



# Prairie and Peregrine Falcon Occupancy and Productivity Monitoring at Pinnacles National Park

## *2012 Annual Report*

Natural Resource Technical Report NPS/SFAN/NRTR—2013/811



**ON THE COVER**

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

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

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## Executive Summary

Pinnacles National Park (“Pinnacles”) provides a diverse habitat for numerous cliff-nesting raptors, including prairie falcons (*Falco mexicanus*) and peregrine falcons (*F. peregrinus*), as well as a spectacular array of summits and cliff-wall routes for rock-climbers. This monitoring program was established to determine long-term trends in the number of occupied territories and productivity of nesting prairie and peregrine falcons. Ancillary data on presence and diversity of other nesting raptors are also collected and documented for this season in the Breeding Raptor Distribution And Nesting Phenology At Pinnacles National Park – 2012 Annual Report (Emmons in review). The monitoring program 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 2012 breeding season and represents the 27<sup>th</sup> year of monitoring at the park, consistent with the standardized methods and procedures detailed in the Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011).

To monitor falcons, field technicians surveyed 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 2012, monitoring was conducted from 1 January 2012 until 26 July 2012, with a total of over 150 possible and active nest sites monitored during 808 observation hours.

Thirteen territorial falcon pairs were documented this year with 12 pairs actively nesting. Nine nests successfully hatched and fledged 31 young; 4 nests failed.

## 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 National Park Service 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. I would also like to extend my appreciation to the park 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 park.

I would like to thank J. Auer, T. Christensen, D. George, B. Johnson, P. Johnson, J. Jones, L. Regan, D. Ryan, J. Tiehm, and A. Welch for contributing valuable observations on raptor territories and pair behavior in the monument. I greatly appreciated efforts by N. Melling and K. Sawyer for their superb monitoring efforts this season. I am also grateful for D. Louie's and P. Johnson's support and efforts, in tandem with D. George 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. D. Adams, D. George, P. Johnson, and A. Welch also provided recommendations and reviewer suggestions for the 2012 annual report, contributing greatly to a concise and efficient document consistent with I&M standards.

The following staff also 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 park, and assisted in the effective management of raptor advisory areas: R. Cruz, G. Gigliotti, M. LaShell, and D. Simmons.

## Introduction

Pinnacles National Park (“Pinnacles”) is a National Park Service (NPS) unit located in the Gabilan Mountains of central California, and was legislatively converted from a national monument to a national park in January 2013. Pinnacles 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. Because prairie falcons nest in the Pinnacles cliffs and in sufficient density to track trends in reproduction over time, this species is the central focus of the monitoring program. Additionally, peregrine falcons are documented in this report because they occupy the same nest habitat and are direct competitors to prairie falcons. Other raptor species in the park either nest in forested habitats or do not nest in sufficient densities within the park and therefore are not a focus of this monitoring program.

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 and Olendorff 1976, Ogden and Hornocker 1977, Harmata et al. 1978, Sitter 1983, Steenhof 1998), peregrine falcons (particularly in remote locations: see Hickey 1942, 1969, Bond 1946, 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 (*Accipiter striatus*; Delannoy and Cruz 1988), and long-eared owls (*Asio otus*; Marks 1986, Marti and Marks 1989, Bloom 1994).

Studies of prairie and peregrine 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 falcons at Pinnacles are visitors who are rock-climbing and hiking on- and off-trail in the park. 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 1981, Suter and Jones 1981, Porter et al. 1987, Holthuijzen et al. 1990, Cade et al. 1996, White et al. 2002). Raptor monitoring program survey data collected at Pinnacles justifies the establishment of climbing/hiking advisories in core areas (high visitor-use areas) each breeding season as a way to protect cliff-nesting raptor species from human disturbance.

The Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011) provides standardized methods and procedures for prairie and peregrine falcon monitoring at Pinnacles and further details the program specifics. The program established two long-term monitoring objectives to:

- Track changes in the total numbers of territorial 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 and peregrine 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 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 such as: golden eagles, Cooper's hawks (*Ac. cooperii*), sharp-shinned hawks, white-tailed kites, and long-eared owls (*Elanus leucurus*). Breeding data for other raptor species during the 2012 season will be documented in the Breeding Raptor Distribution And Nesting Phenology At Pinnacles National Park – 2012 Annual Report (Emmons in review).

## **Study Area and Field Methods**

Pinnacles is located in the Gabilan Mountains of the central Coast Range of California. The national park 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 5.2°C in December to 25.2°C in August (41.4° to 77.4°F). The average yearly rainfall is 42.3 cm (16.6 inches), with the majority of rainfall occurring from November to April (WRCC 2013).

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 creek corridors.

### ***Sample Design***

The prairie and peregrine falcon monitoring focuses on core areas and non-core areas. Core areas (Figure 1) are locations in Pinnacles that can support 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 monitoring surveys are 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 park that can support prairie and peregrine falcon cliff nesting. The Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011) calls for sampling non-core territories on a rotating basis. For 2003–2012, non-core area sampling has been conducted through a census along with core area censuses. This park-wide censusing of core and non-core territories has been possible because of comprehensive historical data on prairie and peregrine falcon nest sites gathered over the past 27 years, extensive monitoring experience of the raptor biologist, and supplemental raptor monitoring efforts by interns, volunteers, and other Pinnacles employees. In addition, GIS modeling completed in 2008 confirmed that all potential prairie and peregrine falcon nesting areas in the park have been surveyed annually during the past 10 years.

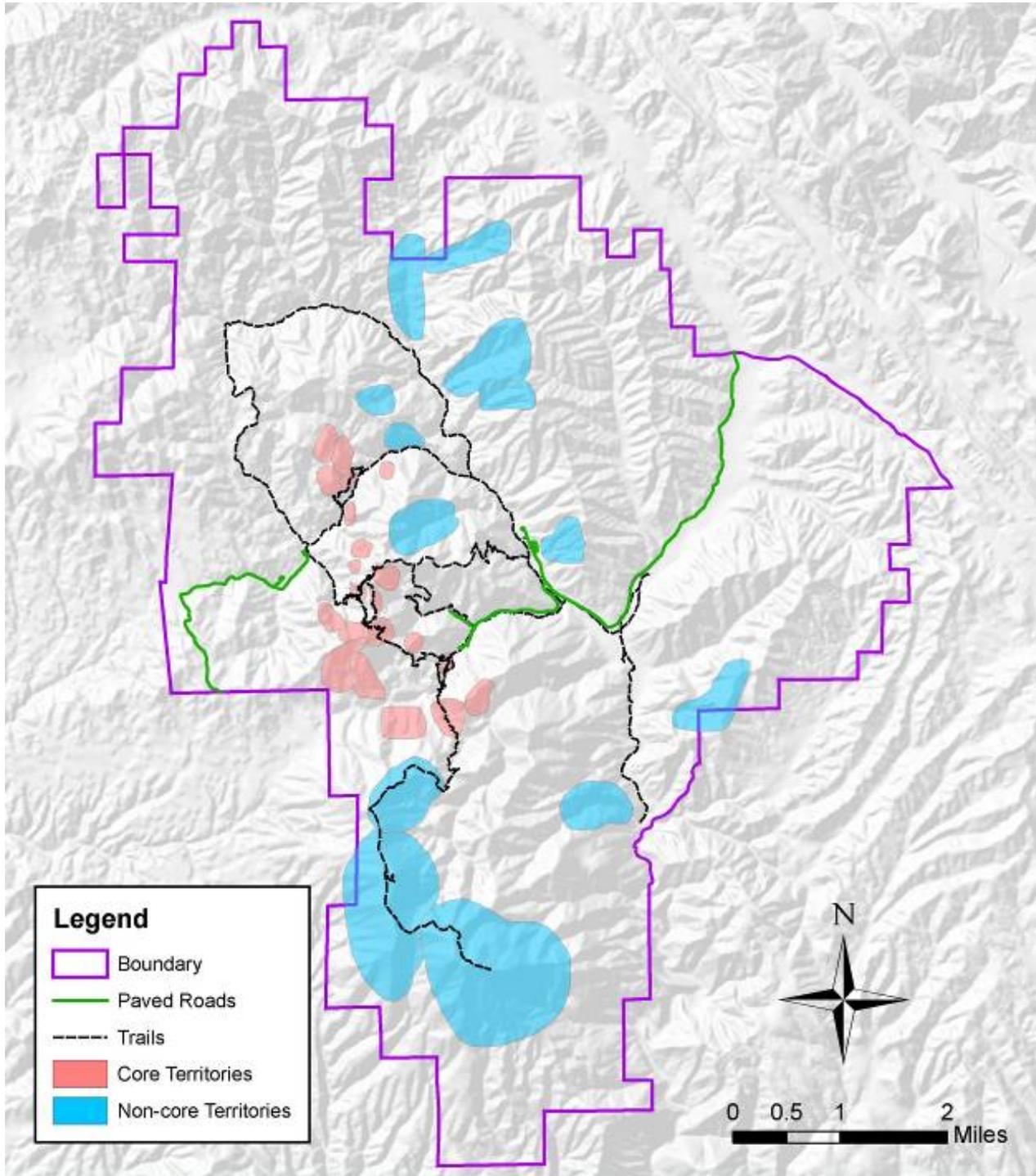


Figure 1. Core and non-core territories at Pinnacles National Park.

## **Field Methods**

Survey methods followed the standard operating procedures detailed in the Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011).

Potential and established prairie and peregrine falcon territories in core and non-core areas were surveyed using Swarovski HD STS-80 and ATS-65 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. Magellan Triton 500 and DeLorme Earthmate PN-60 GPS units were used to plot every observation point. Field data were documented with standardized datasheets and field notebooks and the data were entered into a standardized database (Appendix D).

Three- to five-hour observation periods are commonly recommended to document territorial occupancy of peregrine falcons and prairie falcons (USFWS 1984, Cade et al. 1996, Smith et al. 2006). Steenhof et al. (1999) employed two-hour observation periods during point surveys to document territory occupancy of prairie and peregrine falcons in the Snake River region of Idaho. For a potential 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 and Mosher 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 continues surveys until all young falcons are confirmed as fledged.

During the 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.

**Nestlings:** Hatched young prairie and peregrine 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 aging estimates.

**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.

**Monitoring Schedule**

The prairie and peregrine falcon monitoring season started on 1 January and continued through the end of the nesting season, 26 July (Table 1).

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

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 are generally inactive and therefore monitoring was not done during these periods.

**Data Management**

Data are entered into a Microsoft (MS) Access database designed by the network data manager for the San Francisco 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 California Department of Fish and Wildlife (previously California Fish and Game) California National Diversity Database and the Santa Cruz Predatory Bird Research Group.

Tabular data in the Results section of this report are derived from queries to the Breeding Raptors and Raptor Observations tables in the MS Access database.

**Climbing Advisories**

Climbing advisories went into effect by mid-January. Informational signs were established near territories occupied by prairie and peregrine 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. Photo by Gavin Emmons, 2006.

## Results

During the 2012 field season, Pinnacles staff spent 700 hours in the field surveying for prairie and peregrine falcons and volunteers contributed 108 hours of time. Results for prairie falcon monitoring are detailed below. Results for peregrine falcon monitoring – and tabular data for combined prairie and peregrine falcon productivity – are detailed in Appendix B. Currently, the monitoring protocol (Emmons et al. 2011) focuses specifically on monitoring prairie falcons as a target species. However, both prairie and peregrine falcons have nested at Pinnacles historically, are sensitive to human disturbance, are obligate cliff-nesters, and have identical nest phenology patterns. Results for peregrine falcon monitoring are included in Appendix B with the expectation that the monitoring protocol (Emmons et al. 2011) will be updated to focus on both prairie and peregrine falcon monitoring in the future.

### ***Prairie Falcons***

Eleven prairie falcon pairs attempted to nest this year and 8 successful nests produced 28 nestlings and 27 fledglings, compared to 26-year averages of 9.9 nesting pairs, 7.8 successful nests, 28.5 nestlings, and 26.7 fledglings (Table 2).

### **Occupied Territories**

Through the 2012 season, 12 territorial pairs of prairie falcons (Figure 3) were confirmed over the course of the breeding season. This number is comparable to the average territorial occupancy of 11.9 pairs from 1984-2012 (Table 2). Of these, one pair did not nest or produce young this year. A single pair occupied the Frog/Hand and Discovery Wall territories but abandoned both by April.

**Core Areas:** In 2012, there were 7 territorial prairie falcon pairs within the core areas. The average number of territorial falcon pairs in the core areas over the previous 26 years was 7.4.

**Non-Core Areas:** In 2012 there were 5 territorial prairie falcon pairs within the non-core areas. The average number of territorial falcon pairs in the non-core areas over the last 26 years was 4.5.



**Figure 3.** Prairie falcon fledgling at South Balconies. Photo by Gavin Emmons, 2009.

**Table 2.** 1984–2012 Pinnacles prairie falcon nesting productivity – core and non-core areas combined.

Year	Territorial Pairs	Nesting Pairs	Successful Nests	# Nestlings	# Nestlings / 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	3.0	24	3.0
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	3.0	24	3.0
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	4.0
2004	12	11	9	36	4.0	33	3.7
2005	13	10	9	29	3.2	24	2.7
2006	15	14	10	35	3.5	30	3.0
2007	14	12	9	35	3.9	33	3.7
2008	12	5	4	12	3.0	12	3.0
2009	12	11	10	41	4.1	37	3.7
2010	13	11	7	27	3.9	27	3.9
2011	13	12	8	33	4.1	33	4.1
2012	12	11	8	28	3.5	27	3.4
Averages (1984– 2011)	11.9	9.8	7.8	28.5	3.5	26.7	3.3

**Annual Productivity**

Eleven of the 12 prairie falcon pairs nested. For the 11 nesting pairs, eight successful nesting attempts fledged a total of 27 young (Tables 2, 3). Four nests failed during the 2012 season, three during egg incubation and one after four total nestlings hatched. The Drywall prairie falcon pair double-clutched in 2012: after failing in an initial nest attempt, the pair successfully fledged young in a second nest attempt.

**Table 3.** 2012 Pinnacles prairie falcon breeding summary.

<b>Territory</b>	<b>Nest Used/ Last Year Used</b>	<b># Eggs Laid</b>	<b># Young Hatched</b>	<b># Young Known/ Fledged</b>
Canyon North of Willow Springs	CNWS-3/2011	4	3	3/3
Citadel*	CI-1/2011		0	0
Crowley Towers*	CT-2/2004	5	5	5/5
Drywall	DRY-12/NEW		0	0
Drywall	DRY-13/NEW	2	2	2/2
Egg*	EGG-1/2009	4	4	4/ 4
Machete*	MAC-4/2010		0	0
North Chalone	NC-1/2011	3	3	3/ 3
Pig Canyon	PIG-9/2008	3	2	2/2
Resurrection Wall*	RW-8/NEW	5	5	5/5
South Balconies*	SGB-2/2011	4	4	0
South Chalone	SC-7/2011	4	4	4/4

\*nests within the core area.

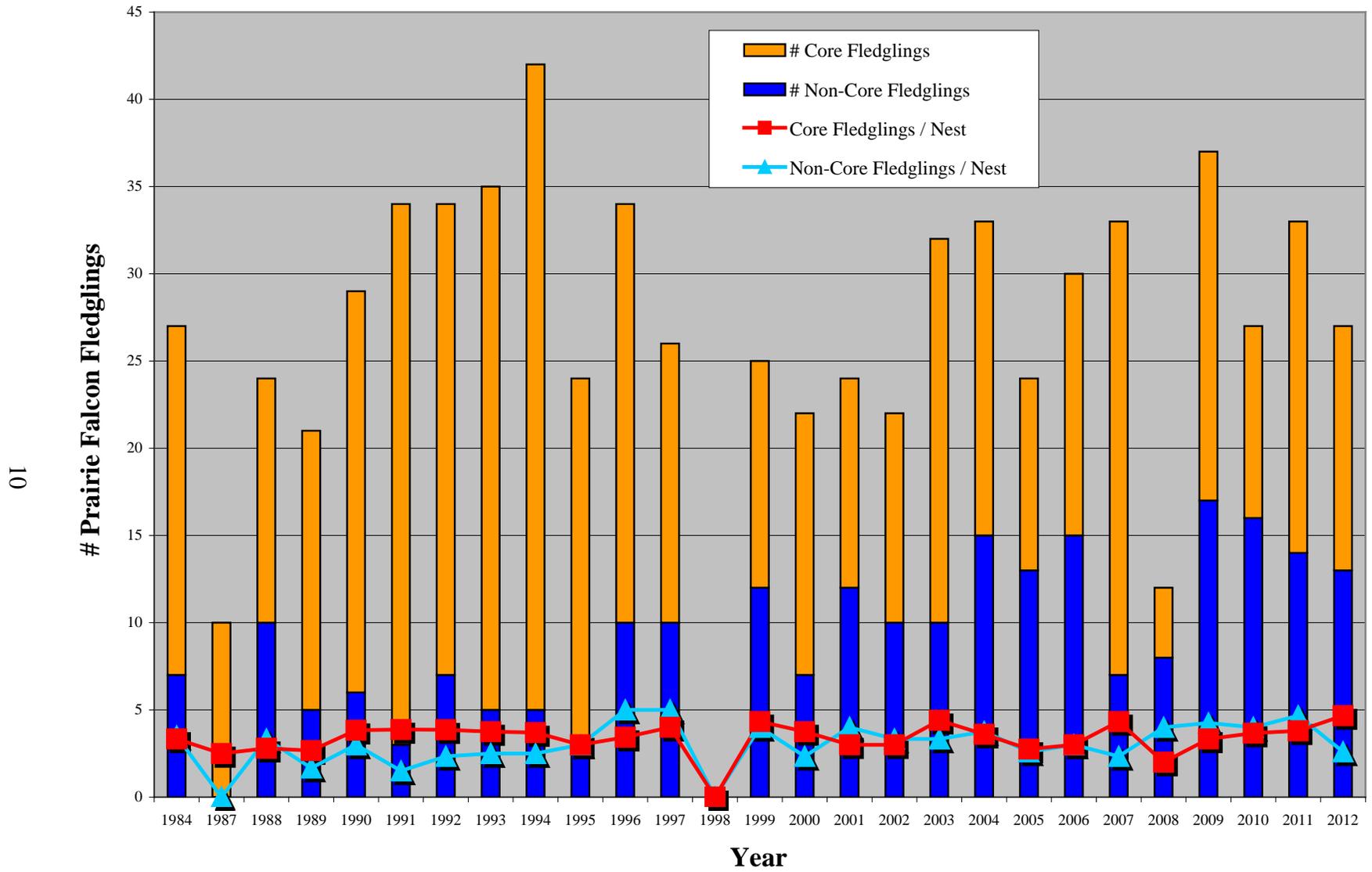


Figure 4. Core vs. non-core Pinnacles prairie falcon fledgling productivity, 1984–2012.

Nesting falcon pairs, total successful nests, and productivity of nestlings and fledglings within core areas this season were lower than the 26-year averages. Additionally, nestlings and fledglings per nest were slightly above average. In the core areas only, five successful nest sites produced 19 total fledglings and 3.8 fledglings per nest, compared to the 26-year averages of 5.2 successful nests, 18.0 total fledglings, and 3.3 fledglings per nest (Table 4).

**Core Areas:** Of the 7 territorial falcon pairs in the core areas in 2012, three nested successfully, producing an average of 4.7 fledglings per nest (Table 4). Productivity numbers are lower than the 1984–2011 averages of 5.2 successful nests per season and higher than the averages of 3.3 fledglings per nest.

**Non-Core Areas:** Of the 5 territorial falcon pairs in the non-core areas in 2012, five nested successfully, producing an average of 2.6 fledglings per nest (Table 5). These numbers are respectively higher than the 1984–2011 average of 2.7 successful nests per season, and lower than the average of 3.0 fledglings per nest.

**Table 4.** 1984–2012 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	3.0	21	3.0
1996	9	8	7	28	4.0	24	3.4
1997	8	6	4	16	4.0	16	4.0
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	3.0	12	3.0
2002	5	5	4	12	3.0	12	3.0
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	3.0	11	2.8
2006	7	6	5	17	3.4	15	3.0
2007	6	6	6	26	4.3	26	4.3
2008	7	3	2	4	2.0	4	2.0
2009	7	7	6	24	4.0	20	3.3
2010	8	6	3	11	3.7	11	3.7
2011	8	7	5	19	3.8	19	3.8
2012	7	6	3	14	4.7	14	4.7
Averages (1984–2011)	7.4	6.4	5.2	19.0	3.5	18.0	3.3

**Table 5.** 1984–2012 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	4.0	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	4.0	6	3.0
1991	5	3	2	3	1.5	3	1.5
1992	4	4	3	9	3.0	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	3.0	3	3.0
1996	3	2	2	7	3.5	10	5.0
1997	4	2	2	10	5.0	10	5.0
1998	3	2	0	0	0	0	0
1999	4	3	3	12	4.0	12	4.0
2000	3	3	3	7	2.3	7	2.3
2001	3	4	3	12	4.0	12	4.0
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	3.0
2007	8	6	3	9	3.0	7	2.3
2008	5	2	2	8	4.0	8	4.0
2009	5	4	4	17	4.3	17	4.3
2010	5	5	4	16	4.0	16	4.0
2011	5	5	3	14	4.7	14	4.7
2012	5	5	5	14	2.8	13	2.6
Averages (1984–2011)	4.5	3.5	2.7	9.5	3.3	8.7	3.0

**Phenology**

The first prairie falcon pairs were observed at Drywall Slide on 3 January 2012 (Appendix A). Incubation was first observed at Egg (a named rock formation) on 7 March. The first hatching occurred between 1–4 April at the Egg nest. The first fledging took place from 20–23 May at Egg. The last fledging took place at Drywall on 17–19 July when 2 young fledged from a late season, second-clutch nesting effort.

**Other Notes**

Nine of the 12 eyries chosen by prairie falcons were used in previous years. All prairie falcon eyries were within historically documented territories. Four nesting attempts failed this year. Three territories occupied by prairie falcon pairs in the past five years – Pipsqueak Pinnacles, Narrows, and Marion Canyon – were vacant this year.

## Discussion

Eleven prairie falcon pairs attempted to nest this year and 8 successful nests produced 28 nestlings and 27 fledglings, compared to 26-year averages of 9.9 nesting pairs, 7.8 successful nests, 28.5 nestlings, and 26.7 fledglings (Table 2).

In core areas, numbers for total successful nests, nestlings, and fledglings were below average in 2012 (Table 4). In non-core areas, respective numbers were above average in 2012 (Table 5). Total productivity numbers in the core and non-core areas were affected by four nest failures, with three at core area nest sites and one at a non-core nest site. One core area nest site failed during development of nestlings, and the other three nest sites failed during egg incubation. All three of the core area nest sites were in close geographic proximity to each other. Given the inaccessible locations of the nest sites, the lack of any human activity observed at the sites through the breeding season (except during a nest entry conducted at the South Balconies site by Doug Bell and NPS staff, as detailed in the Conclusions section below), and the proximity of the nest sites, the nest failures were likely due to predation (e.g., from eagles, ravens, or owls), especially given the documentation of territorial great-horned owls (*Bubo virginianus*) in the area. However, given the lack of constant monitoring at the sites (e.g., through remote video surveillance), nest failure due to human disturbance cannot be entirely ruled out.

The non-core area nest failure at Drywall Slide occurred at a previously undocumented site during egg incubation. The territorial prairie falcon pair attempted a second clutch and successfully fledged two young. This was the first second clutch nest effort by prairie falcons documented during the raptor monitoring program at Pinnacles.

## Conclusions, Management Implications and Recommendations

Climbing management actions, outreach, and recommendations for further management and research are listed below. Refer to Appendix D for further information on public interest highlights for the 2012 season.

### ***Prairie Falcons: Climbing Advisories***

Climbing advisories were put in place in January in areas with historic 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, Crowley Towers, Egg, Tunnel, Teapot Dome, and Goat Rock / Resurrection Wall territories.

Due to the large size and climber popularity of Machete Ridge, a partial advisory was instituted at this territory. A partial advisory was also instituted at Balconies after a nest site was confirmed at South Balconies. Machete Ridge and North Balconies were opened to climber use after the Balconies falcon pair had shifted to focus territorial and nesting efforts at the South Balconies nest site.

All regular advisory signs were affixed to metal brackets and cement foundations to prevent theft and none were vandalized in 2012.

In 2012, two incidents of off-trail hikers in advisory areas were documented. No incidents involving climbers were documented. No territorial defense behavior by prairie falcons was observed during the off-trail hiker incidents.

### ***Human / Falcon Interactions and Nest Failures***

Prairie and peregrine falcon adults in the North Chalone Peak, Crowley, Hawkins, and Balconies territories responded to the presence of on-trail hikers and raptor biologists with agitated behavior by circling and wailing above their respective territories.

Prairie falcon nest entries were conducted at the North Chalone Peak, South Balconies, and Drywall Slide nests by the NPS raptor biologist and raptor researcher Douglas Bell from East Bay Regional Park District (see Public Interest Highlights below for further details). All nestlings at the North Chalone Peak and Drywall Slide eyries fledged successfully, but the South Balconies nest failed to fledge young. Falcon nestlings at the South Balconies eyrie were observed actively beg-calling and feeding on prey two days after the nest entry. However, the nest entry at the South Balconies site may have indirectly led to the nest failure by alerting nest predators to the presence of the falcon nest site. Prairie falcon nest attempts in close proximity to South Balconies—at Citadel and Machete—also failed in 2012. All falcon nestlings at the Crowley nest fledged successfully.

Four prairie falcon nest failures were documented at the Citadel, Machete, South Balconies, and Drywall territories. The South Balconies nest failed when the nestlings at the sites were four weeks old, and the other three nests failed during egg incubation. Causes of the falcon nest failures in 2012 were not confirmed, but could potentially include nest predation (by ravens, eagles, or owls), abandonment, or significant human disturbance. All four nests were not accessible by on-trail hikers. The Citadel and Drywall nests had no historic climbing routes directly adjacent to the nest sites. The Machete nest had rarely used climbing routes next to the eyrie but there were no signs of climber use at or near the site throughout the 2012 season. As noted above, a nest entry was conducted at the South Balconies nest site for genetics research, but no other signs of climber use were documented at or near the site in 2012. Given the conditions at the South Balconies nest—with four prairie falcon nestlings observed at the eyrie before and after the nest entry, and nest failures observed at the neighboring Citadel and Machete nests—nest failure was likely due to predation rather than abandonment.

### ***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 on April 22–24) and informal events (e.g., visitor contact in high-use areas such as High Peaks, Balconies Cliff Trail, and the Bear Gulch Reservoir).

### ***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. Prior to the 2004 season, park rangers and interpreters made more attempts to speak with climbers and hikers at trailheads and to regularly rove on trails to provide interpretation and enforcement of resources. Renewing this strategy of interfacing with visitors at trailheads and on trails would help to preserve compliance with climbing advisories as annual visitation increases at the park.
- Enforce advisories with law enforcement rangers. Although advisories are voluntary, disturbing wildlife is a citable offense that law enforcement rangers should continue to employ to discourage visitors from willfully threatening nesting efforts of breeding raptors at Pinnacles.
- Increase use of staff and visitors to observe raptor activity in the field. This can be achieved through regular communication with NPS staff and visitors, continued use of monthly monitoring updates on raptor status at the monument, and reminders about filling out wildlife observation cards.

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## Appendix A. 2012 nest phenology and success for prairie and peregrine falcons (continued).

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	North Chalone	NC-1	<1/9	<3/20	4/13-15	6/1-3			3	3	3	3	3
PRFA	North Wilderness Rock												Not Occ.
PRFA	Pig Canyon	PIG-9	<3/16	<4/12	5/16-17	7/4-5			3	3	2	2	2
PRFA	Pipsqueak Pinnacles												Not Occ.
PRFA	Prescribed Burn Cliffs												Not Occ.
PRFA	Resurrection Wall	RW-8	<1/17	<3/31	4/9-12	5/28-31			5	5	5	5	5
PRFA	Scout Peak												Not Occ.
PRFA	South Balconies	SGB-2	<1/18	<4/4	5/9-11			6/9-22	4	4	0	0	Failed
PRFA	South Chalone	SC-7	<3/20	<3/20	4/6-9	5/25-28			4	4	4	4	4
PRFA	S. Wilderness Rock												Not Occ.
PRFA	Teapot Dome	*EGG-1	<1/17										Occupied
PRFA	Tugboat												Not Occ.
PRFA	Tunnel	*EGG-1	<1/17										Occupied
PRFA	Upper Bear Gulch												Not Occ.
PRFA	Upper Condor Gulch												Not Occ.
PRFA	Western Front												Not Occ.
PRFA	Willow Spring Slide	*CNWS-3	<1/15										Occupied
PEFA	Hawkins Peak	HP-1	<1/4	<3/21	4/26-5/2	6/7-13			4	4	4	4	4
PEFA	Central High Peaks	*HP-1	<1/4										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. 2012 results and discussion for peregrine falcon occupancy and productivity.

### **Results: Peregrine Falcons**

One peregrine falcon pair occupied and nested at Pinnacles in 2012, at the core territory of Hawkins Peak (Table APP B.1). This marked the eighth consecutive year that a peregrine falcon pair has nested at Pinnacles. Prior to 2004, peregrine falcon occupancy or nesting had not been confirmed at Pinnacles for 48 years. The peregrine falcon pair successfully nested this year and produced four nestlings and fledglings (Figure APP B.1), compared to eight-year averages (since 2004) of 1.0 nesting pairs, 0.9 successful nests, 2.0 nestlings, and 2.0 fledglings (Table APP B.2).

### **Occupied Territories**

**Core Areas:** In 2012 there was one territorial peregrine falcon pair within the core areas. This number is the same as the average number of territorial falcon pairs (1.0) in the core areas over the last eight years.

**Non-Core Areas:** In 2012 there were no territorial peregrine falcon pairs within the non-core areas. This number is consistent with the lack of peregrine falcon presence or occupancy in the non-core areas over the last 27 years.



**Figure APP B.1.** Peregrine falcon fledgling at Hawkins Peak. Photo by Gavin Emmons, 2012.

### **Phenology and Productivity**

The peregrine falcon pair was first observed this year at Hawkins Peak on 4 January 2012 (Appendix A), but was also documented occupying and defending the territory throughout the fall and winter of 2011. Incubation was first observed on 21 March. Hatching of young occurred between 26 April and 2 May. Fledging took place 7–13 June 2012.

**Table APP B.1.** 2012 Pinnacles peregrine falcon breeding summary.

<b>Territory</b>	<b>Nest Used/ Last Year Used</b>	<b># Eggs Laid</b>	<b># Young Hatched</b>	<b># Young Known/ Fledged</b>
Hawkins Peak *	HP-1/ 2008	4	4	4/4

\*nests within the core area.

**Table APP B.2.** 1984–2012 Pinnacles peregrine falcon nesting productivity—core areas only.

<b>Year</b>	<b>Territorial Pairs</b>	<b>Nesting Pairs</b>	<b>Successful Nests</b>	<b># Nestlings</b>	<b># Nestlings / Nest</b>	<b># Fledglings</b>	<b># Fledglings / Nest</b>
1984	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0
2004	1	0	0	0	0	0	0
2005	1	1	1	3	3	3	3
2006	1	1	1	3	3	3	3
2007	1	1	1	3	3	3	3
2008	1	1	1	3	3	3	3
2009	1	1	1	3	3	3	3
2010	1	1	1	1	1	1	1
2011	1	1	0	0	0	0	0
2012	1	1	1	4	4	4	4
Averages (2004–2011)	1.0	0.9	0.8	2.0	2.0	2.0	2.0

***Discussion: Combined Prairie and Peregrine Falcon Occupancy and Productivity***

Given the small sample size and brief period of years that a single peregrine falcon pair has occupied and produced young at a breeding territory at Pinnacles, we cannot currently assign any statistical relevance or trend analyses specifically to peregrine falcon breeding results at the park. However, we have combined prairie and peregrine falcon results over the 27 years of monitoring efforts (Table APP B.3 and Figure APP B.2) to represent overall large falcon occupancy and productivity numbers at Pinnacles.

Combined large falcon occupancy and productivity in core and non-core areas this year were consistent with the 26-year running average rates. Twelve falcon pairs attempted to nest this year and 9 successful nests produced 32 nestlings and 31 fledglings, compared to 26-year averages of 10.1 nesting pairs, 8.1 successful nests, 29.1 nestlings, and 27.3 fledglings (Table APP B.3).

In comparing prairie falcon results (Table 2 and Figure 4) with combined prairie and peregrine falcon results (Table APP B.3 and Figure APP B.2), peregrine falcon breeding efforts appear to be supplementing overall large falcon productivity to yield more stable numbers over the 27 years of falcon monitoring at Pinnacles. A prairie falcon pair consistently nested at Hawkins Peak before a peregrine pair began occupying the territory 9 years ago; since 2004 no prairie falcons have nested at Hawkins Peak. This may suggest that prairie and peregrine falcons compete for territorial occupancy of limited cliff-nest habitat at Pinnacles, with total large falcon productivity unaffected but lower total productivity for prairie falcons in the future, particularly if additional peregrine falcon pairs re-occupy more historical territories in the future. At present, limited peregrine nesting efforts and data are inconclusive in this regard.

**Table APP B.3.** 1984–2012 Pinnacles prairie and peregrine falcon nesting productivity – core and non-core areas combined.

<b>Year</b>	<b>Territorial Pairs</b>	<b>Nesting Pairs</b>	<b>Successful Nests</b>	<b># Nestlings</b>	<b># Nestlings / Nest</b>	<b># Fledglings</b>	<b># Fledglings / Nest</b>
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	3.0	24	3.0
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	3.0	24	3.0
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	4.0
2004	13	11	9	36	4.0	33	3.7
2005	14	11	10	32	3.2	27	2.7
2006	16	15	11	38	3.5	33	3.0
2007	15	13	10	38	3.8	36	3.6
2008	13	6	5	15	3.0	15	3.0
2009	13	12	11	44	4.0	40	3.6
2010	14	12	8	28	3.5	28	3.5
2011	14	13	8	33	4.1	33	4.1
2012	13	12	9	32	3.6	31	3.4
Averages (1984– 2011)	12.2	10.1	8.1	29.1	3.5	27.3	3.3

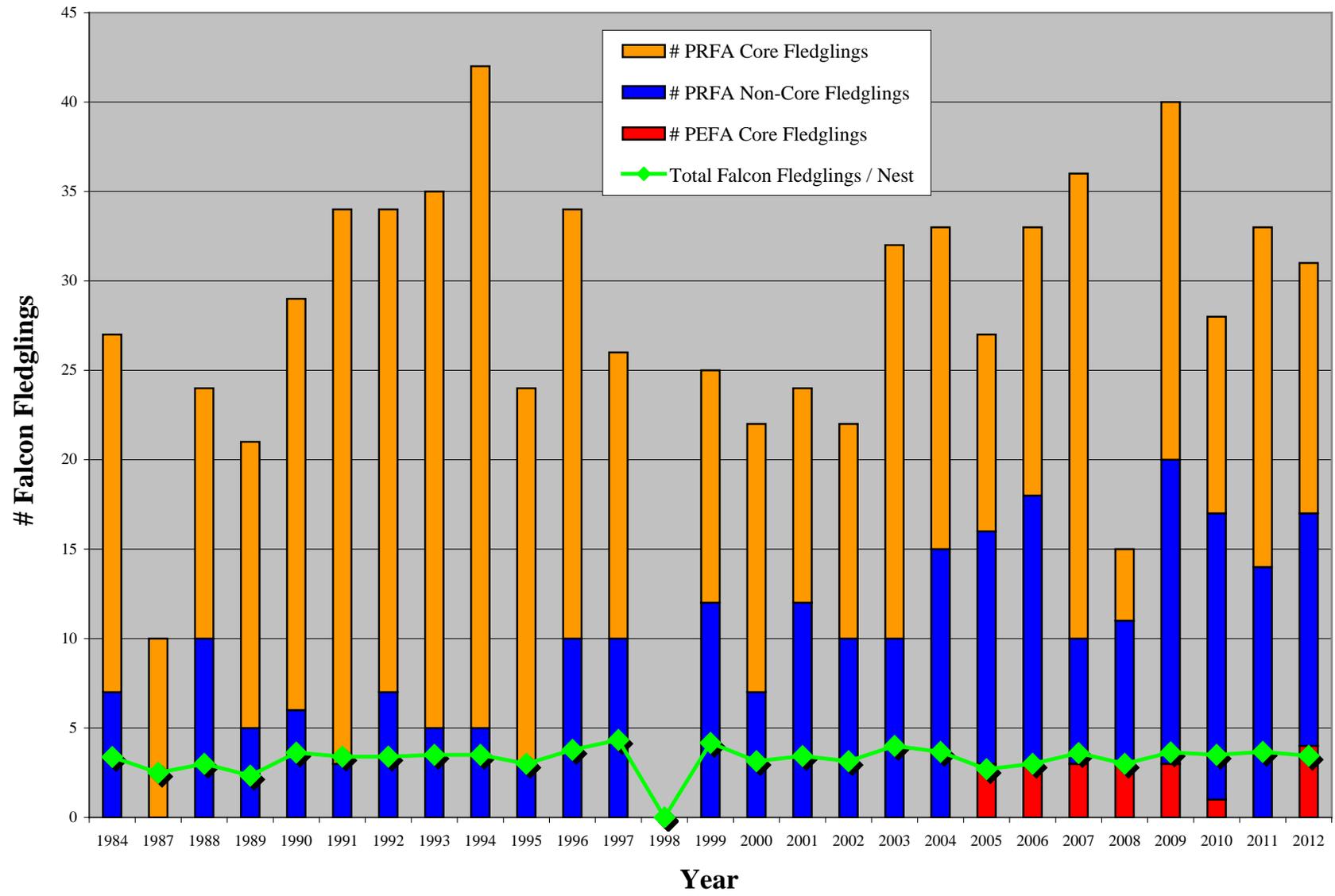


Figure APP B.2. Combined core and non-core Pinnacles PRFA and PEFA fledgling productivity, 1984–2012.

## **Appendix C. Documentation of changes in data collection methods.**

No changes were made to data collection methods for the Pinnacles raptor monitoring program through the course of the 2012 season. In 2010, several changes were made to procedures for entering observations into raptor monitoring databases, and relevant sections in the Raptor Monitoring Protocol were 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. These changes were detailed in the 2010 annual report and are briefly reviewed below.

Through the 2010 season raptor observations and breeding summaries were entered into the “Breeding Raptors” Access database, after development was finalized in 2007–2008. To increase efficient statistical analysis of prairie falcon occupancy and productivity, additional fields were created in the database “Data Entry” form, including fields detailing detection purpose, survey intention, confirmation of territorial behavior, and prairie falcon detection. The SFAN I&M staff is currently completing raptor database revisions to include end-of-season breeding summary queries for number of territories occupied, territorial pairs, nesting pairs, successful nests, total nestlings, nestlings per nest, possible fledglings, and fledglings per nest. The revised raptor database will be used for data collection and management in upcoming seasons.

The 2011 Prairie Falcon Monitoring Protocol was peer reviewed via a blind review process through the task agreement with the University of Washington (UW). Dr. James Agee of UW and Dr. Penelope Latham, Pacific West Region I&M program manager, coordinated and evaluated responses to all peer review comments, successfully completing a five-year process of protocol design and revisions.

## Appendix D. Public interest highlights.

The 2012 breeding season was the 27<sup>th</sup> year of raptor monitoring at Pinnacles. Field observations began 1 January 2012 and ended 26 July 2012, with a total of over 150 possible and active nest sites monitored during 1350 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 NPS raptor biologist conducted prairie falcon nest entries at three Pinnacles prairie falcon eyries with raptor researcher Dr. Doug Bell from East Bay Regional Park District, during the 2012 season. All falcon nestlings at the North Chalone Peak, South Balconies, and Drywall nests were briefly handled, banded, and blood samples were obtained. All nestlings at the North Chalone Peak and Drywall eyries fledged successfully. The falcon nestlings at the South Balconies eyrie were observed feeding and beg-calling actively two days after the nest entry, but the nest ultimately failed, possibly due to predation. Banding and blood sample information collected in 2009–2012 will be used to ascertain genetic insularity and pair fidelity in the Pinnacles prairie falcon population.
- For the eighth consecutive year a peregrine falcon pair was documented nesting at the monument. The site hatched and fledged four young. The last previously confirmed peregrine falcon nest effort at Pinnacles was documented in 1957.
- 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.
- The Fourth 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 the local climbing community, providing visitors with information on historical resource and recreation management at the park.



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 114/122771, November 2013

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