
Predator Management for Protection of the Western Snowy Plover and California Least Tern Breeding on Vandenberg Air Force Base, California

2013 Annual Report



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Acronyms and Abbreviations

| | |
|--------------|--|
| % | Percent |
| § | Section |
| 30 CES/CEANC | 30th Space Wing Asset Management Flight, Natural Resources |
| APHIS | Animal and Plant Health Inspection Service |
| BBS | Breeding Bird Survey |
| CDFW | California Department of Fish and Wildlife |
| CTA | Controlled taste aversion |
| kV | Kilovolt |
| LF | Launch Facility |
| MSRS | ManTech SRS Technologies, Inc. |
| SOW | Statement of Work |
| USFWS | United States Fish and Wildlife Service |
| VAFB | Vandenberg Air Force Base |
| WFVZ | Western Foundation of Vertebrate Zoology |

Beaches

| | |
|-----|----------------------|
| MIN | Minuteman Beach |
| PCO | Purisima Colony |
| PNO | Purisima North Beach |
| SAN | San Antonio Beach |
| SHN | Shuman Beach North |
| SHS | Shuman Beach South |
| SNO | Surf Beach North |
| SSO | Surf Beach South |
| WAL | Wall Beach |

Avian Species

| | |
|------|-----------------------|
| AMKE | American Kestrel |
| CORA | Common Raven |
| GOEA | Golden Eagle |
| LETE | California Least Tern |
| PEFA | Peregrine Falcon |
| MERL | Merlin |
| RTHA | Red Tailed Hawk |
| SNPL | Western Snowy Plover |

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1.0 Introduction

In February 2013, Vandenberg Air Force Base (VAFB or Base) awarded ManTech SRS Technologies, Inc. (MSRS) task order FA4610-13-D-0002-0002 (XUMUOS102313 and XUMUOS101813) to provide predator management for the protection of the federally endangered California least tern (*Sternula antillarum browni*, LETE) and the federally threatened Western snowy plover (*Charadrius nivosus nivosus*, SNPL). In accordance with the Statement of Work (SOW), MSRS provided the following predator management services in 2013:

- 1) Monitoring and lethal removal of predatory corvid and mammalian species as needed and permitted;
- 2) Subcontracted J. Nick Todd and D. Lee Aulman to conduct raptor avian predator management;
- 3) Submitted monthly predator management reports to the 30th Civil Engineer Squadron Installation Management Flight, Natural Resources (30 CES/CEIEA);
- 4) Participated in bi-monthly meetings with the SNPL/LETE management team to coordinate activities with other team members;
- 5) Repaired and maintained the electric and chain-link fences surrounding the LETE colony at Purisima Point on VAFB.

2.0 Location

VAFB is the headquarters for the 30th Space Wing. The Air Force's primary missions at VAFB are to launch and track satellites in space, to test and evaluate America's Intercontinental ballistic missile systems, and to support aircraft operations in the western range. In addition, as a non-military facet of operations, VAFB is committed to promoting commercial space launch ventures.

VAFB is located on the south-central coast of California, approximately half way between San Diego and San Francisco. The base covers 99,492 acres in western Santa Barbara County. The Santa Ynez River and State Highway 246 physically divide the Base into two parts. The area to the north of the Santa Ynez River is commonly referred to as North Base, and the area to the south as South Base. The western boundary of VAFB, characterized by long sandy beaches, is 35 miles of undeveloped coastline managed by a single entity. Sandy beaches on VAFB stretch almost continuously from south of Lion's Head on North Base to approximately four miles south of the Santa Ynez River on South Base. Beaches on VAFB where SNPL and LETE breeding activities occur comprise a total of approximately 13.8 miles. These beach sections are shown in Figure 2-1. The LETE is a colonial nester and nests near Purisima Point as shown in Figure 2-1.

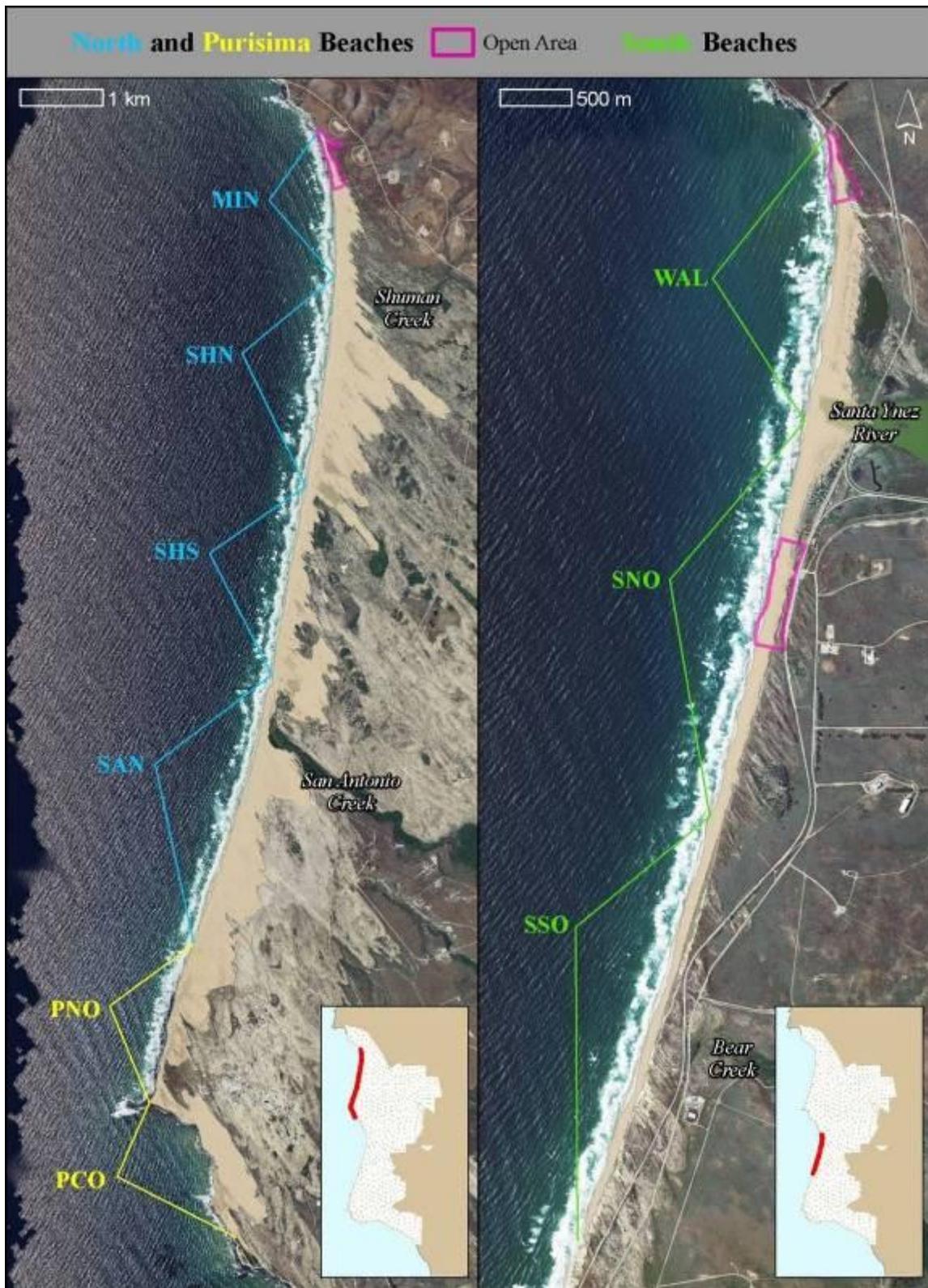


Figure 2-1. VAFB beaches including SNPL and LETE Habitat. Map labeled by beach section code: MIN = Minuteman, SHN = Shuman North, SHS = Shuman South, SAN = San Antonio, PNO = Purisima North, PCO = Purisima Colony, WAL = Wall, SNO = Surf North, SSO = Surf South

3.0 Methods

MSRS conducted corvid and coyote predator management in support of SNPL and LETE breeding on VAFB between March and September 2013. Throughout this period, MSRS coordinated with 30 CES/CEIEA, raptor control subcontractors (J. Nick Todd and D. Lee Aulman), and Point Blue (formerly PRBO Conservation Science) biologists to develop management strategies that maximized the protection of breeding SNPL and LETE while minimizing the effects of control measures on predator populations. This was accomplished by focusing control efforts on those specific predators that posed a direct threat to SNPL and LETE nesting territories. Although there are many potential coastal predators on VAFB, common raven (*Corvus corax*), coyote (*Canis latrans*) and peregrine falcon (*Falco peregrinus*) generally pose the greatest threat to SNPL and LETE breeding. Our species-specific predator control methods and communication strategies are described below.

3.1 Communication and Record Keeping

As in the past, communication between MSRS and Point Blue biologists was crucial as the predator management strategy depended on timely reporting of observations and input from SNPL and LETE monitors that regularly worked within coastal nesting habitat. These monitors notified MSRS of nest losses and the presence of predator sign along all SNPL breeding beaches and within the Purisima Point LETE colony as soon as possible. This input was then used to devise and adapt a management strategy that focused control efforts to those areas where predator activity was highest. To that end, constant cellular and radio communications were maintained to ensure prompt responses to immediate predator concerns, such as the presence of a foraging raven or coyote.

MSRS implemented a communal online calendar for the second year which allowed all parties to upload their predator related observations. This record enabled MSRS to observe patterns of predator activity throughout the season and respond to activity patterns in real-time (see Appendix A, B, and C). In addition, project team members attended a bi-monthly meeting where all parties were updated on the current status of SNPL and LETE nesting and predator control management activities. These meetings also allowed for detailed discussion regarding program strategy, implementation, and program effectiveness. MSRS personnel also maintained daily written logs of observations, raven nest searches, trapping efforts, and predator sign at the Purisima Colony. Reports of predator control efforts, trapping success, and Purisima Colony fence maintenance were provided to 30 CES/CEIEA on a monthly basis.

3.2 Raven Control Strategy

Raven control was accomplished with a three tiered strategy, each tier reflecting the appropriate stage in the raven breeding cycle. The first tier of the strategy focused on the identification of coastal raven breeding territories during the pair bonding and nest building



Figure 3-1. Raven trap set array.

phase of their breeding cycle (March to mid-April). During this period, MSRS biologists searched large sections of potential raven breeding habitat near the coastal strand in an attempt to identify territorial birds. If paired ravens were identified within 2.5 miles of the coast, their breeding status was routinely monitored to determine if nesting was occurring.

The second tier of the strategy was to locate and remove coastal raven nests and/or remove at least one of any nesting pairs prior to the hatching of eggs. MSRS has learned through past experience that late stage disruptions to raven breeding does not afford the remaining bird enough time to successfully bond with a new mate and produce young before the end of peak SNPL nesting (late May to early June). This is critical because the majority of raven predations on SNPL nests occur when ravens are tending nests with chicks (M. Ball, pers. obs.). Unless raven breeding is disrupted, raven chicks typically hatch during or just prior to peak SNPL nesting. This pre-emptive removal significantly decreases the intensity of SNPL predation.

If all raven nests or nesting pairs are not located by mid-May, raven control efforts shift to an intensive trapping effort. During this period, traps are set along the coastal strand in areas where recent raven predations have been documented. Each trap set consists of six #2 Victor-Oneida soft-padded leg-hold traps set in an array around a decoy nest using quail eggs to mimic a SNPL nest (Figures 3-1 & 3-2). Traps are set in areas of high raven activity, based on observations by SNPL monitors. The location of all raven traps deployed during the 2013 breeding season is provided in Figure 3-5. Traps are checked and maintained twice daily while they are open. Traps are covered in times of high wind. This method of trapping is extremely time-consuming; however it selectively targets those birds that are actively foraging the coastal strand in search of SNPL eggs.



Figure 3-2. Completed raven trap set mimicking a SNPL nest.

Trapping and hunting efforts continue through the remainder of the SNPL breeding season until coastal raven activity has ceased. The combined use of pre-emptive removal of coastal ravens early in the season and responsive trapping

during SNPL breeding allows us to focus efforts on those ravens causing predation and thus minimize loss to SNPL breeding success.

All raven removal efforts were conducted in accordance with Federal Fish and Wildlife Depredation Permit #MB165709-0 and California Department of Fish and Wildlife (CDFW) hunting license (#D-0006781317-3) and trapping license (#65454). When hunting, ravens were dispatched using a 12-gauge shotgun or 0.17 rifle with lead-free ammunition. When trapping, ravens were dispatched using a method of cervical dislocation.

3.3 Coyote Control Strategy

SNPL Breeding Areas

Throughout the SNPL and LETE breeding season, MSRS maintained a responsive strategy to minimize coyote nest predations. Coyotes regularly forage the coastal strand without having a significant impact on nesting birds. Decisions to deploy coyote traps are mainly based on observations by monitors and predator control technicians. If patterns of nest predation suggest a coyote is honing in on SNPL nests, rather than just opportunistic encounters, MSRS responds with an intensive trapping program. SNPL monitors play a key role in indentifying the location of coyote predation and areas of heavy foraging activity. Foot prints of the “problem coyote” are tracked to areas where the individual regularly enters and exits the beach. Trap sets are then strategically placed along this footpath in an attempt to selectively trap and dispatch the problem coyote. Coyotes are trapped using #3 Victor-Oneida soft-padded leg hold traps in accordance with CDFW Codes (§4004) and California State Regulations (Title 14, §465.5). Figure 3-3 shows the set-up and Figure 3-4 shows the finished presentation of the trail leg-hold trap.



Figure 3-3. Leg-hold trap in position.

If captured, coyotes are lethally dispatched with a .243 caliber rifle or a .22 caliber revolver loaded with lead-free ammunition. The stomach and intestinal contents of the coyote are collected and later inspected to determine if SNPL remains or bird bands are present. If unintended species, such as bobcat or raccoon, are captured they are released immediately at capture location. If non-target species are captured within the Purisima Point LETE colony fence they are released within the general vicinity outside of the LETE colony fence line. Coyote traps are checked and maintained on a daily basis and remain open until monitors report that coyote predation has ceased in the area.

Coyote predation during 2013 was minimal, with most suspected coyote predation events appearing to be opportunistic, rather than a result of a particular coyote targeting SNPL nests.

As a result, coyote depredation was not required during 2013 and no trapping efforts occurred in SNPL nesting areas.

Purisima Point LETE Colony

The Purisima Point LETE colony is currently the only nesting site for LETE on VAFB. Protection of this federally endangered species requires the aid of an established exclusion perimeter fence to deter mammalian predation. Prior to 2013, The Purisima Point colony perimeter was bound by electric fences on the north and south, a chain link fence to the east, and the Pacific Ocean to the west. It was modified this year to include an additional electric fence to the east, and a newly positioned north segment (Figure 3-6). Throughout the LETE breeding season, MSRS regularly maintained the electric fence, re-erecting collapsed poles, filling in gaps, and cleaning the wires.



Figure 3-4. An example of a coyote leg-hold trap set.

The electric fence is composed of ten alternating grounded and live wires held by fiberglass poles and insulators. The voltage of the electric fence is regularly monitored to ensure an optimal range between 7-10-kilovolts (kV). Occasionally, precipitation and dew collection on the conductive wires caused the voltage to drop below base operational levels, between 4-7-kV. When this occurs, large terrestrial predators, such as coyote, bobcats, and feral pig are able to enter the Purisima Point LETE colony. When predator sign is detected within the fence perimeter, MSRS conducts targeted trapping within the Purisima Point colony to capture and remove the predator before a LETE loss occurs. As with SNPL predator management, captured coyotes are lethally dispatched. However, if a bobcat, gray fox, or raccoon is captured, they are removed from the Purisima Point colony and released within the general vicinity.

Prior to the 2013 retrofit of the perimeter fence, coyotes, pigs, and other small mammals routinely dug under the chain link fence spanning the eastern border of the breeding colony (Figure 3-6). To reduce incursions of these predators onto the breeding colony, MSRS installed a secondary electric fence along the eastern edge of the dune sand sheet running parallel to the chain link fence (Figure 3-6).

In addition, the north section was redesigned with part of the section removed and replaced with a segment running south directly to the cliffs (Figure 3-6). The new alignment excluded an area of dense vegetation that was formally inside the fenced-in area. Previous observations of small mammal tracks suggest a preference for open habitat with mixed dense vegetation. By excluding this fenced-in area, we reduced the enticement of coyotes and other predators to breach the fence (Figure 3-5). While most areas of dense vegetation were excluded from the fenced-in area, a small patch of vegetation was included at the extreme north end of the fenced breeding colony. This habitat structure was left in place to act as an attractant for any terrestrial predators seeking shelter in the event that it breaches the fence and is inside the breeding colony. Throughout this area, a series of leg hold traps were strategically placed to capture predators and prevent them from disrupting LETE breeding.

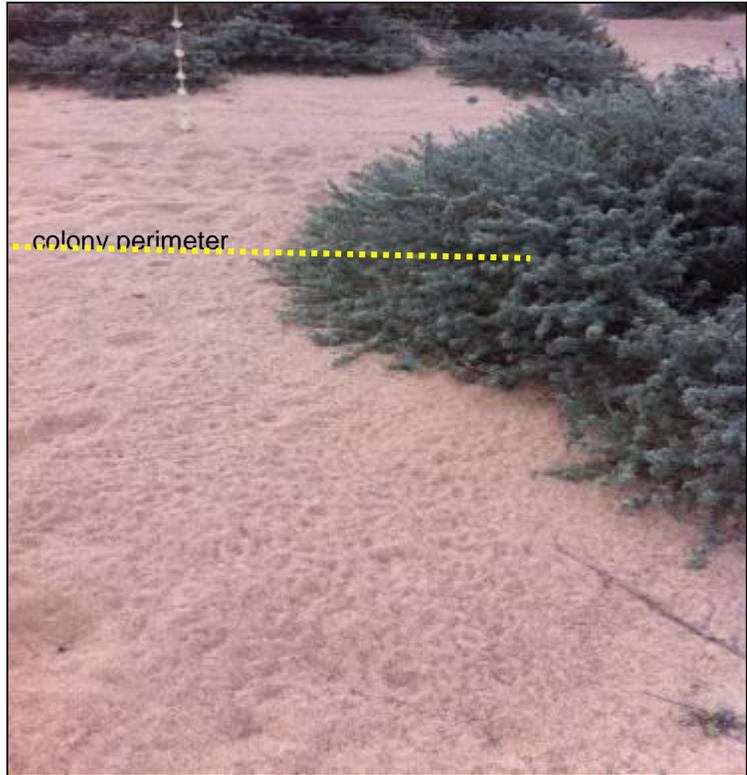


Figure 3-5. Small mammal foot traffic within the LETE colony along the perimeter fence prior to new fence arrangement. Note that there are few small mammal tracks visible outside of the fence perimeter.

Lastly, MSRS replaced the wiring and insulator components of the southern fence to reduce electrical resistance along the fence caused by years of weathering and corrosion (Figure 3-6).

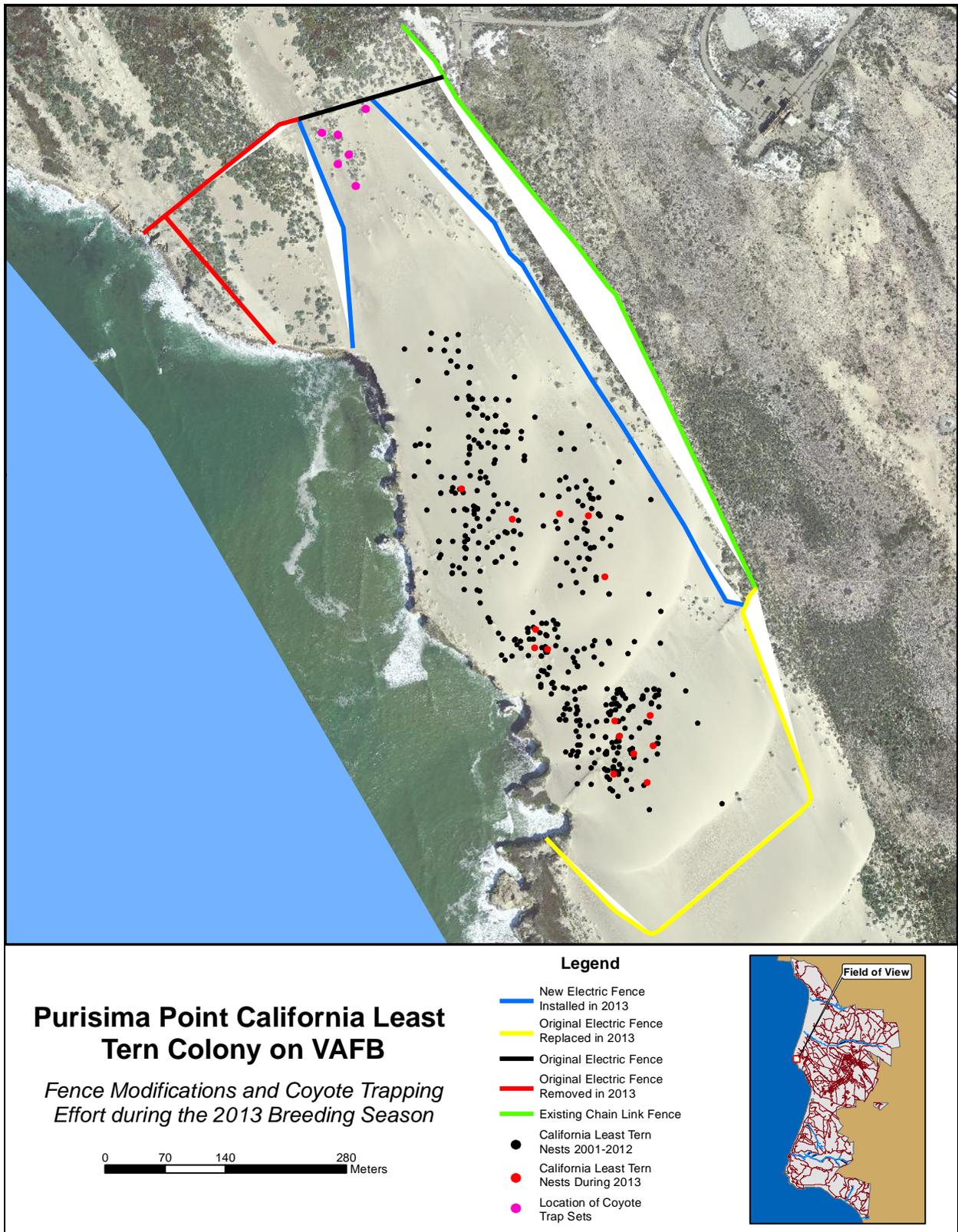


Figure 3-6. Purisima Point LETE colony perimeter fence 2013 retrofit.

3.4 Raptor Avian Predator Management Strategy

Throughout the field season, biologists continuously assessed which individual birds of prey posed significant threats to breeding SNPL and LETE. A significant threat was defined as a known predator with a pattern of behavior that puts it in direct contact with a protected species. Avian predators were surveyed within the Active Management Area (AMA), covering 4,869 acres within 1.7 miles of the LETE colony (Figure 3-7). Active management often consisted of, but was not limited to, banding, trapping, and documenting fledging success. During the LETE breeding season maintaining a continual understanding of the use of the landscape by avian predator populations and where they nest and roost allowed biologists to be efficient when an individual requires removal. Otherwise, considerable time would be lost, likely increasing the number of predated LETE, while trying to locate and problem solve the best means of capture for the offending bird.

The primary method of monitoring was ground-based observations, either on foot or from vehicles, using high-powered binoculars and spotting scopes. For each predatory bird observed, biologists determined the species, age, paired or unpaired, and whether or not bird was banded. Beginning in March and continuing through August, area searches of known nesting and roost sites were made to determine occupancy of breeding territories. Observations of territorial behavior, courtship behavior, the presence of nests, or the presence of young at nest sites were all indicators of territorial occupancy (Steenhoff 1987). Early observations allowed the implementation of management strategies well in advance of the LETE arrival at the colony in May. Continued observations throughout the season enabled biologists to target specific individual predators that exhibit direct threats to the LETE through their foraging behavior or consistent presence in or near the colony.

Biologists used various trapping methods and lures, which are constantly adjusted to complement the situations at hand. The primary methods for trapping both nocturnal and diurnal avian predators included: bal-chatri traps (Berger and Mueller 1959, Bub 1991), radio-controlled bow nets (Jackman et al. 1994), noose-harnessed pigeons and doves (Beebe and Webster 1964), noose carpets (Bloom 1987), dho-gaza nets (Bloom 1987 and Bub 1991), Swedish goshawk traps (Bloom 1987), and dip nets (Bub 1991). The traps that have been the most effective for specific species in the past are: 1) horned owls (*Bubo virginianus*) the bal-chatri, bow net, and harnessed pigeon; 2) American kestrel, bal-chatri, bow net; 3) loggerhead shrike, bow net; and 4) peregrine falcon (*Falco peregrinus*), harnessed bird.

Captured birds were aged, sexed, weighed, measured, photographed and examined for overall fitness (e.g., crop status, keel condition, feather wear, etc.). Captured birds were banded on-site and usually translocated within 24 hours of capture (as pursuant with Federal Permits #20431, #MB165709-1 and #MB017597). Translocation distances vary with species, but are sufficiently great enough to ensure that captured birds will not return to VAFB. For the three most commonly translocated species the maximum/minimum distances translocated are: great horned owl, 350/175 miles; American kestrel 350/175 miles; peregrine falcon, 1,152/452 miles.

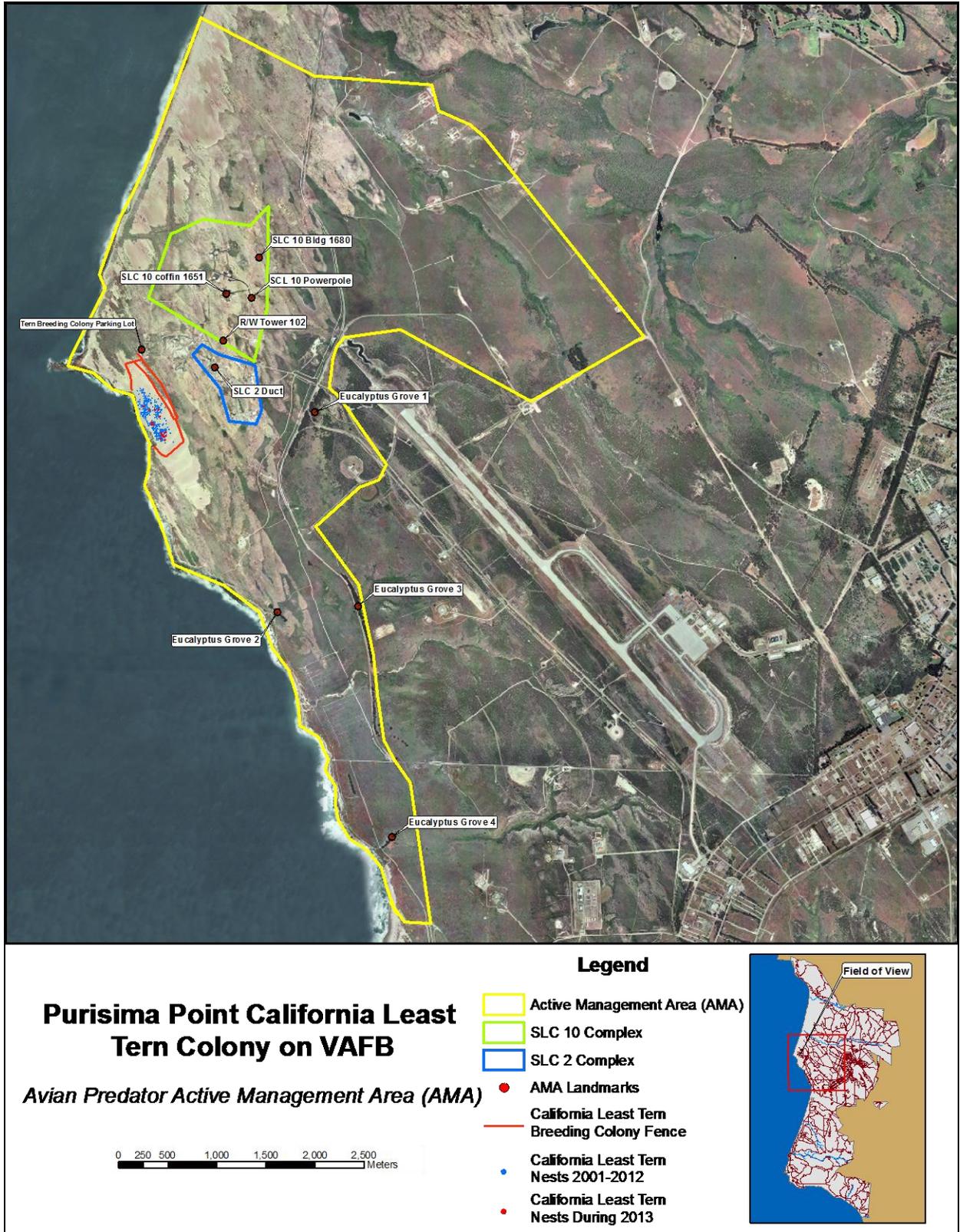


Figure 3-7. Purisima Point LETE colony predatory bird Active Management Area (AMA).

4.0 Results

There was significantly less predation on SNPL nests overall during the 2013 breeding season than in previous years. Of known-fate SNPL nests, only 20% were lost due to predation compared to a 32% average from 1994 to 2013 (Table 4-1). This predation rate represents the second consecutive year of significant decreases since 2011 when 52% of known-fate nests were predated, and 2012, when 37% of known-fate nests were predated. In 2013, confirmed SNPL nest predation was mainly attributed to coyotes which made up 85% of all predation losses. However, SNPL monitors believed these were opportunistic predation events, rather than particular coyotes targeting SNPL nests (Table 4-1). Only one nest predation was attributed to a raven despite frequent raven sightings on both North and South beaches, and one nest predation attributed to a gull (*Larus* spp.; Table 4-1). An additional nine nest predations were the result of unknown predators (Table 4-1).

Of the 15 LETE nests initiated in 2013, all successfully hatched at least one chick. Though coyotes were able to breach the electric fence at Purisima Point four times in 2013, there was no known take of LETE nests or chicks due to coyotes. In addition, there was only one documented instance of adult LETE predation in 2013. The crop and some feathers were found from a possible least tern adult and the remains were consistent with observations of owl or peregrine falcon predation, but no tracks were found to confirm the source. A large proportion of the chick population fledged and there was no evidence that fledglings were taken by predators.

4.1 Raven Predation and Control

Throughout the 2013 SNPL and LETE breeding season, MSRS lethally removed six adult ravens, and wounded another whose fate was unconfirmed. All removals occurred in close proximity to the coastline on North and South Base in areas of high raven activity. In total, one raven was removed from the SAN area, one from near the intersection of Point Sal and Taft Rds., one from the Lion's Head region, one was removed from the Minuteman Beach Parking Area, and two from the South Surf Beach vicinity (Appendix A). The raven that was shot but not recovered was encountered on South Base near the intersection with Coast Road and Kelp Road. All ravens were removed through active hunting efforts by tracking raven movement patterns to allow MSRS personnel to intercept the birds.

While active raven trapping was performed on SAN and MIN from 3 April to 10 May, it did not result in the capture of any ravens (Figure 4-1). This is likely because there was not extensive nest foraging by coastal ravens this year. In total, only one confirmed SNPL nest loss was attributed to a raven at Wall Beach (Figure 4-1, Table 4-1). This is a twenty fold decrease in loss over the previous two years.

In 2013, despite extensive searches in the areas surrounding SNPL and LETE beaches, MSRS was unable to locate any raven nests or observe raven breeding behavior. This is a significant shift from previous years when signs of coastal raven breeding was commonly observed. Instead, ravens were more frequently observed flying to coastal areas on Base from inland locations to the east. Daily field observations of raven activity are provided in Appendix B - Predator (Coyote/Raven) Observation Log.

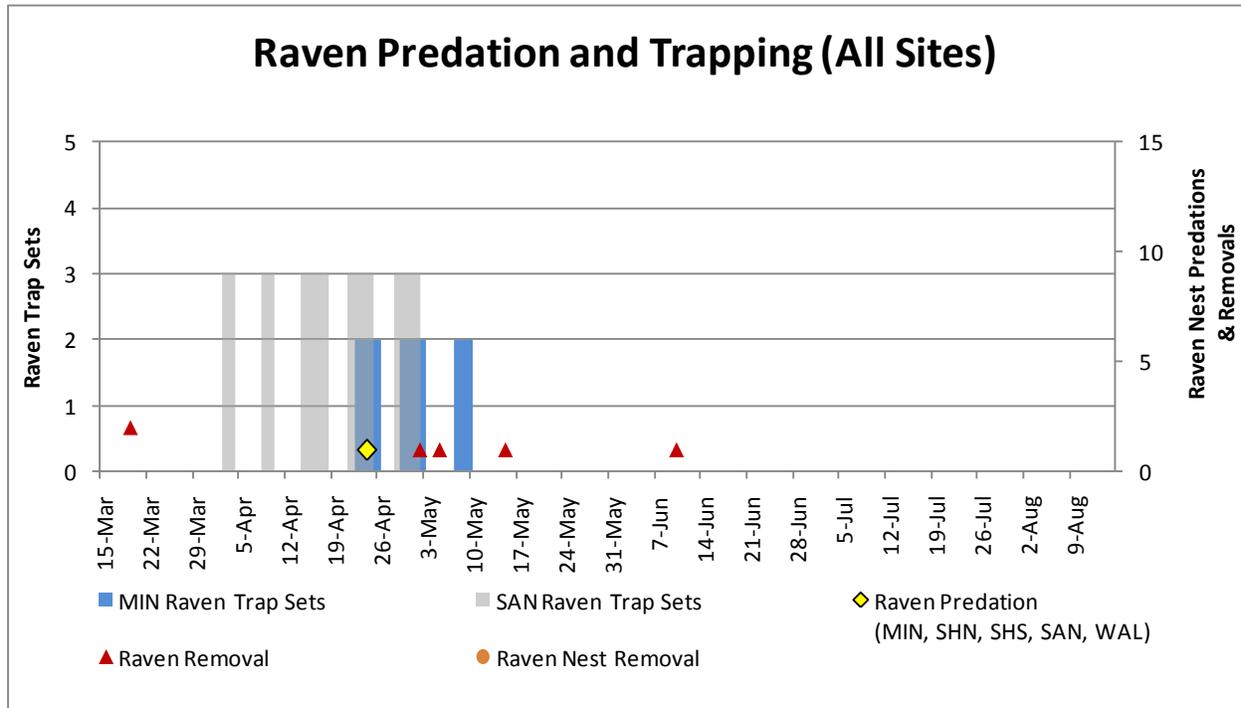


Figure 4-1. Raven predation and control.

4.2 Coyote Predation and Trapping

The majority of SNPL nest predations in the 2013 season were due to coyote predation. In total, 52 predation events, or 17% of nests with known fates, were attributed to coyote. This is slightly above the 20 year average of 15.9% coyote predation from 1994 to 2013 (Table 4-1). Most of the predation events occurred along SNO, WAL and SAN Beaches (Figure 4-2). However, based on the track patterns in the sand and timing of the losses, the SNPL monitors believed these were sporadic, opportunistic predation events, rather than particular coyotes targeting SNPL nests. For this reason, MSRS did not perform coyote trapping within the SNPL breeding areas during the 2013 season.

During 2013, only four breaches of the LETE colony fence by coyotes were documented and responded to. Tracks and observations indicated that the coyotes had breached the colony fence in pursuit of small mammals or while the fence was inactive due to power failure. In either case, the coyotes did not appear to target LETE nests. In an attempt to remove these coyotes from the colony, MSRS performed 80 trap nights over a 7 day period (Figure 4-3). In all of these cases, the coyotes left the colony before being trapped. No coyote predation occurred in the Purisima LETE colony during 2013.

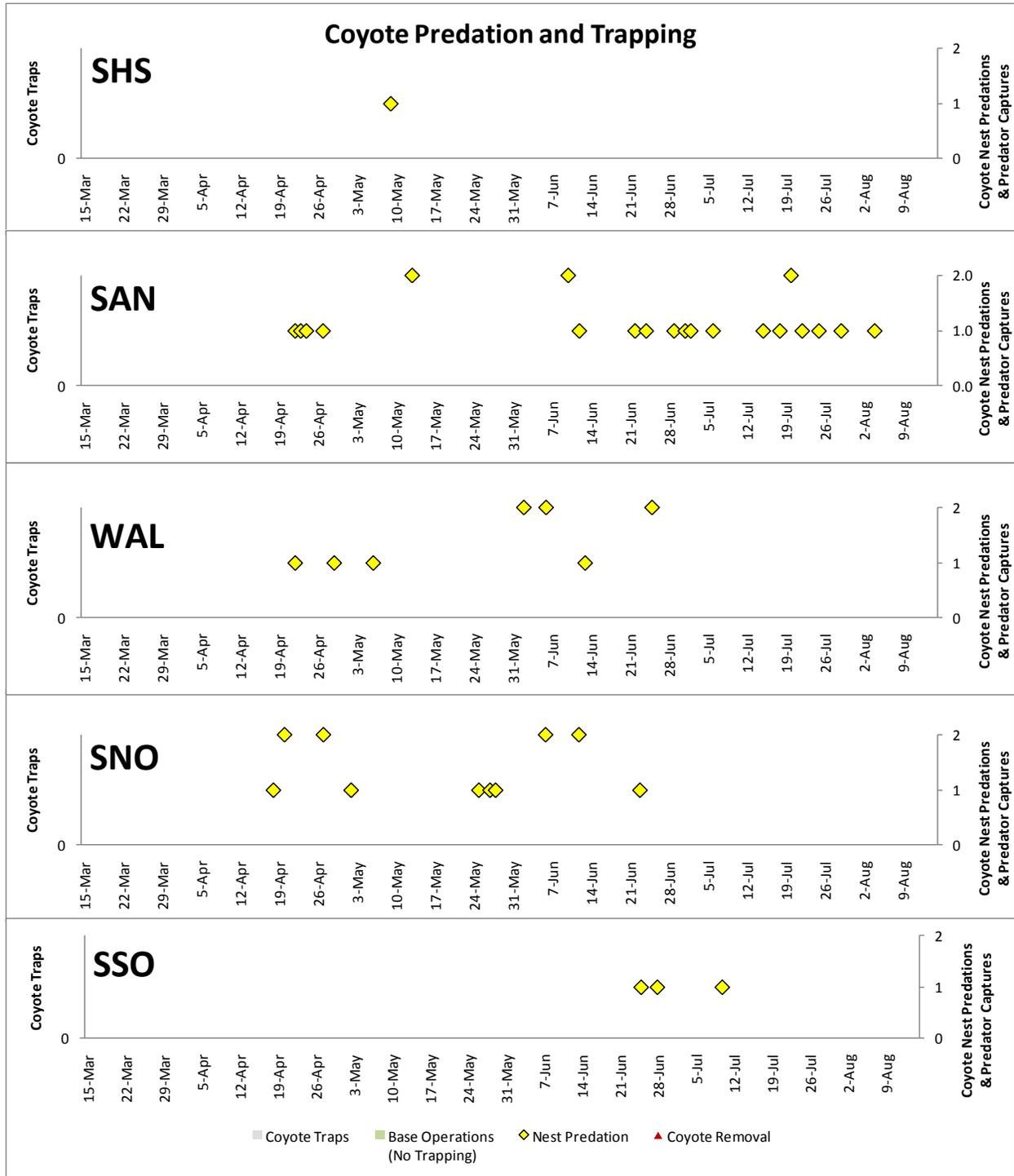


Figure 4-2. Coyote predation and trapping totals for SNPL breeding beach that experienced coyote predation. SHS = Shuman South, SAN = San Antonio, WAL = Wall, SNO = Surf North, SSO = Surf South

Table 4-1. SNPL nest predation totals by species and year. Percentages (%) are the proportion of nests with known fates. *American crow and common raven predation value pooled due to an inability to ascertain the species that caused the predation.

| Year | Coyote | Raccoon | Unknown Mammal | Suspected Raven | Raven | Crow | Gull | Whimbrel | Unknown Avian | Unknown Predation | Total Predation | Total SNPL w/ Known Fates |
|------|-----------|---------|----------------|-----------------|-----------|----------|----------|----------|---------------|-------------------|-----------------|---------------------------|
| 1994 | 41 (18%) | | | | | 13 (6%) | 2 (1%) | | | 26 (11%) | 82 (35%) | 231 |
| 1995 | 20 (10%) | | 8 (4%) | | | 4 (2%) | | | | 9 (5%) | 41 (21%) | 195 |
| 1996 | 31 (11%) | | 6 (2%) | | | 5 (2%) | 2 (1%) | | | 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%) | 1 (1%) | | | | 6 (5%) | | | 1 (<1%) | 25 (20%) | 66 (52%) | 127 |
| 2001 | 10 (6%) | 2 (1%) | 3 (2%) | | 2 (1%) | 6 (3%) | 2 (1%) | | 3 (<2%) | 27 (15%) | 54 (30%) | 181 |
| 2002 | 41 (14%) | | | | | 26 (9%) | 3 (1%) | 1 (<1%) | 1 (<1%) | 1 (<1%) | 75 (25%) | 296 |
| 2003 | 15 (4%) | 2 (<1%) | | | 63 (16%)* | | 5 (1%) | | 6 (2%) | 15 (4%) | 104 (26%) | 393 |
| 2004 | 130 (22%) | | | | 66 (11%)* | | | | 7 (1%) | 28 (5%) | 233 (39%) | 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 (1%) | | | | 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 |
| 2011 | 84 (20%) | | | 53 (18%) | 21 (5%) | | 19 (5%) | | 4 (1%) | 33 (8%) | 215 (52%) | 416 |
| 2012 | 79 (24%) | | | 3 (1%) | 19 (6%) | | 1 (<1%) | | 4 (1%) | 17 (5%) | 124 (37%) | 334 |
| 2013 | 52 (17%) | | | | 1 (0.3%) | | 1 (0.3%) | | | 9 (3%) | 63 (21%) | 302 |

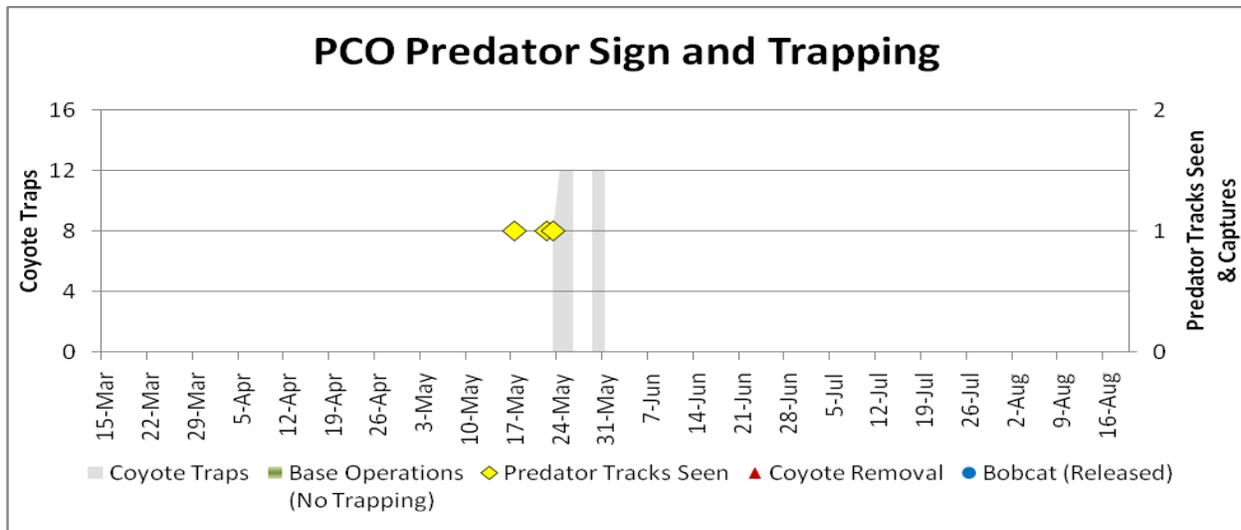


Figure 4-3. Purisima colony coyote activity. PCO = Purisima Point LETE colony.

4.3 Predatory Raptor Predation and Management

Avian predator surveys for the Purisima Point LETE colony began 8 March 2013. Nest searches, monitoring, banding, and trapping within the AMA and surrounding areas occurred from 8 March through 30 August 2013, while LETE made use of the breeding colony (Figure 3-7). During this period, avian predator species observed in the Purisima Point LETE colony, or adjacent habitat were: great horned owl (*Bubo virginianus*), barn owl (*Tyto alba*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), peregrine falcon (*Falco peregrines*), and loggerhead shrike (*Lanius ludovicianus*).

On 8 March, biologists began regular visits of all known raptor territories within the AMA for the presence of potential breeders (Figure 3-7). Three great horned owl territories were visited (Eucalyptus Groves 1, 3, 4; Figure 3-7), three barn owl roost/nest locations (Space Launch Complex [SLC] 10 coffin 1651, Bldg 1680 and SLC-2 Duct; Figure 3-7), four red-tailed hawk nest sites (Eucalyptus Groves 1, 2, 3, and R/W Tower 102; Figure 3-7), one Cooper’s hawk nest site (Eucalyptus Grove 1; Figure 3-7), two northern harrier territories (Launch Facility 576E and West Cross Road), and four known peregrine falcon nest locations (Point Arguello, Lion’s Head, Honda Point and Point Sal; Figure 4-4). All appropriate habitat and structures within a 1.7-mile radius from the LETE colony were surveyed for American kestrels and loggerhead shrikes. Of 17 known raptor nesting sites within the AMA, seven were found to be active as defined by the presence of adult birds at or near a nest (Table 4-2). Three of seven additional raptor territories outside the AMA were surveyed opportunistically and found to be active.

When raptors were detected within the LETE breeding colony, efforts were made to trap those individuals and translocate them before losses could occur. No LETE mortalities were attributed to avian predators in 2013. A total of six raptors were captured and translocated to western Kern County (Figure 4-4; Table 4-3). Since 1999, a total of 155 avian predators have been trapped at VAFB and relocated for LETE and SNPL management (Table 4-3).

Within coastal strand habitat, the peregrine falcon is considered to be the most significant threat to SNPL breeding. This year SNPL bands were recovered from the Lion's Head peregrine falcon nest on North Base for the second consecutive year. No other bands were discovered in any of the other peregrine nests examined in 2013.

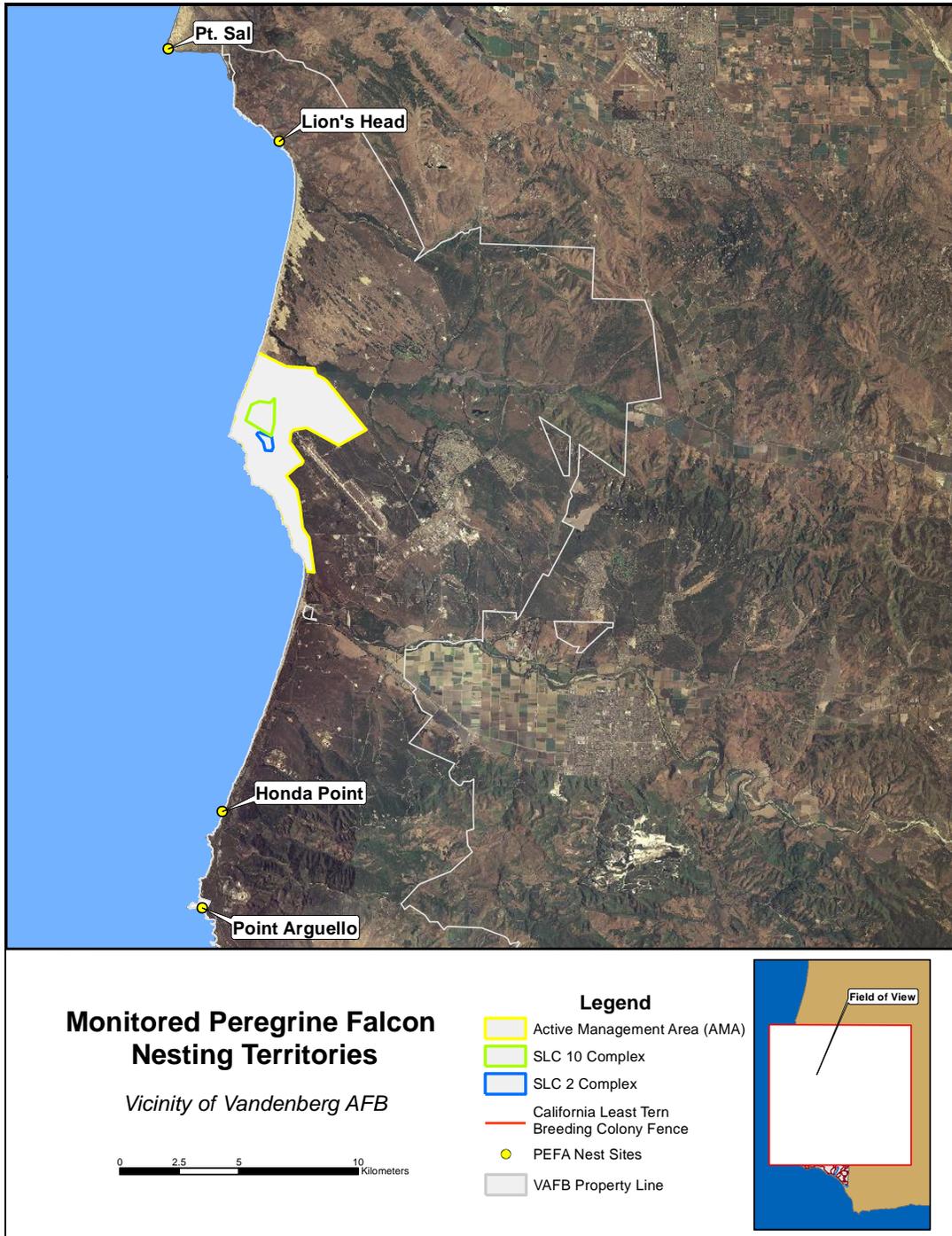


Figure 4-4. Avian Predator Active Management Area on VAFB.

Table 4-2. Active raptor nests within the Active Management Area, including peregrine falcon.

| Species | Nest Name | First Incubation Observed | Number Fledged |
|--|-------------------|---------------------------|----------------|
| <i>Raptor Nesting in the Active Management Area</i> | | | |
| Barn owl | SLC 10 Bldg 1680 | March 11 | 1-2 |
| Great horned owl | Euc 3 | Unknown | 1 |
| American kestrel | SLC 10 Power Pole | Week of March 18th | 2 |
| Red-tailed hawk | Euc 1C | March 9 | 1 |
| Red-tailed hawk | Euc 1E | March 9 | 2 |
| Red-tailed hawk | SLC 10A | March 20 | 1 |
| Red-tailed hawk | Euc 2B | March 20 | 1 |
| <i>Peregrine Falcon Nesting Outside of the Active Management Area</i> | | | |
| Peregrine falcon | Lion's Head | March 25 | 2 |
| Peregrine falcon | Point Arguello | March 26 | 2 |
| Peregrine falcon | Honda Point | ~March 25 | 2 |
| Peregrine falcon | Point Sal | Unknown | Unknown |

Table 4-3. Raptors captured on VAFB and translocated to western Kern County in 2013.

| Species | Band Number | Capture Date | Capture Location | Release Date | Release Location |
|------------------|-------------|--------------|-----------------------------|--------------|-----------------------------|
| Great horned owl | 1177-52940 | May 31 | 34.7627104, -120.6216181 | June 1 | 34.8640835, -125.2383884 |
| Great horned owl | 1177-52941 | June 5 | 34.7341107, -120.6154275 | June 6 | 34.8640835, -125.2383884 |
| Great horned owl | 1177-52942 | June 12 | 34.7341107, -120.6154275 | June 13 | 34.8640835, -125.2383884 |
| Great horned owl | 1177-52943 | June 25 | 34.7481299, -120.6145439 | June 26 | 34.8784261, -119.3412804 |
| Great horned owl | 608-69382 | July 5 | 34.750709, -120.611069 | July 6 | 34.878429, -119.3412710 |
| Barn owl | 2206-85656 | June 21 | 34.7548655, -120.6316956 | June 22 | 34.7627104, -120.6216181 |



Barn and Great Horned Owl Capture and Relocation

Purisima Point California Least Tern Colony on VAFB

- Legend**
- Owl Capture Locations
 - Owl Release Locations

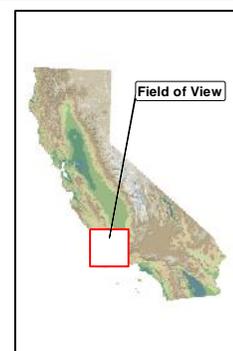


Figure 4-5. Location of owl captures on the LETE breeding colony then relocated to western Kern County.

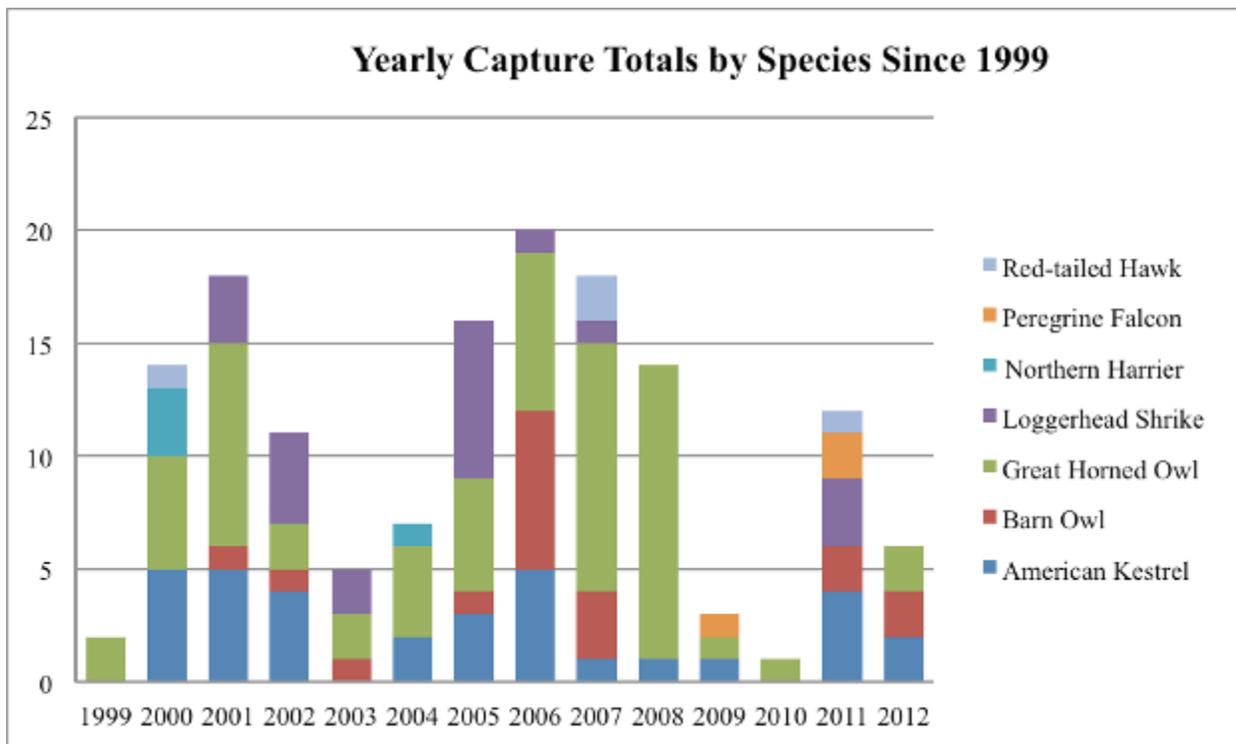


Figure 4-6. The number of raptors trapped on VAFB by species and relocated during the LETE/SNPL breeding season from 1999 to 2013.

5.0 Discussion

5.1 Raven Management

Analysis of Breeding Bird Survey (BBS) data from 1968 to 1990 indicated an increase in raven populations throughout the west, with major increases in California (Robbins et al. 1986, Marzluff et al. 1994). In the Mojave Desert of California, BBS data from 1968 to 1990 indicates an increase in raven population of 1,528% (Boarman & Berry 1995). In Santa Barbara County, ravens have been expanding their range from drier inland areas into south and west coastal areas, including VAFB (Lehman, in press). Prior to the mid-1990's, raven sightings on coastal Santa Barbara County were very rare (Lehman 1994). Throughout the 1990's and 2000's, raven observations have become more and more frequent and by 2010 was considered an uncommon (1 to 7 individuals per day of search in proper habitat) resident on VAFB (Lehman, in press). At this point, it is clear that a breeding population of ravens has become established along the northern coast of Santa Barbara County and numbers appear to be increasing annually (A. Abela, M. Ball, R. Ball, J. LaBonte, M. Holmgren, pers. obs.).

Accounting for approximately 6% of all SNPL nest losses (with known fates) during the past 20-years, corvids are a significant nest predator on VAFB. Prior to 2003, SNPL monitors observed the American crow as the main corvid predator on SNPL nests (Table 4-1). Since 2005, SNPL monitors have only observed the common raven predating SNPL nests (Table 4-1). In addition, the monitors have reported few observations of the American crow over recent years on VAFB beaches. It appears that ravens have displaced crows as the primary corvid along the coastal strand of VAFB. While raven predation on SNPL nests has fluctuated significantly from breeding season to breeding season, the number of raven sightings and confirmed number of coastal breeding pairs has continued to rise. To compensate for this increase, in 2009, MSRS developed and applied the multi-tier management approach detailed in section 3.2. This approach has resulted in four consecutive years of corvid predation rates less than the 20 year average (Figure 4.2).

MSRS has observed that SNPL nest predations by ravens declined dramatically during the breeding season after targeted raven and raven nest removal occurred (MSRS 2007, 2009, 2011, 2012). This is potential evidence that the multi-tiered strategy has been successful. The combination of selectively hunting ravens along VAFB beaches, removing raven nests within the coastal zone, and raven trapping efforts that target problem birds, appears to be limiting raven use of coastal VAFB and reducing losses to SNPL nesting (MSRS 2007, 2009, 2011, 2012). Section 6.0 provides recommendations for additional strategic and preemptive measures that may be taken to improve raven management and depredation activities in the future.

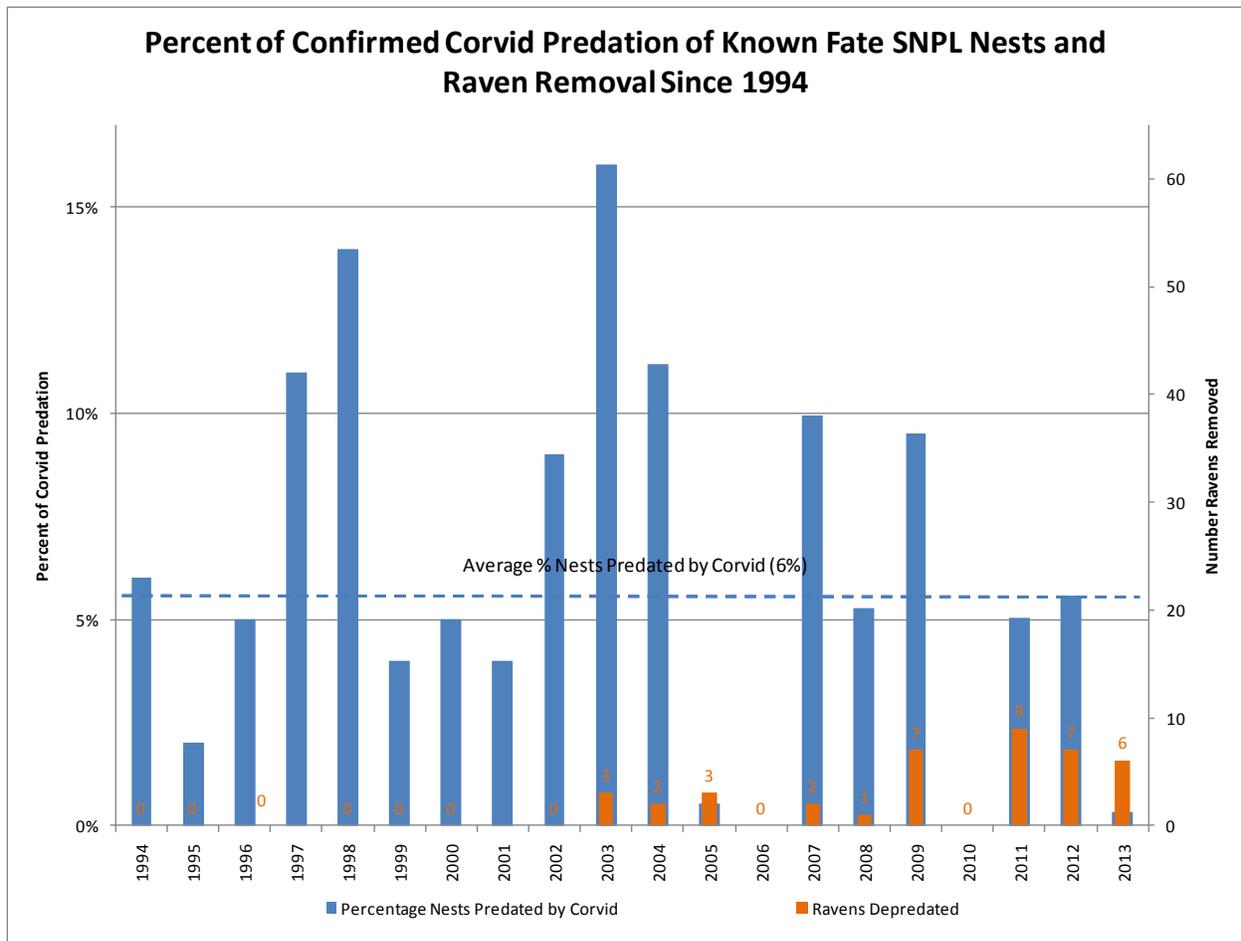


Figure 5-1. Percent of known-fate SNPL nests predated by corvids and number of ravens removed since 2003.

5.2 Coyote Management

Coyotes have been a significant predator of the SNPL on VAFB since full-season monitoring began in 1994. Coyote predation typically accounts for approximately 16% of known-fate SNPL nests each breeding season (Table 4-1). This year was no exception. In total, 17% of nests were attributed to coyote. However, MSRS did not perform coyote trapping in 2013, as explained above.

The south beaches of VAFB have historically experienced greater coyote predation (MSRS 2008), potentially due to habitat differences, SNPL nesting density, localized coyote population densities and foraging preferences, or a combination of these factors. However, this was less of an issue in 2013, with no coyotes in those areas showing specific interest in SNPL nests. Predation appeared to be largely opportunistic, from coyotes continually foraging beaches.

Conner et al. (1998) found no correlation between coyote removal and predation rates when non-selective removal was used. They concluded that non-selective methods lead to the removal of predators not creating a problem. Similarly, Sacks (1999) found that most predation was caused by a few individuals. Coyotes are territorial and removal of dominant adults has

been shown to increase the number of young, transient individuals seeking territories in the area (Knowlton 1972). Knowlton et al. (1999) also found an increase in the reproductive rates and overall populations of younger coyotes in areas where coyotes are heavily exploited. Thus, developing methods to identify and focus on the individuals specifically causing the problems will further VAFB's ability to keep the surrounding ecosystem intact.

In the past, high levels of coyote nest predation have been attributed to small mammal abundance on VAFB (SRS 2006). In March 2001, as part of a predator study, a small mammal trapping effort was initiated to characterize rodent populations at two coastal locations on VAFB. This trapping effort continued through 2005 to determine a correlation between foraging opportunities for coastal coyotes in upland areas along the coastal strand and frequency of coyote predations on SNPL nests. This study identified that the abundance of small mammals is inversely correlated with coyote predations on SNPL nests. When small mammals were abundant, coyotes presumably did not have to forage the beaches for a food supply, resulting in a greater number of SNPL nest successes (Figure 5-2; SRS 2006).

Predicting and anticipating coyote predation pressure would be valuable for SNPL managers; however small mammal trapping is laborious and time-consuming. Small mammal abundance may be correlated to annual precipitation levels (Lima & Jaksic 1998, 1999; Cortes-Calvae & Alvarez-Castaneda 2002; Thibault et al. 2010). MSRS, therefore, examined past precipitation levels on VAFB and coyote predation rates to see if there was a qualitative and quantitative relationship between the two that would support further analysis and potentially lead to a method of anticipating coyote predation with a fair level of confidence. The annual rainfall on VAFB, totaled across the season preceding each SNPL breeding period, was compared graphically to the number of coyote nest predations observed each year on VAFB (Figure 5-2). If precipitation levels are expected to correlate to small mammal density and therefore indirectly correlate to coyote predation pressure, an inverse relationship between precipitation and coyote predation would be expected. No such relationship is evident graphically (Figure 5-2) and a correlation analysis only found a weak relationship ($r = -0.21$, $df = 18$).

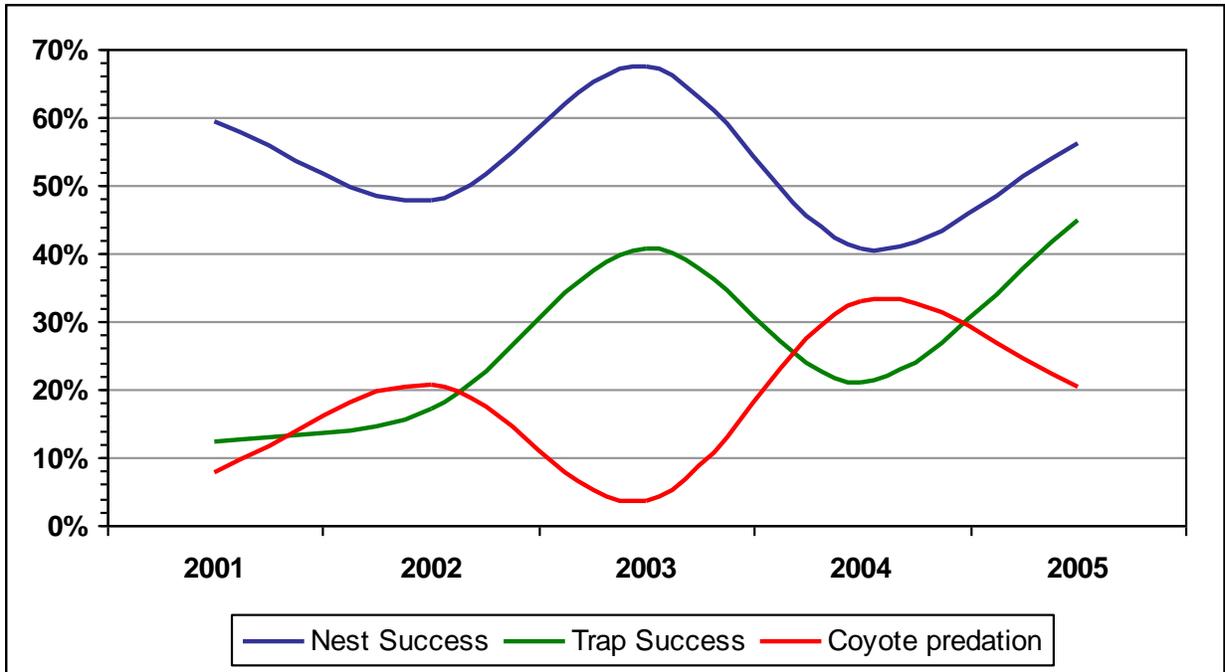


Figure 5-2. SNPL nesting success and small mammal trapping success in coastal areas near Surf Beach from 2001 to 2005.

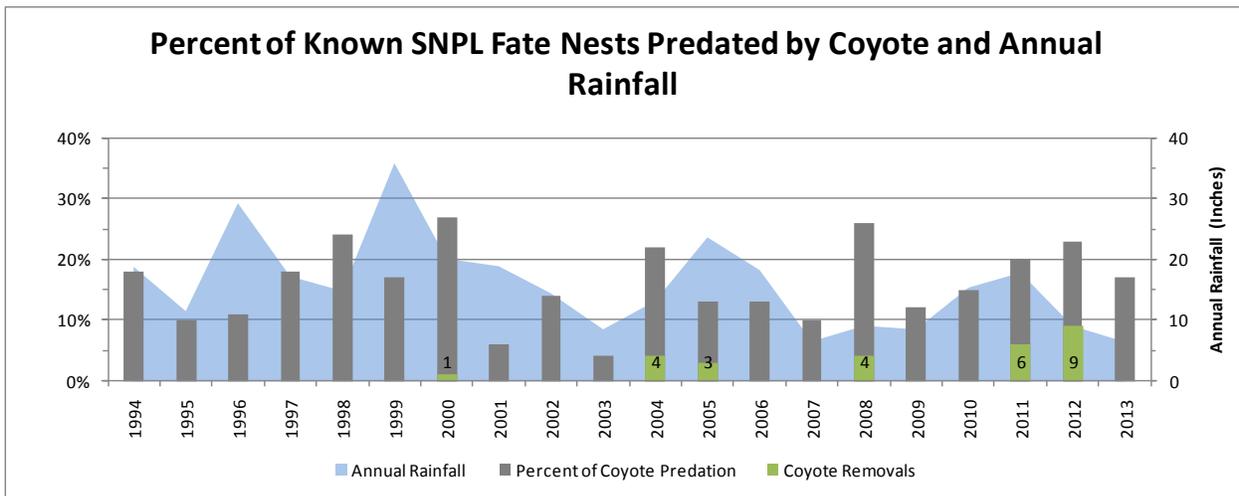


Figure 5-3. Percent of known nest predation by coyote, annual coyote removals (with number of removals listed), and annual rainfall.

The modifications to the California least tern fence discussed in section 3.3 appear to have substantially reduced the number of predator incursions onto the breeding colony in 2013. During the previous year, 14 documented fence breaches by coyotes and bobcats required 257 trap nights over a 33 day period to respond. This year, only three Purisima Colony fence breaches were documented requiring only 80 trap nights over a 7 day period (Figure 4-3). Each of these coyotes left the colony without being trapped. No coyote predation occurred in the

Purisima LETE colony. The few fence breaches that did occur happened during a two week period when the southern and eastern portions of fence were inactive due to a blown fuse (Figure 4-3).

5.3 Predatory Raptor Management

Purisima Point LETE Breeding Colony Raptor Management

By the time LETE appear at the Purisima colony in early to mid-May, some of their potential avian predators are already nesting adjacent to the colony. This makes the raptor's behavior more predictable and the probability of locating an individual bird is greatly increased since they are tied down to a specific location. Weekly monitoring of these sites and known roosting areas allowed our raptor management team to identify lone, non-territorial individuals that can cause issues within the LETE colony or nearby SNPL breeding beaches.

Great horned owls are usually well into the incubation of their eggs by the time of the first survey in March. They have nested in Eucalyptus Grove 1 every year since 1999 and have consistently been incubating by the first week of March (Figure 3-7). However, 2013 was the first year that this owl pair did not breed. They courted, roosted near extant stick nests, and were present into July without laying eggs. These birds were eventually removed and translocated in early July after repeated great horned owl incursions into the Purisima Point LETE colony (Figure 4-7). Typically this pair has been left alone. Unpaired horned owls within the AMA typically spent more time on the Purisima Point LETE breeding colony than members of a mated pair. Capture and translocation of these non-territorial owls is typically sufficient to ensure the protection of the breeding LETE population. Since the Eucalyptus Grove 1 owl pair did not breed, they routinely ventured out onto the LETE breeding colony. Following the removal of these birds and the earlier removal of three other unpaired owls, great horned owl tracks were not observed on the colony. Prior to capture, the unpaired owls were typically observed moving back and forth between roosting at the SLC-10 Coffin 1651 and Eucalyptus Grove 2 (Figure 3-7). Except for one owl, our raptor management team was successful at capturing "problem birds" within 24 to 48 hours of the initial detection of owl track on the colony by LETE monitors. This rapid response time likely contributed to the successful LETE breeding season observed this year.

During the 2013 LETE breeding season, the female American kestrel at SLC-10 established a new mate (Figure 3-7). These birds possessed the territory closest to the LETE breeding colony. Their nesting cavity was located in a hollowed portion of a utility pole inside the SLC-10 gate and 300 meters from the nest pole the female had attempted to use in 2012. The pole used in 2012 was replaced after a fire. This pair of kestrels foraged heavily in the areas immediately east of the Purisima Point LETE colony. Our raptor management team elected not to trap and relocate them because their foraging pattern and behavior did not appear to threaten LETE or SNPL breeding activities. These birds eventually fledged one male and one female offspring.

An unpaired adult male American kestrel was observed during weekly surveys at the Purisima Point LETE colony starting 15 March. By 25 April, sightings of this bird at the LETE breeding colony decreased from multiple times weekly to one observation per week. By the arrival of

LETE on 13 May, this kestrel was no longer observed during weekly surveys. As a result, no trapping efforts were need for this individual.

No other diurnal raptors, including loggerhead shrikes, were documented habitually foraging within the Purisima Breeding LETE colony. Typically, shrike observations both in and out of the colony begin to occur by the middle of June; however this year the first sighting was in April. No shrikes were seen in the colony until 15 July, when two individuals were seen perched within the colony boundaries. No efforts were made to trap these birds because only two sightings were made and the birds did not demonstrate a particular threat to LETE breeding. On 22 May, there was a single instance of a northern harrier perched briefly on the Purisima Point LETE colony sand sheet before it flew out of the colony. Normally, harriers pass through the colony or are mobbed out of the colony by the LETE. No other harrier observations were documented, therefore remedial actions were not needed.

Peregrine Falcon Monitoring and Management

In 2013, our raptor management team identified a new peregrine falcon territory on VAFB. This territory represents the third on VAFB and the fourth along the coast between Point Sal and Rocky Point (Figure 4-4). This eyrie (cliff nesting site), referenced herein as the Honda Point site, is located along the coastal bluffs directly north of the Honda Creek mouth. The nest site is a small pothole, only visible from the water, seven meters above the cobblestone shore. The pothole is made up of either mudstone or shale and is prone to crumbling inside. Even though the cavity appears to be sheltered from the wind, neither prey remains nor eggshell fragments were located inside despite having fledged two female chicks. In 2012, young peregrine falcons were seen near this location by seabird biologists, suggesting that a nest was nearby. In that year, neither nests nor adult birds were located, nor were birds consistently seen in the vicinity of Honda Creek mouth until 2012. Both the male and female were un-banded. On 17 May 2013, the female was trapped by raptor management team and fitted with a USFWS band and an alphanumeric visual identification band (ID# W/42). The male remained un-banded as of the close of the 2013 season. In 2012, a SNPL monitor observed a peregrine falcon take an adult SNPL on SSO Beach. This predation event is likely attributable a member of the Honda Point pair. Their nest will be examined again in 2014 for eggshell fragments and SNPL leg bands.

On 8 June this year, the Point Arguello peregrine falcon territory fledged one male and one female young (Figure 4-4). In addition, two eggs were laid but did not hatch. As in prior years, the most observed foraging direction for this pair was south along the coast towards the boathouse. The Honda Point territory is only 4 kilometers to the north of the Point Arguello territory and is therefore likely to influence the foraging pattern observed in these birds. The male at this site wears an unknown letter/number blue alphanumeric visual identification band from the period between 1992 and 1996. The female wears the black alphanumeric visual identification band (ID# 94/C). This female replaced the prior one during the winter of 2010/2011.

During the week of 3 June 2013, the Lion's Head peregrine territory fledged two female young (Figure 4-4). In 2012, the fledged young from this site dispersed onto the SNPL breeding beaches of MIN, SHN, SHS and SAN. While there were no confirmed SNPL mortalities in these

areas attributed to peregrines, there is no doubt they interacted due to their proximity to one another. This year's offspring from the Lion's Head site did not disperse to these same SNPL beaches as they did in the previous year. There were no observations of a fledgling peregrine on these beaches during 2013. Despite this, the adult peregrines continued to forage in these areas, evident by the recovery of SNPL bands from their eyrie at the end of the 2013 breeding season. In total, five SNPL color bands (1 tan (lost), 1 orange, 1 yellow and 2 green) and one USFWS band (wrapped in red tape) were recovered from the Lion's Head eyrie on 22 August. SNPL monitors indicated that this represented at least two individual adults from the same stretch of beach at VAFB. At the end of the 2011 breeding cycle, our raptor management team banded the female with a black alphanumeric visual identification band (ID# 86/?). The male was left un-banded. At the beginning of the 2012 season, it was observed that the male in the breeding pair wore both a USFWS band and an alphanumeric visual identification band (ID# 74/D). This indicated a replacement of the initial male at this site during the previous winter. The new male had been banded by our raptor management team as a nestling in Lobo Canyon on Santa Rosa Island in 2007. This new male has remained the resident at Lion's Head territory since 2012.

The northern most peregrine territory associated with VAFB is at Point Sal. This historic site is visible only from the water. The territory was occupied again this year, but was not followed through the nesting cycle.

6.0 Recommendations

Current strategies to minimize predation have shown success, but a broader selection of tactics would allow managers to respond to a wider variety of predation scenarios. MSRS recommends that consideration be given to the following strategies for future predator control seasons:

Raven and Coyote Predator Management

1. Camera Traps on Active and/or Decoy SNPL Nests

MSRS recommends setting camera traps on decoy SNPL nests within SNPL habitat early in the SNPL nesting season to identify potential raven and coyote predation early in the season. Currently, a limiting factor in predator control efforts is the inability of the SNPL monitors to effectively determine when ravens are beginning to activity forage the beach for SNPL nests. SNPL monitors rely on tracks and other signs to help attribute a predation event to a given species; however environmental factors (primarily wind) often obscure or completely eliminate these signs.

Setting up camera traps next to active and/or decoy SNPL nests would allow for rapid detection and accurate identification of the causes of predation. This will enable predator managers to respond rapidly to preempt future predation events. These trap sets would be located in areas of historic raven and coyote predation. MSRS suggests MIN, SAN, SNO and SSO Beaches as possible locations.

2. Purisima Colony Electric Fence

Even though the perimeter fence was recently redesigned to omit large patches of dune scrub vegetation from within the fenced extent, some dense patches still abut the outside edge of the fence. To further reduce rabbit and small mammal use near the fence, MSRS recommends establishing a 25 meter buffer of vegetation clearance along outside edge of the northern border.

3. Avicide

The use of an avicide such as DRC-1339 (3-chloro-p-toluidine hydrochloride; APHIS 2011) should be considered as a possible corvid management strategy in conjunction with current hunting and trapping techniques. The avicide has differential toxicity between animals and will target pest birds with minimal adverse effects to non-target species (such as coyotes and raccoons). Exceptions include owls and feline species which are categorized as sensitive to the avicide. However, these species target different prey and therefore will not encounter baited eggs intended for corvids. Furthermore, DRC-1339 degrades quickly and will not persist in the environment.

DRC-1339 can be used to target problematic ravens by injecting quail eggs with the toxin and using them to set out mimic SNPL nests in coastal habitat frequented by foraging ravens. Success in reducing annual raven populations have been achieved using tainted chicken eggs in territories of the sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) and the greater sage-grouse (*Centrocercus urophasianus*) in Nevada (Coates et al. 2007). The use of DRC-1339 as a predator control tactic was used to protect the resident Oregon population of SNPL. An estimated 127 common ravens were lethally removed in 2008 along the Oregon Coast from use of the toxicant (ICF 2010). Safety and practicality issues for the use of DRC-1339, including California and federal regulations, needs further research for the use on VAFB but the avicide offers a significant potential to target problem corvid predators. The use of avicide is not currently approved for predator management according to VAFB's United States Fish and Wildlife Service (USFWS) Depredation Permit and MSRS recommends an amendment to the permit to include this control measure. Amending the permit to include avicide will allow an additional option for predator control techniques to be considered in the future.

4. Controlled Taste Aversion

Non-lethal control methods should be explored such as the use of controlled taste aversion (CTA). Controlled taste aversion uses replicated SNPL nests baited with quail eggs that would taste unpleasant to predators. Predators would then be conditioned to not enjoy eating the eggs that are in SNPL and LETE breeding territory. Controlled taste aversion has been shown to achieve the most successful results when several parameters are met including: a) small predator size; b) predators occupy small, overlapping territory; c) minimal predator species diversity; and d) small treatment area. This approach is therefore considered unlikely to deter nest predators on Base 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). With such a large spatial range of both SNPL nesting area and potential predator territory, it is difficult to predict the

effectiveness of this strategy; however non-lethal options such as controlled taste aversion should be researched further.

5. Assessment of Anthropogenic Food Attractants

MSRS has documented a large number of raven observations at, or near, human structures and waste disposal sites foraging on litter and at garbage collection facilities (e.g. trash cans, dumpsters, trash can enclosures, outdoor lunch areas, etc.). Most of these observations have occurred on North Base surrounding the launch facilities, the buildings and dumpster on Titan Pasture and the VAFB landfill. Ravens are also commonly seen on and around the buildings associated with SLC-3 on South Base. Anthropogenic food waste and litter, if not appropriately disposed of, can act as a major attractant to corvid species. Diminishing the availability of food waste at these facilities within foraging range of the ravens that predate SNPL and LETE has the potential to decrease raven activity around sensitive breeding territory. Anthropogenic sources of food for foraging ravens likely entices ravens to extend territories, and once a food source becomes consistent, can sustain a resident raven population. MSRS recommends that VAFB perform an assessment of waste disposal practices in areas of heavy raven use to identify methods of reducing the potential for supplemental feeding of the local raven population. These may include: reminders to building operators to properly dispose of food waste, keep trash collection areas clean and close trash receptacles; more frequent waste pick-up services to some facilities; and new and/or additional trash bins being placed in areas where they are needed.

6. Hunting Blinds

The current raven control strategy relies first on surveying birds to identify raven nesting territories and movement patterns in the vicinity VAFB beaches. Once identified these ravens are actively hunted; however given the variability of terrain, it is not always possible to get close enough to a targeted bird without alarming it. In these cases, an alternative approach would be to place a hunting blind near a carcass within the nesting territory or flight path of ravens posing a threat to SNPL nesting. This method can potentially reduce the need for trapping, which is the final option for removing ravens, but only after nest predation has already occurred.

Predatory Raptor Management Recommendations

1. Continue intensive surveys of all avian predators throughout the LETE breeding cycle.
2. Continue trapping and translocation of all avian predators that demonstrate themselves as a threat to roosting, foraging, or breeding LETE or SNPL in the Purisima Point LETE colony.
3. Band all resident peregrine falcons with alphanumeric visual identification bands on VAFB to aid in management decisions as they relate to peregrine falcon, SNPL, and LETE.
4. Remove abandoned buildings in proximity to the Purisima Point LETE colony (i.e., SLC-1 east and associated blockhouses) that provide roost and nest sites for owls. Enclosures should be constructed if removing these buildings is not possible.

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5. Conduct a systematic, base-wide raptor population survey to determine occupancy of nesting owls, hawks, American kestrels, northern harriers, loggerhead shrikes, peregrine falcons, Cooper's hawks, and golden eagles. This study could provide baseline data that would help facilitate better decisions as it relates to avian predator management at the Purisima Point LETE colony. This base-wide breeding raptor survey could include the additional of small mammal population sampling and anthropogenic contaminant testing. Results of such a sampling effort could be used to facilitate better land-use decisions as they relate to avian predator management on VAFB.

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Appendix A- Trapping Captures and Hunting Events

| Date | Predator | Action | Location |
|-----------|--------------|----------------|----------------------------|
| 20-Mar-13 | Common Raven | Lethal Removal | Point Sal Rd. x Taft Rd. |
| 20-Mar-13 | Common Raven | Lethal Removal | Lion's Head vicinity |
| 3-May-13 | Common Raven | Lethal Removal | South Surf Beach vicinity |
| 6-May-13 | Common Raven | Lethal Removal | San Antonio Creek vicinity |
| 9-May-13 | Coyote | Released | Minuteman Beach |
| 16-May-13 | Common Raven | Lethal Removal | Minuteman Beach vicinity |
| 11-Jun-13 | Common Raven | Lethal Removal | South Surf Beach vicinity |

Appendix B - Predator (Coyote/Raven) Observation Log

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|--------------------------------------|---------------|---|----------|
| 3/15 | 12:28 | 12:38 | Intersection of Taft & Point. Sal Rd | 2 | 2 CORA S of Taft Rd Harassing RTHA. Flew NE over Pt. Sal Rd circled together, split: one N, one S. Lost sight of both over ridges. | TJM |
| 3/15 | 12:52 | 12:52 | Canyon N of Taft Rd | 1 | 1 CORA heard at Taft Rd. Call in distance from canyon to N. No visual. | TJM |
| 3/15 | 13:40 | 13:40 | Cliffs off LF-05 & LF-04 | 2 | 2 CORA on coast off LF-04. Seen peek up over cliffs. Flew back down lost visual, heading N towards LF-05. | TJM |
| 3/15 | 13:43 | 13:43 | Coast off LF-04 & LF-05 | 2 | 2 CORA at LF-04 moving N via coast towards LF-05. Likely same two from previous entry. | TJM |
| 3/15 | 13:50 | 13:58 | Canyon to ocean by LF-05 | 2 | 2 CORA N of LF-05 Flying from canyon to ocean and back. At 13:58 4 CORA flying/tumbling down canyon from NE of canyon. | TJM |
| 3/15 | 14:02 | 14:02 | Canyon off LF-04 | 4 | 4 CORA flying up and down canyon N of LF-04 broke off into 2 PR. | TJM |
| 3/15 | 14:06 | 14:06 | Canyon off LF-04 | 2 | 2 PR of CORA from previous entry separated at LF-04, 2 went SE (inland) 2 back into canyon N of LF-04. | TJM |
| 3/15 | 14:38 | 14:38 | Sea cliff off LF-09 | 2 | 2 CORA at LF-09 heading N. Lost sight when both CORA dipped down below sea cliff. | TJM |
| 3/15 | 14:44 | 14:44 | Ocean & LF-26 | 2 | 2 CORA at LF-26 on structures from ocean. One perched on tall tower. | TJM |
| 3/15 | 14:52 | 14:57 | Coastline near LF-26 | 2 | 2 CORA seen at LF-26. NOHA on coastline, 1 CORA flew to it. 2nd CORA followed. No harassing. Lost sight of both over ocean cliffs. 1 flew from coastline W of LF-26 to eucalyptus grove E of LF-26. Flew over my car, back to tower at LF-26. 2 CORA on tower platform. | TJM |
| 3/15 | 14:57 | 14:57 | LF-26 & LF-09 | 2 | 2 CORA moved from LF-26 to LF-09. | TJM |
| 3/15 | 15:02 | 15:02 | LF-09 to LF-06 & off to coast | 2 | 2 CORA flew from LF-09 to LF-06. Landed on tower. Flew to coastline off LF-06, back to tower. | TJM |
| 3/15 | 15:12 | 15:12 | LF-06 tower platform | 2 | 2 CORA potential mating on LF-06 tower platform. | TJM |
| 3/15 | 15:32 | 15:32 | Coastline to LF-06 | 2 | 2 CORA spending past 30 min flying from coastline to tower at LF-06. | TJM |
| 3/15 | 15:42 | 15:42 | Combar Rd near rusted cylinder | 7 | 7 CORA flying in group up Combar Rd near rusted cylinder lying on side. Flew from SE to canyon NW of Combar Rd. | TJM |
| 3/15 | 15:43 | 15:47 | Canyon NW of | 9 | 9 CORA (2 added to group of 7) over canyon N NW of | TJM |

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|------------------------------------|---------------|--|----------|
| | | | Combar Rd | | Combar Rd. Lost visual over NW ridge. | |
| 3/18 | 15:35 | 16:00 | End of Lion's Head | 4 | 2 PR of CORA. Kettling over S end of Lion's Head. Lost after 5 minutes to E. | HAF, MLB |
| 3/19 | 12:50 | 13:50 | Paved rd up canyon & S Lion's Head | 2 | 2 territorial CORA chasing 3rd CORA from N-S running rock cliff on E side of paved rd just up canyon and S of Lion's Head proper. Chased out of view N, NE of Lion's Head. Eventually pair came back to cliff area and went S out of view. | JNT |
| 3/19 | 14:05 | 14:10 | Oceanside SLC-1, SLC-2, SLC-10 | 3 | 4 CORA over SLC-1 E came from ocean side of SLC-2 and headed NE over N end of SLC-10 complex. Lost visuals. | JNT |
| 3/20 | 14:25 | 15:25 | San Antonio Sandsheets | 3 | 4 CORA fly N over San Antonio Sandsheets. Continue north over hill and past creek. Appear to be heading in direction of buildings on hill N of Shuman Creek. Lost sight fairly soon after they passed hill. | JKM |
| 3/20 | 15:25 | 16:25 | Bluffs E of Lion's Head | 2 | PR of CORA flying bluffs and ridgeline to E of N Lion's Head. Acting like residents. Took a long shot at one of birds and made solid contact. Bird lost to the north. Was not able to retrieve the carcass. | MLB |
| 3/20 | 16:35 | 17:00 | Taft Rd | 2 | PR of CORA perching together on Taft Road. Shot one of PR. Likely female. Male lost N. | MLB |
| 3/22 | 11:00 | 12:00 | Telephone poles at Surf Open Area | 2 | PR of CORA flying over S end of Surf Open Area; perched on telephone poles in back dune for ~ 2min; Then flew S along back dune landing on highest bluff. One stayed put, one soared around in that vicinity. | MLB |
| 3/26 | 7:34 | 8:34 | San Antonio Sandsheet | 1 | 1 CORA flies SE over San Antonio Main Sandsheet. Lost behind dune. | JKM |
| 3/26 | 12:07 | 13:07 | LETE Colony | 2 | 2 CORA fly W over Colony. | JKM |
| 3/27 | 13:40 | 14:40 | S end of Surf trail | 1 | 1 CORA flies S along bluffs over Surf S end trail. Brief sighting. Lose sight of it beyond rocky point to S. | JKM |
| 3/27 | 17:05 | 17:15 | Titan Pasture & Reagan Memorial | 1 | 1 CORA at Titan pasture on water tank. Flew to secure facility and sat for 10 min then flew rapidly to Reagan Memorial overlook and lost towards Shuman. | MLB, TJM |
| 3/28 | 9:55 | 10:55 | Dunes & San Antonio W rd 2&3 | 1 | 1 CORA on San Antonio W of roads 2 and 3. Foraging and hopping on foredunes. Lost visual as it headed N. Flew in from the S, likely over SLC-10 or the Colony. | JKM |
| 3/28 | 15:50 | 15:55 | Shuman Creek & mesa above Globe Rd | 1 | 1 CORA flying along Shuman Creek from E to W along toe of the North Slope. Lost on mesa top above Globe Road. | HAF, MLB |
| 4/1 | 8:54 | 9:56 | Shuman Creek Dunes | 2 | 2 CORA in Shuman Creek N flying S, midway between foredune and back dune ridge for ~ 30seconds, then turned ESE moved higher and flew out of view over E ridge. | LAH |
| 4/2 | 14:00 | 15:00 | Beach Layia | 1 | CORA W of Beach Layia fence on S Base heading S along coast. | MPW |
| 4/2 | 14:20 | 15:20 | Destroyer Rock | 2 | 2 CORA seen at Destroyer Rock, flew N over quarry ridge and out of sight. | HAF |
| 4/3 | 11:22 | 11:23 | S Shuman | 2 | Heard first at S Shuman, then saw 1 CORA flying N over foredune when 2nd CORA came from E, interacted in flight momentarily, then flew E while other CORA continued N. | LAH |
| 4/3 | 12:13 | 12:16 | S Shuman & San Antonio Creek | 2 | PR CORA flying at S Shuman, circling back dune over veg patch approximately 1 mile N of San Antonio Creek. | LAH |
| 4/4 | 9:02 | 9:05 | LETE Colony | 1 | 1 CORA seen flying over Colony. Seen heading N, circled parking lot at ~ dist. of 400m, lost to S over Colony. | MPW |
| 4/4 | 12:42 | 13:42 | N Rocky Point | 2 | 2 CORA seen flying around N Rocky Pt. One of PR has leucistic 2nd or 3rd primary tips and spot on tail coverts. | HAF |

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|---|---------------|--|----------|
| 4/5 | 7:37 | 7:38 | Minuteman | 2 | PR CORA heading S, flying low, weaving in/out fordune and beach at Minuteman. | LAH |
| 4/5 | 10:45 | 10:55 | Bear Creek Rd & SLC-3 | 1 | 1 CORA flying along Bear Creek Rd E to W. Lost over SLC-3 heading into Bear Creek drainage W bound. | MLB |
| 4/5 | 13:05 | 13:15 | N Rocky Point & Arguello | 1 | 1 CORA at N Rocky Pt for 10mins. As I approached bird flew up coast a lost at Arguello. | MLB |
| 4/8 | 7:16 | 8:16 | Bear Creek Rd & SLC-3 | 1 | CORA feeding on roadkill on Bear Creek Rd just W of SLC-3. | MLB |
| 4/9 | 12:34 | 12:40 | Casmalia Rd to Casmalia parking lot | 2 | 2 CORA feeding on trash in middle of road near Casmalia Rd. Startled by traffic, flew towards Casmalia beach parking lot, lost behind trees. | MPW |
| 4/10 | 10:20 | 10:39 | LF-21 to Bryce | 2 | 2 CORA in LF-21 parking lot, flew W then N along hills. Circled high about 300m N of Pt Sal Rd. Lost in Bryce area to N. | MPW |
| 4/10 | 15:50 | 16:50 | Parking lot near SCL-6 | 1 | CORA circling parking lot area W of SCL-6. | JKM, LAH |
| 4/11 | 9:30 | 9:45 | Intersection of Grant Rd & Point Sal Rd | 2 | 2 Cora on roadkill near intersection of Grant Rd and Pt. Sal Rd. Birds lost up Canyon to the north. Seen foraging around launch facilities. | HAF, MLB |
| 4/11 | 12:55 | 13:55 | Beach Layia & Railroad | 1 | CORA W of Beach Layia fence flying N over RR. | MLB |
| 4/11 | 13:38 | 13:38 | S Surf & beach | 1 | CORA W of South Surf parking spot, flying N over beach. | MLB |
| 4/11 | 14:49 | 14:49 | San Antonio Creek & near beach | 1 | CORA at San Antonio flying N over beach, turns E at creek out of view. | JKM, LAH |
| 4/11 | 14:51 | 14:52 | San Antonio Creek & "Boonies" | 1 | 2nd CORA flew in from S over "San Antonio boonies", 2 minutes after previous individual, heading N toward creek area. | JKM, LAH |
| 4/12 | 9:10 | 9:35 | Grant & Point Sal Rd | 2 | 2 CORA on roadkill ground squirrel near intersection of Grant Rd and Pt. Sal Rd, long shot taken but missed. | MLB |
| 4/12 | 10:20 | 10:25 | Surf Open Area to Surf Station | 2 | 2 CORA foraging on carcass in Surf Open Area, just S of trail. Briefly perched on posts at Surf Station then flew N towards Cypress trees and power station. Tracks measured 115-120mm. | MLB |
| 4/12 | 11:35 | 11:40 | Inland from Surf Open Area & adjacent buildings | 1 | 1 CORA flying ~400m inland from Surf Open Area going NE to SW. Lost behind two large buildings. | MLB |
| 4/15 | 10:35 | 10:45 | Intersection of Taft & Point Sal Rd | 4 | 4 CORA on a roadkill squirrel along Pt. Sal Rd and Taft. | MLB |
| 4/15 | 11:00 | 12:00 | Mountain ridge N of Shuman Creek | 2 | PR of CORA slopes along the mid-mountain ridge crest on N side of Shuman Creek N of Lone Monterey Pine. Seen for 10mins then lost to E. | MLB |
| 4/15 | 11:15 | 11:15 | Hills N of Point Sal Rd | 2 | 2 CORA flying along hilltops N of Pt. Sal Rd. | MLB |
| 4/15 | 12:12 | 12:12 | Top of Globe Rd | 1 | 1 CORA circling by top of Globe Rd. | MLB |
| 4/16 | 9:20 | 9:30 | Coast Rd & N ₂ station | 1 | 1 CORA seen a Coast Rd between liquid N ₂ plant and substation to the S. | MPW |
| 4/16 | 11:35 | 11:35 | Intersection of Terra Rd & 13th St | 1 | 1 CORA seen flying W along intersection of Terra Rd and 13th St. | MPW |
| 4/16 | 12:40 | 12:45 | Intersection of Coast & Kelp Rd | 3 | 3 CORA feeding on roadkill by Coast Rd and Kelp Rd. Startled by traffic, circled for about 3 minutes. I fired, hitting one but did not kill. Wounded CORA dropped below cliffs to the W, lost to view. Others scattered to NE and E. | MPW |
| 4/16 | 15:30 | 15:40 | N Rocky Point & Point Arguello | 1 | 1 CORA observed flying from S to N along the coast at N Rocky point. Bird lost in vicinity of Pt. Arguello. | HAF, MLB |

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|--|---------------|--|----------|
| 4/17 | 10:27 | 11:17 | N Rocky Point | 1 | CORA flies in from S and lands on N. Rocky Pt. Still present, circling point at 11:22. Dead CASL E of Pt. | JLH |
| 4/17 | 13:50 | 13:53 | Colony to SLC-10 | 2 | PR of CORA just S of the Colony flying low over beach, scanning ground, heading N up to SLC-10 sandsheet area, then out of view. | LAH |
| 4/18 | 8:41 | 8:41 | Minuteman | 2 | 2 CORA near Minuteman. | MPW |
| 4/18 | 13:04 | 14:04 | S Surf Parking | 2 | 2 CORA at S. Surf parking area, flew N. | HAF, TJM |
| 4/18 | 16:02 | 5:02 | S Surf Parking | 3 | 3 CORA just N of S. Surf parking area, all 3 spent about 5min in area before flying S. | HAF, TJM |
| 4/22 | 14:38 | 14:40 | Intersection of Cross & Tangair Rd | 1 | 1 CORA flying ESE by Cross Rd and Tangair Rd harassed by unidentified LBB. | MPW |
| 4/23 | 9:24 | 9:24 | Intersection of 13th St & Cross Rd | 1 | 1 CORA flew S over 13th by Cross Rd. | MPW |
| 4/23 | 9:55 | 9:56 | Destroyer Rock cliffs | 2 | 2 CORA circling cliffs by Destroyer Rock. Dropped below cliffs. | MPW |
| 4/23 | 13:00 | 13:01 | Bear Creek Rd & Coast Rd | 1 | 1 CORA by Bear Creek Rd and Coast Rd. Perched on barrier, flew N then W disappeared below cliffs. | MPW |
| 4/24 | 10:00 | 13:40 | Taft & Globe to adjacent canyon | 2 | PR of CORA between Taft Rd and Globe Rd on carcass. Lost to NE up canyon. | MLB |
| 4/25 | 13:55 | 13:55 | Intersection of Taft & Globe Rd | 1 | 1 CORA flying from Taft to Globe Rd. | MPW |
| 4/25 | 14:27 | 14:27 | Canyon between Taft & Globe Rd | 1 | 1 CORA flying up canyon between Globe and Taft Rd harassed by blackbird. | MPW |
| 4/26 | 11:14 | 11:15 | Hills by Taft Rd & Bryce Canyon | 2 | 2 CORA flew W from Bryce Canyon closest to Taft Rd. Banked low over hills as they approached, one called then lost over hills to NE. | MPW |
| 4/26 | 11:23 | 11:23 | Near Taft Rd | 1 | 1 CORA heard calling from nearby Taft Rd | MPW |
| 4/26 | 11:58 | 11:58 | Bryce Canyon Bridge | 1 | 1 CORA heard calling N of wire bridge in Bryce Canyon. | MPW |
| 4/29 | 12:00 | 12:00 | Arguello & Bear Creek Rd | 1 | 1 CORA flying N by Arguello and Bear Creek Rd | MPW |
| 4/30 | 13:44 | 13:59 | Canyons between Taft & Globe Rd | 2 | 2 CORA circling wide area over canyons between Taft and Globe. Came down very close to me, calling whole time. Made several passes into mustard after blackbird nests, were chased off. 1:49 were pursued and attacked by hawk. Disappeared to the SE. | MPW |
| 5/2 | 8:35 | 8:35 | Railroad overpass on Tangair Rd | 2 | 2 CORA perched on overpass over RR on Tangair. Took off and flew NW. | MPW |
| 5/2 | 8:53 | 8:54 | N Blackbird Flats | 2 | 2 CORA at Shuman N Blackbird Flats foredune fly in from S low, circle twice, proceed NE. | JKM |
| 5/2 | 10:36 | 10:36 | Intersection of Bear Creek Rd & Arguello | 1 | 1 CORA flying WNW over Bear Creek Rd by intersection with Arguello. | LAH |
| 5/3 | 7:45 | 8:45 | San Antonio Main Sandsheet | N/A | Extensive CORA tracks on top and E end of San Antonio Main Sandsheet. | JKM |
| 5/3 | 12:25 | 12:25 | Kelp & Coast Rd | 1 | Shot and killed 1 CORA on Coast Rd just S of Kelp. | JKM |
| 5/6 | 7:25 | 7:30 | San Antonio Trestle & adjacent canyon | 1 | 1 CORA eating snails on dirt rd E of San Antonio Trestle near open gate. Perched on fencing. Flew E towards old launch facility. Lost from sight in canyon to E. However, could hear it vocalizing while I was parked at the Trestle. | JKM |
| 5/6 | 9:07 | 9:07 | San Antonio Trestle | 2 | Shot and killed 1 raven E of San Antonio Trestle. 2nd CORA escaped, clipped its tail. | MPW |
| 5/7 | 15:05 | 15:09 | Mustard fields/ canyons & Taft Rd | 1 | 1 CORA flying SW over canyons toward Taft, calling. Cirled over mustard fields, swooping low. | MPW |

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|--------------------------------------|---------------|---|----------|
| 5/7 | 15:09 | 15:09 | Mustard fields/ canyons & Taft Rd | 1 | 1 CORA joined 1st, circled mustard field together harassed by blackbirds. | MPW |
| 5/9 | 12:08 | 12:08 | Taft Rd & adjacent hilltops | 2 | 2 CORA flying SE toward Taft. Circled low towards me, calling, then flew SE lost over hilltops. | MPW |
| 5/9 | 13:13 | 13:16 | Taft Rd & adjacent foothills | 2 | 2 CORA circling low E of canyons, approached, then flew N and continued NW along base of foothills. | MPW |
| 5/10 | 15:00 | 15:16 | Taft & Point Sal Rd | 2 | 2 CORA flew SE from mountains to top of Taft Rd Spent 8 minutes circling/hovering in high wind, then flew S to Pt. Sal Rd. Approached me when I left car, then circled away and flew NW over hills. | MPW |
| 5/13 | 11:15 | 11:15 | Building 330 | 1 | 1 CORA flying S over Bldg 330 lost in fog. | MPW |
| 5/13 | 11:44 | 11:44 | N of Arguello Point | 1 | 1 CORA flying N along coast to Arguello Pt. | MPW |
| 5/13 | 12:20 | 12:22 | N of Arguello Point | 1 | 1 CORA circling Arguello Pt. approached car then flew N along coast. | MPW |
| 5/13 | 14:13 | 14:15 | Arguello Point | 1 | 1 CORA circling Arguello Pt. Then flew N. | MPW |
| 5/14 | 11:31 | 11:31 | Arguello Point | 1 | 1 CORA flying N over Arguello Pt. | MPW |
| 5/14 | 11:49 | 11:49 | Arguello Point | 1 | 1 CORA flying S over Arguello Pt. | MPW |
| 5/14 | 13:01 | 13:01 | Arguello Point | 1 | 1 CORA flying S over Arguello Pt. | MPW |
| 5/14 | 13:31 | 13:38 | Arguello Point | 1 | 1 CORA at Arguello Pt. flew from N, circled buildings, and perched in trees. Hopped between perches harassed by LBBs. | MPW |
| 5/15 | 8:56 | 8:56 | Taft Rd & adjacent S hills | 2 | 2 CORA NW of Taft, flew S over hill. | MPW |
| 5/15 | 9:40 | 9:40 | Combar Rd/ Bryce Canyon | 2 | 2 CORA flying N over Combar Rd/ Bryce Canyon, circled area then flew NE behind hills. | MPW |
| 5/15 | 12:30 | 12:35 | Globe & Taft Rd | 2 | 2 CORA flying downhill over Taft hovering in wind. Turned and flew NW towards Globe, then turned around and flew uphill and disappeared to N. | MPW |
| 5/16 | 9:56 | 10:00 | Globe & Taft Rd | 2 | 2 CORA circling N canyons between Taft and Globe. | MPW |
| 5/16 | 10:15 | 10:15 | Globe & Taft Rd | 1 | 1 CORA approached from N, shot and killed on top of hill. | MPW |
| 5/16 | 10:30 | 10:35 | Globe & Taft Rd | 1 | 2nd CORA circled toward body of mate. Shot at but only clipped. Flew away to NE. Continued to call but stayed behind hills. | MPW |
| 5/16 | 12:44 | 12:46 | Point Sal & Minuteman | 1 | 1 CORA flying N about 200m E of Pt. Sal. Lost around Minuteman. | MPW |
| 5/22 | 10:33 | 11:33 | Honda Canyon & Coast Rd | 1 | 1 CORA flying N past Coast & Honda Cyn. | MPW |
| 5/22 | 10:46 | 11:46 | Honda Canyon & Coast Rd | 2 | 2 CORA flying N past Coast & Honda Cyn. | MPW |
| 5/22 | 10:58 | 11:58 | Honda Canyon & Coast Rd | 1 | 1 CORA flying S past Coast & Honda Cyn. | MPW |
| 5/22 | 15:25 | 15:28 | Bear Creek Rd | 1 | 1 CORA flying NNW alongside Bear Creek Rd. Approached car then flew N away from road. | MPW |
| 5/23 | 11:04 | 11:06 | S Destroyer Rock & adjacent hills | 2 | 2 CORA flying SSE along rd just S of Destroyer Rock. Lost over hills to E. | MPW |
| 5/24 | 10:46 | 10:46 | Building 330 | 1 | 1 CORA flying ESE over Bldg 330. | MPW |
| 5/24 | 11:32 | 11:32 | Arguello Point | 1 | 1 CORA flying N by Arguello Pt. | MPW |
| 5/28 | 15:29 | 16:29 | Coast Rd at Bldg 542 | 1 | 1 CORA flying south down Coast Rd at Bldg 542 w/ nesting material. | MPW |
| 5/29 | 12:13 | 12:13 | Cliffs at Arguello Point | 1 | 1 CORA flying N just South of Arguello pt along cliffs, flew lower and lost behind cliffs. | MPW |

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|------|------------|----------|----------------------------|---------------|--|----------|
| 5/29 | 12:19 | 12:21 | Cliffs at Arguello Point | 1 | 1 CORA circling over cliffs S of Arguello Pt. Flew below cliffs, emerged occasionally. | MPW |
| 5/29 | 12:27 | 12:27 | Arguello Point | 1 | 1 CORA flying N at Arguello Pt about 20m S of RR. Lost behind hills. | MPW |
| 5/29 | 13:12 | 13:15 | Cliffs at Arguello Point | 1 | 1 CORA circling above cliffs S of Arguello Pt. Flew below cliffs. | MPW |
| 6/3 | 11:28 | 11:30 | Cliffs at Arguello Point | 2 | 2 CORA flying NE from coast about 1km S. Arguello Pt. Cirled W of rd, then flew along RR about 400m. Then flew W disappeared below cliffs. | MPW |
| 6/3 | 13:36 | 13:39 | Arguello Point | 2 | 2 CORA flying N along coastline S of Arguello Pt. Disappeared below hills. | MPW |
| 6/3 | 12:20 | 12:24 | Coast Rd & Destroyer Rd | 1 | 1 CORA flying S along Coast Rd just S of Destroyer Rock. Turned SW and disappeared behind hills. I followed and relocated it just as it was disappearing S behind cliffs along RR. | MPW |
| 6/3 | 11:50 | 11:51 | Cliffs at Arguello Point | 2 | 2 CORA flying N along RR S of Arguello Pt. Saw me and crossed over RR and disappeared over cliffs to the NE. | MPW |
| 6/5 | 12:57 | 12:57 | Arguello Point | 1 | 1 CORA flying S by Arguello Pt. | MPW |
| 6/5 | 13:36 | 13:37 | Railroad at Arguello Point | 1 | 1 CORA flying S along RR S of Arguello Pt. | MPW |
| 6/6 | 9:45 | 9:45 | Arguello Point | 1 | 1 CORA flying S, S of Arguello Pt. | MPW |
| 6/11 | 10:20 | 10:50 | Destroyer Rock | 4 | 4 CORA circling below cliffs just S of Destroyer Rock. | MPW |
| 6/11 | 10:27 | 10:27 | Cliffs at Destroyer Rock | 1 | 1 CORA shot and killed on edge of cliff S of Destroyer Rock. Other 3 flew S. | MPW |
| 6/11 | 10:55 | 12:05 | Cliffs at Arguello Point | 3 | 3 CORA flying between perches on cliff S of Arguello Pt. Agitated by my presence, would not let me approach. Eggshells along cliff edge, broken inward | MPW |
| 6/11 | 12:18 | 12:18 | Coast & Kelp Rd | 1 | 1 CORA flew N along Coast Rd with food in beak, circled around parking lot by Kelp then flew S below cliff. | MPW |
| 6/14 | 9:53 | 9:53 | Arguello Point | 2 | 2 CORA flying N at Arguello Pt. 1 Cirled back and flew S, other continued N. | MPW |
| 6/14 | 13:03 | 13:08 | Coast Rd & Rocky Point | 2 | 2 CORA flying SW from Coast Rd to cliffs by Rocky Pt. Turned and flew S near cliffs. | MPW |
| 6/14 | 14:46 | 14:58 | Rocky Point | 3 | 3 CORA circling around S Rocky Pt. Cirled farther N, close to RR, then flew below cliffs. | MPW |
| 6/14 | 15:03 | 15:10 | Coast Rd & Rocky Point | 2 | 2 CORA circling over Coast Rd by turnoff to Rocky Pt. Flew NW to RR, then followed it N. | MPW |

Appendix C – Predatory Raptor Observation Log

| Date | Time Start | Time End | Location | # Individuals | Observation/ Location | Observer |
|--------|------------|----------|---|---------------|---|----------|
| 15-Mar | 12:28 | 12:38 | Intersection of Taft & Pt. Sal Rd | 2 | 2 CORA S of Taft Rd Harassing RTHA. Flew NE over Pt. Sal Rd circled together, split: one N, one S. Lost sight of both over ridges. | TJM |
| 15-Mar | 14:52 | 14:57 | Coastline near LF-26 | 2 | 2 CORA seen at LF-26. NOHA on coastline, 1 CORA flew to it. 2nd CORA followed. No harassing. Lost sight of both over ocean cliffs. 1 flew from coastline W of LF-26 to eucalyptus grove E of LF-26. Flew over my car, back to tower at LF-26. 2 CORA on tower platform. | TJM |
| 26-Mar | 12:10 | 13:10 | LETE Colony | 1 | AMKE Male hunts in the veg W of the Colony. | JKM |
| 29-Mar | 11:47 | 12:00 | Bluff N of San Antonio Creek | 1 | Juv GOEA (white upper tail feathers and white wing patches) perched on bluff N of San Antonio creek, E of sandspit. Mobbed by RTHA, chased N OOV. 1 min observation. | LAH |
| 10-Apr | 11:30 | 12:30 | Dunes N of Shuman Creek | 1 | 1 PEFA, adult, N of Shuman creek, flying low/hunting over foredune. Continued N, then dived to ground flushing shorebird flock, then out of view. Barring on breast came up very high, had full helmet, feet visible, no bands. | JKM, LAH |
| 17-Apr | 10:20 | 10:25 | SLC-2 & SLC-10 | 1 | 1 PEFA chasing RODO at the SLC-2 coffin. Lost to the NW of SLC-10. | JKM |
| 17-Apr | 10:22 | 10:24 | San Antonio Midway | 1 | 1 PEFA flying low over beach at "San Antonio midway" between SLC-10 sandsheet and creek, heading N. No plumage/banding details identified. | JKM |
| 17-Apr | 11:26 | 11:27 | Canon Sandsheet at San Antonio & Beach | 1 | 1 PEFA flew in from SE over Canon Sandsheet in San Antonio heading SW, turned S over beach, then out of view. Distance too great for plumage details. | JLH |
| 2-May | 10:34 | 10:35 | Dunes & S Shuman | 1 | 1 PEFA w/prey Shuman S, flying S over foredune, straight path until OOV. | LAH |
| 4-Apr | 8:45 | 8:46 | San Antonio Beach, PRBO transect block "NICEPERCH" | 1 | 1 Juv M PEFA or F MERL. Small for PEFA, lg for MERL. Perched on log in Nice Perch. Flies S over ocean. No prey remains or pellets at perch. | LAH |
| 16-Apr | 8:40 | 8:42 | Wall Beach | 1 | PEFA flew North over PRBO transect block "WALLBORDER" | JKM |
| 17-Apr | 11:29 | | Shuman Beach South, PRBO transect block "MOLE" | 1 | PEFA flew North over foredunes | JKM |
| 25-Apr | 11:50 | 11:51 | Shuman Beach South, PRBO transect block "BOTTLELOG" | 1 | PEFA flew South along foredunes. Dipped down at TriLog | JKM |

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| 25-Apr | 12:01 | 12:02 | San Antonio, PRBO transect block "SHSEND" | 1 | PEFA perched on log at SHSEnd, preening. Took off W over ocean, then headed North, looks heavy, possibly female. Appears to be carrying prey. Small shorebird flock was flushed from area when flew in. | JKM |
| 26-Apr | 12:06 | 12:07 | San Antonio, PRBO transect block "NARROWS" | 1 | PEFA flew North, no bands seen. | JKM |
| 26-Jun | 13:00 | 13:01 | San Antonio, PRBO transect block "ARROWHEAD" | 1 | PEFA flew North over sandspit chasing a SNPL to the NE, SNPL turned S and PEFA continued N out of view. | LAH |
| 10-Jul | 10:08 | 10:09 | Wall Beach, PRBO transect block "CIGAR" | 1 | PEFA unsuccessfully hunts ducks in lagoon. Flies North | JKM |
| 10-Jul | 10:40 | 10:41 | Wall Beach, PRBO transect block "SPLITLOG" | 1 | PEFA flew North, unknown where perched. | JKM |
| 11-Jul | 7:51 | 7:52 | Minuteman Beach, PRBO transect block "CHEST" | 1 | PEFA flew North low over foredune, heavy barring on chest, poss juv but unsure, did not get good look. | LAH |
| 9-Jul | 12:52 | 12:53 | Shuman Beach South, PRBO transect block "MINIDUMP" | 1 | PEFA flew East; brood w/ 1ch seen in area | JKM |
| 9-Jul | 13:45 | 13:46 | Shuman Beach South, PRBO transect block "OJ" | 1 | PEFA kill site; juvenile gull | JKM |
| 4-Jul | 12:55 | 12:56 | Purisima North Beach, PRBO transect block "POCKET2" | 1 | PEFA kill site at mid-Pocket 2. WHIM. Fresh, late yesterday or this morning. Photos. | JKM |
| 5-Jul | 12:00 | 13:30 | Surf Beach North, PRBO transect block "TIKI" | 2 | 2 PEFA hunt Santa Ynez lagoon. Adult has dark band on left leg. Juv consumes prey on sandspit. Several hunting attempts made, mstly ducks. Move between sandspit and wood at S end of Wall. | JKM |
| 2-May | 10:34 | 10:35 | Shuman Beach South PRBO transect block "SHSSTART" | 1 | PEFA flying low over FD w/prey heading S | LAH |
| 9-May | 8:31 | 8:32 | Wall Beach, PRBO transect block "TP" | 1 | PEFA flew in from SE, swooped down at 2 SAND, missed. Turned back SE continued flying towards estuary out of view. | LAH |
| 8-May | 11:46 | 11:47 | San Antonio Beach, PRBO transect block "ELEPHGRAVE" | 1 | PEFA hunting veg in boonies, then heads N over Main sandsheet. | JKM |

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| 10-Jun | 12:24 | 13:24 | San Antonio Beach, PRBO transect block "ARROWHEAD" | 1 | PEFA perched on tall brach in arrowhead, flies S to L13buoy, lands on flat rock on sand, preening and scanning the surrounding area. I did not continue survey of sandspit due to its presence. | LAH |
| 10-Jun | 11:57 | 11:58 | Shuman Beach South, PRBO transect block "MOLE" | 1 | Classic PEFA kill site yet no tracks obs around immediate vicinity, collected feathers and took photos. | LAH |
| 13-Jun | 9:41 | 9:42 | Shuman Beach North, PRBO transect block "CLUB" | 1 | PEFA flew N over Front. Massive, huge feet, likely F. Did not see bands. Meandering. Slow, searching flight. | JKM |
| 14-Jun | 12:20 | 12:21 | San Antonio Beach, PRBO transect block "PICKUPSTIX" | 1 | PEFA flew N carrying prey. Over Front. | JKM |
| 25-Jun | 11:50 | 11:51 | San Antonio Beach, PRBO transect block "SHORTTRIBS" | 1 | PEFA in shallow area by veg hummock found clipped wings, foot and feathers of SNPL, with coyote tracks and TUVU tracks in area. Likely PEFA kill site with scavengers after tracking. Remains not fresh, appeared to be approximately 2-3 days old. | LAH |
| 25-Jun | 13:00 | 13:01 | San Antonio Beach, PRBO transect block "NICEPERCH" | 1 | PEFA flew North | JKM |
| 24-Jun | 9:00 | 9:01 | Shuman Beach South | 1 | PEFA flew directly south to San Antonio | RBB |
| 23-Jul | 9:25 | | San Antonio Beach, PRBO transect block "NARROWS" | 1 | PEFA near SAN084. Tracks measure 90-105mm. Photos. Prey is SNPL or other small shorebird. Prior to rain 7/22. | JKM |
| 25-Mar | 11:40 | 11:41 | Shuman Beach South, PRBO transect block "BOINGI" | 1 | PEFA flew North over SHALLOW | RBB |
| 13-May | 10:30 | 10:31 | Shuman Beach North, PRBO transect block "HOOF" | 1 | PEFA flew North over beach turns east out of view | LAH |
| 13-Aug | 12:24 | 12:25 | Surf Beach North, PRBO transect block "FORK" | 1 | PEFA hunting FORK/Pile and sandspit, then headed North flushing everything. | JKM |
| 2-Sep | 9:30 | 9:31 | Wall Beach, PRBO transect block "KNOT" | 1 | PEFA kill site | RBB |

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| 12-Sep | 9:20 | 9:21 | Wall Beach, PRBO transect block "LEG" | 1 | PEFA kill site; juv gull, clipped wings, plucked feathers. Photo. Coyote tracks present. Another site seen at Splitlog could be same gull, just 2 sites plucked. | JKM |
| 12-Sep | 9:43 | 9:44 | Wall Beach, PRBO transect block "SPLITLOG" | 1 | PEFA kill site; juv gull, Plucked feathers only. Photo. Coyote tracks present. Another site seen at Leg could be same gull, just 2 sites plucked. | JKM |
| 12-Sep | 9:16 | 9:46 | Wall Beach, PRBO transect block "MEDUSA" | 1 | PEFA perched on log. First viewed from Beachfuzz. Remained perched after I passed it. Several photos. Definite juv. Streaked chest, brown back, grey cere and eye ring, buffy tail tip. Head looks dark from front, but brown from back. | JKM |
| 23-Oct | 11:45 | 11:47 | Wall Beach, PRBO transect block "TIP" | 1 | PEFA observed perched on wood debris then flushed due to my presence, flew south and stooped a western grebe who had been beached at washed zone, continued south out of site | RBB |
| 23-Oct | 9:40 | 9:41 | San Antonio Beach, PRBO transect block "NARROWS" | 1 | Kill site; SNPL feathers, legs, and bill collected. Unbanded bird. Fresh kill site with gut pile obs. Typical pefa kill site in appearance. | LAH |
| 23-Oct | 10:42 | 10:43 | San Antonio Beach, PRBO transect block "POCKET1" | 1 | PEFA kill site; larger shorebird or gull, only contour feathers left in pile just under shallow log perch. No tracks to confirm but neat pile, typical pefa kill site. Coyote tracks pass alongside, likely picked up larger bird pieces. | LAH |
| 23-Oct | 9:18 | 9:19 | San Antonio Beach, PRBO transect block "GROSS" | 1 | Typical PEFA kill site | LAH |
| 23-Oct | 10:55 | 11:56 | Shuman Beach South PRBO transect block "BOTTLELOG" | 1 | PEFA kill site; banded SNPL NW:AG LL. Legs and feather collected. Near flock of 25. Photos. Very fresh, happened this morning. Gut pile present. | JKM |
| 23-Oct | 11:28 | 11:29 | San Antonio Beach, PRBO transect block "SHSEND" | 1 | Collected PEFA pellet at perch in SHSend. | JKM |