat.
3. Conducting research, as needed, to determine successful techniques for managing and controlling predatory wildlife, including studies necessary to ensure effective programs for the management & control of injurious predatory wildlife.
4. Programs for the education of the general public concerning the management & control of predatory wildlife.

Proposed projects to be funded through the current program must be reviewed by the Commission's Wildlife Damage Management Committee (committee), a group comprised of commissioners and sportsmen. The committee reviews all project proposals and forwards its recommendations to the Commission for final approval. These are collectively contained within NDOW's *Predator Management Plan* for the fiscal year. This document summarizes projects implemented from FY2000 through the present. This report appeared in a preliminary version at the Committee's March 30, 2006 meeting.

The success of the Predator Management Program can be found in the title itself. Removal of predatory animals has immediate results, which are often measurable. However these results must be viewed in the context of time. The short-term activity is more correctly termed *predator control*. The relationship is simple and is easily articulated. Remove a predator and that predator's potential prey will not fall victim to the removed animal. However, as explained previously, the ecological relationship between predator and prey is not simplistic. One cannot focus upon individual relationships because the biological system naturally moves toward reestablishing a balance.

Managers understand these relationships and they recognize a need to manipulate natural factors that affect game animals. They do so with the intent of creating a result that benefits people. They also comprehend that successful manipulation is usually achieved over a prolonged period, rather than a single point in time. This is particularly true for many habitat improvement projects. The impact that predation can have within a natural system is highly variable. This factor can be affected by human intervention and when a decision to intervene is concluded, managers have to postulate the period of time necessary to achieve the desired results. It could be a strategic point in time within a single year involving a single treatment, or it could be an action or series of actions that is consistently applied over a long passage of time. Either way, the timely and incisive application of control measures is better termed as *predation management*. This term shall henceforth be applied to the title of NDOW documents relating to actions undertaken to affect predator/prey relationships.

In accomplishing successful predation management, NDOW relies upon partnerships with others to plan, fund and conduct procedures designed to result in a positive project outcome. With limited personnel and narrow margins on how grant money can be spent, NDOW relies upon support among the hunting public, partnerships within the Commission, supporters within the Legislature and colleagues from other agencies in order to perform the functions necessary for effective predation management.

At this juncture, it can be said that the program has enjoyed considerable success in carrying out strategies and fulfilling plan objectives because of these partnerships.

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Project 1: Raven Control to Enhance Sage Grouse Nesting Success

Project Inception: FY2000 - *prior to current funding program*
Project Conclusion: FY2004 (*some activities carried into FY05*)
Project Area: *Treatment Area* – Grassy/Hart Camp are of Washoe County
Control Areas – Sheldon NWR of HU & WA counties, and
Lone Willow area of the Montana Mountains in HU County.
Target Predator: Raven
Predator Control Action: Corvicide-laced chicken eggs were strategically placed within an area occupied by nesting sage grouse so that the aerial predators could detect them. Ravens would ingest the content of these eggs and expire from the toxin. Timing was strategic as well – the bait was distributed prior to the peak of sagegrouse nesting so that the targeted ravens would be eliminated or substantially reduced in number before egg laying. WS personnel also shot ravens when encountered.
Control Period: Mid-March through May
Beneficiary Species: Greater sage grouse.
Desired Result: Increased nest success and chick survival. Measured by NDOW through the analysis of wings collected during the hunting season. Wing feather replacement sequences depict sex and age classes and can reveal whether an adult hen was successful in producing a clutch. Findings between treatment site and control sites were compared in an effort to detect whether raven removal was of value.
Evaluation Period: April through October

Wildlife Services Budget Review:

Table 1.	FY2000	FY2001	FY2002	FY2003	FY2004	TOTALS:
Requested:	$35,903	$47,129	$31,010	$11,038	$11,038	$136,118
Expended:	$25,306	$29,723	$31,274	$8,656	$8,656	$103,615

Summary of Control Activities:

Table 2.	FY2000	FY2001	FY2002	FY2003	FY2004	TOTALS:
Coyote:	92	6	0	0	0	98
Badger:	8	1	0	0	0	9
Bobcat:	3	0	0	0	0	3
Raven:	345	250	194	214	323	1,326
TOTALS:	448	257	194	214	323	1,436

A consumed egg was counted as a dead raven in determining total estimated raven mortality.

Summary of Measured Outcomes:

Table 3. Sagegrouse Wing Classification Results by NDOW & USFWS (Sheldon)

Harvest Year:	**2000**		**2001**		**2002**		**2003**		**2004 (FY05)**	
Juv./Ad.♀:	Σ	ratio	Σ	ratio	Σ	ratio	Σ	ratio	Σ	ratio
Grassy/Hart:	9	--	115	1.24	61	1.04	112	2.26	42	2.40
Sheldon NWR:	165	2.07	182	1.83	134	2.53	191	1.44	230	2.10
Lone Willow:	438	1.91	580	2.06	803	2.19	968	2.38	1,121	3.02
Successful ♀♀:	Σ♀	% of Σ♀	Σ♀	% of Σ♀	Σ♀	% of Σ♀	Σ♀	% of Σ♀	Σ♀	% of Σ♀
Grassy/Hart:	Adult female wings were not classified for nesting success.				24	63%	27	67%	10	10%
Sheldon NWR:					32	ND	68	ND	61	72%
Lone Willow:					214	42%	242	62%	240	35%

Table 4. Observed Raven Density – Ravens/10mile^2					
	March	April	May	June	July*
FY2000	23.1				
FY2001					
FY2002	8.3	4.3	4.0	2.3	4.0
FY2003	8.3	5.3	4.0	5.0	6.0
FY2004	4.6	3.6	4.3	5.6	--

*July is actually in the first month of a fiscal year but the findings are included within the identified fiscal year's results.

Assessment Conclusions:

Year 1 – FY2000

(Fall 1999): NDOW only collected 14 wings. Data inconclusive.

(Spring 2000): WS conducted some control efforts. Combined raven density (ravens/10mile^2) is calculated at 23.1.

Year 2 – FY2001

(Fall 2000): NDOW only collected 9 wings. Data inconclusive.

(Spring 2001): Spring lek attendance data are used to predict an adult population of 800-900 grouse.

Year 3 – FY 2002

(Fall 2001): NDOW implemented a special hunt (75 permits) in the Grassy/Stevens Camp area of Washoe County in order to direct hunter interest into the treatment area. Hunters drawing permits were allowed a daily bag limit of 3 grouse, one greater than most of Nevada's other open hunt areas. A suitable sample of 115 birds was collected in 2001. The juvenile to adult hen ratio in the treatment area was significantly lower than the same ratio documented for the two control areas. However, the treatment area ratio was only slightly less than the value for the rest of Washoe County (*not shown in table 3*). NDOW does not classify the adult female wings to determine the percentage that were successful in hatching broods.

(Spring 2002) WS conducted raven transects from spring to mid summer during this report period. Results are identified in Table 4. They conclude that results are similar to the survey findings of the previous two years but considerably less than the FY2000 pretreatment survey result of 23.1 ravens/mile^2 observed in the spring through summer of 2000. The findings imply that the treatment is effective in suppressing raven numbers.

Spring lek attendance data are used to predict an adult population of 500-600, less than the previous year of 800-900. This is believed to be attributable to the dismal production inferred by the composition of the fall 2001 harvest. After two years of this project, biologists conclude that sagegrouse production rates continue to remain low and the population levels are showing a downward trend.

Year 4 – FY2003

(Fall 2002): Only 61 wings were collected within the special hunt area in the fall of 2002. Although the sample was disappointing, it did yield statistically reliable production data. Production in the treatment area declined from the previous year while the two control areas exhibited increases in the chick/hen ratio. The control area's chick ratio of 1.04 was significantly lower than the control areas and slightly lower than the remainder of Washoe County (1.61). This was the first year that NDOW/WS biologists keyed adult hen wings for nest

success. Of 24 wings examined out of the treatment area sample, almost two-thirds indicated feather replacement patterns indicative of a hen that devoted energy toward brood rearing. Unsuccessful hens can devote more energy to the molt and thus have different molt patterns. Sheldon wings were not keyed for successful hens. In the Lone Willow control area, the sample size was very good. The data demonstrate that 42% of hens were successful. A general, though unconfirmed, supposition is that raven suppression contributed to a greater nest success. This would be particularly significant if the Grassy/Stevens population was larger. However, because the treatment area had a very low chick ratio, it implies that *some other factor* is affecting chick survival and thus recruitment.

(Spring 2003): WS calculates total ravens removed through poisoned eggs and shooting amount to 214. WS conducted raven transects from spring to mid summer during this report period. Results are identified in Table 4. There is reference that these survey results are similar to survey findings of the previous two years. Again, the findings imply that the treatment is effective in suppressing raven numbers.

Spring lek attendance data contribute to the calculation of an adult population of only 500-700, again most profoundly affected by poor recruitment. Now after three years, biologists feel more confident that **raven control aids in sage grouse nest success**, but continued low recruitment suggests that other problems exist in the area. **Future research needs to be focused on factors effecting chick *survival* since this control project is not designed to examine these other extrinsic factors.**

Year 5 – FY2004

(Fall 2003): The special hunt was again held in the Grassy/Stevens treatment area, using the same permit and bag limit parameters established for the previous two years. The wing sample was doubled compared to the previous years. This year's chick ratio is much improved and exceeds the adjacent Sheldon figure while being similar to the other control area in Lone Willow. Again, two-thirds of the examined hen wings showed feather replacement patterns indicative of a hen that successfully hatched a brood. **The results of the study thus far indicate that ravens can have an effect upon sagegrouse nest success.**

(Spring 2004): WS conducted raven density surveys during the spring and early summer. Their observations demonstrate a decline in spring raven density compared to the previous two years. However, comparative densities for the nesting and brood rearing months have higher values in 2004. This was the final year of control work for this project.

Supplementary: (Fall 2004 – *FY2005*): The 2004 wing sample dropped compared to the previous year's. The chick ratio rose to its highest level since the inception of the study but is not as dynamic as the ratio seen in the Lone Willow control area. Only 10 adult hens were pulled out of the total sample, and thus the sample has little statistical power. Only one of these ten hens was successful.

The results of this study indicate that ravens may have an effect on nesting sage grouse, as nest success levels on the project area were higher ($Z_c = 2.69$, $0.0025 < P < 0.005$) than the rest of Washoe County during the years when data was or could be collected. However, of the five years this project was operational, only two years of usable data were available.

During the first year of the project a communication error resulted in several key sage grouse predators being removed rather than just ravens. This was problematic due to the fact that with several species being removed from the project area there was no way to isolate which if any had an effect on sage grouse nesting success. The second year of the project no nest success data was collected, rendering that years results non-existent. The third and fourth years resulted in the data presented above and show significant increases in the nesting success of sage grouse under a raven control program on this unit. The final year resulted in an inadequate sample size so that collected data was unusable.

The recruitment of new grouse into the population was not a factor of this study. *No action was taken to have any effect on sage grouse survival beyond hatching*. The intent was to determine if ravens affected nest success. No part of this study has an effect on chick survival once they have left the nest. However, because sage grouse are a species of interest to the Department, chick/ hen ratios were tracked to help aid in determining recruitment rates. The data from this project neither confirms nor refutes the possibility that raven control can effect recruitment into the population.

This project should serve as one piece of a very large and complex puzzle on the perpetuation of sage grouse in the west. This project demonstrated that nest success can be increased but without the addition of other management efforts (e.g., habitat restoration, predator control after hatch) sage grouse population are unlikely to respond with significant increases.

PROJECT COMPLETED

Project 2: Predator Management to Enhance Sharp-tailed Grouse Reintroduction Success

Project Inception: FY2000 - *prior to current funding program*

Project Conclusion: FY2004 ***Discontinued after FY2003***

Project Area: Snake Range of Elko County -control and treatment areas in the same locale (175 mi^2).

Target Predators: Raven, coyote

Predator Control Action: Corvicide-laced chicken eggs were strategically placed within an area occupied by nesting grouse so that the aerial predators could detect them. Ravens would ingest the content of these eggs and expire from the toxin. Control activities were invoked prior to the peak of grouse nesting so that the targeted predators would be eliminated or substantially reduced in number before egg laying. Remove coyotes through aerial gunning and ground control.

Control Period: Early March through June

Beneficiary Species: Columbia Sharp-tailed grouse.

Desired Result: Support a successful reintroduction of Sharp-tailed grouse. Increased nest success and chick survival. Measured by on site researchers under the guidance of Pete Coates, Idaho State University. A sustained predator management effort - the reduction in raven and coyote densities - may enhance establishment of sharp-tailed grouse to this area.

Table 1. Sharp-tailed Grouse Releases in the Snake Range, Elko County

	2000	2001	2002	**TOTALS:**
Males Released	41 (21)	36 (13)	14 (11)	**91**
Females Released	26 (25)	22 (20)	5 (5)	**53**
TOTALS:	**67**	**58**	**19**	**144**

(Figures in parentheses represent radio-tagged individuals within the complement.)

Evaluation Period: March through June

Wildlife Services Budget Review: (includes a WS position)

Table 2.	FY2000	FY2001	FY2002	FY2003	FY2004	TOTALS:
Requested:	$26,804	$38,479	$34,010	$17,832	discontinued	**$117,125**
Expended:	$21,703	$33,135	$31,419	$13,391		**$99,638**

Summary of Control Activities:

Table 3.	FY2000	FY2001	FY2002	FY2003	**TOTALS:**
Raven:	454	470	370	378	**1672**
Coyote:	130	102	38	13	**283**
Badger:	2	0	1	5	**8**
TOTALS:	**586**	**572**	**409**	**396**	**1,963**

Summary of Measured Outcome:

Table 4. Nesting Status of Females Inside & Outside Control Area						
	Total Nests	Nest Predation	Hatched	Abandoned	**Predation %**	Nesting Success
Inside Control Area	6	2	2	2	**33.3%**	33.3%
Outside Control	*8*	*3*	*3*	*2*	***37.5%***	*37.5%*
2000 Annual Total	14	5	5	4	**35.7%**	35.7%
Inside Control Area	11	7	3	1	**63.6%**	27.3%
Outside Control	*1*	*0*	*1*	*0*	***0%***	*100%*
2001 Annual Total	12	7	4	1	**58.3%**	33.3%
Inside Control Area	4	1	3	0	**25%**	75%
Outside Control	*0*	*0*	*0*	*0*	***0%***	*0%*
2002 Annual Total	4	1	3	0	**25%**	75%
TOTALS:	**30**	**13**	**12**	**5**	**43%**	**40%**

Table 5. Located Sharp-tailed Grouse Mortalities – Indicated Predators								
		April	May	June	July	Aug.	Sept.	**TOTALS**
2001	Terrestrial*	4	6	1	2	2	0	**15**
	Raptor	0	4	1	0	1	1	**7**
	Unknown	2	2	0	1	1	1	**7**
	TOTALS:	**6**	**12**	**2**	**3**	**4**	**2**	**29**

*terrestrial indications may have been scavenged and not responsible for the kill

Table 6. Observed Raven Density – Ravens/10mile^2					
	March	April	May	June	July*
FY2000	36.7 pretreatment				
FY2001					
FY2002	2.3	4.0	1.0	1.6	3.0
FY2003	8.0	2.5	6.0	1.0	0.05

Table 7. Coyote Scent Post Station Results – Coyotes/Station					
	March	April	May	June	July*
FY2000	0.16	*pretreatment*			
FY2001					
FY2002	0.05	0.08	0.02	0.03	0.06
FY2003	0.13	0.07	0.07	0.03	0.04

*July is actually in the first month of a fiscal year but the findings are included within the identified fiscal year's results

Assessment Conclusions:

Year 1

(Spring 2001): Data within Table 4 indicate that nest success in both treatment and control areas was similar. Most nest depredations are attributed to corvids. Predation (table 5) is principally attributed to terrestrial predators in the spring.

Year 2

(Spring 2002): Nineteen sharp-tailed grouse were captured in Idaho and translocated to the site. Only a few hens nested but only one nest was predated. At this point in the study (3 years) 30 nests of radio-instrumented hens have been located. Twelve have hatched (40%), 13 were

predated (43%) and five were abandoned (17%). Researchers conclude at this point in the study that grouse favor nest site selection within the control area.

WS raven density survey findings are reported in Table 6. The 2002 results are similar to findings are considerably less than the pretreatment value of 36.7ravens/10mi^2 indicating that raven numbers were suppressed by the treatment. WS concludes that ravens are being suppressed on the sharp-tailed grouse nesting areas.

Pretreatment scent station data, collected in March 2000, resulted in the detection of 0.16 coyotes per station. WS concludes that coyote densities within the unit during the critical nesting period were suppressed by the treatment. WS concludes that coyotes are being suppressed during the sharp-tailed grouse critical nesting period.

Year 3

(Spring 2003): Researchers conducting sagegrouse research in the area indicate seeing sharp-tailed grouse on seven different occasions during the lekking period. These people described other evidence of active lekking. The researchers also were monitoring three sagegrouse nests within the treatment area – two were successful and one was abandoned.

After three years of project, the study has documented 30 total sharp-tailed grouse nests by following radio-instrumented hens (table 4).

Concluding Analysis

Nest site selection by sharp-tailed grouse the first year (2000) showed no difference ($\chi^2 = 0.29$, $P = 0.05$) between inside the control area and outside. In subsequent years (2001, 2002) nest site selection was highly in favor of inside the control area ($\chi^2 = 12.25$, $P < 0.001$).

An analysis of the production of sharp-tailed grouse on the project area from the period of 2000 through 2003 resulted in the following; during the spring of 2000, twenty-six females were released. Monitoring of radio-tagged hens (n=25) indicated that 56% of all hens nested; of those, 35.7% nested successfully. A total of 5 nests successfully produced chicks. Mitchell and Openshaw[1] indicate the average productivity of sharp-tailed grouse in Utah is 5 chicks per nest. Five successful nests with 5 chicks gives a production prediction of 25 chicks being hatched. Approximately half are females, so we predict 13 new hens are in the population. Hays et. al[2] report that the average survival of sharp-tailed grouse chicks is 59%, so we anticipate that 7 of the female chicks survive to the next breeding season. Hays et. al[2] also reports that adult breeding hen survival ranges from 24 - 40%, meaning that between 7 - 10 of the originally released hens survived to the next breeding season. Taking an average of adult hens and including 7 female chicks which survived, we predict 16 hens carrying over to 2001. In 2001, twenty-two additional hens were released. Combined with the carry over of 16 hens from the previous year, there is predicted to be 38 hens in the population.

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[1] Mitchell D., and J. Openshaw. 2002. Columbian sharp-tailed grouse, Wildlife Notebook Series No. 17. Utah Division of Wildlife Resources. Salt Lake City

[2] Hays, D. W., M. J. Tirhi, and D. W. Stinson. 1998. Washington state status report for the sharp-tailed grouse. Wash. Dept. Fish and Wildl., Olympia. 57 pp.

Monitoring radio-tagged hens (n=20) during 2001, resulted in observed nest rates of 60% while nest success was 33.3%. Following the same predictor model as the previous year, we have 11 hen chicks and 12 adult hens survive to the next year. Following this same model for the entirety of the project, we conclude that from the years 2000 - 2003, 137 total chicks have been produced. Of those, 40 females and 41 males survived and entered the breeding population.

This project was not funded for Fiscal Year 2004 and will therefore end, with no further work being done under the predator management program.

Without continued efforts in both predator control and sharp-tailed release efforts, it is predicted that this species will again become extirpated in Nevada within the next 4-5 years.

Project 3: Coyote Control to Enhance Pronghorn Re-establishment Success in Ione Valley

Project Inception: June 2000 (within FY2000)
Project Conclusion: Spring 2002 (within FY2002) ***Discontinued***
Project Area: Ione Valley, Nye County
Target Predator: Coyote
Predator Control Action: Remove coyotes through aerial gunning and ground control.
Control Period: February through June
Beneficiary Species: Pronghorn.
Desired Result: Reduce fawn predation in order to enhance initial years' production to support re-establishment effort. Target ratio is 30 fawns/100 adult does. Fawn ratios to be measured by NDOW.
Evaluation Period: February through June

Wildlife Services Budget Review:

Table 1.	FY2000	FY2001	FY2002	**TOTALS:**
Requested:	$27,348	$9,266	$17,210	**$53,824**
Expended:	$12,218	$19,056	$15,654	**$46,928**

Summary of Control Activities:

Table 2. Summary of coyotes removed.			
FY2000	FY2001	FY2002	**TOTALS:**
124	33	23	**180**

Summary of Measured Outcomes:
Of six pronghorn surveys conducted between July 2000 and July 2002 none yielded what would be considered reliable sample complements. The largest sample, collected on the last flight in July 2002, was of 44 animals comprised of eight bucks, 23 does and 13 fawns, for a BDF of 35/100/56. This follows releases amounting to 144 animals.

Assessment Conclusions:
Biologists concluded that the pronghorn did not develop a fidelity for the release area – they were not consistently present during birthing and fawn raising period of the years that monitoring was conducted.

The decision in 2002 was to discontinue predator control activities.

Project 4: Coyote Control to Enhance Pronghorn Fawn Production: Vya – Massacre Area of Northern Washoe County

Project Inception: FY2000
Project Conclusion: FY2003
Project Area: Unit 011, Washoe County
Target Predator: Coyote
Predator Control Action: Remove coyotes through aerial gunning and ground control.
Control Period: April through June
Beneficiary Species: Pronghorn.
Desired Result: Reduce fawn predation in order to enhance production in game management Unit 011, where observed fawn/adult ratios had been chronically low. NDOW biologists will measure fawn ratios during their annual September post-hunt surveys.
Evaluation Period: September through October

Wildlife Services Budget Review:

Table 1.	FY2000	FY2001	FY2002	FY2003	FY2004	**TOTALS:**
Requested:	$0	$0	$17,770	$18,179	$22,921	**$58,870**
Expended:	$5,400	$20,633	$22,269	$19,337	$15,420	**$83,059**

Summary of Control Activities:

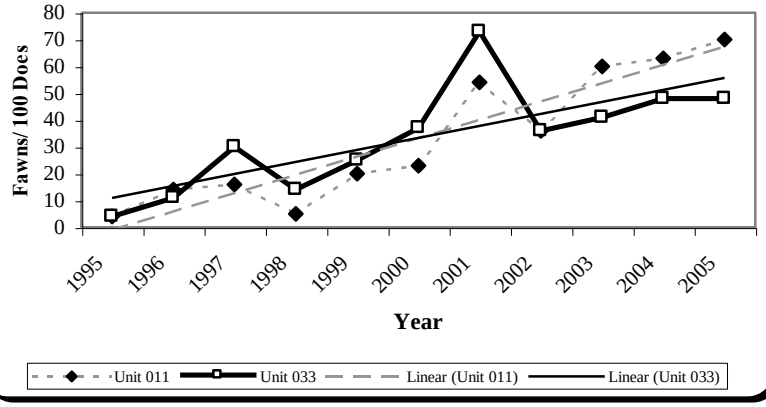
Table 2. Summary of coyotes removed.					
FY2000	FY2001	FY2002	FY2003	FY2004	**TOTALS:**
35	101	89	93*	92	**411**

*includes one cougar

Summary of Measured Outcomes:

NDOW composition surveys are accomplished each year in September. Figure 1 depicts observed fawn ratios in the treatment area (Unit 011–Vya) compared to adjacent Unit 033 (Sheldon), where predator management activities are not conducted.

Figure 1. North Washoe Pronghorn Fawn Production



The two units trend similarly for many of the years depicted in the chart, with the Sheldon fawn ratio generally being greater than the adjacent Vya population. However, separation of values appears to commence in 2003 when observed fawn ratios begin to exceed those for the Sheldon. These latter values contribute to a trend line for Vya that slopes at a higher angle than does the trend for the Sheldon.

Table 3. Pronghorn Production Changes									
		Fawns / 100 Does						Percent Change vs.	
	Unit	1999	2000	2001	2002	2003	20-yr avg.	LTA	Prev. Yr.
Treatment	011	20	23	54	36	60	29.5	103%	66.7%
Control	033	25	37	73	36	41	42.6	-3.5%	13.9%

WS coyote scent post station surveys from March to July resulted in these findings:

Table 4. Coyotes per scent station – Unit 011					
	March	April	May	June	July
2002	0.15	0.05	0.05	0.01	0.02
2003	0.09	0.03	0.03	0.03	0.02
2004	0.08	0.06	0.05	0.03	--

WS concludes that aerial gunning and other removal was successful at suppressing coyote numbers within the treatment area during the critical fawning period.

Assessment Conclusions:
NDOW biologists surmise that the increasing fawn ratios for the two populations are attributable to improving habitat conditions in recent years. Precipitation levels since 2003 have been average or above average while the preceding years were below average. During that time, measured production for other species languished in the midst of near-drought conditions. The recovery is entirely predictable and as previously noted in this report, other species responded similarly.

What is different is that the recovery rate for the two herds becomes disparate beginning in 2003. This could be attributed to proximity to carrying capacity, wherein the Unit 011, having consistently poor recruitment over the years, was further away from range capacity than was the Sheldon population. The phenomenon could also likely be a function of the control effort. It is an ecological maxim that two populations exposed to similar ecological conditions will perform similarly except when one negative extrinsic factor is affected for one of the populations, but not the other. In other words, removal of predation (an extrinsic factor) will result in increased recruitment for the prey species occupying the habitat, where all other factors remain unchanged.

Some interesting hypotheses are emerging from this study and others elsewhere.

1.) Coyote removal has to be sustained for a number of years before the diminished extrinsic factor becomes truly expressed. Some coyotes appear to be more effective as pronghorn fawn predators. The hypothesis suggests that consistent applications of aerial gunning will eventually culminate in the killing of these individual coyotes that retain inherent fawn predation behavior. This behavior is seasonally focused and is the product of previous associations. If there were a method that could discriminate these individuals, it would have a more beneficial effect than random coyote removal would.
2.) Coyotes rearing young have higher nutritional requirements and thus are compelled to obtain more prey for themselves and their young. If there were a method that could discriminate these individuals, it would also have a more beneficial effect than random coyote removal would.

During the analysis of this project it was feared by area biologists managing the North Washoe County area that precipitation could be a confounding issue in this study. Based from that fear the precipitation was added as a factor of consideration in determining effect of predator removal on Game Management Unit (GMU) 011. Further, biologists felt that because of differing precipitation patterns in northern Washoe County, GMU 033 (Sheldon NWR) may not be the best area to use as a control area.

To help alleviate any potential biological noise, additional north Washoe County GMUs were added to the analysis of this project. The results of this project will therefore compare fawn production on GMU 011, which received a treatment of predator removal, and GMUs 013, 014 and 033. All of which will be viewed as control areas that did not receive a treatment. All three control areas are adjacent to and are similar in habitat and topographic features to GMU 011.

A one-way analysis of variance (ANOVA), a statistical method for making simultaneous comparisons between two or more means, was conducted comparing each of the areas with precipitation as a covariate. This test helped determine if precipitation differed between the four GMUs during the time period of the predator control. Results indicate that precipitation did not differ between areas either before or during the project years (2000-2004). ($F=0.37$, $Pr>F=0.8248$).

A mixed model ANOVA was used to analyze fawn production numbers comparing fawn production prior to and during the treatment period (2000-2004). The analysis indicates that control of predators increased the fawn to doe ratio on the control area ($F=12.13$, $Pr>F=0.001$). This analysis used precipitation as a covariate to help eliminate the possibility that annual precipitation could be responsible for any differences. The test ruled out precipitation as a significant factor.

PROJECT COMPLETED

Project 5: Protection of Upland Game Birds & Waterfowl in Moapa Valley

Project Inception: FY2002
Project Conclusion: FY2004
Project Area: Moapa Valley, Clark County – Muddy River Drainage & Apex Dump
Target Predator: Raven
Predator Control Action: Corvicide-laced (DRC-1339) chicken eggs were strategically placed within an area occupied by nesting game birds so that the aerial predators could detect them. Ravens would ingest the content of these eggs and expire from the toxin. Control activities were invoked prior to the peak of game bird nesting so that the targeted predators would be eliminated or substantially reduced in number before egg laying.
Control Period: February through May
Beneficiary Species: Wild Turkey, Gambel's Quail, Pheasant, Waterfowl (various spp)
Desired Result: Improved hatching rates will be demonstrated through observation of more broods and larger average brood sizes.
Evaluation Period: April through October
Wildlife Services Budget Review:

Table 1.	FY2002	FY2003	**TOTALS:**
Requested:	$13,000	$15,552	**$28,552**
Expended:	$13,018	$12,615	**$25,633**

Summary of Control Activities:
2002 - Wildlife Services conducted pre-treatment raven surveys in the area to determine pretreatment and post-treatment densities and to devise a control program that would be most effective given their observations of raven roost areas and travel corridors. Treatment was for a 10-week period, during which WS estimates a total of 494 ravens were removed.
2003 - WS reports that egg placement during a 10-week period in 2003 resulted in the estimated removal of 172 ravens.

Table 2. Observed Raven Density – Ravens/10mile^2				
	March	April	May	June
2002	150	14	13	0.6
2003	14.3	4.0	1.3	1.3

Summary of Measured Outcomes: WS concludes that the treatment was successful in suppressing raven numbers. NDOW did not have pre-treatment figures for brood numbers and total broods with which to compare post-treatment observations.

Table 3. Observed Chicks on Overton WMA								
	Class:	Class I		Class II		Class III		**TOTALS:**
Species:		Σ	Avg brood	Σ	Avg brood	Σ	Avg brood	
Turkey	2002	78	4.9	10	5			**88**
	2003	No specific brood data given						**346**
Quail	2002	10	5	15	7.5			**25**
	2003	No specific brood data given						**242**
Mallard	2002	133	8.3	38	7.6	15	5	**171**
	2003	No specific brood data given						**294**

Assessment Conclusions: No conclusions can be drawn without comparative data.

The decision in 2003 was to discontinue predator control activities.

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

Project Inception: 2002
Project Conclusion:
Project Area: Delamar Range, Lincoln County
Target Predator: Mountain Lion
Predator Control Action: WS hunts lions using dogs.
Control Period: September - March
Beneficiary Species: Desert Bighorn Sheep. Release complements were as follows: 19 in 1997, 25 in 1999, 26 in 2001 and 25 in 2003. Five ewes of the 2001 release were equipped with satellite telemetry collars.
Desired Result: Translocated bighorns can become an established population within this portion of their former range. Reduction of predators should result in improved survival of all age classes. Minimal predation upon mature females contributes to higher total annual production and minimal predation upon the lambs they produce contributes to higher annual recruitment.
Evaluation Period: year-round

Wildlife Services Budget Review:

Table 1.	FY2002	FY2003*	FY2004*	FY2005	**FY2006**	**TOTALS:**
Requested:	$17,000	$840	4mo -$6,528 6mo- $9,792	$9,104	***$9,104***	***$44,001***
Expended:	$17,523	$840	$5,486	$9,104	**$8,222**	**$41,175**

*This budget does not include WS personnel, and indicates expenses related only to fieldwork.

Summary of Control Activities:

Table 2. Summary of Lions Removed.						
2001	2002	2003	2004	2005	**2006**	**TOTALS:**
0	1	0	0	1	**1**	**3**

Summary of Control Activities:
FY 2002 – No lions were removed
FY 2003 – WS removes one large male mountain lion. WS reports that a small lion has moved into the area, but has not established residency, following the removal of the large male tom.
FY 2005 – WS removes one large male mountain lion.
FY 2006 – WS removes one large male mountain lion.

Summary of Measured Outcomes:

Table 3. Summary of Bighorn Surveys in the Delamar Mountains					
Year	Rams	Ram ages	Ewes	Lambs	Total
2002	3	5, 5, 6	15	3	21
2003	7		12	2	21
2004	5		15	5	25
2005	4		23	5	32

Assessment Conclusions:
FY2003 – WS concludes that mountain lion numbers are low in the Delamars, but cautions that due to the vulnerability of bighorn to lion predation, any lion is a threat.

FY2006 – WS specialist works a week long lion surveillance the Delamars. The call box is one of the tools used to detect lions. No lion sign was observed. Following an amendment to the *Biennial Big Game Release Plan for FYs 2006 and 2007*, NDOW plans to release up to 50 bighorns into the Delamar Range in the fall of 2006. A possible proposal for a similar number to be released in the fall of 2007 will be submitted for the next biennial plan. If the latter is approved and the project occurs, then it is anticipated that these large release complements in successive years will contribute to a population that is at a self-sustaining threshold. The continuation of this lion removal project will be supported in the short-term until the threshold level is confirmed.

PROJECT APPROVED TO CONTINUE INTO FY2006

Project 6B: Protection of Desert Bighorn Sheep: East Walker River

Project Inception: FY2002
Project Conclusion: FY2003
Project Area: East Walker River/Pine Grove Hills, Lyon & Mineral Counties
Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Control Period: All year, predominantly in the winter when deer numbers in the area are highest.
Beneficiary Species: Desert Bighorn Sheep. Release complements were as follows: 21 in 1993, 1 ram in 1994, 21 in 1995 and 22 in 2001. Some ewes and at least one ram of each complement were equipped with telemetry collars.
Desired Result: Translocated bighorns can become an established population within this portion of their former range. Reduction of predators should result in improved survival of all age classes. Minimal predation upon mature females contributes to higher total annual production and minimal predation upon the lambs they produce contributes to higher annual recruitment.
Evaluation Period: year-round
Wildlife Services Budget Review:

Table 1.	FY2002	FY2003	**TOTALS:**
Requested:	$17,000	$840	**$17,840**
Expended:	$16,227	$840	**$17,067**

*This budget does not include WS personnel, and indicates expenses related only to fieldwork.

Summary of Control Activities:

Table 2. Summary of lions removed.			
FY2002	FY2003	FY2004	**TOTALS:**
4	3	discontinued	**7**

- 2 lions were removed during pretreatment program.

Table 3. Summary of all Lion Removal Within Unit 204 (Mar. 1, 2001-Feb. 28, 2006)						
	2001-02	2002-03	2003-04	2004-05	2005-06	**TOTALS:**
Sport	0	1	0	1	2	**4**
Depredation	3	2	1	0	0	**6**
Other	1	0	0	0	0	**1**
TOTALS:	**4**	**3**	**1**	**1**	**2**	**11**

Summary of Control Activities:
FY2002 – WS removes two resident lions (ad♂, ad♀) killed in October 2001. These lions were taken during the pre-treatment period. Later, WS catches one very large male with a snare in the treatment area. Another is taken just off the treatment are by an employee of the Flying M Ranch. WS concludes that the lion has been working in and out of the control area, so it is counted.
Summary of Measured Outcomes:
FY2002 – NDOW observes five ewes [2 collared] and five lambs during a July 2002 survey.
FY2003 - NDOW conducts a survey in Aug 2003 – 20 total (3♂[2 yg, 1 older], 11♀, 2L).
Assessment Conclusions: NDOW estimated that 12-15 bighorns existed prior to the 8/01 augmentation (FY2002). A lion killed one of the ewes from this release. One collared ewe was also killed but COD could not be determined. Bighorn sheep carcasses, death attributed to lion predation, had been discovered prior to and during the treatment period. Emigration from the release area had been documented before the treatment period and sightings away from this release site continue. At this point,

biologists believe that lion predation is at least partially responsible for the poor success of previous reintroduction attempts. The original release plan cautioned that lion predation was a principle concern.
FY2003- NDOW pleased to see within the survey sample that some reproduction is occurring.

This project was not funded for FY 2004 and will therefore end with no further work being done under the predator management program. A proposal to resurrect this project within the FY2006 Plan was not funded. WS will continue control work for livestock protection in the area and NDOW has consented to support control activities in the canyon.

Project 7: Bighorn Sheep Establishment Cost Comparison: East Range and Tobin Range

Project Inception: FY2003
Project Conclusion: Project ongoing – work subsequently directed through Projects 11 & 12.
Project Area:

- Treatment Area: southern end of East Range and northern end of Stillwater Range in Pershing County. Area of concentration is habitat north and south of McKinney Pass including Granite Mountain and Root Springs.
- Control Area: southern end of the Tobin Range in Pershing County.

Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Control Period: September - March
Benefit: Results of the analysis will guide NDOW in determining the most cost effective process toward future bighorn reestablishment efforts.
Desired Result: Biologists should be able to compare rates at which reintroduced bighorn sheep populations establish themselves within areas that share common geographic and physiographic attributes. The expectation is that the controlled population will reach a sustainable population level more rapidly.
Evaluation Period: Year-round

Wildlife Services Budget Review: FY2003 budget is$600.

Beginning in FY2004, project expenditures in ensuing years will be reported under Projects 11 & 12

Summary of Control Activities: WS removes three lions total in FY2003 and one in July 2003, which is actually in FY2004.
Assessment Conclusions: Analysis will be by direct associated expenditure on each area and will be reported within Projects 11 & 12. Once populations in each area are determined to have reached sustainability, total costs will be calculated and compared.

Project 7 was not funded for FY2004 and was therefore ended with no further work being done under the predator management program. This project was discontinued due to concern over releasing bighorn sheep into the control area (Tobin Range) without prior removal of large predators. It was felt by the Wildlife Damage Management Commission Committee that release of a valuable resource such as bighorn sheep release stock would not be prudent without prior treatment of the release site.

In FY2005 Projects 11 & 12 were approved which authorized lion removal prior to the release of bighorns in the East Range and Tobin Range – see individual reports for these projects.

Project 8: Wilson Creek-White Rock, Mule Deer Predator/Prey Relationship

Project Inception: FY2003
Project Conclusion: 1 to 5 years
Project Area:

- Treatment Area: management Unit 231, Northeast Lincoln County.
- Control Area: Area 22, Units 221, 222 & 223, Lincoln County.

Target Predator: Coyote & Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Other Action: NDOW will capture 15 deer each from treatment and control areas and fit these with telemetry senders. Monitoring will be conducted weekly.
Control Period: September - March.
Desired Result: Accuracy of deer population estimates depends largely upon accurate assessment of mortality rates.
Evaluation Period: FY2003. In an effort to determine that these conditions exist within the proposed study area, thereby assuring that predator management actions are both warranted and effective, the Department proposes *a one-year evaluation period*. After this evaluation the Department will use information collected to assess a need for protection of mule deer in GMU 231. NDOW will monitor deer population composition, distribution and density during annual spring deer flights. NDOW will also re-evaluate previous years' population models to validate deer population data. If predators are found to be a limiting factor, Wildlife Services, in cooperation with Department of Wildlife, will design a management strategy that will best utilize their resources for the protection of mule deer within the study area.

Budget Review:

Table 1. Project 8 Budget.		FY2003	FY2004	**TOTALS:**
NDOW	Requested:	$44,400	$18,000	**$62,400**
	Expended:	$30,294	$3,551	**$33,845**

Summary of Activities:
FY2003 – NDOW places 30 radio transmitters on mule deer within the study area during the first week of December. Monitoring was completed as follows:

Table 2. Mule Deer Monitoring Results (figures represent live signals heard)			
Survey Date:	**Unit 231**	**Area 22**	**Comments**
Feb 17, 2003	29 found, 25 'live'		4 transmitters had dropped off.
Apr. 21-23, 2003	13	7	Some deer still on winter range in Unit 231. Some deer still on winter range in Area 22. Search cut short by weather.
June 12 & 13, 2003	13	10	Area 22 survey found 5 of the 6 not found in previous survey
Aug. 14 & 15, 2003 [FY04]	11	10	

Summary of Measured Outcomes:
Survey results have been interpreted and biologists have concluded mule deer distribution patterns at least in the time frame prior to inception of predator removal activities associated with Project 14 (the predator removal action phase of this study). See also Assessment Conclusions section.

Table 3. Project 8 Mule Deer Telemetry Monitoring Results

Transmitter Frequency	Capture Location	Recovery Locations				
	December, 2002	February, 2003	April, 2003	June, 2003	August, 2003	October, 2003
160.140	Ely Springs Range	Ely Springs Range	S. end Ely Springs Range	Not Located in June	Ward Mountain	Alive but no waypoint saved
160.040	Muleshoe Valley	Mud Springs	Not found	Horse & Cattle Camp	Horse & Cattle Camp	South Cave Valley
160.060	Meloy Spring	N. of Meloy Spring	NW end Mt. Grafton	S. of Milk Ranch Canyon	Egans	W. of Bullwack Summit
160.070	Muleshoe Valley	SW of Burnt Peak	Not found	Horse & Cattle Camp	Horse & Cattle Camp	South Muleshoe Burn
160.010	Muleshoe Valley	Mud Springs	Not found	South of Basque Canyon	Horse & Cattle Camp	South Muleshoe Burn
160.090	W. of Silver King Pass	N. of Silver King Pass	Not found	S. of Shingle Pass	Horse & Cattle Camp	2 mile east of Jasper Spring
160.100	Ely Springs Range	Ely Springs Range	S. end Ely Springs Range	Big Jacks	Burnt Canyon Area	Camp Valley - N of Pearsons
160.310	Dry Valley	North of Eagle Valley	SW of Cobb Cr.	N. of White Rock Mtn.	Burnt Canyon Area	1 Mile north of Rose Valley
160.080	Ely Springs Range	Ely Springs Range	S. end Ely Springs Range	Upper Pine Creek	Burnt Canyon Area	Not Found
160.180	Dry Valley	E. of Caliente, S. of tracks	Horsetheif Chaining	Ripgut Springs	Burnt Canyon Area	2.5 M's E Bloodstain Ranch
160.190	Dry Valley	North of Dry Valley	Dry Valley	White Rock Mtn.	Burnt Canyon Area	2 M's W of Rose Valley
160.300	Dry Valley	South of 9-mile Rocks	W. of Cobb Cr.	S. of Cobb Cr.	Table Mountain	2 M's E Pioche Honor Camp
160.270	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain	West Table Mountain
160.230	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain	West Table Mountain
160.260	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain	SW Table Mountain
160.200	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain	West Table Mountain
160.210	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain	Table Mountain
160.150	Ely Springs Range	Ely Springs Range	S. end Ely Springs Range	Horse & Cattle Camp	Horse & Cattle Camp	South of Patterson Pass
160.110	Muleshoe Valley	E. of Burnt Peak	Not found	Horse & Cattle Camp	Horse & Cattle Camp	2.5 M's W of Grassy Mountain
160.130	Ely Springs Range	Ely Springs Range	S. end Ely Springs Range	W. side Mt. Wilson	Not found	Not Found
160.020	Meloy Spring	SW end Grassy Mtn.	E. side Mt. Grafton	Not found	Not found	NW Grassy Mountain
160.250	Dry Valley	N. of Oak Springs Summit	Oak Springs Summit	Near Echo Reservoir	Not found	Red Ridges
160.290	Dry Valley	SE of Panaca	Dry Valley	West of Cobb Creek	Little Spring Valley	Near Old Delmue Ranch - Mortality Signal
160.240	Dry Valley	North of Dry Valley	Cobb Cr.	W. of Cobb Cr.	W. of Cobb Cr.	Near Rattlesnake Spring - Mortality Signal
160.120	Muleshoe Valley	Not Found	Not found	Not found	Not found	Not Found
160.220	Dry Valley	S. of Delmue Ranch	W. of 9-mile Rocks	Flatnose Ranch	Not found	↑ SE of Dry Valley - Radio picked up 10/03 - bite marks/ no carcass/ inconclusive cause
160.160	Dry Valley	West of Echo Resv.	↑ Mortality Signals detected – all transmitters found 2/03			
160.170	Dry Valley	North of 9-mile Rocks				
160.030	Ely Springs Range	Ely Springs Range				
160.050	Meloy Spring	SW of Meloy Spring				

Table 4. Deer telemetry study survival rates Dec. 2002 - Dec. 2003								
t		*r*	*d*		S(*t*)			
Period	Month	# at risk	# deaths	# censored	Survival	95% C.I. High	95% C.I. Low	VarS(*t*)
1	Dec	30	0	0	1.0000	1.0000	1.0000	0.0000
2	Jan	30	0	5	1.0000	1.0000	1.0000	0.0000
3	Feb	25	0	0	1.0000	1.0000	1.0000	0.0000
4	Mar	25	0	0	1.0000	1.0000	1.0000	0.0000
5	April	25	0	0	1.0000	1.0000	1.0000	0.0000
6	May	25	0	0	1.0000	1.0000	1.0000	0.0000
7	June	25	1	1	0.9600	0.9745	0.9455	0.0074
8	July	23	0	0	0.9600	0.9751	0.9449	0.0077
9	Aug	23	0	0	0.9600	0.9751	0.9449	0.0077
10	Sept	23	0	0	0.9600	0.9751	0.9449	0.0077
11	Oct	23	2	3	0.8765	0.9153	0.8378	0.0198
12	Nov	18	0	0	0.8765	0.9203	0.8327	0.0224
13	Dec	18	0	0	0.8765	0.9203	0.8327	0.0224

Assessment Conclusions: Transmitters were only viable for approximately 17 months. Data collected through monitoring suggest that deer survival is high. Telemetry locations suggest that some deer movements occurred that were outside of predicted patterns.

MULE DEER TELEMETRY PHASE OF THIS PROJECT ENDS
CONTROL WORK IN THIS AREA IDENTIFIED WITHIN PROJECT 14

Project 9: Predator Control to Protect Waterfowl Nesting on Key Pittman WMA

Project Inception: FY2003
Project Conclusion: FY2003 (not renewed)
Project Area: Key Pittman Wildlife Management Area, Lincoln County
Target Predators: Raven & Coyote
Predator Control Action: Corvicide-laced (DRC-1339) chicken eggs were strategically placed within an area occupied by nesting game birds so that the aerial predators could detect them. Ravens would ingest the content of these eggs and expire from the toxin. Control activities were invoked prior to the peak of game bird nesting so that the targeted predators would be eliminated or substantially reduced in number before egg laying.
Control Period: February through June
Desired Result: Improved waterfowl nest hatching rates. Improved brood survival. Increased recruitment. Success will be indicated by an increase in waterfowl production on the area.
Evaluation Period: March through July. NDOW will monitor production through annual pair counts and annual production surveys.

Wildlife Services Budget Review:

Table 1.	FY2003	FY2003
Requested:	$2,040	discontinued
Expended:	$2,040	

Summary of Control Activities: WS estimates the removal of 42 ravens. Eighteen coyotes were also removed.

Summary of Measured Outcomes:

Table 2. Observed Waterfowl Production – Key Pittman WMA - 2003

Species:	# Broods	# Young	Young / Brood
Canada Geese	18	130	7
Mallard	13	87	7
Gadwall	18	124	7
Pintail	2	9	4
Cinn. Teal	7	38	5
Shovelor	2	13	6
Redhead	41	291	7
Canvasback	5	32	6
Ruddy Duck	23	186	8

Assessment Conclusions: While several species of waterfowl were noted during spring brood counts, analysis of this project was to be determined with brood survey data of Canada goose and mallards only, as these two species have the best historical data for a comparison. Production for both Canada goose and Mallard dropped significantly below both short term and long term production rates for the Key-Pittman WMA. *During the 2002 season Canada goose production resulted in only 2 broods with a total of 5 goslings. Mallard production was non-existent during the 2002 season.* This represented a dramatic drop from long-term averages (Canada goose brood average = 12.5, Canada goose average gosling production = 83; mallard brood average = 3.4, mallard average duckling production = 21). The sudden drop caused concern, which prompted managers to initiate this project.

After the 2003 season, when predator control activities took place on Key-Pittman WMA, a comparison of the number of Canada goose broods during 2003 compared to the long term (1985-2001) average of number of goose broods indicates that there was no difference (χ^2 = 2.65). A comparison of Canada goose gosling production in 2003 compared to the long-term difference (1985-2001) does, however, indicate a significant increase (χ^2 = 26.64, $P < 0.001$) in number of goslings produced in 2003. Similarly, comparing the number of mallard broods in 2003 to the long-term (1985 - 2001) average indicates that there was a significant difference in broods for the 2003 season (χ^2 = 27.11, $P < 0.001$). Duckling production comparisons between 2003 and the long-term (1985-2001) average also indicate a significant increase for 2003 (χ^2 = 207.43, $P < 0.001$).

These results indicate not only a dramatic improvement from the nearly non-existent production of 2002, but also a significant increase over the average production of Key-Pittman over the last 17 years. A correlation analysis between annual precipitation and number of broods produced was conducted with results ($r = 0.400$), indicating a poor correlation. Much of Key-Pittman WMA's water comes in the form of ditch water from local irrigation sources. A correlation between allotted ditch flows and brood production also showed a poor correlation ($r = 0.360$).

Project 9 was not funded for Fiscal Year 2004 and will therefore end with no further work being done under the predator management program.

Project 10: Mormon Mountains, Desert Bighorn Sheep Predator/Prey Relationship

Project Inception: FY 2003
Project Conclusion: FY 2003 (not renewed)
Project Area: Management Unit 271, Southeast Lincoln County.
Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Other Action: NDOW will capture 15 deer each from treatment and control areas and fit these with telemetry transmitters. Monitoring will be conducted weekly. ***Not done.***
Control Period: September - March
Benefit: Results of the analysis will guide NDOW and Wildlife Services in designing management strategies that best utilize their resources for the protection of bighorn in this area.
Evaluation Period: NDOW will monitor bighorn population composition, distribution and density during annual flights.

Wildlife Services Budget Review: WS requested and spent $240 for this project.

Summary of Control Activities: In March 2003, Wildlife Services' personnel inspected the Mormon Mountain area for possible mountain lion activity. A total of two days was spent riding mules into remote locations inspecting mountain lion travel corridors. During the two-day inspection no mountain lion sign was found on the Mormon Mountain Range. Wildlife Services personnel feels that the best period for finding lions or fresh sign would be during the summer months. Because the area has only a few watering locations for big game, desert bighorn sheep would be more restricted in their range and easier targets for lions hunting water holes. Wildlife management actions aimed at mountain Lions would be difficult in this area due to the sporadic nature of lion activity.

Summary of Measured Outcomes: NDOW conducts an aerial survey on September 19 and 20, 2002 - 71 total: 7♂[2,3,3,3,3,3,5]/ 55♀/ 6L. Three bighorn mortalities were also noted on this survey, but no indication was given as to the cause of these losses.

Assessment Conclusions:
Project 10 was not funded for FY2004 and will therefore end with no further work being done under the predator management program.

Project 11: East Range Bighorn Sheep Pre-Augmentation Treatment/ Mule Deer Protection

Project Inception: FY 2004
Project Conclusion: ongoing
Project Area: Southern end of East Range and northern end of Stillwater Range in Pershing County. Area of concentration is habitat north and south of McKinney Pass including Granite Mountain and Root Springs.
Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Control Period: October - May
Benefit: Biologists should be able to compare rates at which reintroduced bighorn sheep populations establish themselves within areas that share common geographic and physiographic attributes. The expectation is that the controlled population will reach a sustainable population level more rapidly.
Desired Result: Results of the analysis will guide NDOW and Wildlife Services in designing management strategies that best utilize their resources for the protection of bighorn in this area.
Evaluation Period: NDOW will monitor bighorn population composition, distribution and density during annual flights.

Wildlife Services Budget Review: *Priced jointly with Project 12*

Table 1. FY2004 Project 11 Expenditure Only		
Funding Source:	Requested	Expended
Predator Program:	$12,500[(1)]	$1,162
Other source:	$18,000[(2)]	

[(1)]This budget summary includes a WS personnel position
[(2)]This project is priced in conjunction with Project 12, Tobin Range bighorn sheep augmentation treatment. This project is being funded for 4 months, up to $12,500 from the Predator Management budget, the remaining 2 months of the project equaling $5,500 will be secured through private contribution to the project.

Table 2. Summary of all Lion Removal Within Unit 182 (Mar. 1, 2001-Feb. 28, 2006)						
	2001-02	2002-03	2003-04	2004-05	2005-06	**TOTALS:**
Sport	0	1	0	0	0	**1**
Depredation	0	0	2	0	0	**2**
Other	0	0	0	0	0	**0**
TOTALS:	**0**	**1**	**2**	**0**	**0**	**3**

Summary of Control Activities: No data is provided within the reports other than to state that three lions were removed.

Summary of Measured Outcomes: NDOW released 23 bighorns into the East Range on October 31, 2003. Five were radio-tagged to aid in monitoring.

Assessment Conclusions: Assessment will be ongoing, but there will be no further predator control work.

NO FURTHER BUDGETED EXPENDITURES BEYOND FY2004

Project 12: Tobin Range Bighorn Sheep Pre-Augmentation Treatment/ Mule Deer Protection

Project Inception: FY 2004
Project Conclusion: ongoing
Project Area: Southern end of the Tobin Range in Pershing County.
Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Control Period: October - January
Benefit: Biologists should be able to compare rates at which reintroduced bighorn sheep populations establish themselves within areas that share common geographic and physiographic attributes. The expectation is that the controlled population will reach a sustainable population level more rapidly.
Desired Result: No loss of bighorn sheep from predation will equate to successful protection.
Evaluation Period: NDOW will monitor bighorn population composition, distribution and density during annual flights.

Wildlife Services Budget Review: Priced jointly with Project 11. Total FY2004 expenditure in this treatment area amounted to $11,446.

Summary of Control Activities: No data is provided within the reports other than to state that one lion was removed.

Summary of Measured Outcomes: NDOW released 22 bighorns into the Tobin Range on October 30, 2003. Seven were radio-tagged to aid in monitoring. Table 2 (following page) describes the extent of monitoring to this date.

Table 1 depicts the mountain lion harvest that has occurred

Table 1. Summary of all Lion Removal Within Unit 045 (Mar. 1, 2001-Feb. 28, 2006)

	2001-02	2002-03	2003-04	2004-05	2005-06	**TOTALS:**
Sport	0	0	0	1	1	**2**
Depredation	0	0	1	0	0	**1**
Other	0	0	0	0	0	**0**
TOTALS:	**0**	**0**	**1**	**1**	**0**	**3**

Assessment Conclusions: Assessment will be ongoing, but there will be no further predator control work. Thus far, there have been no detected bighorn sheep mortalities attributed to lion predation.

NO FURTHER BUDGETED EXPENDITURES BEYOND FY2004

Table 1. Tobin Range Bighorn Sheep Monitoring

Date	Note	Composition				R/100E/L	Collars Detected			
		Rams		Ewes	Lambs		Live		Mortality	
		#	Ages	#	#		♂	♀	♂	♀
10/30/03	Release of 22 - *source Toquima Range*	3	1.5, 2.5, 1.5	17	2	18 / 100 / 12		8		
11/2/03	ewe w/ freq 159.710 found dead along #102 & 103									1
11/7/03	helicopter telemetry			6				6		
12/1/03	fixed wing telemetry			5				5		
01/26/04	fixed wing telemetry (2 of the radios were located in Unit 151 Mt. Moses)			7				7		
03/23/04	helicopter mule deer compositon			3	2	0 / 100 / 67				
06/25/04	fixed wing telemetry (3 of the radios located Mt. Moses w/ 1 mortality)			4		0 / 100 / 0		4		2
07/1/04	ground telemetry ear tag # 101 & 108 rams	2	2, 3	1		200 / 100 / 0		0		
07/5/04	Larry Teske ground telemetry Unit 151 (now 2 mortalities in Mt Moses)									1
07/24/04	sportsman reported ear tag # 101 & 108 rams	2	2, 3	1		200 / 100 / 0				
08/26/04	deer hunters reported observing DBHS on Mt. Moses			4	1	0 / 100 / 25				
09/9/04	helicopter telemetry & composition (2 radio mortalites in Unit 045)			8	3	0 / 100 / 38		1		2
09/24/04	ground telemetry to located mortality signals (found 1 radio in Unit 045)									
10/14/04	ground telemetry (one alive radio in Unit 045 & 1 alive radio in Unit 151)			1				1		
12/3/04	report from Wildlife Services in helicopter (observed 21 bighorns unclassified)									
08/05	deer hunters reported observing DBHS on Mt. Moses	1	N/A	4	1	25 / 100 / 25				
11/3/05	helicopter fall mule deer flights	2	2, 4	5	4	40 / 100 / 80				
01/13/06	BLM-Winnemucca report (ewe lamb group unclassified)	5	N/A	16		31 / 100 / 0				
02/22/06	ground observations (1 ewe w/ green ear tag)	1	3	14		7 / 100 / 0				
03/30/06	ground observations	2	2 , 4	14	2	14 / 100 / 14				

Of the 8 radio ear tags 2 mortalites Unit 151 & 4 mortalites Unit 045, 3 of the mortalites recorded in Unit 045 are thought to be dropped radios not auctual deaths. One radio was recovered and appeared to be dislodged. It appears there was some movement to Unit 151. However, currently the Unit 045 DBHS population is estimated at 30 animals and increasing. Animals are being observed near their release site in Golconda Canyon. Upon last telemetry survey 1 radio ear tag ewe was left in Unit 045 and 1 in Unit 151.

Project 13: Santa Rosa Bighorn Sheep Pre-Augmentation Treatment/ Mule Deer Protection

Project Inception: FY 2004
Project Conclusion: Project is scheduled to run from 4 to 6 months contingent on securing private donations to fund predator control work.
Project Area: Martin Creek Drainage of the Santa Rosa Range in Humboldt County.
Target Predator: Mountain Lion
Predator Control Action: WS to remove lions through hunting with dogs, traps & snares.
Control Period: November - May
Desired Result: No loss of bighorn sheep from predation will equate to successful protection.
Evaluation Period: NDOW will monitor bighorn population composition, distribution and density during annual flights.

Wildlife Services Budget Review:

Table 1.	**FY2004 (1)**
Requested	4 months $20,494 (2) 6 months $30,744 (2)
Expended	Not conducted

(1)This budget includes a WS personnel position.
(2)This project is scheduled for 4 to 6 months and is contingent upon securing a source of private donations.

Summary of Control Activities: No control work occurred since bighorns were not released.

Summary of Measured Outcomes: NDOW did not release into the site.

PROJECT DISCONTINUED
A California bighorn sheep translocation project is scheduled for the autumn of 2006.

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

Project Inception: FY 2004
Project Conclusion: FY 2008 (5 year project)
Project Area: Management Unit 231, Lincoln County.
Target Predator: Coyote
Predator Control Action: WS to remove coyotes through aerial gunning, traps & snares.
Control Period: Control focused upon high elevation fawning grounds during March through August. Control on summer and other habitat will also occur August through February.
Desired Result: Mule deer numbers should increase if fawn survival improves through the removal or diminution of coyote predation.
Evaluation Period: Mule Deer population and fawn production levels from before, during and after the project will be compared to help assess the effectiveness of the project. An age structure analysis will be conducted on coyotes during the course of the project to help determine coyote population dynamics. NDOW to monitor fall fawn ratios. Final evaluation to occur at the end of the project.

Budget Review:

Table 1. Budget Summary for Project 14.

		FY2004	FY2005	FY2006	TOTALS:
Wildlife Services	Requested	$18,060	$13,640	$10,560	**$42,760**
	Expended	$9,774	$12,186	**$9,108**	**$31,068**
NDOW	Requested	$1,500	$500	$500	**$2,500**
	Expended	$214	$0	$0	**$214**

This budget does not include a WS personnel position indicates expenses related to fieldwork

Summary of Control Activities:

Table 2. Summary of Coyotes Removed.

FY2004	FY2005	FY2006	TOTALS:
138	148	**145**	**431**

Summary of Measured Outcomes:

Table 3. Observed Fawn/Adult Ratios for Unit 231 and Adjacent Unit Groups

Survey Type:	Unit Group:	Averages: 85-94	Averages: 95-04	Averages: 99-03	2004	2005	2005 compared to: 2004	2005 compared to: 5yr avg.
Post-season	**231**	43	40	38	43	**68**	+58%	+79%
	221-223	39	37	39	36	43	+19%	+10%
	241-244	47	42	45	--	--	--	--
	114-115	No segregated data.						
Spring *	**231**	37	38	39	34	**62**	+82%	+59%
	221-223	33	35	38	27	54	+100%	+42%
	241-244	42	38	38	38	60	+58%	+58%
	114-115	**		25	22	59	+168%	+136%

* Spring data for the herd year (June-May) is actually collected in the calendar year following the year indicated for the post-season survey
** Unit group separated as a separate population beginning in 1999

Table 4. Calculated Prehunt Adult Mule Deer Population Estimates for Unit 231 and Adjacent Unit Groups						
Unit Group:	**Averages:**			**2004**	**2005**	**2006**
	85-94	**95-04**	**99-03**			
231	3,000	2,300	2,100	2,100	2,200	**2,600**
221-223	--	4,600	4,150	4,000	4,100	**4,600**
241-245	--	1,150	1,100	1,000	700	**750**
114-115	See table 3.		3,450	2,500	2,100	**2,500**

Table 5. Summary of Coyote Age Data								
	FY2004		**FY2005**		**FY2006**		**Average:**	
Number *:	60		68		113		*64*	
Avg. age:	2.9		2.7		Not yet submitted		*2.8*	
	♂	♀	♂	♀	♂	♀	♂	♀
Number:	30	30	33	35	59	55	*32*	*33*
#> 1 yr.	24	23	15	11	--	--	*20*	*17*

*Number of teeth analyzed, not total coyotes controlled

Table 6. Summary of all Lion Removal Within Project 14 and Adjacent Area (Mar. 1, 2001-Feb. 28, 2006)							
Harvest Year	Harvest Type	**Treatment**	**Adjacent Area Comparison**				
		Unit 231	Unit 222	Units 221&223	Units 241-245	Units 114&115	**TOTAL**
2001-02	Sport	**7**	2	4	3	6	**22**
	Depdn.	**4**	0	0	0	0	**4**
	Other	**3**	0	0	2	0	**5**
2002-03	Sport	**6**	2	2	3	2	**15**
	Depdn.	**0**	0	0	1	0	**1**
	Other	**0**	0	0	0	0	**0**
2003-04	Sport	**3**	3	2	2	4	**14**
	Depdn.	**4**	0	0	0	0	**4**
	Other	**0**	0	0	0	0	**0**
2004-05	Sport	**0**	4	1	2	2	**9**
	Depdn.	**0**	0	0	0	1	**1**
	Other	**0**	0	0	0	0	**0**
2005-06	Sport	**5**	2	1	2	4	**14**
	Depdn.	**0**	1	0	1	0	**2**
	Other	**0**	0	0	0	0	**0**
TOTALS:		**32**	14	10	16	19	**91**

Assessment Conclusions:

Coyote Composition: Following the removal of 138 coyotes in the initial year of control activities, another 143 were controlled in the second year of the project followed by 145 through June of 2006. For FY 2005 an examination of the composition of the coyote population,

determined through carcass examination (for sex, N=138 for FY04 and 143 for FY05) and tooth sectioning (for age, N=60 & 68, respectfully), reveals little difference in average age following the initial removal. The proportion of coyotes older than one year did decline in the second year, and a preliminary assumption is that the representation of a few older animals within the total influenced the average age within the second year sample. Examined inversely, considerably more yearling coyotes were taken in the second year. This could infer that coyotes surviving the initial removal effort demonstrated remarkable fecundity within the suddenly less dense circumstances. It will be interesting to evaluate the third year data. The sexes are almost identically represented in both samples. Coyote teeth collected for FY2006 will not be submitted for analysis until early August. Wildlife Services personnel did establish the sex of the 114 animals that were controlled and the sex ratio this year favors males, though not significantly, particularly when compared to the two previous years' ratios. Of this total, 113 samples will be submitted for cementum annuli sectioning.

Mule Deer Composition

2005 Post-season surveys: The fall fawn ratio for Unit 231 was remarkably elevated compared to the previous year and the five-year average preceding 2004, which was the first year of coyote removal. The 2005 post-season survey gathered a good sample comprised of many groups. Biologists observed and recorded unprecedented fawn ratios; the final figure being 87 fawns/100 does (converts to 68/100 adults) for Unit 231. Area 22 yielded ratios that also were improved against the short-term and the pre-2004 five-year-average; however, these increases were less impressive. It is important to mention at this point that the study was somewhat compromised a few years ago when Unit 222, which had originally been a unit within the adjacent control Area 22, was selected for coyote removal under Project 15 (see page 33). Unit 222 supports fawning habitat and the predator management work done there likely resulted in improved initial fawn survival there. However, the post-season survey for Area 22 is not focused on Unit 222, since most does and their fawns migrate out of that unit and mingle with does and fawns in the other units in the Management Area, thus the post-season data for Area 22 is a mixture of treated and controlled sub-populations (sub-populations defined by summer range).

2004 Post-season surveys: In the first year of coyote removal, the 2004 fawn ratios were not statistically different than the preceding average (Table 7). One can infer that two years of removal were necessary to stimulate the desired result. Or one can review the following climatic data and relate habitat improvement to the dramatic improvement in fawn ratios for both Areas 22 & 23. The Department hoped to offer further comparisons against adjacent Area 24 and Unit Group 114&115, but post-season surveys were not conducted in these areas in either 2004 or 2005.

Table 7. 2004 PS Fawns vs. 5 yr avg.

Unit Group	99-03	2004	%chg
231	38	43	+13%
221-223	39	36	-8%

2004 Spring surveys: (gathered in the spring of 2005 – see note for Table 3). Originally spring fawn adult ratios were not considered for analysis. By suggestion of the Committee, spring composition data has been included in this final document. This is fortunate since there are more adjacent areas to compare to. During the first year of coyote removal, spring fawn ratios did not do well compared to the previous year.

Table 8. 2004 Spring Fawns vs. 5 yr avg.

Unit Group	99-03	2004	%chg
231	39	34	-13%
221-223	38	27	-29%
241-244	38	38	--
114-115	25	22	-12%

2004 Spring (con't)

Mortality factors affecting fawns beginning in November and ending in March, when spring surveys occur, can be quite significant and research indicates that nutrition and body condition are more of a factor than predation. It is important to recognize this when attempting to address additional environmental factors when attempting to stimulate improved recruitment rates. Increased standing fawns in October is good, but if their mothers were in poor condition and the fawns themselves are in poor condition, then they will not survive to breeding age the following year.

2005 Spring Surveys: All units exhibited remarkably improved spring fawn ratios, particularly Units 114-115 (the Snake Range). This latter Unit Group has terrain characteristics that support riparian features that are more extensive than the other adjacent areas so it is not surprising that improved precipitation applied across the entire region would result in demonstrably improved fawning habitat here.

Managers recognize that timely application of predation management yields the best results when applied to areas where the deer population is both below carrying capacity and is exhibiting chronic low recruitment. Although one cannot predict precipitation when coyote removal commences, the results are much more obvious concurrent with greatly improved precipitation and the resultant improvement of riparian habitat. It is likely that this occurred here and this postulate is offered again for Project 18 (see page 40)

This study is a five-year project for a reason – it will take a period of time to examine measured responses. If long-term expectations are met, successive coyote removal efforts will result in fewer coyotes taken over time and concomitant improved fawn survival. These observations lend validity to predator control as a management tool. Whether continuous coyote removal is warranted merits discussion. Not withstanding results to this point, annual or semi-annual removal efforts will most likely result in diminished coyotes per successive attempt, possibly to the point that the effort is no longer cost effective. In the wake of successive years of good fawn production and survival/recruitment, the deer population will reach carrying capacity and the influence of predation will be less significant.

Lincoln County Climatic Assessment: According to BLM precipitation data, 26 areas throughout Lincoln County received an average of 136% of the previous 10-year average precipitation between January and December 2005. According to WRCC/DRI, the weather station in Pioche indicates that over 138% of the average annual precipitation was received during 2005. Since January 2006, nearly 3" of precipitation has fallen in Pioche according to WRCC/DRI. Despite a relatively dry fall and winter, range conditions appear to be good. Animals likely went into the winter in better body condition due to favorable range conditions. Moderate to low snow pack and open conditions at lower elevations should result in higher recruitment of young into big game populations. The mild winter appears to have resulted in relatively low fawn loss in mule deer populations. Although the effects of the drought of 2002 are still being felt, back-to-back wet years should result in upward trends to big game populations.

PROJECT APPROVED TO CONTINUE

Project 15: Horse and Cattle Camp Loop, Schell Creek Range Coyote Control to Enhance Mule Deer Fawn Production

Project Inception: FY 2004
Project Conclusion: FY 2008 (5 year project)
Project Area: Management Unit 222, White Pine County. North of Patterson Pass to the northern border of the unit.
Target Predator: Coyote
Predator Control Action: WS to remove coyotes through aerial gunning, traps & snares.
Control Period: Control focused upon high elevation fawning grounds during March through August. Control on summer and other habitat will also occur August through February.
Desired Result: Mule deer numbers should increase if fawn survival improves through the removal or diminution of coyote predation.
Evaluation Period: Mule Deer population and fawn production levels from before, during and after the project will be compared to help assess the effectiveness of the project. An age structure analysis will be conducted on coyotes during the course of the project to help determine coyote population dynamics. NDOW to monitor fall fawn ratios. Final evaluation to occur at the end of the project.

Budget Review:

Table 1. Budget Summary for Project 15.

		FY2004	FY2005	FY2006	TOTALS:
Wildlife Services	Requested	$12,240	$9,600	$8,640	**$30,480**
	Expended	$6,282	$7,398	$5,850	**$13,680**
NDOW	Requested	$1,500	$500	$500	**$2,500**
	Expended	$213	$0	$0	**$213**

This budget does not include a WS personnel position indicates expenses related to fieldwork

Summary of Control Activities:

Table 2. Summary of Coyotes Removed.

FY2004	FY2005	FY2006	TOTALS:
71	84	**86**	**241**

Summary of Measured Outcomes:

Table 3. Observed Post-season and Spring Mule Deer Fawn Ratios for Unit 222 (Alone)

	Averages			2004	2005
	85-94	95-04	99-04		
Post-season	Unit specific fawn ratio data is not available for this unit.				
Spring	45	45	45	47	60

* Spring data for the herd year (June-May) is actually collected in the calendar year following the year indicated for the post-season survey

Biologists are unable to provide post-season fawn ratio data for Unit 222. When the helicopter becomes available for Lincoln County, the population has migrated to winter range, most of which is not within this unit. A decision to prioritize survey timing for the explicit intent of collecting data for Unit 222 is not warranted because of concerns about interfering with an ongoing elk season. Additionally, and more importantly, realigning the survey schedule to accommodate this unit would have an impact upon survey efforts for the remainder of the state.

Table 4. Summary of Coyote Age Data								
	FY2004		FY2005		FY2006		Average:	
Number *:	39		16		82			
Avg. age:	2.5		1.8		Not yet submitted			
	♂	♀	♂	♀	♂	♀	♂	♀
Number:	18	21	7	9	28	54		
#> 1 yr.	14	9	0	3				

*Number of teeth analyzed, not total coyotes controlled

Table 5. Summary of all Lion Removal Within Project 15 and Adjacent Area. (Mar. 1, 2001-Feb. 28, 2006)

Harvest Year	Harvest Type	Treatment	Adjacent Area Comparison				
		Unit 222	Unit 231	Units 221&223	Units 241-245	Units 114&115	TOTAL
2001-02	Sport	**2**	7	4	3	6	**20**
	Depdn.	**0**	4	0	0	0	**4**
	Other	**0**	3	0	2	0	**5**
2002-03	Sport	**2**	6	2	3	2	**13**
	Depdn.	**0**	0	0	1	0	**1**
	Other	**0**	0	0	0	0	**0**
2003-04	Sport	**3**	3	2	2	4	**11**
	Depdn.	**0**	4	0	0	0	**4**
	Other	**0**	0	0	0	0	**0**
2004-05	Sport	**4**	0	1	2	2	**5**
	Depdn.	**0**	0	0	0	1	**1**
	Other	**0**	0	0	0	0	**0**
2005-06	Sport	**2**	5	1	2	4	**12**
	Depdn.	**1**	0	0	1	0	**1**
	Other	**0**	0	0	0	0	**0**
TOTALS:		**14**	32	10	16	19	**91**

Assessment Conclusions:

March 30, 2006 – Similar to Project 14, Coyote numbers taken in years one and two are fairly similar. In the second year, a full time wildlife specialist was established in the unit. This situation allowed for greater focus on this area's coyote control work.

Coyote composition cannot be inferred from the age class data since the second year sample was quite small. Samples are obtained from recovered coyotes, those taken in traps and snares and those taken from the air and subsequently relocated from the ground. Obtaining canine teeth from coyotes taken from the air is uncommon.

Also similar to Project 14, the post-season fawn ratio dramatically increased in 2005 compared to the previous year and preceding averages. Given similar patterns between these units and adjacent units, a reference to improved habitat conditions in the wake of beneficial precipitation is necessary.

PROJECT APPROVED TO CONTINUE

Project 16: Elko County Sage Grouse

Project Inception: FY2004
Project Conclusion: FY2005
Project Area: Snake Range of Elko County – the approximate size of the treatment area is 175 miles^2.
Target Predator: Raven and coyote.
Predator Control Action: WS strategically placed corvicide-laced (DRC-1339) chicken eggs within an area occupied by nesting sage grouse so that the aerial predators could detect them. Ravens ingest the content of these eggs and expire from the toxin. Timing is strategic as well – the bait is distributed prior to the peak of sagegrouse nesting to target ravens before egg laying.
Control Period: Early March through June.
Other Action: Captured sagegrouse within the treatment area were fitted with radio transmitters. Signal monitoring occurred twice weekly until the onset of nesting. Thereafter, monitoring through the use of miniaturized still photography and videography occurred to assess nest fate. Successful nest hatch at least one egg. Unsuccessful nests are those that are predated or abandoned.
Beneficiary Species: Greater sage grouse.
Desired Result: Increased nest success and chick survival.
Evaluation Period: April through October

Wildlife Services Budget Review:

Table 1.	FY2004	FY2005	**TOTALS:**
Requested:	$12,616	$13,038	**$25,654**
Expended:	$13,319*	$12,030	**$25,169**

***This project was funded by outside sources for 2004; no costs were billed to NDOW.**

Summary of Control Activities:

Table 2. Summary of Ravens Controlled		
FY2004	FY2005	**TOTALS:**
192	234	**426**

Summary of Measured Outcomes:

Table 3. Nesting Status within Project 16						
Year	**Total Nests**	**Nest Predation**	**Hatched**	**Abandoned**	**Predation %**	**Nest Succ. %**
TOTALS:	**24**	**3**	**19**	**2**	**12.5%**	**73.6%**

Table 4. Observed Raven Density – Ravens/10mile^2					
	March	April	May	June	July*
FY2004	8.0	2.5	6.0	1.0	0.05
FY2005	--	7.0	4.3	1.7	--

*July is actually in the first month of a fiscal year but the findings are included within the identified fiscal year's results.

Assessment Conclusions:

Biologists lack direct knowledge of sage grouse nest success prior to raven removal because this project was initiated two years following the onset of raven removal. However, a translocated population of Columbian sharp-tailed grouse was monitored prior to the onset of substantial efforts to remove ravens during 1999-2000. The average nest success of sharp-tailed grouse prior to raven removal was 42%. During the systematic raven removal activities nest success of sharp-tailed grouse was 75%. Raven removal possibly increased nest success of sharp-tailed

grouse. Therefore, it is possible that nest success was greater than the expected value of greater sage grouse in this study due to raven removal activities and may be consistent with a study in Oregon that described increase nest success due to predator removal. Ravens are considered primary predators but the photography did not identify any raven encounters at monitored sage grouse nests. It is possible that raven removal decreased the occurrence of raven depredations.

Further investigation at this site, such as measuring nest success at various distances from the raven removal route, is needed to truly understand the relationship between raven removal and nest success. The findings are preliminary and during 2004-2005 efforts will measure nest success at various distances from the raven removal route to further identify any correlation.

Ground squirrels have been documented as effective sage grouse nest predators. However, we observed the Wyoming and Paiute ground squirrels encounter nests and not depredate any eggs. On one occasion, a Wyoming ground squirrel appeared to bite 3 eggs but did not penetrate the eggshells. Least chipmunk and Northern pocket mouse were observed eating and crushing eggshells following a hatch. Therefore, subsequent scavenges by rodents may result in misidentifying sage grouse nest predators based on egg and nest remains.

Video recording is useful for evaluating the effectiveness of management activities on estimating raven "take." We observed a Wyoming ground squirrel depredate 2 egg baits but not sage grouse eggs. If ground dwelling animals prove to be substantial egg bait predators, then elevated egg platforms may be important to target only corvids. Further egg bait recordings may provide an identification of these predators and an empirical basis for estimating raven "take."

Videography appears to be an effective tool for identifying sage grouse nest predators. Remains of eggshells and nests alone may not be reliable due to biases that we observed associated with identifying predators from egg and nest remains, such as subsequent eggshell scavenging and inter-specific predation patterns.

In conclusion, it is probable that direct raven removal increased sage grouse nest success in NE Nevada. This is consistent with experimental research of raven removal impacts on sage grouse nest success in Oregon. The majority of management plans recommend restoring habitat as a means of minimizing the predator-prey interactions. Due to the time lag between the beginning and completion of restoring sagebrush steppe communities and the rapidly declining rate of sage grouse abundance, it may be important to incorporate raven damage management activities for endangered populations until habitat quality is sufficient at concealing nests from predators.

PROJECT COMPLETED

Project 17: Elko County Deer & Elk

Project Inception: FY 2005
Project Conclusion: FY 2009 (5 year project)
Project Area: South-central Elko County.
Treatment Area: East Humboldt Range - units 101, 105 & 107
Control Area: Ruby Mountains – units 102, 103, 104 & 108
Target Predator: Coyote, Mountain Lion
Predator Control Action: WS to remove coyotes and lions using all practical methodology.
Control Period: Control activities shall be deployed as follows:

Table 1. Predator Control Actions – Project 17.

Unit	Season of Control	Target Species	Protected Species
101	Spring, summer	Mule deer	Coyotes, lions
105	Spring, summer	Elk	Coyotes, lions
105/107	fall, summer	Mule deer	Coyotes, lions

Desired Result: Mule deer numbers should increase if fawn survival improves through the removal or diminution of coyote predation. Elk calf ratios have lagged in this unit. The project can be considered a success if predator removal results in improved recruitment in the Unit 105 elk herd.

Evaluation Period: NDOW shall conduct post-season mule deer aerial surveys and winter aerial elk surveys within the project area each year of the project. Composition of the findings shall reveal fawn and calf survival from parturition to approximately five months old.

Wildlife Services Budget Review:

Table 1.	FY2005	FY2006	**TOTALS:**
Requested:	$45,766	$61,136	**$106,902**
Expended:	$44,923	$50,986	**$95,909**

Summary of Control Activities:

Table 2.	FY2005	FY2006	**TOTALS:**
Coyotes	416	490	**906**
Lions	3	4	**7**

Summary of Measured Outcomes:

Table 3. Observed Fawn/Adult Ratios for Project 17 Treatment & Control Areas

Survey Type:	Unit Group:	1989-1994	1995-2004	2000-2004	2004	2005
Post-season	***101, 105, 107***	*50*	*46*	*44*	*45*	*34*
	102, 103, 104 & 108	50	46	43	40	29
Spring*	***101, 105, 107***	*34*	*33*	*33*	*39*	*28*
	102, 103, 104 & 108	34	36	35	40	30

Table 4. Area 10 Elk Estimates & Survey Findings						
	2001	2002	2003	2004	2005	2006
Pop. Estimate	180	180	170	160	160	250*
Calves/100♀	57	31	26	12	24	25

* The official elk population estimate for this unit group has not been published, as final modeling has not been accomplished. It is noteworthy that because of immigration from an adjoining population this unit group will increase significantly compared to the previous year.

Table 5. Summary of all Lion Removal Within Project 17 and Control Area.
(Mar. 1, 2001-Feb. 28, 2006)

Harvest Year	Harvest Type	Treatment Area				Control Area				
		Unit 101	Unit 105	Unit 107	**Totals:**	Unit 102	Unit 103	Unit 104	Unit 108	**Totals:**
2001-02	Sport	4	0	0	**4**	6	4	2	2	**14**
	Depdn.	0	0	0	**0**	0	2	0	0	**2**
	Other	0	0	0	**0**	0	0	0	0	**0**
2002-03	Sport	0	1	1	**2**	4	1	1	1	**7**
	Depdn.	0	0	0	**0**	0	2	0	0	**2**
	Other	0	0	0	**0**	1	0	0	0	**1**
2003-04	Sport	5	1	0	**6**	7	4	0	0	**11**
	Depdn.	0	0	0	**0**	0	0	0	0	**0**
	Other	0	0	0	**0**	0	0	0	0	**0**
2004-05	Sport	3	1	1	**5**	6	2	0	1	**9**
	Depdn.	1	0	0	**1**	0	2	1	0	**3**
	Other	0	0	1	**1**	0	0	0	0	**0**
2005-06	Sport	2	0	0	**2**	3	2	0	0	**5**
	Depdn.	1	1	1	**3**	0	0	0	0	**0**
	Other	0	0	0	**0**	1	0	0	0	**1**
TOTALS:		16	4	4	**24**	28	19	4	4	**55**

Assessment Conclusions:

1st Year – WS removed an impressive number of coyotes and lions within the treatment area in the first year of the project. A seasonal employee was hired to contribute to control effort efficacy. Project funding was exhausted in July, but work continued into the next FY. Two lions were removed from Spruce Mountain in Unit 105. A lion 'call box' has been utilized to assist in locating & capturing lions. Simply stated, the effort appears to be quite thorough.

2nd Year - Predator control activities again resulted in the removal of many coyotes within FY2006. Total predator removal is impressive on face value, with Wildlife Services removing over 900 animals in just two years. Meanwhile, sport lion harvest has remained high in Area 10 (Table 5), with more than twice the total number of lions removed in the control area versus the treatment area. However, this served as a premise for the study – lion harvest in eastern area 10 was much less than in the remainder of the area and biologists surmised that deer densities played a factor in this regard.

Observed fawn ratios are performing similarly between the treatment and control unit groups. Both exhibited diminished production and recruitment values compared to 2004 observations and compared to the preceding five, ten and fifteen year averages. Performance is remarkably balanced between the two areas. It is unknown whether the fawn ratios represent a density-dependent response since population data has not yet been analyzed as of this report. Compared to Project 18 (Washoe County) fawn ratios, which are much more dynamic, the Area 10 fawn production rates are unimpressive. However, Washoe County fawn ratios are likely attributable to a response in habitat improvement following years of chronic low recruitment. This is a classic density-dependent response.

PROJECTED APPROVED TO CONTINUE THROUGH END OF FY2006

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.
Target Predator: Coyote, Mountain Lion
Predator Control Action: WS to remove coyotes and lions using all practical methodology.
Control Period: Year-round.

Other Action: NDOW will capture 30 mule deer in the area and fit them with radio transmitters. Generally, distribution of the capture complement will be split between opposing slopes of the Granite Range.

Desired Result: Mule deer numbers should increase if fawn survival improves through the removal or diminution of coyote predation. The project can be considered a success if predator removal results in improved recruitment in the Unit 014 deer herd.

Evaluation Period: Post-season deer aerial surveys within the project area shall occur each year of the project. Composition of the findings shall reveal fawn survival from parturition to approximately five months old. NDOW will also annually review climatic and precipitation data compiled by other agencies in an attempt to segregate control activity effects from natural ecological response. Population estimates and fawn production for this herd will be compared to those for other populations within.

Wildlife Services Budget Review:

Table 1. Summary of project 18 Budget.

		FY2005	FY2006	**TOTALS:**
Wildlife Services	Requested:	$28,502	$33,859	**$62,361**
	Expended:	$20,511	**$25,966**	**$46,477**
NDOW	Requested:	$50,000	$19,000	**$69,000**
	Expended:	$33,340		**$33,340**

Summary of Control Activities:

Table 2. Summary of Predators Removed

	FY2005	FY2006	**TOTALS:**
Coyotes	145	**220**	**365**
Lions	2	**2**	**4**

First Year: A full-time Wildlife Specialist with WS began control activities in September 2004 and continued control through January 2005, where after work was accomplished by a seasonal hire. In the spring, control activities were focused upon those areas in the Granites where doe telemetry data suggested the location of fawning sites.

Second Year: Control work continued through Wildlife Services. Control activities included winter range habitat found in Hog Ranch Mountain. Again this year, WS was able to dispatch two lions.

Summary of Other Actions:

First Year (FY2005): 24 mule deer were captured and collared in December 2004. The complement was comprised of ten adult females, five adult males, four juvenile males and four juvenile males. Telemetry monitoring via the NDOW Cessna fixed-wing was accomplished on 2/12 and 3/25 and ground monitoring was accomplished twice in March.

Second Year (FY2006): A ground monitoring effort occurred on July 1, 2005 (1st day of FY2006) and was closely followed by an aerial follow up on July 8th. Again, aerial surveys found all instrumented animals alive. During the 2005 hunting season, one of the marked bucks was legally harvested by a Unit 014 tagholder. Findings thus far indicate that deer movements within the Granite Range are not very extensive. On June 21, 2006 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. These latter instruments were determined to have been located in remote areas and several attempts were made in the early summer to locate them from the ground. The newly acquired UTM locations will help to better 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. Additional ground searches will be conducted over the next two weeks in an effort to locate the two transmitters that are emitting in the mortality mode and determine the cause or reason for the mortality signal.

Summary of Measured Outcomes:

The following table depicts both fawn survival and recruitment rates for the treatment area and surrounding units. Ratios represent the number of observed fawns (approximately five months old in the post-season and 10 months in the spring) compared to the number of observed adult deer. The survival rate of this cohort into the next breeding cycle is high, thus biologists consider these observations as a good index of recruitment, an important factor in determining the pre-hunt adult estimate.

Table 3. Observed Fawn/Adult Ratios for Unit 014 and Adjacent Unit Groups

Survey Type:	Unit Group:	Averages:			2004	2005	2005 compared to:	
		1989-1994	1995-2004	2000-2004			2004	5yr avg.
Post-season	014	30	45	37	38	52	+37%	+41%
	Washoe	31	39	33	56	47	-16%	+42%
	033	25	48	50	56	57	+2%	+14%
Spring*	014	18	36	32	44	65	+48%	+103%
	Washoe	19	31	30	48	60	+25%	+100%
	033	17	37	33	44	58	+32%	+76%

* Spring data for the herd year (June-May) is actually collected in the calendar year following the year indicated for the post-season survey

Table 4. Summary of Coyote Age Data						
	FY2005		FY2006		Average:	
Number *:	57		199			
Avg. age:	1.8		Not yet submitted			
Sex:	♂	♀	♂	♀	♂	♀
Number:	30	27	70	49		
#> 1 yr.	10	8				

Table 5. Comparison of Prehunt Adult Population Estimates Between Treatment (Unit 014) & Control Areas						
	1989-1994	1995-2004	2000-2004	2004	2005	2006
Unit 014	1,603	900	925	850	900	1,000
Balance of N. Washoe*	Unable to segregate			2,300	2,650	2,900
Unit 033	1,450	1,250	1,500	1,300	1,450	1,500

*Estimate for Units 011, 012 & 013 + Nevada's apportionment of the Lassen-Washoe Interstate Herd residing in Unit 015.

Table 6. Summary of all Lion Removal Within Project 18 and Control Area. (Mar. 1, 2001-Feb. 28, 2006)								
Harvest Year	Harvest Type	Treatment	Adjacent Control Area					
		Unit 014	Unit 033	Unit 011	Unit 012	Unit 013	Unit 015	TOTALS:
2001-02	Sport	**3**	No Harvest	1	0	0	2	**3**
	Depdn.	**0**		0	0	0	1	**1**
	Other	**0**		0	0	0	0	**0**
2002-03	Sport	**0**		1	0	2	0	**3**
	Depdn.	**0**		2	0	0	2	**4**
	Other	**0**		0	0	0	0	**0**
2003-04	Sport	**5**		2	1	3	3	**9**
	Depdn.	**0**		1	0	0	0	**1**
	Other	**0**		0	0	0	0	**0**
2004-05	Sport	**1**		0	1	2	1	**4**
	Depdn.	**0**		1	0	3	1	**5**
	Other	**0**		1	0	0	0	**1**
2005-06	Sport	**0**		3	0	2	0	**5**
	Depdn.	**4**		2	0	0	1	**3**
	Other	**0**		0	0	0	0	**0**
	TOTALS:	**13**	0	14	2	12	11	**39**

Depredation harvest includes lions removed through Project 18.

Assessment Conclusions:

General – Deer composition survey samples collected in some of the units may not be adequate to assess individual population productivity or recruitment values. Therefore comparisons of composition data for the Control Area are drawn against these same data for the combined units of northern Washoe County, namely units 011-013, 015 (resident deer only) and 033. Mule deer numbers are still relatively low to moderate when compared with highs experienced in the late

1980's and early 1990's. Mule deer can be much more difficult to locate in the spring and sample sizes have been relatively low in recent years.

Washoe County Climatic Assessment:
During the winter of 2004-05 the hardest hit areas were 014, 015 and 012. Snow depths of 2 to 3 feet were observed in most valley locations in these units for up to two months (similar to what occurred around Reno). The heaviest snow accumulations occurred on the Granite Range in Unit 014 and diminished in depth throughout the surrounding areas relatively proportional to distance from the massif. Unit 033 experienced generally mild conditions that same winter. Pogonip (freezing fog) persisted for two weeks in most of the valleys and precluded snowmelt. Pronghorn were most effected, while mule deer seemed to do very well despite these severe winter conditions.

Habitat throughout Washoe County has benefited from the improved precipitation receipts over the past two years. All basins reported average to above average precipitation in 2005-06. Biologists have made a cursory examination of key vegetation in the treatment and adjacent areas, leading them to anecdotally determine that forage and cover species are in the best condition seen in a long time. The extensive drought period commenced in the early 1990's and lasted through 2003.

1st Year (FY2005) – Project goals have been met thus far with control activities resulting in the removal of a significant number of coyote and two lions. Telemetry follow-up did not occur at the frequency that NDOW had hoped for due to a number of circumstances. However, recovered signals indicated that all the marked animals were all alive into the next fiscal year.

2nd Year (FY2006) – Movement patterns of the 24 marked deer based upon telemetry monitoring by ground and air have been depicted on a map. This roughly describes season range configurations. The data demonstrate that this population does not undergo the long distance migrations common in Nevada and eastern California deer. It can be surmised that some movement is likely attributed to prevailing climatic conditions rather than a traditional passage between distinct summer and winter ranges. During the monitoring period, data demonstrate that survival among the marked deer was very high.

Mule deer demonstrated good recruitment throughout Washoe County and the Sheldon in 2005-06. The strongest observed recruitment was observed in 014 and 015 (65 and 66 fawns per 100 adults respectively) values that were yielded by very good sample sizes. Unit 011 was also strong at 62 fawns but sample sizes were extremely small and the ratio is not statistically valid. Also in 012 a fair sample of 122 deer yielded a ratio of 54. Preliminarily, one can surmise that herd performance is similar throughout the northwest part of Nevada, and that the improvement for Unit 014 is not a stand-alone anomaly. This can be further correlated with the broad-ranging improvement in habitat conditions. This is not unexpected when herbivore populations existing in low density following years of poor recruitment are provided with the conditions necessary to promote vegetative health. Concurrently, species preying upon these herbivores should respond similarly. In this regard, this study benefits from fortuitous timing. It is hoped that an unnatural reduction of predation at a time when prey is naturally responding to improved habitat conditions will result in improved fawn survival between birth and weaning. This should be easily detected.

It is important to avoid snapshot conclusions. With just two years of data gathered in this five-year study it is too early to draw any real conclusions. Mule deer herds need consecutive years of above average recruitment to rebound significantly from the low to moderate population levels that exist today. One cannot discount other factors either. Past wildfires have burned thousands of acres of important mule deer habitat in much of Washoe County, hindering herd recovery.

PROJECT APPROVED TO CONTINUE