Ursula Banasch
Geoff Holroyd
(Editors)

The 1995 Peregrine Falcon survey in Canada

Occasional Paper
Number 110
Canadian Wildlife Service

Canada

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Occasional Paper
Number 110
Canadian Wildlife Service
July 2004

Également disponible en français sous le titre
Relevé de 1995 du Faucon pèlerin au Canada
Service canadien de la faune, Publication hors série n° 110.

[1] Canadian Wildlife Service, 4999–98 Avenue, Edmonton, Alberta T6B 2X3

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Cover photo: Adult female Peregrine Falcon and young (Gordon Court).
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Catalogue No. CW69-1/110E
ISBN 0-662-37153-4
ISSN 0576-6370

Online at http://cws-scf.ec.gc.ca

HTML
Catalogue No. CW69-1/110E-HTML
ISBN 0-662-37164-X

PDF
Catalogue No. CW69-1/110E-PDF
ISBN 0-662-37163-1

National Library of Canada cataloguing in publication

Main entry title :

The 1995 Peregrine Falcon survey in Canada

(Occasional paper, ISSN 0576-6370 ; no. 110)
Issued also in French under title : Relevé de 1995 du Faucon pèlerin au Canada.
Includes bibliographical references.
Issued also on the Internet.
ISBN 0-662-37153-4 Cat. no. CW69-1/110E

1. Peregrine falcon – Monitoring – Canada.
2. Endangered species – Canada.
3. Bird populations – Canada.
4. Wildlife management – Canada.
I. Banash, Ursula.
II. Holroyd, Geoffrey L.
III. Canadian Wildlife Service.
IV. Titre.
V. Series: Occasional paper (Canadian Wildlife Service) ; no. 110.

QL696.F34N53 2004 333.95’896 C2004-980194-5

Abstract

During 1995, provincial/territorial/federal wildlife agency personnel and volunteers conducted the sixth Canada-wide Peregrine Falcon *Falco peregrinus* survey. This survey covered the largest number of *anatum* populations to date and resulted in a larger number of occupied *anatum* territories and territorial *anatum* pairs than found in any of the previous surveys. The largest increases took place in Ontario and in central and southern Alberta, where mass reintroductions of captive-raised young had occurred yearly since 1992.

North of 58°N, the Mackenzie Valley and Yukon River populations had average annual growth rates indicating stability. These are the largest and longest surveyed populations in Canada. Although the Southern Lakes population of the Yukon Territory disappeared during the 1970s, a pair reoccupied a historic (known) site in 1995 and successfully fledged three young. The northern Alberta population, which had an average annual growth rate of 21%, has been managed since 1975, and surveys of additional nesting habitats resulted in five new territories.

South of 58°N, the British Columbia *anatum* population has recovered. In central and southern Alberta, 12 pairs occupied sites, but only three pairs successfully fledged young. In Saskatchewan, two pairs reoccupied the two known city sites in Regina and Saskatoon and successfully fledged young. Similarly, in Manitoba, four pairs occupied city sites in Winnipeg and Brandon, but only two pairs successfully fledged young.

The Ontario population reoccupied seven historic (known) sites in addition to eight new sites, and 10 pairs successfully fledged young. In southern Quebec, pairs occupied 13 sites and singles two sites. Ten pairs successfully fledged young. In the Maritimes, five sites in New Brunswick and one site in Nova Scotia were occupied. This latter site was the first site occupied by a territorial pair in Nova Scotia in over 40 years. In Labrador, peregrines reoccupied 20 of 31 known sites, and surveys of additional nesting habitats located 11 new sites.

Within the *tundrius* populations, the Yukon North Slope population may be experiencing a recovery from its demise in 1970. Only a single adult was seen in 1990, but surveys between 1990 and 1995 located four occupied territories. During the 1995 survey, an additional occupied territory was found. In the Northwest Territories, which included Nunavut, populations appear stable. Coastal *pealei* populations in British Columbia, including Langara Island, appear stable.

Acknowledgements

The success of the 1995 Peregrine Falcon survey highlights the excellent cooperation between various government wildlife agencies and non-government personnel. These same individuals, the majority of whom are Peregrine Falcon recovery team members, designated the areas to be surveyed, planned the timing of the surveys and survey routes, and procured the necessary funding. Once the actual data had been collected, much time and effort were expended in interpreting, collating, verifying, and analyzing the data and writing reports.

We thank H.J. Armbruster, S.J. Barry, D. Bird, G. Court, and J.A. Keith for their comments on this manuscript. H. Boyd provided many useful technical comments, which we appreciate.

The Scientific and Technical Documents Division of the Canadian Wildlife Service produced this publication. The following people were responsible for different aspects of the publication process: Pat Logan and Maureen Kavanagh — coordination and supervision; Sylvie Larose — layout; Marla Sheffer (contract editor) — scientific editing; Andrée Marcotte and Elizabeth Morton — production editing; and Mark Hickson — printing.

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Introduction

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Historically, Peregrine Falcons *Falco peregrinus* bred sparsely throughout Canada (Bent 1938; Enderson et al. 1995). Three subspecies exist in Canada. *F. p. anatum* breeds south of the treeline from the Atlantic Ocean to the Pacific Ocean. North of the treeline, *tundrius* nests on cliffs along the oceans, rivers, and lakes. *F. p. pealei* occupies coastal islands and areas of adjacent coastal mainland British Columbia north to the Aleutian Islands of Alaska.

Globally, some peregrine populations experienced population declines and reduced productivity during the late 1940s, through the 1950s and 1960s, and up to approximately 1975 (Kiff 1988), which led to the extirpation of this species in some areas. In England, the increased agricultural use of insecticides such as DDT, ß-hexachlorocyclohexane, dieldrin, and heptachlor epoxide after 1946–1947 resulted in the presence of these chemicals in peregrine eggs and carcasses and some prey species. The presentation of these data by Derek Ratcliffe at the 1965 Cornell conference led to population and pesticide monitoring of a number of raptor populations and their prey in both Canada and the United States (Hickey 1969). This monitoring produced evidence of a decline in some raptor populations, especially peregrines, that was associated with high levels of organochlorines, specifically the DDT metabolite DDE, mainly in eggs. In 1978, the Committee on the Status of Endangered Wildlife in Canada classified *F. p. anatum* as endangered, *tundrius* as threatened (*tundrius* was reclassified as vulnerable in 1992; Bromley 1992), and *pealei* as rare (Martin 1979).

1. Life history

Peregrines traditionally return to the same nesting territory year after year (Ratcliffe 1980). In Canada, peregrines generally nest on cliffs, although tall buildings have also been used as nest sites in recent years. *Anatum* and *tundrius* peregrines have occasionally nested on the ground and gravel ridges (Cade 1960), behind vegetation on slopes, or in deserted hawk or eagle nests on cliffs (Bent 1938). *Pealei* have nested in abandoned Bald Eagle *Haliaeetus leucocephalus* stick nests in trees (Campbell et al. 1977).

Peregrines usually mature at two years of age; however, some first-year birds are known to have bred successfully. Males, generally the first to return from the wintering grounds, establish and defend a territory against other falcons and raptors. After the female's arrival, an elaborate courtship ensues. If a pair bond forms, the female remains at the nest cliff while the male hunts. Because of the peregrine's skill at aerial pursuit, its prey consists almost exclusively of small to medium-sized living birds. Mammals are taken occasionally and may constitute a substantial portion of the diet in some peregrine populations (Court 1986).

Laying occurs from early April onward in southern Canada and in early June in Arctic Canada. The first clutch normally consists of four eggs. In southern Canada, renesting usually occurs if the first clutch is lost during early incubation. Females do most of the incubating, for 28–33 days. In stable and healthy populations, average production is two to three young per successful pair (Hickey and Anderson 1969). Young peregrines remain in the nest for approximately five weeks, after which they move onto the surrounding cliff and practise flying. Following fledging, adults continue to supply the young with food for another 25–30 days (Sherrod 1983).

Both *anatum* and *tundrius* migrate southwards to their wintering grounds in the southern United States, the Gulf of Mexico, and Central and South America. This first migration is critical for young peregrines, because they are still developing their hunting skills. From band returns, it appears that between 50 and 75% of fledged young fail to survive their first migration (Enderson 1969; Lindberg 1975).

2. Threats to populations

Prior to the Second World War, peregrine breeding populations were known for their remarkable stability. Hickey (1942) analyzed records of 408 territories known up to 1940 in North America east of the Rocky Mountains. Discounting tree-nesting pairs, only 4% of the territories had been definitely deserted. Sixty-six of the sites had been in use for 10 to more than 50 years. Shooting had been the principal cause of death of breeding adults.

From 1950 to 1965, there was an unprecedented population crash of nesting *anatum* in both the United States and Canada, with "complete extirpation in the eastern one-third of the United States" (Hickey 1969). DDE-induced reproductive failure is widely accepted as the principal cause of this crash. There was no evidence that these losses were caused by natural predation or by major declines of prey species or their habitats. Of the three North American subspecies, *anatum* populations declined the most. Similar population declines and associated symptoms in Europe were linked to contamination by organochlorine pesticides

(Ratcliffe 1969). Consequently, researchers and volunteers have conducted Canada-wide peregrine population surveys every five years, beginning in 1970 (Cade and Fyfe 1970; Fyfe et al. 1976; Murphy 1990; White et al. 1990). Surveys included previously known sites and areas of potential nesting habitat for all three subspecies.

3. Need for a 1995 survey

Since 1970, ongoing management efforts in many peregrine populations have included occupancy and productivity surveys of known (historic) sites, surveys of other potential nesting habitats, improvement of existing nest sites, banding of young, reading of bands on peregrines seen, collection of eggs and carcasses for pesticide analyses, captive breeding, and introduction to the wild of captive-raised young. The main purpose of the 1995 survey was to determine whether, and to what degree, recovery plan goals had been achieved in all six management zones.

4. Purpose of this Occasional Paper

The main purpose of this Occasional Paper is to document the population and productivity status of *anatum* Peregrine Falcon populations in all six management zones in Canada during mainly 1995, with some 1996 data for British Columbia. These data will aid the recovery team and its members in evaluating the success of recent reintroductions. By assessing the status, composition (captive-raised versus wild-produced versus unknown origin), and rate of recovery of these populations, progress in achieving self-sustaining populations can be tracked and pesticide monitoring needs can be determined.

Continued documentation of *tundrius* and *pealei* populations is also needed to maintain up-to-date knowledge of their status.

5. Terminology

The terminology used in this report is from Murphy (1990). A “nest site” is the actual site of the nest; “occupied nest site or territory” is a nest site or territory occupied by one or two territorial adults; “breeding pair” is a pair that produced at least one egg; “productive or successful pair” is a pair that is known or assumed to have raised at least one young to fledging; and a “territorial pair” is a pair that defended its nesting cliff against other peregrines (Ratcliffe 1980). “Known sites” include all historic sites and any sites found prior to the survey year. Sites found during the survey are “new sites.” If single falcons are sighted only once and no territorial behaviour is observed, they are referred to as “sightings.” Only wild-produced young are included in the determination of successful pairs and in productivity estimates.

The 1995 Peregrine Falcon survey in Labrador

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Abstract

In 1970, 1975, and 1985, researchers conducted Peregrine Falcon *Falco peregrinus* surveys in Labrador, but the surveys were restricted to several historic sites and a few coastal areas. The 1990 survey covered more potential nesting habitat. During 1995, the total number of known territories increased to 42, probably because extra areas had been surveyed. Peregrines occupied 31 of the 42 known territories. Productivity observed for 26 occupied sites included 28 eggs and 28 young.

1. Introduction

With the exception of 1980, surveys for Peregrine Falcons *Falco peregrinus* in Labrador were carried out every five years as part of the five-year monitoring efforts. Prior to 1990, the survey effort was restricted to a few coastal areas and was sometimes limited to checking only several historic sites. In 1990, the survey areas and effort were much expanded from previous years, largely because annual surveys (Lemon and Brazil 1990) along the Labrador coast and inland areas had identified a number of new occupied sites. Surveys comprised one part of an ongoing impact monitoring program for the Department of National Defence (Jacques Whitford Environmental Ltd., pers. commun.) and were a part of the dedicated five-year monitoring effort under the direction of the Inland Fish and Wildlife Division of the Newfoundland and Labrador Department of Tourism, Culture and Recreation.

2. Methods

Peregrine surveys were carried out by helicopter with one pilot/observer, one navigator/observer, and usually two observers in the rear seat. Areas with historic or recent peregrine activity as well as areas with good nesting potential were targeted for surveying. The large area of coverage, coupled with the significant expense involved, meant that only one visit was planned for many of the sites. When an area could be visited only once, that visit was timed to coincide with an ongoing banding and prey monitoring effort when young were two to three weeks old.

Surveys were conducted from 10 to 14 June for inland areas and from 20 to 29 July for coastal areas (Fig. 1). Surveys were flown along cliffs at an average speed of 100 km/h, approximately 20–50 m from the cliff face. When cliff faces were more than 200 m high, several passes were made at different elevations to ensure maximum coverage. Several searches of an area were made if there were signs of recent peregrine activity. At each historic or recently found peregrine site, occupancy was recorded using recommended definitions (U. Banasch, pers. commun.). In addition to describing occupancy, other information collected at occupied ledges included a full description of the nest site, number of eggs, age and number of young, and identifiable prey remains. When possible, young were banded.

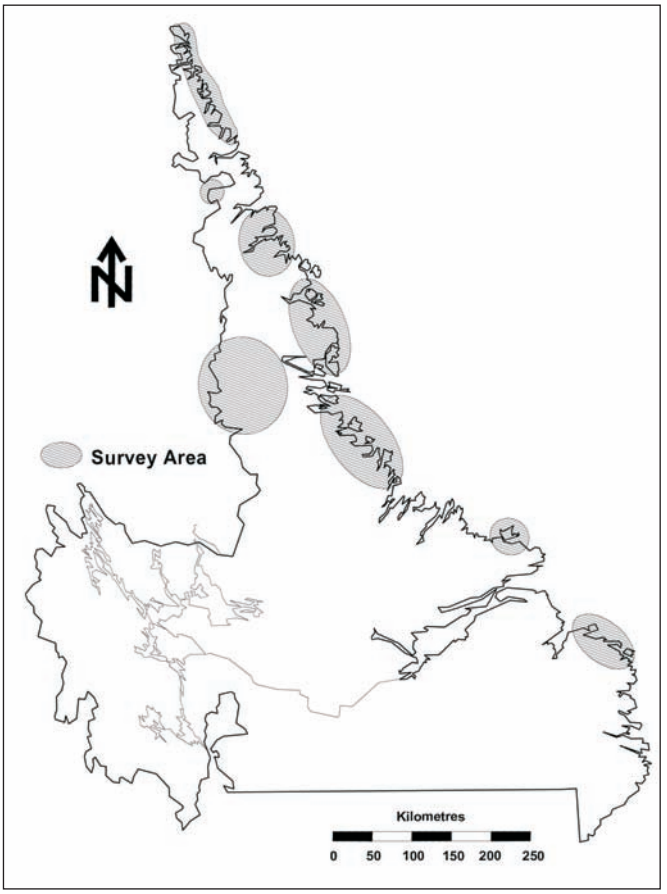
3. Results

Thirty-four historic sites were checked. Three territories were thought to contain at least two known nest sites; therefore, the 34 sites represented 31 territories. Of these 31 historic territories, peregrines occupied 20. In addition, 11 previously unknown territories were discovered, bringing the total of known occupied territories to 31 and elevating the total number of historic and recently discovered territories to 42. Two other areas were investigated where peregrine activity had been reported. However, these areas had no history of peregrines nesting and no signs of current or recent breeding activity. These sites were therefore excluded from the territorial site records. Nest contents were seen in 26 of the 31 occupied sites, totalling 28 eggs and 28 young.

4. Discussion

The 31 occupied peregrine territories in 1995 were the highest number ever recorded during a single breeding season in Labrador. The significant increase in the number of known territories from 1990 to 1995 (26 versus 42) is probably the result of an increased search effort in the intervening period. For example, since the early 1990s, a number of inland river systems have been surveyed thoroughly as part of the military low-level flying avoidance monitoring program. As a result, nine new nests were found. Also, some of the other 11 sites, which were classified as unoccupied, may not necessarily be unoccupied territories. Peregrines often use more than one nest ledge along a cliff and more than one nest cliff within their territory. Nesting sites being used by the same pair in different years can sometimes be more than 12 km apart (Ratcliffe 1980). Thus, in order to determine with confidence that a territory is unoccupied, a

Figure 1
Peregrine Falcon areas surveyed in Labrador during 1995



more thorough search would have to be carried out over a broader area.

5. Acknowledgements

A survey of this size involves a lot of preparation and cooperation among many people. The following agencies made major contributions towards the completion of the 1995 survey: Canadian Coast Guard, Canadian Wildlife Service, Department of National Defence, Jacques Whitford Environmental Ltd., Newfoundland and Labrador Inland Fish and Wildlife Division, Universal Helicopters of Newfoundland and Labrador, and World Wildlife Fund Canada (Endangered Species Recovery Fund). We thank them all.

The 1995 Peregrine Falcon survey in the Bay of Fundy

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Abstract

The monitoring of four known nest sites in New Brunswick and a survey of suitable habitats in the upper Bay of Fundy, Nova Scotia, determined the status of the Peregrine Falcon *Falco peregrinus anatum* in the Maritime provinces. Six nesting pairs were found along the Bay of Fundy: five pairs in New Brunswick and one pair in Nova Scotia. Average production was estimated at 2.00 young per territorial pair. The population in the Maritime provinces is thought to be stable or expanding.

1. Introduction

Peregrine Falcons *Falco peregrinus anatum* were never common in the Maritimes (Stocek and Pearce 1978), although historical numbers appeared to be stable. The number of pairs nesting in the Maritimes prior to the decline in the early 1950s and 1960s is unknown. However, Stocek and Pearce (1978) documented 13 nest sites in Nova Scotia and New Brunswick, predominantly on steep cliff slopes along the Bay of Fundy coastline. The last documented wild pair nested at Cape d'Or, Nova Scotia, in 1955.

An intensive program to reintroduce peregrines to the Maritimes began in 1982 and continued until 1991. Cooperating wildlife agencies released 178 young captive-raised peregrines, including 69 young in New Brunswick and 109 in Nova Scotia (Sam et al. 1994). Over half (66%) of the young were released through mass hacks between 1987 and 1991.

Throughout the duration of the release program, banded peregrines were seen on a regular basis. Observers saw the first territorial pairs in 1986, but the first nesting was confirmed only in 1989. The return of the peregrine to the Maritimes continues to be monitored annually through site visitations, naturalist observations, and periodic surveys. This report provides details on the status of the peregrine in the Maritimes, with specific reference to observations during the 1995 survey and updated information since the 1990 survey.

2. Methods

2.1 New Brunswick

Recent efforts focused on monitoring the success of known pairs and verifying, where possible, the existence of new pairs. During 1995, no comprehensive survey of all known, historic, and potential nest sites was conducted, as had been done during 1990.

Inspections of four known nests occurred during May–July. As part of the routine nest visits, young were banded, prey remains were noted, and two addled eggs were collected for subsequent chemical analyses.

2.2 Nova Scotia

On 12 July, the Nova Scotia Department of Natural Resources and the Canadian Wildlife Service conducted a helicopter survey of suitable nesting habitat along the upper Bay of Fundy to determine the presence of nesting peregrines. The flight paths included islands and coastal areas starting near Five Islands (Cumberland County) and travelled west around Cape d'Or, Advocate Bay, and Cape Chignecto and north to Apple River. To complete the survey, researchers crossed the Minas Channel and scanned the cliffs along Cape Split and Cape Blomidon.

Although no historic nest sites are known from Cape Breton, several peregrine sightings in the highlands area were reported in recent years. No surveys occurred in this area during 1995, although partial ground surveys of this area had been undertaken in the past.

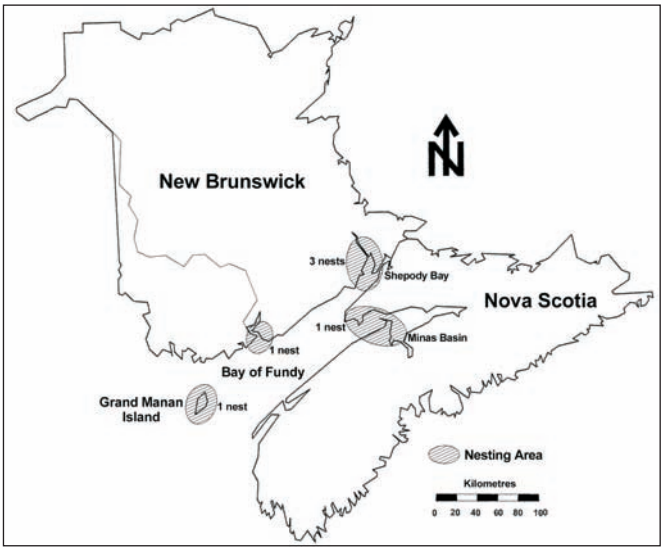
3. Results

The number of known occupied nests increased from five pairs in 1990 to six pairs in 1995; all pairs nested along the Bay of Fundy. Five nests were in cliff crevices, while a single "urban" site was sheltered under a bridge support beam.

3.1 New Brunswick

The peregrine population consisted of five pairs. Three nests were in the upper Bay of Fundy, one was in Saint John, and the other was on Grand Manan Island, at the

Figure 1
Location of Bay of Fundy Peregrine Falcon nest sites in 1995



mouth of the Bay of Fundy (Fig. 1). Four of the occupied sites were used historically.

The four monitored pairs probably fledged nine young falcons. Two young from one nest were banded with black rivet bands bearing unique alphanumeric codes and standard U.S. Fish and Wildlife Service bands.

Two addled eggs were collected from one upper Bay of Fundy nest site. One egg had been collected from the same site during 1993. Analyses from both years indicated only trace levels of toxic chemicals.

3.2 Nova Scotia

During 1995, observers obtained the first conclusive evidence of nesting peregrines in Nova Scotia in over 40 years. A nest with three young was discovered in the Minas Basin (Fig. 1). This apparently is the only known nest site in the province and is thought to have been one of the original nest locations (Stocek and Pearce 1978).

4. Discussion

Information obtained since the 1990 survey suggests that there is reason to be optimistic for the future of the Peregrine Falcon in Maritime Canada. The number of pairs nesting in the Bay of Fundy has increased since 1990. The six successful nesting pairs counted during 1995 represent an increase of one territorial pair and twice the number of successful pairs compared with 1990. This increase, coupled with the increased annual number of peregrine sightings, suggests that the population is now well reestablished.

Despite the many recent sightings and reports of peregrines in Nova Scotia, the 1995 survey resulted in the first documented nesting attempt since the species' extirpation from this province. The increased observations of single birds in suitable nesting habitat on Cape Breton Island since 1990 suggest the possibility of another previously unknown site. Similarly, since 1992, observations of single birds in the upper Bay of Fundy at or near where a nest site was located during 1995 suggest that nesting may have occurred there in the past. Because of the inconsistency in monitoring techniques and effort between years, it is impossible to determine if 1995 was the first year the site was occupied. The lack of good quality nesting and feeding habitats was not implicated in peregrine population declines in the Bay of Fundy, which continues to provide many suitable nesting and feeding sites.

Table 1
Productivity of *anatum* Peregrine Falcons in the Bay of Fundy from 1991 to 1995

Year	No. of territorial pairs	No. of successful pairs	Total no. of young	Average no. of young/ territorial pair	Average no. of young/ successful pair
1991	5	5	10[a]	2.00	2.00
1992	5	4	10[a]	2.00	2.50
1993	5	5	11	2.20	2.20
1994	5	5	9	1.80	1.80
1995	6	5	12[a]	2.00	2.40

[a] A minimum number of young.

Since the first documented nesting attempts during 1989, an estimated 61 young have fledged from monitored nests. These young were produced from natural pairings, but many of the adults wore red rivet bands that identified them as captive-raised birds.

A natural replacement of a single individual was reported at one nest site. At the only urban site, both original adults were red-banded captive-raised release birds. However, during 1994, an unbanded wild female replaced the banded female. Furthermore, both adults of an upper Bay of Fundy pair were unbanded. Thus, this population may have some natural capacity for replacing lost individuals and perhaps even expansion.

Average productivity at New Brunswick nests during 1991–1995 ranged from 1.80 to 2.20 young per territorial pair. The overall average production for the five-year period is 2.00 young per territorial pair. Only in 1994 did the average production fall below 2.00 young per territorial pair (Table 1). However, the 2.00 young per territorial pair exceeds the 1.00–1.50 rate estimated to be needed to maintain a stable population (Newton 1979) and therefore suggests either a stable or an expanding population.

Productivity at New Brunswick nests increased from 1.20 to 2.00 young per territorial pair from 1990 to 1995 (Holroyd and Banasch 1996). Although average productivity has increased, the number of young produced per nest varies greatly between sites, particularly in contrast to the urban site. Since 1989, the urban pair fledged an average of 1.60 young per year, while one upper Bay of Fundy pair fledged 3.20 young per year. In addition, many of the young at the urban site were killed by vehicles while learning to fly.

The three addled eggs collected and submitted for toxic analyses appeared to be relatively free of harmful chemicals. The fact that these peregrines have been able to reestablish wild populations suggests that toxic chemicals in the environment may be less of a concern.

The *anatum* recovery plan recommended that 10 territorial pairs be established in zone 1, which includes the Maritimes, parts of Quebec, and Labrador (Erickson et al. 1988). This goal was met in 1990. Since then, the population level has been maintained and has exceeded the original goal.

Future strategies for the conservation of the Peregrine Falcon in the Maritimes include continued emphasis on periodic surveys of historic habitats and visits to known nest sites to monitor the status of the population. Access to the exact location of nest sites will continue to be restricted in order to minimize the possibility of human disturbance of this recovering population.

5. Acknowledgements

We wish to extend our gratitude to D. Baldwin, J.S. Boates, L. Boudreau, D. Christie, R. Hall, B. Johnson, M. Majka, E. Mersereau, D. Sam, R. Walker, and J. Wilson for their contributions to Peregrine Falcon monitoring and recovery efforts.

The 1995 Peregrine Falcon survey in Quebec

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Abstract

In southern Quebec, Peregrine Falcon *Falco peregrinus* surveys have occurred every five years since 1970, except during 1975. Ungava Bay peregrines have been surveyed every five years since 1970. During 1995, the areas surveyed covered only the southern part of Quebec, south of 50°N, which included 112 historic and potential nest sites. Pairs occupied 13 sites, and single adults two other sites. Fledged young were observed at 10 sites.

1. Introduction

The inventory of nesting Peregrine Falcon *Falco peregrinus* pairs during 1995 covered only the southern part of Quebec, the part south of 50°N. Because of budgetary constraints, parts of Hudson Bay, Ungava Bay, and the north shore of the Gulf of St. Lawrence that were inventoried in 1990 were not visited in 1995.

2. Methods

All historic and potential nest sites south of 50°N were inventoried — i.e., a total of 112 sites. The majority were visited by foot, boat, or helicopter. A few sites were overflown with an ultralight composed of one sail and a fixed propeller motor behind the observer.

3. Results

The occupation of 15 sites was confirmed. Two sites were occupied by only one adult each; pairs occupied the other 13 sites. At least 26 young fledged at 10 sites, which represents 2.00 young per territorial pair and 2.60 young per successful pair. Two new sites were found in Parc d'Aiguebelle: one in the Abitibi area and another along the Saguenay River.

Eggs were laid between 5 April and 3 June. The earliest nesting occurred at a Montreal site, and the latest nesting occurred in the Abitibi area.

4. Discussion

The majority of the nest sites (i.e., 13 of 15 sites) are on natural rock cliffs. The other two sites are on a skyscraper and on a bridge. The distribution of the occupied nest sites is now similar to the distribution of release sites used from 1976 to 1992. Moreover, the Saguenay River now has three occupied sites. Only the Gaspé Peninsula area has not yet been recolonized. The natural rock cliffs scattered in the St. Lawrence valley and in the Outaouais are particularly well suited for peregrines because of their proximity to open water and fields attractive to prey species.

The observation sites available did not permit the reading of bands on banded birds. It was impossible to verify the presence or absence of bands on 18 of the 28 falcons that occupied sites. Of the other 10 falcons that were observed, only two were banded. One wore a red and an aluminum band, and the other wore at least an aluminum band. The number of unbanded birds suggests that wild-hatched birds now occupy several sites.

5. Acknowledgements

We wish to thank the following people for their cooperation: B. Blais, head of the survey team; the Association québécoise des groupes d'ornithologues; staff at the Ministère de l'Environnement et de la Faune; and the many birdwatchers who provided us with survey data.

The 1995 Peregrine Falcon survey in Ontario

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Abstract

In Ontario, the Peregrine Falcon *Falco peregrinus anatum* showed positive signs of a population recovery. This recovery was centred in northern Ontario (11 of 15 territories), with the greatest concentration of nesting activity occurring within the Lake Superior basin. The southern Ontario population showed its first signs of recovery during this year, with four occupied territories. Cliff habitats were reoccupied in northern Ontario, while the population recovery in southern Ontario was primarily restricted to urban environments. Productivity of 10 monitored pairs was 1.50 young per successful pair.

1. Introduction

Ontario's population of the Peregrine Falcon *Falco peregrinus anatum* declined dramatically during the 1950s and 1960s. Researchers recorded the last documented nesting attempt in northern Ontario during 1963. As part of the national *anatum* Peregrine Falcon recovery plan in Ontario, releases of captive-raised young peregrines began in 1977 and continued annually until 1995.

Ontario's peregrine population recovered more slowly than populations in other jurisdictions in southern Canada. Observers found no breeding pairs during national surveys conducted every five years between 1965 and 1985, although a lone adult occupied a territory during 1985. During 1986, one pair bred and a lone bird occupied a territory (Murphy 1990). Observers documented two nesting pairs and a single territorial bird during 1990 (Holroyd and Banasch 1996). Additional occupied nest sites were located and documented between 1990 and 1995. Ontario therefore considered this survey important to assess the current status and trends of the recovering peregrine population in the province.

2. Methods

Efforts focused on monitoring known territories and locating new occupied territories. Volunteers and Ontario Ministry of Natural Resources staff relied upon past experience and on survey guidelines developed by the Canadian Wildlife Service. Territory occupancy at known nest sites was confirmed by a ground visit or by viewing from a helicopter. Within the Lake Superior basin of northwestern Ontario, observers used helicopters and boats to search for peregrine activity along cliffs with suitable nesting habitat. When territorial birds were confirmed, more intensive helicopter surveys ensued to locate the actual nest site.

Sightings of peregrines or occupied nests were solicited from the public by inserting articles in various naturalist and birder publications to profile the survey and describe peregrine identification and nesting habitat. The Federation of Ontario Naturalists produced and distributed a small brochure with an attached mail-in postcard describing peregrines and look-alike species. Researchers investigated all reliable reports of peregrine sightings received from the public.

3. Results

Fifteen occupied territories were recorded; pairs occupied 14 sites (Table 1). Seven of these occupied territories were previously known, and the additional eight sites were new. In southern Ontario, south of Georgian Bay, peregrines occupied four sites, three of which were urban territories occupied by pairs. The fourth, a rural territory with limited cliff habitat, was occupied by a single bird. Unfortunately, the actual nest site was not located for four of the 14 territorial pairs. Observers counted 15 young at the 10 nests monitored, for an average of 1.50 young per successful pair and 1.07 young per territorial pair.

4. Discussion

Although Ontario's breeding peregrine population is still small, the increase since 1990 indicates a steady recovery (Table 1). Peregrines have begun to recolonize historic range, particularly the Lake Superior basin, which has an abundance of shoreline cliff habitat. Eleven of 15 occupied territories were in this area.

For reasons unknown, historic natural cliff habitats in southern Ontario have remained unoccupied. This was the first survey to show significant signs of a population recovery in southern Ontario, even though three of the four sites found in southern Ontario were urban and the fourth territory was the only rural site.

Recognizing that historic nest sites in southern Ontario continued to be unoccupied since the population crash and owing to limited funding and equipment and staff availability, not all historic and potential nest sites were resurveyed. Difficult access to some cliff sites during the

Table 1
Total nest sites occupied by Peregrine Falcons in Ontario from 1965 to 1995[a]

Year	Total no. of known sites	No. of known sites checked	No. of known sites occupied[b]	No. of new sites	Total no. of sites occupied by	
					Single birds	Pairs
1965	0	0	0	0	0	0
1970	29	29	0	0	0	0
1975	26	8	0	0	0	0
1980	26	26	0	0	0	0
1985	35	35	0	1	1	0
1990	35	23	1	2	1	2
1995	36	15	7	8	1	14

[a] Number of sites considered "known" or "historic" varied, depending on assessment criteria.
[b] Data from Holroyd and Banasch (1996).

optimal time to determine nest occupancy and productivity made visits to all nest sites impossible. The extreme forest fire conditions across northwestern Ontario reduced the availability of helicopters. However, available productivity figures indicated that the initial targets set in the recovery plan have almost been achieved. Continued monitoring of known territories and potential nesting habitats is needed to maintain current nest site occupancy and productivity data so that achievement of the recovery plan goals can be determined and their continued maintenance can be ensured.

5. Acknowledgements

We wish to thank the many volunteers who assisted in this survey. The Federation of Ontario Naturalists was instrumental in developing and distributing the identification brochure and attached mail-in postcard. The assistance of the staff from the Ontario Ministry of Natural Resources, Parks Canada, and the Canadian Wildlife Service is appreciated.

The 1995 Peregrine Falcon survey in Manitoba

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Abstract

During 1995, observers located and identified members of four territorial Peregrine Falcon *Falco peregrinus anatum* pairs in Winnipeg and Brandon, all on buildings. Three pairs nested: two in Winnipeg and one in Brandon. One Winnipeg pair produced two young; the Brandon pair produced four young. These peregrines appear to be part of a mid-continental population. Some questions exist as to whether this small population can maintain itself without some ongoing management. To assess the long-term viability of these urban peregrines, additional data on immigration and emigration are required. Further input from artificial sources, such as a hack release program or augmenting of unsuccessful pairs by fostering young, may be needed.

1. Introduction

Peregrine Falcons *Falco peregrinus anatum* were probably a rare breeder in southern Manitoba (Bechard 1981). The sole collection of two eggs from a nest near Gladstone, Manitoba, by O.G. Turner, Jr. in 1887 supports this assumption (Berger and Nero 1992). Robert Rafuse (pers. commun.) reported that a pair of peregrines had nested above the Churchill River near Leaf Rapids in northern Manitoba during the 1980s.

In southern Manitoba, a provincial recovery program began in 1981 and continued until 1995. The goal of the Manitoba project was to establish a self-sustaining breeding population of four pairs of peregrines. The first successful nesting attempt occurred in downtown Winnipeg during 1989. In 1993, a second and third nesting attempt occurred in south Winnipeg and in Brandon.

2. Methods

North of Churchill, the nesting habitat is similar to that used by peregrines in the Rankin Inlet area. Personnel from the Northwest Territories Department of Resources, Wildlife and Economic Development, which included Nunavut (Tungavik Federation of Nunavut and the Minister of Indian Affairs and Northern Development 1990), and the Manitoba Department of Natural Resources suggested that a survey of this area might yield more nesting peregrines. Between 12 and 14 July, with a twin-engine aircraft from Transport Canada, we surveyed many areas of potential peregrine nesting habitat in northern Manitoba (Duncan 1990). Local residents and public officials provided further observations of peregrines and potential breeding peregrines.

In southern Manitoba, observers examined rock quarries and steep cut riverbanks, which nesting falcons had used in other areas (Palmer 1988; Johnsgard 1990; J.R. Duncan, unpubl. data). Early in the spring, previously occupied sites in southern Manitoba were checked. We relied on volunteer observers to secure additional peregrine information and check each report carefully. Peregrines were watched throughout the nesting season with spotting scopes and binoculars to ascertain if they were banded and, if so, to determine the band number and colour. When feasible, each nest site was visited and examined for eggs and young. All young were banded with black anodized aluminum bands having unique alphanumeric codes as well as U.S. Fish and Wildlife Service bands.

3. Results

Observers saw no peregrines or occupied nest sites during the survey of northern Manitoba (Duncan and Wheeldon 1995). Four pairs of peregrines occupied territories in southern Manitoba; three pairs were in Winnipeg, and one pair was in Brandon. Two pairs produced young: a Winnipeg pair produced two young, and the Brandon pair produced four young. In Winnipeg, a young male was electrocuted on 6 September. In Brandon, a fledged young female was found dead on the McKenzie Seeds Building. A collision with a building wall is the suspected cause of death.

4. Discussion

The Manitoba peregrines are part of a larger mid-continental population. Their movements across borders are amply demonstrated by the number of Manitoba peregrines reported in other jurisdictions and furnished by other jurisdictions to the Manitoba population. All known young were banded up to and including 1995.

Considering the large area of Manitoba, researchers may have overlooked some nest sites occupied by falcons in both northern Manitoba and the Winnipeg area. Given the close proximity of the areas surveyed to a healthy population in the Northwest Territories, including Nunavut (Rankin Inlet; Murphy 1990), which is not expanding but potentially could supply young to northern Manitoba, we suggest that

the areas searched in 1995 will likely be among the first naturally colonized by peregrines in Manitoba.

Is the Manitoba population of peregrines self-sustaining? While the mid-continental population is apparently self-sustaining, there is some concern as to whether local populations as small as Manitoba's are secure enough to allow a reduction in management activities. Pagel et al. (1996) suggested that delisting the *anatum* peregrine in the United States may be premature and that this population may have genetic problems as yet unaccounted for. They also recommended that both management and long-term fieldwork be continued. While Manitoba's four nesting pairs contribute to the recovery of the mid-continental population, they appear to fail to provide the security necessary to allow management activities to completely cease.

5. Acknowledgements

We wish to thank the Manitoba Peregrine Falcon Recovery Team under the sponsorship of the Zoological Society of Manitoba, including M. Gillespie, J. Gosselin, L. Jarman, S. Levandowski, R.W. Nero, B. Racicot, R. Striemer, and R. Stardom. Appreciation is expressed to the Canadian Wildlife Service for the young peregrines and to the Delta Hotel Winnipeg, the City of Winnipeg Parks and Recreation, the Advance Electronics Consumer Division, Servo Electronic Systems, the Captain Richard Lloyd Trust, and Falconbridge Ltd. for their support and contributions throughout the year. The Brandon segment was supported by the Manitoba Department of Natural Resources Green Team Program and E. Blatz-Harvey. We would like to express our appreciation for assistance to McKenzie Seeds Ltd., Brandon University, Assiniboine Community College Audio-Visual Department, the Brandon Gallery, volunteer observer L. Ogg and volunteers from the Manitoba Telephone System Building, and the Scotia Towers Building managers. The Manitoba Raptor Foundation acknowledges the assistance of D. Abernathy, B. Bailey, L. Bennet, E. Bowman, M. Bradley, B. Chartier, D. Debets, J. Delaney, K. Donkersloot, P. Duncan, S. Edwards, C. Elliot, K. Gardner, I. Hildebrand, A. Majkut, B. McMillan, D. Mills, W. Pateman, B. Ratcliff, D. Speers, R. Tardi, P. Thompson, N. Wheeldon, J. Williams, and T. Zanewich.

The 1995 Peregrine Falcon survey in Saskatchewan

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Abstract

Historic evidence for Peregrine Falcon *Falco peregrinus* nesting in Saskatchewan is scarce. No survey occurred during 1995. Anecdotal information indicated no new pairs. Previously known sites in Saskatoon (one site) and Regina (one site) were visited. The Saskatoon pair produced two young, of which one survived but suffered a broken wing after fledging and was unreleasable. The Regina pair successfully fledged three young.

1. Introduction

Few historic records of Peregrine Falcon *Falco peregrinus* nest sites exist in Saskatchewan. Therefore, with limited resources to survey a vast area in the north (e.g., Lake Athabasca), where no peregrine pairs were found during previous surveys, no province-wide survey was undertaken. Instead, the data consist of anecdotal sightings collected by biologists and birders working on Piping Plovers *Charadrius melodus*, Prairie Falcons *Falco mexicanus*, and snakes along the South Saskatchewan River from Outlook, Saskatchewan, to the Alberta border.

2. Methods

Previously known nest sites in Saskatoon and Regina were visited once at banding age to determine productivity and sex of the young, band the young, and, where possible, determine the band number of the adults.

3. Results

Two urban pairs of peregrines nested in the province, one in each of Saskatoon and Regina. The Saskatoon pair nested on a gravel and sand ledge located just below the roof on a 25-storey condominium complex adjacent to the South Saskatchewan River. In 1995, the banded pair (the male wore a black band and the female wore a red band but was not specifically identified) raised two young, a male and a female. In late August, the young male was found dead. The young female was brought to the University Veterinary Clinic with a broken wing and was unreleasable.

The Regina pair nested in an artificial nest box on the roof of City Hall. Both adults were red-banded birds. This pair produced three young, all of which fledged and were believed to have achieved independence.

4. Discussion

Although no formal survey occurred in Saskatchewan during 1995, it is unlikely that a significant population exists there, especially considering the lack of historic records. Anecdotal reports about the northern half of the province are received from fishermen, amateur birders, and adventurers every year. However, no occupied rural peregrine nest sites have been confirmed to date.

The Saskatoon site has been occupied continuously since 1986 by a captive-raised hacked male. In 1988, this male acquired a wild mate with which he fledged captive-raised young, and in 1989, this pair produced wild young. Since then, this site has produced young every year and has had a healthy turnover of adults; all wore either red or black bands. The Regina site, established in 1992, has had little adult turnover. The same female, originally released in Winnipeg, has occupied this site since 1992 with two different males.

The Western College of Veterinary Medicine, University of Saskatchewan, receives injured raptors from all over the province. During 1995, it received four peregrines in late spring and early fall. It was not always possible to determine the subspecies, but several could be confidently described as *anatum*. Interestingly, three of the four peregrines received were adult females. The increased number of peregrines brought to the College could be an indicator of the general upward trend in peregrine numbers during migration.

The Regina site continued to generate more interest in the falcons than the Saskatoon site, so more follow-up observations of the young post-fledging occurred. In both cities, the public was well informed and aware of the peregrines, so that when an injured peregrine was found, the proper agencies were contacted promptly.

5. Acknowledgements

I wish to acknowledge the following people for their assistance with the peregrine project in Saskatchewan: K. Holliday in Regina, who established an online website with full video; R. Espie and D. Lieske, for their help during the banding of the young; and L. Oliphant, my partner in overseeing the whole program.

The 1995 Peregrine Falcon survey in central and southern Alberta

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Abstract

During 1995, Peregrine Falcon *Falco peregrinus anatum* numbers increased in southern Alberta. This increase was a direct result of lower levels of organochlorine pesticide residues in the environment and an intensive peregrine management program within the province. Researchers surveyed 55 of 66 known nest sites in southern Alberta for peregrines. Twenty-four of the 32 areas that had had recent peregrine sightings or contained potential nesting habitat were surveyed. Territorial pairs occupied 12 sites, a lone territorial bird occupied one site, and non-territorial peregrines were observed at three additional sites. Of the 12 pairs located, 10 laid eggs, five hatched young, and three successfully fledged young. The average number of young fledged per successful pair was 3.00. We attributed the low number of pairs that successfully fledged young to predation, poor weather conditions, and inexperienced adults.

1. Introduction

Peregrine Falcons *Falco peregrinus anatum* have been the focus of continuous management activities in Alberta for nearly 25 years. Before population declines in the mid-20th century, the peregrine was a relatively common summer resident that nested along the riverbanks of central and southern Alberta (Court 1993a). The decline in peregrine numbers was primarily caused by residues of organochlorines ingested from prey. In southern Alberta, the ultimate low in peregrine numbers occurred during the 1975 survey, when no breeding pair was found. Only recently have the levels of toxic contaminants in Alberta's peregrines been low enough to allow for "normal" reproductive success in the population (Court 1993b; Court et al. 1996).

The most intensive management programs occurred between 1985 and 1995. The Southern Alberta Peregrine Falcon Reintroduction Project released 180 captive-raised young falcons between 1992 and 1995 (Stepnisky 1996). These management efforts were a strong factor in the rapid recovery of the peregrine in central and southern Alberta. This report details the findings of the 1995 survey in central and southern Alberta and compares these results with previous records.

2. Methods

Major river systems throughout central and southern Alberta were searched for peregrine activity (Fig. 1). Surveys began on 16 May and lasted until 25 August. As during past surveys, emphasis was placed first on searching historic nest sites intensively rather than surveying new areas (Court 1993a), then on recent sightings, and finally on searching occupied sites. Past evidence suggested an affinity to traditional breeding territories, even when peregrines are reoccupying formerly abandoned areas (Ratcliffe 1973).

At least 26 individuals, including volunteers and provincial and federal government employees, surveyed sites or potential nesting habitats. The majority of sites were surveyed from the ground, with some of the more inaccessible sites being surveyed by helicopter or boat. Observers revisited occupied territories to identify adult falcons by reading bands with a spotting scope, to band all young, to foster young, if deemed appropriate, and to record the number of successfully fledged young. Only naturally produced young were used in productivity estimates and determination of pair success.

The Canadian Wildlife Service provided specific survey guidelines so as to standardize data collection and terminology. In addition to peregrine data, the presence of other raptors or nest sites was noted.

3. Results

Of the 66 nest sites known in Alberta, 55 were surveyed by observers. Territorial pairs occupied nine known sites, and a lone territorial falcon occupied one known site. Twenty-four of the 32 areas that had had recent sightings or were suitable nesting habitat were surveyed. Researchers found three new territorial pairs (Table 1). In addition, three peregrines were sighted but were excluded, as they exhibited no territorial behaviour.

Of the 13 sites occupied by territorial peregrines, eight were on buildings or bridges in urban environments and five on rural cliffs. Ten of the 12 pairs of peregrines produced 34 eggs (Table 2). Only three pairs successfully fledged nine young, resulting in an average of 0.75 young per territorial pair and 3.00 young per successful pair (Table 3). Predation by Great Horned Owls *Bubo virginianus* and Common Ravens *Corvus corax* resulted in two nest

Figure 1
Peregrine Falcon areas surveyed during 1995 in central and southern Alberta and in northern Alberta

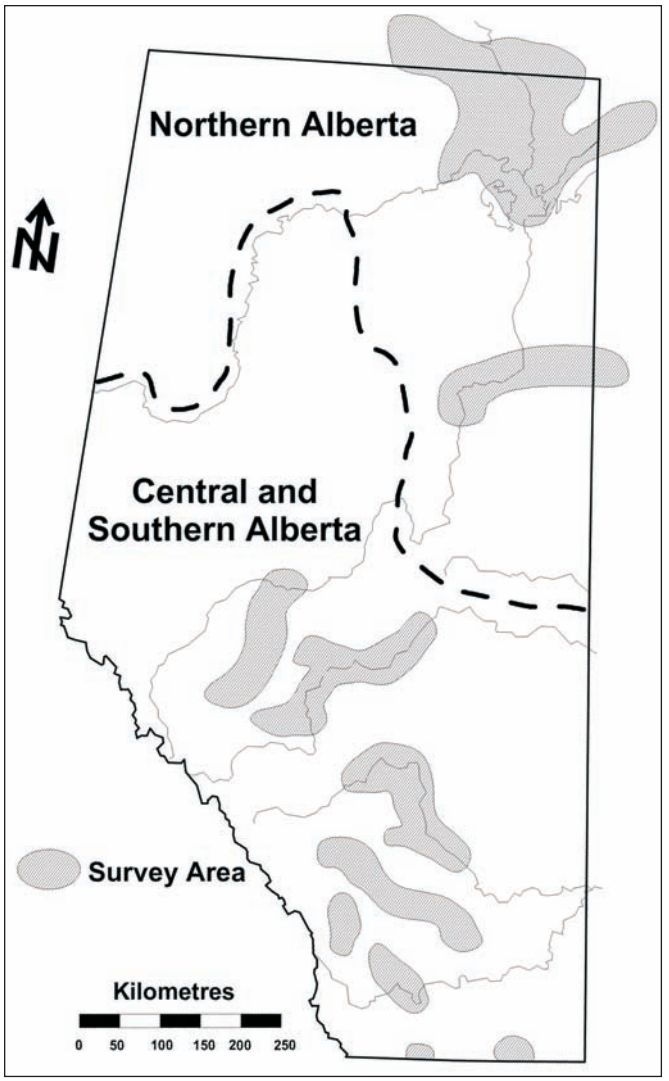

Table 1
Nest site occupancy by *anatum* Peregrine Falcons in central and southern Alberta from 1970 to 1995

Year	No. of known sites	No. of known sites checked	No. of known sites occupied	No. of new sites	Total no. of sites occupied by	
					Single birds	Pairs
1970	29	29	2	0	1	1
1975	35	31	1	0	1	0
1980	53	53	0	0	0	0
1986	59	59	0	2	0	2
1990	61	61	2	1	0	3
1995	66[a]	55	10	3	1	12

[a] One historic site, which was previously surveyed with the southern survey, was part of the northeastern peregrine population.

failures. Poor weather was believed to have been responsible for the failure of one pair.

Of the 25 territorial adults in the southern Alberta population, 12 originated from captive-breeding programs; six were from wild nests; five were unbanded; and the banding status for two falcons was undetermined. Based on these findings, 48% (12/25) of the currently identified territorial peregrines in southern Alberta were a direct result of management activities, such as fostering and hack release programs.

Table 2
Productivity of *anatum* Peregrine Falcons in central and southern Alberta, 1995

Nest location	No. of eggs laid	No. of eggs hatched	No. of young fledged
Edmonton, downtown	3	2	2
Edmonton, Inland Cement	3	3	3
Edmonton, north	5	0	0
University of Alberta	3	1	0
Brazeau Dam[a]	4	4	4
Calgary, downtown	4	0	0
University of Calgary	2	0	0
Balzac	3	0	0
Rosebud River[a]	4	3	0
Ardley[a,b]	0	0	0
Red Deer	3	0	0
Bow City[a,b]	0	0	0
Totals	34	13	9

[a] Rural locations.
[b] First-year female.

Table 3
Productivity of *anatum* Peregrine Falcons in central and southern Alberta from 1970 to 1995

Year	No. of territorial pairs	No. of successful pairs	Total no. of young	Average no. of young/ territorial pair	Average no. of young/ successful pair
1970	1	1	3	3.00	3.00
1975	0	0	0	0	0
1980	0	0	0	0	0
1986	2	2	2	1.00	1.00
1990	3	2	3	1.00	1.50
1995	12	3	9	0.75	3.00

Several other raptors were recorded at the 79 survey sites. Prairie Falcon *Falco mexicanus* pairs occupied 14 territories, and observers saw three lone Prairie Falcons. Great Horned Owl pairs occupied two territories, and observers saw one lone Great Horned Owl.

4. Discussion

The vast geography of Alberta makes it difficult to conduct comprehensive wildlife surveys. Because of time and personnel limitations and the difficulty of accessing all portions of the province, incomplete coverage occurred during the 1995 survey. Based on the average dispersal distances of 92 km for male peregrines and 168 km for female peregrines in southern Alberta (Stepnisky 1996), the observation of unbanded falcons suggests that several undetected pairs may exist in Alberta. Thus, a population estimate of 25 territorial pairs of peregrines in central and southern Alberta is conservative.

Ongoing surveys of central and southern Alberta indicated that the peregrine population is recovering. The number of sites occupied by territorial pairs in southern Alberta increased from three during 1990 to 12 during 1995 (Table 3). Although eight occupied sites were in urban settings, four pairs did occupy rural cliff sites (Table 2). This reestablishment at natural cliff sites is an encouraging step towards the peregrine's recovery in rural Alberta. As the peregrine population in southern Alberta increases, the number of rural pairs should also increase.

The increased numbers of peregrines recorded in 1995 can be attributed to two major factors: reduced levels of toxins accumulating in peregrine eggs and intensive management efforts through reintroduction projects. As a management objective of continued importance, Alberta has monitored pesticide levels in peregrine eggs for several decades. Owing to the lower levels of pesticides in peregrines (Court 1993b; Court et al. 1996), more falcons bred successfully in Alberta during the last decade without harmful side-effects of pesticide exposure, such as thin eggshells.

The Canadian Wildlife Service Peregrine Falcon Captive-Breeding Facility was the other important force in the reestablishment of the peregrine in southern Alberta. During 1975, the first captive-raised young were fostered into peregrine broods in northern Alberta. The first hack releases of captive-raised young in Canada occurred during 1976 in Alberta and Quebec; hack releases continued in Alberta until 1996. More recently, between 1992 and 1996, the Southern Alberta Peregrine Falcon Reintroduction Project released 223 falcons (Rowell 1995; Stepnisky 1996). The number of captive-raised birds in the recovering population, at least 48% (12/25), emphasizes the significance of the captive-breeding and release program.

The number of successful pairs of peregrines was low during 1995; only three of 12 (25%) pairs fledged young (Table 3). Predation of eggs and young, inclement weather conditions, and the inexperienced first-time breeders may all contribute to reduced nest success in raptors (Newton 1979). It is likely that all these factors affected Peregrine Falcons in Alberta during 1995. Productivity per successful pair (i.e., 3.00 young per pair) was relatively high, indicating low pollutant loads in successful adults and the ability to rear a full brood of young when factors such as weather and predation do not interfere. As breeding adults in the population mature, their average productivity will likely increase.

The almost doubling of the southern Alberta peregrine population in the early 1990s indicated the success of past management activities. Yearly monitoring of the population and its productivity should continue in the future until the peregrine is no longer considered an endangered species in Alberta. These data are vital to assist in evaluating the continued effects of previous management activities and in locating pairs of breeding falcons that may require fostering of captive-raised young. Manipulation of nest sites through habitat improvement should also continue.

5. Acknowledgements

The survey of numerous sites across central and southern Alberta would have been impossible without the combined interest, personnel, and logistical support of several agencies. Alberta Sustainable Resource Development thanks U. Banasch of the Canadian Wildlife Service for providing the national survey guidelines. Moreover, grants were made available from the Edmonton Natural History Club (Nest Egg Fund) and the Beaverhill Bird Observatory, through an application to Canada Trust, to assist volunteer surveyors with field expenses. Thanks also go to the many volunteers and employees of Alberta Sustainable Resource Development and the Canadian Wildlife Service, who actively surveyed and submitted all peregrine sightings and data. A final thanks goes to PetroCanada and Alberta Sport, Recreation, Parks and Wildlife Foundation for their strong support of the peregrine reintroduction program in Alberta.

The 1995 Peregrine Falcon survey in northern Alberta

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Abstract

All 31 known (historic) Peregrine Falcon *Falco peregrinus anatum* territories in the northern Alberta population were surveyed. Potential nesting habitat on 163 cliffs was also surveyed. These surveys confirmed 23 occupied territories, including five new territories. Twenty pairs of falcons laid eggs, and 17 pairs fledged up to 32 young. Five historic sites along the Athabasca and Clearwater rivers near Fort McMurray and along the Athabasca River near its confluence with the La Biche River were also examined.

1. Introduction

Peregrine Falcons *Falco peregrinus anatum* were first reported nesting along the Peace River within Wood Buffalo National Park in 1966. Beginning in the early 1970s, the northern Alberta wild population was monitored annually by Alberta Fish and Wildlife Division, Canadian Wildlife Service, and Wood Buffalo National Park staff. This study area is bounded by the Saskatchewan border on the east, latitude 58°30'N to the south, latitude 60°20'N to the north, and longitude 114°W to the west. In addition, this survey covered the historic northern Alberta wild Peregrine Falcon nest sites and historic or reported nest sites along the Athabasca and Clearwater rivers near Fort McMurray and along the Athabasca River near its confluence with the La Biche River, north of Lac La Biche.

2. Methods

We conducted surveys of known nest sites between 9 June and 18 July by helicopter, fixed-wing aircraft, boat, vehicle, or foot. Where possible, we accessed each occupied nest site to confirm the number of eggs or young, to collect unhatched eggs for pesticide analyses, and to band young. Three captive-raised young were added to one brood. We observed adults with spotting scopes and binoculars to determine if they were banded and to read band numbers where possible. Potential nesting cliffs were identified from 1:50 000 National Topographic System maps and then were examined during the helicopter survey.

Survey crews consisted of staff and volunteers from Wood Buffalo National Park (seven), the Canadian Wildlife Service (two), Alberta Fish and Wildlife Division (six), and the Northwest Territories Department of Resources, Wildlife and Economic Development, which included Nunavut (one).

3. Results

Peregrines occupied 23 territories, 18 of which were known sites. During the survey of 163 potential nesting cliffs from Fort Chipewyan to Uranium City, five new nest sites were located. Pairs occupied 20 sites; single birds occupied three sites (Table 1). Survey personnel noted no evidence of occupied peregrine territories along the Athabasca, La Biche, and Clearwater rivers (see Fig. 1 in preceding paper).

Twenty pairs laid a minimum of 70 eggs, resulting in an average clutch size of 3.50. One pair failed to hatch its eggs. We banded 32 of 45 wild young at 12 nests that survived to banding age plus three captive-raised young. In the remaining five territories, the exact number of young was unknown. Natural productivity was at least 1.60 young per territorial pair and 2.67 young per known successful pair (Table 2).

The analyses of the four unhatched eggs indicated that DDE residues averaged 2.96 µg/g (range from 1.57 to 3.98 µg/g), PCB residues averaged 2.10 µg/g (range from 1.60 to 2.70 µg/g), heptachlor epoxide residues averaged 0.072 µg/g (range from 0.024 to 0.110 µg/g), and dieldrin residues averaged 0.106 µg/g (range from 0.023 to 0.290 µg/g).

Thirty-one of the 46 adults in the observed population had their banding status fully or partially determined. Fifteen of the adults were unbanded on both legs, and two were observed to be unbanded on at least one leg. Eleven adults were identified by reading their colour bands (two red and nine black). Colour bands (one red and two black) were observed on a further three adults, but the entire alpha-numeric sequences could not be read.

4. Discussion

Thorough surveys of known sites and potential nest cliffs along the Clearwater and Athabasca rivers failed to confirm any occupied territories. However, surveys of additional potential nesting habitats east of the Slave River and north to the Alberta–Northwest Territories border resulted in five new occupied territories. Compared with available historic data, the northern Alberta wild population appears to be expanding gradually. The presence of unbanded adults in

Table 1
Nest site occupancy by *anatum* Peregrine Falcons in northern Alberta from 1970 to 1995

Year	No. of known sites	No. of known sites checked	No. of known sites occupied	No. of new sites	Total no. of sites occupied by	
					Single birds	Pairs
1970	5	5	1	0	0	1
1975	13	11	3	0	0	3
1980	18	18	9	0	0	9
1986	18	16	6	0	1	5
1990	18	18	7	2	0	9
1995	31	31	18	5	3	20

Table 2
Productivity of *anatum* Peregrine Falcons in northern Alberta from 1970 to 1995

Year	No. of territorial pairs	No. of successful pairs	Total no. of young hatched[a]	Average no. of young/ territorial pair	Average no. of young/ successful pair
1970	1	0	0	0	0
1975	3	0	0	0	0
1980	9	6	19[b]	2.11	3.17
1986	5	0	0	0	0
1990	9	5	13	1.44	2.60
1995	20	12	32	1.60	2.67

[a] Includes only native young that hatched and survived to banding age.
[b] Plus one young hatched from a wild egg at the Wainwright Facility, returned to and fledged by wild adults.

the population indicates that we are missing some occupied territories or that these adults have moved into the population from outside the study area.

We assumed that young at all sites fledged, even though limited personnel and funding precluded follow-up visits to some remote sites. Therefore, we conclude that the observed productivity per territorial pair and per successful pair are adequate for a stable and healthy population. Few single adults occupied territories.

From the levels of pesticide residues in eggs, we conclude that pesticide contamination is no longer a concern at this time in this population.

5. Acknowledgements

For participating in this survey, we would like to thank the staff and volunteers from Wood Buffalo National Park: D. Bergeson, N. Bourke, S. Franks, A. Hall, T. Letcher, and E. Taylor; from the Canadian Wildlife Service: J. Duxbury and H. Trefry; from Alberta Fish and Wildlife Division: G. Court, G. Gunderson, F. Kunnas, R. Matsuba, and B. Treichel; and from the Northwest Territories Department of Resources, Wildlife and Economic Development, which included Nunavut: M. Bradley.

The 1995 Peregrine Falcon survey in the Yukon Territory

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Abstract

During 1995, researchers and volunteers surveyed four *anatum* and one *tundrius* Peregrine Falcon *Falco peregrinus* subpopulations. In total, they visited 124 known nest sites. New sites were located along the Porcupine, Peel, and Yukon rivers. The Peel River population experienced the largest increase since the 1990 survey. The most exciting find occurred in the Southern Lakes population, which had disappeared during the 1970s. Here, a pair reoccupied a historic (known) site and successfully fledged three young. The North Slope *tundrius* population also appears to be experiencing a recovery. During 1990, only a single adult remained at 15 occupied sites known prior to the decline. Annual surveys from 1990 to 1995 resulted in four occupied territories plus a new one in 1995. Three pairs produced young in 1995.

1. Introduction

In the mid-1960s, observers found a large population of the interior race of Peregrine Falcon *Falco peregrinus anatum* breeding on the riparian cliffs of the rivers draining the central Yukon (Cade and Fyfe 1970). Systematic regular surveys date from the late 1970s, when the Yukon government began funding a small non-game wildlife management program. A database spanning the 1970s, 1980s, and 1990s now exists that follows the progress of peregrine populations in this part of the Canadian northwest.

Five subpopulations of peregrines, based in part on geographic separation, developed from the recognition that various regional groups performed differently in terms of population demographics. The Porcupine River *anatum* population declined in the late 1960s, but retained a remnant population. This population showed the first recoveries in 1980 (Hayes and Mossop 1982) and was still increasing in 1990. The Peel River *anatum* population declined in the 1960s, but also retained a remnant population. This population began increasing slowly in 1990. Through the early 1970s, the Yukon River population declined; by 1978, only one known occupied territory remained. Captive-raised young were fostered from 1978 to 1992. Since then, a strong and sustained recovery has occurred; by 1990, this population was well above historic levels. The few known breeders in the Southern Lakes *anatum* population disappeared during the 1970s. In 1990, this population was thought to be extinct, even though the British Columbia portion had never been surveyed.

The North Slope Peregrine Falcon *F. p. tundrius* population was thought to be locally extinct by 1980. Reintroductions of captive-raised young occurred from 1983 to 1985. In 1990, a single adult occupied a territory that was last occupied by a pair in 1989 (Holroyd and Banasch 1996).

2. Methods

Thirty-four field crew participated in the survey; 21 were volunteers. Surveys began in early July on southern populations and ended during the first week of August on the North Slope. Each nest site was visited once during the brood-rearing period in July. Although survey designs depended on the fidelity of peregrines to former nest sites, field personnel attempted to cover all potential nesting habitat between known pairs in all five regions (Fig. 1). A systematic search of riparian cliffs occurred from the ground (the majority), by boat, and, when necessary, by helicopter. In the North Slope, all surveys were conducted by helicopter.

At all potential nest sites, a standardized procedure was followed. The presence of adults defending a site was determined from the birds' reaction to people at the site. Generally, observers used a spotting scope to locate the nest ledge and view occupying adults. During nest visits, young were counted, aged, and banded with tarsal bands. Additionally during the visits, researchers collected unhatched eggs or eggshell fragments, prey remains, and a feather sample from each young for isotope analysis.

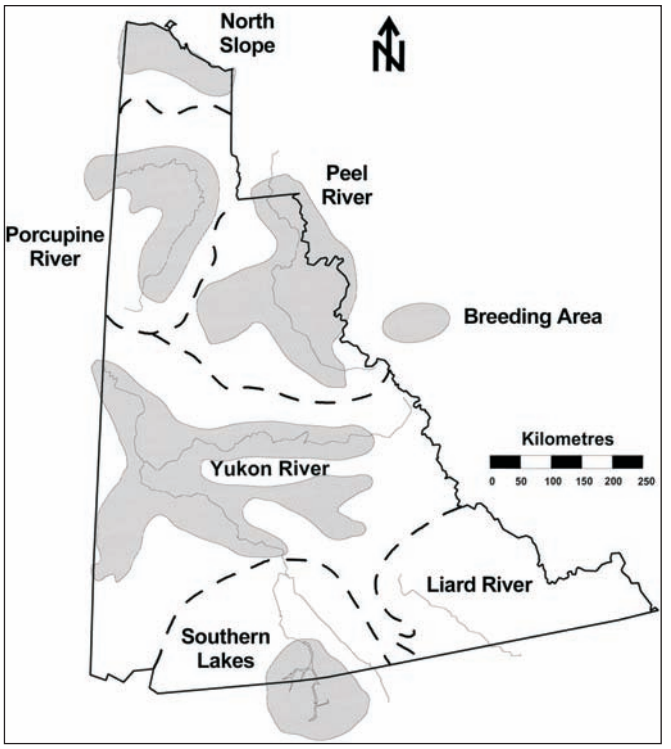
3. Results

All five regional populations were surveyed. Of the 132 known sites, 124 were visited and eight could not be reached. Another 30 sites were known outside the survey routes, but they were not surveyed during this year's work.

3.1 Porcupine River (*anatum*)

The last monitoring survey occurred in this drainage during 1990. Now at 29 occupied sites, well above its known pre-decline size of 21 sites, this population is apparently still expanding. During this year's survey, five newly established breeding pairs were discovered. Occupancy at historic sites

Figure 1
The Yukon Territory, showing the major drainage basins and the five Peregrine Falcon subpopulations surveyed during 1995



was 100%, and 52% of all known sites produced young (Table 1).

3.2 Peel River (*anatum*)

This subpopulation exhibited the strongest increase since the last survey. Only one small segment near the Dempster Highway was monitored annually between surveys. During 1995, observers discovered an astounding 16 newly established pairs. Adults occupied about 88% of the known sites, and approximately 50% of known pairs produced young (Table 1).

3.3 Yukon River (*anatum*)

This breeding group was monitored the most intensively over the years, but, since 1990, was visited only one year in part. During 1995, the number of adults in this group far exceeded those known pre-decline. The current year's survey turned up seven newly established breeding pairs. Overall, pairs occupied about 91% of previously known sites; 63% produced young (Table 1).

Table 1
Status of the Peregrine Falcon in the Yukon Territory during 1990 and 1995

Area	Year	Total no. of known sites	No. of known sites checked[a]	No. of known sites occupied[b]	No. of new sites	Observed no. of successful pairs	Observed average no. of young/ successful pair (±SD)[b]
Anatum							
Porcupine River[c]	1990[d]	34	34	30	6	18 (n = 29)[e]	2.80 ± 0.5
	1995	40	24	24	5	14 (n = 24)	2.30 ± 0.8
Peel River[f]	1990	31	13	12	1	9 (n = 12)	3.20 ± 0.5
	1995	32	24	21	16	8 (n = 24)	2.10 ± 0.8
Yukon River[g]	1990	36	34	27	8	19 (n = 27)	2.40 ± 0.5
	1995	50	43	39	7	23 (n = 43)	2.70 ± 0.8
Southern Lakes[h]	1990	3	3	0	0	0	0
	1995	3	3	1	0	1 (n = 3)	3.00
Tundrius							
North Slope[i]	1990	17	17	1[j]	0	0	0
	1995	18	13	4	1	3 (n = 4)	2.30 ± 1.2

[a] Actual number of sites checked.
[b] Sample size shown and observed number of young per successful pair calculated exclude newly discovered pairs from that year's survey.
[c] Twenty-one sites known pre-decline.
[d] Holroyd and Banasch (1996).
[e] n = actual number of sites checked for occupancy.
[f] Twelve sites known pre-decline.
[g] Thirteen sites known pre-decline.
[h] Three sites known pre-decline.
[i] Fifteen sites known pre-decline.
[j] Single bird.

3.4 Southern Lakes (*anatum*)

By far the most exciting find of the current survey was the reoccupancy of one of three known sites by a pair. This pair successfully fledged three young.

3.5 North Slope (*tundrius*)

Equally important is the recovery of the *tundrius* peregrine population of the North Slope, clearly in its initial stages. In 1990, only a single adult was seen (Mossop and Mowat 1990). Annual visits occurred in most years since 1990, and, by 1995, an additional five nesting pairs were known. Three pairs produced young (Table 1).

4. Discussion

Overall, the *anatum* in the Yukon Territory is faring extremely well and continues to increase. Since 1990, researchers have found 33 newly established pairs; of all known pairs, about 58% apparently produced young, averaging 2.50 young per pair.

Several of the subgroups surveyed now contain more known breeding pairs than were known before the decline, making the original population numbers seem almost irrelevant. In total, the number of peregrines is now about two and a half times the known "historic" population, and numbers apparently continue to climb. In particular, the Peel River population, which exhibited the largest increase since the 1990 survey, displayed improved productivity, and its number of breeding pairs jumped markedly since the last report.

The Southern Lakes group's reappearance is exciting. These findings, from interior British Columbia and southern Yukon habitats, will make surveys of these as yet not completely surveyed areas a high priority for the future to further document the status of the *anatum* peregrines in Canada's northwest.

Of significance is recently occupied habitat identified since 1990, which was not surveyed during 1995. Based on the size of the unsurveyed habitats of the Stewart and Pelly rivers, an extrapolation of the Yukon's *anatum* Peregrine Falcon numbers undoubtedly places this population now in the 200-pair range.

At one-third of its original size, *tundrius* is clearly not doing as well, but it is again faring better than in 1990. The five established pairs apparently bred and produced young at about the same rate as for the more southerly populations, at 2.30 young per successful pair. Careful monitoring of the habitats on Yukon's North Slope, particularly where this can be done concurrently with other activities in the area, will be essential to further document the fate of the population.

5. Acknowledgements

J. Bauer, R. Brenneman, and D. Drummond surveyed the White River and a portion of the Yukon River main stem. P. Denison, B. Hayes, T. Hunter, and P. Merchant covered the lower Yukon River. Naturalists hired to work on the Dempster Highway Nature Interpretive Program supplied the breeding data from the upper Ogilvie River. A large group, organized by J. Snyder and led in the field by G. Baird, A. Milani, and J. Snyder, covered the huge area of the Peel River drainage. The assistance of this body of help was absolutely essential to cover the over 3000 km of Yukon waterways.

Polar Continental Shelf Project (Ottawa) provided helicopter support for the northern portion of the survey; the World Wildlife Fund Canada and Environment Canada (Canadian Wildlife Service), through the Endangered Species Recovery Fund, provided support to hire two students: M. Martin of Yukon College and L. Blake of the Vuntut G'witchin First Nation, who worked valiantly to provide technical support for the project.

The 1995 Peregrine Falcon survey in the Northwest Territories

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Abstract

In 1995, 245 occupied Peregrine Falcon *Falco peregrinus* sites were located at five locations in the Northwest Territories, which included Nunavut. In the Mackenzie Valley, 83 sites were occupied by the *anatum* subspecies. For *tundrius* peregrines, 30 occupied sites were located in the Rasmussen Lowlands, 64 at Kugluktuk, 41 at Hope Bay, and 27 at Rankin Inlet. Numbers of sites occupied by peregrines increased until about 1990 and have remained fairly constant since.

1. Introduction

Regular and methodically consistent Peregrine Falcon *Falco peregrinus* surveys have been undertaken for many years at a variety of locations in the Northwest Territories, which included Nunavut. Surveys for *anatum* peregrines along the Mackenzie River began in the 1970s, while annual *tundrius* surveys began at several locations in the early 1980s. In 1995, these surveys were repeated as part of the 1995 Canadian Peregrine Falcon survey.

2. Methods

Peregrines often use different nest ledges on the same stretch of cliff. Consequently, the term "site" is used to indicate the general nesting location of a pair — usually a stretch of cliff. First-time sites were not recorded until the actual nest site was recorded — i.e., the presence of defensive adults was not enough to designate a new site. Peregrine sites were classified as "occupied with eggs" (OE), "occupied with young" (OY), "occupied territory" (OT), or "not seen" (NS). A nest site seen to be occupied in previous years was designated OT if no nest was found but one or both adults acted defensively — i.e., returning to the same stretch of cliff after several helicopter passes. If no birds or nest was seen, the site was classified NS. This classification results in an underestimate of occupancy, as many incubating adults sit tight on the nest and are therefore hard to see. Later during the breeding cycle, both adults are sometimes off hunting. Peregrine nests in the north tend to be scrapes without any whitewash or *Xanthophyllus* lichen to make them conspicuous.

In 1995, peregrine surveys were undertaken in the following five locations:

- the Mackenzie River from Fort Norman to Inuvik — surveyed by helicopter on 17–21 July by Leslie Wakelyn and Steve Matthews; accessible sites surveyed by boat and on foot over a two-week period in late July to early August by Keith Hodson
- the Rasmussen Lowlands, located 50 km south of the community of Taloyoak (68°40'N, 93°00'W; previously called Spence Bay) — surveyed by Chris Shank on 1 to 3 July
- the 4000-km^2 area around Kugluktuk (68°00'N, 115°00'W; previously called Coppermine) — surveyed annually for raptors since 1983, and surveyed on 6–8 July by Chris Shank and Joanne Coutu
- the 2500-km^2 Hope Bay area, south of Cambridge Bay (67°45'N, 107°00'W) — surveyed annually since 1982, and surveyed by Chris Shank on 9–11 July
- the Rankin Inlet area (62°45'N, 92°00'W) — ground visits to peregrine nest sites at all stages of the breeding cycle organized by Robin Johnstone (University of Saskatchewan).

3. Results

3.1 Mackenzie Valley (*anatum*)

Surveys covered 600 linear kilometres of the Mackenzie Valley. Peregrines occupied 83 sites, including 11 new ones. At 26 sites, defensive adults were seen, but no nest site was found. Those sites accessible from the river by boat were rechecked, and 16 young were banded. The mean brood size for the 57 nests in which young could be counted was 2.63 (Table 1).

3.2 Rasmussen Lowlands (*tundrius*)

During environmental impact assessment surveys by LGL Ltd. for the Polar Gas pipeline in the mid-1970s, this area was recognized as an important waterfowl and shorebird area. Whereas the Lowlands themselves contain little peregrine nesting habitat, the hills bounding the area on the east are suitable nesting habitat. In 1975, four peregrine nests were located. In 1976, two of the four nests found in 1975 were reoccupied, and three new sites were located.

During 1995, the Canadian Wildlife Service was gathering biological data to determine whether the area

Table 1
Productivity of Peregrine Falcons in the Northwest Territories during 1995

Area	No. of occupied territories[a]	Mean clutch size	Mean brood size	Mean no. of young fledged/ successful pair	Mean no. of young fledged/ territorial pair
Mackenzie Valley[b]	83	–	2.63 (n = 57)[d]	–	–
Rasmussen Lowlands[c]	30	3.62 (n = 21)[d]	–	–	–
Kugluktuk (Coppermine)[e]	64	3.33 (n = 24)[d]	–	–	–
Hope Bay[e]	41	3.63 (n = 16)[d]	–	–	–
Rankin Inlet[f]	27	2.67 (n = 18)[d]	2.25 (n = 12)[d]	2.11 (n = 9)	0.70 (n = 27)

[a] A known nest site with one or more territorial birds present, or the nest was observed.
[b] Data from a combined helicopter and boat/ground survey done during the mid to late fledging period.
[c] Helicopter survey during late egg incubation period.
[d] n = number of nests used to calculate mean clutch and brood size and mean number of young fledged per successful pair and per territorial pair.
[e] Helicopter survey done near hatch.
[f] Multiple surveys throughout the entire nesting cycle.

should be recommended as a National Wildlife Area. Upon their request, a reconnaissance survey was undertaken to determine whether sufficient raptors used this area to warrant the inclusion of the hills in a National Wildlife Area proposal. Peregrines occupied virtually all suitable nest locations. Pairs occupied 30 territories, and four single peregrines defended territories, but no nest sites were found. Eggs were counted in 21 clutches, with a mean clutch size of 3.62 ± 0.72 (Table 1).

3.3 Kugluktuk (*tundrius*)

In 1995, surveys of the area located 64 occupied peregrine territories, the largest number of occupied sites recorded in the study area to date. We determined the average clutch size at 24 sites to be 3.33 ± 0.75 (Table 1).

3.4 Hope Bay (*tundrius*)

In 1995, surveys located 41 occupied peregrine territories, which was similar to numbers from the past four years. A mean clutch size of 3.63 ± 0.48 was determined for 16 sites (Table 1).

3.5 Rankin Inlet (*tundrius*)

In 1995, pairs occupied 27 territories in the spring (Table 1). Of these, 18 pairs laid 48 eggs (mean = 2.67 ± 1.05). Of these 18 pairs, 12 pairs hatched 27 eggs (mean number of young per successful pair = 2.25 ± 0.60). Nineteen young fledged from nine nests.

4. Discussion

In the Northwest Territories, which included Nunavut, breeding peregrine numbers increased dramatically through the 1980s, presumably as a result of the recovery from the effects of DDT. During 1995, observers noted no major changes in the number of pairs occupying territories or in reproductive parameters relative to 1990. Available data for the intervening years, some not presented here, support a general conclusion that breeding peregrine numbers reached "ecological carrying capacity" around 1990 and remained near these levels despite annual fluctuations in breeding success.

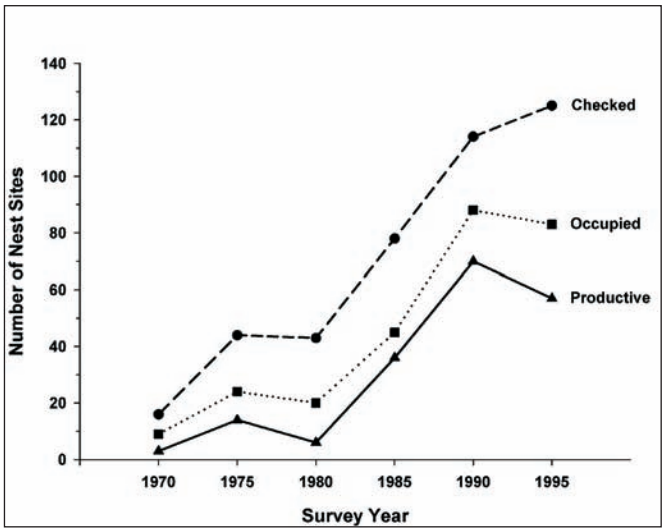
The results suggested a small decline in peregrine productivity for the Mackenzie Valley. However, the probability of nest success differed between the southern and northern parts of the survey. For example, nest occupancy between Grandview and Fort Norman was only 24%, whereas it was 45% between Grandview and Inuvik. Peregrine nest occupancy for the Gwich'in area had been essentially stable since 1988 (Fig. 1). It is possible that the large forest fires south of Norman Wells may have had an effect on peregrine production. Because peregrine reproductive success is so variable from year to year in the North, generalizations based on a few years of data should be viewed with caution.

"Percentage of known nesting sites occupied" is not a particularly useful measure for dense populations surveyed by helicopter, since quick judgement is required to decide whether different nests/sites are alternative nest sites within the same or different territories. In good breeding years, sites that are usually alternatives for one pair can be occupied by two pairs. The best measure of peregrine breeding populations is the number of territorial pairs within a circumscribed area surveyed using a consistent technique. Withdrawal experiments (G. Court and R. Johnstone, pers. commun.) done at Rankin Inlet suggested that non-breeders were numerous, reinforcing the notion that surveys of nesting peregrines index the size of a "breeding" population, not the total population size.

Clutches or broods counted from the air tend to be underestimated. It is particularly difficult to differentiate individual chicks from a helicopter. Clutch and brood sizes also decline through the breeding cycle due to mortality. Consequently, among-year comparisons are valid only when surveys are done at the same stage in the cycle.

In the Rankin Inlet area, it was a poor year in terms of eggs laid and number of young fledged, which can be attributed primarily to the late spring arrival of the majority of Rankin peregrines. Laying normally starts 30 May to 1 June; in 1995, however, many pairs were still absent by those dates. The last pair arrived 9 June. These events apparently interrupted the normally prolonged courtship, forcing pairs to lay with few preliminaries. Satellite tracking data showed that peregrines arrived late that year in Greenland as well (J. Dayton, pers. commun. to R. Johnstone). However, migration dates through Padre Island, Texas, were normal (J. Dayton and T. Maechtle, pers. commun. to R. Johnstone).

Figure 1
Peregrine Falcon population data for the Mackenzie Valley from 1970 to 1995



5. Acknowledgements

Thanks go to the many persons who took part in the 1995 surveys. These include J. Coutu, B. Firth, K. Hodson, R. Johnstone, S. Matthews, R. McDonald, G. Sullivan, and L. Wakelyn. I gratefully acknowledge funding from the Gwich'in Renewable Resources Board, the Northwest Territories Department of Resources, Wildlife and Economic Development (formerly the Department of Renewable Resources), and the Polar Continental Shelf Project.

The 1995 Peregrine Falcon survey in British Columbia

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Abstract

Five sources of data exist for the Peregrine Falcon *Falco peregrinus* in British Columbia during 1995, but only four of these data sources are referenced here; Langara Island data are reported separately by R. Wayne Nelson. For *F. p. anatum*, 19 occupied nest sites were reported from the southwestern and interior areas. Debate continues as to whether Gulf Island birds are *F. p. anatum* or *F. p. pealei*. Surveys for coastal populations of *F. p. pealei* occurred on Vancouver Island, adjacent islands, and the Queen Charlotte and Triangle islands. For these areas, observers estimated 98 occupied nest sites.

1. Introduction

In British Columbia, coastal Peregrine Falcons *Falco peregrinus pealei* are Blue-listed and have been surveyed regularly by the British Columbia Wildlife Branch on the Queen Charlotte Islands since the early 1960s and in the Vancouver Island area since 1980. During 1970, 1975, 1992, and 1994, surveys were aimed at determining only status and occupancy rates for the Red-listed *F. p. anatum* of British Columbia's southwestern corner and the interior (B.C. Wildlife Branch data files, pers. commun.). Consequently, limited data exist for productivity. This report details the findings of surveys conducted during 1995 in British Columbia, excluding surveys of Langara Island, which are reported by R. Wayne Nelson in the next paper.

2. Methods

Sites were selected based on previous surveys and other historic records. Occasionally, additional suitable cliffs were also surveyed when encountered. Incidental sightings of peregrines were also recorded. Sites were deemed occupied if a pair or a single bird was present and actively defending the site. Only during the *anatum* surveys was an attempt made to collect productivity data.

Survey methods varied depending on location, access, and logistics. Coastal sites surveyed by boat were visited only once, except for Triangle Island sites, which were scanned 2–15 times each during trips around the island. If no birds were seen at a site during the first visit by helicopter, a second visit occurred. Historic and potential *anatum* sites were visited from the ground at least twice.

In the Queen Charlotte Islands, between 23 May and 3 June, survey teams of two experienced observers searched historic sites and other suitable cliffs from inflatable boats. Upon approaching such cliffs, observers discharged a firearm three times; peregrines that responded to the shots were recorded. In May and June, one experienced observer, accompanied by a pilot or navigator, surveyed the Vancouver Island areas by helicopter, boat, or foot, depending on site accessibility and method of transport available. From 20 March to 29 April 1996, students from Simon Fraser University recorded peregrines during their travels by boat past Triangle Island between study sites. From 12 June to 24 July, either one or two experienced observers conducted *anatum* peregrine surveys from the ground, by vehicle, or on foot.

3. Results

Field personnel surveyed 800 km of coastline on the east and west sides of the Queen Charlotte Islands. Rough weather precluded surveys of the west coast of Graham Island, from Gilbert Bay south to Cape St. James. In all, 162 sites were checked, with 78 of them occupied by peregrines; 62 sites were apparently occupied and defended actively by pairs (45 sites) or by singles (17 sites) (Table 1). Not included in the totals were an additional 16 non-territorial single birds. Using a correction factor of 1.1 for survey efficiency (determined from previous surveys in the area) and extrapolating the results to the area of coastline where weather conditions precluded surveying, the total number of occupied sites for the Queen Charlotte Islands was estimated at 71.

The Vancouver Island area surveys were broken into southern and northern units. In the southern unit, which included the Gulf Islands, 10 sites were checked, with seven deemed to be occupied: two by pairs and five by singles actively defending (Table 1). In the northern unit, 17 sites were surveyed, resulting in 10 occupied sites, including three pairs at each of two offshore islands and four singles, all defending their sites. A lighthouse keeper reported a pair nesting at one of the seven unoccupied sites, and a single bird flew by another site but did not act defensively.

Because of logistical access problems, Beresford, Sartine, and Triangle islands, which in the past accounted for up to 11 occupied nest sites, were not surveyed. However, students reported at least 10 pairs defending territories on

Table 1
Nest site occupancy by Peregrine Falcons in British Columbia during 1995

Area	Total no. of known sites	No. of known sites checked	No. of known sites occupied	No. of new sites	No. of sites occupied by	
					Single birds	Pairs
Anatum						
Southwest and interior British Columbia	50	38	17	2	1	18
Pealei						
South Vancouver Island	13	9	6	1	5	2
North Vancouver Island	23	17	9	1	4	6
Triangle Island	9	9	9	1	0	10
Queen Charlotte Islands	167	162	62	0	17	45

Triangle Island. In addition, they saw five immature birds that showed no noticeable attachment to any cliff sites (U. Steiner, pers. commun.).

Paul DeBruyn surveyed 38 historic sites for *F. p. anatum*. Twenty-one sites were in the southwestern Fraser River area, adjacent cliffs, and the Gulf Islands. Eleven other sites were checked in the southern interior, four from the central interior, and one each from the northwest and northeast interior areas of the province. Peregrine pairs occupied 18 sites and one single bird another site: 17 occupied sites were in the southwest, one was in the southern interior, and one was in the central interior. Of these pairs, 14 successfully fledged young: 13 in the southwest and one in the southern interior. It is probable that some of the Gulf Islands sites checked by DeBruyn may be duplicates of the seven occupied sites recorded by B.C. Wildlife Branch personnel in the same area. Because of circumstances beyond our control, these data cannot be further verified. However, since DeBruyn's sites included a previously unknown tree nest site, the maximum duplication would be six sites.

4. Discussion

All this evidence points to a stable to increasing population of peregrines in British Columbia, allowing for cautious optimism for its future. Recent surveys for *F. p. anatum* showed that they have returned in good numbers along the lower Fraser River, on adjacent suitable cliff habitats by lakes and other rivers, and along the coast. At present, this area alone likely accounts for about 10 occupied territories (P. DeBruyn, pers. commun.). Reports of peregrine sightings in the Fraser Lowlands during the summer have also increased.

DeBruyn also reported two occupied sites from the interior. One was a historic site in the northern part of the central interior, and the other was a new site in the Thompson area of the southern interior, which DeBruyn considered to be an extension of the coastal *anatum* population. During 1996, surveys in the extreme southern interior of the province located a site occupied by a pair of peregrines — the first record for the area since 1959. In addition, a single non-territorial peregrine was seen again at the Thompson area interior site found by DeBruyn in 1995.

Due to recent increases in the southern Yukon population of *F. p. anatum*, it is likely that peregrines are now nesting in the northwest corner of the province (D. Mossop, pers. commun.), even though no surveys were conducted to confirm this.

Coastal populations of *F. p. pealei* from the Queen Charlotte Islands and Vancouver Island areas remained largely stable, with some local increases. DeBruyn cautions that some Gulf Island birds may be intergrades between *F. p. pealei* and *F. p. anatum*. Efforts to maintain and enhance seabird nesting colonies in the Queen Charlotte Islands by eradicating or controlling introduced seabird nest predators such as rats (G. Kaiser, pers. commun.) will help preserve the peregrine's major prey source.

5. Acknowledgements

A. Edie and D. Burles provided fieldwork and summary reports for the Queen Charlotte Islands. R. Davies provided data for the Vancouver Island area. Triangle Island data were obtained from U. Steiner, a student at Simon Fraser University. P. DeBruyn, a graduate student at Washington State, and J. Cooper provided survey information regarding the *anatum* peregrines. Logistical assistance for field crews was provided by British Columbia Wildlife Branch and Canadian Wildlife Service biologists, Parks Canada staff, and the crew of *Anvil Cove*, mothership used for the Queen Charlotte Islands surveys. Funding was provided by the B.C. Wildlife Branch, the Forest Renewal B.C. Fund, the Habitat Conservation Fund of British Columbia, the Canadian Wildlife Service, Parks Canada, the Simon Fraser University Research Network, and World Wildlife Fund Canada's Endangered Species Recovery Fund.

The 1995 Peregrine Falcon survey on Langara Island

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Abstract

In May–June 1995, six pairs and two single female Peregrine Falcons *Falco peregrinus pealei* occupied territories on Langara Island, British Columbia. Only 10 young were raised (1.67 young per territorial pair; 2.00 young per successful pair). This was the lowest production since eight nestlings were produced in 1985. Each year from 1968 to 1995, this population fluctuated between five and eight pairs, raising 5–21 nestlings. Productivity between 1990 and 1995 was similar to that between 1980 and 1989. In 1995, the Canadian Wildlife Service began a project to poison all the rats on the island to allow the recovery of the large seabird population, the major prey species of this peregrine population. The recovery of this seabird population may result in the recovery of falcon populations to levels seen in the 1950s and earlier.

1. Introduction

The population of Peregrine Falcons *Falco peregrinus pealei* nesting on Langara Island, British Columbia, has been closely observed annually since 1968. A dramatic decline in an important prey source for falcons, nesting seabirds — primarily Ancient Murrelets *Synthliboramphus antiquus* — on Langara Island between the mid-1950s and 1968 caused the number of falcon pairs to drop from over 20 to only six (Beebe 1960; Nelson and Myres 1976). However, a substantial decline in the numbers of nesting murrelets on Langara Island from the late 1960s to the 1990s (Gaston 1994a; Bertram 1995) was not paralleled by a marked further decline in nesting falcons. In 1977–1978 and in 1986–1987, Langara Island had only five pairs, but up to eight pairs in the intervening years.

From the mid-1960s to 1995, the number of nesting falcons appeared to have been dependent on the relatively large number of seabirds commuting nearby from two large colonies, 33 and 65 km away, rather than on the diminishing number of murrelets breeding on Langara Island (Nelson 1990). This paper reports on the number of territorial falcons at Langara Island during the 1995 survey and updates earlier (Nelson 1990) occupancy and productivity data for this population between 1990 and 1995. It also shows some of the uncertainties found in the data obtained from five-year surveys and outlines changes in a peregrine population that is dependent upon a narrow, changing prey base.

2. Methods

Langara Island is located in the most northwesterly portion of the Queen Charlotte Islands in the northern Pacific Ocean off the coast of British Columbia. It is about 10 km long and 6 km wide, with roughly 40 km of shoreline.

Annually since 1968, the island was visited for about 10 days during the last week of May and first two weeks of June. A small inflatable boat with an outboard engine provided transportation for observers to inspect shoreline cliffs; cliffs farther inland were checked by foot. Every year, historic nesting locations and other potential nesting cliffs were investigated. The behaviour of eagles and crows sometimes was an indicator of occupancy by falcons. Falcons occupying a site usually were relatively conspicuous. A starter pistol with cracker shells was fired if no falcons were observed at a site. When a single falcon or a pair seemed to have disappeared from a site since the previous year, I usually spent up to two hours watching the site from a distance to ascertain whether any birds were present and, if so, which ones. Even though the weather varied considerably between years, the methods were such that the likelihood of missing territorial pairs or singles was low.

Nests were investigated directly or viewed from afar with a spotting scope. Most nestlings were banded. Adults were identified with a spotting scope from photographs and face sketches (cf. Nelson 1988).

3. Results

In 1995, six territorial pairs plus two territorial females occupied nest sites on Langara Island (Table 1). One female was unpaired for her second year. The other female had been recently widowed and was seen on two days; by late August, a pair again occupied the site (D. Dekker, pers. commun.). The Cox Island site, routinely occupied by poor producers from 1987 onward, was vacant during several inspections in 1995. In 1994, the Langara Island lightstation keepers reported a new, noisy pair of falcons at a cliff that had been unoccupied since 1968. (This site was apparently unknown during surveys carried out between 1952 and 1958 [Beebe 1960].) I was unable to visit the site during 1994, but in 1995, a productive pair occupied the site.

In 1990, the island held seven pairs plus a single male (Table 1). That male had held a historic site unoccupied since

Table 1
Nest site occupancy by *pealei* Peregrine Falcons at Langara Island, British Columbia, during 1990–1995

Year	Total no. of known sites	No. of known sites checked	No. of known sites occupied	No. of new sites	Total no. of sites occupied by	
					Single birds	Pairs
1990	7	7	7	1	1	7
1991	8	8	8	0	0	8
1992	8	8	8	0	0	8
1993	8	8	8	0	0	8
1994	8[a]	8	8	0	2	6
1995	8	8	7	1	2	6

[a] Excluded a pair reported by lightkeepers at new site but not visited in 1994; this site was found occupied and successful in 1995.

Table 2
Productivity of *pealei* Peregrine Falcons at Langara Island, British Columbia, during 1990–1995

Year	No. of territorial pairs	No. of successful pairs	Total no. of young	Average no. of young/ territorial pair	Average no. of young/ successful pair
1990	7	5	14	2.00	2.80
1991	8	6	14	1.75	2.33
1992	8	7	18	2.25	2.57
1993	8	6	21	2.63	3.50
1994	6	5	12[a]	2.00	2.40
1995	6	5	10	1.67	2.00
Average	7.2	5.7	14.8	2.05	2.60

[a] Excluded young from a pair reported by lightkeepers at new site not visited in 1994 but found occupied and successful in 1995.

at least as early as 1968; observations suggested that a neighbouring paired female kept him single in his territory. From 1991 to 1993, the island held eight pairs, the greatest number since prior to 1968. The site that held the single male in 1990 was occupied by the same female from 1991 to 1995, but she was unpaired for 1994 and 1995, and observations suggested that the adjacent paired males kept her single. In 1994, a second site had a single female, but that site was occupied by a new pair in 1995. During spotting scope inspections, I found no territorial falcons with brown, immature feathers. These changes appear to be normal adjustments in occupancy by members of a healthy population.

Productivity of this population has varied considerably (Table 2). In most years, one or two pairs failed prior to visits. The Cox Island male and female, both resident from 1990 to 1994, produced very poorly: nil (1990); one live and one dead nestling plus an addled egg (1991); one nestling plus two addled eggs (1992); nil (1993); and two addled eggs (1994). In 1995, both adults were missing, and the site was vacated. In addition to those losses, in 1990, one pair failed; in 1991, one pair failed and another was incubating only two addled eggs; in 1992, one pair failed; in 1993, one pair had a live tiny nestling plus a dead tiny nestling; and in 1995, one pair failed with three addled eggs.

Between 1990 and 1995, the lowest number of young produced was 10 in 1995, and the highest number was 21 in 1993. During the 1980s, the lowest number was eight in 1985, and the highest number was 20 in 1982. In the 1970s, the lowest number was six in both 1978 and 1979, and the highest number was 13 in 1975. Since the poor production of 1979, there have been four five-year surveys. The 1985 and 1995 surveys had the poorest, almost identical, production of the 16-year period. Between 1990 and 1995, the average production per territorial pair (2.05) and per successful pair (2.60) was slightly lower than the respective figures for the 1980s, 2.31 and 2.76 (Nelson 1990).

4. Discussion

The annual production of the Langara Island falcons appears to be linked to broad aspects of the winter–spring weather, although the correlated factors are as yet not determined. As other authors have noted, caution must be exercised when viewing productivity of five-year surveys as a potential indicator of population health (Court et al. 1988). Although not as dramatic as seen in Arctic peregrines, the Langara Island falcons showed marked annual variation in production.

The number of falcons nesting at Langara Island is inextricably linked to the numbers of small seabird prey in the vicinity of the island, but the connections between changes in the numbers of the prey and numbers of predators are complicated (cf. Nelson 1990). The changes in the falcon population from 1968 to 1995 suggested unseen changes in the numbers or availability of seabirds near Langara Island.

By 1968, the murrelet population probably was reduced by half, and by 1993, it was less than 10% of the numbers estimated for the 1950s (Gaston 1994b). From 1957 to 1968, the falcon populations dropped from 20+ pairs to six pairs, but from 1968 to 1995, the falcon numbers remained at five or more pairs, despite the continued decline in the murrelet population. According to Nelson (1990), since the mid-1960s, the falcons have relied primarily on the seabirds commuting near Langara Island from the large colonies that remained at Fredrick and Forrester islands, 33 km and 65 km away, respectively. However, despite the unprecedented low numbers of murrelets nesting at Langara Island, the island held an unprecedented high number of eight pairs of falcons between 1991 and 1993, which dropped to six (possibly seven) pairs with two singles in 1994 and six pairs and two singles in 1995. These changes suggest some fluctuations in the number or availability of the offshore seabirds.

Rats had been noted on Langara Island since at least the mid-1940s (Drent and Guiguet 1961). For several decades, they were thought to pose no serious problem for the extremely large numbers of nesting nocturnal small seabirds on the island. However, Bertram (1995) showed that the rats had had a devastating effect on these seabirds by killing adult murrelets and eggs in their underground nest burrows. I have suggested that in the 1950s and earlier, the rats were swamped with enormous numbers of seabirds. However, after an ocean current change caused a decline in numbers of nesting seabirds, the rats then may have had a depressing effect on the smaller seabird population (Nelson 1990). Bertram (1995) noted the large number of fishing boats around Langara Island from 1954 to at least 1965, including a small proportion of gill netters, and suggested that large numbers of murrelets were killed by light attraction into ships' rigging at night and by being caught accidentally in gill nets. A change from black rats *Rattus rattus* to the more aggressive Norway rat *R. norvegicus* on Langara Island

since the 1960s may have also contributed to the rate of seabird decline (Bertram and Nagorsen 1995).

After months of arduous preparation, in August 1995, Gary Kaiser (pers. commun.) of the Canadian Wildlife Service began a two-year rat poisoning program on Langara Island and adjacent Lucy and Cox islands. If this program succeeds in removing all the rats (Langara Island is the largest island from which rat eradication has been attempted) and if rats can be prevented from reinvading the island, the murrelet population is expected to rebound towards the large numbers seen in the 1950s and earlier. Whether they reach those numbers may depend on whether the present productivity of the ocean is lower than it was in the mid-1950s. The Langara Island falcon population is expected to respond to the increase in murrelets in roughly the opposite way to how they responded to the murrelet decline. It will be another fascinating chapter in this long-term study.

5. Acknowledgements

Among the many kind people who have assisted in this study in recent years, I particularly thank J. Schweers and G. Schweers of Langara Lightstation, C. Bellis and P. Buck for logistical help, and, for field assistance in the last six years, D. Bell, D. Dekker, D. Ellis, M. Ellis, K. Hodson, R. Skibsted, and my wife, A. Nelson.

General discussion

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1. Significance of the Peregrine Falcon survey

The goal of the *anatum* Peregrine Falcon recovery plan was to enhance the wild *anatum* Peregrine Falcon in Canada to a level at which the Committee on the Status of Endangered Wildlife in Canada no longer considers this subspecies to be endangered or threatened (Erickson et al. 1988). The recovery plan provided guidelines against which to measure population and productivity levels to determine if recovery has been achieved. This 1995 survey effort attempted to cover all "historic or known sites" as well as previously unsurveyed potential Peregrine Falcon nesting habitats. As a result, field personnel surveyed the largest number of *anatum* populations to date. The results indicate that all *anatum* peregrine populations achieved and surpassed the population plan objective of 10 territorial pairs in each of management zones 1 to 6. Except for interior British Columbia and Labrador populations, for which only partial or no productivity data were collected, all *anatum* populations attained or surpassed the productivity objective of a minimum of 10 territorial pairs naturally fledging 15 or more young annually in each of five of six zones.

Tundrius surveys included some previously known populations; however, due to budgetary constraints, the Ungava Bay population in northern Quebec was excluded. The Yukon North Slope population appeared to be recovering, while in the Northwest Territories, which included Nunavut, populations appeared stable since 1990. Survey coverage of *pealei* populations in British Columbia remained unchanged, except for the exclusion of three islands due to logistical access problems; populations appeared stable to increasing.

2. Status of the Peregrine Falcon in Canada in 1995

Caution should be exercised in comparing survey data among years because of varying effort in previously surveyed areas, new efforts in previously unsurveyed areas, timing of surveys, and the lack of consistency of observers and techniques used. For populations that were more difficult to access — i.e., those north of 58°N and along the coasts — single surveys between late June and early July resulted in the recording of only a minimum number of occupied territories. Because pairs that failed prior to the survey and singles may have less affinity to their territory, they may have been missed during single surveys or at best were undercounted. Furthermore, in these remote areas, inclement weather and cost often preclude collecting complete occupancy and productivity data.

To calculate *anatum* population changes between 1990 and 1995, data for the interior B.C. *anatum* population were omitted, because data for that population were omitted during 1990. Therefore, between 1990 and 1995, the total number of occupied *anatum* territories observed increased by 31% (233 to 305), about one-third of the increase that occurred from 1985 to 1990. Nevertheless, this is the largest number of occupied *anatum* territories found during any five-year survey. Of the 13 *anatum* populations surveyed, the largest overall increases occurred in populations south of 58°N, in Ontario and in central and southern Alberta, where mass reintroductions of captive-raised young *anatum* had occurred from 1992 to 1996. Surveys of previously surveyed or unsurveyed potential nesting habitats resulted in some newly found pairs or occupied territories in all populations except in Manitoba and Saskatchewan.

Similarly, the total number of territorial pairs in these same 13 populations, except for the Porcupine River population, where only partial surveys of known sites had occurred, increased by 41% (214 to 301) from 1990 to 1995. This is again the largest number of territorial *anatum* pairs found during any previous five-year survey, with the largest increases recorded in Ontario, in central and southern Alberta, and in Manitoba. From 1990 to 1995, the number of single peregrines observed in populations south of 58°N declined by 50% (8 to 4), while the number of pairs increased by 113% (24 to 51). The Ontario and central and southern Alberta populations experienced the greatest increases in the number of pairs.

Newton (1979) described a stable population as one in which "breeding numbers remained absolutely constant or changed by less than 15% of the mean over the period concerned." In the peregrine populations north of 58°N, between 1978 and 1983, limited reintroductions of captive-raised young *anatum* peregrines occurred in the Mackenzie Valley and Yukon River populations. For these two populations, the average annual growth rates for the number of occupied territories and territorial pairs (Mackenzie Valley [–1% (2%)] and Yukon River [7% (11%)]) between 1990 and 1995 indicate stability. From 1975 to 1995, management manipulations of the northern Alberta *anatum* population had included double-clutching and fostering of captive-raised young *anatum* (>150 young). Here, the average annual

growth rate of 21% from 1990 to 1995 for both the number of occupied territories and the number of territorial pairs indicated an increasing population. Added survey efforts in potential nesting habitats during 1995 did locate five new pairs.

In populations south of 58°N, between 1977 and 1996, reintroductions of captive-raised young *anatum* peregrines occurred in the major extirpated population areas: the Bay of Fundy (11 years; 1982–1991, 1993), southern Quebec (17 years; 1976–1990, 1992, 1994), central and southern Alberta (19 years; 1977–1985, 1987–1996), and Ontario (20 years; 1977–1996). From 1992 to 1996, mass hack releases occurred in central and southern Alberta and in Ontario. The combination of declining DDE levels in prey species and eggs and the concurrent release of large numbers of captive-raised young into these extirpated population areas had resulted in major increases by 1990 in two populations and lesser increases in the other two populations (Holroyd and Banasch 1996). However, by 1995, average annual growth rates since 1990 in the number of occupied territories and territorial pairs observed in these same populations ranged from 3% (4%) in the Bay of Fundy to 0% (2%) in southern Quebec to 34% (32%) in central and southern Alberta and to 38% (48%) in Ontario. These data indicate stability in the Bay of Fundy and Quebec populations, while the populations in central and southern Alberta and in Ontario were still increasing.

In southern populations, the overall ratio of occupied rural to urban territories was reversed between 1985 (1:3) and 1990 (2.5:1), but declined somewhat in 1995 (1.6:1). Thus, the number of rural occupied territories surpassed the number of urban occupied territories between 1985 and 1990. Sufficient prey are available in cities, even though specific buildings may be hazardous to fledging young (Cade and Bird 1990). Cities do offer suitable nest sites; however, in some cities, a limited number of potential nest sites may exist. Present data appear to indicate that the majority of city-released young prefer to nest in cities. Future surveys will verify whether city-produced young move to unoccupied rural sites once preferred city sites are occupied and whether the reverse will happen. Moreover, we do not as yet know whether city environments are a source or a sink for peregrine populations.

Of the *tundrius* populations surveyed, the Yukon North Slope population increased from one adult in 1990 to five pairs in 1995. Of the four Northwest Territories populations, two appear to have remained stable since the previous survey. In the Rankin Inlet area, inclement weather had delayed the spring arrival of the adults, which then resulted in fewer young fledging.

Since 1990, population data for the Queen Charlotte Islands *pealei* indicate stability, with a marked increase in the number of single adults. However, single surveys and the inability to access nest sites to verify occupancy may account for some of these single birds. The Langara Island population appeared stable, as did its productivity.

3. Survey limitations

Insufficient funding, insufficient staff, and limited helicopter time affected the coverage in larger and more difficult to access areas during 1995. Single surveys provide only indications of territory occupancy and no or only partial productivity data. Surveyors' inability to land and spend time on the ground results in lower counts of territory occupancy, because nest sites are not checked for recent scrapes. Failed pairs or single birds may not be observed because of these birds' reduced affinity to the territory. Because of these considerations, the designation of difficult to access populations as stable, declining, or increasing is based solely on the number of occupied territories, not on the number of breeding pairs.

4. Future management needs

Even though *anatum* Peregrine Falcon populations have achieved both objectives of the recovery plan goals, these are only minimum goals that were set with a five- and 10-year framework. To consider that these objectives have been achieved and have resulted in self-sustaining populations, the recovered populations and their productivity levels should be maintained for a specified number of consecutive years in selected populations across the peregrine's range — e.g., 10 years, as for Whooping Cranes *Grus americana* (Edwards et al. 1994).

Checking for and reading bands of returning falcons will indicate when and at what rate the composition of these recovering populations changes. If captive-raised released falcons (red-banded) constitute a major portion of the breeders, the recovery phase has just begun. However, if wild-produced falcons (black-banded or unbanded) are appearing in a population but are still a minority, the recovery is under way but is still incomplete. Should a population be composed of all black-banded or unbanded falcons, the transition from a recovering to a self-sustaining population has probably occurred.

To monitor the origin of wild-produced young, banding should occur in a comprehensive manner annually. Any unbanded birds would then originate from unknown pairs.

To minimize human disturbance in recovering or small populations, access to nest sites may need to be restricted. On the breeding, migration, and wintering grounds, habitats of prey species may require some protection or maintenance. In some nesting habitats, improvement of nest sites may be a management need.

Tracking the number of injured falcons received, the time of year received, type of injury, and location found may provide some migration data and allow some management along these migration corridors. In addition, occupied city sites should be checked to ascertain if and for how long they are occupied, the turnover of adults, their banding status, and their productivity.

5. Towards the next survey

A survey took place in 2000 to verify the continued recovery of *anatum* Peregrine Falcon populations, to collect productivity data, and to aid in planning a recovery strategy.

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