

DRAFT
**Environmental Assessment for Limiting Mountain Lion Predation
on Desert Bighorn Sheep
on the Kofa National Wildlife Refuge**

Lead Agency: U.S. Department of the Interior
Fish and Wildlife Service
Kofa National Wildlife Refuge

Cooperating Agencies: Arizona Game and Fish Department
USDA –APHIS Wildlife Services
Bureau of Land Management

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ENVIRONMENTAL ASSESSMENT

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

Introduction

The Kofa National Wildlife Refuge (Refuge) is a unit of the National Wildlife Refuge System (System) and is administered by the United States Fish and Wildlife Service (Service). The Refuge was established in 1939 by Executive Order 8039 which described the legal purpose being “for the conservation and development of natural wildlife resources, and for the protection of public grazing lands and natural forage resources.” The Refuge is managed to fulfill the mission and goals of the System, as well as the specific purpose for which the Refuge was established. The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The conservation of desert bighorn sheep (*Ovis canadensis mexicana*) was the driving factor in the establishment of the Refuge. As such, much of the Refuge management has and continues to focus on the bighorn sheep population.

With the passage of the Arizona Desert Wilderness Act of 1990, most of the Refuge became designated wilderness. That act and the Wilderness Act of 1964 provide general legal guidance for wilderness portions of the Refuge. About 510,000 acres of the Refuge’s 665,400 acres are designated wilderness. For wilderness areas within the System, the purposes of the Wilderness Act are considered to be “within and supplemental” to the purposes for the specific Refuge, i.e., the wilderness purposes are additional purposes for the Refuge and must be considered within the legal context of the applicable wilderness statutes. The preservation of wilderness values, which includes wildlife populations, is an important mandate that is considered in the management of the Refuge.

The Service, together with the Arizona Game and Fish Department (AGFD), conducts wildlife surveys, including desert bighorn sheep surveys. Recent bighorn sheep surveys have shown a decline in their numbers on the refuge and nearby lands. The Service has determined that limiting mountain lion (*Puma concolor*) predation on desert bighorn sheep could benefit desert bighorn sheep populations under certain circumstances. This environmental assessment (EA) analyzes various alternatives to actively manage mountain lion predation on desert bighorn sheep on the Refuge.

1.1 Purpose of the Proposed Action

The purpose of the proposed action is to provide the Service additional options for the management of the Kofa desert bighorn sheep population by allowing the Service to limit predation by mountain lions. This would include the removal of “offending” lions by either lethal means or through translocation. For purposes of this analysis, an offending mountain lion is defined as one that has killed two or more desert bighorn sheep within a six-month period.

1.2 Need for the Proposed Action

The National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd as amended) states, “The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” Executive Order 8039 described the legal purpose to be, amongst other things, “for the conservation and development of natural wildlife resources. The bighorn sheep population on the Refuge is a natural wildlife resource in significant decline and in need of further management. The proposed action needs to be taken in order to meet the requirements of the National Wildlife Refuge System Improvement Act and Executive Order 8039.

Mountain lion predation may be additive to other sources of mortality and sufficient to prevent the Service from attaining bighorn sheep population objectives. Limited removal of individual mountain lions specifically identified as regularly preying on bighorn sheep, whether lethally or through translocation, could help the bighorn sheep population reach objective levels. The option of lethally removing offending mountain lions was identified in the *Investigative Report and Recommendations for the Kofa Bighorn Sheep Herd (Investigative Report)* in April 2007. The *Investigative Report* was jointly produced by the AGFD and the Refuge. The *Investigative Report* can be found on the internet at both the AGFD website (www.azgfd.gov/w_c/bhsheep/index.shtml) and the Service website (www.fws.gov/southwest/refuges/arizona/kofa).

1.3 Location

The proposed action would be conducted by the Service within the boundaries of the Refuge (Figure 1). However, surrounding land and wildlife management agencies [including the Bureau of Land Management (BLM), U.S. Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services (APHIS-WS), and the AGFD] are cooperating agencies in this process, and cooperative management practices could be facilitated at a landscape level. The AGFD’s predation management plan (the *Kofa Mountains Complex Predation Management Plan*) for non-Refuge lands is very similar to the proposed action in this document and AGFD has been implementing that plan on public lands surrounding the Refuge.

The Refuge is geographically part of the Kofa Mountains Complex, which consists of the Plomosa, New Water, Kofa, Little Horn, Tank, and Castle Dome mountain ranges. The Complex forms a contiguous block of bighorn sheep habitat within which there is concern about declining bighorn sheep numbers.

1.4 Cooperating Agencies

Arizona Game and Fish Department. AGFD, acting under the Arizona Game and Fish Commission, and Arizona Revised Statutes Title 17, has trust responsibilities for the protection and management of all wildlife in the state. They have been a cooperator with the Service on the management of the wildlife on the Refuge since the Refuge was established. The Service and

AGFD work jointly to improve wildlife habitat, to support and survey wildlife populations, participate together in research, translocation efforts, and outreach activities for the public.

Bureau of Land Management. The Bureau of Land Management (BLM), Yuma Field Office, manages approximately 1.1 million acres of public land in California and Arizona. The BLM manages public land adjacent to the Refuge, including the New Water Mountains Wilderness. The BLM and the Service jointly produced the *Kofa National Wildlife Refuge and Wilderness and New Water Mountains Wilderness Interagency Management Plan* which was completed in 1997. The public lands that are managed by BLM are set aside for a variety of uses. BLM participates in wildlife management primarily through the improvement of wildlife habitat. As a cooperating agency, BLM has provided input into the preparation of this document.

U.S. Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services. The U.S. Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services (APHIS-WS) has particular expertise in wildlife damage management. They have assisted the Service in the past with attempts to capture mountain lions to fit them with radio collars for tracking. They have provided expertise to the Service concerning the writing of environmental documents.

1.5 Objectives and Scope

The objective and scope of this EA is to analyze possible approaches to managing mountain lion predation on desert bighorn sheep on the Refuge when the bighorn sheep population falls below the desired population level. The current objective for bighorn sheep management is to “maintain an optimal desert bighorn sheep population while providing for maximum viable species diversity” and the transplant goal is to “reestablish bighorn sheep throughout all suitable historic habitat.” The optimal desert bighorn sheep population objective is 800 animals based on historic survey data (USDI 1997). Maintaining this size population is also dependent on a number of population limiting factors, including adequate habitat conditions. It is the intention of the Refuge to manage the bighorn sheep population to support state and regional transplant programs. Predator management, which is not the elimination of predation altogether, is consistent with this objective.

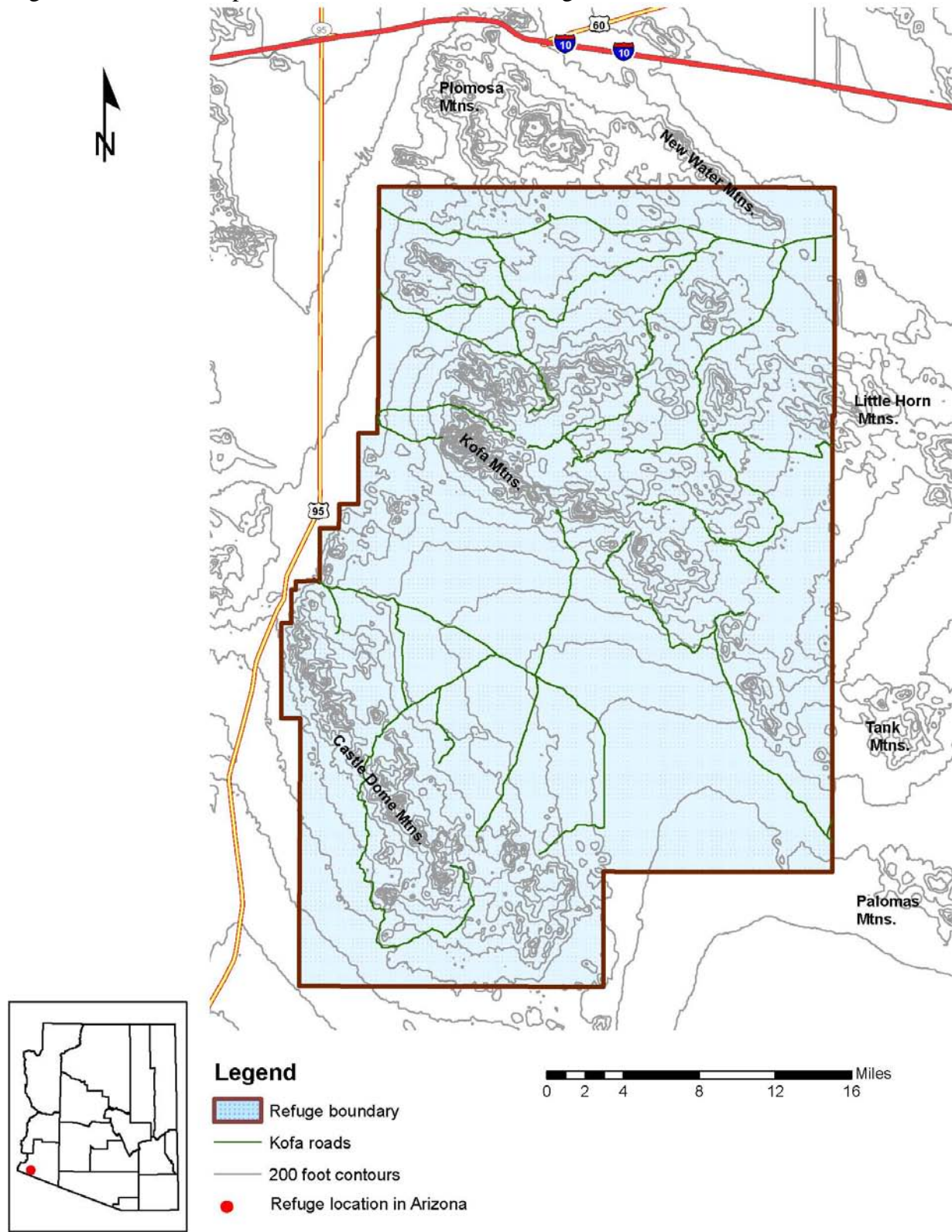
Setting population objectives for one species at very high levels, seemingly at the expense of another species, warrants further discussion as it relates to Service policy. The Service’s Biological Integrity, Diversity, and Environmental Health policy (601 FWS 3) states that each refuge will be managed to fulfill the refuge purpose as well as the Refuge System mission, and we will accomplish this by ensuring that the biological integrity, diversity, and environmental health of the refuge is maintained. Biological integrity, diversity, and environmental health can be described at various landscape scales from refuge to ecosystem, national, and international. Each landscape scale has a measure of these factors dependent on how the existing habitats, ecosystem processes, and wildlife populations have been altered in comparison to historic conditions. Individual refuges can contribute to biological integrity, diversity, and environmental health at larger landscape scales, especially when they support populations and habitats that have been lost at a larger scale. In pursuit of refuge purposes, individual refuges may at times compromise elements of biological integrity, diversity, and environmental health at

the refuge scale in support of those components at a larger landscape scale. When evaluating the appropriate management direction for refuges, the Service considers the refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales.

The bighorn sheep population objectives set for Kofa NWR are an example where management direction was developed in support of landscape level conservation efforts. This is particularly true with regard to objectives meant to support transplant programs across a multi-state area. Service policy states that we manage populations for natural densities and levels of variation, however, on some refuges, including those with purposes tied to particular species, we can establish goals and objectives to maintain densities higher than those that would naturally occur in order to support conservation at multiple scales. Service policy also promotes, when and where practical, the support of reintroduction programs for native species in the context of surrounding landscapes.

The results of this EA will remain applicable until the Service determines that the need for action should be revisited or issues driving this EA change substantially. The need to intensively manage mountain lions will change as bighorn numbers increase and as data from ongoing research projects are analyzed, the results of which will guide future efforts. The Service is scheduled to begin the development of a Comprehensive Conservation Plan (CCP) no later than 2012. That planning process may ultimately revisit this issue, along with other issues and management programs for the Refuge.

Figure 1 – location map of Kofa National Wildlife Refuge



1.6 Relationship of this Environmental Assessment to Other Environmental Documents

Kofa National Wildlife Refuge and Wilderness and New Water Mountains Wilderness Interagency Management Plan, Environmental Assessment, and Decision Record (USDI 1997). This is the Refuge's comprehensive management plan which directs and authorizes management of the Kofa National Wildlife Refuge, including management objectives for bighorn sheep, other wildlife, wilderness, and recreation. Finalized in 1997, this document will be supplanted by the Refuge's CCP which will be developed beginning no later than 2012.

Investigative Report and Recommendations for the Kofa Bighorn Sheep Herd. This document, prepared by AGFD and the Service in 2007, outlines management strategies for the Refuge bighorn sheep population.

Kofa Mountains Complex Predation Management Plan. This document was prepared by the AGFD in 2007 to address predation on bighorn sheep within the Kofa Mountains Complex, including the Kofa, New Water, South Plomosa, Tank, Little Horn, and Castle Dome Mountains.

Arizona Comprehensive Wildlife Conservation Strategy. AGFD prepared a wildlife management strategy in 2006 which guides actions to be conducted in Arizona to conserve wildlife resources.

Minimum Requirements Analysis and National Environmental Policy Act Worksheet for Limiting Mountain Lion Predation on Desert Bighorn Sheep on Kofa National Wildlife Refuge (2009). This document evaluates the impacts of mountain lion capture, tracking, and removal on the wilderness resource (attached as Appendix C).

2.0 BACKGROUND AND RESOURCE ISSUES

2.1 Background

The regional importance of the Kofa desert bighorn sheep population is widely recognized, and has been a source for translocations since 1957. From 1957 through 2006, 569 bighorn sheep were captured on the Refuge and released in new areas to supplement populations in Arizona, New Mexico, Colorado, and Texas. The Refuge bighorn sheep have provided vital population boosts and genetic variety to bighorn sheep herds throughout the southwest. The state status of desert bighorn sheep in New Mexico recently changed from endangered to threatened and the Refuge is the source population of New Mexico's largest herd. After the decline noted in 2006, the translocation program was suspended indefinitely until the population meets translocation guidelines set out in USDI 1997. The suspension includes a pending translocation of additional bighorn sheep to San Andres NWR in southern New Mexico, along with planned transplants in Arizona to the Mineral, Bighorn, and Santa Catalina Mountains among other locations. If the population objectives can be met, translocations can continue, which would provide benefits to bighorn populations over the entire southwestern region, while still maintaining a source population of sheep on the Refuge.

Desert bighorn sheep are the key species of importance on the Refuge, and the goal of many refuge visitors is to see and photograph bighorn sheep. The decline in sheep population has made viewing sheep more difficult. In addition, hunting desert bighorn sheep on the Refuge is a lifelong goal for many individuals, and for those individuals who draw a bighorn sheep tag for the Refuge, the effort to locate trophy rams has become more difficult than in the past. Desert bighorn sheep tags are very limited; they are only issued for 10 to 15 percent of the Class 3 (6 to 8 years old) and Class 4 rams (8 years and older) estimated from the most recent surveys. For the December 2009 hunt, the Arizona Game and Fish Commission has approved 6 desert bighorn sheep tags for the Refuge.

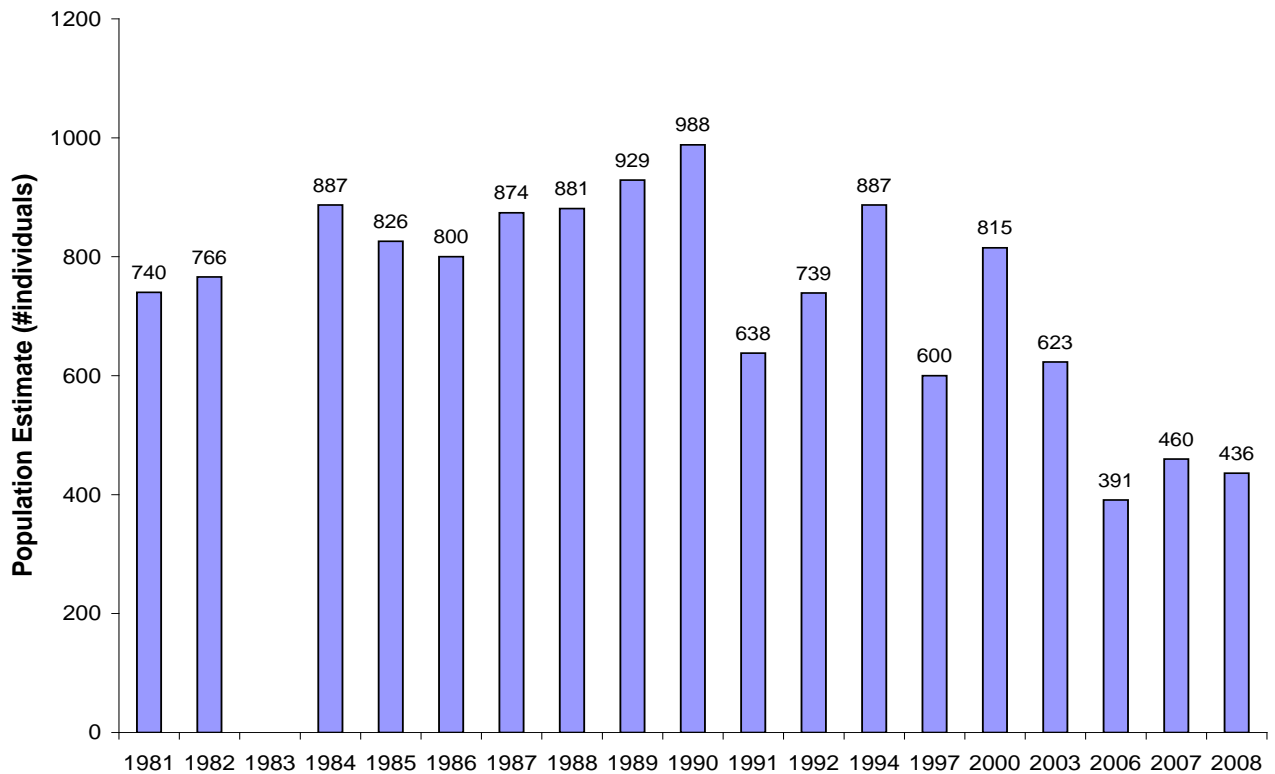
The current method of systematically surveying the Refuge sheep population by helicopter triennially was initiated in 1992. The Kofa, New Water, Little Horn, Tank, and Castle Dome Mountains are divided into blocks using geographic features in order to standardize the areas flown and level of effort in each area. Sheep populations are estimated using the “Kofa Group Size Estimator” developed by Hervert et al. (1998). Surveys from 1987-1991 were based on the same block system as is used now, but a sample of 50% of the Refuge was surveyed annually and the estimate extrapolated to the whole. This tended to result in more variable estimates than complete surveys. From 1981-1987, complete aerial surveys were conducted but the current survey blocks had not been defined. Before 1980, population estimates were based on animals observed during foot and aerial lamb surveys and water hole counts. Thus, data before 1992 may not be comparable to data obtained after 1992. Population estimates for 1981-2007 are given in Figure 2. The estimate of 390 sheep from the 2006 survey was the first time since 1980 that the population estimate was below 600 bighorn and represents the sharpest drop recorded.

Even though survey methods have changed since the early 1980s, limiting comparisons between years, systematic aerial surveys indicate that an approximate 50% decline in the Refuge population has occurred between the years 2000 and 2006. Surveys in 2007 (a population estimate of 460 animals) and 2008 (an estimate of 436 animals) suggest that the population of desert bighorn sheep remains at about half of the 20-year survey average.

2.2 Desert Bighorn Sheep Conservation Efforts

In addition to suspending translocations of bighorn sheep from the Refuge, the population decline noted in 2006 by resource management agencies motivated the Service and AGFD to implement several actions, outlined in the jointly-written *Investigative Report*. In order to better understand the reasons for the population decline, 40 ewes were captured and collared in 2007 and 2008 for monitoring, tested for disease, and measured for body condition. Since their capture, these ewes have been monitored regularly by the U.S. Geological Survey (USGS) – New Mexico Cooperative Research Unit, for information on habitat use and lamb production. The Service and USGS are also collaborating on mountain lion diet and genetics research through the Arizona Cooperative Research Unit. Results from research efforts will be incorporated into planning for bighorn sheep and lion management as they become available. Preliminary information from these research efforts indicates that predation by mountain lions is an important cause of desert bighorn sheep mortality on the Refuge. More information concerning the ongoing studies can be found in Section 4, Affected Environment.

Figure 2. Refuge Bighorn Sheep Population Estimates, 1981-2008*



* Population estimates from 1981-1986 and 1987-1991 were obtained using different survey methods than estimates from 1992-2008. Data from before 1992 are not directly comparable to data obtained after 1992 but can be used to show trends.

As recommended in the *Investigative Report*, two permanent water redevelopments and one new temporary water source have been placed for sheep, and existing waters considered critical for bighorn sheep have been actively maintained through water hauling, when required. The Service and AGFD have also conducted aerial surveys every year since 2006, as opposed to the historical triennial schedule that has been followed since 1994. The impacts of disturbance from public use are unknown and the Service intends to further investigate this possible adverse effect.

In addition, one of the strategies proposed in the *Investigative Report* is the removal of “offending” mountain lions from the Refuge. The report defines an “offending” mountain lion as one that kills two or more bighorn sheep within a six month period. The purpose of this EA is to provide the regulatory compliance and public participation required for evaluating the mountain lion management approach proposed in the *Investigative Report*, since it has not been addressed in previous Refuge decision documents.

2.3 Mountain Lion Predation

The impact of predation on bighorn sheep populations and the rationale for removing offending mountain lions for bighorn sheep management were discussed in the *Investigative Report*. An updated summary of the history behind this issue follows.

Mountain lions are one of ten big game species hunted in Arizona. The statewide population is estimated by the AGFD to be between 2,500 and 3,000 animals. Hunters take an average of 300 mountain lions a year in Arizona. Mountain lion densities are much higher in the mountainous regions of Arizona compared to the deserts.

Mountain lions have historically been suspected to be largely transient on the Refuge. There were no verified records of mountain lions on the Refuge until a U.S. Bureau of Sport Fisheries and Wildlife employee killed a male mountain lion near Squaw Tank in 1944 (Halloran and Blanchard 1945). There were no additional verified records between 1944 and 2001. From 1995-1997, Germaine et al. (2000) conducted surveys for mountain lions in 18 mountain ranges and along the Colorado and Gila rivers in southwestern Arizona, including the Refuge. They suggested that a distinct, self-sustaining mountain lion population did not currently exist in southwestern Arizona. They found no evidence of lions on the Refuge.

After a cached deer was found at Little White Tanks in the Castle Dome Mountains in 2001 and three mountain lions (believed to be a female lion and two kittens) were seen on an aerial survey in the Kofa Mountains in 2003, Refuge staff placed eight active infrared and two passive heat-and motion-sensing digital remote cameras at water holes in the Kofa Mountains beginning in December 2003. A single camera was placed at a water source in the Castle Dome Mountains in 2002 and additional cameras were added in the Castle Dome Mountains beginning in 2006.

Using photographs from these cameras in combination with surveys by expert lion trackers, at least five lions were documented on the Refuge in 2006, including both the Kofa and Castle Dome mountain ranges. The actual density of mountain lions on the Refuge and immediate surrounding area is unknown, but photographs of spotted juveniles or females with kittens have been obtained on the Refuge in successive years (2004, 2005, 2006, and 2007), suggesting a local breeding population.

In 2007, the Service and AGFD collared 3 adult male mountain lions (designated KM01, KM02, and KM03) with satellite Global Positioning System (GPS) collars. Data on sheep predation from the 3 radio-collared mountain lions (KM01, KM02, and KM03) were used to estimate the impacts of mountain lions on the bighorn sheep herd. The lions were found to kill and consume desert mule deer (*Odocoileus hemionus*), bighorn sheep, coyotes (*Canis latrans*), and badgers (*Taxidea taxus*). The lions killed an average of 1.09 bighorn sheep per month, per lion. Extrapolating this number to 12 months would indicate that 3 lions on average would kill 41 bighorn sheep per year. A fourth mountain lion (KM04) was collared on the Refuge in February 2009 and has since been found to have killed three bighorn sheep - one lamb, one ewe, and one ram.

The average yearling:ewe ratio for bighorn sheep within the Refuge, as determined by aerial surveys during the years of recent decline (2003-2008), is 14 yearlings:100 ewes. This ratio is accepted as the yearly recruitment into the population because bighorn sheep are considered to be adults and capable of breeding after their second year. The 2003-2008 average ewe estimate for the Refuge is 248 ewes. Using these average numbers, the annual recruitment into the sheep population within the Refuge would be 34 animals. Half the bighorn sheep killed by collared mountain lions were taken off the Refuge, indicating that the impact of the 3 lions on the Refuge results in the loss of about 20 bighorn sheep per year from the Refuge, or about 58% of the average annual recruitment within the Refuge boundaries. This analysis underestimates the true impact of lions on desert bighorn sheep since it does not take into account sheep killed by any uncollared mountain lions. It also does not account for any desert bighorn sheep lambs killed by collared or uncollared lions, since lions would take a relatively short period of time to consume a lamb. Because of battery life constraints, the GPS collars are programmed to take locations every 4 hours when lions are most active, and a lion can consume a lamb and depart the area in less than 4 hours. Thus, a lion is unlikely to remain in one area long enough to produce a “cluster” of GPS coordinates which usually marks the locations where larger animals are killed and consumed, and where a follow-up investigation can be conducted by a biologist. Thus lamb kills by collared lions can be missed using current methods.

Previous investigations from other localities (See Section 5.2.2) indicate that mountain lion predation can limit bighorn sheep populations under some circumstances and that removing those mountain lions that regularly target bighorn sheep is the most effective way to reduce the impacts of predation. The Service recognizes that mountain lion predation is not the only factor limiting the population size of bighorn sheep on the Refuge. For example, if individuals cannot maintain adequate levels of physical condition, populations cannot be productive regardless of the status of other potential limiting factors.

2.4 Summary of Public Involvement Efforts

On April 23, 2008, the Service announced its intent to prepare an Environmental Assessment of alternatives for the management of mountain lions on the Refuge. A 30-day scoping period from April 24 to May 24, 2008 was established under that notice. The Service provided a news release and sent out 4,007 letters and emails to potential interested parties announcing the initial scoping period for development of a lion management EA. In response to requests from the public, the Service extended the public scoping period an additional 30 days, to June 23, 2008.

During the scoping period the Service received 122 response letters or emails with comments that were considered as part of this analysis. See Appendix B for a list of agencies, individuals, and organizations that provided scoping comments and a summary of the scoping comments.

A Notice of Availability of this Draft EA has been published in the Federal Register and is available for review. Additional copies of this EA are available upon request. Inquiries should be directed to Kofa National Wildlife Refuge, 9300 E. 28th St., Yuma, AZ 85365.

2.4.1 Issues and Concerns The following issues and concerns were identified during the scoping period for this EA:

Mountain lion populations – What impact will the removal of mountain lions have on local and statewide mountain lion populations? What would the cumulative and direct impacts be from implementing the proposed action or other alternative? Should mountain lion hunting be allowed on the Refuge as a method of reducing their population? Are these mountain lions actually the rare Yuma puma (*Puma concolor browni*) subspecies, which should be protected, although McIvor *et al.* 1995 present evidence suggesting Yuma puma is not likely a subspecies?

Bighorn sheep populations - What impact will the removal (or lack thereof) of mountain lions have on the local and statewide desert bighorn sheep populations? What would the cumulative and direct impacts be from implementing the proposed action or other alternative? Are mountain lions the cause of the drop in the sheep population estimates, or is there an alternative cause, such as disease or malnutrition? Should hunting of desert bighorn sheep be suspended until sheep populations have increased? Will the number of bighorn sheep on the Refuge continue to affect the state and regional bighorn sheep transplant programs?

Impacts on non-target species – What impact will the removal (or lack thereof) of mountain lions have on other species not targeted, including desert mule deer?

Impacts on public recreation – Will there be impacts from alternatives to visual resources and visitor use of the Refuge?

Impacts to wilderness – Will there be impacts from alternatives to wilderness values on the Refuge or conflicts with wilderness management? Should management actions be curtailed or eliminated in wilderness and “nature be allowed to take its course?”

Humaneness – How humane are the respective alternative strategies? Because humaneness can be dependent on perspective (USDA 1997), how is humaneness perceived by the various interests?

Cumulative impacts – What are the impacts of the alternatives when considered with other relevant management actions on the Refuge and in nearby regions over time?

2.4.2 Issues Not Analyzed in Detail with Rationale

Impacts from water developments

The Service has developed numerous water sources for wildlife on the Refuge since its establishment in 1939. Currently, the Service maintains water at 23 critical sites (two springs, 15 modified tinajas, five man-made catchments, and one windmill) for bighorn sheep that were identified in the *Investigative Report*. There are an additional 11 windmills, 11 springs, 26 tinajas or manmade catchments, and 10 dams throughout the Refuge. Except for springs, wells, and critical waters, most of these water sources are ephemeral depending on rainfall. The extent to which these water developments may have influenced wildlife populations over the past 70 years is not known, although several recent studies have documented extensive wildlife use of waters in southwestern Arizona and on the Refuge (O’Brien *et al.* 2006, Lynn *et al.* 2006). Marshall *et al.* (2006)

found no association between wildlife water developments and reduced forage availability in the Lower Colorado River Valley in California, and Bleich et al. (2006) concluded that the quality of water at man-made water sources in southeastern California desert environments does not constitute a wildlife health threat. Data from the collared lions indicates that 28% of ungulate kills occurred within 1600 meters of a water source, while 20% occurred within 800 meters. Only 12% of ungulate kills occurred within 100 meters of a water source (USFWS, unpubl. data).

Thus, it is known that the Refuge water sources are used extensively by a variety of wildlife species, including desert bighorn sheep and mountain lions. There is no indication that wildlife use of water on the Refuge causes “overgrazing” near the water sources. The data from the radio-collared mountain lions suggests that wildlife water sources do not constitute a “predator trap” where prey species are likely to be killed by a predator.

Impacts from climate change.

Most climate prediction models indicate that the southwest will become hotter and possibly drier over the next few decades, but predictions for specific areas are unreliable. If the southwest does become hotter and drier, the Refuge may become even more critical for the preservation of desert bighorn sheep herds since it includes areas of relatively high elevation (up to over 4,800 feet); these areas might become vital to bighorn sheep herds if lower elevation habitat becomes unsuitable. This issue is a serious concern because it could potentially impact Refuge habitat in the future. Thus, global warming will be addressed in the Service’s future planning efforts for the Refuge. It currently has no noticeable impact on the current bighorn sheep population, since other bighorn sheep populations in southwestern Arizona have increased or been stable while the Refuge population has declined.

2.5 Development of Alternatives for the EA from the Identified Issues

This EA was prepared using guidelines of the National Environmental Policy Act of 1969 (NEPA). NEPA requires examination of the effects of proposed actions on the natural and human environment. In the following chapters, three alternatives for future management of mountain lion predation on the Refuge are described, along with the environmental consequences of each alternative in relation to the issues identified in this chapter. The alternatives were designed to cover an array of possible actions and the proposed alternative was selected on the basis of its environmental consequences and ability to achieve the purpose and the mission of the Refuge and System.

3.0 DESCRIPTION OF THE ALTERNATIVES (INCLUDING PROPOSED ACTION)

A variety of alternatives were considered in the development of this EA.

The Service has identified the alternatives, developed through interagency planning and public scoping, that could meet the need for action and objectives identified in Chapter 1 and that

represent viable scenarios for future management of the Refuge. The alternatives that will be considered are 1) the No Action Alternative which is to continue current management efforts, 2) the Proposed Action Alternative which involves limited removal of mountain lions, and 3) an Indiscriminate Removal of Mountain Lions Alternative.

3.1 Alternative A: No Action Alternative – Continue Current Management Efforts

Under the No Action Alternative, the Refuge would continue to be managed as it has been in the past. This is considered the environmental baseline, or *status quo*. Since bighorn sheep management and mountain lion predation management outside the Refuge have been conducted in Arizona for decades, the environmental baseline can be considered as including the effects of the current ongoing programs. The wildlife population baselines are those that are in place under the current condition of the human environment which means they incorporate and reflect the populations as they have been and are being affected by humans.

The Service currently has no Refuge-wide plan to guide the management of mountain lions. Current management efforts, described in USDI 1997 focus on the maintenance of critical wildlife water sources for bighorn sheep, and, in annual coordination with the AGFD, monitor desert bighorn sheep and mule deer numbers, set the number of hunt permits, and consider desert bighorn sheep transplants to augment populations elsewhere in the region. Research on wildlife and wildlife water sources would continue. Collection of mountain lion scat for composition analysis and the collaring of mountain lions and desert bighorn sheep would continue. The study of desert bighorn sheep health and causes of mortality on the Refuge would continue.

The Service would not take action to prevent mountain lion predation on desert bighorn sheep within the Refuge boundaries under this alternative.

3.2 Alternative B: the Proposed Action Alternative – Conduct Limited Removal of Mountain Lions

The proposed action is to allow the Service the option of removing specific individually-identified offending mountain lions, through translocation or lethal removal, from the Refuge under certain circumstances to recover and maintain an optimal population of desert bighorn sheep.

The proposed action has several components:

1. When the Refuge bighorn sheep population estimate is below 600 animals, active mountain lion removal would occur, absent any significant mitigating circumstances. Active mountain lion control is the removal of mountain lions found to kill two or more bighorn sheep within a 6 month period, as determined by investigation of predation sites which are often identified by a cluster of GPS locations. These lions would be designated as “offending” mountain lions. The definition of “offending” mountain lion was modified from Ernest et al. (2002) and designed to target only mountain lions that establish a pattern of killing multiple bighorn sheep. Box traps, neck or foot snares, or hounds may be used to assist in the removal of offending lions. Helicopters may be used

to transport biologists to very remote locations to investigate possible kill sites or to place box traps. Aerial darting of mountain lions may take place. The Service, or its agents, would carry out the lethal removal, or translocation, in the most efficient and humane way available to them. If killed, the lion would be retained for scientific analysis.

2. When the Refuge bighorn sheep population estimate is at or above 800 animals, active mountain lion control would not occur, absent any significant mitigating circumstances. Mountain lions on the Refuge may continue to be captured and fitted with satellite GPS collars to aid in continuing research.
3. When the Refuge bighorn sheep population estimate is between 600 and 800 animals, active mountain lion control may or may not be employed based on the totality of the circumstances at the time. In order to meet the bighorn sheep population objectives while minimizing the necessary impacts to mountain lions, some flexibility is warranted when the sheep population is at this stage. Decisions regarding whether active mountain lion control is necessary will be based on an adaptive management approach and based on the following factors:
 - a. The current sheep population estimate.
 - b. The current sheep population trend (an increasing or decreasing population trend of the bighorn sheep herd based on the prior 3 surveys [annual or triennial as funding allows]).
 - c. Bighorn sheep lamb survival and recruitment.
 - d. The estimate of the number of mountain lions currently using the Refuge.
 - e. The level of predation by individual mountain lions currently using the Refuge. Mountain lions that are found to kill four or more bighorn sheep annually could be removed.
 - f. Current and forecasted habitat conditions.
 - g. Available funding and manpower.
4. Translocation of offending mountain lions may be an option though it is not anticipated to be a viable option in most circumstances. This is based on the costs and logistical challenges associated with capture and transport of animals within and to remote areas, the sociopolitical challenges associated with locating appropriate release sites, and the fact that mountain lion populations are stable in Arizona and there is no known need to repopulate lions in any part of the state. Any potential translocation will be done in coordination with the AGFD, in compliance with their regulations. Any translocated offending lions that return to the Refuge may be lethally removed from the Refuge using means outlined above.
5. The Service and AGFD would monitor the program by assessing impacts of removing mountain lions on the overall lion population and on the bighorn sheep population. This will be accomplished by assessing 1) the population estimate of bighorn sheep through annual surveys, 2) causes of mortality and assessment of mortality impacts to the bighorn sheep population, through ongoing cooperative research projects and 3) ongoing assessment of mountain lion diet and distribution. A regional cooperative research

project to determine the status, distribution, and diet of mountain lions throughout southwestern Arizona is currently in the planning stages, although adequate support has not been developed. Should any of these assessments indicate that mountain lion predation is not (or is no longer) the limiting factor on the bighorn sheep population, or that lion removals are not having the desired effect, this program will be reassessed.

The proposed action would include a number of measures to minimize animal suffering as much as possible. Any personnel involved in captures, translocations, or lethal removals will be trained and qualified in capture and handling methods specific to large felids, including correct dosing procedures, monitoring of vital signs, reversal of chemical immobilization, and ensuring the animal is fully recovered before departing the capture area. The equipment used would include pan tension devices, break-away snares, and chemical immobilization or euthanasia procedures that would minimize or not cause pain. Although the inadvertent death of a mountain lion during capture and chemical immobilization is possible, the protocols used have been developed from hundreds of capture attempts in previous mountain lion research studies and have demonstrated no adverse effects in the 3 previous captures on the Refuge. Therefore, humane treatment of mountain lions would be emphasized, injuries would be minimized, and selectivity maximized. Research continues to improve selectivity and humaneness of management devices (USDA, 1997).

The Service would follow American Veterinary Medical Association (AVMA) recommendations for humane animal treatment (AVMA 1993, Beaver *et al.* 2001), AGFD Article 3 (R12-4-301 through 319) on the Taking and Handling of Wildlife, and AGFD Policy on Captivity Standards (R12-4-248) when applicable. The AVMA states that euthanasia is the act of inducing a humane death in an animal, and the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness (Beaver *et al.* 2001). Some people would prefer accepted methods of euthanasia be used when killing all animals, including wild animals. The AVMA states that for wild and feral animals, many of the recommended methods of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible (Beaver *et al.* 2001). Thus, AVMA euthanasia methods were developed principally for companion animals, and not for free-roaming wildlife. However, the AVMA (1993) considers under some circumstances a gunshot to the head or neck to be the only practical and acceptable method of euthanasia. They recommend it be performed by highly skilled personnel using a firearm appropriate for the situation (AVMA 1993). This would be the predominant method for lethal removal of lions. Any lions that are captured alive and slated for lethal removal or lions that are captured and found to be injured to the degree they can not survive would be euthanized by gunshot to the head or neck. Euthanizing drugs might also be used following methods recommended by the AVMA (AVMA 1993, Beaver *et al.* 2001).

3.3 Alternative C – Indiscriminate Removal of Mountain Lions

Under this alternative, there would be no attempts to radio collar and distinguish “offending” lions. Lions would be lethally removed or captured and translocated out of the area of the Kofa Mountains Complex (Kofa, New Water, South Plomosa, Tank, Little Horn, and Castle Dome Mountains). Efforts would be made to remove approximately two mountain lions per year from

the area until the sheep population reached approximately 800 animals and exhibited an increasing trend based on at least 3 sheep population surveys. Lion removals would resume if the desert bighorn sheep population was found to again go below 800 animals. Lethal removal and translocation techniques would be identical to those in the preferred alternative.

Under this alternative, the indiscriminate removal of mountain lions may or may not meet the objectives stated in Section 1.5. The indiscriminate removal of mountain lions may not necessarily remove those animals known to regularly kill desert bighorn sheep.

3.4 Alternatives Considered But Not Analyzed in Detail with Rationale

Several alternatives were considered but not analyzed in detail. The alternatives eliminated from detailed consideration, along with the rationale for their dismissal, are as follows:

3.4.1 Sport Hunting Alternative

Sport hunting of mountain lions was considered as an alternative to reduce the impact of mountain lion predation on desert bighorn sheep, but was rejected because of its ineffectiveness in reducing abundance of mountain lions and decreasing predation of desert bighorn sheep (T. McKinney, AGFD, unpubl. data). Arizona's statewide population of mountain lions is estimated to be about 2,500 animals. Since 1990, between 210 and 325 mountain lions are taken by sport hunting annually in Arizona. Since 1982, mountain lion hunters have been required to contact the AGFD within 48 hours of taking a lion (AGFD 2007). Within 10 days of taking a lion, a hunter must submit for inspection the lion's skull, hide, and attached proof of sex. A tooth from the skull is taken during the inspection in order to accurately determine the age of the animal. Mountain lion hunters are permitted to take one lion per day until the harvest objectives for the particular game management unit or units is reached, but may not take spotted kittens or female mountain lions accompanied by spotted kittens. Hunters must call the AGFD prior to hunting to learn whether or not the harvest objective has already been attained.

A year-long mountain lion season for the Game Management Units surrounding the Refuge was established in July 1996, and included units 16A, 40B, 41, 43A, 43B, and 44B. The harvest objective for this area was set at one lion total. From 1996 through 2007, no lions in this area were reported to have been taken by hunters (R. Henry, AGFD, pers. comm. 2008, AGFD 2007). Beginning with the 2007-2008 hunt season, those game management units were added to the statewide hunt units and lion hunting was restricted in the statewide hunt to September 1, 2007 to May 31, 2008. The statewide hunt has no harvest objective; hunters are limited to one lion per calendar year. Service personnel, in coordination with the AGFD will monitor take from sport hunters, but believe that this will continue to be minimal, if any.

Very few mountain lions are taken in the desert portions of Arizona by sport hunters. For example, only one lion was reported taken by a sport hunter in game management unit 44A between 2002 and 2006, which includes the Harquahala and Harcuvar Mountains, areas that are known to have mountain lions (AGFD 2006). One factor that may be related is that most lion hunters use dogs to help locate mountain lions. In 2007, 163 of the 250 mountain lions harvested by sport hunters in Arizona were taken with the aid of dogs (AGFD 2008). However, dogs

traveling in the deserts of southwestern Arizona suffer from contacts with cactus spines and sharp rocks. The usual hot and dry conditions also limit a dog's ability to use scent in tracking (R. Thompson, pers. comm.). The low density and secretive nature of mountain lions limit the ability of hunters to harvest them without the use of dogs.

The addition of mountain lion hunting would expand hunter opportunities on the Refuge but for the reasons discussed above, not result in the taking of many, if any, mountain lions by sport hunting. Therefore, sport hunting of mountain lions was eliminated from further consideration as a method of affecting changes in lion or sheep populations.

3.4.2 Translocation of All Offending Mountain Lions Alternative

Although translocation is not necessarily precluded, in many cases it would be logistically impractical and biologically unwise. Translocation of some animals is included in the proposed action, but not all mountain lions would likely be relocated. Translocation of wildlife is often discouraged because many factors can affect the outcome (stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats) (Ruth et al. 1998). However, translocation may be appropriate in some situations if mountain lions are a suitable age for relocation (two to three years old), suitable relocation sites are available, and funding required for relocation is available. However, mountain lions are relatively abundant in most locations of Arizona where populations exist and translocation is not necessary for the maintenance of viable populations. Relocation may also result in future depredations if the relocated animal encounters bighorn sheep in other areas of Arizona. Any decisions on relocation of wildlife by the Service are coordinated with AGFD and consultation with the appropriate land management agency(ies) or manager(s) associated with proposed release sites. It should be noted that the American Veterinary Medical Association, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists oppose the relocation of mammals due to the potential for disease transmission to a healthy local population. Thus, the Service and AGFD are aware of this potential and take precautions to minimize transferring disease to another population.

3.4.3 Nonlethal Harassment Only Alternative

Under this alternative, offending mountain lions would be harassed by first treeing them with dogs, then shooting them with rubber bullets and/or fitting them with electronic shock collars and releasing them. Hebert and Lay (1996) made the case that mountain lions harassed would associate the area with negative stimuli and leave. Koehler et al. (1990) found that visual and acoustic stimuli such as scarecrows, loud music, and recordings of barking dogs had been tried with little evidence of efficacy against felids. The rubber bullets were not especially effective for black bears (*Ursus americanus*), but did work for a third of the nuisance bears. These methods are labor intensive and require people in the field much more frequently to monitor for mountain lions in the area of bighorn sheep. Several studies described that the closer and more frequent the human disturbance to bighorn sheep, the further they moved away from the source of disturbance (Krausman and Hevert 1983, Papouchis et al. 2001). This raises the concern that bighorns may move into areas more conducive to predators or with less desirable habitat conditions. Thus, it has been determined that currently available aversive conditioning methods

are not likely to be effective for mountain lions and that the additional activity could disrupt sheep behavior reducing the desired outcome. Thus, this potential alternative was dropped from further analysis.

4.0 AFFECTED ENVIRONMENT

This section describes the general environmental setting of the Refuge and focuses on the affected environment for the proposed action. The characterization of existing conditions provides a baseline for assessing potential environmental impacts from the proposed activities.

4.1 Climate and setting

The Refuge is located in a low-elevation, hot, and arid desert, the Sonoran Desert in the southwest corner of Arizona. Clear skies, low relative humidity, low rainfall, and wide daily temperature variations (high daytime temperatures with much lower nighttime temperatures) characterize the climate. Meteorological records indicate that the average daily temperatures range from 80°F to well over 100°F during summer months and from 40°F to 65°F during winter months. Average yearly precipitation is less than 4 inches. Typically, two “rainy” seasons provide the bulk of the rainfall: July through September (monsoon) and December through March. April through June is usually extremely dry while October and November are somewhat variable, but tend to be dry as well. Prevailing winds are from the north-northwest during autumn until early spring. As temperatures warm, winds shift to a more southerly direction. Winds associated with summer monsoons shift more toward the southeast. There are no perennial lakes or streams within the boundaries of the Refuge, although there are 10 known active springs and 63 named dams, impoundments, tinajas (natural or modified) and wells.

The Refuge displays a relief of two major block-faulted mountain ranges (Kofa and Castle Dome Mountains, and portions of the Little Horn, Tank, and New Water Mountains) typified by extensive exposures of bedrock, sparse vegetative cover, lack of soil development, steep slopes and structurally controlled drainage systems. Elevations range from 680 feet on the desert floor to 4,877 feet atop Signal Peak. Shallow, stony soils and rock outcrops are predominant in the mountainous and steep slope areas. Alluvial fans and valley floors are characterized by deep, gravelly, moderately fine textured soils high in lime concentrations.

The town of Quartzsite is located about 10 miles northwest of the Refuge and is the nearest population center, and the City of Yuma is located about 36 miles to the southwest.

4.2 Vegetation

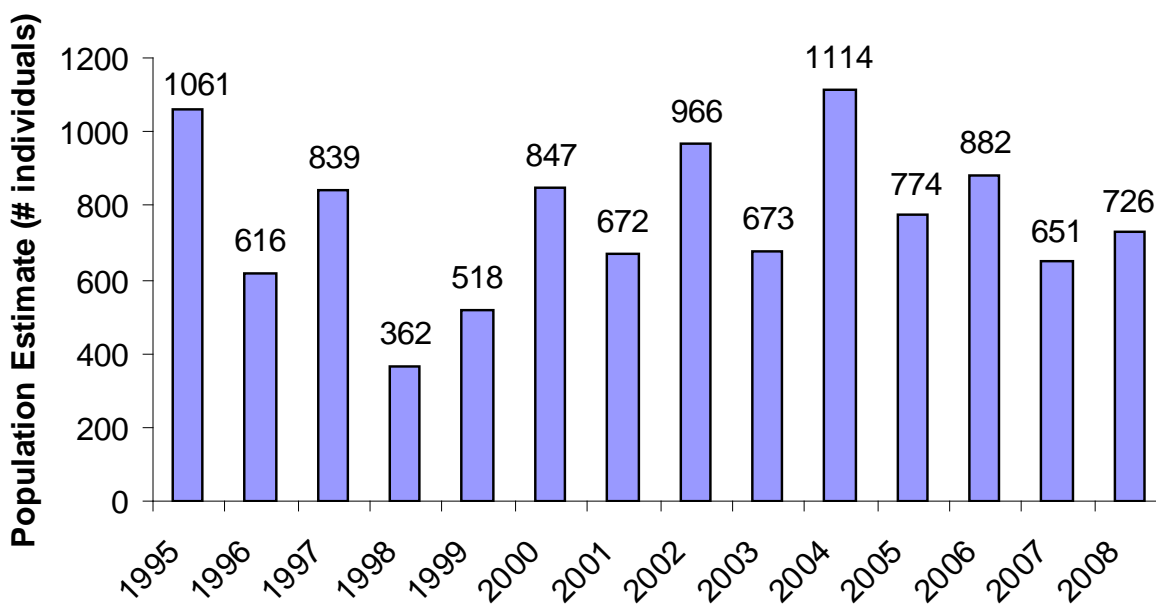
More than 400 taxa of flora are found on the Refuge. The dominant perennial vegetation of the area includes creosote (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), ocotillo (*Fouquieria splendens*), ironwood (*Olneya tesota*), jojoba (*Simmondsia chinensis*), honey mesquite (*Prosopis juliflora*), desert lavender (*Hyptis emoryi*), catclaw (*Acacia greggii*), foothills paloverde (*Parkinsonia microphyllum*), blue paloverde (*Parkinsonia floridum*), and saguaro cacti (*Carnegiea gigantea*).

4.3 Wildlife

The refuge hosts a diversity of wildlife species. The species found in the area are primarily those that are common to the mountains and bajadas of the Sonoran Desert. This includes species such as Gambel's Quail (*Callipepla gambelii*), White-winged and Mourning Dove (*Zenaida asiatica* and *Z. macroura*), Red-tailed Hawk (*Buteo jamaicensis*), numerous passerine species, such as Verdin (*Auriparus flaviceps*) and Canyon Towhee (*Pipilo focus*), desert bighorn sheep, mule deer, desert cottontail (*Sylvilagus auduboni*), coyote, ringtail (*Bassariscus astutus*), gray fox (*Urocyon cinereoargenteus*) western diamondback rattlesnakes (*Crotalus atrox*), kingsnakes (*Lampropeltus getulus*), side-blotched lizard (*Uta stansburiana*), and western whiptail lizard (*Aspidoscelis tigris*). In all, 193 species of birds, 49 species of mammals, and 41 species of reptiles and amphibians have been documented on the Refuge (USDI 2006).

The mule deer population on the Refuge is estimated each January by the Refuge and AGFD cooperatively, using both fixed-wing and helicopter surveys. The average deer population estimate from 1995-2008 is 764 animals, with a range from 362 animals in 1998 to 1114 animals in 2004. The 2008 population estimate is 726 animals (Figure 3). Mule deer regularly have twin fawns (Schmidt and Gilbert 1978), which allows their numbers to rebound from population lows more readily than bighorn sheep. Male mule deer, or bucks, may be hunted by a limited number of sportsmen during a regular rifle season in late October or early November and an archery season in January. Hunters usually harvest about 40 desert mule deer from the Refuge annually.

Figure 3. Refuge mule deer population estimates, 1985-2008.



The mule deer population historically demonstrates high variability from year to year, which is thought to be tied largely to rainfall and habitat conditions. For example, the sharp population drop from 1997 to 1998 was most likely due to the severe drought that occurred in 1997. There has been no severe “crash” in deer numbers observed recently that might precipitate prey switching from deer to bighorn sheep in mountain lions, nor is mountain lion predation thought to be a significant limiting factor on the mule deer population, although data from the collared lions and preliminary scat analysis data indicate that mule deer are an important, if not the majority, species in mountain lion diets on the refuge.

4.4 Threatened and Endangered Wildlife and Plants

No Federally designated threatened or endangered species are known to occur within the proposed project area. Ten other species occur on the Refuge that are on the AGFD list of Wildlife of Special Concern. These species have some status of concern, but no formal protection, and are listed in Appendix A. None of the 11 species’ populations listed in Table A1 are anticipated to be adversely effected under any of the alternatives analyzed in this EA.

4.5 Mountain Lions

4.5.1 Background. Mountain lions, also known as pumas, or cougars, have historically had the broadest geographic distribution of any terrestrial mammal in the western hemisphere, except for humans (Logan and Swenor, 2001). Mountain lions have occupied almost every type of biogeographic zone, including boreal foothills, temperate mountains and forests, tropical rainforests, grasslands, and deserts (Young 1946) along an elevation gradient ranging from sea level to 3,350 m in North America (Nowak 1991). By the late 1800s in North America, eastern populations were extinct or severely reduced, and by the early 1900s, western populations were diminished (Nowak 1976), to a contraction to about one-half of their modern geographic range (Logan and Swenor 2000).

Although extirpated from much of the eastern United States, a sub-population still exists in southern Florida. Despite public sentiment to exterminate large predators such as the mountain lion through government and bounty programs, lions have survived throughout the western United States. Mountain lions are reoccupying some of their former range in the eastern United States (The Cougar Network, <http://easterncougarnetwork.org/bigpicture.html>, last visited 12/17/2008).

The AGFD estimates that there are between 2,500 and 3,000 mountain lions in the State of Arizona. The Yuma puma is no longer considered to be a valid subspecies of mountain lion (Culver et al. 2000, McIvor et al. 1995).

4.5.2 Mountain Lion Densities, Home Range, and Life History. Mountain lion density is related closely to prey availability and the social tolerance for other mountain lions. Prey availability directly influences mountain lion nutritional health, and reproductive and mortality rates. Studies indicate that as available prey increases, so do lion populations. As lion population density increases, mortality rates from intra-specific fighting and cannibalism also increase, and/or lions disperse into unoccupied or less densely occupied habitat. The relationship

of the mountain lion to its prey and to other lions is why their densities do not reach levels observed in a number of other wildlife species (ODFW 1993).

Mountain lion densities in other states, based on a variety of population estimating techniques, range from a low of about 0.98 lions/100 mi² to a high of 23 lions/100 mi² (Johnson and Strickland 1992). An average density estimate for the western states was 7.3 lions/100 mi² (Johnson and Strickland, 1992). In the Southwest, reported mountain lion densities have ranged from 1.76 lions/100 mi² to 6.9 lions/100 mi² (Shaw 1977, Shaw 1980, Cunningham et al. 1995, Logan and Sweanor 2001)

Individual resident mountain lions can have very large home ranges, averaging 15-31 square miles (40-80 square kilometers) for females and 25-35 square miles (65-90 square kilometers) for males (Schmidt and Gilbert, eds. 1978). One male lion in California was recorded to have a home range of 174 square miles (450 square kilometers) (Christensen and Fisher 1976). Desert mountain lions tend to have larger home ranges: in the San Andres Mountains of New Mexico, the average adult male home range was 74.6 mi², ranging from 22.8 to 246.9 mi² (Logan and Sweanor 2001). The average adult female home range was 26.9 mi², ranging from 5.05 to 110.9 mi².

Female mountain lions typically breed for the first time between 21 and 29 months of age (Ashman et al. 1983, Logan and Sweanor 2001). Mountain lions can have litters of kittens in any month of the year, and litter size ranges from 1 to 6, with an average of about 2.6 (Robinette 1961). Normal habits of mountain lions minimize the possibility that diseases or parasites will limit the size of any mountain lion population. These habits include: (1) using dens for only short periods, (2) not using any bedding in dens, (3) avoiding spoiled meat, (4) seeking isolation except in breeding and rearing, (5) remaining almost continuously mobile, and (6) occurring in low densities (Schmidt and Gilbert, eds. 1978). However, mountain lions are subject to infectious diseases and parasites with several cases of plague having been documented in recent years (Univ. Wyoming, 2008).

The frequency of kills by mountain lions varies depending on the individual lion's hunting skill, disposition, sex, presence of kittens, availability and type of prey, season of year, and correspondingly, the rate at which meat spoils (Shaw 1977).

Mountain lions are not readily observed from the air or ground, and their nocturnal habits make them difficult to observe. The only methods available for determining mountain lion numbers are prohibitively time-consuming and expensive, usually involving a combination of intensive camera trapping, hound tracking, track surveys, and attempting to census a population by collaring all individuals in an area. For this reason, systematic surveys are few and reliable population estimates for large areas (such as statewide) do not exist.

4.5.3 Mountain Lion Occurrence on the Refuge. Mountain lions have historically been suspected to be largely transient on the Refuge. There were no verified records of mountain lions on the Refuge until a Bureau of Sport Fisheries and Wildlife employee killed a male mountain lion near Squaw Tank in 1944 (Halloran and Blanchard 1945). There were no additional verified records between 1944 and 2001. In 2001, a mountain lion-killed mule deer

was found in the Castle Dome Mountains, and subsequent investigations have verified the continual presence of mountain lions on the Refuge since that time.

It is worth noting that multiple investigations prior to 2001 did not reveal the presence of mountain lions on the Refuge. During an AGFD research project in the Kofa Mountains from 1993 through 1996, approximately 6% (50) of the approximately 750 bighorn sheep were radio-collared and 17 mortalities were investigated. These mortalities showed no signs of predation and were attributed to either drowning or unknown causes, likely disease or malnutrition. From 1995-1997, Germaine et al. (2000) conducted track surveys for mountain lions in 18 mountain ranges and along the Colorado and Gila rivers in southwestern Arizona, including the Refuge. They confirmed the presence of only 3 individual mountain lions (in the Mohawk and Growler Mountains southeast of the Refuge) believed to be males, and suggested that a distinct, self-sustaining mountain lion population did not currently exist in southwestern Arizona. They found no evidence of lions on the Refuge.

Three mountain lions believed to be a female and two nearly-grown kittens were observed from a helicopter during a bighorn sheep survey in 2003. Since remote cameras were placed at water sources on the Refuge in 2003, mountain lions, including spotted juveniles, and a female with kittens, have regularly been photographed.

Three cache sites were found on the Refuge between 2001 and 2007 (prior to any lions being radio-collared) and contained one mule deer, one bighorn sheep, and one badger. Mountain lions are also scavengers, and some cache sites may be the result of lions scavenging upon animals they did not kill (Bauer et al. 2005). Four more lion kills identified opportunistically (not in conjunction with GPS monitoring) on the Refuge from 2005 to 2008 included three mule deer and one bighorn sheep. Animals killed by lions can be distinguished from animals that die from other causes. Tooth marks, hemorrhaging at the wound sites in the muscle or under the skin, splashes of blood on the surrounding terrain, disturbed soil and rocks indicating a struggle, evidence of asphyxiation or a broken neck, consumption of the nose and the ends of the ribs, removal and separate burial of the intestinal tract, as well as the carcass being dragged, placed under a tree or partially buried by rocks and sticks are all indicator that a mountain lion was the cause of death (Shaw et al. 2007).

Mountain lions may be increasing their densities and expanding their ranges in many parts of Arizona. This possibility is currently under proposal for study by the AGFD (R. Thompson, AGFD, pers. comm. 2008).

4.5.4 Radio-collared Mountain Lions. Three mountain lions have been captured on the Refuge and fitted with GPS satellite radio collars and their movements monitored. A synopsis of the information gained from each of these lions is as follows:

KM01 – This male mountain lion was captured and fitted with a satellite GPS radio collar in April 2007. In June 2007, KM01 was determined to have met the offending lion criteria defined in the *Investigative Report* and was lethally removed by the AGFD on BLM-managed public land adjacent to the Refuge, under the authority of the *Kofa Mountains Complex Predation Management Plan* (AGFD 2007). It was later determined

by examining data from this lion's collar that KM01 had killed five bighorn sheep in three months.

KM02- This male mountain lion was captured and fitted with a satellite GPS radio collar in June 2007. During the two months that the lion had a collar, it was found to kill two coyotes, four mule deer, and one desert bighorn sheep ewe. The ewe was killed in the Palomas Mountains, outside of the area covered in the *Kofa Mountains Complex Predation Management Plan*. In late July, 2007, a release mechanism on KM02's collar failed and the collar fell off before its programmed release date. The collar was recovered, but attempts to recapture and replace the collar on this lion have been unsuccessful.

KM03 – This male mountain lion was captured and fitted with a satellite GPS radio collar in October 2007. In March 2008, KM03 was determined to have met the offending lion criteria and was lethally removed by the AGFD off the Refuge on the Yuma Proving Ground. Investigation of GPS data from KM03's collar revealed that he had killed six bighorn sheep in the five months that he was collared, including one satellite-collared ewe (from the USGS New Mexico Cooperative Research Unit effort – See Section 4.6.3).

KM04 – This male mountain lion was captured on the Refuge and fitted with a satellite GPS radio collar in February 2009. As of this writing, it has killed one bighorn sheep ewe, one lamb, and one ram.

It was noted that all four collared lions, KM01, KM02, KM03 and KM04 moved on and off the Refuge regularly. Each lion killed and consumed a large animal (mule deer or bighorn sheep) every 5.2 days on average (ranging from one to 12 days). All four lions together killed and consumed 15 mule deer, 15 bighorn sheep, two badgers, and two coyotes while they were being monitored.

4.5.5. Mountain Lion Scat Composition Analysis. Composition analysis of lion and bobcat scat is being completed by a researcher and graduate student from the USGS Arizona Cooperative Research Unit. Preliminary results from mountain lion scat collected on the Refuge revealed mule deer, desert bighorn sheep, badger, gray fox, and domestic sheep (*Ovis aries*) as prey items.

4.6 Desert Bighorn Sheep

4.6.1 Background. Bighorn sheep occupy portions of the western United States and southern Canada, from British Columbia to New Mexico and into portions of Mexico including Baja California, Sonora, and Chihuahua (Schmidt and Gilbert, eds. 1978). Desert bighorn sheep are found in southeastern California, southern Nevada, Arizona, and portions of New Mexico. The largest contiguous block of habitat for desert bighorn sheep of the subspecies *mexicana* (*O.c. mexicana*) in Arizona is the Kofa, New Water, Plomosa, Little Horn, Castle Dome, and Tank Mountains, sometimes referred to as the Kofa Mountains Complex. The Refuge covers a majority of this area.

4.6.2 Life History. Bighorn sheep have life history traits such as slow growth rates, late maturation, long gestation, low fecundity, and long lives (Remington 1989). Their social structure revolves around retention of juveniles on the home ranges of adults, versus dispersal of young from adult home ranges. Bighorns have low rates of population growth, which means their ability to recover rapidly from herd depletion is much less than other species (Geist 1975). Deer (*Odocoileus spp.*), on the other hand, are adapted to exploit early successional habitats and reproduce at an early age, produce more offspring with relatively lower survival rates, but generally have the ability to recover rapidly after depletion (Krebs 1972). Thus bighorn sheep appear to be more vulnerable to population declines and extinction than species with life history traits like deer.

Bighorns have evolved population maintenance strategies that revolve around social mechanisms that transmit home ranges and migratory patterns from one generation to the next (Geist 1975). Rather than expulsion of juveniles from the population, bighorn dispersal usually occurs irregularly through segmentation of herds when population densities are high. These behaviors are likely adaptations to the naturally fragmented habitats bighorn sheep occupy, but barriers such as development and roads have necessitated the capture and translocation of bighorn sheep to historic ranges to facilitate re-occupancy of historical habitat. By virtue of bighorn sheep ecology and compensatory mechanisms for population maintenance, recovery from population declines is an inherently slow process.

Bighorn sheep are primarily browsers and are able to consume a variety of plants to meet their dietary needs. They select foods based on their availability and palatability which may change from season to season and from year to year. During droughts or hot periods, the availability of water, such as found on the Refuge at water developments, springs, and natural rock waterholes, allows desert bighorn sheep to consume plants that have a lower moisture capacity (Geist 1975). Thus the ability of a particular area to support a number of desert bighorn sheep (or carrying capacity) varies depending on habitat conditions and water availability.

Bighorn sheep have evolved a variety of behavioral adaptations to avoid predation. A stocky build and relatively short legs provide agility on steep and rugged terrain, but preclude the fleetness necessary to escape predators in more gentle slopes. Another important adaptation is “group living” (Hamilton 1971, Alexander 1974). Groups provide more eyes and ears and enable members to spend more time feeding and less time surveying for predators. Studies of this phenomenon have found that a group size of six or more bighorn sheep confer an advantage in the proportion of time allocated to feeding (Berger 1978, Risenhoover and Bailey 1985). The selfish herd concept of Hamilton (1971) suggests that greater group sizes may confer further behavioral comfort. Bighorn sheep are primarily diurnal (Krausman et al. 1985), coupled with keen eyesight to detect predators, diurnal behavior minimizes predation risks. Nights generally are spent on rocky slopes.

4.6.3 Desert Bighorn Sheep Health and Causes of Mortality. Beginning in November 2007, the USGS New Mexico Cooperative Research Unit began a four-year study on the health and causes of mortality of desert bighorn sheep on the Refuge. The study began with the radio-collaring and initial health analysis of 30 ewes in November 2007. Two of these ewes were killed by mountain lions, one by KM03 as noted in Section 4.5.4, and one by an uncollared lion

in August 2008. In November 2008, an additional 10 ewes were collared. One of these ewes died a few days later from capture myopathy, and her body was later fed on by a mountain lion, and a ewe from the original collared group was killed by a mountain lion in late November. An additional collared ewe was killed by a mountain lion in January 2009, another in March 2009, and another in April 2009. At the time of this writing, 33 collared ewes are still alive and being monitored by a graduate research assistant on a regular basis. Analysis of biological samples taken at the time of their initial capture has shown that the animals have not been affected by pneumonia or pneumonia-like diseases. Analysis of blood samples is still pending, as is pregnancy testing, but preliminary results suggest that all ewes were pregnant at the time of collaring. Two additional captures and re-assessment of the same animals is planned for October – November of 2009 and 2010.

4.6.4 Desert Bighorn Sheep Hunting. Hunting has been used as a population management tool for many species, including desert bighorn sheep. Arizona's first bighorn sheep hunt was held in 1953 (AGFD 2006). Research in Alberta has shown that a healthy vigorous herd can be maintained by conservative harvest of mature rams and population maintenance below carrying capacity (Canadian Fish and Wildlife Service, 1993). Bighorn sheep hunters typically select the largest, hence the oldest, rams in the herd. In 2005, the average age of sheep taken in Arizona was seven years old, with an average Boone & Crockett green score of 152 3/8. In Arizona, bighorn sheep are harvested under a general, male-only open season. Hunters can take only one desert bighorn sheep in their lifetime and hunters must personally check out within three days following the close of the season in accordance with AGFD rule 12-4-308.

For the purposes of hunt management, AGFD has divided the state into a series of Game Management Units (GMUs). The refuge is divided into three GMUs: GMU 45A comprises roughly the northwestern third of the refuge, GMU 45B the southeastern third, and GMU 45C the southwestern third. Other surrounding GMUs contain the remaining sections of the greater Kofa Mountains Complex. AGFD has issued five to 17 bighorn sheep permits for the Kofa GMUs since 1960. The hunter success rate has averaged 89% for bighorn sheep on the Kofa over the last 20 years. Currently, the number of desert bighorn sheep tags issued is equal to approximately 15% of the Class 3 and 4 rams found in the most recent surveys, although hunters may take any ram. Class 3 and 4 rams are six years old or older. The Arizona Game and Fish Commission has approved the issuance of six desert bighorn sheep tags for the Refuge for the December 2009 hunt, outside of the New Water Mountains where one bighorn sheep tag will be issued. Removal of a limited number of rams through hunting does not affect the reproductive potential of the population since bighorn rams may, and often do, breed with more than one ewe. Conflicts between rams over females during the breeding season are common and well documented (Monson and Sumner, eds. 1980).

4.7 Visual Resources

Visual resources are tied to both recreation and wilderness values. The Refuge has a predominantly natural appearance, except for several areas of surface disturbance or debris from past mining and exploration activities, roads, and a utility right-of-way on the north end that contains several gas pipelines with aboveground valves and a 500kV powerline, as well as a Department of Energy powerline that touches on the Refuge's western boundary. Visual resources within wilderness are managed to preserve the existing character of the landscape.

Any changes to the wilderness characteristics by Refuge management should be very minor, repeating the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape, and should not attract attention.

4.8 Recreation

The Service allows a variety of recreational uses. The System is mandated to consider wildlife first in all management activities, and all public uses are considered secondary. The National Wildlife Refuge System Improvement Act of 1997 identified six wildlife-dependent priority public uses to be generally appropriate on Refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. However, all public uses must undergo a compatibility analysis to determine if the uses are compatible with the purposes for which the Refuge was established and consistent with the System mission. A finding that funding is available for the management of these activities must be included in the analysis. Uses within designated wilderness must also conform to requirements of the Wilderness Act.

The majority of recreational use on the Refuge, including hunting, wildlife observation, hiking, climbing, road exploration in four-wheel drive vehicles, occurs almost exclusively in the fall, winter, and spring months. The public is not permitted to drive vehicles more than 100 feet off of the designated roads regardless of whether or not the road is adjacent to wilderness. Hunters, participating in any of the various hunting seasons, may presently hunt anywhere on the Refuge outside of private inholdings.

The Refuge hosts an estimated 50,000 - 60,000 visitor each year. Many visitors are members of the retirement community that spend the winter in the Yuma/Quartzsite area. Hunters are included in these totals and contribute approximately 2000 visits per year. Tourism is one of the top two industries in Yuma (after agriculture), resulting in considerable socioeconomic benefit to the area. The Refuge contributes an estimated \$8.5 million annually to the economy of La Paz and Yuma Counties (see Table 1). These monies create 106 full and part-time jobs and generate a total tax revenue, including federal, state, and county, of \$891,000.

Table 1. Recreation expenditures (\$/person) that were incurred by the public visiting Kofa NWR in 2004 (Caudill and Henderson 2005).

	Resident	Non-Resident	Total
Non-Consumptive	\$2,651	\$3,889	\$6,541
Big Game	\$49	\$24	\$73
Small Game	\$31	\$30	\$61
Total Hunting	\$80	\$54	\$134
Total Expenditures	\$2,732	\$3,943	\$6,675

The Refuge also provides a positive cost:benefit with the taxpayer money that funds the Refuge. Overall, the Refuge brings \$9 to the local area for every \$1 spent by the Refuge, a \$1:\$9 cost benefit (Table 2).

Table 2. The cost:benefit of expenses, in thousands of dollars, incurred by Kofa NWR (Caudill and Henderson 2005).

	FY 2004 Budget	Recreation Expenditures	Net Economic Value	Cost:Benefit Budget:Economic Benefit
Kofa NWR	735	6,674.8	6,330.3	\$1:\$9.08

4.9 Wilderness

In 1990 the Arizona Desert Wilderness Act (Act) was enacted, establishing over 510,000 acres of designated wilderness on the Refuge. This law effectively mandated management that had been established when the area was designated as a wilderness study area in the mid-1970s. Vehicle use had been restricted to designated roads since 1976, but about 25 miles of roads were closed for all use with passage of the Act (more than 300 miles are still available for public use). In addition, mechanized equipment was prohibited from the wilderness areas.

The definition of Wilderness from Section 2(c) of the 1964 Wilderness Act identifies four qualities of wilderness related to wilderness character. All wilderness areas, regardless of size, location, or any other feature, are unified by this statutory definition of wilderness:

- Untrammeled – wilderness is essentially unhindered and free from modern human control or manipulation.
- Natural – wilderness ecological systems are substantially free from the effects of modern civilization.
- Undeveloped – wilderness is essentially without permanent improvements or modern human occupation.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation – wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge.

The wilderness on the Refuge has a predominant natural appearance. However, there are several areas with surface disturbances or debris from past mining and exploration activities and from former vehicle routes. Regardless, the size and unique features of the Kofa Wilderness Area make it a valuable unit of the National Wilderness Preservation System.

5.0 ENVIRONMENTAL CONSEQUENCES

This section analyzes the direct, indirect, and cumulative environmental impacts or consequences that can reasonably be expected from the implementation of each of the three alternatives described in Section 3.0 of this EA. This EA reviews and documents the potential effects of implementing the proposed action and its alternatives on the physical, biological, and social aspects of the human environment.

Because the activities will occur in wilderness, a Minimum Requirement Analysis (MRA) was completed to evaluate the alternatives. An MRA is a decision-making process, documented in writing, which we use to determine if proposed refuge management activities conducted in wilderness are necessary to administer the area as wilderness and to accomplish the purposes of the refuge including Wilderness Act purposes. If the activities are necessary, the MRA also describes how to minimize resultant impacts. The MRA can be found in Appendix C of this document.

None of the Alternatives examined in this EA involve any kind of ground or vegetation disturbance, and therefore, these resources would not be impacted. Based on review of the proposed action, it was determined that the following resources would not be affected by the various alternatives, and do not require any additional analysis or further discussion in this EA:

Physical Considerations - climate and air quality; topography and soils; geology; hazardous, solid, or toxic wastes; water quality and quantity; floodplains; and wild and scenic rivers

Biological Considerations – vegetation; threatened or endangered species

Social Considerations - cultural or archaeological resources; Native American religious concerns; land use and ownership; prime or unique farmlands; environmental justice

The following analysis focuses on resources with the potential to be affected by the Alternatives.

5.1 Alternative A – No Action – Continue Current Management Efforts

Alternative A, the No Action Alternative, represents a continuation of current management practices and serves as the baseline against which other management alternatives are compared. The No Action Alternative has the potential to impact biological resources, considered in Sections 5.1.1, 5.1.2, and 5.1.3, and social factors considered in Sections 5.1.4, 5.1.5 and 5.1.6.

5.1.1 Impact on Mountain Lion Populations. In this alternative, no mountain lions would be removed from the Refuge. Alternative A would be the most humane since no mountain lions on the Refuge would be subject to stress, discomfort, or direct or indirect mortality from translocations. Since it has been well documented that lions move on and off the Refuge, they would still be subject to removal by AGFD or hunters once off the Refuge. Lion density is dependent on prey availability and it is unlikely that a large population of lions could ever be supported on the Refuge, even without removals.

5.1.2 Impact on Bighorn Sheep Populations. Mountain lion predation appears to have the greatest impact on bighorn sheep herds when compounding factors are involved, such as a drought or decline in primary prey populations (mule deer). The Refuge bighorn sheep herd could persist at high numbers without active lion management in years with plentiful rainfall and excellent vegetative conditions, but it is probable that as happened from 2003-2006, the population could decline sharply when lion predation becomes additive to other causes of mortality. Sharp declines lead to loss of genetic diversity in the bighorn sheep herd and can make management and recovery difficult, possibly requiring drastic management actions, such as transplants of desert bighorn sheep from other areas to the Refuge. This alternative may further reduce the numbers of bighorn sheep. To further understand the impact of lion predation on the bighorn sheep herd, the Service has engaged in cooperative research with New Mexico State University examining causes of mortality of bighorn sheep and the effects on bighorn production and growth rates. However, the best available data now indicates that lion predation is an important factor: 6 out of 7 mortalities of collared bighorn sheep on the refuge were attributed to lion predation, and each of the collared lions preyed upon a bighorn sheep at least once. Although mountain lion predation was not likely the sole cause of the decline (USFWS, unpubl. data), lion predation may limit herd recovery by depressing production. As discussed in previous sections of this document, there is ample evidence that mountain lions can negatively impact bighorn sheep populations. Under the No Action Alternative, it is possible that the bighorn sheep herd would decline, conceivably to extirpation, but more likely to low levels that may be difficult to recover. Transplanting desert bighorn sheep from the Refuge to augment or restore historic herds would not be possible. The limited hunt of desert bighorn sheep rams may not take place. Allowing the herd to decline to very small numbers reduces genetic diversity and the vigor of the herd.

If limited mountain lion control takes place off-Refuge, there may be some increase in bighorn sheep populations on the Refuge.

5.1.3 Impact on Non-target Species Mountain lions on the Refuge would continue to take mule deer as their primary prey. Thus, mule deer could decline in number dependent on the number of mountain lions that use the Refuge. Mule deer numbers are expected to change based on vegetation quality and quantity, the number of fawns born, hunting success, and the number of mountain lions on the Refuge. Implementation of the No Action Alternative is anticipated to have minimal potential to impact any other species.

5.1.4 Impact on Visual Resources and Recreation The No Action Alternative would have no effect on visual resources. The No Action Alternative might affect recreational opportunities for hunters and wildlife watchers. If lions are impacting the bighorn sheep herd to the extent believed, a continued decline in the population would lessen the number of hunting permits issued and may eventually lead to the discontinuation of bighorn sheep hunting on the Refuge. Fewer sheep also means the likelihood of a visitor seeing bighorn sheep may be reduced. The reduction in the availability of wildlife for both viewing and hunting would likely reduce the number of Refuge visitors, which would have an economic impact in the local area.

5.1.5 Impact to Wilderness Values The No Action Alternative could be considered more consistent with wilderness values than the proposed action from the standpoint that natural processes would be allowed to occur. However, what is considered “natural” on the Refuge is subjective and difficult to define. Bighorn sheep are also an important component of wilderness and should be maintained as such. If mountain lion predation is allowed to continue unchecked, the bighorn sheep herd could continue to decline. While it is unlikely that the bighorn sheep herd would be completely extirpated, it could drop to levels that require much more intensive, invasive management procedures to prevent extirpation, such as a translocation of sheep from outside the Refuge. These activities could reduce wilderness values in the long term. See the Minimum Requirement Analysis for a more detailed description of these impacts (Appendix C).

5.1.6 Other Considerations Alternative A is the alternative most likely to meet the concerns of those individuals, agencies, and organizations that would prefer to see no limits on mountain lion predation on the Refuge. Approximately 50% of the scoping comments received (61 of 122) favored Alternative A.

If there are no limits placed on mountain lion predation on desert bighorn sheep on the Refuge, the desert bighorn sheep numbers are likely to decrease to low levels and the transplant and hunt programs would be suspended indefinitely. This would limit the funding donated (from all sources, including government and private) and effort expended on desert bighorn sheep conservation efforts on the Refuge. Kofa Refuge was established as a habitat for the restoration and conservation of desert bighorn sheep, and this emphasis would end.

Money from both agency and private sources would not be spent on the Refuge for the translocation or lethal removal of mountain lions.

5.1.7 Cumulative Impacts Under the No Action Alternative, the Refuge desert bighorn sheep populations may continue to decline. Arizona contains numerous isolated or semi-isolated bighorn sheep herds, and the desert bighorn population has been declining statewide (Table 2). The removal of two lions (to date) from lands surrounding the Refuge is limited and has taken place so recently that significant increases of bighorn sheep have not yet been observed. It is expected that the removal of just two mountain lions would not likely impact the desert bighorn sheep population over time as it is anticipated that these lions will be replaced by new dispersing lions.

Other activities expected to take place in the near future in the project area include the addition of a second 500 kilovolt powerline by Southern California Edison (the Devers Paloverde #2) which would likely cross the northern portion Refuge, paralleling the existing Devers Paloverde #1 powerline. El Paso Natural Gas Company can be expected to maintain, refurbish and replace their existing oil and natural gas pipelines that parallel the Devers Paloverde #1 powerline and also run north/south near the Refuge’s western boundary. The Department of Energy (Western Area Power Administration) powerline that parallels the Refuge’s western boundary may be completely changed from wooden to steel support structures. Five of the support structures are on the Refuge. American Tower’s 369-foot steel communication tower in the Livingston Hills may eventually be decommissioned and removed, along with the cement support building at its base. Efforts to maintain the Refuge’s roads can be expected to continue, including efforts by

Yuma and La Paz County to grade and potentially regravell those roads that are county roads. The Service would continue to maintain and grade the Palm Canyon, MST&T, and Crystal Hill/Blevins Roads, while keeping the remaining Refuge roads passable. Other activities outside of the Refuge may include the establishment of wind and solar farms on public land managed by BLM. If gold and silver prices continue to rise, there may be an increase in mining activity including the establishment of new mines on public lands not withdrawn from mineral entry.

Table 2-Statewide desert bighorn sheep population estimates for Arizona as reported in the status reports in the *Desert Bighorn Council Transactions*.

Year	Statewide Population Estimate
1991	4500
1992	4500
1993	5500
1994	6000
1995	6500
1996	6500
1997	6000
1998	6000
2000	6000
2001	6000
2002	6000
2003	5500
2005	5500
2007	4500

From 1955 to 2000, over 1,200 bighorn sheep were transplanted within Arizona (Lee et al. 2000), and bighorn populations increased from 2,500 to over 6,000 during that time. The first successful translocation of sheep from Kofa Refuge was in 1957 when four bighorn were released at the Black Gap Wildlife Management Area in west Texas. From 1957 through 2006, 569 bighorn sheep have been translocated from the Refuge. The Kofa bighorn herd has been essential as a source population for reestablishing and maintaining other bighorn herds in Arizona, including the Buckskin, Harcuvar, Eagletail, Saucedo, Superstition, and Peloncillo Mountains and desert bighorn herds in Texas, New Mexico, and Colorado. If the herd remains at current levels or continues to decline, bighorn sheep translocations cannot occur to repopulate historical bighorn sheep habitat.

5.2 Alternative B – Proposed Action – Conduct Limited Removal of Mountain Lions

Alternative B, the Proposed Action Alternative, would involve the limited removal of mountain lions through lethal control or translocation. The thresholds for mountain lions to be removed or considered “offending” are discussed in Section 3.2; an offending mountain lion is one that has

killed two or more desert bighorn sheep within a six-month period. The Proposed Action Alternative has the potential to impact biological resources, considered in Section 5.2.1, 5.2.2, and 5.2.3, and social factors considered in Sections 5.2.4, 5.2.5, and 5.2.6.

5.2.1 Impact on Mountain Lion Populations Under this alternative, mountain lions that regularly kill desert bighorn sheep on the Refuge could be translocated or lethally removed; therefore, this alternative would have direct impacts on individual mountain lions. Alternative B would be less humane than Alternative A because of these direct impacts. Alternative B would create consistent management policies for mountain lions in occupied bighorn sheep habitat both on the Refuge and on adjacent lands (i.e., BLM, YPG) off the Refuge. The removal of a few mountain lions per year from the Refuge would be consistent with the AGFD guidelines for the management of mountain lions in Arizona.

As of this writing, at least three adult lions are known (from photographs at water sources and the collared lion KM04) to be using the Refuge: a male and a female in the Kofa Mountains and a male in the Castle Dome Mountains. It is expected that mountain lions would periodically visit and reoccupy the Refuge from adjacent mountain ranges.

The male lions might leave the Refuge if the adult female was removed. The proposed removal of offending mountain lions under Alternative B is not expected to extirpate lions from the Refuge. The time consuming and difficult logistics of capturing and collaring mountain lions and following their movements to determine whether they are offending lions, or not, limits the number of animals that could be removed.

Logan et al. (1996) determined the rate of increase in a study of New Mexico mountain lion populations varied from 8-11% in an unharvested, uncontrolled population to 21-28% in a mountain lion population where harvest and control was simulated by removing half of the mountain lions from the study area. They concluded that rates of increase in mountain lion populations are density dependent; as a population declines in relation to carrying capacity, the rate of increase becomes greater. This is a natural mechanism of wildlife populations that serves to protect species by enhancing the ability of populations to recover from declines. Logan et al. (1996) suggested that, for a lion population to remain at or near maximum carrying capacity, no more than 11% of the adults should be harvested annually. It also suggested that, for a population managed for control, the harvest level might need to exceed 28% per year to cause the population to decline substantially. It appears that a viable population can be maintained at about 50% of carrying capacity with harvest levels that range from 21% to 28%. Mountain lions that prey primarily on mule deer or other prey would remain on the Refuge and the surrounding lands.

Translocations are stressful to animals and mortality from capture and handling is always a possibility, although techniques to reduce stress are employed. Mountain lions that survive the capture and translocation effort are still subject to intraspecific competition that may lead to direct mortality through fighting or indirect mortality from starvation. Translocated mountain

lions may also disrupt the dynamics of the population into which they are introduced, possibly causing unintended mortality among mountain lions in the receiving population.

Translocations do not always work. Translocated lions have been known to return to their capture area, which would defeat the purpose of translocation. If a translocated lion returned to the Refuge and continued killing bighorn sheep, lethal removal would be the only practical option. Translocated lions are also likely to be killed by resident lions in the area to which they are translocated, or to die from indirect effects of intra-specific competition. In this sense translocations are less effective than lethal removal and may be less humane and more costly.

A study in New Mexico (Ruth et al. 1998) designed to determine the feasibility of translocating mountain lions as a tool to manage populations and problem individuals, moved 14 adult lions an average of 477 kilometers (km) (296 miles) from their home range. Upon introduction, the mountain lions moved from 3 to 494 kilometers (1.8 to 307 miles) from the release site. Two of the mountain lions returned the distance to their original home range. Nine of the 14 translocated mountain lions died during the study period, due to intraspecific aggression, injuries associated with prey capture, human causes, bacterial infection, or unknown causes. This study suggests that translocation should only be done to bolster populations elsewhere (vacant territories) with younger mountain lions; young mountain lions are not as likely to return to their capture site.

5.2.2 Impact on Bighorn Sheep Populations Alternative B is the most likely alternative to meet the objectives presented under Section 1.5. The removal of mountain lions known to regularly kill desert bighorn sheep is the action most likely to result in an increase in the number of desert bighorn sheep since disease and nutritional concerns have not been found to be a significant cause of mortality to date (see Chapter 4 for a discussion of the causes of sheep mortality).

Removing offending lions should be beneficial to the bighorn sheep herd, depending on other factors limiting their population. Long-term lamb to ewe ratios determined during fall aerial surveys when lambs are less than 12 months old have averaged about 20 lambs per 100 ewes. This low level of production requires extremely high adult ewe survival rates (>0.90) for population persistence (Bender and Weisenberger 2005, Bender 2006). Because recruitment is so low, bighorn sheep take a long time to increase their numbers and the longevity and productivity of ewes is vital to maintaining a population. Bighorn sheep have low intrinsic rates of population growth, which means their ability to recover rapidly from herd depletion is compromised relative to other species (Geist 1975).

Predation by mountain lions can be a substantial source of mortality in some bighorn sheep populations (McKinney et al. 2006b, Kamler et al. 2002, Logan and Sweanor 2001, Hayes et al. 2000, Schaefer et al. 2000), and mountain lions appear to be the only predators that can cause significant mortality in bighorn sheep populations that occupy suitable habitat (Sawyer and Lindzey 2002). Research indicates individual lions may be responsible for the majority of predation in a given area, and adverse effects are most likely to occur in small isolated desert populations (Sawyer and Lindzey 2002). For example, there is considerable evidence that increased mountain lion predation during the 1980s sent Sierra Nevada bighorn herds toward

extinction in California and given the social nature of bighorn sheep biology the herd has not recovered (Wehausen 1996). Festa-Bianchet et al. (2006) documented that switches to mountain lion predation as the limiting factor occurs surprisingly frequently in bighorn sheep populations, and that the onset of high predation episodes was unrelated to bighorn sheep density. In the Mazatzal Mountains of central Arizona, McKinney et al. (2006b) found that nutritional status and mountain lion predation during a drought influenced desert bighorn sheep population parameters and that short-term removal of mountain lions contributed to higher growth and productivity of the small, isolated population - even during periods of drought. The recent findings of McKinney et al. (2006a) support the idea that predation of desert bighorn sheep by mountain lions is independent of predator abundance, and thus may be more a function of learned behavior by individual predators. Removing offending lions may allow the herd to increase to levels better able to sustain lion predation in the future and allow resumption of the bighorn sheep translocation program.

5.2.3 Impact on Non-Target Species Impacts to nontarget species from efforts to capture, translocate, or lethally remove mountain lions are anticipated to be small. When foot snares are used to capture lions, they are equipped with a pan-tension device that excludes animals of lighter weight. Non-target animals might be captured in box traps, but can be easily released unharmed. Shooting is highly target specific and does not pose a risk to non-target animals when conducted by professional wildlife specialists trained in firearm use and trained to identify target and non-target species. Dogs used to track mountain lions do not pose a threat to non-target species because they are trained to trail only mountain lions.

5.2.4 Impact on Visual Resources and Recreation Alternative B – the Proposed Action would have only minimal impacts on visual resources. Snares used for capturing lions are inconspicuous and set well away from heavily used public areas. It is unlikely that a visitor would encounter any of these devices, and they cannot be seen from a distance.

The proposed action is expected to lead to an increase in recreational opportunities for both hunters and wildlife watchers due to an anticipated expansion of the refuge desert bighorn sheep population. This could be expected to result in a positive economic impact to the local area from increased visitation to the Refuge by both non-consumptive wildlife viewers and hunters.

5.2.5 Impact to Wilderness Alternative B would involve little use of motorized equipment in wilderness. Personnel involved in the placement of snares, radio-collaring of mountain lions, and lethal removal of offending lions would access portions of the Refuge away from the roads on foot. Translocation of mountain lions would likely involve the brief uses of a helicopter to transport tranquilized lions. Wilderness issues arise from wilderness values, of which both mountains lions and bighorn sheep are a part. Mountain lions are a native predator, albeit one that has not been historically common in the immediate region. Desert bighorn sheep are also native to the region and their preservation was the driving force behind establishment of the Refuge. Under the proposed alternative, the wilderness value of the Refuge could be diminished from the standpoint that a natural predation process is being limited and a component of wilderness is being removed. The wilderness value of the Refuge might also be increased by a rise in the population of desert bighorn sheep.

For wilderness areas within the System, the purposes of the Wilderness Act are considered to be “within and supplemental” to the purposes for the specific Refuge; i.e., the wilderness purposes are additional purposes for the Refuge and must be considered within the legal context of the applicable wilderness statutes. The preservation of wilderness values, which includes wildlife populations, is an important mandate that is considered in the management of the Refuge. Thus, wilderness designation does not preclude active management of resources, but it does require greater scrutiny of management activities such that wilderness character is preserved

Preserving wilderness character is a primary criterion for judging the appropriateness of proposed refuge management activities in wilderness. Preserving wilderness character requires that we maintain both the tangible and intangible aspects of wilderness. Wilderness character increases as it approaches the highest measure of natural conditions and being untrammelled.

Service policy (610 FW 2.16) states that we conserve fish, wildlife, and plant resources and their habitats in wilderness in a manner consistent with the National Wildlife Refuge System Administration Act of 1966, the National Wildlife Refuge System Improvement Act of 1997, and refuge purposes, including Wilderness Act purposes. Fish, wildlife, plants and their habitat are essential and inseparable components of wilderness.

Service policy [610 FW 2.16B(1)] also states that we will not interfere with natural processes in wilderness unless necessary to accomplish refuge purposes, including Wilderness Act purposes. This includes the disruption of predator/prey relationships. Service policy (610 FW 2.20) specifically addresses predation control in Refuge wilderness areas and states:

“Predation is an essential and integral process in the wilderness ecosystem. We will initiate actions intended to alter natural predator/prey relationships only when compelling evidence exists that the proposed action will correct or alleviate identified impacts on native fish, wildlife, plants, or their habitats and would be in compliance with section 2.16. We will direct control at the individual animal(s) causing the problem using the method least likely to adversely impact nontarget species and wilderness visitors. We will not manage predation solely to protect livestock, wilderness visitors, or other users.”

Alternative B conforms to the policy because it is being proposed to reduce adverse impacts to the Refuge bighorn sheep herd. The continued presence of the herd is essential to meeting the purposes of the Refuge. The Service also proposes to target the individual animals causing the problem and there would be few, if any, potential adverse impacts to non-target species. See the Minimum Requirement Analysis for a more detailed description of these impacts (Appendix C).

5.2.6 Other Considerations Implementing Alternative B, the Proposed Action, is most likely to meet the concerns of those individuals, agencies, and organizations that expressed a desire for prompt action on the part of the Service to address the bighorn sheep decline. Approximately 50% of the scoping comments received (52 of 122) favored Alternative B.

Alternative B also meets the needs of those who expressed concern that mountain lions on the Refuge might undo some of the efforts to date toward the conservation of bighorn sheep.

Alternative B would be the most costly, however, of the three action alternatives, in the short term.

Under Alternative B, contract trappers would continue to be hired to work on the Refuge to trap and radio-collar mountain lions. The funding for these efforts, like those in the past, would come from both agency and private sources and would cost approximately \$25,000 per year. Other expenses include GPS-equipped radio collars which cost approximately \$5000 each, along with drugs to temporarily immobilize lions. Alternative B would also continue to support an additional position at the Refuge, a temporary biological technician.

5.2.7 Cumulative Impacts

5.2.7.1 Cumulative Impacts to Mountain Lions The AGFD estimates that there are 2,500 to 3,000 mountain lions in the state of Arizona. Since 1982, the year mandatory check-outs were established, mountain lion harvest has ranged from 193-384 lions per year, approximately 15% of which were taken by APHIS-WS wildlife specialists and private individuals to solve depredation issues (AGFD 2007, AGFD 2008). The removal of these mountain lions has occurred while mountain lions apparently re-occupied and expanded their range in Arizona, including into the Refuge. Mountain lion hunting is not allowed on any of the nine National Wildlife Refuges in the state of Arizona, although it is allowed in all of the GMUs surrounding the Refuge. However, no sport hunter has ever reported harvesting a lion in any of these surrounding units.

In a regional setting, removal of offending lions will not adversely affect the statewide mountain lion population and is within the mountain lion population objectives set by the AGFD. Mountain lion population densities were documented as high as 6.9 lions/100 mi² in the area surrounding Aravaipa Canyon and Klondyke, Arizona (Cunningham et al. 1995), and mountain lions are known to occupy every mountain range between the Refuge and central Arizona, including the Vulture, Harquahala, Harcuvar, Bighorn, Weaver, Date Creek, and Granite Wash Mountains. However, it is possible that the local Refuge population of lions could be reduced below a sustainable population, especially if females are removed. Mountain lions are solitary animals that may reoccupy vacated areas slowly (Logan et al. 1996). The proposed alternative is not intended to extirpate lions from the Refuge, if a sustainable population exists and persists, and past experience capturing lions on the Refuge has demonstrated that removing all lions would be extremely difficult, expensive, and unlikely. At this time, only one breeding female is known to be on the Refuge. If this female is removed it may take some time for another female to establish a territory on the Refuge. Male mountain lions have large home ranges and disperse widely; if a male mountain lion is taken it would probably take less time for another male to replace the male that is removed. The male mountain lion KM04 has already been documented as using parts of the territories previously occupied by mountain lions KM01 and KM03, so it is possible that the adult mountain lion numbers on the Refuge have returned to pretreatment conditions (before the removal of mountain lions KM01 and KM03). The Refuge mountain lion population was long considered transient and may become so again.

The impacts of transplanting mountain lions into a new area on the wildlife already present in that area would vary upon the location(s) selected and are outside the scope of this document.

5.2.7.2 Cumulative Impacts to Bighorn Sheep The Refuge bighorn sheep herd has been a source population for bighorn sheep translocations since 1957. From 1957 through 2006, 569 bighorn sheep were translocated from the Refuge to supplement populations in Arizona, New Mexico, Colorado, and Texas. After the decline noted in 2006, the translocation program was suspended indefinitely until the sheep population recovers to the translocation guidelines set out in the USDI 1997. This includes an effort to reestablish desert bighorn sheep in the San Andres Mountains on San Andres NWR in New Mexico, along with transplants in Arizona to the Mineral, Bighorn, and Santa Catalina Mountains among other locations. The Refuge bighorn sheep have provided vital population boosts and genetic variety to bighorn sheep herds all over the southwest. If the population recovers, these transplants can continue, which would provide benefits to bighorn populations over the entire southwestern region

5.3 Alternative C – Indiscriminate Removal of Mountain Lions

Alternative C, the Indiscriminate Removal of Mountain Lions Alternative, would involve removal of mountain lions through lethal control or translocation. This alternative is somewhat similar to Alternative B, the Proposed Action, with some differences. Alternative C, if implemented, has the potential to impact biological resources, considered in Sections 5.3.1, 5.3.2, and 5.3.3, and social factors considered in Sections 5.3.4, 5.3.5, and 5.3.6.

5.3.1 Impacts on Mountain Lion Populations Because mountain lions would be removed indiscriminately until the mountain lion population is reduced enough to effect a change in the bighorn population, this alternative could possibly result in the removal of more mountain lions overall because removing non-offending mountain lions may not produce the desired results. Ernest et al.'s (2002) modeling indicated that landscape-level removal resulted in more removals of mountain lions that did not prey on bighorn sheep than selective removal of offending lions. Because of this possibility, Alternative C is the least humane of the three Alternatives.

Indiscriminate removals would be the most effective and cost-efficient way to remove mountain lions; however, indiscriminate removals would remove mountain lions that do not necessarily prey on bighorn sheep, resulting in additional mountain lions likely being removed, and their possible extirpation from the Refuge. Additionally, this alternative would be less effective than Alternative B in gathering information to be used for mountain lion management.

5.3.2 Impact on Bighorn Sheep Populations Impacts to bighorn sheep populations would be similar to those mentioned under Alternative B, or possibly more beneficial. Ernest et al. (2002) found that as a general rule, indiscriminate removals were equal or superior to selective removals in terms of reducing bighorn sheep predation mortality. Thus, the removal of mountain lions under this alternative would likely have the same or slightly better effect on the bighorn sheep population than under Alternative B.

5.3.3 Impact on Non-target Species Impacts to non-target species would be similar to those discussed under Alternative B.

5.3.4 Impact on Visual Resources and Recreation Impacts to visual resources and recreation would be similar to those discussed under Alternative B.

5.3.5 Impact to Wilderness Impacts to Wilderness would be similar to those discussed under Alternative B. See the Minimum Requirement Analysis for a more detailed description of these impacts (Appendix C).

5.3.6 Other Considerations Implementing Alternative C in part meets the concerns of those individuals, agencies, and organizations that expressed a desire for prompt action on the part of the Service to address the bighorn sheep decline. Alternative C meets the needs of those individuals, agencies, and organizations that requested the removal of as many mountain lions as possible from the Refuge. Alternative C does not meet the needs of those who requested that the Service limit or avoid any action that causes the death of animals. Alternative C would be the second most costly of the three action alternatives in the short term, with Alternative B being the most expensive.

Under Alternative C, contract trappers would continue to be hired to work on the Refuge to trap and mount lion skins. The funding for these efforts, like those in the past, would come from both agency and private sources and would cost approximately \$25,000 per year. As in Alternative B, drugs would be needed to temporarily immobilize lions if they were translocated, but no funds would be needed for radio-collars. Alternative C would also continue to support an additional position at the Refuge, a temporary biological technician.

5.3.7 Cumulative Impacts Cumulative impacts to mountain lions and bighorn sheep would be similar to those discussed under Alternative B, the proposed action.

5.4 Unavoidable Adverse Impacts

The selection of any alternative would have no unavoidable adverse direct or indirect impact on the environmental parameters evaluated in this EA.

5.5 Irreversible and Irretrievable Commitments of Resources

The management actions identified in this document will require a commitment of funds that would then be unavailable for use on any other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. Non-renewable or non-recyclable resources committed to implement the proposed action, such as fuel, would also represent irreversible and irretrievable commitments of resources, but would be very minor in scope and not appreciably different under any of the alternatives.

5.6 Summary and Conclusions

Three alternatives were evaluated for potential impacts to environmental resources. Alternative A - the No Action Alternative, Alternative B – Proposed Action, and Alternative C – Indiscriminate Removal of Mountain Lions.

Alternative A – would be the least effective at meeting the Refuge’s objectives related to bighorn sheep. Alternative A would be the least costly alternative in the short term since no mountain lions would be removed from the Refuge. It may also be the most costly in the long term, since desert bighorn sheep numbers may be expected to continue to decline, necessitating more costly management measures in the future to increase their numbers. Alternative A is considered the most humane alternative since no mountain lions on the Refuge would be subject to the stresses and anxiety that would be involved in translocation or removal.

Alternative B – is the alternative that is the most likely to be effective in increasing numbers of desert bighorn sheep while maintaining mountain lions that do not regularly kill bighorn sheep on the Refuge. Alternative B would be the most costly alternative in the short term since it is logistically difficult and time-consuming to capture, collar, monitor, and then remove offending lions. Alternative B allows mountain lions that do not regularly kill desert bighorn sheep to remain on the Refuge. This alternative also provides the most information concerning mountain lions including their movements and diet. Alternative B is expected to be less costly in the long term than Alternative A.

Alternative C – would be intermediate in cost between Alternatives A and B, but would result in the removal of mountain lions that do not regularly kill desert bighorn sheep. This alternative would provide little new information concerning mountain lion movements and diet, and is considered the least humane of the three alternatives.

This EA is intended to support adaptive management and implementation of additional management approaches as more information is gathered.

6.0 COMPLIANCE, CONSULTATION AND COORDINATION

This section provides information regarding consultation and coordination that has occurred with other federal and state agencies, interested stakeholders, and the public; list of preparers; and references used in preparation of this EA.

6.1 Authority and Compliance

The Service cooperates with land and wildlife management agencies to resolve management problems in compliance with applicable federal, state, and local laws.

Based on agency responsibilities, missions, and legislative mandates, the Service is the “lead agency” and “decision maker” for this EA and therefore responsible for the EA’s scope and content. As cooperating agencies, the AGFD, APHIS-WS, and BLM have provided input on this EA and will provide advice and recommendations to the Service on when, where, and how mountain lion management could be conducted.

6.1.1 Authority of Federal and State Agencies

USDI - U.S. Fish and Wildlife Service. The Service, under the National Wildlife Refuge Administration Act of 1966 (as amended) and the National Wildlife Refuge Improvement Act of 1997, administers lands and waters in the National Wildlife Refuge System for the conservation, management, and restoration of fish, wildlife and plant resources and their habitats.

USDI - Bureau of Land Management – The Bureau of Land Management, Yuma Field Office, manages approximately 1.1 million acres of public land, including some of the lands surrounding the Refuge, under the Federal Land Policy and Administration Act of 1976. BLM has the responsibility to manage the resources on public lands for multiple uses including livestock grazing, timber production, recreation, and wildlife habitat, while recognizing the State’s authority to manage wildlife populations. These uses are outlined in Resource Management Plans. BLM is an integral part of the overall plan to reduce mountain lion predation on desert bighorn sheep because the public lands they manage are adjacent to the Refuge.

Arizona Game and Fish Department. AGFD, acting under authority of the Arizona Game and Fish Commission, and Arizona Revised Statutes Title 17, has trust responsibilities for the protection and management of wildlife in the state.

USDA -APHIS-Wildlife Services. The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, and the Act of December 22, 1987 which authorize and direct APHIS-WS to manage damage caused by wildlife, in cooperation with other agencies.

6.1.2 Compliance with Federal Laws

The following federal laws are relevant to the actions considered in this EA;

National Environmental Policy Act of 1969 (NEPA). (42 USC Section 4231, et seq.); the President’s Council on Environmental Quality (CEQ) Regulations, 40 Code of Federal Regulations (CFR) Section 1500 - 1508; Department of the Interior’s Departmental Manual for NEPA compliance, Fish and Wildlife Service (516 DM 6). Individual actions by any federal agency implementing conservation or recovery actions identified in conservation or recovery plans may be subject to NEPA.

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C § 668dd-668ee). This Act, derived from sections 4 and 5 of Public Law 89-669, consolidated game ranges, wildlife ranges, wildlife management areas, waterfowl production areas, and wildlife Refuges into a single National Wildlife Refuge System. It also established the “compatibility standard” for allowing uses on a refuge only when such uses do not materially interfere with or detract from the purpose of the refuge.

National Wildlife Refuge System Improvement Act of 1997 (H.R. 1420, 105th Congress). This law amended the National Wildlife Refuge System Administration Act of 1966 and provided comprehensive direction with regard to how National Wildlife Refuges are to be administered. There are several key themes of the legislation including management of National Wildlife Refuges as a system to fulfill the stated mission. The law also created a hierarchy of activities, putting wildlife first, priority public uses next, and then other uses. The law further mandated that all uses of a Refuge be compatible with the System mission and the unit’s purpose. Comprehensive conservation planning was also mandated for all Refuge units.

Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890) -- Public Law 88-577. This law defined allowable and prohibited uses of wilderness, and directed the Secretary of the Interior to review every roadless area of five thousand contiguous acres or more within the national wildlife refuges and game ranges, and report his recommendation as to the suitability or nonsuitability of each such area or island for preservation as wilderness.

Arizona Desert Wilderness Act of 1990. P.L. 101-628. This law designated portions of the Kofa National Wildlife Refuge as part of the National Wilderness Preservation System.

6.2 Consultation, Comment Period, Acronyms, and References

a. Agencies and Organizations Consulted

USDA-APHIS-Wildlife Services

Thomas C. Hall, Operational Support Staff and Environmental Management
Coordinator

US Army –Yuma Proving Ground

Jason C. Gibbons, Wildlife Biologist

Arizona Game and Fish Department

Bob Henry, Region IV Game Specialist

John Hervert, Region IV Wildlife Program Manager

Russ Engel, Region IV Fisheries Program Manager (previously Habitat Program Manager)
 Ron Thompson, Big Game Habitat and Large Carnivore Specialist
 Bureau of Land Management, Yuma Field Office
 Winfred Wong, Wildlife Biologist
 J. Todd Shoafe, Yuma Field Office Manager
 Karen Reichhardt, Team Lead, Natural Resources Specialist
 US Fish and Wildlife Service – Region 2, Albuquerque
 Mitch Ellis, Project Leader, Southwest Arizona NWR Complex
 Thomas Harvey, Refuge Supervisor – Arizona and New Mexico
 Kathy Granillo, Wildlife Biologist
 Carol Torrez, Chief, Chief, Division of Planning
 Grant Harris, Ph.D., Conservation Goals Coordinator
 Justin Tade, Field Solicitor
 US Fish and Wildlife Service – Washington Office – Arlington, Virginia
 Andy Loranger – Division Chief, Natural Resources and Conservation Planning
 Greg Siekanic – Chief of Refuges

b. Technical Preparers

Susanna Henry, Kofa NWR Refuge Manager, USFWS
 Lindsay Smythe, Kofa NWR Wildlife Biologist, USFWS

c. Comment and Review Period

This Draft EA has been published and is available for review to those agencies and individuals listed in Appendix B, as well as all of the individuals, agencies, and organizations that provided comments during the scoping period. Additional copies of this EA are available upon request. Inquiries should be directed to Kofa National Wildlife Refuge, 9300 E 28th St., Yuma, AZ 85365.

d. List of Acronyms

AGFD	Arizona Game and Fish Department
APHIS	Animal and Plant Health Inspection Service (USDA Agency)
AVMA	American Veterinary Medical Association
BLM	Bureau of Land Management
CCP	Comprehensive Conservation Plan
CFR	Code of Federal Regulations
EA	Environmental Assessment
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
NEPA	National Environmental Policy Act
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior

VHF Very high frequency
WS Wildlife Services

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Appendix A - Species of Special Concern

The Refuge has 11 species of special concern. One of these species is a federally listed endangered species that is rarely present on the refuge during migration, the Southwestern Willow Flycatcher. It also has ten other species considered state sensitive. None of these species is expected to be impacted by any Alternative.

Table A1. Species of Special Concern potentially on Kofa NWR (AGFD 2008 - Heritage GIS Database @ http://www.azgfd.gov/w_c/edits/hdms_abstracts.shtml, Last visited 12/17/2008)

Scientific Name	Common Name	ESA Rank	State Rank	Status
BIRDS				
<i>Egretta thula</i>	Snowy Egret	-	WSC	Mfs
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	-	WSC	Mfws
MAMMALS				
<i>Euderma maculatum</i>	Spotted Bat	-	WSC	U
<i>Lasiurus blossevillii</i>	Western Red Bat	-	WSC	Mfs
<i>Lasiurus xanthinus</i>	Western Yellow Bat	-	WSC	R
<i>Macrotus californicus</i>	California Leaf-nosed Bat	-	WSC	R
REPTILES				
<i>Gopherus agassizi</i> (Sonoran pop.)	Sonoran Desert Tortoise	-	WSC	R
PLANTS				
<i>Mammillaria viridiflora</i>	Varied Fishhook Cactus	-	SR	R??
<i>Opuntia echinocarpa</i>	Straw-top Cholla	-	SR	R??
<i>Washingtonia filifera</i>	California Fan Palm	-	SR	R??

State Rank – WSC=Wildlife of Special Concern, SR=Salvage Restricted – Collection only with permit

Status – M=Migrant (seasonal: f (fall), w (winter), s (spring)), R=Resident, U=Unknown (no records on Kofa, but possible)

Appendix B - Scoping Comments

On April 23, 2008, the Service announced its intent to prepare this Environmental Assessment exploring possible alternatives for the management of mountain lions and their impacts to desert bighorn sheep on the Refuge. A 30-day scoping period running April 24 to May 24, 2008 was established under that notice. The Service provided a news release to the media and sent out 4,007 letters and emails to potential interested parties announcing the initial scoping period for development of a lion management EA. In response to requests from the public for additional time to identify issues they would like addressed in the planning process, the Service extended the public scoping period an additional 30 days, to June 23, 2008.

During this scoping period the Service received 122 response letters or emails with comments that were considered as part of this analysis. The following agencies, organization, and individuals provided scoping comments:

Agencies

Arizona Game and Fish Department
Arizona State Parks
Laguna Natural Resource Conservation District
Yuma Natural Resource Conservation District
International Boundary and Water Commission
Town of Buckeye
U.S. Department of Agriculture – APHIS, Wildlife Services
U.S. Department of the Interior – Bureau of Land Management
Yuma County Board of Supervisors

Organizations

Animal Protection Institute
Animal Welfare Institute and Animal Defense League of Arizona
Arizona Antelope Foundation
Arizona Deer Association
Arizona Desert Bighorn Sheep Society
Arizona Sportsmen for Wildlife
Arizona Wildlife Federation
Defenders of Wildlife
Foundation for North American Wild Sheep – California Chapter
The Cougar Fund
The Humane Society of the United States
Public Employees for Environmental Responsibility – Southwest (PEER)
Safari Club International/Safari Club International Foundation
Sierra Club – Grand Canyon Chapter
Wild Sheep Foundation
Yuma Audubon Society (2 letters)

Yuma Valley Rod and Gun Club

Individuals

Warren Adams	Greg Ferguson	Cheri Pillsbury
Lynn Ashby	C.F. Gansberg, D.V.M.	Steve Pollack
Larry Audsley	Rich Glinski	Bonnie Poulos
Janet E. Blevins Bailey	Larry Heathington	S. Raftery
Gary D. Barcom	Dick Henry	Debra Raymond
David Barnes	Mike Hirsch	Paul Roetto
Kim Bauer	Melissa Hughes	B. Sahcua
Dave Berry	Lisa Hunt	Bruce R. Schoeneweis
Bettina Bickel	Stewart A. Jackson, Ph.D.	Justin Schmidt
Barbara Bockman	Bruce H. Johnson	Harley G. Shaw
Gerald R. Bouck	Ron Kearns (2 letters)	Roger Sherman
Carl Brashears	David Kennedy	Sue W. Shimer
Michael Breslow, M.D.	Emily Kenny	Carl Shores
Tom Britt	Don Kleck	William Smith
Nuntanit Bumrungsap	Colette Klinkenberg	Glenn D. Sosebee
Catherine	Nancy Kroening	Gregory Stainton
Rick Carosone	Lisa Kyriacos	Doug Stancill
Richard Caudill	Patricia Lambert	David Strauch
Doris Cellarius	Rev. Davidson T.	Halina Szyposzynski
Gary Christensen	Landers	William C. Thornton
Steve Clark	Mike Laughlin	Gina Torgersen
Collins L. Cochran	James Loaris	Jim Unmacht
David Colvin	Kim Maddox	Angelina Valles
John F. Colvin, Jr. (2 letters)	Ron Marks	Dwight Van Brunt
Mark Coryell	Mary Martin, Ph.D.	Rich Veit
Patty Danley	Clint Robert Matkovich	Dr. Elizabeth Wallace
Mike Daily	Alan McGee	Devan Wastchak
Rudy Dankwort	David McKee	James T. White
Lou Ann Denison	Kaitlyn McKee	Mary Williams
Brian Dolan	Pam Nelson	Lloyd and Patrick
A. Donnici	Nancy Newkirk	Wundrock
Debora Durant	Doug Newton	Mark Zachary
Bob Eck	Jean and Franklin	
George Elledge	Olmsted	
Bea Elliott	Brooks Pangburn	
Kevin Emmerich	Sandy Peterson	
	Paul Pietrocarlo	

Approximately 42% of the scoping comments received (52) expressed opinions in favor of Alternative B – the Proposed Action Alternative, while approximately half (61) expressed opinions in favor of Alternative A – the No Action Alternative. Eight of the comments were

neutral or general in nature. Many comments requested that information be included in the EA, including the long-term history of desert bighorn sheep on the Refuge, the methods of assessing the numbers of desert bighorn sheep and mountain lions, and information on lion predation and its effect on bighorn sheep in other areas. Some letters requested that the Service establish clear bighorn population guidelines detailing when lions would be removed or removals curtailed. Several mentioned that they would like to see the document include the impacts of water catchment construction on the bighorn sheep, mountain lions, and other wildlife species on the Refuge. Several commenters asked about the effects of drought on desert bighorn sheep. Concerns were expressed for the Refuge's mule deer population, and how it might be impacted by mountain lion predation. One commenter asked for a description of the biology of mountain lions and desert bighorn sheep and a detailed description of the relationship between climate and predator/prey dynamics. Another individual asked if mountain lions only kill what they can consume. Questions were expressed including how an animal can be shown to have been killed by a collared lion rather than scavenged. Several writers requested that the Service consider the ecosystem as a whole and provide a reasonable range of alternatives. A few letters requested that the Service include a minimum tool analysis with the EA. One individual asked the Service to be open-minded. Arizona State Parks requested that the Service take into account cultural resources in the EA.

Several of the comments that generally appeared to favor Alternative A, the no action alternative, requested that the Refuge not allow mountain lion hunting, or hunting of any species. One commenter expressed concern about the cost of capturing and placing collars on mountain lions and asked if the funds should be spent on additional water sites instead. A few commenters likened the removal of offending lions from the Refuge to aerial wolf hunts or seal hunts in Canada and asked that "nature take its course." One organization stated "the practice of killing radio-collared mountain lions is flawed. Collared mountain lions are much more valuable to improving our understanding of their ecology and dynamics with bighorn alive than dead." Another organization asked for more empirical evidence describing how it is known that mountain lion predation is the cause of the desert bighorn sheep decline. Several individuals suggested that the Refuge be closed to all vehicles. A few writers suggested relocation of offending mountain lions, and one writer suggested relocating offending mountain lions to places where there is an overpopulation of deer. Several individuals and organizations asked the Service to consider no removal of mountain lions by agencies or hunters. Other writers asked that all desert bighorn sheep hunting be suspended. One writer asked the Service to use experienced observers and navigators during aerial bighorn sheep surveys.

Comments that generally appeared to favor Alternative B, the proposed action, requested that the Service go ahead with efforts to collar, monitor, and remove offending lions. Some commenters asked the Service to make a special effort to capture and remove a specific breeding female lion known to use the Refuge. Several writers asked that the Service emphasize that bighorn sheep and mountain lions are both non-endangered and non-migratory and that the formerly recognized Yuma puma (*Puma concolor browni*) does not really exist as a genetically unique subspecies. Several suggested opening the Refuge to lion hunting. Some writers suggested removing lions even before the EA is completed. Others pointed out the long history of desert bighorn sheep conservation on the Refuge and asked the Service to act quickly before the sheep population

dwindled to nothing, wasting all of the effort the Service has done to date for sheep. Several provided comments stating that the Service should not allow the Wilderness status of the majority of the Refuge to inhibit the implementation of lion management strategies. Several individuals stated that mountain lions need to be removed from the Refuge just like they were in GMU 22 (in central Arizona). Others pointed out that the expansion of a breeding population of lions into the Refuge is an indicator that mountain lion populations in the surrounding areas of southwestern Arizona are doing well. Several commenters mentioned that there has been considerable urbanization in Arizona and the pressures put on wildlife could be making problems for bighorn sheep worse. Some suggested removing all but one mating pair of lions or asked the Service to remove all lions. One writer stated “I hunted Kofa for sheep in 2007 and it took me 20 days to find my ram; there was lots of lion sign and very few sheep.”

The broad range of comments received was considered in the drafting of this document. Information on several specific issues and alternatives was provided in the EA as a result of scoping comments. It is believed that this has helped to create a document that more completely explains the science, logic, and management emphasis driving the decision-making process.

Appendix C



ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

“ . . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act...”

– the Wilderness Act, 1964

Please refer to the accompanying MRDG instructions for filling out this guide.
The spaces in the worksheets will expand as necessary as you enter your response.

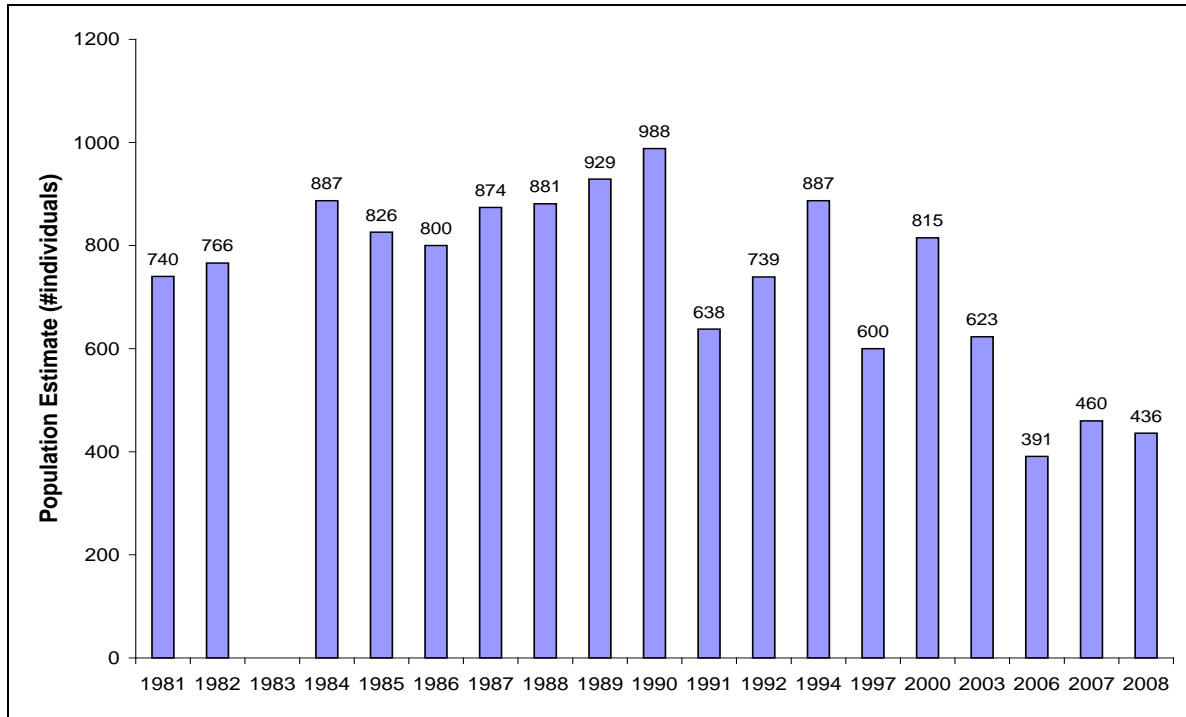
Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

Recent surveys have shown a significant decline in bighorn sheep (*Ovis canadensis mexicana*) numbers on Kofa National Wildlife Refuge (Refuge). Annual surveys over the past 3 years indicate the sheep population is roughly 50% of the long-term average of 760 (Figure 1). This limits the Refuge’s ability to meet wildlife conservation mandates as they relate to desert bighorn sheep. The Refuge is also unable to support landscape level translocation programs for bighorn sheep when the population is at this level. Providing sheep for transplants is an important landscape level goal identified by the Refuge and partner agencies. Maintaining a viable bighorn sheep population is critical to fulfilling the Refuge’s purpose and maintaining an important wilderness value.

Figure 1. Kofa NWR Bighorn Sheep Population Estimates, 1981-2008.



To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: No:

Explain:

The Kofa Wilderness is one of the few areas left that is large enough and has the correct habitat configuration to support large numbers of desert bighorn sheep in a single protected area. While there are many mountain ranges in southern Arizona that contain bighorn sheep, these populations are often too small to ensure sustainability or to serve as source populations for broader conservation efforts. Many of these isolated areas are also federally designated wilderness managed by the BLM or FWS.

The significance of the Refuge is that it contains the largest contiguous block of habitat for desert bighorn sheep in southwest Arizona. While site-specific actions can sometimes be effectively conducted outside wilderness, broad scale management actions must occur within wilderness. Wilderness designation covers 510,000 acres of the Refuge's 665,400 acres. In many instances, conservation actions directed at bighorn sheep on the Refuge will need to be conducted within wilderness.

Desert bighorn sheep populations are at risk or declining in many areas throughout their range in the southwest. Intervention to manage adverse impacts brought on by anthropogenic forces is frequently necessary. The impact of natural factors such as drought, disease and predation

are exacerbated by unnatural factors such as habitat fragmentation, disease transmission by livestock, and direct disturbance caused by recreation. Historically, natural cyclic population fluctuation, even complete extirpation from specific mountain ranges, posed no serious lasting effect. This was true because bighorn sheep were able to move easily between mountain ranges, and often did, enabling appropriate habitats to be re-colonized and existing herds to receive genetic exchange. Unfortunately, human induced habitat fragmentation has seriously limited the ability of desert bighorns to move between areas of their historic range. Specific barriers in southern Arizona would include the cities of Tucson, Phoenix, other municipalities, the Central Arizona Project, other large canals, agricultural development along the Gila River, Interstate 10, Interstate 8, other highways, and growing recreational pressures. The introduction of disease through contact with livestock can also have dramatic impacts on bighorn herds, sometimes eliminating them in areas altogether. Isolated populations can also be vulnerable to human disturbance as was demonstrated near Tucson's Pusch Ridge, where hikers and their pets had dramatic effects on bighorns. Considering this information collectively, one can begin to understand the need for active management of this species, including the need to conduct transplants of desert bighorn sheep to specific areas as the need arises. For example, suitable habitats currently unoccupied due to a disease event may justify a translocation of several sheep at once, while smaller numbers of sheep may be needed for translocations to maintain genetic viability in smaller populations. The management of desert bighorn sheep populations in the few larger blocks of habitat that remain is critical in order to have lasting source populations.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: No: Not Applicable:

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: No: Not Applicable:

Explain:

The National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. §668dd, as amended) states, "the mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." The Act emphasized that the Refuge System was created to conserve wildlife and their habitats. The Act defines conservation as sustaining, restoring or enhancing healthy populations of fish, wildlife, and plants utilizing methods and procedures associated with modern scientific resource programs. The Act directs the Service to manage each refuge to fulfill the mission of the System as well as the specific purposes for which that refuge was established. The specific purpose of Kofa National Wildlife Refuge is found in Executive Order 8039 and is "for the conservation and development of natural wildlife

resources.” The conservation of desert bighorn sheep was the driving force behind the establishment of the Refuge.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: No: Not Applicable:

Explain:

The *Kofa National Wildlife Refuge & Wilderness and New Water Mountains Wilderness Interagency Management Plan and Environmental Assessment* (USDI 1997) does not address predator management. However, it does address the significance of the bighorn sheep population on the Refuge and its importance in helping to achieve Refuge purposes, including its value as a wilderness resource and source population for regional translocations. The plan states that the Service will maintain and enhance the natural diversity of flora and fauna within the planning area and this will be done within a dominant wilderness context. The plan goes on to state that the Service will manage wilderness portions of the planning area using the minimum tools needed for maintaining an optimal desert bighorn sheep population while providing for maximum viable species diversity.

E. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: Yes: No: Not Applicable:

Undeveloped: Yes: No: Not Applicable:

Natural: Yes: No: Not Applicable:

Explain: The presence of desert bighorn sheep in the wilderness is important, and they represent an important aspect of the naturalness of this specific wilderness area. The appropriate stewardship of this wilderness resource is required to fulfill the purposes of the Refuge, including the Wilderness Act.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: No: Not Applicable:

Other unique components that reflect the character of this wilderness:

Yes: No: Not Applicable:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: Yes: No: Not Applicable:

Scenic: Yes: No: Not Applicable:

Scientific: Yes: No: Not Applicable:

Education: Yes: No: Not Applicable:

Conservation: Yes: No: Not Applicable:

Explain: As described earlier in the document, the conservation of desert bighorn sheep at the Refuge is necessary for broader scale management and restoration of this important wildlife resource. The Kofa bighorn herd is one of very few populations able to support transplant programs for landscape level conservation of this species.

Historical use: Yes: No: Not Applicable:

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: No: More information needed:

Explain:

The Refuge was established in 1939 by Executive Order 8039 which described the legal purpose being “for the conservation and development of natural wildlife resources, and for the protection of public grazing lands and natural forage resources.” The Refuge is managed to fulfill the mission and goals of the Refuge System, as well as the specific purpose for which the Refuge was established. The conservation of desert bighorn sheep was the driving factor in the establishment of the Refuge. The presence of a thriving bighorn sheep population is an important indication that the Refuge is fulfilling its purpose.

With the passage of the Arizona Desert Wilderness Act of 1990, about 510,000 acres of the Refuge’s 665,400 acres became designated wilderness. For wilderness areas within the Refuge System, the purposes of the Wilderness Act are considered to be “within and supplemental” to the purposes for the specific Refuge. Put another way, the wilderness purposes are additional purposes and must be harmonized with specific Refuge purposes as well as the mission of the Refuge System.

In response to the noted decline of bighorn numbers on the Refuge, the Service and the Arizona Game and Fish Department (AGFD) prepared a report in April 2007 titled: *Investigative Report*

and Recommendations for the Kofa Bighorn Sheep Herd (Investigative Report). The purpose of the report was to provide an analysis of the probable causes of the decline and a strategic approach to a management program intended to lead to the recovery of this important wildlife resource. The plan includes three sections. Part 1 describes the current problem and provides some historical context. The heart of the plan is Part 2, where issues are identified, and strategies to manage them are recommended. Part 3 is a concise matrix that contains prioritized implementation strategies. Many of the proposed management strategies are currently being implemented and include annual surveys to assess population dynamics, monitoring mortality factors such as disease and predation, and managing water availability. The need to manage predation was also recommended in the report. However, additional analyses, such as this “minimum requirements analysis” were needed prior to implementing that particular action.

The specific action being considered is to provide the Service additional options for the management of the Refuge’s sheep population by allowing the Service to limit predation by mountain lions. This would include the removal of “offending” lions by either lethal means or through translocation. An “offending mountain lion” is defined as one that has killed two or more desert bighorn sheep within a six-month period.

As stated earlier, the Refuge contains the largest contiguous block of habitat for desert bighorn sheep in southwest Arizona. The regional importance of this sheep population is widely recognized and has been a source for translocations since 1957. In fact, over the years 569 bighorn sheep have been captured on the Refuge and released in new areas to supplement populations in Arizona, New Mexico, Colorado, and Texas. The Refuge bighorn sheep have provided vital population boosts and genetic variety to bighorn sheep herds throughout the southwest.

The Refuge’s role in the landscape level management of desert bighorn sheep cannot be overstated. Very few areas are able to provide sheep for translocations. The Refuge must meet the population objectives for sheep in order to carry out these conservation actions. Implementing the management actions outlined earlier in the document are needed to help meet both Refuge purposes and population objectives tied to the transplant program. This includes limiting mountain lion predation on bighorn sheep.

Maintaining an optimal desert bighorn sheep population requires a multi-faceted approach. Predation management as one of the tools is appropriate under certain circumstances, and guidance for such activity is found in several policies. For example, the Refuge Wilderness Policy (610 FW 2.20) allows actions that alter natural predator-prey relationships when they help achieve our purposes and compelling evidence exists that the proposed action will correct or alleviate identified impacts on native fish, wildlife, plants, or their habitats and the control is directed at the individual animal(s) causing the problem. The Service’s wilderness policy also states that we will maintain or restore the biological integrity, diversity, and environmental health of the wilderness area.

Setting population objectives for one species, seemingly at the expense of another species, warrants further discussion as it relates to Service policies. The Service’s Biological Integrity, Diversity, and Environmental Health policy (601 FWS 3) states that each refuge will be managed to fulfill the refuge purpose as well as the Refuge System mission, and we will accomplish this by ensuring that the biological integrity, diversity, and environmental health of the refuge is maintained. Biological integrity, diversity, and environmental health can be described at various landscape scales from refuge to ecosystem, national, and international. Each landscape scale has a measure of these factors dependent on how the existing habitats, ecosystem processes, and wildlife populations have been altered in comparison to historic conditions. Individual refuges can contribute to biological integrity, diversity, and environmental

health at larger landscape scales, especially when they support populations and habitats that have been lost at a larger scale. In pursuit of refuge purposes, individual refuges may at times compromise elements of biological integrity, diversity, and environmental health at the refuge scale in support of those components at a larger landscape scale. When evaluating the appropriate management direction for refuges, the Service considers the refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales.

The bighorn sheep population objectives set for the Refuge are an example where management direction was developed in support of landscape level conservation efforts. This is particularly true with regard to objectives meant to support transplant programs across a multi-state area. Service policy states that we manage populations for natural densities and levels of variation, however, on some refuges, including those with purposes tied to particular species, we can establish goals and objectives to maintain densities higher than those that would naturally occur in order to support conservation at multiple scales. Service policy also promotes, when and where practical, the support of reintroduction programs for native species in the context of surrounding landscapes.

In addition, removing mountain lions to reduce predation of bighorn sheep is intended to reduce the number of lions on the refuge, not eliminate them entirely. In a larger context, mountain lions have expanded their North American range eastward in recent years and occupy mountain ranges throughout the state of Arizona. Reducing mountain lion numbers on the refuge would have little to no impact on statewide or nationwide populations.

While actively managing predation in wilderness introduces a form of human supervision, this manipulation is in response to larger scale human disruption of landscape level ecosystems. There is a trade-off of trammeling one aspect of wilderness character locally to enhance or restore another wilderness resource for broader purposes. The predator-prey processes will be trammled as a result of the action, but other wilderness values related to bighorn sheep will be enhanced.

Again, natural processes are difficult to describe in this case. The anthropogenic forces described earlier have had larger impacts. Specific management actions directed at bighorn sheep in wilderness may not be meant to increase or maintain the "naturalness" of the wilderness at a specific location or for a specific process. Rather, they may be intended to allow the numbers of desert bighorn sheep on the Refuge to increase for broader purposes. Prior to significant alteration of the region by humans, desert bighorn sheep would have been able to move between mountain ranges and cross desert floodplains and re-colonize mountain ranges where sheep numbers may have dropped for a variety of reasons, including predation or disease. Movements of sheep are now greatly restricted by highways, fences, canals, and human habitation.

In conclusion, there is a need to provide conservation actions in wilderness for desert bighorn sheep on the Refuge. The specific administrative action of limiting predation is needed in order to enhance the bighorn sheep population. This will further Refuge purposes, including Wilderness Act purposes, and help meet the Refuge System mission.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

<h4>Alternative No. 1 – Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Refuge (Proposed Action)</h4>

Description:

The proposed action includes capturing mountain lions, fitting them with tracking devices, and releasing them in order to follow their movements and document what prey they kill. This allows Service biologists to gather the necessary data to determine “offending lion status.” The EA defines an “offending lion” as one that, subsequent to its release, kills two or more bighorn sheep in a six month period. Under certain circumstances, lions fitting those criteria would be subject to removal. Lions removed would either be killed humanely, or relocated, if appropriate areas or organizations are found to receive the lion(s).

The primary circumstances that would guide lion removal actions are bighorn sheep population estimates. When the bighorn sheep population on the Refuge is estimated to fall below 600 animals, those mountain lions found to kill two or more sheep within a six-month period could be removed from the refuge. If the bighorn sheep population is estimated to be 800 animals or greater, the capturing, collaring, and monitoring of mountain lions could continue, but no lions would be removed. When the bighorn sheep population is estimated to be between 600 and 800 animals, multiple factors would be used to consider the totality of the circumstances before lions are removed. Lamb survival and recruitment, bighorn sheep population trend, and environmental conditions would be considered. The behavior of individual lions would be taken into account as well. For example, lions may be allowed to kill up to four desert bighorn sheep within a six-month period before removal. Long-term monitoring of mountain lion populations through use of remote cameras, scat surveys, scent stations and subsequent tracking of captured lions with satellite GPS or radio collars is proposed to continue at all estimated desert bighorn sheep population levels.

The equipment used to capture mountain lions would include pan tension devices and break-away snares. The trap sites may be baited or unbaited and optimal trap sites may be located by individuals on horseback with the assistance of lion-tracking hounds. Scent stations would typically consist of a 1-meter square area of fine dust centered on scent bait used to attract predators. Aerial darting of mountain lions, cage trapping where the box cages are placed by helicopter and the use of hounds may also take place. All handling of lions, including sedation, would be done according to established protocols.

When the lions kill a prey item, the sites are investigated by a biologist. Typically, this would be accomplished by hiking to the site. Only rarely, and in the case of a very remote kill site, would the visit be accomplished by using a helicopter. The information gathered at the kill site is time sensitive and requires a quick response by the biologist in order to obtain the most possible data.

Effects:

Wilderness Character

“Untrammeled”

The proposed action affects wilderness character, in so far as it alters natural predator-prey relationships. Service policy states that predation is an essential and integral process in the wilderness ecosystem and that we will initiate actions intended to alter these processes only when compelling evidence exists that the proposed action will correct or alleviate identified impacts on native wildlife, plants, or habitats (610 FW 2.20). Service policy also states that we will not interfere with these processes or the wilderness ecosystem’s response to such natural events unless necessary to accomplish refuge purposes, including Wilderness Act purposes, or in case where these processes become unnatural (610 FW 2.16). Discussion in the associated EA points out anthropogenic influences such as habitat fragmentation, climate change, recreation, artificial waters, and others may currently be impacting bighorn sheep numbers within the Refuge and that the multi-faceted management program being implemented, including predation management, is needed to address the issue. Service policy also states that predation management in wilderness will be directed at the individual animal(s) causing the problem. These actions must support the conservation of wildlife and their habitats in wilderness in a manner consistent with the National Wildlife Refuge System Improvement Act of 1997 and Refuge purposes, including Wilderness Act purposes. The proposed action is part of the broader approach intended to conserve desert bighorn sheep consistent with applicable statutes and Refuge purposes. The proposed action targets only the individual mountain lions preying on sheep and is not intended to eliminate mountain lions from the ecosystem. Mountain lions are expected to remain part of the ecosystem and contribute to wilderness character and play an important ecological role.

“Undeveloped”

There would be temporary visual intrusion in the wilderness from equipment and materials, including small cameras and materials placed at trap sites. However, the discreet nature of trap placement reduces the chance that the public will encounter these devices and so this activity is not expected to significantly detract from the visiting public’s experience. Scent stations may constitute a new visual intrusion but the effect would be temporary and affect only a very small area. All of these activities are expected to occur in short duration at each location and permanent impacts to the sites will be negligible or non-existent. No more than 18 trap sites are expected to be managed on the Refuge at any one time during any trapping effort, making encounters with the public extremely unlikely. All vehicles would remain on the Refuge’s designated roads. The imprint of man’s work would remain substantially unnoticeable and the Refuge would continue to contrast with other areas of growing mechanization.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”

The use of helicopters would be a temporary visual and auditory intrusion in wilderness. Should a member of the public encounter a trap site or witness the use of a helicopter, it may adversely affect their wilderness experience. Conversely, the expected increase in the number of desert bighorn sheep and the increased possibility of viewing sheep may improve the wilderness experience of the visiting public. Visitors are unlikely to be able to view mountain lions under any of the Alternatives due to the lions’ secretive nature and nocturnal habits.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation offered on the Refuge would continue in the proposed action.

“Natural”

The removal of mountain lions found to regularly prey on desert bighorn sheep is expected to allow the numbers of desert bighorn sheep on the Refuge to increase. Before human influence in the region, desert bighorn sheep would have been able to move between mountain ranges and cross desert floodplains and re-colonize mountain ranges where sheep numbers may have dropped for a variety of reasons, including predation or disease. Movements of sheep are now greatly restricted by highways, fences, canals, and human habitation.

In contrast, mountain lions are able to move great distances at night and have been found to cross highways and other barriers and travel near and through areas of human habitation. Mountain lions have apparently re-colonized the Refuge after a long period (from 1944 until 2001) when mountain lions were not detected. AGFD estimates that there are between 2,500 and 3,000 mountain lions in Arizona. The ability of mountain lions to produce several kittens in one litter and to cross manmade barriers gives lions greater reproductive potential compared to desert bighorn sheep. The removal of lions known to regularly prey on desert bighorn sheep would allow the numbers of desert bighorn sheep to increase while allowing mountain lion movements and reproduction to continue.

Other unique components that reflect the character of this wilderness

The Refuge wilderness is characterized by rugged desert mountain ranges surrounded by bajadas and separated by vast desert flats. There is evidence of past hard rock mining, livestock grazing, and the work of the Arizona Conservation Corps in the form of old roads, small concrete dams, mines, tailings piles, cemeteries, historic buildings, wells, windmills, and a corral in and immediately adjacent to wilderness. There is also past evidence of the work of the Service in the form of spring improvements and small shades and other structures in and near wildlife water sources. The Refuge is known since its inception for its conservation of desert bighorn sheep and its habitat. These unique components would not be altered or affected in the proposed action.

Heritage and Cultural Resources

In the proposed action, traps, cameras, scent stations would not be placed where they would impact Refuge cultural or historic resources. Prior to their placement, the area would be checked for cultural resources including rock art, lithic scatters, and pot shards, and those resources would be avoided.

Maintaining Traditional Skills

The proposed action includes a long-term effort to trap and release mountain lions. Trapping of animals is a traditional skill that requires intimate knowledge of animal behavior and great care in the cryptic placement of traps. Hiking cross-country to place cameras, scent stations, and traps or to reach kill sites could be considered a traditional skill. Locating and evaluating evidence at the kill sites (including drag marks, dried blood, caches, scrapes, and carcass remains) can also be considered a traditional skill. The use of horses for transportation and hounds trained to track mountain lions is an additional traditional skill.

Special Provisions

The special provisions of wilderness designation which allow mining activity to continue on unpatented mining claims that were present at the time of the passage of the Desert Wilderness Act of 1990 would not be changed by the implementation of Alternative 1 – Proposed Action.

The maintenance of wildlife water sources considered critical for bighorn sheep using mechanized tools covered in the Refuge's existing planning (USDI 1997) would continue.

Economic and Time Constraints

The proposed action requires a multi-year financial commitment by the Service, as trapping, tracking, and removing lions will require significant funding. Arrangements and agreements are in place with partner organizations to share the cost of implementing this alternative. It is anticipated that funding will be provided through the Service and partners.

The urgency of the action is driven by the depressed numbers of sheep on the Refuge and the cessation of regional translocation programs. Also, recent rainfall patterns on the Refuge have been favorable (at or above average since 2004) and have resulted in vegetation and habitat conditions beneficial for most wildlife, including bighorn sheep. The removal of "offending mountain lions" during this period may provide an exceptional opportunity to bolster desert bighorn sheep numbers on the Refuge.

Additional Wilderness-specific Comparison Criteria

The Refuge is at the center of the largest contiguous piece of desert bighorn sheep habitat for the subspecies *mexicana* (*Ovis canadensis mexicana*). While other mountain ranges contain this subspecies, they generally do not have a population of desert bighorn sheep large enough to support transplants of sheep from those mountain ranges to other mountain ranges where desert bighorn sheep numbers have declined or have been extirpated. The Refuge has been a source population for sheep transplants within Arizona and in the surrounding states for over 50 years. Transplants have been suspended since 2006, when the Refuge sheep population was found to have dropped to approximately 390 animals. Other mountain ranges in Arizona have been found to be able to support the removal of a few animals at a time, but cannot support the removal of 25 to 30 animals at one time, which is the desired number of bighorn sheep to effectively re-colonize a new area. The San Andres NWR in New Mexico, and the Bighorn, Santa Catalina, and Mineral Mountains in Arizona are examples of areas where proposed desert bighorn sheep transplants are on hold pending an increase in sheep numbers on the Refuge. Alternative 1 – the Proposed Action supports the restoration of sheep numbers to allow sheep transplants to resume.

Safety of Visitors, Personnel, and Contractors

Individuals operating power tools would need safety glasses, hearing protection and gloves for initial placement of cameras/monitoring equipment. Subsequent monitoring efforts would continue to require appropriate outdoor work attire (large-brimmed hat, sunscreen, etc) and preparation. Individuals responsible for handling and administering drugs to mountain lions and potentially relocating mountain lions would receive appropriate training and certification. Those individuals riding or working near helicopters or participating in any airborne capture attempts would require additional training and personal protective equipment.

Alternative No. 2 – No Action

Description:

Under the No Action Alternative, the Refuge would continue to be managed as it has been in the past. The Service would not limit mountain lion predation on desert bighorn sheep on the

Refuge under this alternative. This is considered the environmental baseline, or *status quo*. Since bighorn sheep management and mountain lion predation management outside the Refuge have been conducted in Arizona for decades, the environmental baseline can be considered as including the effects of the current ongoing programs. The wildlife population baselines are those that are in place under the current condition of the human environment which means they incorporate and reflect the populations as they have been and are being affected by humans.

The Service currently has no plan to guide the management of mountain lions. Current management efforts, described in the Refuge's management plan (USDI 1997), focus on the maintenance of critical wildlife water sources for bighorn sheep, and, in coordination with the AGFD, monitor desert bighorn sheep numbers, set the number of hunt permits, and consider transplants to augment populations elsewhere in the region. Research on wildlife and wildlife water sources would continue. Collection of mountain lion scat for composition analysis and the collaring of mountain lions and desert bighorn sheep would continue. The study of desert bighorn sheep health and causes of mortality on the Refuge would continue.

Effects:

Wilderness Character

“Untrammeled”

The No Action Alternative could be considered more consistent with wilderness values than the proposed action from the standpoint that natural processes would be allowed to occur since there would be no direct alteration of the predator-prey relationship within the wilderness area. However, the predator-prey relationship of mountain lions and desert bighorn sheep on the Refuge may be influenced by AGFD efforts to limit mountain lion predation on desert bighorn sheep outside of the Refuge.

“Undeveloped”

The effect of Alternative 2 – No Action would be similar to that of Alternative 1 – Proposed Action, except that no intrusions from trapping sites would be present. There would still be limited intrusions from camera monitoring and other research activities

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”

The use of helicopters for wildlife surveys and other administrative activities described in the Refuge's existing planning (including USDI 1997) would be a temporary visual and auditory intrusion in wilderness. Should a member of the public witness the use of a helicopter, it may adversely affect their wilderness experience. Outstanding opportunities for solitude or a primitive and unconfined type of recreation offered on the Refuge would continue under Alternative 2 – No Action.

“Natural”

As pointed out earlier, the naturalness of the Refuge is somewhat compromised by prior and ongoing anthropogenic forces, and has become increasingly difficult to evaluate. Bighorn sheep are an important component of wilderness and if mountain lion predation is not managed or limited, bighorn sheep numbers may decline. While it is unlikely that the bighorn sheep herd would be completely extirpated, it could drop to levels that require much more intensive,

invasive management procedures to prevent extirpation. These activities could also impact wilderness values in the long term.

Other unique components that reflect the character of this wilderness

The effect of Alternative 2 – No Action is the same as Alternative 1 – Proposed Action.

Heritage and Cultural Resources

The effect of Alternative 2 – No Action is the same as Alternative 1 – Proposed Action.

Maintaining Traditional Skills

The effect of Alternative 2 – No Action would be similar to that of Alternative 1 – Proposed Action. Traditional skills used for trapping, including uses of hounds and horses, would not be maintained, although the use of skills necessary for cross-country hiking and investigation of kill sites of collared sheep would continue.

Special Provisions

The effect of Alternative 2 – No Action is the same as Alternative 1 – Proposed Action.

Economic and Time Constraints

Continued efforts to monitor desert bighorn sheep and mountain lions through collaring efforts, scat analysis, and remote camera monitoring carry a financial cost that is similar to Alternative 1. However, future conservation actions to manage bighorn sheep on the Refuge may be more intrusive and costly if numbers continue to fall.

Additional Wilderness-specific Comparison Criteria

Under Alternative 2 – No Action, the desert bighorn sheep population on the Refuge would not be expected to increase to the point where sheep transplants can resume. The priority placed on desert bighorn sheep conservation on the Refuge would end, and transplants to mountain ranges where sheep numbers have declined or disappeared entirely would not take place.

Safety of Visitors, Personnel, and Contractors

The effect of Alternative 2 – No Action is the same as Alternative 1 – Proposed Action.

Alternative No. 3 – Indiscriminate Removal of Mountain Lions

Description:

Under this alternative, there would be no attempts to distinguish “offending lions.” Lions would be lethally removed or captured and relocated out of the Kofa Mountains Complex (Kofa, New Water, South Plomosa, Tank, Little Horn, and Castle Dome Mountains). Efforts would be made to remove approximately two mountain lions per year from the area until the sheep population reached approximately 800 animals and exhibited an increasing trend based on at least 3 sheep population surveys. Lion removals would resume if the desert bighorn sheep population was found to again go below 800 animals. Lethal removal and translocation techniques would be identical to those in Alternative 1. Research and monitoring of wildlife would continue as earlier

described. Under this alternative, the indiscriminate removal of mountain lions may not necessarily remove those animals known to regularly kill desert bighorn sheep.

Effects:

Wilderness Character

“Untrammeled”

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action. The indiscriminate removal of mountain lions may allow the numbers of desert bighorn sheep to increase, but it may also include the removal of animals that are not regularly consuming desert bighorn sheep. Because of this, Alternative 3 may not meet Service policy under 610 FW 2.20.

“Undeveloped”

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

“Outstanding opportunities for solitude or a primitive and unconfined type of recreation”

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

“Natural”

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Other unique components that reflect the character of this wilderness

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Heritage and Cultural Resources

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Maintaining Traditional Skills

The effect of Alternative 3 No Action is the same as Alternative 1 – Proposed Action except that the traditional skill of evaluating wildlife sign and evidence would not take place since the mountain lions would not be collared and released on the Refuge. There would be no regular opportunity to evaluate mountain lion kill sites since finding these locations without following the movements of a radio-collared mountain lion are very rare. The exception would be when a radio-collared bighorn sheep is found dead and the carcass examined.

Special Provisions

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Economic and Time Constraints

This would be the least costly and least time consuming alternative, since no effort would be made to monitor the activities of mountain lions before they are removed. This alternative might also avoid more costly, invasive efforts to preserve sheep populations that might be required under Alternative 2.

Additional Wilderness-specific Comparison Criteria

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Safety of Visitors, Personnel, and Contractors

The effect of Alternative 3 is the same as Alternative 1 – Proposed Action.

Comparison of Alternatives

It may be useful to compare each alternative’s positive and negative effects to each of the criteria in tabular form, keeping in mind the law’s mandate to “preserve wilderness character.”

	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3
Untrammelled	-	+	-
Undeveloped	-	+	-
Natural	+	-	+
Solitude or Primitive Recreation	-	+	-
Unique components	+	-	+
WILDERNESS CHARACTER	++/--	+++/--	++/--

When considering wilderness character, Alternative 2 is the most beneficial.

	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3
Heritage & Cultural Resources	NA	NA	NA
Maintaining Traditional Skills	+	+	-
Special Provisions	NA	NA	NA
Economics & Time	-	-	+
Additional Wilderness Criteria	+	-	+
OTHER CRITERIA SUMMARY	++/-	+/--	++/-

When considering other criteria, Alternatives 1 and 3 are the most and equally beneficial.

	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3
SAFETY	NA	NA	NA

Safety Criterion

If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation:

Safety issues do not override impacts to wilderness character or other criteria in this analysis.

<h2>Step 2 Decision: What is the Minimum Activity?</h2>
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Selected alternative:

Alternative 1 – Proposed Action

Rationale for selecting this alternative:

Alternative 1 - the Proposed Action is selected because it supports the effort to meet the bighorn sheep population goals described in the existing Refuge planning documents and supports the transplanted goals for desert bighorn sheep within Arizona and in other parts of the southwest. Alternative 1 is in compliance with Service policy (610 FW 2.20) since the proposed predation management in wilderness would be directed at the individual animal(s) causing the problem. Alternative 1 is also in compliance with Service policy (610 FW 2.16) since the Service has determined that the interference with ecosystem processes (in this case, predator/prey relationships) and the ecosystem's response to this natural event is necessary to accomplish refuge purposes, including Wilderness Act purposes. Alternative 1 supports the conservation of wildlife and their habitats in wilderness in a manner consistent with the National Wildlife Refuge System Improvement Act of 1997. The proposed action targets only the individual mountain lions preying on sheep and is not intended to eliminate mountain lions from the ecosystem. Mountain lions are expected to remain part of the ecosystem and contribute to wilderness character and play an important ecological role.

Alternative 1 would be implemented by qualified Service employees or their agents upon completion of the associated Environmental Assessment / Management Plan and issuance of a FONSI.

Monitoring and reporting requirements:

The effectiveness of the Proposed Action would be accomplished through regular aerial surveys of the desert bighorn sheep populations. Populations of mountain lions would continue to be monitored using cameras, scent stations, and radio-collaring. The health of the desert bighorn sheep would continue to be monitored using radio-collars and health checks including, but not limited to, laboratory analysis of blood samples collected at the time of radio-collaring.

The location for trap sites and other activities associated with the action will be determined through ongoing monitoring efforts. This monitoring is accomplished with temporarily-installed remote cameras and scent stations in order to obtain more information about the number and movements of mountain lions on the Refuge. We will periodically attempt to capture and radio-collar mountain lions using snares, box traps, or pan-tensioning devices, which would be set and removed after each mountain lion capture effort. We would follow the movements of the mountain lions using the GPS locations obtained remotely from the collars, and investigate those locations where a lion kill is likely to have taken place. We would remove mountain lions found to kill two or more desert bighorn sheep in a six-month period. All equipment and tools would be carried on foot by and all equipment and materials would be removed after completion of each phase of the project. Helicopters may be used to check remote locations where collared mountain lions have made a kill. All vehicles would remain on designated roads outside of wilderness. Any cameras, snares, box traps, scent stations, or other equipment would be located using GPS so no permanent marking would be required. Any disturbance would be temporary and localized.

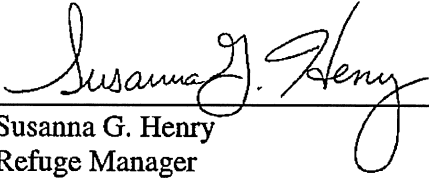
All equipment used would be packed in and out on foot or horseback or with the use of helicopters and would be removed at the conclusion of each phase of the work. All individuals involved would employ Leave No Trace techniques throughout the project. All vehicles would remain on designated roads outside of the wilderness. If horses and hounds are used, all water and feed required by horses and hounds during lion capture must be brought in and use of pelletized feed and feed containers will be encouraged.


Check any Wilderness Act Section 4(c) uses approved in this alternative:

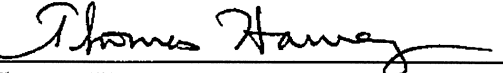
- | | |
|---|---|
| <input type="checkbox"/> mechanical transport | <input checked="" type="checkbox"/> landing of aircraft |
| <input type="checkbox"/> motorized equipment | <input type="checkbox"/> temporary road |
| <input type="checkbox"/> motor vehicles | <input type="checkbox"/> structure or installation |
| <input type="checkbox"/> motorboats | |

**Minimum Requirements Decision
(Approvals, Reviews, Concurrence)**

***Limiting Mountain Lion Predation
on Desert Bighorn Sheep
on the Kofa National Wildlife Refuge***

Prepared by:  4 MAY 2009
Susanna G. Henry
Refuge Manager
Kofa National Wildlife Refuge
Date

Approved:  5-4-09
Mitch Ellis
Complex Manager
Southwest Arizona National Wildlife Refuge Complex
Date

Concurred:  5-4-09
Thomas Harvey
Refuge Supervisor, AZ/NM &
Regional Wilderness Coordinator
Date