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Raptor Breeding Season Report for Pinnacles National Monument – 2007

Natural Resource Technical Report NPS/SFAN/NRTR—2008/087



ON THE COVER

Fledgling Prairie Falcon, D. Soto Canyon.

Photograph by: Gavin Emmons, San Francisco Bay Area Network Inventory and Monitoring Program.

Raptor Breeding Season Report for Pinnacles National Monument - 2007

Natural Resource Technical Report NPS/SFAN/NRTR—2008/087

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	Report Checklist
X	Cover page lists all authors and addresses.
X	Document has been reviewed for content, spelling and grammar.
X	Abstract and keywords are provided on page 9 of final report.
X	Body of document includes introduction, description of study area, methods, results, and discussion.
X	Conclusion Section includes Public Interest Highlights.
X	Conclusion Section includes Management Recommendations.
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X	Tables, figures, maps, and illustrations have descriptive titles and are sequentially numbered.
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Abstract

Pinnacles National Monument (PINN) provides a diverse habitat for numerous cliff-nesting raptors, including prairie falcons (*Falco mexicanus*), peregrine falcons (*F. peregrinus*) and golden eagles (*Aquila chrysaetos*), as well as a spectacular array of summits and cliff-wall routes for rock-climbers. This monitoring effort was established to determine long-term population trends of nesting prairie falcons and other raptors. The effort grew out of a need to reduce potential disturbance that climbers and off-trail hikers may have on cliff-nesting raptors. This report summarizes the results from the 2007 breeding season and represents the 21st year of monitoring at the monument. Field observations began 7 January 2007 and ended 25 July 2007.

The 2007 raptor-breeding season was successful for prairie falcons. Fourteen territorial falcon pairs were documented this year with 12 pairs actively nesting. Thirty-five prairie falcons hatched, with 33 possible fledglings confirmed. Three nests failed (two likely due to predation or environmental exposure and one to eggs failing to hatch), one pair occupied a territory without nesting for the season, and one pair abandoned a territory after occupying the area through the first half of the season.

A peregrine falcon pair successfully nested and fledged three young in the Hawkins territory, marking the third consecutive year that a successful peregrine falcon nesting effort has been documented at PINN in the last 49 years.

Golden eagles were observed throughout the monument. Five nests in three known territories in the monument were not occupied this year. One known nest on the west side of North Chalone Peak produced one nestling, and a documented nest in the Eucalyptus Grove territory outside of the monument produced two eaglets. Fledging from the Eucalyptus Grove nest was confirmed for one young but likely for both. Fledging at the North Chalone nest was likely but unconfirmed.

The 2007 breeding season was also successful for additional raptor species nesting in the monument, with 45 nests representing 12 raptor species. This is the second highest number of nests and species documented in a single season after the record numbers in the 2006 season. Nests for California species of concern were recorded this season for long-eared owls (*Asio otus*), Cooper's hawks (*Accipiter cooperii*), sharp-shinned hawks (*A. striatus*), and white-tailed kites (*Elanus leucurus*). However, nesting pairs, successful nests, and fecundity rates for these species were all lower than numbers documented in 2006. One active nest for turkey vultures (*Cathartes aura*) was documented in 2007, and represented the third confirmed in the monument in 23 years. One long-eared owl nest produced three hatchlings, with two fledglings confirmed and a third likely. One white-tailed kite nest failed to produce hatchlings or fledglings, likely due to predation or abandonment. Other nesting raptor species documented in the monument included red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*B. lineatus*), American kestrels (*Falco sparverius*), and great-horned owls (*Bubo virginianus*).

2007 also marked the fourth year that captive-bred California condors (*Gymnogyps californianus*) were active and free-flying at PINN, with up to 19 condors active from Grassy Canyon to the High Peaks, and moving between PINN and Big Sur on the coast throughout the season. 2007 also marked the first deaths of PINN condors, with #307 and #417 dying due to causes not related to lead poisoning. Condors were aggressively stooped by territorial raptors including peregrine and prairie falcons on numerous occasions. Condors were also observed displacing golden eagles, turkey vultures, and corvids from the Grassy Canyon condor feeding sites.

Key Words: raptor ecology, resource management, wildlife conservation, raptor breeding phenology, behavioral ecology, human-raptor interactions, climbing management

Introduction

Pinnacles National Monument (PINN) is a National Park Service unit located in the Gabilan Mountains of Central California, and provides a diverse habitat for cliff-nesting raptor species, including sensitive species such as prairie falcons (*Falco mexicanus*), peregrine falcons (*F. peregrinus*), and golden eagles (*Aquila chrysaetos*). The dramatic landscapes, extensive trails, arrays of summits, and cliff-wall routes at PINN are also used intensively for recreation by rock-climbers and hikers.

Many scientific studies have documented the negative impacts of human disturbance of raptor nest and roost sites, and the resulting nest failures and territorial abandonment associated with these disturbances. Nesting raptor species at PINN sensitive to human disturbance include prairie falcons (Steenhof 1998, Harmata et al. 1978, Ogden and Hornocker 1977, Sitter 1983, Fyfe et al. 1976), peregrine falcons (particularly in remote locations: see Steenhof 1998, Hickey 1942 and 1969, Bond 1946), golden eagles (Newton 1979 and 1990, Kochert et al. 1999, Steenhof et al. 1997, Scott 1985, Steidl et al. 1993, Watson 1997), sharp-shinned hawks (Delannoy and Cruz 1988), and long-eared owls (Marks 1986, Marti and Marks 1989, Bloom 1994).

Prairie falcons nest in particularly high numbers at PINN, with an average of 9.7 nesting pairs per year documented from 1984-2007 (see Table 4). Studies of prairie falcon nest occupancy and productivity have also shown the species to be especially sensitive to human disturbance from mining (Becker and Ball 1981, Bednarz 1984), recreation (Boyce 1982), agriculture (U.S. Dept. of Interior 1979), habitat destruction and nest site limitation (Becker and Ball 1981, Steenhof et al. 1997), and proximity to major roadways (Boyce 1982, Platt 1974).

The main sources of human disturbance of nesting raptors at PINN are visitors that are rock-climbing and hiking on- and off-trail in the monument. Scientific studies have consistently suggested that these recreation activities can be balanced against raptor nesting by establishing closure or advisory areas that act as buffers between human activity and raptor nesting during the breeding season (White et al. 2002, Olsen and Olsen 1978, Cade et al. 1996, Porter et al. 1987, Suter and Jones 1981, Holthuijzen 1990, Becker and Ball 1980, Fyfe et al. 1976). Therefore, the primary management objective of the Pinnacles raptor monitoring program is to establish climbing/hiking advisories in core areas (high visitor-use areas) each breeding season and monitor prairie falcon population status as a way to protect cliff-nesting raptor species from human disturbance.

Monitoring efforts began initially to establish annual climbing/hiking advisories in core areas. The program established two long-term monitoring objectives to:

- Track changes in the total numbers of territorial prairie falcon pairs in core climbing areas and non-core areas.

- Track changes in average annual productivity (young of year hatched/pair, young of year at banding age/pair, young of year fledged/pair) in core climbing areas and non-core areas.

Core climbing areas are locations at PINN suitable for prairie falcon cliff-nesting where climbing impacts could occur, based on the presence of historic climbing routes accessible to visitors. Non-core areas refer to all other areas within PINN suitable for cliff-nesting. The core vs. non-core sampling design is detailed further in the Methods section. GIS locations of the core areas are depicted on a map of PINN (see Appendix 3).

A side benefit of the monitoring program is that a substantial amount of information can also be gathered on other raptor species at PINN, particularly California species of concern that may be impacted by human presence and disturbance in riparian habitats: Cooper's hawks (*Accipiter cooperii*), sharp-shinned hawks (*A. striatus*), white-tailed kites (*Elanus leucurus*), and long-eared owls (*Asio otus*). Although lack of consistent nesting data for these species over the course of the 21-year raptor monitoring program precludes statistical and trend analysis, the presence/absence data nevertheless provides valuable information on the diversity of breeding raptors at PINN, and through inference, the quality of their nesting habitats and prey sources.

Study Area and Methods

PINN is located in the Gabilan Mountains of the central Coast Range of California and encompasses 26,426 acres, with elevation ranging from 244 to 982 meters. The climate is Mediterranean with hot, dry summers and cool, damp winters. Temperatures range from a mean of 8.2° C in January to 22.6° C in July. The majority of the rainfall occurs from November to April with average yearly rainfall of 44 cm (National Oceanic and Atmospheric Administration, NOAA, 1997).

PINN provides a diverse range of habitat types for birds and other species: volcanic rock formations and outcroppings, California mixed chaparral, pine-oak woodlands, grasslands, and riparian habitats.

Survey methods followed the standard operating procedures detailed in the 2004 Raptor Monitoring Protocol for Pinnacles National Monument, California (Emmons and Fesnock 2004). Prairie falcon nest phenology and productivity are emphasized because this is the raptor species most affected by management through climbing advisories and with the most quantifiable and statistical data gathered over the 21 years of the raptor monitoring program. However, all nesting raptor species at PINN are monitored following the same general survey methods, allowing for the different nest phenology patterns and breeding habitats favored by particular species.

Potential and established cliff-nesting raptor territories in high-use climbing areas and remote locations in the monument were surveyed using spotting scopes (20-60x) and binoculars (10x42). Observations were made from the locations that provided the best view of an eyrie or territory. A Trimble GeoExplorer 3 GPS unit was used to plot every observation spot. Surveys typically lasted 1.5 to 6 hours, depending upon the raptor behavior and amount of data collection needed. For a survey visit to be classified as “no birds” a minimum watch time of 4 hours was required. Territories were revisited on a 7-21 day schedule based on level of visitor use, the progress and age of raptors at territories (to obtain the most critical data for each territory for that time period), and the number of territories to be monitored. High visitor use areas were monitored more frequently and during weekend days when climbers were more likely to be present. While other monitoring programs infer fledging success at 90% fledge age (Anderson and Squires 1997, Steenhof and Kochert 1982, Steenhof 1998), our protocol was to continue surveys until all young raptors were confirmed as fledged. For a territory to be classified as unoccupied, a minimum of three 4-hour surveys of “no birds” confirmed over three different months were required. Survey duration was ultimately dependent upon visibility. When birds cooperated and the necessary data were collected in short survey durations, nearby territories were visited as well.

Sample Design

The two sample universes for the raptor monitoring program are defined as core areas and non-core areas, each of which has distinct sampling schemes.

Core areas are locations in PINN that can support prairie falcon cliff-nesting, and where climbing impacts can occur based on historic rock-climbing use and access. Core area sampling is conducted through a census, because the area is sufficiently small to allow for complete coverage by raptor monitors.

Non-core areas refer to all other areas within the monument that can support prairie falcon cliff-nesting. For 2003-2007, non-core area sampling has also been conducted through a census. This has been possible due to the lead raptor monitor's experience and capacity in locating and documenting territorial and nesting falcon pairs throughout the monument, and the comprehensive, historical data on prairie falcon nest sites gathered over the past 21 years. In the future, non-core areas will be sampled based on probabilistic samples chosen from potential falcon nest sites identified via GIS modeling and historical data.

Monitoring Schedule

In January, late afternoon and evening surveys were conducted to locate territorial prairie falcons. Perching, flying, diving, interacting, and roosting locations were sought as evidence of territorial behaviors and territory establishment. By mid-January climbing advisories went into effect and territories were monitored to record courtship behaviors, territorial disputes, and disturbance. Advisories were used to inform visitors of areas likely to have breeding raptors. Generally these areas were occupied by raptors at least once during the preceding three years. Visitors were advised to avoid these areas but compliance was voluntary. Advisory areas with posted signs included the Balconies, Hawkins, Scout Peak, and Little Pinnacles territories.

In late winter and early spring, copulation behavior was observed and duration quantified. Food-swapping and eyrie selection were also recorded. Surveys during this period focused on evening and late-afternoon surveys until eyrie selections were made.

Incubation was determined by female prairie falcons (and to a lesser extent male falcons during nest switches) flying into a nest hole and not reappearing for extended periods of



Figure 1. Setting up Advisory Sign. ©Gavin Emmons, 2006.

time. Attempts to count eggs were made by surveying while the best light was available for visibility, and when the incubating falcons temporarily left the nest during food drops and nest switches. Soft incubation – the onset of incubation – was determined by a small number of eggs laid and the female incubating for short durations (15-75 minutes). Hard incubation was characterized by the adult falcons – primarily the females – incubating a full clutch of eggs for hours in duration. Surveys were done in early morning and late evening hours to catch periods of greatest raptor activity, such as food drops, and to have a maximum amount of time for observation.

Hatched young prairie falcons were aged by physical features using an aging guide (Moritsch 1983). Hatch dates were determined by counting backwards from at least two (preferably three or more) independent agings. Nestlings were observed from late spring to early summer, primarily during early morning and evening hours when they were most active, but observation periods at midday provided further data on nestling activity while prairie falcon adults were hunting for prey away from the nest sites. From early to mid summer, prairie falcon young were observed primarily in early to mid-morning hours, when they were nearing fledging and most actively exercise-flapping. Full fledging of falcon young was confirmed by all young being seen perched and/or in flight away from the nest site, with fledging dates determined by the coordination and strength of flight, the size of perches, and the amount of vocalization during flight.

Weather was always an important factor. During temperature extremes, heavy fog, or rain, most birds of prey were not active and therefore monitoring was not done during these periods.

Results

In the 2007 season, 46 breeding records and 45 active nests were documented for 12 raptor species, the second-highest numbers (after the record 2006 season) recorded during the 21 years of the raptor monitoring program. Breeding and phenology data are detailed by species below. Refer also to Appendices 4-6, for summary information on raptor productivity throughout the 2007 season.

Prairie Falcon, *Falco mexicanus*

The first prairie falcon pairs were observed at Teapot Dome and Goat Rock/Resurrection Wall on 9 January 2007. Incubation was first observed at Teapot Dome and Resurrection Wall on 24 March 2007. The first hatching occurred between 15-17 April 2007 at D. Soto Canyon. The first fledging took place from 26-28 May 2007, also at D. Soto Canyon. The last young to fledge were 4 young falcons at Little Pinnacles, from 16-18 June 2007, and the 5th young



Figure 2. Prairie Falcons. ©Gavin Emmons, 2006.

from the Machete nest on 20-21 June 2007 (with the 4 other young fledging from 11-13 June 2007). The last confirmation of a nesting pair was on 11 June 2007 in the South Chalone territory after one egg had been laid and the nest had been abandoned, though the falcon pair was observed defending the South Chalone territory as early as 19 April 2007.

Through the 2007 season, 12 nesting pairs and two non-nesting pairs of falcons were confirmed at PINN. Eight of the 12 eyries chosen by prairie falcons were used in previous years. However, one of these eyries was a new prairie falcon nest site: the D. Soto Canyon nest site was used once previously as a common raven nest in 2006. Additionally, two of the new prairie falcon nest sites – at Machete and NE Sec 15 – were in territories previously undocumented for nesting. The Machete falcon pair also occupied the Citadel territory, while the NE Sec 15 pair also occupied the North Chalone territory.

Table 1: 2007 PINN Prairie Falcon Nests. Numbers in the “Closest Climb” column refer to climbing route numbers listed in Rubine (1995).

Territory	Nest Used/ Last Year Used	Sensitivity to Visitor Disturbance	Height (ft) From Ground	Height (ft) From Top	Closest Climb	Aspect
Crowley	CT-1/ 2005	High				E
D. Soto Canyon	DS-4/ 2006 (by CORA)	Medium				SE
Drywall	DRY-2/ 2005	Low				S
Little Pinnacles	LP-8/ 2004	High				SE
Machete	MAC-4/ NEW	High	75	65	#354b	W
NE Sec 15	NES-2/ NEW	Low	20	15	None	E
Pig Canyon	PIG-6/ 2004	Low				E
Resurrection Wall	RW-5/ NEW	High	25	20	#368	SE
South Balconies	SGB-15/ NEW	High	30	20	#295a	SW
South Chalone	SC-1/ 2006	Low				WNW
Teapot Dome	TD-1/ 2006	High				SE
Willow Spring Slide	WSS-2/ 2004	Low				S

Two prairie falcon pairs did not nest or produce young this year. The Pipsqueak Pinnacles/Scout Peak prairie falcon pair actively perched, courted, and defended both

territories early in the breeding season, but abandoned both areas by the middle of March. The Narrows prairie falcon pair actively perched, courted, and defended the territory and the main fork of Marion Canyon throughout the season, but did not settle on a nest site to produce eggs or young.

Eggs were counted this season at four of the 12 prairie falcon nests. Eggs could not be observed at the other falcon nest sites this year due to nest site locations and egg placement within the nest sites during incubation. Nestlings were successfully counted at nine territories with a mean of 3.9 nestlings per eyrie and 3.7 fledglings per eyrie.

From nine nest sites, 35 nestlings were produced of which 33 fledged. Within the core area, six nests produced at least four fledglings each, with two of the nests – at Machete and Teapot Dome – producing five fledglings each. Three non-core prairie falcon nests – at D. Soto Canyon, Drywall, and Pig Canyon – combined to produce seven fledglings. Three nests (at NE Sec 15, South Chalone Peak, and Willow Spring Slide) failed to hatch eggs.

Table 2: 2007 PINN Prairie Falcon Breeding Summary.

Territory	Nest Used/ Last Year Used	# Eggs Laid	# Young Hatched	# Young Known/ Possibly Fledged
Crowley	CT-1/ 2005	Unknown	4	4/ 4
D. Soto Canyon	DS-4/ 2006 (by CORA)	Unknown	4	4/ 4
Drywall	DRY-2/ 2005	Unknown	3	1/ 1
Little Pinnacles	LP-8/ 2004	Unknown	4	4/ 4
Machete	MAC-4/ NEW	5	5	5/ 5
NE Sec 15	NES-2/ NEW	Unknown	0	0 Note: Nest failed due to abandonment.
Pig Canyon	PIG-6/ 2004	Unknown	2	2/ 2
Resurrection Wall	RW-5/ NEW	4	4	4/ 4
South Balconies	SGB-15/ NEW	Unknown	4	4/ 4
South Chalone	SC-1/ 2006	1	0	0 Note: Nest failed due to abandonment.
Teapot Dome	TD-1/ 2006	5	5	5/ 5
Willow Spring Slide	WSS-2/ 2004	Unknown	0	0 Note: Nest failed due to abandonment.

California Condor, *Gymnogyps californianus*

2007 marked the fourth year that captive-bred California condors were free-flying and monitored by NPS biologists at PINN, with up to 19 condors flying actively and feeding on proffered carcasses in the monument. From January through March, condors moved frequently between PINN and the Big Sur area monitored by Ventana Wildlife Society staff along the central California coast, with condor populations from both locations often mixing and flying together. Through the summer months, Pinnacles condors have continued to explore the regions surrounding PINN, but have also focused on scavenging for both proffered carcasses in the monument and non-proffered sources just outside of the monument. In general, the Pinnacles condors have continued to explore further afield, reaching west to the Big Sur coast, north to the San Luis Reservoir, south to Paso Robles, and east to Interstate 5. Several Big Sur condors have been documented regularly at PINN, including #194 – the oldest condor to visit the monument yet – and #242, #278 (a previous Pinnacles bird), #294, #301, #311, #318, #356, and #377. Five juvenile condors were released in 2007 after being reared in the Grassy Canyon facility: #400 and #401 were released on 24 April, #417 was released on 3 May, #405 was released on 21 August, and #411 was released on 22 August.



Figure 3. Juvenile California condor #307 balancing on net mesh of Grassy Canyon facility. Condor #307 was one of 2 PINN condors that died due to non-lead related causes in 2007. ©Gavin Emmons, 2006.

Table 3: 2007 PINN Breeding Raptor Nesting Productivity (not including Prairie Falcons)
(NOTE: ☼ = California Species of Concern)

Species	Territorial Pairs	Nesting Pairs	Successful Nests	# Possible Fledglings	# Fledglings / Nest
Peregrine Falcon ☼	1	1	1	3	3
Turkey Vulture	1	1	1	2	2

Golden Eagle ☼	2	2	2	3	1.5
Red-tailed Hawk	12	6	6	10	1.7
American Kestrel	14	8	5	8	1.6
Red-shouldered Hawk	5	5	4	7	1.8
Cooper's Hawk ☼	6	6	3	7	2.3
Sharp-shinned Hawk ☼	1	1	1	3	3
White-tailed Kite ☼	3	1	0	0	0
Long-eared Owl ☼	2	1	1	3	3
Great-horned Owl	5	2	2	2	1

The PINN program suffered its first condor deaths when #417 and #307 were found dead on 12 May and 17 May, respectively. Neither condor died of lead-related causes. Condor #301 also died as a result of a collision with power lines along the Big Sur coast. Although other Pinnacles and Big Sur condors were tested for elevated lead levels in 2007, no other deaths occurred. Pinnacles condor #332 was observed picking at a significant, necrotic wound along its forewing in mid-spring, but after months of treatment and rehabilitation, the bird made a full recovery and was released from the Pinnacles facility in late August.

Territorial interactions between condors and other raptors were observed. Immature and adult golden eagles were observed at the Grassy Canyon feeding site early in the year, and were repeatedly flushed from cattle carcasses by condors in the area until the eagles left the area. In the High Peaks, falcon species – particularly the Hawkins peregrine falcon pair – stooped condors on numerous occasions, flushing them from near the HP-5 nest site and out of the Hawkins territory. Prairie falcons and American kestrels were also observed stooping on condors in the High Peaks. Despite these physical interactions, no lasting physical injuries to the attacked condors were observed. The condors were also observed feeding with turkey vultures in Grassy Canyon, and roosting with them in Grassy Canyon and in the High Peaks.

Peregrine Falcon, *Falco peregrinus*

A peregrine falcon pair occupied and successfully nested in the Hawkins territory, marking the third consecutive year in the past 49 years that a peregrine pair

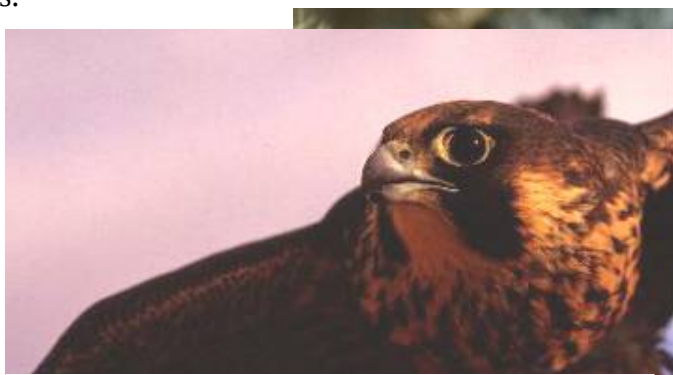


Figure 4. Juvenile Peregrine Falcon. ©Gavin Emmons, 2005.

Figure 5. Turkey vulture nestling at the Narrows nest. ©Gavin Emmons, 2007.

nested and produced fledglings in the monument. The peregrine falcon pair was first observed by the raptor monitor perching near the historic HP-5 nest and soaring near Hawkins Peak on 7 January 2007. However, additional Pinnacles employees confirmed observations of the peregrine falcon pair in October through December 2006, suggesting the falcons were resident at the monument through the 2006 winter season. Through mid-March, the peregrine falcon pair copulated often, inspected historical nest sites at Hawkins regularly, and actively stooped other raptors in the Hawkins territory. The peregrine falcon pair began incubating 3 eggs at the HP-5 site by late March, with all the eggs successfully hatching on 24-26 April. The 3 peregrine falcon young fledged on 4-6 June 2007.

Turkey Vulture, *Cathartes aura*

One previously undocumented nest site was confirmed for turkey vultures at PINN in 2007. Due to the cryptic behavior and remote nest locations of turkey vultures, confirmed breeding records have been rare at Pinnacles. The 2007 nest represents only the 4th breeding record confirmed in the monument since 1984. Incubation of 2 eggs at the turkey vulture nest was confirmed on 2 April 2007 on the dry streambed up the east fork of Marion Canyon in the Narrows. Two nestlings hatched at the Narrows nest from 6-9 June. Full fledging was unconfirmed but highly likely; vulture nestlings were observed just prior to fledging at the Narrows nest, and a distinct trail of feather down was observed leading up the sides of the canyon walls above the nest, strongly suggesting that the vulture young hop-flapped out of the canyon drainage.

Golden Eagle, *Aquila chrysaetos*

Golden eagles were observed nesting on the west side of North Chalone Peak in PINN and at the Eucalyptus Grove outside of PINN's West Side. Golden eagle adults and juveniles were active throughout the monument, but no territorial occupation beyond North Chalone was confirmed within the monument. Historic nest sites in 3 territories – Frog Canyon, South Chalone Peak, and Eagle Rock – contain 5 former nest sites observed in mid-winter through late spring, with no new greenery added to any of the nests.

Golden eagle nesting was confirmed at North Chalone and the Eucalyptus Grove. The nest site at the Eucalyptus Grove was used the past 3 years by a nesting eagle pair. The North Chalone nest was last documented as an active golden eagle nest in 1996. The golden eagle pairs were first observed at the Eucalyptus Grove on 14 January 2007 and at North Chalone on 24 February, with incubation confirmed by 11 February and 26 February respectively. Two eaglets hatched at the Eucalyptus Grove nest on 9-16 March, and one eaglet hatched at North Chalone on 1-8 April. Full fledging at the Eucalyptus Grove nest was highly likely from 15-27 May, but only 1 eaglet was confirmed fledged. The eaglet at North Chalone was observed just prior to fledging, but fledge was not confirmed from the nest. Eagles were occasionally seen off the monument.

Red-tailed Hawk, *Buteo jamaicensis*

Six red-tailed hawk nesting pairs were documented in PINN this year. Three were at historical nest sites at Cemetery Gates, the Western Front, and South Wilderness (North End), while 3 previously undocumented nests were found in the Kingman Land North territory extending from the Regan Ranch Canyon road north to Highway 146. The 3 Kingman Land North nests were all stick nests in trees, two of them on gray pines and one on a live oak (the first documented at the monument).



Figure 6. Juvenile Red-tailed Hawk. ©Gavin Emmons, 2005.

Although red-tailed hawk pairs occupied historical territories at Crowley Drainage/North Balconies, Eagle Rock, and Hand/Prescribed Burn Cliffs, no active nests were documented in these territories in 2007. Two additional red-tailed hawk nests were documented outside of PINN, along Highway 25 South from the PINN East Side Entrance. Data for these nests are included in Appendix 5, given their relatively close proximity to monument boundaries, but are not discussed here because they did not occur within PINN. Incubation was first observed at one of the Kingman Land North nest sites – KLN-2 – on 30 March 2007. The earliest hatching of nestlings occurred on 21-25 April at 2 of the Kingman Land North nests, KLN-2 and KLN-4, with the latest hatching of the season estimated at 11-15 May 2007 at the 3rd Kingman Land North nest, KLN-6. Ten nestlings were observed in total at the 6 nest sites, with 2 young each in the Cemetery Gates, South Wilderness (North End), Western Front, and KLN-4 sites, and 1 young each in the remaining Kingman Land North nest sites. Fledging of all 10 red-tailed hawk young was likely, but full fledge was confirmed only at the South Wilderness (North End) and 3 Kingman Land North nests. Partial fledging of young was confirmed at the other 2 nest sites. Fledging was confirmed first at the KLN-4 nest on 4-6 June 2007, and last at the KLN-6 nest on 26-28 June 2007.

American Kestrel, *Falco sparverius*

Kestrels were observed occupying 14 territories in the monument this year, with evidence of eight breeding records documented. New nest sites were documented at four territories: Crowley, Discovery Wall, Kingman Land North (two nest sites), and Little Pinnacles. Seven active nest sites were documented, with five in cliff cavities and two in valley oak tree cavities. Nest incubation was



Figure 7. American kestrel nestlings in Discovery Wall nest. ©Gavin Emmons, 2007.

first confirmed at the Prescribed Burn Cliffs territory on 16 May 2007. Hatching was confirmed at all seven nest sites, with the earliest hatching record confirmed at Drywall by 9 May 2007. Fledglings were not confirmed from any of the documented nests sites, but at least five nestlings observed in the seven nest sites likely fledged. Three young kestrels were also observed soon after fledging in Marion Canyon, with a likely but unconfirmed live oak tree cavity nest located in the vicinity of the fledglings. Other kestrel pairs not confirmed nesting occupied the following territories: D. Soto Canyon, Mating Rocks, McCabe Canyon, NE Sec 15, North Chalone, and South Balconies.

Red-shouldered Hawk, *Buteo lineatus*

Five active red-shouldered hawk nests were documented in the monument this year, in the following territories: South Wilderness Trail, Pinnacles Campground, McCabe Canyon, Regan Ranch Canyon, and Kingman Land South. (Although Regan Ranch Canyon is a private inholding, it is surrounded by NPS property and is within the congressionally designated boundary of the monument) The Pinnacles Campground, Regan Ranch Canyon, and Kingman Land South nests were all previously undocumented sites. All the nest constructs were built along riparian corridors, with the Kingman Land South nest built on a valley oak, the Pinnacles Campground nest on a live oak, the South Wilderness Trail nest on a sycamore, and the McCabe Canyon and Regan Ranch nests on gray pines. The first territorial red-shouldered hawk pair was observed at the Pinnacles Campground on 10 January 2007, and nest incubation was first confirmed on 20 April 2007 at the Pinnacles Campground, Regan Ranch Canyon, and Kingman Land South nests. The Kingman Land South nest failed to hatch any nestlings, the Regan Ranch nest hatched one nestling, and the remaining three nests hatched two nestlings each. The earliest hatching of young occurred at the Regan Ranch Canyon nest on 22-23 April. At least partial fledge was confirmed at the four successful nests, with full fledge confirmed at the McCabe Canyon, Pinnacles Campground, and Regan Ranch nests. Although not confirmed, full fledge of seven hawk nestlings was very likely, given observations of full fledge at three nests and partial fledge at one nest. The Regan Ranch Canyon nest fledged young on 6-7 June 2007. The latest fledge of young was observed at the Pinnacles Campground nest on 12-14 June 2007.

Cooper's Hawk, *Accipiter cooperii*

Six active nests were confirmed for Cooper's hawks at PINN in 2007. Five of the stick nest constructs were built on live oaks along riparian corridors, in the following territories: Balconies Cave Trail, Grassy Canyon, Kingman Land North, Kingman Land South, and Upper Bear Gulch. The remaining nest – in Marion Canyon – was built on a gray pine. The first Cooper's hawk pair was observed defending the Grassy Canyon territory on 10 January 2007. Nest incubation was first confirmed at the Kingman Land South nest on 20 April. Four of the 6 Cooper's hawk nests hatched 10 nestlings, with the 2 remaining nests – at Balconies Cave Trail and Grassy Canyon – failing due to abandonment prior to hatching eggs. The Kingman Land North nest produced the earliest hatchlings of the season on 24-28 May. Fledging of 7 young was confirmed at three nests, with full fledge confirmed at two nests: Kingman Land North and Upper Bear

Gulch. Partial fledge was confirmed at the Marion Canyon nest, though full fledge was highly likely, given observations of all young at the nest just prior to fledging. The remaining nest – at the Kingman Land South territory – produced two nestlings and likely fledged both, but fledge was not confirmed from the site.

Sharp-shinned Hawk, *Accipiter striatus*

One sharp-shinned hawk nest was confirmed at PINN in 2007. The nesting pair was first documented occupying the Upper Bear Gulch territory near the trail tunnel en route to Bear Gulch Reservoir on 23 January 2007. Incubation was confirmed by 12 May and hatching of eggs occurred on 4-7 June. Three nestlings were observed at the nest site. Partial fledging of two young was confirmed on 1-5 July 2007, but full fledge was highly likely, given observations of all 3 nestlings at the nest site just prior to fledging. The nest was a stick construct conspicuously covered in feather down and whitewash located on a live oak. The nest site was well-concealed in a relatively dense, wooded grove along the Bear Gulch riparian corridor. Sharp-shinned hawk adults were also observed near the North Wilderness Trail junction along Old Pinnacles Trail, in Lower Bear Gulch, in Lower Condor Gulch, near Willow Spring, along the South Wilderness Trail, and in the Pinnacles Campground.

White-tailed Kite, *Elanus caeruleus*

During the 2007 season, only one breeding and nesting record was confirmed for white-tailed kites, a marked contrast to the seven breeding records for kites documented in 2006. Four territories with active nests in 2006 – Double Gates, Jawbone Canyon, Marion Canyon, and South Wilderness Trail – were not occupied by white-tailed kites this year. Two additional territories – McCabe Canyon and Kingman Land North – were defended by kite pairs, and although copulations and nest site inspections were observed at both territories, the pairs did not actively nest. The one confirmed white-tailed kite nest was at a previously undocumented site in the Kingman Land South territory and was a stick nest built at the top of a live oak. The nest site was built in an open riparian habitat in close proximity to exposed meadows and grasslands. Territorial occupation by a white-tailed kite pair was first confirmed in the McCabe Canyon territory on 5 February 2007, but breeding was not confirmed for this kite pair. Nest incubation was confirmed at the Kingman Land South nest on 5 May 2007. The nest failed from 30 May to 10 June 2007, likely due to predation and/or abandonment. Given monitoring observations of seven known white-tailed kite territories and no evidence of successful nesting, the 2007 season appears to have been wholly unproductive for kites at PINN.

Long-eared Owl, *Asio otus*

There were two territorial records for long-eared owls at PINN this season at the Chalone Picnic Area and Marion Canyon. The long-eared owl pair in Marion Canyon nested successfully, but the Chalone Picnic Area was occupied primarily by a calling male, only infrequently by a female, and did not produce an active nest. Territorial occupation by an adult long-eared owl pair was first confirmed in the Chalone Picnic Area on 18 February 2007, with the adult male hooting regularly between dorm housing and the Trails building. The active nest in Marion Canyon represents only the fourth ever documented during the raptor monitoring program, after the three nests documented in 2006. The Marion Canyon nest was a stick construct on a gray pine, 30-40 meters downstream of the 2006 Marion Canyon long-eared owl nest. The identity of the original occupant of the nest is not known, though by size and shape the nest was likely a Cooper's hawk construct. Nest incubation was confirmed at the Marion Canyon nest on 2 April 2007. The hatching of nestlings was estimated at 19-26 April, and 3 nestlings were observed. Fledging of 2 of these nestlings was confirmed on 24-31 May 2007, with both seen perching together on a live oak 20-30 meters from the nest site. Although the third nestling was not observed, full fledge from the Marion Canyon nest is highly likely given observations of the 3 nestlings prior to fledging.



Figure 8. Long-eared owl adult near Chalone housing area. ©Gavin Emmons, 2006.

Great Horned Owl, *Bubo virginianus*

Two great horned owl nests were confirmed during the 2007 season, in the Pinnacles Campground and Kingman Land North territories. These nests mark the third and fourth confirmed for the species since 1996. The Pinnacles Campground nest was a stick construct built on a valley oak, used in 2006 by a nesting red-shouldered hawk pair. The Kingman Land North nest was a previously undocumented stick construct built on a locust tree. Great-horned owls were also confirmed occupying three additional territories in 2007: Pig Canyon, Pipsqueak Pinnacles, and Upper Condor Gulch. Territorial occupation by a great horned owl pair was first confirmed in the Upper Condor Gulch territory on 7 January 2007, with nest incubation confirmed at the Pinnacles Campground territory on 11 March. Hatching of young was confirmed at both nests, with the Pinnacles Campground nest producing one young on 3-10 April and the Kingman Land North nest hatching 1 nestling by 12-19 April. Fledging of the owl young from the Kingman Land North nest was confirmed on 30 May to 7 June. Fledging of the one young from the Pinnacles Campground nest was not confirmed but highly likely given observations of the nestling prior to fledging.

Other Raptors

Barn owls (*Tyto alba*) were documented sleep roosting at D. Soto Canyon and Drywall in 2007. Although a barn owl pair at D. Soto Canyon was observed roosting in the cliff cavity used as a nest in 2005 and 2006, the site was not used for nesting in 2007.

Western screech-owls (*Megascops kennicottii*) were seen and heard hooting, particularly near the Bear Gulch Visitor Center and in Upper Bear Gulch, beginning in January. Western screech-owls were also heard hooting along the High Peaks Trail west of Chalone housing, and a single owl was seen sleep-roosting in a blue oak cavity in late May to early June.

An osprey (*Pandion haliaetus*) was also observed circling and soaring over the High Peaks in late February. Bald eagles (*Haliaeetus leucocephalus*) and northern harriers (*Circus cyaneus*) were observed flying near the monument boundaries through late spring.

Climbing Management Actions

Climbing advisories were put in place in January, and revised in March to reflect territories in which prairie and peregrine falcon pairs were nesting. The advisories were put in place in areas with known climber usage to protect nesting raptors from disturbance. Signs detailing climbing advisories were posted at Little Pinnacles, Balconies, Hawkins, Scout Peak, and Frog/Hand territories. GPS data and digital photographs were recorded for the locations of all the advisory signs, for inclusion in the raptor monitoring ArcMap and MS Access databases. Other climbing advisory areas – detailed in press releases, trailhead signs, and pamphlets at the Bear Gulch Visitor Center – included Crowley Towers, Egg, Tunnel, Teapot Dome, Pipsqueak Pinnacles, and Goat Rock/Resurrection Wall territories. Prairie falcons were confirmed nesting at Machete in March to April, marking the first time that a falcon pair has been documented nesting on Machete. Due to the large size of Machete Ridge, a partial advisory was instituted at this territory, covering the south half of the cliffs where the nest site was located. All of the above territories – except the Frog/Hand and Pipsqueak Pinnacles territories – were actively used and occupied by nesting falcon pairs.

Human Interactions

In general, climbers and hikers did an excellent job of heeding climbing advisories this year. More securely affixed advisory signs were posted in the Scout Peak and South Balconies areas, and an additional advisory sign was posted en route to the Frog/Hand territory, to address off-trail hiking, backcountry climbing, and BASE jumping incidents documented in advisory areas in 2005. In 2007, five incidents of off-trail hikers in advisory areas were documented, but no significant defensive falcon behavior was observed. No climbers were observed in advisory areas in 2007, suggesting that climbers visiting the monument are adhering to advisories posted on the internet, signs, bulletin boards, and in press releases.

Prairie and peregrine falcon adults in the Goat, Crowley, Hawkins, Machete, and Balconies territories did respond to the presence of on-trail hikers and raptor monitors by circling and wailing above their respective territories, but did not otherwise display significant and prolonged disturbance behavior threatening nest productivity and survivorship. When visitors adhere to them, the advisory signs for raptor area closures and postings at climbing accesses seem to be effective, given full fledging this year in all advisory territories.

International Migratory Bird Day (13 May 2007) was celebrated at PINN with interpretation of raptor behavior at a trailside watch spot at Teapot Dome. Planned activities for International Migratory Bird Day were not as extensive or effective in 2007 as in previous years, largely due to lack of NPS staff involvement and planning. Raptor Monitor Gavin Emmons interpreted raptor behavior for visitors along the High Peaks Trail with assistance by NPS Interpreter Brant Porter, and both roved through the High Peaks and along the Balconies Cliff Trails to provide further interpretation for visitors. Throughout the season, Gavin Emmons also met with and interpreted falcon activity for local birding groups, PINN staff, regional Inventory & Monitoring staff, and monument visitors in high-use areas in the High Peaks, along the Balconies Cliff Trail, and near the Bear Gulch Reservoir.

Discussion

The 2007 nesting season at PINN was characterized by 12 breeding raptor species and 45 nest sites documented, the second-highest on record for the raptor monitoring program after the 2006 season. Nest records were confirmed for 7 California Species of Concern (California Department of Fish and Game [CDFG] 2006): prairie and peregrine falcons, golden eagles, Cooper's and sharp-shinned hawks, white-tailed kites, and long-eared owls. Additionally, nest records were confirmed for red-tailed and red-shouldered hawks, American kestrels, and great-horned owls. The confirmed nest and breeding records for the California Species of Concern listed above represent important baseline data which have been incorporated into the Resource Management archives at PINN and CDFG records in the California National Diversity Database.

In 2007 a high number of new and historical nest sites were documented, for falcons as well as all other breeding raptor species. Over the course of the breeding season, 12 nesting pairs of prairie falcons were active, with 5 nest sites previously undocumented. Record highs for the number of nesting territories in one season were matched with the 2006 season numbers for 2 raptor species: red-shouldered hawks and great-horned owls. For all raptor species except prairie falcons, 21 previously undocumented nest sites were confirmed, the second-highest number on record after the 2006 breeding season.

Prairie falcon nesting this year was highly successful with above average rates of total fledglings and fledglings produced per nest. From nine nest sites, the total fledglings produced were 33 and the average rate of fledglings produced was 3.7, higher than the 21-year averages of 26.9 and 3.2, respectively (Table 4). The number of territorial falcons nesting within core areas was below average (n=6) but productivity was much higher. Six nest sites produced 26 total fledglings and 4.3 fledglings per nest, compared to the 21-year averages of 19.0 and 3.3, respectively (Table 5). This represented the 2nd highest rate of fledglings per nest on record.

A preliminary comparison of prairie falcon breeding and productivity data from 1984-2007 (Tables 4 and 5) suggests important trends in prairie falcon productivity at the monument over the course of the 21-year program (Figure 1). With the exception of the 1998 season – characterized by heavy precipitation and major flooding throughout the raptor breeding season, and nest failures for the entire breeding population of prairie falcons at Pinnacles for the year – the averages for total fledglings/nest (3.2) and core fledglings/nest (3.3) appear to have remained constant throughout the past twenty years. Additional statistical analyses, however, are needed confirm that the stable population is not the result of changing levels of search effort.

Visitors apparently generally adhered to raptor advisories in the core area and did not disturb nest sites in 2007. The 2 nests that produced 5 fledglings – at Teapot Dome and Machete – are both in high visitor use areas and accessible by climbers. Use of the latter territory has never before been documented for prairie falcon nesting and is one of the

most popular climbing destinations on the west side of PINN. The nest success at both sites points to the effectiveness of the advisories and the visitors' awareness of and respect for raptor nest protection at PINN.

The 3 nest failures documented in 2007 were in remote, inaccessible areas of PINN, and there was no evidence suggesting that any of the failures were the result of direct human disturbance. Instead, the nest failures are more likely attributed to a combination of exposure to elements, possible depredation, or inexperience of the breeding pairs. Nests at Drywall (where 3 nestlings were produced and only 1 young fledged), Willow Spring Slide (where the nest failed to hatch eggs), and the Narrows (where the territorial prairie falcon pair did not nest in 2007), were more exposed to the elements than typical nest cavities on rock cliffs. The NE Sec 15 nest – a previously undocumented site – may have failed due to depredation or marginal nest placement in a cliff cavity on a small rock face. The South Chalone nest likely failed due to a combination of poor nest placement – on a very exposed, historical golden eagle site – and lack of experience on the part of the adult pair, given the failure of the one laid egg to hatch. (See Appendix 4: 2006 Nest Phenology and Success – Falconids, for more details.)

For raptor species other than prairie and peregrine falcons, productivity was noticeably lower at PINN in 2007 than in the 2006. Certain raptor species – including red-tailed hawks, red-shouldered hawks, Cooper's hawks, and great-horned owls – were documented with lower nest productivity and rates of fledglings per nests. For long-eared owls, only 1 breeding record was confirmed for the species this year, compared with 5 breeding records for 2006. No confirmed nest records were documented for barn owls this year compared with 3 successful nests for 2006. White-tailed kite productivity was very low in 2007, with only 3 territorial pairs, 1 breeding record, and no successful nests documented, compared with 6 breeding records and 18 fledglings documented for 2006.

Table 4: 1984-2007 PINN Prairie Falcon Nesting Productivity – Core and Non-Core Areas Combined.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Possible Fledglings	# Fledglings / Nest
1984	9	8	8	27	3.4
1987	6	4	4	10	2.5
1988	12	9	8	24	3
1989	11	10	8	19	2.4
1990	14	11	10	35	3.5
1991	14	11	10	32	3.2
1992	13	11	10	34	3.4
1993	13	12	10	35	3.5
1994	13	12	12	42	3.5
1995	13	11	8	24	3
1996	10	10	9	34	3.8
1997	12	8	6	26	4.3
1998	10	7	0	0	0
1999	10	8	6	27	4.5
2000	8	8	7	22	3.1
2001	10	9	7	24	3.4
2002	11	8	7	22	3.1
2003	12	9	8	32	4
2004	12	11	9	33	3.7
2005	13	10	9	27	3
2006	15	14	10	30	3
2007	14	12	9	33	3.7
Averages (1984-2007)	11.6	9.7	7.9	26.9	3.2

Table 5: 1984-2007 PINN Prairie Falcon Nesting Productivity – Core Areas Only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Possible Fledglings	# Fledglings / Nest
1984	7	6	6	20	3.3
1987	5	4	4	10	2.5
1988	8	6	5	18	3.6
1989	8	7	6	16	2.7
1990	9	7	6	25	4.2
1991	9	8	8	31	3.9
1992	9	7	7	27	3.9
1993	10	10	9	30	3.3
1994	11	10	10	35	3.5
1995	10	9	7	21	3.0
1996	9	7	6	24	4.0
1997	8	6	4	17	4.3
1998	7	5	0	0	0
1999	6	6	4	13	3.3
2000	5	5	4	15	3.8
2001	7	6	5	12	2.4
2002	5	5	4	12	3.0
2003	5	5	5	22	4.4
2004	7	7	5	18	3.6
2005	5	4	4	11	2.8

2006	7	6	5	15	3.0
2007	6	6	6	26	4.3
Averages (1984-2007)	7.4	6.5	5.5	19.0	3.3

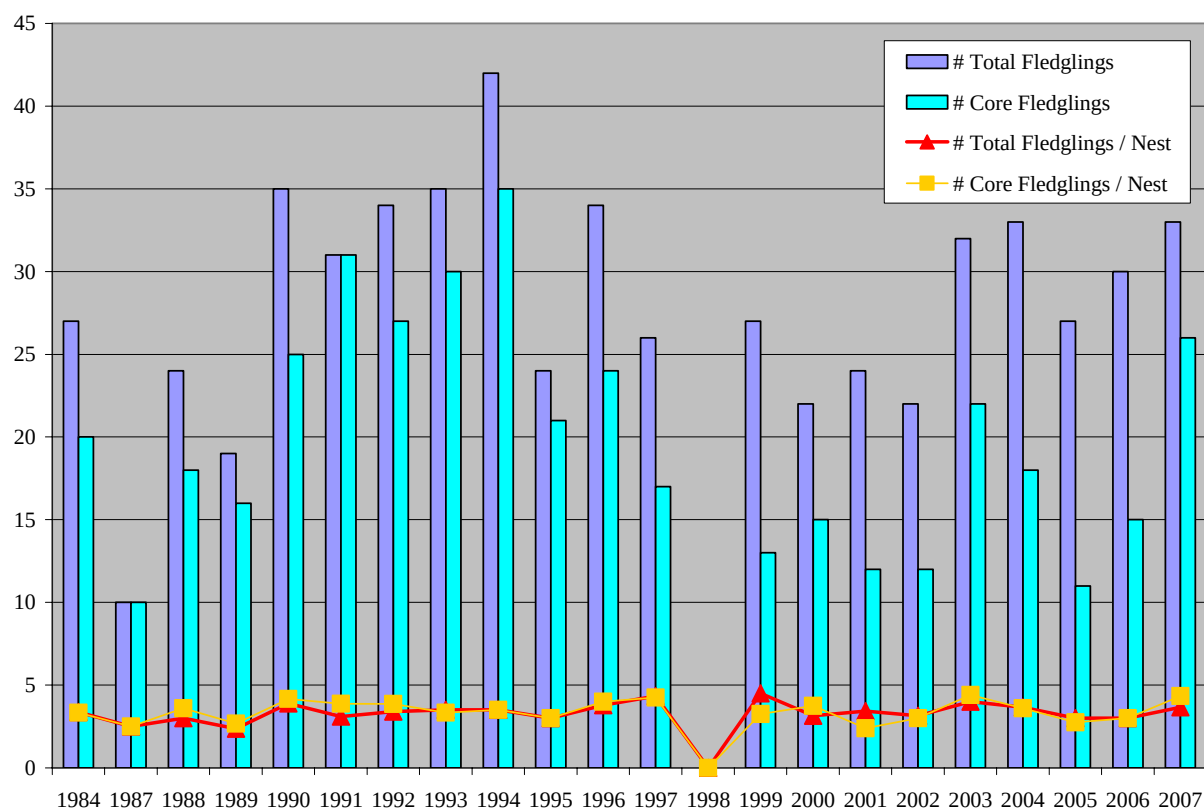


Figure 9. Total vs. Core PINN PRFA Fledgling Productivity, 1984-2007

Conclusion/Recommendations

Public Interest Highlights

The 2007 breeding season was the 21st year of raptor monitoring at PINN. Field observations began 7 January 2007 and ended 25 July 2007, with a total of over 100 possible and active nest sites monitored during 964 observation hours. Climbing advisories were put into effect in January, updated according to active raptor nest sites in March, and ended in July to reflect the end of the raptor breeding season. Advisory areas impact visiting climbers and hikers, and have been put into effect for the past 21 years.

- For the third consecutive year in 49 years, a peregrine falcon pair was documented successfully nesting at the monument, producing 3 fledglings.
- Accipiter species were confirmed nesting in the monument, with only the 6th sharp-shinned hawk nest record ever documented in the monument confirmed in 2007.
- One turkey vulture nest was documented in 2007, representing only the 3rd nest record for the species in the monument in 22 years.
- One long-eared owl nest produced 3 fledglings in 2007 and represented the 4th nest documented for the species in the monument since 1964.
- Twelve breeding raptor species and 45 nests – the second-highest numbers recorded in a season – were confirmed in the monument in 2007.
- Seven sensitive species of concern were confirmed breeding this year: prairie falcon, peregrine falcon, golden eagle, Cooper's hawk, sharp-shinned hawk, white-tailed kite, and long-eared owl.
- An ArcMap project was updated to visually display GPS and GIS information relating to the raptor monitoring program, including historical nest sites, monitoring watch spots, nest distribution by geologic and habitat layers, and locations of advisory signs posted at PINN.
- A 4' x 8' poster detailing research and management objectives of the raptor monitoring program at PINN over the past 21 years was presented this year at the ESA (Ecological Society of America)/SER (Society for Ecological Restoration) Joint Meeting in San Jose, California.
- Twenty-five breeding records for raptor species at Pinnacles were reported to the Santa Cruz Predatory Bird Research Group and the California Natural Diversity Database (through the California Department of Fish and Game).

Management Recommendations

The primary management objective of the Pinnacles raptor monitoring program is to establish climbing/hiking advisories in core areas (high visitor-use areas) each breeding season and monitor prairie falcon population status as a way to protect cliff-nesting raptor species from human disturbance. Based on prairie and peregrine falcon phenology and productivity data collected in 2007 and lack of observed disturbances by climbers and hikers, the advisory signs seem to be successful in balancing the reproductive needs of nesting raptor species with the recreational activities enjoyed by visitors to PINN. The effectiveness of advisories has also been made possible by additional efforts that should continue to be employed in future seasons: sending press releases on advisories to all local climbing gyms, organizations, and newspapers; interpreting raptor nesting and climbing advisories for visitors at trailheads; and emailing bi-weekly raptor monitoring updates to all monument staff and any interested local organizations (including Friends of Pinnacles, local Audubon Society groups, etc.). The lead raptor monitor for the past 5 years also rock-climbs regularly at PINN, allowing for additional lines of communication, unofficial interpretation of raptor nesting, and justifications for climbing advisories at the monument.

Much of the success of compliance with voluntary measures to restrict use can be attributed to the fact that the climbing community understands that the advisories are based on actual raptor monitoring data. By using current data, management is able to restrict use only to areas absolutely necessary for raptor nesting, with other areas not used for nesting remaining open for climbing. As a result, the local climbing community feels that management is making good-faith efforts to balance visitor use with protection of monument resources. An absence of current monitoring data would require management to close a much larger area of the monument to protect nesting raptors, potentially causing the climbing community to litigate this action, as was the case in 1986. In essence, this provided the catalyst for beginning the raptor monitoring program in 1987 and 1988. The local climbing community's adherence to the climbing advisories has been cultivated over the 21 years of the raptor monitoring program, and every effort should be made to keep the climbing community updated on the most recent advisory conditions at PINN.

The detailed and accurate raptor monitoring data gathered throughout the breeding season also provide the justification necessary to continue setting up advisories in future years, and should be emphasized here. The raptor monitor returned for a 5th consecutive season this year, and his past experience as a monitor and prior knowledge of raptor territories and watch spots was no doubt reflected in the high number and diversity of breeding raptor species and nests documented at the monument in 2007. The importance of having an experienced raptor monitor over multiple seasons cannot be stressed enough, and can significantly broaden the scope of nesting species and sites recorded within a particular breeding season. Creating a permanent raptor monitoring position at the monument would provide a strong impetus for wildlife technicians to return to the position from year to year. Given the 21 consecutive years of data collected for the program, and the priority

that the monument and Resource Management department have placed on the program, such a position seems justified. Given the inevitability of changing raptor monitors in certain years, having access to an experienced or prior raptor monitor – on staff as a half-time position through the first half of the breeding season – would help to orient the current raptor monitor to the specifics of the program that cannot be easily conveyed through the Raptor Monitoring Protocol and existing database resources.

In 2006 the raptor monitor was also assisted regularly in the field by Biologist Alacia Welch, after she was trained in the 2004-2005 seasons in the standardized procedures for raptor monitoring field work. This assistance helped significantly to alleviate the time constraints necessitated by the focus on prairie falcons and golden eagles and the high-use raptor advisory areas, and allowed for more detailed coverage of “non-target” raptor species in the monument. During the 2007 season, an assistant monitor position was not made readily available to gather data for the raptor monitoring program. Although priority species including prairie and peregrine falcons were still fully monitored, “non-target” species were not documented as extensively. Though in at least some cases environmental factors contributed to lower raptor nest productivity in 2007 than in 2006 (see Discussion section above), lack of staff assistance to the lead raptor monitor during the 2007 season likely played a part in fewer nest records being documented. Continuing to have a resource staff “half-position,” trained and field-supervised directly by the raptor monitor, would allow for consistent monitoring data, adherence to survey protocols, greater coverage of nesting raptors in the monument, and continuity in years when the lead raptor monitor does not return. Additionally, I would offer the following recommendations for incoming raptor monitors.

Continuing to make use of the efforts and enthusiasm of staff and visitors observing raptor activity in the field will allow for the broader documentation of nesting raptor species and nests seen in 2006 and 2007. This can be achieved through regular communication with NPS staff and visitors, bi-weekly monitoring updates on raptor status at the monument, and reminders on filling out wildlife observation cards. More detailed training and information on accipiters, red-shouldered hawks, kites, owls, and kestrels should be made available to raptor monitors and other NPS staff. Literature on nesting habits, observation methodologies, and nesting phenology for these species would be beneficial, and would be most easily addressed through a subscription to the Birds of North America Online site (<http://bna.birds.cornell.edu/BNA/>). Raptor monitors should also make use of historic raptor monitoring field notes, cataloged photographs, and GPSed watch spots for these species. Finally, monitors should be very familiar with the standardized written set of raptor protocols, and these should be revised and edited on a regular basis. In particular, incoming monitors should thoroughly review the following: raptor monitoring techniques; raptor identification skills; navigation and orientation in the backcountry; appropriate use of GPS and monitoring equipment; backcountry safety skills; management of raptor advisory areas; raptor monitoring ArcMap projects and geographic locations of nest sites and watch spots; and guidelines for database management of field notes, wildlife observation cards, and archived nest site photographs, for both confirmed and possible nest sites.

In regards to effective monitoring and a standardized set of protocols, two key aspects of raptor monitoring deserve further discussion because they are difficult to quantify but are essential for providing the monitor with successful data on nesting phenology – timing of raptor observations, and ideal locations for watching nests. Both factors vary as the breeding season proceeds and ultimately require self-motivation, adaptability, and a sensitivity to gaining effective data on the part of the raptor monitor. For the 2005-2007 prairie falcon breeding seasons, I found that afternoon and evening surveys were ideal in winter when determining where falcons would roost for the night, and in locating potential eyries. The falcons were most active about 2 to 3 hours before sunset, and circled and perched visibly – occasionally inspecting potential nest sites – in their respective territories before retreating to sleeping roosts for the night. Evening surveys also had the benefit of providing initial data on locations of vocalizing owls within the monument. As the season proceeded, I found that it was useful to check on nest sites in specific territories at different times of the day. Nestlings seemed most active near sunrise and sunset, but even observations during the high temperatures of midday provided useful data on nestling numbers while adults were out hunting. Near fledging, falcon and other raptor young seemed most active from sunrise to 1000 hours, when they were most consistently practice-flapping and later flying and perching near the nest sites. Depending on the aspect of nest sites, morning and evening lighting provided varying levels of visibility into the nests, as well. As stated above, my recommendation would be that raptor monitors cultivate a philosophy and work attitude of adaptability to the timing of observations, observing raptor activity in response to the particular physical and behavioral conditions at a given nest territory.

The same general recommendations would apply to locating effective observation points for monitoring raptor territories and nest sites; remaining attentive to the behavior and movement of falcons and other raptors within given territories, raptor monitors should be adaptable to moving to different vantage points within nesting territories to most effectively observe raptor behavior and nesting phenology. Based on 21 years of data, the raptor monitoring protocol, photo points, and GPS coordinates for watch spots over the past 4 years, raptor monitors should have the basic framework necessary to set up observation points as dictated by the behavior and nest selection of given raptor pairs and young in nest sites. This standardized framework, in combination with flexibility to the physical and behavioral conditions within a specific nest territory, should allow the raptor monitor to consistently and effectively observe raptor nesting throughout the breeding season.

A final management recommendation relates to the management of raptor monitoring databases in the monument. From 2004-2006, Jason Herynk served as the Inventory & Monitoring (I&M) Database Manager stationed at PINN. His efforts were critical in converting many of the raptor monitoring databases from FileMaker Pro to MS Access and in managing ArcMap and GIS layers for the program. Jason's position was terminated in early 2006, and since then Dave Press has served as the network I&M data manager at Fort Cronkhite. Dave has provided invaluable support to the management of raptor monitoring databases at PINN consistent with I&M policies and procedures, and I would strongly recommend that incoming monitors communicate regularly with Dave

Press in regards to any confusions and complexities that arise in the management and maintenance of the MS Access databases and FileMaker Pro databases for the program that have not yet been converted to MS Access.

Research Recommendations

In regards to raptor monitoring research needs at the monument, I would offer several further recommendations. Historically, the raptor monitoring program has focused on managing for the protection of cliff-nesting raptors, particularly prairie falcons and golden eagles, because they are species of concern in California and are directly impacted by climbing advisories in the monument. The standardization of raptor monitoring procedures and raptor advisories, and effective communication with hikers and climbers at the monument, has helped to ensure the continuing breeding success of prairie falcons and golden eagles, and the return of breeding peregrine falcons to the monument. However, four sensitive species of concern in California – Cooper’s hawks, sharp-shinned hawks, white-tailed kites, and long-eared owls – have received little monitoring attention historically, despite the confirmation of active nesting for all of these species in the monument in 2006-2007 and in the past. These four raptor species all tend to reproduce along riparian corridors where many of the trails are located and potential disturbance of nest sites by visitors should be studied further. As the staff at PINN prepare for the management of the Pinnacles Ranch and former Kingman property extending out to Highway 25, the need for further monitoring of forest and woodland nesting raptors becomes even more important, because much of this new monument property contains riparian corridors and oak/pine woodlands suitable for accipiter, kite, and long-eared owl nesting habitat. Allocating funds for an additional raptor monitoring position focused on accipiter, kite, and long-eared owl monitoring would allow the visitor impacts on these species to be documented more clearly, and would help justify seasonal closures of riparian and woodland areas determined to be essential nesting habitat for the accipiters, kites, and owls.

The recent acquisition of the Kingman property may provide the monument with nesting habitat for another raptor species: burrowing owls. This owl species is also listed as a sensitive species of concern in many western states including California (Martell 1990, James 1992, Haug et al. 1993), with local populations in California – particularly near the San Francisco Bay and the Central Valley – declining steeply in recent years (Johnson 1992). The first record for burrowing owls in the monument was documented in October 2006 near the Bear Creek Headwaters. These owls may inhabit the rangeland and fields between the Pinnacles Campground and Highway 25, and this property should be inventoried for their presence prior to the implementation of management decisions for the acquired land. The nest burrows for this species are visible, with prey matter, feathers, and cow manure decorating the entrances to active burrows clearly. I would recommend funding for a biological science technician position to document for presence of active burrowing owl burrows in acquired rangeland habitat. Alternatively, the raptor monitor’s position could be extended through September or October, as active burrows will likely produce fledgling owls in July, which should perch very visibly near burrows. This

would at least provide preliminary evidence of burrowing owl presence or absence in the monument.

I would also recommend the color banding and GPS tagging of the entire prairie falcon population as a possibility. Radio telemetry studies conducted from 2002-2005 revealed important preliminary data about the prairie falcon population at PINN never confirmed before: the population is resident in or near the monument throughout the year, and all radio-tracked falcons feed primarily on prey items just south and west of the monument boundaries, with no evidence of adult falcons feeding north or east of the monument boundaries (Buranek 2006). This information suggests that alteration of habitat south and west of the monument boundaries, near the town of Soledad, could have significant negative consequences for a viable, long-term population of prairie falcons at PINN. Color banding and GPS tagging of falcons in the monument would build upon these results and provide much more extensive information on the raptors, including individual movements of single and paired falcons within breeding seasons and from year to year, rates on short- and long-term pair bonds, rates of birds returning to nest in the monument annually, loyalty of individual falcons to specific territories, and fledgling survivorship and dispersal. Additionally, GPS tagging would reveal more conclusively where the falcon population resides near the monument during non-breeding seasons, and any potential threats to prairie falcon productivity in their feeding ranges, including rodenticide, pesticide, and land development pressures. Color banding and GPS tagging could provide valuable tools for continuing to broaden our experience and understanding of the prairie falcons as a sensitive species, a management concern for the monument and surrounding region, and an amazing bird of prey that returns to breed at the monument annually.

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Appendix 1: Volunteer Support

This season's full-time Raptor Monitor was Gavin Emmons. Park employee volunteers and staff assisted me in the field when available, and forwarded observations of raptors to me through wildlife observation cards and personal communications.

The total number of observation hours by staff was 904 hours. Volunteers' observation hours totaled 60. Total time in the field was 964 hours.

Appendix 2: Documentation of Changes in Data Collection Methods

Through the course of the 2007 season, several changes were made to procedures for collecting field data and entering observations into raptor monitoring databases, and relevant sections in the Raptor Monitoring Protocol will be revised accordingly. Primarily these changes were put in place to address Inventory & Monitoring standards for data management and storage, the need for a standardized means of collecting raptor observations in the field, and the development of a more efficient workflow and structuring of existing MS Access databases. These are listed here as general raptor monitoring metadata, as “works in progress” in the process of being finalized.

Through the 2007 season, raptor observations and breeding summaries were entered into the existing “Breeding Raptors” Access raptor database. A new Access database format is being developed by Dave Press with the assistance of Gavin Emmons, to create a more efficient workflow in entering raptor observations and to create a more effective means of storing and archiving past years of monitoring data. The existing “Photolog.FP5” database will also be transferred from FileMaker to Access format and incorporated into the “Breeding Raptors” database to provide more data consistency and availability in the Access format. SOP #8 in the Raptor Monitoring Protocol is simultaneously being revised to reflect these changes and to address I&M standards for scientific rigor and data management.

To provide a more standardized approach to data collection, a datasheet has been created – a Word document called “Raptor Datasheet” – that monitors will use in tandem with field notebooks when recording raptor observations. The datasheet acts as a distillation of observations documented in field notebooks, and generally follows the data entry format contained within the “Breeding Raptors” Access database. Use of the datasheet will be formalized beginning in the 2008 season. The datasheet is electronically stored in the “important data files” folder (see below), and guidelines for using the datasheet have been added to the SOP #3 in the Raptor Monitoring Protocol, with relevant sections in other SOPs also updated.

A subfolder in the “database folder” titled “important data files” was created to provide a central location for some of the most important files not attached directly to theme folders in the Breeding Raptors folder. The folder contains a subfolder titled “PRFA Occupancy Data” that includes an Access database called “Fecundity,” as well as Excel spreadsheets detailing prairie falcon occupancy by territory, season, and day for the 2002-2007 seasons. The Access database details breeding summary data for prairie falcon pairs for each season over the 21-year period of the program. These data were compiled to provide for statistical analyses currently being finalized by staff at San Francisco State University. The “important data files” folder also contains a subfolder titled “CNDDDB” that stores electronic copies of the 25 data sheets printed and mailed to the California Department of Fish and Game California Natural Diversity Database for the 2007 season.

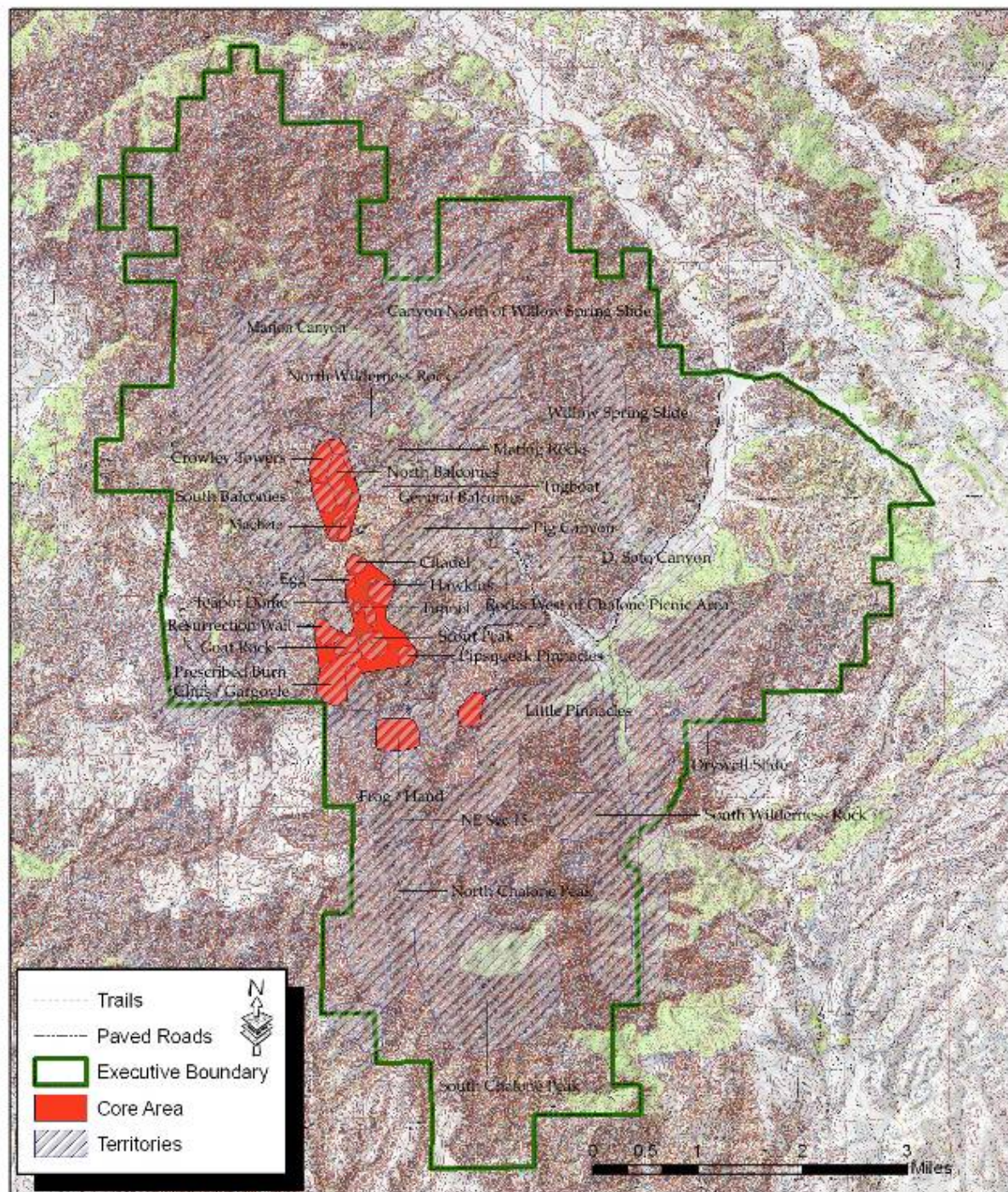
The “RaptorPoster” Adobe Illustrator file is also contained in the “important data files” folder, and is an electronic copy of the printed poster that was presented at the ESA/SER Joint meeting in San Jose in 2007. The “Photolog.FP5” database (mentioned above) and two Excel spreadsheets – “raptor summary data with graphs” and “Raptor Nests” – are also in this folder. The former spreadsheet contains a summary table of all statistical data related to prairie falcon breeding at Pinnacles over the 21-year monitoring program, as well as statistical data specifically for core nesting areas affected by climbing advisories and high visitor use. The latter spreadsheet is a summary of all active raptor nests listed by year, species, and nest codes.

**Appendix 3: Parkwide Raptor Territories at PINN with
Core & Non-Core PRFA Territories Labeled.**

Pinnacles National Monument

Raptor Monitoring Core Area and Territories

National Park Service
U.S. Department of the Interior



Appendix 4: Nest Phenology and Success for Prairie and Peregrine Falcons, and Eagles.

Nest Species	Territory Occupied	Nest Code	Arrival Date	Begin Incub.	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Eggs	# of Nestlings	Known Fledglings	Possible Fledglings	Occup. Status
PRFA	Cyn N of Willow Spgs	*WSS	<1/22										Occupied
PRFA	Citadel	*MAC	<1/14										Occupied
PRFA	Crowley	CT-1	<1/13	<3/31	4/17-19	5/28-30			4	4	4	4	4
PRFA	D. Soto Canyon	DS-4	<1/13	<4/15	4/15-17	5/26-28			4	4	4	4	4
PRFA	Drywall	DRY-2	<1/10	<3/25	4/29-5/1	6/9-11			3	3	1	1	1
PRFA	Egg	*TD/TU	<1/9										Occupied
PRFA	Frog / Hand												Not Occ.
PRFA	Goat / Resurrection	RW-5	<1/9	<3/24	4/22-24	6/2-4			4	4	4	4	4
PRFA	Hanging Valley												Not Occ.
PRFA	High Pks Trl W of CPA	*DS	<1/13										Not Occ.
PRFA	Little Pinnacles	LP-8	<1/15	<4/1	5/6-8	6/16-18			4	4	4	4	4
PRFA	Machete	MAC-4	<1/14	<3/30	5/1-3	6/11-21			5	5	5	5	5
PRFA	Marion Canyon	*NARR	<4/2										Occupied
PRFA	Mating Rocks												Not Occ.
PRFA	Narrows	*MAR	<4/2										Occupied
PRFA	NE Sec 15	NES-2	<1/26	<4/19				<5/10		0	0	0	Failed
PRFA	North Balconies	*SGB	<1/13										Occupied
PRFA	North Chalone	*NES	<1/26										Occupied
PRFA	North Wilderness Rock												Not Occ.
PRFA	Pig Canyon	PIG-6	<1/17	<3/26	4/24-28	6/4-8			2	2	2	2	2
PRFA	Pipsqueak Pinnacles	*SP	<1/24				<3/5						Abandon
PRFA	Prescribed Burn Cliffs												Not Occ.
PRFA	Scout Peak	*PP	<1/24				<3/5						Abandon
PRFA	South Balconies	SGB-15	<1/13	<3/30	5/1-3	6/11-13			4	4	4	4	4
PRFA	South Chalone	SC-1	<4/19	<6/11				<6/11	1	0	0	0	Failed
PRFA	South Wilderness Rock												Not Occ.
PRFA	Teapot Dome	TD-1	<1/9	<3/24	4/26-27	6/6-7			5	5	5	5	5
PRFA	Tugboat												Not Occ.
PRFA	Tunnel	*EGG/TD	<1/9										Occupied
PRFA	Willow Spring Slide	WSS-2	<1/22	<4/15				<5/6		0	0	0	Failed
PEFA	Hawkins	HP-5	<1/7	<3/24	4/24-26	6/4-6			3	3	3	3	3
GOEA	Eucalyptus Grove	EG-3	<1/14	<2/11	3/9-16	5/15-27			2	2	1	2	2
GOEA	North Chalone West	NCW-1	<2/24	<2/26	4/1-8					1	0	1	1

(Note: for the "Occup. Status" column, # refers to possible fledglings, "Occupied" = territorial occupation, "Not Occ." = no occupation, "Failed" = failed nest, "Abandon" = territory abandoned after confirmed occupancy, "Unknown" = breeding confirmed (see nest code) or likely, but nest status unknown. For the "Nest Code" column, * refers to territorial links for raptor pairs occupying more than one territory.)

Appendix 5: 2007 Nest Phenology and Success for American Kestrels and Buteos

Nest Species	Territory Occupied	Nest Code	Arrival Date	Begin Incub.	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Eggs	# of Nestlings	Known Fledglings	Possible Fledglings	Occup. Status
AMKE	Crowley	CT-7	<3/2		<6/2				1	1		1	1
AMKE	D. Soto Canyon		<2/5										Occupied
AMKE	Discovery Wall	DIS-4			5/12-16					2		2	2
AMKE	Drywall	DRY-3	<1/10		<5/9								Unknown
AMKE	Kingman Land North	KLN-3	<3/23	<5/25	<6/7								Unknown
AMKE	Kingman Land North	KLN-5	<3/23	<5/25	<6/7				1	1		1	1
AMKE	Little Pinnacles	LP-9	<2/25		<6/1								Unknown
AMKE	Marion Canyon		<5/17			5/31-6/2				3	3	3	3
AMKE	Mating Rocks		<1/20										Occupied
AMKE	McCabe Canyon		<4/6										Occupied
AMKE	NE Sec 15		<3/14										Occupied
AMKE	North Chalone		<1/26										Occupied
AMKE	Prescribed Burn Cliffs	PB-3	<2/19	<5/16	<6/9				1	1		1	1
AMKE	South Balconies		<2/11										Occupied
RTHA	Crowley Drainage	*NB	<1/13										Occupied
RTHA	Eagle Rock		<3/18										Occupied
RTHA	Frog / Hand	*PB	<1/30										Occupied
RTHA	Grassy Canyon	*SWN	<2/1										Occupied
RTHA	Highway 25 South	+HWYS-1	<2/26	<3/30	4/1-4	5/19-27			2	2	2	2	2
RTHA	Highway 25 South	+HWYS-2			4/18-21	5/25-27			2	2	2	2	2
RTHA	Kingman Land North	KLN-2	<1/14	<3/30	4/21-25	6/5-6			1	1	1	1	1
RTHA	Kingman Land North	KLN-4	<3/23	<4/20	4/21-25	6/4-6			2	2	2	2	2
RTHA	Kingman Land North	KLN-6	<3/15		5/11-15	6/26-28			1	1	1	1	1
RTHA	Lower Condor Gulch	LCG-1	<1/7	<4/14	5/4-8	6/18-22			2	2	1	2	2
RTHA	North Balconies	*CD	<1/13										Occupied
RTHA	Prescribed Burn Cliffs	*HAND	<1/30										Occupied
RTHA	Regan Ranch Canyon		<4/20										Occupied
RTHA	S Wilderness – N End	SWN-2	<2/1	<4/12	4/27-5/1	6/12-14			2	2	2	2	2
RTHA	Upper Condor Gulch	*LCG	<1/7										Occupied
RTHA	Western Front	WF-1	<2/21	<4/28	4/25-30	6/11-12			2	2	1	2	2
RSHA	Kingman Land South	KLS-5	<2/11	<4/20				5/6-29					Failed
RSHA	McCabe Canyon	MC-2	<2/11		4/26-28	6/10-12			2	2	2	2	2
RSHA	Pinnacles Campground	PCG-2	<1/10	<4/20	4/28-30	6/12-14			2	2	1	2	2
RSHA	Regan Ranch Canyon	RR-1	<3/23	<4/20	4/22-23	6/6-7			1	1	1	1	1
RSHA	South Wilderness Trail	SWT-4	<2/28		4/23-25	6/7-9			2	2	1	2	2

(Note: for the “Occup. Status” column, # refers to possible fledglings, “Occupied” = territorial occupation, “Not Occ.” = no occupation, “Failed” = failed nest, “Unknown” = breeding confirmed (see nest code) or likely, but nest status unknown. For the “Nest Code” column, * refers to territorial links for raptor pairs occupying more than one territory, and + refers to nests confirmed near but outside of the park boundaries.

Appendix 6: 2007 Nest Phenology and Success – Accipiters, Kites, Owls (Barn Owls, Long-eared Owls, Great-horned Owls, and Western Screech-owls), Cathartids, and Corvids

Nest Species	Territory Occupied	Nest Code	Arrival Date	Begin Incub.	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Eggs	# of Nestlings	Known Fledglings	Possible Fledglings	Occup. Status
COHA	Balconies Cave Trail	BCT-1		<5/2	<6/17			6/18-27			0	0	Failed
COHA	Grassy Canyon	GC-2	<1/10	<5/25				5/26-6/12			0	0	Failed
COHA	Kingman Land North	KLN-7	<5/5	<5/23	5/24-28	6/25-26			4	4	4	4	4
COHA	Kingman Land South	KLS-4	<1/28	<4/20	6/3-5				2	2			Unknown
COHA	Marion Canyon	MAR-4		<5/17	6/5-8	7/6-7			2	2	1	2	2
COHA	Upper Bear Gulch	UBG-4		<5/27	6/8-12	7/10-12			2	2	1	1	1
SSHA	Upper Bear Gulch	UBG-3	<1/23	<5/12	6/4-7	7/1-5			3	3	2	3	3
WTKI	Double Gates												Not Occ.
WTKI	Jawbone Canyon												Not Occ.
WTKI	Kingman Land North		<3/15										Occupied
WTKI	Kingman Land South	KLS-6	<2/11	<5/5				5/30-6/10					Failed
WTKI	Marion Canyon												Not Occ.
WTKI	McCabe Canyon		<2/5										Occupied
BNOW	D. Soto Canyon		<1/13										Occupied
LEOW	Chalone Picnic Area		<2/18										Occupied
LEOW	Marion Canyon	MAR-3		<4/2	4/19-26	5/24-31			3	3	2	3	3
GHOW	Kingman Land North	KLN-1	<3/15	<3/23	4/12-19	5/30-6/7			1	1	1	1	1
GHOW	Pig Canyon		<2/6										Occupied
GHOW	Pinnacles Campground	PCG-1		<3/11	4/3-10					1	0	1	1
GHOW	Pipsqueak Pinnacles		<2/17										Occupied
GHOW	Upper Condor Gulch		<1/7										Occupied
WESO	Headquarters		<2/6										Occupied
WESO	High Pks Trl W of CPA		<3/26										Occupied
TUVU	Narrows	NARR-4		<4/2	6/6-9	7/16-23			2	2	0	2	2
CORA	Crowley	CT-3	<3/31										Unknown
CORA	D. Soto Canyon	DS-5	<4/15	<4/15									Unknown
CORA	Drywall	DRY-9	<3/25	<4/18		5/25-6/12			3	3	3	3	3
CORA	Hanging Valley	HV-1		<4/19									Unknown
CORA	NE Sec 15	NES-3	<4/5		<5/19				1	1			Unknown
CORA	North Wilderness Trl	NWT-3	<5/2	<5/2									Unknown
CORA	Prescribed Burn Cliffs		<1/30										Occupied
CORA	South Balconies		<2/11										Occupied

(Note: for the “**Occup. Status**” column, # refers to possible fledglings, “Occupied” = territorial occupation, “Not Occ.” = no occupation, “Failed” = failed nest, “Unknown” = breeding confirmed (see nest code) or likely, but nest status unknown. For the “**Nest Code**” column, * refers to territorial links for raptor pairs occupying more than one territory.

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