



# 2007 American Peregrine Falcon (*Falco peregrinus anatum*) Monitoring along the Upper Yukon River in Yukon-Charley Rivers National Preserve, Central Alaska Network

Natural Resource Report NPS/CAKN/NRTR—2008/079



**ON THE COVER**

Wildlife Biologists Chris Florian, Skip Ambrose and John Burch observe American Peregrine Falcon eyries along the bluffs of the Upper Yukon River in Yukon-Charley Rivers National Preserve, May of 2007.

Photograph by: Melanie Flamme, Yukon-Charley Rivers National Preserve.

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## Executive Summary

American peregrine falcons along the upper Yukon River, including Yukon-Charley Rivers National Preserve (YUCH), Alaska, have been monitored almost continuously since 1973. This and other local populations in interior Alaska have increased steadily since the late 1970s, following the ban of DDT in the United States in 1972, and their listing as endangered in 1973 under the Endangered Species Act (U.S. Congress). In August 1999, the U.S. Fish and Wildlife Service (USFWS) removed the American peregrine falcon from the list of Threatened and Endangered Wildlife. Section 4(g)(1) of the Endangered Species Act requires that all species which have recovered and have been removed from the list are monitored for not less than five years following delisting. In 2004, the last year of this five-year monitoring program was implemented by the Air Force, USFWS, and National Park Service (NPS). In 2003, the upper Yukon River peregrine falcon population was identified as one of two index populations in Alaska for long-term monitoring beyond 2004 (USFWS 2003), and in 2005 by the Central Alaska Network (as part of the NPS Vital Signs Inventory and Monitoring Program) as an important vital sign in determining ecosystem health (MacCluskie and Oakley 2005). A monitoring protocol was prepared (Ambrose et al. 2005) following standards of Oakley et al. (2003), which is currently in the peer review process.

In 2007, 265 kilometers of the upper Yukon River were surveyed. Fifty nesting territories were occupied by American peregrine falcons (49 pairs and 1 single adult on territories). Thirty-one of 49 pairs (63.3%) were successful, and produced 82 nestlings. Productivity was 1.67 nestlings per total pair and 2.65 nestlings per successful ( $\geq 1$  nestling observed) pair. Between 1975 and 2007, the number of total and successful pairs nesting along the upper Yukon River has been steadily increasing, though the percentage of total pairs nesting successfully has been declining. This may be attributable to increased competition for resources due to increased density and birds moving into sub-optimal territories (i.e. territories with insufficient resources and cover from predators).

Recent contaminants analyses of Peregrine Falcon eggs from YUCH suggest that mercury is currently at levels that may affect reproduction, and trends suggest that mercury levels may be increasing (Ambrose et al. 2000). Mercury is a persistent compound which bioaccumulates at high trophic levels causing toxic effects (similar to DDT). Additionally, DDT and other pesticides are still being used in wintering grounds, which may cause continued risk to the population. In response to these threats, addled eggs and samples of nestling feathers are collected to determine contaminants levels on the nesting grounds. Molted adult feathers are collected to assess contaminants levels on the wintering grounds. In addition, samples of nestling and molted adult feathers, buccal swabs (Handel et al. 2006) and egg-shell fragments are collected for genetic comparison of the upper Yukon River population to other North American peregrine populations.

## Introduction

American peregrine falcons (*Falco peregrinus anatum*) are medium-sized raptors that prey almost entirely on birds. Their breeding range extends from Mexico north to the tree-line in Canada and Alaska. In Alaska, they occur in the forested interior, nesting primarily on cliffs along the major rivers. In the northern parts of its range, the American peregrine falcon is highly migratory, wintering as far south as Brazil and Argentina.

Beginning in the late 1940s, the use of persistent organochlorine pesticides greatly affected American peregrine falcons in North America. These pesticides affected mortality and behavior, and caused birds to lay thin-shelled eggs that often failed to hatch and consequently lowered productivity. American peregrine falcons were classified as endangered in 1973 under the Endangered Species Act (U.S. Congress). In interior Alaska, American peregrine falcons declined to approximately 20 percent of historical levels by the mid-1970s. In 1972, the United States restricted the use of persistent organochlorine pesticides, and since 1978, American peregrine falcons in interior Alaska have been increasing.

Though population numbers have increased, recent evidence suggests that American peregrine falcons are still threatened by environmental contaminants. Analyses of American peregrine falcon eggs from the upper Yukon River suggest that mercury, a persistent compound which bioaccumulates at high trophic levels causing toxic effects (similar to DDT), is currently at levels that may affect reproduction, and trends suggest that mercury levels may be increasing (Ambrose et al. 2000). High levels of mercury are made biologically available through industrial processes such as mining and waste incineration, and will likely increase with global industrialization. Additionally, DDT and other pesticides are still being used on wintering grounds, which may cause continued risk to the population.

American peregrine falcons in the upper Yukon River corridor, within and adjacent to Yukon-Charley Rivers National Preserve (YUCH), have been identified by the National Park Service (NPS) as an important vital sign within the Central Alaska Inventory and Monitoring Network (CAKN). *Fauna Distribution and Abundance* was identified as one of CAKN's highest priority vital signs, and American peregrine falcons were specifically identified because they are top trophic level predators that are indicators of persistent bioaccumulative contaminants (MacCluskie et al. 2005). Additionally, the upper Yukon River study area was identified as 1 of 2 index areas for Alaska in the National *Monitoring Plan for the American Peregrine Falcon* (USFWS 2003). A monitoring protocol which incorporates national and network objectives was prepared (Ambrose et al. 2005) following standards of Oakley et al. (2003), which is currently in the peer review process.

The upper Yukon River, from the Alaska – Yukon Territory border to Circle, Alaska, provides excellent cliff-nesting habitat for American peregrine falcons as well as an abundant variety of prey species. The majority of this habitat lies within YUCH, with American peregrine falcon protection being one of the primary reasons for the Preserve's establishment in 1980 (U.S. Congress). The enabling legislation establishing YUCH, the Alaska National Interest Lands Conservation Act (U.S. Congress 1980), states:

*“the preserve shall be managed for the following purposes... to protect habitat for, and populations of, fish and wildlife, including but not limited to peregrine falcons and other raptorial birds, ...”*

The American peregrine falcon population breeding within the upper Yukon River valley is believed to be one of the best studied populations in North America. Over 30 years of data document the population’s recovery from 11 pairs in 1973 (Ritchie 1976) to 52 pairs in 2004 (Guldager et al. 2005). The number of total pairs nesting along the upper Yukon River has been steadily increasing, although the percentage of total pairs nesting successfully has been declining. This may be attributable to increased competition for resources due to increased density and birds moving into sub-optimal territories (i.e. territories with insufficient resources and cover from predators). Further monitoring is necessary to understand the natural variation of a “healthy” American peregrine falcon population, which will allow us to later detect population change that is beyond normal limits of variation.

One important aspect of the American peregrine falcon population in Yukon-Charley Rivers National Preserve is that this population has never been manipulated. No nest manipulations, no captive breeding, no releases, and no take for harvest have ever occurred there. In all other populations in the lower-48 states, there have been influences of these manipulations and captive-breed releases. Hence, the upper Yukon River population is unique for this subspecies as one where the recovery has been completely natural and well studied.

Surveys for American peregrine falcons along the upper Yukon River (between Circle, Alaska and the Alaska – Yukon Territory border) have been conducted annually since 1973 by Skip Ambrose. He has collected most of the data (over 95%) in the current data set over these many years and has expertise and intimate knowledge of the study area and these raptors. To ensure that survey results are comparable to previous years, Skip Ambrose assisted with the field surveys and data entry. Observations, survey and productivity data for most of these surveys were recorded each survey year on the Alaska Raptor Nest Record (USFWS 1989), a field survey form developed in 1989 and most recently revised in 2007. All historical data are currently being entered into a new Access database developed by CAKN. The new database has fields that match the revised Alaska Raptor Nest Card, and all historical data (including photos, notes, territories and eyries information) will be entered in this new database. The new peregrine database was field tested in 2007 and modifications are being made by the CAKN data managers to make the database more efficient for both field data entry and historical data entry.

## **Objectives**

The three primary objectives for the American peregrine falcon monitoring program in the upper Yukon River study area are:

1. To monitor temporal trends in the breeding performance of American peregrine falcons within YUCH. This includes annual measures of territory occupancy, nest success and productivity.
2. To monitor levels of contaminants in eggs produced by American peregrine falcons breeding in YUCH. This includes repeated analyses of eggs for persistent organic pollutants (e.g. DDT and polychlorinated biphenyls (PCBs) and heavy metals (e.g. mercury and cadmium); contaminants found in eggs reflect contaminants that the birds were exposed to at wintering grounds and along migration routes.
3. To monitor levels of contaminants accumulated in feathers of nestling American peregrine falcons on the breeding grounds within YUCH. This includes repeated analyses of nestling feathers for heavy metals (e.g. mercury and cadmium); contaminants found in nestling feathers reflect natal area contaminants exposure.

## Methods

### Site Selection

The study area is located on a section of the Yukon River between the Alaska – Yukon Territory border and Circle, Alaska, a distance of 265 km. The study area is limited to 0.5 km on either side of the river (Figure 1). The river elevation varies from 260 m (865 ft) above sea level at the Alaska – Yukon Territory border to 170 m (560 ft) at Circle, Alaska. Cliffs, rock outcrops, and dirt banks are common along the river, ranging from 8 m to 600 m above the river. The area's diverse topography, frequent wildfires, discontinuous permafrost, and climate interact to create a complex mosaic of taiga and tundra within the subarctic boreal forest zone (NPS 1993). Spruce/hardwood forest, wet meadows, tussock tundra, shrub thickets, and sparsely vegetated gravel bars dominate. Black spruce (*Picea mariana*) forest occurs in poorly drained areas on north facing slopes, low terraces and floodplains. White spruce (*P. glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and/or balsam poplar (*P. balsamifera*) are common at well drained sites along riparian areas, steep drainages, and south facing slopes.

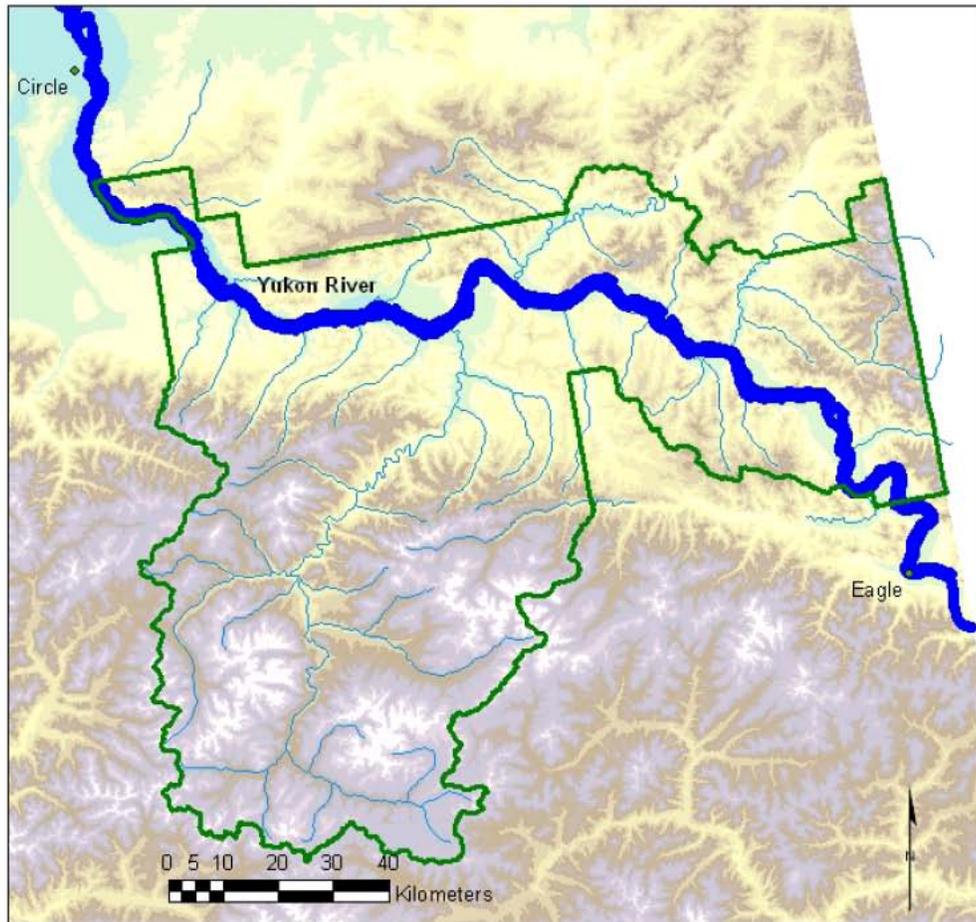


Figure 1. The Upper Yukon River study area includes all available habitat within 0.5 km of the section of the Yukon River between the Alaska – Yukon Territory border and Circle, Alaska. Yukon-Charley Rivers National Preserve is outlined in green.

## Methods

Refer to the *American Peregrine Falcon Monitoring Protocol for Yukon-Charley Rivers National Preserve* (Ambrose et al. 2005) prepared for the CAKN Monitoring Program, NPS, for a detailed description of methods.

Twenty-six days were spent in the study area in 2007, 17 May to 30 May, and 7 July to 18 July. The early survey (mid- to late-May) located occupied nesting territories; the trip in July determined breeding success and productivity. Surveys were conducted using a 21-ft USFWS river boat launched from Circle. For each field visit, the field crew motored up the river from Circle to the Alaska – Yukon Territory border, and returned to Circle. During the first survey, all potential nesting territories along the river were observed from shoreline or islands using binoculars and spotting scopes. Observations were conducted for a minimum of 4 hours at each potential nesting territory. When possible, campsites were chosen for their proximity to potential nesting territories to extend survey periods. During the second survey in July, all occupied territories were observed using binoculars and spotting scopes to determine the number and age of nestlings. In May, the survey was conducted by a crew of 4 (Ambrose, Florian, Burch and Flamme). The July survey was conducted by a crew of 3 (Burch, Flamme, Frank Keim). See Table 1 for a list of participants.

Table 1. Field crew members, their affiliations, and dates in the field, 2007.

Crew Member	Affiliation	Dates in Field
Skip Ambrose	Wildlife Biologist, Sandhill Company, Utah	17 May –30 May
Chris Florian	Wildlife Biologist, Sandhill Company, Utah	17 May –30 May
Melanie Flamme	Wildlife Biologist, Yukon-Charley Rivers National Preserve, NPS	17 May – 30 May 7 July – 18 July
John Burch	Wildlife Biologist, Yukon-Charley Rivers National Preserve, NPS	17 May – 30 May 7 July – 18 July
Frank Keim	Volunteer, Fairbanks, AK	7 July – 13 July

Nesting territories were noted on U.S. Geological Survey topographic maps (1:63,360), and latitude and longitude from GPS units were recorded for new territories. Nest occupancy data and nest site characteristics were entered onto Alaska Raptor Observation Record Cards (USFWS 1989, updated 2007). Narrative descriptions of behavior, nest site locations, and other observations were kept in field notebooks. Terminology and definitions followed that described in the National Wildlife Federation’s Raptor Management Techniques Manual (1987) (Appendix I).

The following information was collected:

1. Number of nesting territories occupied by a pair;
2. Number of nesting territories occupied by a single adult;
3. Number of pairs attempting to breed;
4. Number of pairs with nestlings;
5. Number of nestlings reaching 2 to 4 weeks of age; and
6. Estimated Age of nestlings at time of nest visit.

Nesting phenology was calculated based on 7 days for clutch completion, 33 days for incubation (with incubation beginning after the third egg), and 40 days from hatching to first flight (Cade et al. 1996). Ages of nestlings were estimated during nest visits using photographs of known-age nestlings (Cade et al. 1996).

The following nest site information was collected for each new occupied eyrie and/or territory (previously used sites were documented in past years):

1. Cliff height (primary rock surface area, m);
2. Cliff height above river (talus slope or forested area below cliff, m);
3. Cliff length (km);
4. Nest height on cliff (relative to rock surface area, m); and
5. Nest height above river (m).

## Results

Fifty nesting territories were occupied by American peregrine falcons along the upper Yukon River in 2007 (49 pairs and 1 single adult on territory). Extra adults were observed at 6 territories occupied by pairs. Thirty-one of the 49 pairs (63.3%) were successful, and produced 82 nestlings in 2007. Productivity was 1.67 nestlings per total pair and 2.65 nestlings per successful pair (Tables 2 and 3 and Figures 2 and 3).

Table 2. American peregrine falcons observed by territory along the Upper Yukon River, Alaska, in 2007.

KM	Name (Local Description)	Adults	Nestlings
3.5	Border + 3.5 km	2	1
9.5	Eagle Creek	2	2
14.0	Eagle Village	2	0
20.0	Eagle Bluff	2	0
26.0	Boulder Creek + .5 km	2	1
31.5	Shade Creek - 1.0 km	2	4
38.0	Calico Bluff	2	3
44.5	Stink Creek, upper	3	0
48.5	70 Mile - 2.5 km	3	0
51.5	70 Mile + 0.5 km	2	3

56.0	70 Mile + 5.0 km	2	2
57.5	Tatonduk - 3.0 km	2	2
76.5	Montauk Bluff	2	4
83.0	Trout Creek	2	0
88.0	Nation River - 5.0 km	3	2
90.5	Nation River - 2.5 km	2	3
95.5	Nation River + 2.5 km	2	0
112.0	Logan Creek + 2.0 km	3	0
117.0	Glenn Creek + 0.5 km	2	2
126.5	Kathul Mountain-Middle	2	4
129.0	1.5 km SO VABM Kat	2	1
138.0	Upper Kandik-Weshranarian	2	1
141.0	Kandik Middle (Lower)	2	3
149.5	Biederman Bluff, middle	2	2
154.0	Chester Bluff, upriver	2	3
155.5	Lower Chester Bluff	3	0
166.0	Sam Creek	2	0
176.5	Coal Creek -.5 km	2	2
180.0	McGregor's Cabin	2	0
181.5	Edward's Creek	2	3
183.0	Edward's Creek + 1.5 km	2	1
187.0	Woodchopper Creek	2	3
191.5	Woodchopper Creek + 4.5 km	2	3
195.0	Woodchopper Creek + 8.0 km	2	3
197.0	Woodchopper Creek + 6.0 km	2	0
199.0	Webber Creek, middle	3	0
200.0	Webber Creek, downriver	2	4
205.5	Thanksgiving Creek	2	0
208.5	Takoma Creek	2	0
210.5	Takoma Bluff, upriver	2	0
211.5	Takoma Bluff, downriver	1	0
229.0	23 Mile	2	4
231.0	22 Mile	2	4
233.0	21 Mile	2	0
235.0	19 Mile	2	3
238.7	15.5 Mile	2	2
243.2	13 Mile	2	0
249.0	10 Mile	2	3
250.0	9 Mile	2	0
254.0	7 Mile	2	4

Table 3. American peregrine falcons along the Upper Yukon River, Alaska, 1975 – 2007.

<b>Year</b>	<b>Occupied Territories</b>	<b>Adults</b>	<b>Total Pairs</b>	<b>Pairs w/ Nestlings</b>	<b>Total Nestlings</b>	<b>% Pairs Successful</b>	<b>Nestlings/Total Pair</b>	<b>Nestlings/Succ. Pair</b>
<b>1975</b>	12	24	12	9	17	75.0	1.42	1.89
<b>1977<sup>a</sup></b>	15	27	12	9	22	75.0	1.83	2.44
<b>1978</b>	19	35	16	12	28	75.0	1.75	2.33
<b>1979</b>	19	38	19	15	39	78.9	2.05	2.60
<b>1980</b>	20	37	17	16	44	94.1	2.59	2.75
<b>1981</b>	20	38	18	17	54	94.4	3.00	3.18
<b>1982</b>	25	48	23	16	40	69.6	1.74	2.50
<b>1983</b>	29	56	27	21	56	77.8	2.07	2.67
<b>1984</b>	27	52	25	21	48	84.0	1.92	2.29
<b>1985</b>	27	52	25	16	40	64.0	1.60	2.50
<b>1986</b>	27	54	27	18	48	66.7	1.78	2.67
<b>1987</b>	33	64	31	25	61	80.6	1.97	2.44
<b>1988</b>	34	67	33	24	57	72.7	1.73	2.38
<b>1989</b>	35	68	33	23	54	69.7	1.64	2.35
<b>1990</b>	36	71	35	28	76	80.0	2.17	2.71
<b>1991</b>	35	69	34	26	55	76.5	1.62	2.12
<b>1992</b>	40	75	35	18	41	51.4	1.17	2.28
<b>1993</b>	41	81	40	30	80	75.0	2.00	2.67
<b>1994</b>	43	85	42	24	55	57.1	1.31	2.29
<b>1995</b>	46	89	43	30	71	69.8	1.65	2.37
<b>1996</b>	45	86	41	26	66	63.4	1.61	2.54
<b>1997</b>	47	91	44	27	60	61.4	1.36	2.22
<b>1998</b>	46	98	45	33	75	73.3	1.67	2.27
<b>1999</b>	48	96	44	29	65	65.9	1.48	2.24
<b>2000</b>	46	98	45	17	35	37.8	0.78	2.06
<b>2001</b>	48	98	47	22	52	46.8	1.11	2.36
<b>2002</b>	48	98	47	32	67	68.1	1.43	2.09
<b>2003</b>	49	100	48	27	62	56.3	1.29	2.30
<b>2004<sup>b</sup></b>	52	106	52	16	32	41.0	0.82	2.00
<b>2005</b>	50	102	48	31	70	64.6	1.46	2.26
<b>2006</b>	48	106	46	27	60	58.7	1.30	2.22
<b>2007</b>	<b>50</b>	<b>105</b>	<b>49</b>	<b>31</b>	<b>82</b>	<b>63.3</b>	<b>1.67</b>	<b>2.65</b>

<sup>a</sup>Data was not collected in 1976 and thus, was not included herein. <sup>b</sup>Only 39 of 52 pairs were checked for success due to smoke in 2004.

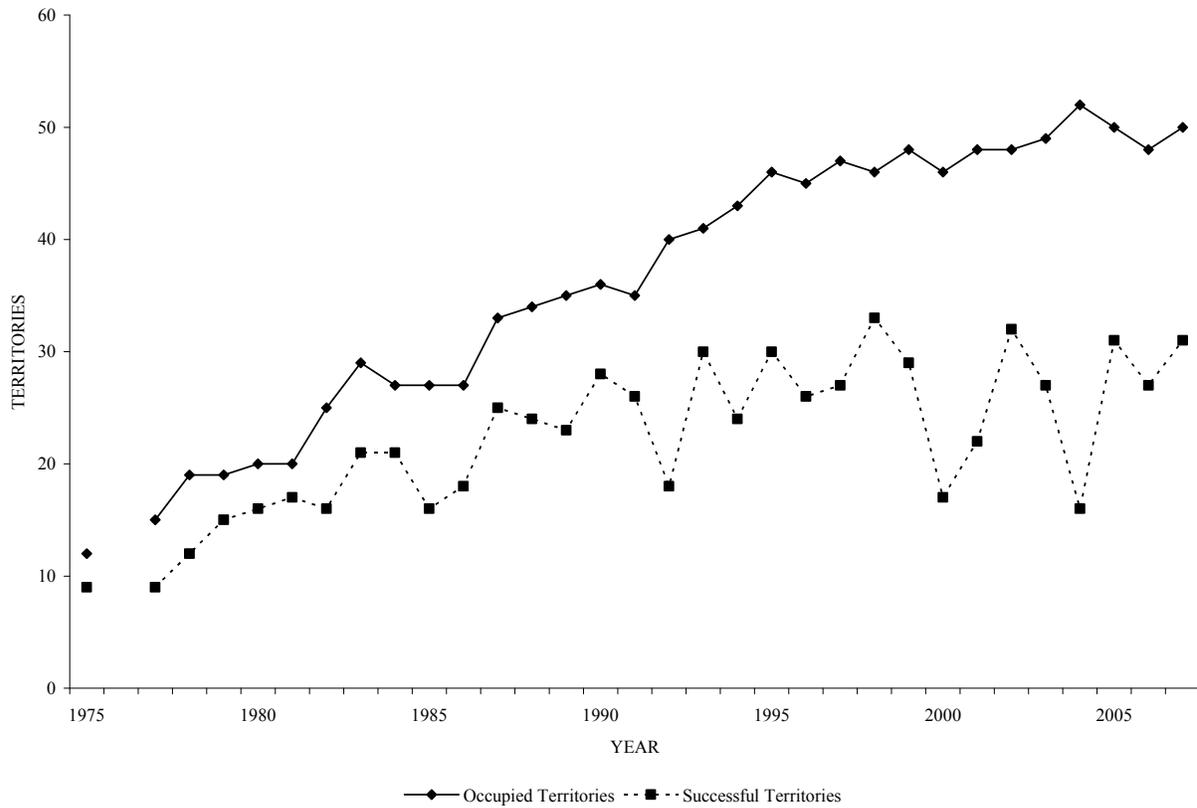


Figure 2. Number of occupied and successful ( $\geq 1$  nestling) American peregrine falcon territories, Upper Yukon River, Alaska 1975 – 2007. Data was not collected in 1976 and thus, was not included herein. In 2004, only 39 of the 52 pairs were checked for success and productivity due to smoke from forest fires.

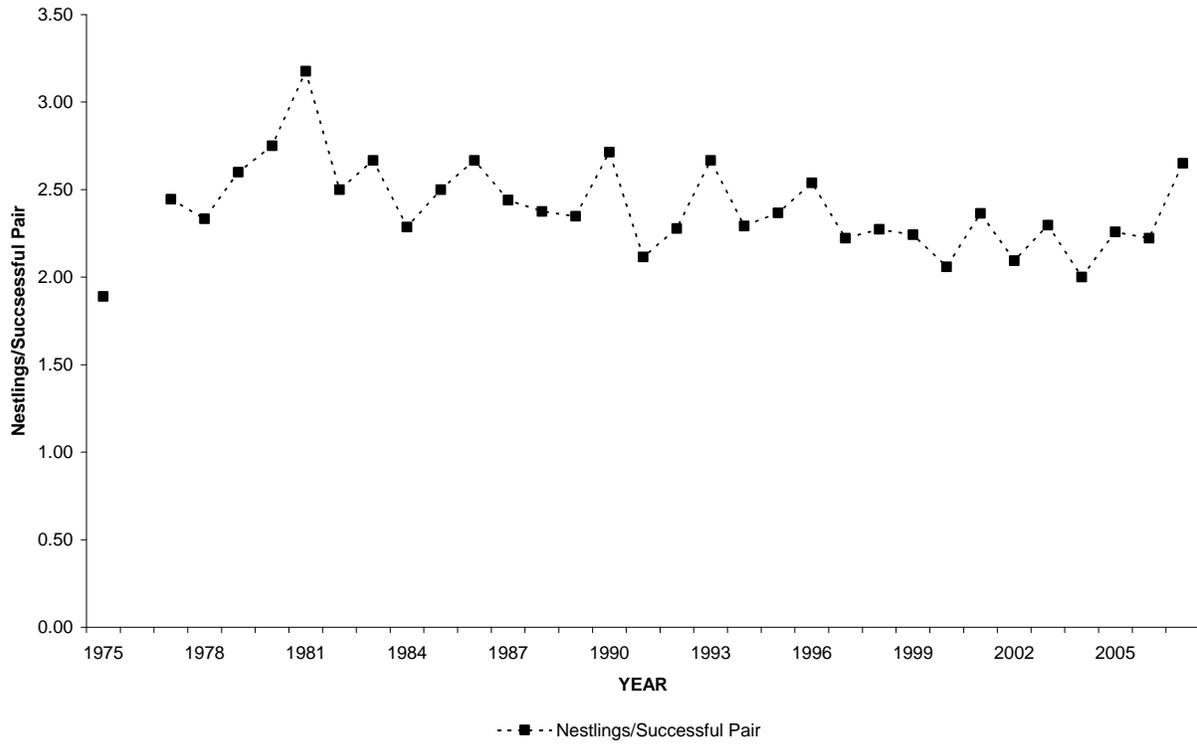


Figure 3. American peregrine falcon nestlings per successful pair, Upper Yukon River, Alaska, 1975 – 2007. Data was not collected in 1976 and thus, was not included herein. In 2004, only 39 of the 52 pairs were checked for success and productivity due to smoke from forest fires.

## Nesting Phenology

American peregrine falcons generally arrive in interior Alaska in late April and initiate courtship almost immediately. Egg-laying usually begins in early May and fledging occurs in late July or early August. Phenology in 2007 is presented in Table 5. The mean dates for nesting events in 2007 were approximately the same as the mean for previous years in the study period, 1975 – 2006 (Ambrose and Florian 2003).

Table 4. Nesting phenology, American peregrine falcons, Upper Yukon River, Alaska, 2007.

<b>Event</b>	<b>Mean</b>	<b>Range</b>
<b>Arrive Area</b>	Mid to Late April	?
<b>First Egg</b>	11 May	3 May – 7 June
<b>Start Incubation</b>	18 May	10 May – 14 June
<b>Hatch</b>	20 June	12 June – 17 July
<b>Fledged</b>	28 July	22 July – 26 August
<b>Leave Area</b>	Early to Mid September	?

## Discussion

Local American peregrine falcon populations in interior Alaska probably began to decline soon after the use of DDT became widespread in the 1950s, and subsequently began to rebound following the United States ban on DDT in 1972. The upper Yukon River population has increased steadily from 12 total pairs in 1977 to a high of 52 total pairs in 2004. From 1975 to 1985, when density was the lowest in the study area, most occupied territories produced nestlings. In subsequent years as the number of occupied territories steadily increased, a lower percentage of the population was producing nestlings, though the number of pairs with nestlings and the total number of nestlings produced in the study area continued to increase (Figure 2). This lower proportion of successful pairs may be attributable to increased competition for resources due to increased density and birds moving into sub-optimal territories (i.e. territories with insufficient resources and cover from predators). The number of nestlings per successful pair also showed no significant change from 1975 – 2007 (Figure 3), indicating no density effect on those pairs able to successfully fledge young. The population seems to be continuing to increase at a steady rate, though a lower percentage of pairs are producing nestlings.

The upper Yukon River study area has many potential nesting territories of varying quality. Many of the occupied territories are considered high quality relative to those found and occupied throughout interior Alaska. As the population increased within the study area, pairs have begun to use sub-optimal territories. These sub-optimal territories are interspersed among high-quality territories (those with a long history of use) and often seem to be more easily accessible and on less stable substrates. As the population continues to grow it will be important to follow the

success of the sub-optimal sites and to periodically survey areas outside of the study area. The occupancy and success at sites outside of the study area, such as along the Charley, Kandik and Nation rivers or those some distance from any river, may provide the best indication of habitat saturation.

Intensive surveys for American peregrine falcons in interior Alaska were not conducted prior to the introduction and use of DDT in the late 1940s. As a result, little is known about nesting densities, breeding success, and productivity of a healthy American peregrine falcon population. With continued surveys of this study area, we have the opportunity to better understand the breeding biology of a recovered population of American peregrine falcons.

## **Research Recommendations**

1. Continue to annually monitor territory occupancy, breeding success, and productivity of American peregrine falcons along the upper Yukon River.
2. Continue to collect addled eggs, nestling feathers, and adult feathers for contaminants monitoring, specifically for monitoring mercury contamination.
3. Conduct surveys in sub-optimal habitats that are in close proximity to the upper Yukon River study area (e.g. Nation, Kandik and Charley Rivers) every 3-5 years. As the population continues to increase, birds may begin to use more sub-optimal habitat.
4. Develop a protocol for measuring adult survivorship using photos to identify individuals. Mercury contamination may first affect adult survivorship.
5. Continue to modify and improve the Microsoft Access American peregrine falcon database for historic and ongoing data collection and entry.
6. Populate the Microsoft Access American peregrine falcon database with historic data including nest card data, photographs of territories, maps and field notes 1975 – 2007.
7. Collect shed adult feathers and nestling feathers, egg-shell fragments and buccal swabs (Handel et al. 2006) from nestlings for genetic analyses.
8. Develop a series of photographs to document the development of wild American peregrine falcon nestlings along the upper Yukon River each day from hatch until fledging, for more accurate aging of nestlings.
9. Develop a spreadsheet to track which eyries have been observed when traveling upriver and downriver.
10. Develop a spreadsheet to record locations of shallow water, good viewing areas for each eyrie, good camping spots for eyrie viewing and appropriate times of day for viewing each eyrie so lighting does not impede observations.

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## **Appendix I. Breeding Status Terminology for Raptor Observations**

### 1. Unoccupied:

A nesting territory where no bird showing an affinity for the territory during the breeding season was observed (investigators must spend a minimum of 4 hours at the territory during the incubation period to make this determination).

### 2. Occupancy Unknown:

A nesting territory where no bird showing an affinity for the territory during the breeding season was observed but investigators spent less than 4 hours at the territory during the incubation period.

### 3. Occupied--Non-breeding:

A nesting territory where one or two birds showing an affinity for the nesting territory during the breeding season were observed but no eggs were laid (note: this category requires confirmation that no eggs were laid, therefore only those nests that were frequently observed can be assigned to this category).

### 4. Occupied--Breeding:

An occupied nesting territory where eggs were laid (evidence includes young in nest, eggs or eggshells, or adults seen incubating) but where final breeding success was not determined.

### 5. Occupied--Unsuccessful Breeding:

An occupied nesting territory where breeding was attempted but where no young reached 80% of its fledging age (for example, eggs destroyed or otherwise lost, eggs failed to hatch, or young hatched but died prior to fledging).

### 6. Occupied--Successful Breeding:

An occupied nesting territory where one or more young reached 80% of its fledging age.

### 7. Occupied--Breeding Status Unknown:

An occupied nesting territory where breeding or non-breeding could not be determined.

### 8. Occupied--Breeding Status Unknown, No Young Fledged:

An occupied nesting territory where breeding or non-breeding could not be determined but it was certain that no young fledged.

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