SPECIES PROFILE

Peregrine Falcon
Falco peregrinus

Federal Listing: Not listed
State Listing: Endangered
Global Rank: G4
State Rank: S1
Author: Christian J. Martin, New Hampshire Audubon

Element 1: Distribution and Habitat

Habitat Description

The peregrine falcon is a wide-ranging species that uses many different habitats across the United States for breeding, wintering, and migration. Open landscapes and air spaces, where peregrine falcons can locate and attack their prey in the air, are important components of most habitat types. Peregrine falcons in cliff habitats are often generalist feeders, preying on medium-sized birds roughly in proportion to their local abundance. Peregrine falcons sometimes travel several miles from cliffs to obtain prey. Preferred habitats include mountainous terrain, agricultural land, wide river valleys, lake shorelines, ocean coastlines, and islands (White et al. 2002). The urban environment, with high-rise buildings, major bridges, and tall smokestacks, has become an increasingly important habitat for peregrine falcons within the past quarter century (Cade et al. 1996b).

The home range of a territorial individual can be relatively small (100 km^2) when prey populations are abundant, but may be much larger (350 to 1,500 km^2) when prey populations are more dispersed (White et al. 2002). Peregrine falcons prefer to raise young on vertical cliffs or on man-made structures that possess physical characteristics similar to cliffs. Peregrine falcons can potentially establish breeding territories anywhere in the United States provided that areas with suitable nest sites and sufficient prey base occur in close proximity.

1.2 Justification

Peregrine falcons historically established breeding territories in relatively low densities in suitable cliff habitats throughout the United States. Between the late 1800s and the early 1940s, many cliff breeding sites in the eastern half of the country were identified and documented (Hickey 1942). Extensive reproductive failure caused by increasing levels of persistent synthetic chlorinated hydrocarbons (DDT and others) in their avian prey caused a dramatic population decline and range reduction starting in the late 1940s and continuing through 1970 (Hickey 1969, Enderson et al. 1995). In New Hampshire, peregrine falcons ceased to breed productively by the late 1950s and all known nesting areas in the state became vacant by the mid-1960s (Spofford 1975). By the late 1960s, peregrine falcons no longer occupied any historical breeding sites in states east of the Rocky Mountains (Cade et al. 1988). A massive restoration program began in the mid-1970s and was unprecedented in scope and scale. This effort resulted in the gradual recovery and re-occupancy of vacant historical territories in New Hampshire and across the United States starting in the early 1980s and continuing to the present day (Cade and Burnham 2003).

1.3 Protection and Regulatory Status

The peregrine falcon is protected in the United States under the Migratory Bird Treaty Act of 1918, which prohibits the possession or killing of most non-game birds and the collection of their eggs or nests. The American peregrine falcon, (F. p. anatum), the subspecies which formerly occupied the eastern United States, was first listed as Endangered by the federal government in 1970 under the Endangered Species Conservation Act of 1969 (Public Law 91-135, 83

Stat. 275). This authority was later transferred to the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.). Since 1979, the species has been listed as Endangered by the State of New Hampshire (R.S.A. 212-A:1 et seq.).

As a result of the population recovery throughout the United States during the 1980s and 1990s, the American peregrine falcon was removed from the federal Endangered Species List in 1999 (Mesta 1999). As required for any delisting under the ESA, the United States Fish and Wildlife Service (USFWS), in cooperation with state wildlife agencies, developed and implemented a post-delisting monitoring plan to track the post-delisting status of peregrine breeding populations in the United States through 2015 (Green et al. 2003).

Other federal protective measures that continue after delisting under ESA include those offered by the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136) for new and existing pesticide registration and use, the National Forest Management Act (16 U.S.C. 1600), and the Federal Land Management and Policy Act (43 U.S.C. 1701) (Green et al. 2003). Peregrine falcons are protected from unregulated international trade by an agreement of the 1975 Convention on International Trade in Endangered Species of Wild Flora and Fauna.

1.4 Population and Habitat Distribution

Cliffs are abundant in New Hampshire. Suitable nesting substrate does not appear to be a limiting factor in peregrine falcon distribution. Prior to the mid-1940s, at least 350 peregrine falcon pairs were estimated to breed at sites in the eastern United States (Hickey 1942). Following extirpation of the original F. p. anatum population in the region, biologists released approximately 2500 captive-produced young (consisting of at least seven F. peregrinus subspecies) to the eastern United States starting in 1974 (Tordoff and Redig 2001). The Eastern Peregrine Falcon Recovery Plan, first developed in 1979, designated northern New York and northern New England (i.e., the Adirondacks and most of Maine, New Hampshire, and Vermont) as Recovery Region 2 (USFWS 1987). Recovery Region 2 contained about 85 territorial pairs prior to the early 1940s (Hickey 1942), but no pairs from the mid-1960s through 1980 (Berger et al. 1969).

Through the mid-1950s, all documented peregrine falcon territories in New Hampshire were associated with cliffs. Most sites were scattered throughout the White Mountains from the west central to the far northeastern parts of the state (Table 1). The now recovering population occupies territories in a similar pattern, occurring mostly in the White Mountains with a few additional occupied cliffs in the far north and one urban site in southern New Hampshire (Table 1 and Figure 1). Recovery data for individually marked peregrine falcons clearly show that individuals breeding in New Hampshire are not isolated from those breeding in other New England states, but instead are part of an interconnected regional population (Barclay 1995, M. Amaral, USFWS, personal communication).

1.5 Town Distribution Map

Not completed for this species.

1.6 Habitat Map

See Cliff habitat profile.

1.7 Sources of Information

General natural history information and some sources of original research were obtained primarily from White et al. (2002). Unless otherwise noted, the source for New Hampshire species data is field monitoring and management activities conducted by the New Hampshire Audubon (NHA) from 1983 though 2004 under annual contracts and/or grants received from the New Hampshire Fish and Game Department (NHFG) and/or the USFWS (e.g., Martin 1993, Martin 2004).

1.8 Extent and Quality of Data

Since the early 1980s, the peregrine falcon has been one of the most intensively monitored and managed species in New Hampshire (see Appendix 1 for example of detailed data available for each documented breeding site). Breeding site data are derived from 2 decades of field monitoring by NHA staff and trained volunteers. These observers employ standardized monitoring techniques at historical, active, and other potential sites throughout the state (see Cade et al. 1996a). Remote sites and sites located close to roads and trails are surveyed, although remote sites are vis-

ited less frequently.

1.9 Distribution Research

Spring surveys of recently active and potential breeding sites should be used to monitor the distribution and abundance of peregrine falcons in New Hampshire. Recently active sites should be checked annually to determine occupancy status and reproductive outcome. Surveys of potential sites should be conducted on a rotating basis, with annual survey intensity determined by funding and available human resources. For example, sites could be checked on a 3-year rotation covering 33% of sites annually, on a 5-year rotation covering 20% annually, or on a 10-year rotation covering 10% annually. New Hampshire should continue to participate in the federal post-delisting monitoring program established by the USFWS to track the status of a subset of the breeding population across the United States in 2006, 2009, 2012, and 2015 (Green et al. 2003).

Element 2: Species/Habitat Condition

2.1 Scale

See Cliff Habitat Profile.

2.2 Relative Health of Populations

New Hampshire's 17 documented historical breeding territories and 18 recently occupied breeding territories are listed in Table 1. Of the 17 historical territories documented in the state, 5 (29%) have been reoccupied while 12 (71%) were unoccupied between 1970 and 2004. Thirteen recently occupied territories have no documented record of historical use, suggesting that the number of territories in the state prior to 1950 was underestimated. Table 2 documents the temporal pattern of territory occupancy in New Hampshire beginning in 1981. During the 10-year period from 1985 to 1994, the breeding population expanded at an annual rate of 15.9%. From 1995 to 2004, the population continued to expand, but at a less vigorous annual rate of 3.6%. The population is continuing to grow. The highest numbers of occupied territories, territorial pairs, nesting pairs, successful pairs, and number of young fledged in the post-DDT era have all been attained within the past three breeding seasons.

2.3 Population Management Status

Volunteers from NHA conduct productivity monitoring and presence/absence surveys of approximately 30 potential peregrine falcon breeding sites. Other activities include salvage of eggs and chicks, evaluation and management of human (i.e., recreational) influences, internet broadcasting of nesting activity, and extensive outreach and education to the public and rock-climbing community.

2.4 Relative Quality of Habitat Patches

All peregrine falcon breeding sites are cliffs except the site on the New Hampshire Tower in the City of Manchester. Potential and currently occupied cliff sites in New Hampshire appear to provide the key ecological attributes required to support a healthy breeding population. Of 172 documented incubation attempts on cliffs in New Hampshire from 1981 to 2004, 134 (78%) took place directly on rock ledges, 34 (20%) were in former common raven nests, and 4 (2%) occurred on undetermined substrates. The greatest concern for habitat quality at cliff sites is the growing popularity of recreational climbing and its potential to suppress nesting success and productivity.

Each of the four known urban nesting attempts occurred in a human-built nesting box. The number of potential urban nesting sites is expected to increase (10-20 currently exist) with increasing development. Peregrine falcons use tall office buildings, church steeples (e.g., in Nashua, Manchester, Concord, and Berlin), major industrial buildings, tall smokestacks, large dams (e.g., Seabrook Station, Merrimack Station, Newington Station, Nexfor Paper Mill, Moore Dam, and Comerford Dam), and substructures of the state's largest bridges (e.g., Interstate 95 at Piscataqua River, Route 16/4 at Little Bay mouth, Route 9 at Connecticut River, Route 101/293 at Merrimack River). The most serious habitat quality concerns at urban sites are pigeon abundance, the potential risk of secondary poisoning due to pigeon control efforts, the limited availability of suitable nesting substrates, and the highly variable maintenance schedules of urban structures.

2.5 Habitat Patch Protection Status

Of 15 occupied peregrine falcon breeding territories in New Hampshire in 2004, 11 sites (73%) were on public land, 3 (20%) were on private land, and one (7%) was on a mix of public and private land. Of the 11 sites on public land, 6 sites were managed by the United States Forest Service, 4 were on state land managed by the New Hampshire Division of Resources and Economic Development, and one was on municipal land managed by the Town of Woodstock. Of the 3 sites on private land, one was protected by a conservation easement, while 2 were not. Fifteen sites were cliff habitat, and one was urban habitat.

2.6 Habitat Management Status

Cliff habitats in New Hampshire are subject to very little direct habitat management. There are no efforts to promote or discourage any particular vegetation type or density on cliffs. Establishing temporary restrictions for the recreational use of cliffs is the only current management action. Urban habitat management consists of voluntary adjustments in building maintenance to avoid potentially disruptive activities such as window washing or antenna construction during the breeding season.

2.7 Sources of Information

Information on New Hampshire's peregrine falcon population and habitat is derived directly from summary reports and field data on monitoring and management activities conducted by NHA from 1983 though 2004 under annual contracts and/or grants from the NHFG and/or the USFWS (e.g., Martin 1993, Martin 2004).

2.8 Extent and Quality of Data

Peregrine falcons have been listed as Endangered on both federal and state lists for much of the past four decades, and so there is a relatively complete data set on occurrence, productivity, and habitat condition. Annual summaries of this information are on file at the NHFG.

2.9 Condition Ranking

2.10 Condition Assessment Research

The population of peregrine falcons in northern New England has been individually marked. Band resighting helps collect critically important and hard-to-acquire data on dispersal patterns and population demography, individual longevity, and nest site fidelity. It links contaminant data from eggs to individual female peregrine falcons of known age and reproductive history.

Element 3: Species and Habitat Threat Assessment

3.1.1 Recreation

(A) Exposure Pathway
Human presence near nest sites provokes aggressive defensive behaviors, limiting incubation, brooding, or feeding, and increasing chick exposure to temperature fluctuations and predation. These factors may also result in higher mortality and reduced productivity due to premature fledging of young.

(B) Evidence
Peregrine falcons nesting in remote areas are intolerant of human encroachment (Cade et al. 1996a). Recreational rock climbing activity and hiking on or near cliffs can produce aggressive nest defense behaviors (Lanier and Joseph 1989, Pyke 1997). The popularity of recreational rock climbing has grown exponentially in northern New England during the post-DDT era and is becoming a serious problem for land managers trying to protect nesting peregrine falcons (Mesta 1999). Few cliffs in New Hampshire are free from fixed climbing hardware, including cliffs in federally designated wilderness areas that are located as far as 4 miles from the nearest roadside trailhead.

3.1.2 Non-point Source Pollution

(A) Exposure Pathway
Various neurotoxins accumulate in animal tissues and are magnified in predatorial trophic webs, with ingestion by top predators producing reproductive, behavioral, neurological, and physiological stresses. These changes lead to reduced vigor and breeding

success (Evers 2005, Sharp and Lunder 2004). Organochlorine pesticides, most notably DDT, accumulate in animal tissue and are magnified in predatorial trophic webs, causing lethal and sub-lethal effects in peregrine falcons.

(B) Evidence
Brominated fire retardants, commonly known as PBDEs, are similar in chemical structure to PCBs. They are used in a wide range of synthetic household and consumer products. PBDEs have been shown to be accumulating in wildlife populations worldwide, and some of the highest concentrations yet documented occur in peregrine falcon populations in the United Kingdom (European Union 2003).

Elevated levels of organochlorine pesticides are still being detected in some North American peregrine falcon populations and pose a possible risk to sustained recovery (Mesta 1999). Even though these chemicals have been banned for sale and use in North America, their use continues to be largely unrestricted in Latin America. DDT residues continue to be detected in some migratory songbird populations and toxic residues in avian prey species can cause lethal and sub-lethal effects in peregrine falcons, including eggshell thinning that results in a loss of productivity (Cade et al. 1988, White et al. 2002). There are direct correlations between concentrations of DDE residues in egg contents and eggshell thickness (Peakall and Kiff 1988).

3.1.3 Mercury

(A) Exposure Pathway
Mercury bioaccumulates in much the same way as other persistent toxins. See 3.1.2 above.

(B) Evidence
Mercury levels are high and pervasive in the aquatic food webs and terrestrial systems of northeastern North America (Evers 2005). Current research shows that even forest songbird populations have elevated mercury burdens (Rimmer et al. 2005).

3.1.4 Energy and Communication Infrastructure

(A) Exposure Pathway
Construction associated with the building of cellular towers and wind turbines may limit incubation, brooding, or feeding, and increase chick exposure to temperature fluctuations and predation. These factors may lead to higher mortality and reduced productivity due to premature fledging of young. Death or serious injury may result when peregrine falcons collide with towers, supporting wires, and/or wind turbine blades.

(B) Evidence
Activities on the tops of nesting cliffs tend to be more disruptive than similar activities below cliffs (Cade et al. 1996a). Construction that involves road building, logging, and blasting is potentially disruptive to nesting peregrine falcons and needs to be controlled roughly one half mile from nest sites (Cade et al. 1996a). Collisions with structures and support wires are a known source of mortality for fledglings and after hatch-year peregrine falcons (White et al. 2002).

3.2 Sources of Information

Information on threats to peregrine falcons was obtained from a literature review, from NHA field data, and from consultation with specialists from the USFWS and NHA in Concord, New Hampshire, and from BioDiversity Research Institute in Gorham, Maine.

3.3 Extent and Quality of Data

Researchers working outside of New Hampshire examined most of the threats to peregrine falcons described above. There are sufficient data on the climbing and hiking threat in New Hampshire to justify concern and warrant management actions. The potential effects of mercury and PBDEs on terrestrial species are just now gaining the attention of researchers nationwide. Egg samples in the archives of the USFWS could potentially produce New Hampshire data to assess this issue. Threats related to exposure to DDT and other organochlorine pesticides are well documented, including data from New Hampshire. There is no data specific to New Hampshire on the effects of cellular tower/wind turbine construction or operation. With relatively little data nationwide, this topic warrants further field investigation.

3.4 Threat Assessment Research

Investigate the tolerance thresholds of peregrine falcons for recreational rock climbing activity in the vicinity of nest sites, and examine the impacts of climbing activity on the cliff habitat in general. Analyze archived peregrine falcon egg and prey remains to produce data specific to New Hampshire on current levels of mercury, PCBEs, DDE, and other bio-accumulative pollutants. Investigate the likely future extent of cellular tower/wind turbine construction and operation in New Hampshire to determine their potential impact on peregrine falcons and other cliff-dwelling wildlife. Develop guidelines for the location, construction, and operation of these facilities.

Element 4: Conservation Actions

4.1.1 Monitor Threatened and Endangered Breeding Status, Monitoring

4.1.2 Develop State Recovery Plan, Regulation and Policy (see Strategies, Agency Regulation and Policy)

4.1.3 Advise ESA Recovery Efforts, Regulation and Policy (see Strategies, Inter-Agency Regulation and Policy)

4.1.4 Cultivate Recreational User Stewardship, Education and Outreach (see Cliff Habitat, see also Strategies, Education and Outreach)

4.1.5 Advise Land Managers on Mitigation of Recreational Impacts, Regulation and Policy (see Cliff Habitat, see also Strategies, Inter-Agency Regulation and Policy)

4.1.6 Identify High Risk Areas for Recreation, Wind Energy, and Pollutants, Conservation Planning see Strategies, Conservation Planning)

4.1.7 Engage in Inter-Agency Risk Assessments for Recreation, Wind Energy, and Pollutants, Regulation and Policy (see Strategies, Inter-Agency Regulation and Policy)

4.1.8 Restrict Access to High Risk Areas, Regulation and Policy (see also Strategies, Inter-Agency Regulation and Policy)

4.1.9 Advise Wind Energy Developers on Best Management Practices for Construction, Regulation and Policy (see Strategies, Inter-Agency Regulation and Policy)

4.1.10 Prioritize Cliffs for Protection, Land Protection (see Strategies, Conservation Planning)

4.1.11 Protect Unfragmented Blocks, Land Protection (see Strategies, Land Protection)

4.1.12 Monitor as an Indicator of Bio-Accumulation of Contaminants, Monitoring (see Strategies, Monitoring)

Element 5: References

5.1 Literature

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5.2 Data Sources

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Peregrine falcon banding database, United States Fish and Wildlife Service, New England Field Office, Concord, New Hampshire.

Element 6: List of Figures

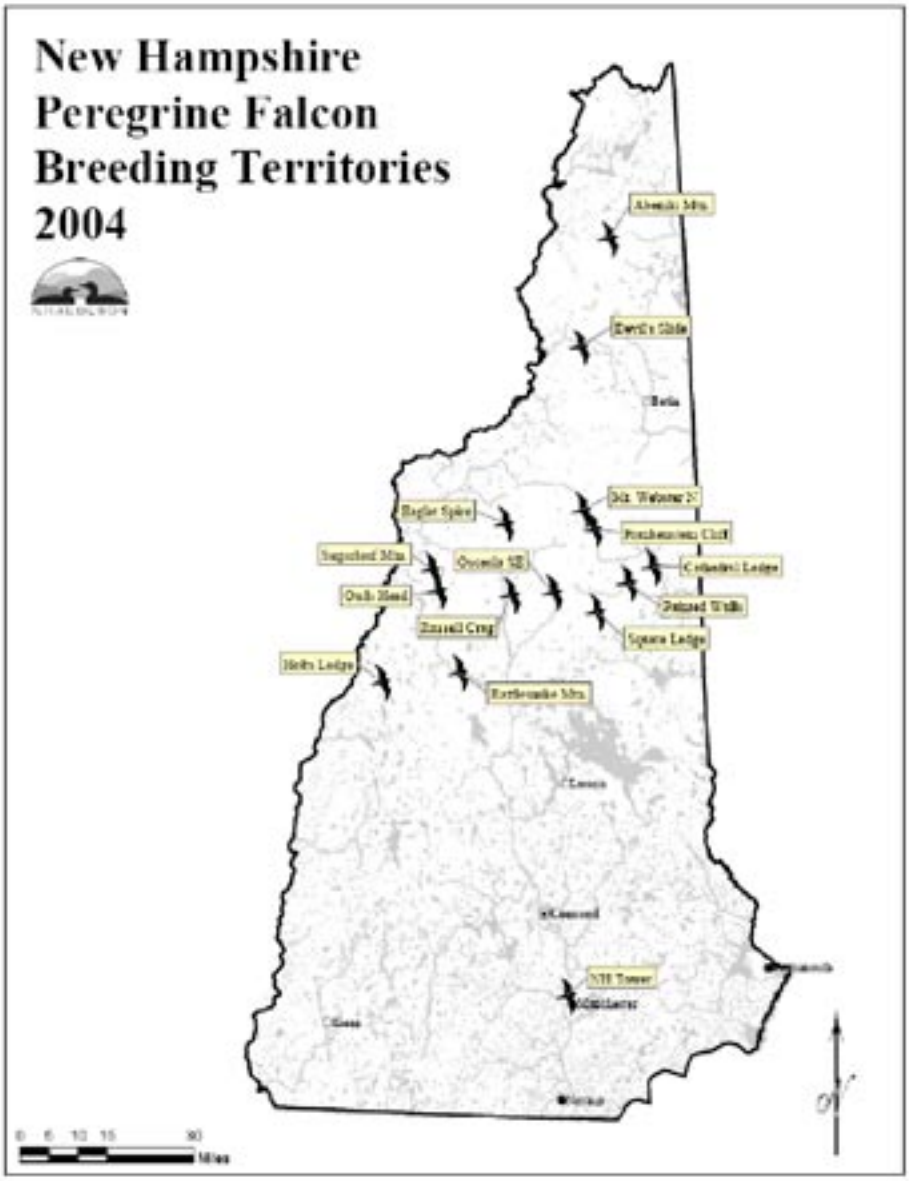


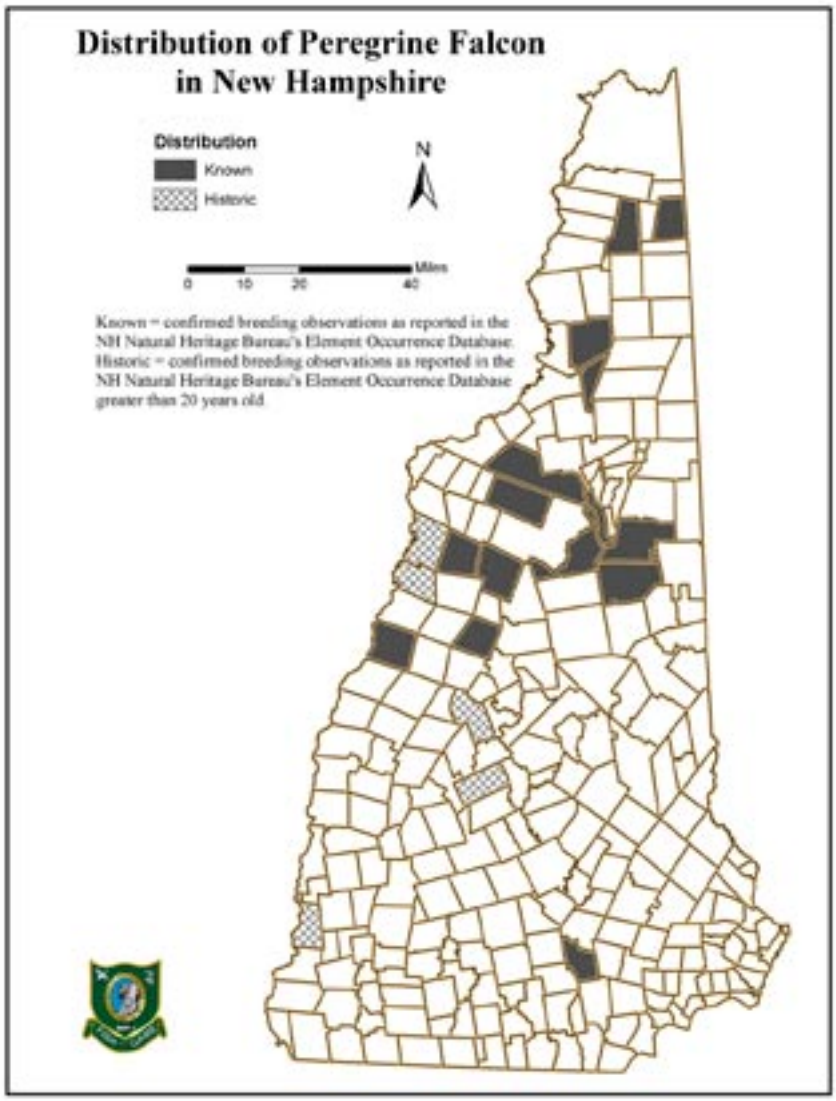
Figure 1. Distribution of peregrine falcon breeding territories in New Hampshire in 2004.

Breeding site	**NH Township**	**Most recent documented occupancy**
Unoccupied since 1970, but with documented prior historical use		
Baldface	Beans Purchase/Chatham	no specific date given
Black Mtn.	Benton	no specific date given
Percy Peaks	Stratford	no specific date given
Moat Mtn.	Albany	1870
Humphreys Ledge	Bartlett	1902
Sugarloaf	Alexandria	1927
Mt. Monadnock	Jaffrey	1938
Ragged Mtn. Bulkhead	Andover	1939
Pond Ledge	Haverhill	1940
Polar Caves	Rumney	1949
Peaked Mtn.	Piermont	1954
Mt. Kilburn	Walpole	1955
Occupied since 1970 with documented prior historical use		
Cathedral/White Horse	Bartlett	1986-89, 1997-2004
Holts Ledge	Lyme	1987-2004
Owls Head	Benton	1993-2004
Rattlesnake Mtn.	Rumney	1994-2004
Diamond Peaks	2nd College Grant	1997-1999
Occupied since 1970, but with no documented prior historical use		
Eagle/Eaglet/Cannon	Franconia	1981-2004
Square Mtn.	Kilkenny	1984-1998
Frankenstein Cliff	Harts Location	1985-2004
Willard/Webster	Harts Location	1985-1995, 1997-1998, 2001-2004
Abeniki Mtn.	Dixville	1988-2004
Painted Walls	Albany	1989-1990, 1993-2004
Square Ledge	Albany	1991-1992, 1995-2004
Devils Slide	Stark	1994-2004
Osceola East/South	Livermore	1995, 1999-2004
Beaver Pond Cliff	Benton	1998
New Hampshire Tower	Manchester	2000-2004
Russell Crag	Woodstock	2002-2004
Sugarloaf Mtn.	Benton	2004

Table 1. Historical and recent peregrine falcon breeding sites in New Hampshire.

Year	Occupied Territories	Territorial Pairs	Nesting Pairs	Successful Pairs	Young Fledged	Young fledged/ nesting pair
1981	1	1	1	1	2	2
1982	1	1	1	0	0	0
1983	1	1	1	0	0	0
1984	2	0	0	0	0	0
1985	4	4	3	2	5	1.67
1986	5	5	4	4	9	2.25
1987	6	6	5	1	2	0.4
1988	7	7	4	2	3	0.75
1989	8	7	7	5	10	1.43
1990	7	7	7	4	11	1.57
1991	7	6	6	3	7	1.17
1992	7	7	7	3	5	0.71
1993	8	8	7	5	11	1.57
1994	10	9	8	5	10	1.25
1995	11	11	10	8	15	1.5
1996	9	9	8	5	13	1.63
1997	12	11	10	6	16	1.6
1998	12	10	10	7	16	1.6
1999	12	11	9	8	25	2.78
2000	11	10	10	10	25	2.5
2001	13	12	12	10	22	1.83
2002	14	14	14	9	27	1.93
2003	14	14	14	10	21	1.5
2004	15	13	11	8	15	1.36
24 yrs	**197**	**184**	**169**	**116**	**270**	**1.6**

Table 2. New Hampshire peregrine falcon productivity summary: 1981-2004.


Distribution of Peregrine Falcon
in New Hampshire
Distribution
Known
Historic
N
Miles
0
10
20
40
Known = confirmed breeding observations as reported in the NH Natural Heritage Bureau's Element Occurrence Database.
Historic = confirmed breeding observations as reported in the NH Natural Heritage Bureau's Element Occurrence Database greater than 20 years old