



Raptor Breeding Season Report for Pinnacles National Monument – 2009

Natural Resource Technical Report NPS/SFAN/NRTR—2010/307



ON THE COVER

Prairie Falcon Fledgling, Discovery Wall, Pinnacles National Monument, California.

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

Raptor Breeding Season Report for Pinnacles National Monument – 2009

Natural Resource Technical Report NPS/SFAN/NRTR—2010/307

Gavin Emmons
National Park Service
Pinnacles National Monument
5000 Highway 146
Paicines, CA 95043

April 2010

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

The National Park Service, Natural Resource Program Center publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate high-priority, current natural resource management information with managerial application. The series targets a general, diverse audience, and may contain NPS policy considerations or address sensitive issues of management applicability.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report are those of the author(s) and do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

This report is also available from the San Francisco Bay Area Network (<http://www.nature.nps.gov/im/units/SFAN>) and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/NRPM>) on the Internet.

Please cite this publication as:

Emmons, G. 2010. Raptor breeding season report for Pinnacles National Monument - 2009. Natural Resource Technical Report NPS/SFAN/NRTR—2010/307. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	iv
Tables.....	v
Appendices.....	vi
Executive Summary.....	vii
Acknowledgements.....	ix
Introduction.....	1
Study Area and Field Methods.....	3
Sample Design.....	3
Field Methods.....	4
Monitoring Schedule.....	6
Data Management.....	7
Climbing Advisories.....	7
Results.....	9
Prairie Falcons.....	9
Other Species.....	17
Climbing Management Actions.....	22
Education Opportunities.....	22
Summary.....	23
Public Interest Highlights.....	23
Discussion.....	25
Management Recommendations.....	25
Research and Monitoring Recommendations.....	25
Literature Cited.....	29

Figures

	Page
Figure 1. Core and non-core areas at Pinnacles National Monument.....	4
Figure 2. Setting up advisory sign. ©Gavin Emmons, 2006.	7
Figure 3. Prairie Falcon fledgling at South Balconies. ©Gavin Emmons, 2006.	10
Figure 4. Core vs. Non-Core Pinnacles PRFA Fledgling Productivity, 1984-2009.	14
Figure 5. Juvenile sharp-shinned hawk. ©Gavin Emmons, 2003.....	20
Figure 6. Long-eared owl adult near Chalone housing area. ©Gavin Emmons, 2006.	21

Tables

	Page
Table 1. Timing of nesting behavior of prairie falcons at Pinnacles National Monument.	6
Table 2. 2009 Pinnacles breeding raptor nesting productivity.	9
Table 3. 1984-2009 Pinnacles prairie falcon nesting productivity – core and non-core areas combined.....	10
Table 4. 2009 Pinnacles prairie falcon breeding summary.....	11
Table 5. 1984-2009 Pinnacles prairie falcon nesting productivity – core areas only.	15
Table 6. 1984-2009 Pinnacles prairie falcon nesting productivity – non-core areas only.	16

Appendices

	Page
Appendix A. 2009 nest phenology and success for prairie falcons.	35
Appendix B. 2009 nest phenology and success for peregrine falcons, American kestrels, golden eagles, and hawks.	37
Appendix C. 2009 nest phenology and success for accipiters, kites, and owls (barn owls, long-eared owls, great-horned owls, and Western screech-owls).....	39
Appendix D. Documentation of Changes in Data Collection Methods.....	41

Executive Summary

Pinnacles National Monument (“Pinnacles”) 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 trends in the number of occupied territories and productivity of nesting prairie falcons. Data on presence and diversity of other nesting raptors are also collected. 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 2009 breeding season and represents the 23rd year of monitoring at the monument.

To monitor falcons, field technicians survey all potential nest sites three times per breeding season spaced 21-28 days apart. Nests determined to be active were revisited to confirm rearing of nestlings and fledging of young. In 2009, monitoring was conducted from 3 January 2009 until 17 July 2009.

This year represented the 2nd most productive year for prairie falcon nesting in the past 23 years. Twelve territorial falcon pairs were documented this year with 11 pairs actively nesting. Of the 41 observed hatchlings, 37 were confirmed to have fledged. Observed breeding productivity during the 2009 breeding season was consistent with 23-year averages for other raptor species nesting in the monument, with 22 breeding records representing 6 raptor species in addition to prairie falcons. A peregrine falcon pair successfully nested and fledged 3 young in the Hawkins territory, marking the 5th consecutive year that a successful peregrine falcon nesting effort has been documented at Pinnacles in the last 50 years.

Two golden eagle nests were observed this year. One known nest in the monument produced 1 hatchling, with fledging possible but unconfirmed. A historically documented nest just outside of the monument produced 2 eaglets, with fledging confirmed for 1 young but likely for both. Nests for sensitive California species were recorded this season for Cooper’s hawks (*Accipiter cooperii*) and sharp-shinned hawks (*A. striatus*). Other nesting raptor species documented in the monument included red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*B. lineatus*), and American kestrels (*Falco sparverius*), with high productivity and numbers of nesting pairs observed for red-tailed hawks. No raptor detection was confirmed for white-tailed kites (*Elanus leucurus*) and long-eared owls (*Asio otus*) in the monument this year.

Acknowledgements

This program would not be as successful as it is without the eyes and ears of helpful Pinnacles employees. Therefore, I would like to thank the NPS employees for their help, encouragement, and passion for the raptors and wildlife diversity at Pinnacles. The many local climbers involved with Friends of Pinnacles also deserve my thanks for their ongoing support of resource protection and breeding raptors at the park and particularly their efforts to publicize and honor advisories in effect. Additionally, members of Friends of Pinnacles played a key role in shaping the success of the second annual Rockpile Rendezvous event this year. I would also like to extend my appreciation to the monument visitors, for their reports and observations on raptor sightings and for their appreciation and value of the importance of monitoring, managing, and protecting the nesting sites and breeding productivity of raptors in the monument.

I would like to thank Alacia Welch, Daniel George, Dan Ryan, Jess Auer, Scott Scherbinski, Paul Johnson, Brent Johnson, Linda Regan, and William Wright for contributing valuable observations on raptor territories and pair behavior in the monument. I am also grateful for Denise Louie's and Daniel George's support and efforts, in tandem with Marcus Koenen as the manager of the Inventory and Monitoring (I&M) Program, to keep the Pinnacles raptor monitoring program funded annually and on a permanent basis. Paul Johnson and Marcus Koenen also served as editors of the 2009 annual report and Amy Fesnock peer-reviewed the report, contributing greatly to a concise and efficient document consistent with I&M standards.

As the network I&M Data Manager, Dave Press deserves my thanks for his ongoing efforts in developing more effective data entry and management models for recording, storing, and archiving raptor monitoring data for Pinnacles. Daniel George has also provided valuable assistance by exporting the legacy raptor data into the current raptor database and streamlining the database for more inclusive and efficient documentation of raptor behavior and observations. The following staff shared their experience, excitement, and observations of raptors with me throughout the season, granting me a more complete picture of raptor breeding and diversity at the monument, and assisted in the effective management of raptor advisory areas: Brett Hergert, Pete Fonken, Debbie Simmons, Wendy Lanier, Michael Rupp, Tessa Christensen, and Russell Jones.

Introduction

Pinnacles National Monument (“Pinnacles”) 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 Pinnacles 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 Pinnacles sensitive to human disturbance include prairie falcons (Fyfe et al. 1976; Ogden and Hornocker 1977; Harmata et al. 1978; Sitter 1983; Steenhof 1998), peregrine falcons (particularly in remote locations: see Hickey 1942; Bond 1946; Hickey 1969; Steenhof 1998), golden eagles (Newton 1979, 1990; Scott 1985; Steidl et al. 1993; Watson 1997; Steenhof et al. 1997; Kochert et al. 1999), 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 Pinnacles, with an average of 9.5 nesting pairs per year documented from 1984-2008. 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 (USDI 1979), habitat destruction and nest site limitation (Becker and Ball 1981; Steenhof et al. 1997), and proximity to major roadways (Platt 1974; Boyce 1982).

The main sources of human disturbance of nesting raptors at Pinnacles 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 (Fyfe et al. 1976; Olsen and Olsen 1978; Becker and Ball 1980; Suter and Jones 1981; Porter et al. 1987; Holthuijzen 1990; Cade et al. 1996; White et al. 2002). 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 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 areas and non-core areas.

Core areas are locations at Pinnacles 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 Pinnacles suitable for cliff-nesting. The core vs. non-core sampling design is detailed further in the Methods section.

A secondary benefit of the monitoring program is that with incidental observations during falcon surveys and a small investment of additional time for area searches during foot travel between falcon activity sites, a substantial amount of information can also be gathered on other raptor species at Pinnacles, particularly sensitive California species 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 23-year raptor monitoring program precludes statistical and trend analysis, the presence data nevertheless provide valuable information on the diversity and location of breeding raptors at Pinnacles. This has been used for planning purposes relating to the revision of the General Management Plan (GMP), and for guiding timing of routine maintenance activities.

Study Area and Field Methods

Pinnacles is located in the Gabilan Mountains of the central Coast Range of California and encompasses 10,694 hectares (26, 425 acres) with elevation ranging from 244 to 1007 meters (800 to 3304 feet). 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 (47° F to 73° F). The average yearly rainfall is 44 cm (17.3 inches), with the majority of rainfall occurring from November to April (NOAA 1997).

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

Sample Design

The prairie falcon monitoring focuses on core areas and non-core areas. Core areas (Figure 1) are locations in Pinnacles that can support prairie falcon cliff-nesting, and where impacts to raptors due to rock climbing activities 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.

Non-core areas refer to all other areas within the monument that can support prairie falcon cliff-nesting. For 2003-2009, non-core area sampling has also been conducted through a census. This has been possible because of comprehensive historical data on prairie falcon nest sites gathered over the past 23 years. In addition, GIS modeling completed in 2008 confirmed that all potential prairie falcon nesting areas in the monument have been surveyed during the past 6 years.

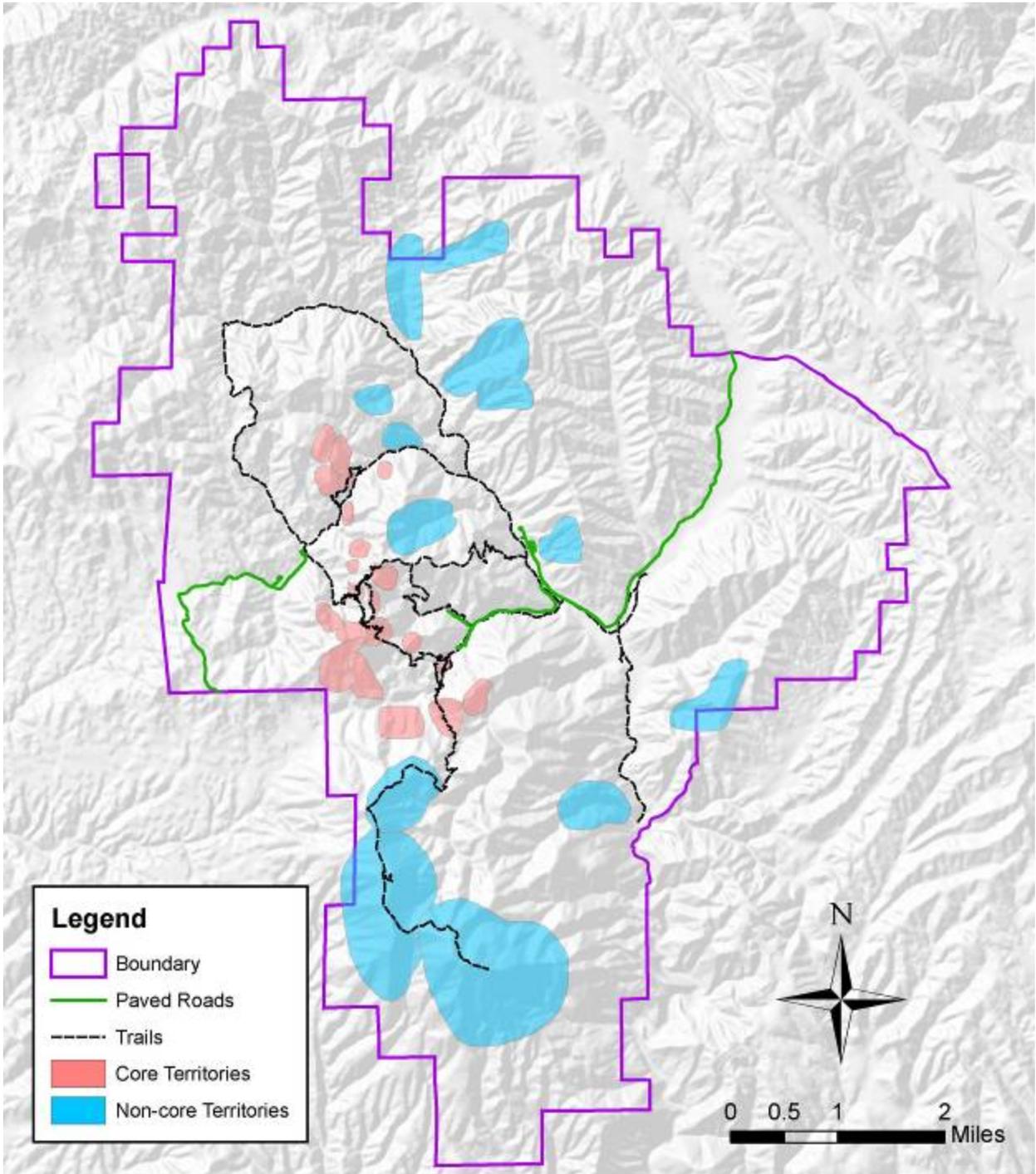


Figure 1. Core and non-core areas at Pinnacles National Monument.

Field Methods

Survey methods followed the standard operating procedures detailed in the Raptor Monitoring Protocol for Pinnacles National Monument, California (Emmons et al. In Prep). While the protocol focuses on monitoring population and productivity trends of prairie falcons, presence and productivity data for 14 other cliff- and riparian-nesting

raptor species is noted where possible in order to provide the monument with proactive management information. Many of these species are considered “species at risk” but do not currently have official federal or state protection status (CDFG 2009).

Cliff-nesting Raptors

Besides prairie falcons, peregrine falcons are the other obligate cliff-nesting “species at risk” at Pinnacles. Potential and established cliff-nesting raptor territories in core and non-core areas were surveyed using Swarovski STS-60 HD 20-60x spotting scopes and Zeiss Victory FL 10x42 binoculars. Observations were made from the locations that provided the best view of an eyrie or a territory. A Magellan Triton 500 GPS unit was used to plot every observation point. Field data were documented with standardized datasheets and field notebooks (Appendix D).

Three- to five-hour observation periods are commonly recommended to document territory occupancy of peregrine falcons and prairie falcons (USFWS 1984; Cade et al. 1996; Smith et al. 2006). Steenhof et al. (1999) employed 2-hour observation periods during point surveys to document territory occupancy of prairie falcons in the Snake River region of Idaho. For a potential prairie falcon territory to be classified as unoccupied at Pinnacles, we adopted a conservative standard of visiting potential nest sites at least three times per breeding season spaced 21-28 days apart to confirm territorial occupancy, courtship, and incubation of eggs within a breeding season (Fuller et al. 1981; Fraser et al. 1983; Steenhof 1998). Survey duration was ultimately dependent upon visibility but at least three 4-hour surveys (12 hours total) were required to verify that “no birds” were present. Nests determined to be active were revisited to confirm rearing of nestlings and fledging of young. Nests in core 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 (Steenhof and Kochert 1982; Anderson and Squires 1997; Steenhof 1998), our protocol was to continue surveys until all young raptors were confirmed as fledged.

During the prairie falcon breeding season status was asserted as follows:

Territories: Territorial behavior included perching, flying, territorial disputes and defense, stooping and scold calling, and roosting locations.

Courtship: Courtship behavior included copulation, food drops and swapping, and potential nest site inspections and preparation.

Incubation: Incubation status was determined by observing prairie falcons flying into a nest hole and not re-emerging for extended periods of time. During this time, egg counts were made whenever possible (e.g. when lighting conditions allowed and when incubating falcons temporarily left the nest during food drops and/or 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 of incubation and 20 minutes or more not incubating the eggs). Hard incubation was characterized by the adult falcons – primarily the females – incubating a full clutch of eggs for hours in duration.

Hatchlings: 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.

Fledging: Fledging was confirmed by seeing young perched and/or in flight away from the nest site. Fledging dates were estimated by the coordination and strength of flight, the size of perches, and the amount of vocalization during flight.

Riparian-nesting Raptors

Riparian-nesting raptor activity was documented en route to observation points for cliff-nesting raptor monitoring. Additionally, historical riparian raptor nest sites were monitored for raptor presence, and Pinnacles staff/visitor observations of breeding raptor activity were checked for confirmation of raptor presence.

Potential and established riparian-nesting raptor territories were surveyed using spotting scopes (20-60x) and binoculars (10x42). Observations were made from locations where breeding raptor activity was documented and raptor nest sites were most visible. A Magellan Triton 500 GPS unit was used to plot observation points.

For each riparian-nesting raptor species all riparian corridors with suitable nesting structure were visited at least 2 times per breeding season spaced 21-28 days apart. Visits were scheduled to correspond with general phenology patterns for egg incubation and nesting per species to allow for the highest possibility of confirming territorial occupancy and active nesting of raptor species. Active nest sites were revisited approximately every 28 days to document rearing of nestlings and fledging of young.

Monitoring Schedule

The monitoring season started on 3 January and continued through the end of the nesting season, 17 July (Table 1).

Table 1. Timing of nesting behavior of prairie falcons at Pinnacles National Monument.

Behavior	January	February	March	April	May	June	July
Territorial Falcons							
Courtship Behavior							
Nesting							
Fledging							

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.

Data Management

Data are entered into a MS Access database designed by the Data Manager for the Bay Area Network Inventory and Monitoring Program. Original data sheets are archived with Pinnacles Resource Management. An annual (static) copy of the Access database is archived on the Golden Gate National Recreation Area computer network drive. Nest data are also submitted to the CDFG California National Diversity Database, and the Santa Cruz Predatory Bird Research Group.

Climbing Advisories

Climbing advisories went into effect by mid-January. Informational signs were established near territories occupied by prairie falcons at least once during the preceding three years. Visitors were advised to avoid these areas but compliance was voluntary. Advisory areas with posted signs (Figure 2) included the Balconies, Hawkins, Scout Peak, Frog/Hand, Discovery Wall, and Little Pinnacles territories.



Figure 2. Setting up advisory sign. ©Gavin Emmons, 2006.

Results

During the 2009 field season, Pinnacles staff spent 772 hours in the field to make raptor observations. Volunteers contributed 100 hours of time in the field to make observations. Observers documented 11 territorial raptor species at Pinnacles. Of these, eight species were documented as breeding at Pinnacles (Table 2) including five species of concern tracked by the California Natural Diversity Database (CDFG 2009). For all breeding raptor species, seven previously undocumented nest sites were confirmed.

Table 2. 2009 Pinnacles breeding raptor nesting productivity.

Species	Territorial Pairs	Nesting Pairs	Successful Nests	# Fledglings	# Fledglings / Nest
Prairie Falcon *	12	11	10	37	3.7
Peregrine Falcon *	1	1	1	3	3
Golden Eagle *	2	2	2	3	1.5
Red-tailed Hawk	12	8	7	13	1.9
American Kestrel	13	5	3	7	2.3
Red-shouldered Hawk	5	2	1	3	3
Cooper's Hawk *	4	3	3	8	2.7
Sharp-shinned Hawk *	2	1	1	4	4
Western Screech-Owl	1	0	0	0	0
Barn Owl	1	0	0	0	0
Great-horned Owl	7	0	0	0	0

* Species of Concern tracked by California Natural Diversity Database.

Prairie Falcons

Occupied Territories

Through the 2009 season 12 territorial pairs of prairie falcons (Figure 3) were confirmed over the course of the breeding season (Table 3). This number is comparable to the average territorial occupancy of 11.8 territories from 1984-2008. Of these, one pair did not nest or produce young this year. A single pair actively perched and defended both the Willow Spring Slide and Canyon North of Willow Springs territories early in the breeding season, but abandoned both areas by the middle of March.



Figure 3. Prairie Falcon fledgling at South Balconies. ©Gavin Emmons, 2006.

Table 3. 1984-2009 Pinnacles prairie falcon nesting productivity – core and non-core areas combined.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Hatchlings	# Hatchlings / Nest	# Fledglings	# Fledglings / Nest
1984	10	9	8	30	3.8	27	3.4
1987	6	4	4	13	3.3	10	2.5
1988	12	9	8	24	3	24	3
1989	12	12	9	24	2.7	21	2.3
1990	14	10	8	31	3.9	29	3.6
1991	14	11	10	34	3.4	34	3.4
1992	13	11	10	38	3.8	34	3.4
1993	13	12	10	39	3.9	35	3.5
1994	13	13	12	45	3.8	42	3.5
1995	13	11	8	24	3	24	3
1996	12	10	9	35	3.9	34	3.8
1997	12	8	6	26	4.3	26	4.3
1998	10	7	0	0	0	0	0
1999	10	8	6	25	4.2	25	4.2
2000	8	8	7	22	3.1	22	3.1
2001	10	10	7	24	3.4	24	3.4
2002	11	9	7	26	3.7	22	3.1
2003	12	9	8	33	4.1	32	4
2004	12	11	9	36	4	33	3.7
2005	13	10	9	29	3.2	24	2.7
2006	15	14	10	35	3.5	30	3
2007	14	12	9	35	3.9	33	3.7
2008	12	5	4	12	3	12	3
2009	12	11	10	41	4.1	37	3.7
Averages (1984- 2007)	11.8	9.8	7.8	28.4	3.5	26.4	3.2

Core Area: In 2009 there were seven territorial prairie falcon pairs within the core area. This number is similar to the number of territorial falcon pairs in the core area over the last four years.

Annual Productivity

Eleven of the 12 pairs nested. Thirty-seven nestlings fledged from the ten successful nests (Tables 3, 4). The number of fledglings was higher only in 1994 (Table 3, Figure 4). High numbers documented in 1990 through 1994 represented the period of highest prairie falcon productivity on record. Following the very low productivity documented in the 2008 season, the high falcon productivity in 2009 may have represented a “rebound” year in which higher prey availability allowed for increased nesting success and feeding of nestlings. For the 2009 season rainfall was at average levels and monitoring efforts were on par with historical levels.

Table 4. 2009 Pinnacles prairie falcon breeding summary.

Territory	Nest Used/ Last Year Used	# Eggs Laid	# Young Hatched	# Young Known/ Fledged
Drywall	DRY-10/2006	4	4	4/ 4
Crowley Towers*	CT-4/ 2006	5	5	5/ 5
Pig Canyon	PIG-2/ 2001		5	5/ 5
Little Pinnacles*	LP-8/ 2007		1	1/ 1
Discovery Wall*	DIS-3/ NEW	5	5	5/ 5
South Balconies*	SGB-16/ 2008	1	0	0 Note: Nest abandoned prior to hatch.
Goat Rock*	GOAT-3/ NEW		5	5/ 5
Machete Ridge*	MAC-4/ 2007		3	3/ 3
D. Soto Canyon	DS-2/ 2005			
Egg*	EGG-1/ 2005	5	5	2/ 2
North Chalone	NC-1/ 2006		5	5/ 5

*nests within the core area.

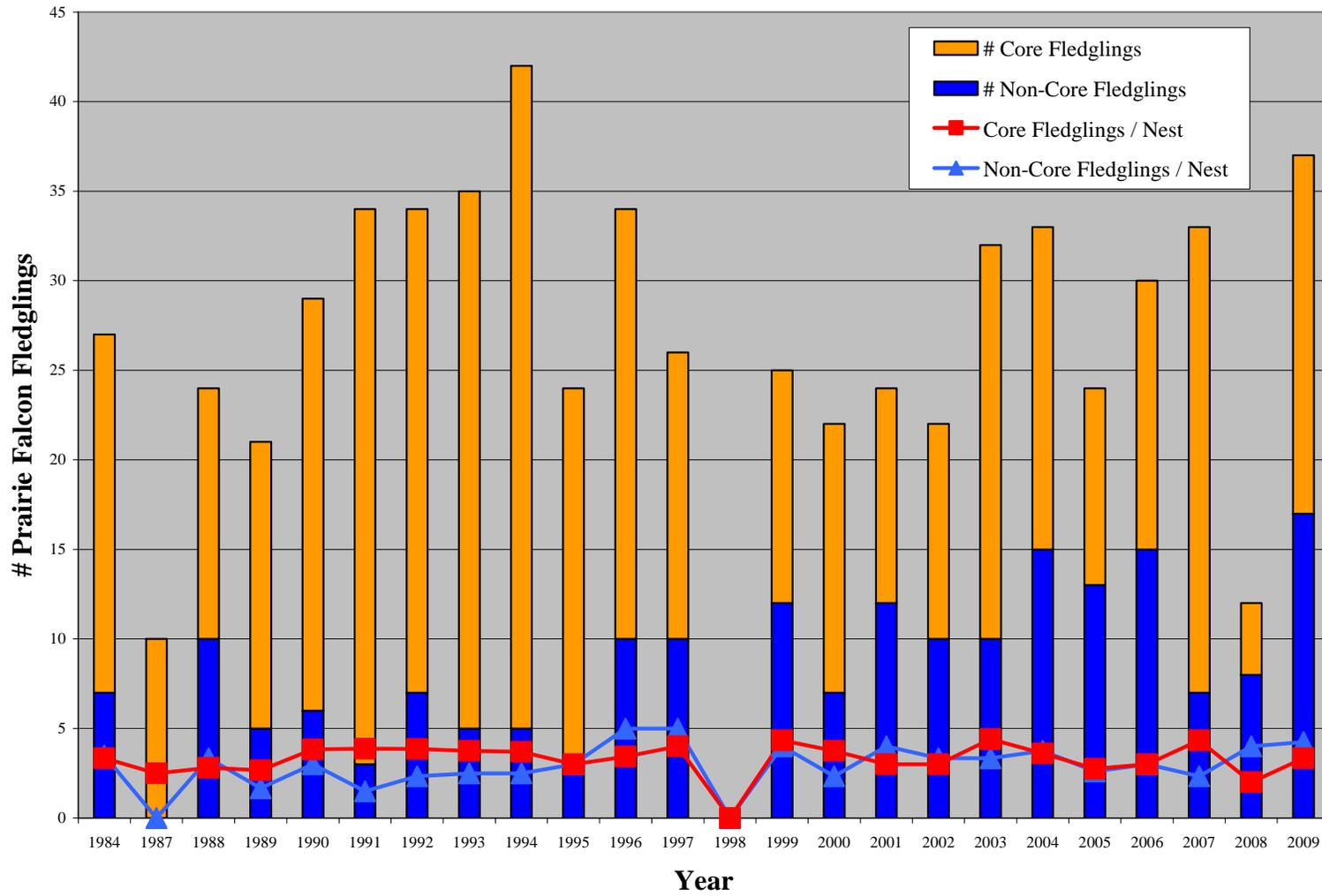


Figure 4. Core vs. Non-Core Pinnacles PRFA Fledgling Productivity, 1984-2009.

From the 10 successful nest sites, 37 total possible fledglings were produced. Nesting falcon pairs and nest productivity within core areas this season were consistent with the 23-year average. Six successful nest sites produced 20 total fledglings and 3.3 fledglings per nest, compared to the 23-year averages of 5.3 successful nests, 18.2 total fledglings, and 3.3 fledglings per nest (Table 5).

Table 5. 1984-2009 Pinnacles prairie falcon nesting productivity – core areas only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	7	6	6	22	3.7	20	3.3
1987	5	4	4	13	3.3	10	2.5
1988	8	6	5	14	2.8	14	2.8
1989	8	8	6	16	2.7	16	2.7
1990	9	7	6	23	3.8	23	3.8
1991	9	8	8	31	3.9	31	3.9
1992	9	7	7	29	4.1	27	3.9
1993	10	9	8	34	4.3	30	3.8
1994	10	10	10	38	3.8	37	3.7
1995	10	9	7	21	3	21	3
1996	9	8	7	28	4	24	3.4
1997	8	6	4	16	4	16	4
1998	7	5	0	0	0	0	0
1999	6	5	3	13	4.3	13	4.3
2000	5	5	4	15	3.8	15	3.8
2001	7	6	4	12	3	12	3
2002	5	5	4	12	3	12	3
2003	5	5	5	22	4.4	22	4.4
2004	7	7	5	21	4.2	18	3.6
2005	6	5	4	12	3	11	2.8
2006	7	6	5	17	3.4	15	3
2007	6	6	6	26	4.3	26	4.3
2008	7	3	2	4	2	4	2
2009	7	7	6	24	4	20	3.3
Averages (1984-2007)	7.4	6.4	5.3	19.3	3.4	18.2	3.3

Core Areas: Of the seven territorial falcon pairs in the core areas in 2009, six nested successfully, producing an average of 3.3 fledglings per nest (Table 5). These numbers are consistent with the 1984-2009 averages of 5.3 successful nests per season and 3.3 fledglings per nest.

Non-Core Areas: Of the five territorial falcon pairs in the non-core areas in 2009, four nested successfully, producing an average of 4.3 fledglings per nest (Table 6). These numbers are higher than the 1984-2009 averages of 3.2 successful nests per season and 2.9 fledglings per nest.

Table 6. 1984-2009 Pinnacles prairie falcon nesting productivity – non-core areas only.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / Nest	# Fledglings	# Fledglings / Nest
1984	3	3	2	8	4	7	3.5
1987	1	0	0	0	0	0	0
1988	4	3	3	10	3.3	10	3.3
1989	4	4	3	8	2.7	5	1.7
1990	5	3	2	8	4	6	3
1991	5	3	2	3	1.5	3	1.5
1992	4	4	3	9	3	7	2.3
1993	3	3	2	5	2.5	5	2.5
1994	3	3	2	7	3.5	5	2.5
1995	3	2	1	3	3	3	3
1996	3	2	2	7	3.5	10	5
1997	4	2	2	10	5	10	5
1998	3	2	0	0	0	0	0
1999	4	3	3	12	4	12	4
2000	3	3	3	7	2.3	7	2.3
2001	3	4	3	12	4	12	4
2002	6	4	3	14	4.7	10	3.3
2003	7	4	3	11	3.7	10	3.3
2004	5	4	4	15	3.8	15	3.8
2005	7	5	5	17	3.4	13	2.6
2006	8	8	5	18	3.6	15	3
2007	8	6	3	9	3	7	2.3
2008	5	2	2	8	4	8	4
2009	5	4	4	17	4.3	17	4.3
Averages (1984-2007)	4.4	3.4	2.6	9.1	3.2	8.2	2.9

Phenology

The first prairie falcon pair was observed at Crowley Towers 6 January 2009 (Appendix A). Incubation was first observed at Discovery Wall on 25 March. The first hatching occurred between 20-23 April at the Crowley Towers and Machete nests. The first fledging took place from 2-4 June, also at Crowley Towers and Machete. The last fledging took place at South Balconies on 31 June to 1 July when one young fledged from a late season nesting effort by the breeding falcon pair.

Other Notes

Nine of the eleven eyries chosen by prairie falcons were used in previous years. One other eyrie – at Goat Rock – was within an historical territory, but the nest site was previously undocumented. The Discovery Wall eyrie represented the first occupancy and breeding efforts by a prairie falcon pair ever documented within the territory. The Discovery Wall eyrie was first used by a common raven pair that constructed a stick nest at the site in 2004. The stick nest was reused by a breeding barn owl pair in 2006, and then by the prairie falcon pair in 2009. Two territories occupied by prairie falcon pairs in the past five years – Narrows and Marion Canyon – were vacant this year.

Other Species

Throughout the season data were collected on other raptor species nesting at Pinnacles. Notes are presented below. See Appendices B and C for further phenology and breeding data.

Peregrine Falcon (Falco peregrinus)

A peregrine falcon (Figure 5) pair occupied and successfully nested in the Hawkins territory, marking the 5th consecutive year that a peregrine pair nested and produced fledglings in the monument. The last previously confirmed peregrine falcon nest effort at Pinnacles was documented in 1957. The pair was first observed courting, perching, and circling near Hawkins Peak on 25 January 2009, and chasing a prairie falcon out of the Hawkins territory on 1 February. The pair was previously observed November through December 2008, suggesting the falcons were resident at the monument through the 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 laid four eggs, three young hatched, and all fledged by mid June.



Figure 5. Juvenile Peregrine Falcon. ©Gavin Emmons, 2005.

Golden Eagle (Aquila chrysaetos)

Golden eagles were observed nesting on the west side of North Chalone Peak in Pinnacles and at the Eucalyptus Grove outside of the west entrance of Pinnacles. Golden eagle adults and juveniles were active throughout the monument, but no other territorial or breeding activity was confirmed. Historical nest sites in three territories – Frog Canyon, South Chalone Peak, and Eagle Rock – contain five 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 five years by a nesting eagle pair. The North Chalone nest was documented as an active golden eagle nest in 2007 and 2008. The golden eagle pairs were first observed at the Eucalyptus Grove on 18 January 2009 and at North Chalone on 27 January. Two eaglets hatched at the Eucalyptus Grove nest, and one eaglet hatched at the North Chalone nest. Full fledging at the Eucalyptus Grove

nest was highly likely but only one eaglet was confirmed fledged. Fledging was not confirmed at the North Chalone nest but was possible based on observations of the eaglet near fledging age perched at the nest site.

Red-tailed Hawk (Buteo jamaicensis)

Twelve red-tailed hawk (Figure 6) pairs occupied territories at Pinnacles in 2009. Eight nesting pairs were confirmed, representing the most red-tailed hawk nests documented within a season over the past 23 years of the Pinnacles raptor monitoring program. Seven pairs successfully produced fledglings. Historical nest sites at the Western Front and South Wilderness (North End)/Grassy Canyon were not used this year despite territorial occupation by red-tailed hawk pairs in both of these areas. All eight active red-tailed hawk nests were made of sticks and located at Eagle Rock, Hand, Kingman Land North, Lower Condor Gulch, McCabe Canyon, North Balconies, North Wilderness Trail, and West Side Entrance. The nest sites at McCabe Canyon and North Balconies were previously undocumented. The other six nests had been used by red-tailed hawk pairs in previous years. Thirteen young successfully fledged from seven nests. The red-tailed hawk pair at Hand began egg incubation but failed to hatch any young.



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

American Kestrel (Falco sparverius)

Thirteen territorial pairs and five breeding records were confirmed this year. Breeding pairs were observed at Drywall, Neglected Valley, South Balconies, and two Kingman Land North territories. Active nests were confirmed at historical sites at Drywall and Neglected Valley and at a previously undocumented site at one of the Kingman Land North territories. The Drywall site hatched young on May 8-10. Nest incubation and hatching dates were not otherwise confirmed. Hatchlings were confirmed at all three nests: one at Drywall, three at the Kingman Land North nest, and one at Neglected Valley. Additionally, young kestrels were confirmed for the two other breeding pairs soon after fledging: a male and female each at South Balconies and the second Kingman Land North territory. Other kestrel pairs for which nesting was not confirmed occupied

the following territories: D. Soto Canyon, Eucalyptus Grove, Goat Rock, Marion Canyon, Mating Rocks, Pig Canyon, South Chalone Peak, and South Wilderness Trail.

Red-shouldered Hawk (Buteo lineatus)

Five territorial red-shouldered hawk pairs were documented in the monument this year, in the following territories: Kingman Land South, McCabe Canyon, Pinnacles Campground, Regan Ranch Canyon, and South Wilderness Trail. (Although Regan Ranch Canyon is a private inholding, it is surrounded by NPS property on three sides and is within the congressionally designated boundary of the monument). Only two red-shouldered hawk pairs nested successfully this year. The Kingman Land South and McCabe Canyon nests were both previously undocumented. Both nests were built along riparian corridors on valley oaks. Red-shouldered hawk pairs at Pinnacles Campground and South Wilderness Trail added fresh material to historical nest sites, but neither pair laid or incubated eggs. The first territorial red-shouldered hawk pair was observed at the Pinnacles Campground on 24 January 2009. The McCabe Canyon red-shouldered hawk pair began egg incubation but no young hatched. The Kingman Land South nest produced three hatchlings. Fledging of at least two young was confirmed from the nest and full fledge was likely.

Cooper's Hawk (Accipiter cooperii)

Three active nests were confirmed for Cooper's hawks (Figure 7) at Pinnacles in 2009. All three stick nests were built along riparian corridors in the Kingman Land North, Marion Canyon, and Upper Bear Gulch territories. The Marion Canyon nest was last used in 2008, the Kingman Land North nest was last used in 2006, and the Upper Bear Gulch nest was previously undocumented. All of the Cooper's hawk nests hatched nestlings, with two each at Kingman Land North and Marion Canyon, and four hatched at Upper Bear Gulch. Full fledge was confirmed at the Kingman Land North and Marion Canyon nests. No fledglings were confirmed at the Upper Bear Gulch nest, though full fledge was possible given prior observations of the nestlings' advanced development. A non-nesting Cooper's hawk pair was also confirmed at the Kingman Land South territory.



Figure 7. Cooper's hawk nestling in Marion Canyon nest. ©Gavin Emmons, 2008.

Sharp-shinned Hawk (Accipiter striatus)

One sharp-shinned hawk (Figure 8) nest was confirmed at Pinnacles in 2009. The nesting pair was first observed incubating eggs in the Peaks View Area territory west across Chalone Creek from the parking area on 16 May 2009. Four nestlings were observed at the previously undocumented nest site, and full fledging was confirmed by mid-July. The stick nest was located in a pine / live oak grove near the sharp-shinned hawk nest used last year. A sharp-shinned hawk pair was also observed occupying the Mating Rocks territory, but active nesting was not confirmed.



Figure 5. Juvenile sharp-shinned hawk. ©Gavin Emmons, 2003.

Long-eared Owl (Asio otus)

There were no territorial or nesting records for long-eared owls (Figure 9) at Pinnacles in 2009, in contrast to nesting records documented in 2005-2008.



Figure 6. Long-eared owl adult near Chalone housing area. ©Gavin Emmons, 2006.

White-tailed Kite (Elanus leucurus)

There were no territorial or nesting white-tailed kite pairs documented in Pinnacles in 2009. All six historical territories were unoccupied.

Barn Owl (Tyto alba)

A territorial barn owl pair was documented at South Balconies in 2009, but breeding was not confirmed. Historical sites at D. Soto Canyon, Drywall, and the High Peaks Trail West of Chalone Housing were unoccupied.

Great-horned Owl (Bubo virginianus)

Great horned owls were documented vocalizing and occupying territories at Chalone Picnic Area, Frog Canyon, Machete Ridge, Pig Canyon, Scout Peak, South Wilderness (South End), and Upper Condor Gulch, but no breeding pairs or nests were confirmed for the species in 2009.

Western Screech Owls (Megascops kennicottii)

Screech owls were seen and heard hooting near the Bear Gulch Nature Center beginning in January. No breeding or nest records were confirmed for 2009.

Osprey (Pandion haliaetus)

An osprey was observed soaring over the High Peaks in late March.

Bald Eagle (Haliaeetus leucocephalus)

Bald eagles were occasionally observed near the monument through late spring. An immature eagle was observed feeding sporadically at the Grassy Canyon condor feeding site in January.

Northern Harriers (Circus cyaneus)

Harriers were occasionally observed hunting near the monument boundaries through late spring. No territorial or nesting records were documented within Pinnacles boundaries.

Climbing Management Actions

Climbing advisories were put in place in January in areas with known climber usage to protect nesting raptors from disturbance. In March and April advisories were updated and lifted in territories that were confirmed unoccupied by prairie and peregrine falcon pairs. Signs detailing climbing advisories were posted at Little Pinnacles, Balconies, Hawkins, Discovery Wall, Scout Peak, Frog/Hand, Crowley Towers, Egg, Tunnel, Teapot Dome, Pipsqueak Pinnacles, and Goat Rock/Resurrection Wall territories.

Due to the large size and climber popularity of Machete Ridge and Discovery Wall, partial advisories were instituted at both territories. Both advisories covered the south half of the cliffs where the falcon pairs successfully nested and fledged young.

All regular advisory signs were affixed to metal brackets and cement foundations to prevent theft, and none were vandalized in 2009. Two temporary advisory signs were placed at the south end of the Discovery Wall cliffs, and likewise neither of these was stolen or vandalized.

In 2009, three incidents of off-trail hikers in advisory areas were documented. No incidents were documented involving climbers.

Prairie and peregrine falcon adults in the Discovery Wall, Drywall, Goat/Resurrection, Crowley, Hawkins, Machete, and Balconies territories were agitated by on-trail hikers and raptor biologists by circling and wailing above their respective territories.

Education Opportunities

Throughout the year, the raptor biologist and park staff participated in public outreach opportunities to inform visitors about raptor conservation. Educational opportunities included participation in formal events (e.g. Rockpile Rendezvous – April 4; International Migratory Bird Day – May 9; Pinnacles Partnership Science Camp – May 20-22) and informal events (e.g. visitor contact in high-use areas such as High Peaks, Balconies Cliff Trail, and the Bear Gulch Reservoir).

Summary

The seven breeding raptor species and 33 nest sites documented at Pinnacles in 2009 were generally consistent with averages recorded in the past six years. However, the number of prairie falcon nests and productivity this year were the second highest on record and were above the running average rates of nesting pairs, successful nests, and total fledglings produced. Eleven falcon pairs attempted to nest this year and ten nests were successful, producing 41 nestlings and 37 fledglings, compared to 23-year averages of 9.8 nesting pairs, 7.8 successful nests, 28.4 nestlings, and 26.4 fledglings (Table 4).

Public Interest Highlights

The 2009 breeding season was the 23rd year of raptor monitoring at Pinnacles. Field observations began 3 January 2009 and ended 17 July 2009, with a total of over 130 possible and active nest sites monitored during 872 observation hours. Climbing advisories were put into effect in January to reduce nest disturbance by visitors, updated to reflect unoccupied territories in March, and lifted in July at the end of the raptor breeding season.

- The raptor biologist conducted prairie falcon nest entries at 3 Pinnacles falcon eyries with raptor researcher Dr. Doug Bell during the 2009 season. All falcon nestlings at the Crowley, Goat Rock, and Drywall nests were briefly handled, banded, and bled. Banding and bleeding information collected by the Pinnacles raptor biologist and Dr. Bell in 2009-2011 will be used to ascertain genetic insularity and pair fidelity in the Pinnacles prairie falcon population, and to support management thresholds in the event of downward trends in prairie falcon occupancy and productivity.
- Seven breeding raptor species and 33 nests were confirmed in the monument.
- Five sensitive species were confirmed breeding this year: prairie falcon, peregrine falcon, golden eagle, Cooper's hawk, sharp-shinned hawk.
- For the 5th consecutive year a peregrine falcon pair was documented successfully nesting at the monument, producing 3 fledglings. The last previously confirmed peregrine falcon nest effort at Pinnacles was documented in 1957.
- Accipiter species were confirmed nesting in the monument, with the 8th sharp-shinned hawk nest ever documented.
- Eighteen 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).
- 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 Pinnacles.

- All raptor advisory signs were affixed to metal brackets in cement foundations to make the signs more secure and to prevent their theft and movement.
- The second annual Rockpile Rendezvous – a centennial event to emphasize climber contributions, history, and management at Pinnacles over the past 60 years – was organized by the raptor biologist and other monument staff, drawing in the local climbing community and providing visitors with information on historical resource and recreation management at the monument.
- A PowerPoint presentation on the raptor monitoring program, its objectives, and trend results over the past 22 years was given by the raptor biologist during the 2009 SFAN Inventory and Monitoring Program Science Day at Sausalito.

Discussion

Management Recommendations

- Continue to establish climbing/hiking advisories in core areas (high visitor-use areas) each breeding season to protect cliff-nesting raptor species from human disturbance.
- Increase information opportunities for visitor use assistants and park rangers to educate park visitors about advisories. In past years, the park made more attempts than this year to speak with climbers and hikers at trailheads, and to regularly rove on trails to provide interpretation and enforcement of resources.
- Enforce advisories with law enforcement rangers. Although advisories are voluntary, disturbing wildlife is a citable offense that law enforcement rangers should employ to discourage visitors from willfully threatening nesting efforts of breeding raptors at Pinnacles.
- Increase field staff. While the monitoring program focuses on the status and trends of prairie falcons, the park is interested in additional data on non-target species. In order to monitor non-target species adequately, at least 1 other 0.5 FTE field technician is needed during the breeding season.
- Increase use of staff and visitors observing raptor activity in the field. This can be achieved through regular communication with NPS staff and visitors, bi-weekly monitoring updates on raptor status at the monument, and reminders about filling out wildlife observation cards.
- Provide housing to field technicians. The closest housing available to the park staff is 40-50 minutes away. To fulfill the current duties the raptor biologist works very early and late hours throughout the raptor breeding season with long breaks during the day. In addition, the raptor biologist must adjust weekly schedules to accommodate inclement weather and raptor behavior. Safety and effective monitoring would be enhanced if an exception can be made from the usual policy of permanent employees living outside the monument for field staff.

Research and Monitoring 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. These four raptor species 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. Fletcher (2003) conducted graduate-level fieldwork on accipiter nest site selection and recreational trail use at Pinnacles in 1999-2001, documented 20 nests and two nest failures along trails in the monument, and recommended further studies to determine the effects of visitor disturbance on accipiter breeding in the monument.

As the staff at Pinnacles continue to transition into managing 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. Much of this new monument property contains riparian corridors and oak/pine woodlands suitable for accipiter, kite, and long-eared owl nesting habitat. Recommendations for monitoring of riparian-nesting raptor species include:

- Inventory nest sites for species of concern in riparian habitats in the monument.
- Determine what percentage of riparian raptor nests occur along trails and in high-use visitor areas relative to low-use areas, and how breeding behavior and productivity rates compare in high- and low-use areas.
- Recommend that new trails, buildings, and visitor use areas avoid documented nest sites and likely nest habitat for riparian raptor species, based on results from inventory and research data above.

Without this baseline information, it may be necessary for resource managers at Pinnacles to enforce seasonal closures of these new developments in order to protect these species from disturbance.

Other recommendations for monitoring and research:

- Conduct an inventory of burrowing owls on recently acquired Pinnacles Ranch property. This owl 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 on the western boundary near the Bear Gulch Headwaters. These owls may also inhabit the rangeland and fields between the Pinnacles Campground and Highway 25. Field work could be done by a biological science technician or by the extending the raptor biologist through September or October.
- Determine potential threats to prairie falcons nesting at Pinnacles. Radio telemetry studies conducted from 2002-2005 revealed important preliminary data about the prairie falcon population at Pinnacles: the population is resident in or near the monument throughout the year, and all radio-tracked falcons fed

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 (Buranek 2006). This information suggests that alteration of habitat south and west of the monument boundaries, especially near the town of Soledad, could have significant negative consequences for a viable, long-term population of prairie falcons at Pinnacles. In addition, the effects of pesticide (e.g. rodenticide) in the area are poorly understood.

Literature Cited

- Anderson, S. H. and J. R. Squires. 1997. *The Prairie Falcon*. University of Texas Press. Austin, Texas.
- Becker, D. M. and I. J. Ball. 1981. Impacts of surface mining on Prairie Falcons: Recommendations for monitoring and mitigation. Unpubl. rep. Montana Cooperative Wildlife Research Unit, Montana State Univ., Missoula.
- Bednarz, J. C. 1984. Effect of mining and blasting on breeding Prairie Falcon (*Falco mexicanus*) occupancy in the Caballo Mountains, New Mexico. *Raptor Research* 18:16–19.
- Bent, A.C. 1937. Life histories of North American birds of prey. Part 1. U.S. National Museum Bulletin 167:95–111.
- Bloom, P. H. 1994. The biology and current status of the Long-eared Owl in coastal southern California. *Bulletin California Academy of Science* 93:1–12.
- Bond, R. M. 1946. The Peregrine populations of western North America. *Condor* 48:101–116.
- Boyce, D. A., Jr. 1982. Prairie Falcon fledgling productivity in the Mojave Desert, California. Thesis. Humboldt State University, Arcata, California.
- Buranek, S. 2006. Pinnacles Prairie Falcon home range and habitat analysis. Thesis. California State University, Sacramento, California.
- Cade, T. J., J. H. Enderson, and J. Linthicum. 1996. Guide to management of Peregrine Falcons at the eyrie. The Peregrine Fund, Boise, Idaho.
- California Department of Fish and Game (CDFG). 2009. Special Animals. Online. (<http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf>). Accessed 24 February, 2009.
- Clarke, R. G. 1984. The Sharp-shinned Hawk in interior Alaska. Thesis, University of Alaska, Fairbanks, Alaska.
- Delannoy, C. A. and A. Cruz. 1988. Breeding biology of the Puerto Rican Sharp-shinned Hawk (*Accipiter striatus venator*). *Auk* 105:649–662.
- Emmons, G., A. Fesnock, M. Koenen, and J. Petterson. In Press. Raptor monitoring protocol for Pinnacles National Monument. Natural Resource Report NPS/PWR/SFAN/NRTR—2010/XXX. National Park Service, Fort Collins, Colorado.

- Fischer, D. L. 1984. Successful breeding of a pair of Sharp-shinned Hawks in immature plumage. *Raptor Research* 18:155-156.
- Fletcher, Clay. 2003. Accipiter nest site selection and recreational trail use effects at Pinnacles National Monument. Thesis. California Polytechnic State University, San Luis Obispo, California.
- Fraser, J. D., L. D. Frenzel, J. E. Mathisen, F. Martin, and M. E. Shough. 1983. Scheduling Bald Eagle reproduction surveys. *Wildlife Society Bulletin* 11: 13-16.
- Fuller, M. R. and J. A. Mosher. 1981. Methods of detecting and counting raptors: a review. *Studies in Avian Biology* 6: 235-246.
- Fyfe, R. W. and R. R. Olendorff. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. *Canadian Wildlife Service Occasional Papers* No. 23: 1-17.
- Harmata, A. R., J. E. Durr, and H. Geduldig. 1978. Home range, activity patterns and habitat use of Prairie Falcons nesting in the Mojave Desert. Unpubl. rep., Colorado Wildl. Services, Fort Collins, CO for U.S. Department of the Interior, Bureau of Land Management, Riverside, CA. (Contract No. YA-512-CT8-4389)
- Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing Owl (*Athene cunicularia*). *The Birds of North America*, No. 61.
- Hickey, J. J. 1942. Eastern population of the Duck Hawk. *Auk* 59: 176-204.
- Hickey, J. J. 1969. Peregrine Falcon populations: their biology and decline. University of Wisconsin Press, Madison, Wisconsin.
- Holthuijzen, A. M. A., W. G. Eastland, A. R. Ansell, M. N. Kochert, R.D. Williams, and L. S. Young. 1990. Effects of blasting on behavior and productivity of nesting Prairie Falcons. *Wildlife Society Bulletin* 18:270-281.
- Imberski, M. 1998. 1998 Breeding Season Report. Prepared for the National Park Service, Pinnacles National Monument. California. Unpublished.
- James, P. C. 1992. Operation Burrowing Owl in Saskatchewan: The first five years. Abstract, Burrowing Owl Symposium. Raptor Research Foundation Annual Meeting, Seattle, Washington, 1992.
- Johnson, B. S. 1992. Characterization of population and family genetics of the Burrowing Owl by DNA fingerprinting. Abstract, Burrowing Owl Symposium. Raptor Research Foundation Ann. Meeting, Seattle, Washington, 1992.

- Kochert, M. N., K. Steenhof, L. B. Carpenter, and J. M. Marzluff. 1999. Effects of fire on Golden Eagle territory occupancy and reproductive success. *Journal of Wildlife Management* 63:773–780.
- Marks, J. S. 1986. Nest-site characteristics and reproductive success of Long-eared Owls in southwestern Idaho. *Wilson Bulletin* 98:547–560.
- Martell, M. S. 1990. Reintroduction of Burrowing Owls into Minnesota: A feasibility study. Thesis. University of Minnesota, Minneapolis, Minnesota.
- Marti, C. D. and J. S. Marks. 1989. Medium-sized owls. Proceedings of the Western Raptor Management Symposium and Workshop. National Wildlife Federation Science and Technology Series No. 12, Washington, D.C., 1989: 124-133.
- Moritsch, M. Q. 1983. Photographic guide for aging nesting Prairie Falcons. United States Department of the Interior, BLM, Snake River Birds of Prey Project. Boise District, Idaho.
- Newton, I. 1979. Population ecology of raptors. Buteo Books. Shipman, Virginia.
- Newton, I. 1990. Birds of prey. Facts on File, Inc. New York, New York.
- National Oceanic and Atmospheric Administration (NOAA). 1997. Pinnacles National Monument station. Climatological Data: California. Vol. 101 No.1-13. National Oceanic and Atmospheric Administration, Washington D.C.
- Ogden, V. T. and M. G. Hornocker. 1977. Nesting density and success of Prairie Falcons in southwestern Idaho. *Journal of Wildlife Management* 41:1–11.
- Olsen, P. and J. Olsen. 1978. Alleviating the impact of human disturbance on the breeding Peregrine Falcon. *Ornithologists Corella* 2(1): 1–7; and 4(3): 54–57.
- Palmer, R. S. 1988. Handbook of North American birds. Vol. 4. Yale Univ. Press, New Haven, Connecticut.
- Platt, S. W. 1974. Breeding status and distribution of the Prairie Falcon in northern New Mexico. Thesis. Oklahoma State University, Stillwater, Oklahoma.
- Porter, R. D., M. A. Jenkins, and A. L. Ganski. 1987. Working bibliography of the Peregrine Falcon. National Wildlife Federation Science and Technology Series No. 9, Washington, D.C.
- Rechtin, J. A.. 1992. Raptor nesting at Pinnacles National Monument: 1984-1992. Pinnacles National Monument. Unpublished. Unpublished report.

- Rubine, D. 1995. Climber's guide to Pinnacles National Monument, 2nd Edition. Chockstone Press. Evergreen, Colorado.
- Scott, T. A.. 1985. Human impacts on the Golden Eagle population of San Diego County. Thesis. San Diego State University, San Diego, CA.
- Sibley, D. A. 2000. National Audubon Society: The Sibley guide to birds. Alfred A. Knopf, Inc. New York, New York.
- Sitter, G. 1983. Feeding activity and behavior of Prairie Falcons in the Snake River Birds of Prey Natural Area in southwestern Idaho. Thesis. University of Idaho, Moscow, Idaho
- Smith, J. P., and A. Hutchins. 2006. Northeast Nevada Nest Survey 2005. Hawkwatch International, Inc., Salt Lake City, Utah. Retrieved online from: <http://www.hawkwatch.org/publications/Technical%20Reports/NNNS%20Report%202005.pdf> (accessed 20 Sept. 2008)
- Steenhof, K. 1998. Prairie Falcon (*Falco mexicanus*). The Birds of North America, No. 346.
- Steenhof, K. and M. N. Kochert. 1982. An evaluation of methods used to estimate raptor nesting success. Journal of Wildlife Management, 46: 885-893.
- Steenhof, K., M. N. Kochert, L. B. Carpenter, and R. N. Lehman. 1999. Long-term Prairie Falcon population changes in relation to prey abundance, weather, land uses, and habitat conditions. Condor 101: 28-41.
- Steenhof, K., M. N. Kochert, and T. L. McDonald. 1997. Interactive effects of prey and weather on Golden Eagle reproduction. J. Anim. Ecol. 66:350-362.
- Steidl, R. J., K. D. Kozie, G. J. Dodge, T. Pehovski, and E. R. Hogan. 1993. Effects of human activity on breeding behavior of Golden Eagles in Wrangell-St. Elias National Park and Preserve; a preliminary assessment, WRST Research and Resource Management Report No. 93-3. National Park Service, Wrangell-St. Elias Natl. Park Preserve, Copper Center, Alaska.
- Suter, G. W. and J. L. Jones. 1981. Criteria for Golden Eagle, Ferruginous Hawk, and Prairie Falcon nest site protection. Raptor Research 15: 12-18.
- United States Department of the Interior (USDI). 1979. Snake River Birds of Prey special research report to the Secretary of the Interior. Boise District Bureau of Land Management, Boise, Idaho.

United States Fish and Wildlife Service (USFWS). 1984. American Peregrine Falcon Rocky Mountain/Southwest population recovery plan. Rocky Mountain/Southwest Peregrine Falcon Recovery Team, U.S. Fish and Wildlife Service, Denver, Colorado.

Watson, J. 1997. The Golden Eagle. London, United Kingdom.

White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt. 2002. Peregrine Falcon (*Falco peregrinus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: http://bna.birds.cornell.edu/BNA/account/Peregrine_Falcon (accessed 8 Sept., 2008)

Young, B. 2007. A Climber's Guide to Pinnacles National Monument. Brad Young and Steve Dawson. Twain Harte, California.

Appendix A. 2009 nest phenology and success for prairie falcons.

35

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	Ball Pinnacle	*EGG	<1/10										Occupied
PRFA	Cyn N of Willow Spgs	*WSS	<2/3										Occupied
PRFA	Citadel												Not Occ.
PRFA	Crowley Towers	CT-4	<1/6	<3/28	4/20-23	6/2-4			4	4	4	4	4
PRFA	D. Soto Canyon	DS-2	<3/10	<3/29	5/6-8	6/17-19				3	3	3	3
PRFA	Discovery Wall	DIS-3	<2/24	<3/25	4/24-26	6/5-6			5	5	5	5	5
PRFA	Drywall	DRY-10	<1/12	<3/26	4/24-28	6/7-8			4	4	4	4	4
PRFA	Egg	EGG-1	<1/20	<3/27	4/27-29	6/8-10			5	5	2	2	2
PRFA	Frog / Hand												Not Occ.
PRFA	Goat / Resurrection	GOAT-3	<1/10	<3/31	5/2-4	6/14-16				5	5	5	5
PRFA	Hanging Valley												Not Occ.
PRFA	Hawkins												Not Occ.
PRFA	High Pks W of CPA	*DS	<3/10										Occupied
PRFA	Little Pinnacles	LP-8	<1/7	<4/24	5/22-24	6/31-7/1				2	1	1	1
PRFA	Machete		<1/18	<3/28	4/20-23	6/2-4				3	3	3	3
PRFA	Marion Canyon												Not Occ.
PRFA	Mating Rocks												Not Occ.
PRFA	Narrows												Not Occ.
PRFA	NE Sec 15												Not Occ.
PRFA	Neglected Valley												Not Occ.
PRFA	North Balconies	*SGB	<1/18										Occupied
PRFA	North Chalone	NC-1	<1/27	<4/16	4/29-5/1	6/12-14				5	5	5	5
PRFA	N. Wilderness Rock												Not Occ.
PRFA	Pig Canyon	PIG-2	<2/2	<3/27	5/2-4	6/15-17				5	5	5	5
PRFA	Pipsqueak Pinnacles												Not Occ.
PRFA	Prescribed Burn Cliffs												Not Occ.
PRFA	Scout Peak	*GOAT	<1/10										Not Occ.
PRFA	South Balconies	SGB-16	<1/18	<3/28				>3/28	1	0	0	0	Failed
PRFA	South Chalone												Not Occ.
PRFA	S. Wilderness Rock												Not Occ.
PRFA	Teapot Dome	*EGG	<1/10										Occupied
PRFA	Tugboat												Not Occ.
PRFA	Tunnel	*EGG	<1/10										Occupied
PRFA	Willow Spring Slide	*CNWS	<2/3										Occupied

(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 1 territory.)

Appendix B. 2009 nest phenology and success for peregrine falcons, American kestrels, golden eagles, 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
PEFA	Hawkins Peak	HP-2	<1/25	3/27-4/7	4/27-29	6/9-10			4	3	3	3	3
AMKE	D. Soto Canyon		<1/29										Occupied
AMKE	Drywall	DRY-3	<2/10		<5/27					1			Unknown
AMKE	Eucalyptus Grove		<3/6										Occupied
AMKE	Goat Rock		<2/20										Occupied
AMKE	Kingman Land North					5/20-21					2	2	2
AMKE	Kingman Land North	KLN-12			5/8-10					3	0	3	3
AMKE	Marion Canyon		<5/7										Occupied
AMKE	Mating Rocks		<3/21										Occupied
AMKE	Neglected Valley	NV-2	<1/14		<5/9					1	0		Unknown
AMKE	Pig Canyon		<1/17										Occupied
AMKE	South Balconies		<1/18			6/3-4				2	2	2	2
AMKE	South Chalone		<4/16										Occupied
AMKE	South Wilderness Trail		<2/18										Occupied
GOEA	Eucalyptus Grove	EG-3	<1/18	<2/8	3/26-28	5/28-30				2	1	2	2
GOEA	North Chalone	NCW-1	<1/27	<3/6	3/29-4/1	6/1-4				1	0	1	1
RTHA	Eagle Rock	ER-2	<1/17	<4/15	5/11-13	7/5-6				2	1	2	2
RTHA	Frog Canyon		<2/19										Occupied
RTHA	Frog / Hand	HAND-1	<2/4	<5/3				<6/3			0	0	Failed
RTHA	Grassy Canyon		<1/16										Occupied
RTHA	Kingman Land North	KLN-4	<4/22	<4/22	5/8-10	6/21-23				2	2	2	2
RTHA	Lower Condor Gulch	LCG-1	<1/10	<4/20	4/28-30	6/14-15				1	1	1	1
RTHA	McCabe Canyon	MC-3	<4/13	<4/13	5/12-14	6/24-26				1	1	1	1
RTHA	North Balconies	NB-7	<2/7	<3/21	4/28-30	6/10-13				2	2	2	2
RTHA	North Wilderness Trail	NWT-1	<4/24	<4/24	4/24-26	6/8-9				2	1	2	2
RTHA	South Wilderness Rock		<3/11										Occupied
RTHA	West Side Entrance	WSE-1	<4/18	<4/18	4/27-29	6/17-19				3	3	3	3
RTHA	Western Front		<3/14										Occupied
RSHA	Kingman Land South	KLS-7	<3/18	<4/25	4/25-27	6/9-11				3	2	3	3
RSHA	McCabe Canyon	MC-4	<2/26	<5/13				<6/8	1	0	0	0	Failed
RSHA	Pinnacles Campground		<1/24										Occupied
RSHA	Bench Trail												Not Occ.
RSHA	Regan Ranch Canyon		<3/15										Occupied
RSHA	South Wilderness Trail		<2/18										Occupied

37

(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 1 territory.)

Appendix C. 2009 nest phenology and success for accipiters, kites, and owls (barn owls, long-eared owls, great-horned owls, and Western screech-owls).

39

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	Kingman Land North	KLN-7	<4/22	<5/22	6/13-16	7/13-15				2	2	2	2
COHA	Kingman Land South		<4/22										Occupied
COHA	Marion Canyon	MAR-4	<5/7	<5/7	5/19-22	6/20-21				2	2	2	2
COHA	Upper Bear Gulch	UBG-5	<2/2	<6/10	6/10-13	7/7-11				4	0	4	4
SSHA	Mating Rocks		<1/19										Occupied
SSHA	Peaks View Area	PVA-2	<5/16	<5/16	6/2-6	6/31-7/2				4	4	4	4
WTKI	Double Gates												Not Occ.
WTKI	Jawbone Canyon												Not Occ.
WTKI	Kingman Land North												Not Occ.
WTKI	Kingman Land South		<5/10										Not Occ.
WTKI	Marion Canyon												Not Occ.
WTKI	McCabe Canyon												Not Occ.
WTKI	S Wilderness – N End												Not Occ.
BNOW	D. Soto Canyon												Not Occ.
BNOW	Discovery Wall												Not Occ.
BNOW	South Balconies		<5/24										Occupied
LEOW	Chalone Picnic Area												Not Occ.
LEOW	Kingman Land North												Not Occ.
LEOW	Regan Ranch Canyon												Not Occ.
GHOW	Chalone Picnic Area		<2/11										Occupied
GHOW	Frog Canyon		<3/6										Occupied
GHOW	Machete Ridge		<2/8										Occupied
GHOW	Pig Canyon												Occupied
GHOW	Scout Peak												Occupied
GHOW	S. Wilderness – N End												Occupied
GHOW	Upper Condor Gulch		<2/13										Occupied
WESO	Headquarters		<1/31										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 1 territory.)

Appendix D. Documentation of Changes in Data Collection Methods.

Through the course of the 2009 season, several changes were made to procedures for 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, and the development of a more efficient workflow and structuring of existing MS Access databases.

Through the 2009 season raptor observations and breeding summaries were entered into the new “Breeding Raptors” Access raptor database, after development was finalized in 2007-2008. This created a more efficient workflow in entering raptor observations and a more effective means of storing and archiving past years of monitoring data. Daniel George finalized the importing of the 21-year legacy dataset into the current Access database design. To increase efficient statistical analysis of legacy data, additional fields were created in the database “Data Entry” form, including fields detailing survey purpose, raptor ages observed, and numbers of raptor adults, fledglings, and nestlings. The location field was also updated for easier querying of observation points according to survey purpose. Dave Press is currently completing the Access raptor database revisions to include fields (e.g. detailing presence/absence of prairie falcons) for statistical occupancy and productivity analyses. The revised Access raptor database will be used for data collection and management beginning in the 2010 season.

The 2008 Raptor Monitoring Protocol was peer reviewed by experts in the San Francisco Bay Area Network in early 2009. The protocol continues to be revised to address remaining peer reviewer questions and concerns. Statistical modeling and analyses of prairie falcon occupancy and productivity data are currently being finalized prior to sending the Protocol back to peer reviewers in the San Francisco Bay Area Network.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 114/101812, April 2010

National Park Service
U.S. Department of the Interior



Natural Resource Program Center
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA™