Predator Management Plan for Protection of Breeding Western Snowy Plovers at Vandenberg Air Force Base

5-year Plan, 2011-2015

February 2011

INTRODUCTION

This Predator Management Plan (Plan) was developed by Vandenberg Air Force Base (VAFB) to address protection of breeding Western snowy plovers (*Charadrius alexandrinus nivosus*) (snowy plover) on VAFB. This Plan fulfills the U.S. Air Force responsibilities for predator management under the plan for beach management and the snowy plover on VAFB per the Biological Opinion (BO) 1-8-05-F-5R, supports ecosystem-based predator management objectives established in VAFB's Draft Integrated Natural Resources Management Plan (U.S. Air Force 2008), and complies with Air Force Instruction 32-7064 (U.S. Air Force 2004). The Plan reflects an adaptive management approach developed and implemented in coordination with the U.S. Fish and Wildlife Service (USFWS), which can be modified and refined as new information becomes available from VAFB studies, and elsewhere on snowy plovers and their predators. The goal of the Plan is to reduce the rate of predation on breeding snowy plovers, their eggs, and young. The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (USFWS 2007) has determined criteria for population levels and fledging rates for consideration of delisting under the Endangered Species Act (ESA). Predator management is needed to meet these recovery criteria.

The Plan addresses management of known avian and mammalian predators of snowy plovers, their eggs and young, and is subject to cooperative review and modification by VAFB and the USFWS if the management techniques described fail to achieve an adequate reduction in predation. In developing this Plan, VAFB has endeavored to obtain the best scientific information available, including predation data from past snowy plover monitoring reports, consultations with expert snowy plover and predator biologists, extensive literature reviews, and field studies conducted on base. Management actions conducted under this Plan will emphasize selective control of individual problem predators, using non-lethal techniques wherever possible in the control of native predators. VAFB's predator management decisions must also include the assessment of these actions on the larger ecosystem, with the priority being that ecosystem stability and integrity are maintained.

BACKGROUND

The Pacific coast breeding population of the snowy plover was listed as threatened under the ESA in March 1993 (USFWS 1993). Habitat loss and degradation, disturbance by humans, and predation have been cited as important causes of the decline of the species (USFWS 1993).

The USFWS designated critical habitat for the snowy plover in 1999 and revised this designation on September 29, 2005 (70 Federal Register 56970). VAFB was excluded from this designation under Section 4(b)(2) of the ESA. VAFB is required to continue comprehensive management programs of this population to avoid future Critical Habitat designations and to comply with the BO. The USFWS has identified snowy plover conservation as a very high priority at VAFB because a significant percentage of the total coastal population breeds on its beaches, and because of the high quality and quantity of habitat on VAFB.

In evaluating the factors that affect the survival and reproductive success of federally listed species, the number of factors subject to human control is limited. For example, weather extremes can adversely affect survival and productivity. Many factors may contribute to one site being more favorable than the other such as beach topography, prey availability, weather, and wrack deposits during the season. In 2004 and 2005, Dr. Jenny Dugan (University of California Santa Barbara) performed a study to determine the potential differences in habitat suitability and prey availability on VAFB. Dugan found that higher nest density was directly correlated to beaches with larger prey species richness, wrack, and lower beach slope (Dugan et al. *In Progress*). These factors may change from year to year and fluctuations in these variables may contribute to the shift in nest distribution. Habitat is limiting throughout much of the range of snowy plovers, largely due to human encroachment and development. However, VAFB is one of the few locations where extensive habitat is still available. Direct and indirect human disturbance has been proven to adversely impact snowy plovers. Recreational beach management practices developed by VAFB and the USFWS are aimed at protecting snowy plovers and their nesting habitat from human disturbances.

Predation is one of the factors presently limiting snowy plover reproductive success on VAFB. Human activity exacerbates predation by avian predators by providing attractants such as perches and nest sites, and influences foraging behaviors of both avian and mammalian predators by attracting predators to trash and food discarded on snowy plover beaches. Human influence on predator presence and predation rates is of particular concern on beaches that are used for recreation (primarily Surf and Wall, also referred to as South Beaches). A significant difference between hatch success in closed beach areas and open beach areas has been observed at Surf Station Beach (Table 1), attributable to a higher predation rate in the open area.

Table 1. Historical hatch rate of Surf North closed area and Surf North open area (Surf Station Beach).

Year	% of hatched nests in closed area	% of hatched nests in open area
2002	47%	50%
2003	69%	64%
2004	42%	43%
2005	58%	75%
2006	84%	80%
2007	70%	20%
2008	40%	8%
2009	58%	38%
2010	69%	29%

The objective of this Plan is to describe an approach and lay a framework for reducing predation on snowy plovers using selective, sustainable measures with the emphasis on maintaining ecosystem integrity. This Plan describes and builds upon measures that are already being implemented on VAFB. Predation is a natural phenomenon that cannot and should not be eliminated; however, it has

the potential to be reduced through the implementation of specific management techniques and actions.

PREDATION

Predation has been identified as a major factor limiting snowy plover reproductive success at many Pacific Coast sites (Wilson-Jacobs and Meslow 1984; Page 1988, 1990; Applegate and Schultz 1999; 2000). Predation can cause abandonment of nests when breeding adults are lost. Additionally, broods are likely to be lost if the chicks are not close to fledging when an adult is captured by a predator (USFWS 2001). Unsuccessful attempts to prey on snowy plovers can result in injury to the adults and a subsequent inability to incubate eggs or care for chicks, separation of adults and chicks, and excessive energy demands resulting in the abandonment of the nest (Warriner et al. 1986).

As with other limiting factors, the nature and severity of predation is site-specific. Predators of snowy plover eggs, chicks, and adults at many sites include native species such as American crow (*Corvus brachyrhynchos*), common raven (*Corvus corax*), gulls (*Larus* spp.), American kestrel (*Falco sparverius*), American peregrine falcon (*Falco peregrinus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*); as well as non-native species such as red fox (*Vulpes vulpes*), and domestic dogs and cats.

Substantial evidence exists indicating that human activities affect the type, number, and activity patterns of predators, thereby altering natural predation patterns. The presence of trash on beaches increases visitation by opportunistic predators and scavengers. Some predators can become accustomed to the presence of humans and even rely on their presence for securing food supplies (Stern et al. 1990, Hogan 1991).

The presence of the non-native red fox at snowy plover breeding sites is a mounting concern due to its specialized ability to prey on ground nesting birds and documented evidence of devastating impacts to nesting snowy plovers (Wilson-Jacobs and Meslow 1984; Page 1998, 1990; Stern et al. 1991). The red fox has not been documented at snowy plover nesting areas on VAFB. Only one confirmed sighting of red fox has occurred on VAFB (in 2000 outside of snowy plover nesting habitat), although their presence in surrounding areas and sites has been confirmed. This is likely a result of the stable coyote population on VAFB property. Coyotes are known to suppress and even exclude red fox populations in areas where they coexist through direct competition and even predation (Sergeant 1982, Schmidt 1986, Major and Sherburne 1987, Sargeant et al. 1993, Blankenship 1995, Allen 1996). The only other non-native predators documented to date in snowy plover habitat are feral pig. This Plan includes measures to address the threat of these predators to nesting snowy plovers.

Predation Losses of Snowy Plovers on VAFB

Predation is a factor affecting snowy plover nesting success on VAFB. Predators that are known to have affected snowy plover reproductive success on VAFB include American crow, common raven, gulls, and coyotes. Substantial numbers of nests are also lost to predators that cannot be identified to species due to lack of clear tracks or other evidence. Historically, predation on VAFB has resulted in annual nest losses ranging between 17% and 52% of total known fate nests (Table 2).

Table 2. Nest losses to predators on VAFB, 1994 to 2010. Percentages are based on number of known fate nests.

Year	Coyote	Raccoon	Crow	Raven	Gull	Whimbrel	Unknown mammal	Unknown avian	Unknown predator	TOTAL PREDATION	Known Fate Nests
1994	41 18%		13 6%		2 1%				26 11%	**82 35%**	231
1995	20 10%		4 2%				8 4%		9 5%	**41 21%**	195
1996	31 11%		5 2%		2 1%		6 2%		11 4%	**55 20%**	271
1997	73 18%		43 11%		18 5%				72 18%	**206 52%**	398
1998	32 24%		19 14%		2 2%				10 8%	**63 47%**	134
1999	16 17%		4 4%							**20 21%**	97
2000	34 27%		6 5%					1 <1%	25 20%	**66 52%**	127
2001	10 6%	1 1%	6 3%	2 1%	2 1%		3 2%	3 <2%	27 15%	**54 30%**	181
2002	41 14%	2 1%	26 9%		3 1%	1 <1%		1 <1%	1 <1%	**75 25%**	296
2003	15 4%		63*	16%*	5 1%			6 2%	15 4%	**104 26%**	393
2004	130 22%	2 <1%	66*	11%*				7 1%	28 5%	**233 40%**	590
2005	49 13%			2 <1%	4 1%			4 1%	12 3%	**71 19%**	371
2006	47 13%				4 1%				10 3%	**61 17%**	366
2007	24 10%			25 10%				3 1%	18 7%	**70 28%**	251
2008	73 26%			15 5%	1 <1%				10 3%	**99 35%**	284
2009	37 12%			29 10%				1 <1%	28 9%	**95 31%**	305
2010	36 15%				1 <1%				6 3%	**43 18%**	240

NOTES:
Numbers may not add up due to rounding.
* In 2003 and 2004 crow and raven predation was lumped together due to the inability to ascertain whether raven or crow were responsible for predation of a number of predated nests.

Nest losses to predators have varied between North Beaches and South Beaches since full season monitoring began in 1994. Some of the factors likely to influence predation rates include the topography of the beaches, the attraction of human influenced predators to beaches with higher human presence, and the availability of prey and food sources in areas outside of snowy plover nesting habitat. Also, different predator species have had varying impact on the different beach segments. Corvids (both crows and ravens) have had a relatively greater impact on North Beaches compared to South Beaches, while coyotes have had far less impact to snowy plovers on North Beaches compared to South Beaches.

Nest losses to opportunistic predators are likely also influenced by the presence of carrion on the beaches and the yearly and seasonal variability in density of preferred prey species. Monitoring reports from VAFB indicate that the presence of carrion on beaches influences the abundance of predators and the subsequent losses of nests to predation or destruction by predators (Persons 1995a, 1995b; Applegate and Schultz 1999).

Another factor that may influence predation rates are the cyclic microtine rodent population trends. Although there are no indications that rodent prey are limiting on VAFB, relative prey abundance and availability influences opportunistic predator foraging patterns.

5-YEAR MANAGEMENT PLAN, 2011-2015 SNOWY PLOVER NESTING SEASONS

The objective of this Plan is to protect the snowy plover and increase its reproductive success by reducing predation without significantly altering the natural ecosystem on VAFB. As previously

discussed, natural threats from predation are exacerbated by human activities in beach areas. The cumulative impacts from habitat loss, human disturbance, and small population size decrease the snowy plover's ability to withstand predation. The Air Force is aware that some level of predator management is essential to the recovery and survival of the snowy plover. The Air Force is also mindful of the role keystone native predators play on natural systems, including control of non-native predators to the local region and mesopredators (e.g. common ravens, skunks, raccoons, and opossums), that can themselves be significant snowy plover nest predators. VAFB has not routinely controlled native predators through lethal removal since 1978.

On VAFB, three wildlife species that are known to significantly impact snowy plover reproductive success are common ravens, American crows and coyotes. Although other predators are present on the beaches and have on occasion been documented as being directly responsible for the loss of nests, their impact to date has been minimal and is considered to be within the natural levels of predation expected in a natural system. This Plan addresses avian and mammalian species in a general manner, but focuses on methods for reducing losses of snowy plovers to these three target species, during the breeding season. VAFB will also be prepared to respond to threats by other predators. Efforts will also be undertaken, in consultation with tracking experts, to identify species that are responsible for nest losses that are presently categorized as "unknown predator".

Snowy plovers will continue to be monitored to determine hatch and fledge rate, adult survivorship, population size, and predator activity.

Effective response to predation threats requires close communication between VAFB Wildlife Management personnel and field personnel. Key field personnel during snowy plover nesting season include:

- USFWS-permitted snowy plover monitors recording predator activity;
- Biologists conducting live-trapping as required; and
- Predator management specialists conducting selective lethal predator control only as directed by VAFB Wildlife Management personnel.

In an effort to increase response time to particular predation threats, the above team will work together early in the season to select as many locations as possible where predator monitoring and control activities can safely be conducted without disturbing nesting snowy plovers. Changes to these locations will be made as needed based on the judgement of snowy plover monitors, who will notify other field personnel and VAFB Wildlife Management personnel if new snowy plover nesting activity makes an established location unusable.

All nests located on VAFB are mapped using Global Positioning System (GPS) coordinates. This data will be used to map locations of predated nests, to help identify areas of particular concern for predator management.

Management techniques considered for implementation on VAFB to reduce the impact of predators on snowy plover nesting success are described below.

Nest Exclosures

Nest exclosures are used at several snowy plover nesting sites to protect nests from predators as well as human disturbance and trampling. Exclosures were considered at VAFB and are not currently considered as a feasible alternative for the following reasons:

- Recent reports from Point Reyes Bird Observatory indicate that although exclosures have been successful at protecting nests from predators, some species of avian and mammalian predators

(e.g. foxes, crows, ravens, owls) have keyed in on the presence of birds in these exclosures. If they are unsuccessful in entering the exclosure, predators often remain near the exclosure, harassing the adult and ultimately causing the abandonment of the nest and/or the predation of the adult when entering or exiting the exclosure (G. Page, pers. comm.).

- Snowy plovers nest along 12.5 miles of sandy beach on VAFB. Erecting exclosures would require access to beach areas with an all-terrain vehicle to carry the materials necessary for each exclosure. During peak nesting season, this would result in daily (and occasionally more frequent) disturbances to nesting birds by a motorized vehicle. In addition, the weather climate at VAFB is such that daily maintenance of the exclosures would be required to prevent their burial by sand. Placement of exclosures would be unfeasible in most beach sectors due to the distances between access points and locations of exclosures, the need to maintain them on a daily basis to prevent burial by sand, and the consequent disturbance to the plover and its habitat as a result of these activities.

For these reasons, exclosures are currently not considered a feasible and practicable alternative. However, nest exclosure materials have been purchased by VAFB, and exclosures may be placed if, in particular circumstances, plover monitors, VAFB and the USFWS agree that exclosures are warranted.

Invisible Fencing/Electronic Collaring of Coyotes

Similar to the electronic collars used by dog owners to maintain dogs within a non-fenced area, the use of electronic collars on coyotes was evaluated as a potential technique to keep these predators away from the beaches during the snowy plover breeding season. These collars emit a small electrical shock when the animal crosses into the forbidden area. Various concerns arose when this option was evaluated:

- The placement of an in-ground line along the entire 12.5 miles of beach sector is likely unfeasible due to geography and accessibility.
- Research on the use of electronic collars for the protection of San Clemente loggerhead shrike from island fox predation indicates that although this technique is successful in protecting individual nesting tree sites, it fails when applied to a larger area because animals will break through the invisible electric line to maintain and patrol their home ranges.
- Excluding resident coyotes from such large areas could result in some of the same adverse ecological effects that are of concern with large-scale lethal coyote removal, such as increased predation by mesopredators and immigration by uncollared/ uncontrolled coyotes.

Exclusion Fencing

Fencing (electric and standard non-electric) to exclude predators from a sector of beach was also considered. This approach was not deemed feasible due to the following:

- The topography of the coastline and beaches on VAFB would require that fencing extend into the water perpendicular to the coastline. This eliminates electric fencing as an option, and would not be feasible for standard non-electric fencing as the tides would be constantly damaging it.
- The routine inspection and maintenance required to ensure fence integrity would not be possible due to the extent of the coastline.

- Predators finding their way around, under or over these extensive fences could become trapped inside the area where we want to exclude them, posing additional risk to snowy plovers. In addition, standard non-electric fencing would not be effective in preventing some predators (i.e., raccoons) from entering the area.

Aversion Feeding

Aversion feeding involves the application of a noxious chemical compound to eggs, to train potential predators that the ingestion of such items is undesirable due to the ensuing sickness that occurs. This technique has been used to increase productivity of waterfowl in some regions of the United States and is successful in reducing predation by some wildlife species. This approach was not deemed feasible for deterring nest predators because VAFB does not meet all of the criteria to effectively use aversion feeding; including predators which occupy small home ranges, and areas to be treated need to be rather small (Nicolaus and Nellis 1987, Conover 1990).

Diversion Feeding

This management technique aims to train animals to use specific areas for foraging and reduce their presence in other areas of their home range. This is accomplished through the strategic placement of carcasses within their home range in an area where we want them to forage and away from the area where we want them to minimize their presence. In 2008 the USFWS denied VAFB's request for using diversion feeding.

Relocation

Relocation is a practicable and feasible alternative for some wildlife species, but not practicable or ecologically sound for others. Ecologically, relocation has the same effect as lethal removal of the predator from the ecosystem. Relocation efforts, like lethal control, must therefore be limited, highly selective, and include evaluation of potential ecological effects. In addition, relocated animals may compete with resident animals at the relocation site, with potential consequences to the stability of predator populations there. Some species that are territorial, such as coyotes, would also be expected to have poor survival rates, as they would likely be excluded from the new habitat by the resident coyotes. However, VAFB has successfully relocated some raptor species (e.g. great horned owls) to reduce predation on California least terns (*Sterna antillarum browni*), with subsequent monitoring confirming survival of the birds and no return to the vicinity of the capture site. Relocation of raptors and shrikes may therefore be considered on a case-by-case basis.

Lethal Removal

Species that are themselves listed by federal or state agencies as Threatened or Endangered (e.g. peregrine falcon) will not be lethally removed. For non-listed species, lethal removal will be considered by VAFB for species that fall within the following categories:

- Species that are known to be extremely difficult to trap.
- Species for which non-lethal management techniques are determined to be infeasible or not available.
- Individual animals that are identified as being directly responsible for predation, when their removal is expected to result in reduced predation to snowy plover nests.

- Lethal removal of top-level predators (i.e., coyote, raptors) will be considered within the following criteria:
    - Selective lethal removal will target individual problem animals, after failure to live-trap the animal (if applicable to the species in question), and in consultation with professionals.
    - Selective lethal removal will occur only when evidence indicates a nest or nests has been predated by an animal, there is evidence to indicate that further losses are probable due to observed foraging patterns in the area where the loss occurred, and there are other nests at risk of predation in that area.
    - Lethal removal will cease once it is confirmed that the identified predation problem in the area has ceased.

Trash Removal

To avoid attracting predators to snowy plover nesting habitat, VAFB will conduct regular clean-up of litter in open beach areas, and educational materials and displays will encourage trash removal and discourage feeding of wildlife by beach visitors. Trash containers are available for public use at each beach access location. On VAFB property at Wall and Minuteman beaches, large plastic containers with lids and disposal hatches are available for use by beach visitors, and their use is encouraged. Trash receptacles at Surf Station are maintained by Santa Barbara County and/or Union Pacific Railroad. Containers at Ocean Park are the responsibility of the County of Santa Barbara.

Trash collection will take place routinely throughout areas open to recreational beach access on VAFB to ensure beaches are maintained free of trash items that may attract opportunistic predators. Trash receptacles at beach entrances that are the responsibility of the Air Force, will be emptied out routinely to ensure trash is not overflowing to reduce potential of attracting scavengers and predators to nesting areas. Trash clean-up activities within all habitat restricted to the public will be accomplished in the presence of or by VAFB Wildlife Management personnel or other USFWS authorized personnel. VAFB snowy plover monitors will be contacted prior to accessing these sectors to confirm whether any nests or chicks are potentially present. Disturbances to adults, nests and chicks will be avoided or minimized to the maximum extent possible.

AVIAN PREDATORS

Nixalite® will be installed on posts and fencing where practicable in snowy plover nesting habitat to deter perching of avian predators. Avian predators observed foraging within the vicinity of the beaches will be monitored. Monitoring will include recording the species, number of individuals, exhibited behaviors, and habits.

American Crows and Common Ravens

American crows and common ravens are known to be predators of eggs and chicks. Although crows are widely seen throughout VAFB, their presence near snowy plover nesting areas is sporadic. Common ravens were first identified on VAFB beaches during the 2001 breeding season, when one pair of ravens was observed and held as responsible for the predation of at least two nests. Since that time, common ravens have become a constant presence on VAFB during the snowy plover breeding season. The extended range and more frequent observations of ravens along the VAFB

coastline suggest that raven populations are increasing along the Central Coast of California. The devastating effect ravens have on snowy plover nesting success is documented from experiences at other sites where corvid species are prevalent (USDA-APHIS 2002). Ravens have been a significant predator on VAFB, with 200 snowy plover nest losses since 2003 confirmed through direct observation or tracking evidence. However, the number of nest losses to raven predation is likely underestimated because of indiscernible evidence at nest sites due to high winds resulting in sand movement that fill in tracks.

The placement of effigies has not proven consistently effective on VAFB and snowy plover nesting areas are far too extensive to deter corvids from frequenting snowy plover breeding areas with this technique. For these reasons, under this Plan, crows and ravens confirmed predating snowy plover nests and/or chicks will be lethally removed. The determination will be made by VAFB Wildlife Management personnel upon consultation with the snowy plover monitors. Removal of crows and ravens will be done by authorized predator management personnel. Removal will take place from pre-determined locations to avoid disturbance to nesting snowy plovers. If a particular situation requires predator management personnel to enter nesting habitat to remove crows or ravens, this action will be carefully coordinated between snowy plover monitors and VAFB Wildlife Management personnel. Additional predator management measures to preclude corvid predation on snowy plovers eggs and chicks include coordination among adjacent land managers and pre-season and during season surveys and surveillance to determine nest locations.

In the 2004 and 2005 season, five adult ravens were lethally removed near snowy plover nesting areas. Subsequently, there were no known nest losses due to ravens in 2006. In 2008 and 2009, eight adult ravens were lethally removed. In 2010, there were no known nest losses due to raven predation. This absence in raven predation in 2006 and 2010 may have been the product of intensive predator management conducted in the previous years. Given that ravens are very adept at identifying potential dangers, the use of blinds in future years may increase the success of raven management on VAFB for the protection of snowy plovers. This method is currently prohibited by the USFWS Migratory Bird Permit Office.

Other avian predators

VAFB began a program to live-trap raptors and loggerhead shrikes that threatened nesting California least terns in 1994. Permission was obtained from the California Department of Fish and Game and USFWS to relocate some captured birds, with the requirement they be monitored post-release. Others are released near their capture site at the end of the nesting season. To date great horned owls, barn owls, American kestrels, northern harriers, and loggerhead shrikes have all been successfully relocated away from least tern nesting habitat, with no evidence of either return of the predator to the capture site, or of adverse impacts to the predator from relocation. The program has been successful in reducing the threat of avian predation on least terns. VAFB proposes to implement this program to protect nesting snowy plovers by selectively live-trapping raptors and shrikes that prey on nesting snowy plovers, their nests or chicks.

Upon determining that an individual predator poses a threat to snowy plovers on VAFB, an effort will be undertaken to trap, band, and relocate the predator as soon as possible.

- The determination will be made by VAFB Wildlife Management personnel upon consultation with the snowy plover monitors.
- Knowledge of the avian predator's habits will determine the trapping technique to employ.
- The decision to remove a predator must take into account the potential disturbance of the removal activity on nesting snowy plovers relative to the potential threat of the predator. Trapping will be

conducted in coordination with snowy plover monitors and VAFB Wildlife Management Personnel to avoid disturbance to snowy plovers to the maximum extent practicable.

- Trapped birds will be held in a licensed and permitted rehabilitation/holding facility until they can be released back into the wild.
- Relocated birds will be released in an area with suitable habitat at a distance from which they would not be expected to return.

Lethal control will only be used when trapping attempts have failed, when there is a continued and immediate direct threat to snowy plovers or their chicks, and when VAFB determines that additional live-trapping efforts are not likely to be successful.

- The decision to lethally remove an avian predator will be determined on a case-by-case basis, after taking into consideration the degree of threat, breeding phase of the snowy plovers, feasibility (or lack thereof) of live-trapping options, legal status and rarity of the predator species, and professional knowledge of the situation and species involved. Peregrine falcons, although federally delisted, are still state-listed as Endangered. Only live-capture by qualified and permitted biologists will be utilized to control peregrine falcons; no lethal removal of this species will occur.
- Lethal removal will only be conducted by authorized personnel under the direction of VAFB Wildlife Management personnel.
- Lethal removal will only be done when there are no people present in the area, to avoid any human safety hazard.

Avian predators that are captured and relocated will be fitted with USGS bands. In addition, color bands and/or radio-transmitters will be applied when practicable to aid in the identification of the birds after their release. Monitoring of avian predators will include efforts to identify individuals with bands and/or transmitters, and to evaluate whether release sites are sufficiently distanced from snowy plover nesting habitat.

These management actions will occur from 1 March through 30 September of every year this Plan is in effect, excepting crow and raven control which will be initiated in early February.

MAMMALIAN PREDATORS

Coyote Research on VAFB

A 1993 Biological Opinion issued by the USFWS for the Delta II and Taurus launch programs in the Purisima Point area of VAFB mandated actions to address the threat of predation to the endangered California least tern and the snowy plover. In 1998, VAFB re-initiated consultation with the USFWS regarding launches from SLC-2W and 576-E in the Purisima Point area of VAFB. During that consultation, the USFWS expressed interest in seeing VAFB expand its predator studies to encompass snowy plover nesting areas outside Purisima Colony, and expand the scope of the studies to include mammals, particularly coyotes. As a result, VAFB developed a plan aimed at developing and implementing non-lethal, selective, sustainable techniques for reducing predation on least terns and snowy plovers. The USFWS established Term and Condition (1)(a)(vi) in the final 1999 Biological Opinion, which reads: “The Air Force shall expand current predator management activities to include a scientifically defensible study of predator populations in the vicinity of Purisima

Point. The Air Force shall develop a predator management plan in coordination with USDA-Wildlife Services to address control measures at the existing Purisima Point colony…"

From 1999 through 2005 a study was conducted to obtain data on the population size, territoriality and stability of coyotes inhabiting coastal areas of VAFB, specifically the vicinity of Purisima Point and the Surf/Ocean Beach area. Coyotes were captured, sexed, checked for overall health, aged and fitted with radio-transmitting collars. To understand how coyotes are using the habitats in those areas, the extent of their travels, and the stability of their territories, radio-telemetry locations were collected on the animals residing near Surf/Ocean Beach.

The results of the coyote research on VAFB demonstrate that coyotes on VAFB generally maintain small, stable, and exclusive home ranges, with very little overlap between territories. For example, home ranges of coyotes in the vicinity of Surf Beach range from 1.1 to 7.9 square kilometers, (mean = 3.0 square kilometers), with core activity areas at Ocean Park and Surf Station beach access points. In addition, a shift observed in coyote activity within one home range appeared to coincide with feeding of wildlife that occurred at a base facility (against VAFB policy). These results indicate that coyotes are attracted to areas of concentrated human activity where food is made available, either intentionally or unintentionally. This situation makes coyotes on VAFB good candidates for further research into non-lethal techniques that endeavor to modify coyote behavior to reduce their presence in snowy plover nesting areas.

An extensive review of scientific literature and consultations with experts on coyote behavior, predation, and management techniques (both lethal and non-lethal), in exploited and non-exploited populations, was completed to determine those management actions most likely to reduce predation on snowy plover nests, while maintaining a healthy and stable native faunal community. The goal of these investigations was to develop science based non-lethal management approaches that may be implemented in the future. Such measures may include diversion feeding, aversion techniques, or other actions designed to modify coyote behavior to reduce nest predation, while maintaining stability within the coyote population and the ecosystem at large.

In 2001, as part of the predator study on VAFB, a small mammal trapping effort was initiated to characterize the rodent population levels at two coastal sites, in an attempt to better understand the association between foraging opportunities for coastal coyotes in upland areas and frequency of foraging on beaches. An initial comparison of small mammal trapping success (a recognized method of assessing wild rodent population levels) in Southern California and snowy plover nest success for the years 1995 through 2000 provided an indication of a correlation between rodent population levels and nesting success on VAFB (Figure 1). Rodent trapping data from the site near South Beaches for the years 2001 and 2005, illustrates a relationship between small mammal abundance and coyote predation on snowy plover nests (Figure 2).

Coyote predation control for the 2011-2015 snowy plover nesting seasons

VAFB proposes to reduce predation by coyotes by implementing the following actions during the 2011-2015 snowy plover nesting seasons:

- Coyote activity will be monitored to identify their impact on snowy plover nesting efforts.

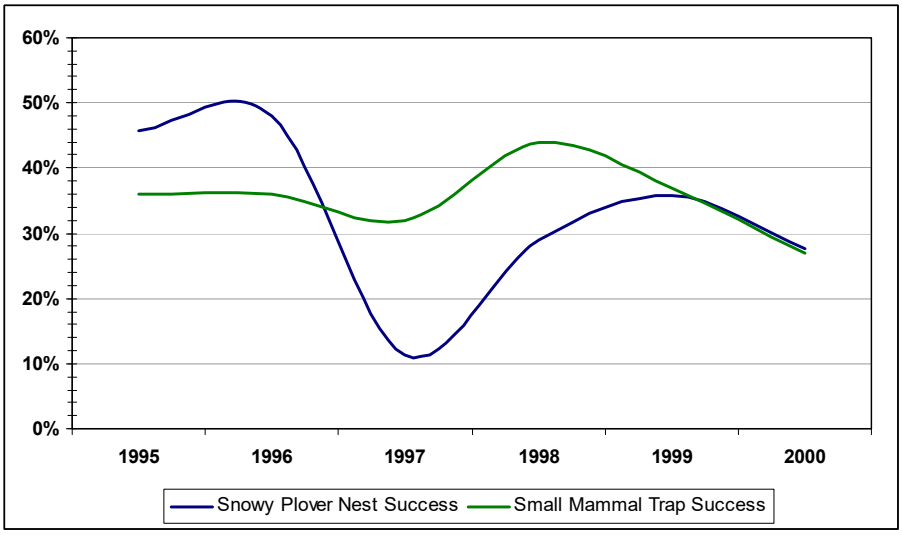


Figure 1. Snowy plover nesting success (VAFB) and small mammal trap success (Orange County, California).

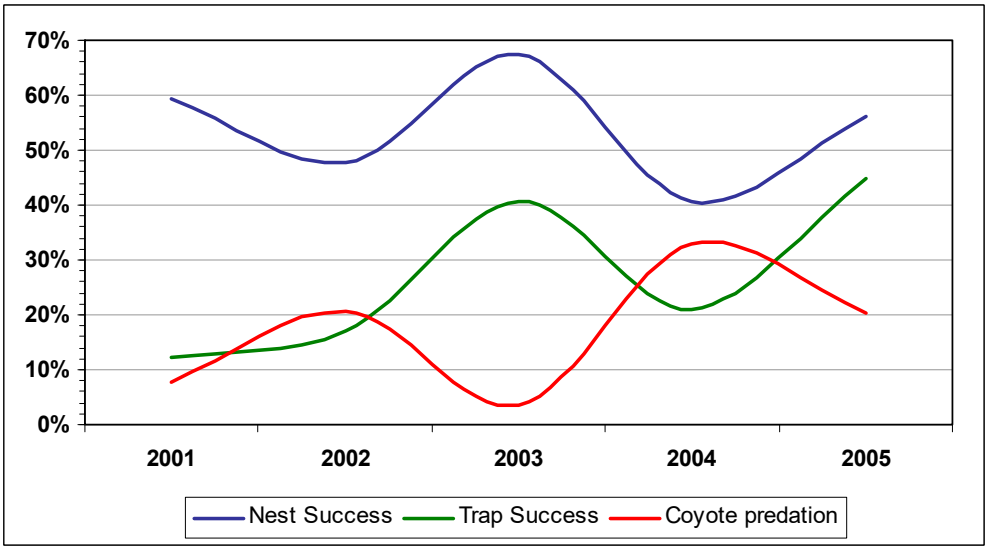


Figure 2. Snowy plover nesting success on South VAFB and small mammal trapping success in coastal areas near Surf Beach, VAFB, between March 2001 and September 2005.

- The biological monitors will report coyote activity at nesting areas and will provide VAFB Wildlife Management personnel with all available information that indicates potential predation by this species. To the extent possible, monitors will attempt to recognize any distinguishing features of coyotes they see in the field, and distinguish between animals using the beach as a travel corridor and those actively foraging in plover habitat.

- If the snowy plover monitors report the loss of a nest to coyotes, tracking observations will attempt to identify the animal or animals that are foraging in snowy plover breeding areas. Upon identification of the animal or animals, VAFB Wildlife Management personnel will direct predator management personnel to remove them.
- Traps will be placed at the closest beach access points of the most commonly used corridor by that specific animal or animals. Any animal trapped while accessing a beach for which documented predation exists, will be lethally removed.
- Lethal removal will only be conducted by authorized predator management personnel at the direction of VAFB Wildlife Management personnel.
- Whenever practical, lethal removal will be done outside of snowy plover nesting habitat to minimize disturbance to nesting birds.
- Lethal removal within snowy plover nesting habitat will only be done when the public is not present in the area, to avoid any human safety hazard.
- Lethal removal within nesting habitat will be accomplished in such a manner that will minimize disturbance to nesting snowy plovers. Permitted snowy plover monitors will be present during such actions.

Feral pig control in snowy plover nesting habitat

Feral pigs have not been reported in past years as being responsible for the losses of snowy plover nests on VAFB. However, their presence in beach areas is of concern. Feral pigs could predate eggs and chicks and destroy nests by trampling. The presence of large groups of feral pig north of San Antonio Creek was confirmed in October of 2000, and pig tracks have been seen in snowy plover nesting habitat in subsequent years.

Control of feral pigs on North Beaches will be a difficult task due to the remoteness of the area and the very limited number of access points. VAFB will attempt to identify areas where feral pigs are accessing snowy plover nesting habitat and will control their presence through the following measures:

- Feral pig activity will be monitored to identify their impact on snowy plover nesting. The snowy plover monitors will report feral pig activity at nesting areas and will provide VAFB Wildlife Management personnel with all available information that indicates potential losses caused by this species.
- Predator management personnel, directed by VAFB Wildlife Management personnel, will locate pig trails away from nesting areas used by pigs to access plover nesting habitat. Predator management personnel from will then remove pigs by shooting and/or trapping. Because pigs are an invasive non-native species that does considerable damage to VAFB's ecosystem lethal control will be emphasized in an ongoing effort to attempt to avoid any and all pig impacts to nesting plovers.
- Feral pigs that are trapped will be lethally removed.

REFERENCES

Allen, S. 1996. Coyotes on the move: Changes in distribution of coyotes and red fox in North Dakota. North Dakota Outdoors 58:6-11.

Applegate, T.E., and S.J. Schultz. 1999. 1998 Western Snowy Plover on Vandenberg Air Force Base. 1998 Final Report. Unpub. Report, BioResources, Los Osos, California. 31pp.

Applegate, T.E., and S.J. Schultz. 2000. 1999 Western Snowy Plover on Vandenberg Air Force Base. 1999 Final Report. Unpub. Report, BioResources, Los Osos, California. 23pp.

Applegate, T.E., and S.J. Schultz. 2001. Western Snowy Plovers on Vandenberg Air Force Base. 2000 Final Report. Unpub. Report, BioResources, Los Osos, California. 28pp.

Blankenship, T.L. 1995. Coyote interactions with other carnivores. Symp. Proc. Coyotes in the southwest: a compendium of our knowledge. San Angelo, Texas. December 1995.

Conover, M.R. 1990. Reducing mammalian predation on eggs by using a conditioned taste aversion to deceive predators. Journal of Wildlife Management 54:360-365.

Hogan, C. 1991. Snowy plover and human activities at Damon Point, Washington. May 1 to June 10, 1991. Unpubl. report to Washington Department of Wildlife, Olympia, Washington. 10pp.

Major, J.T., and J.A. Sherburne. 1987. Interspecific relationships of coyotes, bobcats, and red foxes in western Maine. Journal of Wildlife Management. 51:606-616.

Nicolaus, L.K., and D.W. Nellis. 1987. The first evaluation of the use of conditioned taste aversion to control predation by mongoose upon eggs. Applied Animal Behavior Science. 17:329-334.

Page, G.W. 1988. Nesting success of snowy plovers in central coastal California in 1988. Report of the Point Reyes Bird Observatory, Stinson, Beach, California. 7pp.

Page, G.W. 1990. Nesting success of snowy plovers in central coastal California in 1989 and 1990. Report of the Point Reyes Bird Observatory, Stinson Beach, California. 13pp.

Persons, P.E. 1995a. Western Snowy Plover Populations Size and Reproductive Success in 1994 at Vandenberg Air Force Base, California. Prepared for U.S. Fish and Wildlife Service, Ventura Field Station, Ventura, California. 21pp.

Persons, P.E. 1995b. Western Snowy Plover Population Size and Reproductive Success in 1995 at Vandenberg Air Force Base, California. Unpub. Report, Point Reyes Bird Observatory, Stinson Beach, California. 23pp.

Persons, P.E., and T.E. Applegate. 1996. Western Snowy Plover Population Size and Reproductive Success in 1996 at Vandenberg Air Force Base, California. Unpubl. Report, Point Reyes Bird Observatory, Stinson Beach, California. 35pp.

Persons, P.E., and T.E. Applegate. 1997. Monitoring of the Western Snowy Plover at Vandenberg Air Force Base in 1997: Population Size, Reproductive Success, and Management. Unpubl. Report, Point Reyes Bird Observatory, Stinson Beach, California. 30pp.

Sargeant, A.B. 1982. A case history of a dynamic resource – the red fox. Pages 121-137 *in* G.C. Sanderson (Ed.) Midwest furbearer management. Midwest Fish and Wildlife Conference, Wichita, Kansas.

Sargeant, A.B., R.J. Greenwood, M.A. Sovada, and T.L. Shaffer. 1993. Distribution and abundance of predators that affect duck production-Prairie Pothole Region. U.S. Fish and Wildlife Service Resource Publication No. 194. 96pp.

Schmidt, R.H. 1986. Community-level effects of coyote population reduction. Pages 49-65 *in* J. Cains, Jr. (Ed.) Community toxicity testing. American Society for Testing and Mat. STP920.1.

SRS Technologies. 2002. Breeding Activities of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) on Vandenberg Air Force Base, California. 2002 Final Report. Prepared for United States Air Force. Unpub. Report, SRS Technologies, Lompoc, California. 59pp.

SRS Technologies. 2003. Breeding Activities of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) on Vandenberg Air Force Base, California. 2003 Final Report. Prepared for United States Air Force. Unpub. Report, SRS Technologies, Lompoc, California. 58pp.

SRS Technologies. 2004. Breeding Activities of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) on Vandenberg Air Force Base, California. 2004 Final Report. Prepared for United States Air Force. Unpubl. Report, SRS Technologies, Lompoc, California. 58 pp.

Stern, M.A. J.S. McIver, and G.A. Rosenberg. 1990. Investigations of the western snowy plover at the Coos Bay North Spit and adjacent sites in Coos and Curry Counties, Oregon, 1990. Report to Oregon Department of Fish and Wildlife Nongame Program. 33pp.

U.S. Air Force. 2008. Draft Integrated Natural Resources Management Plan, Vandenberg Air Force Base, California. Plan Period 2008 - 2013. November 2008.

U.S. Air Force. 2004. Air Force Instruction 32-7064, Civil Engineering Integrated Natural Resources Management.

USDA-APHIS. 2002. Environmental Assessment, Predator Damage Management to Protect the Federally Threatened Pacific Coast Population of the Western Snowy Plover, Oregon.

USFWS. 1993. U.S. Fish and Wildlife Service (USFWS), 58 FR 12864, *Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover*; March 5, 1993.

USFWS. 1999. U.S. Fish and Wildlife Service (USFWS), 64 FR 68507, *Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover*; December 7, 1999.

USFWS. 2001. U.S. Fish and Wildlife Service (USFWS) letter, *Biological Opinion for Beach Management and the Western Snowy Plover on Vandenberg Air Force Base for the 2001 Breeding Season (1-8-01-F-13)*, 30th Space Wing, March 9, 2001.

USFWS. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). California/Nevada Operations Office, Sacramento, California. 274pp. plus Appendices.

Warriner, J.S., J.C. Warriner, G.W. Page, and L.E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. Wilson Bulletin 98:12-37.

Wilson-Jacobs, R., and E.C. Meslow. 1984. Distribution, abundance, and nesting characteristics of snowy plovers on the Oregon coast. Northwest Science 58(1):40-48.