The 2007 Ungava Bay (QC) peregrine falcon (*Falco peregrinus*) survey

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A report presented to the Canadian Wildlife Service

October 2009

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Abstract

Peregrine falcons (*Falco peregrinus*) nesting in the Ungava Bay (QC) region, a historically important population, were censused in 2007 for the first time since 1990. A routine population survey was carried out over a relatively limited portion of the known regional breeding range and blood samples were collected from nestlings for pending BFR (Brominated Flame Retardant) contaminant analysis. The number of active nests found in the areas covered as well as reproductive performance were comparable to the high figures of 1985 – 1990, indicative of a healthy and productive population. In addition, there was evidence of the population having reached a point of saturation within its historic range and expanding inland despite increased human presence and activities in the region.

Introduction

The Ungava Bay region of northern Quebec has long been known to accommodate a breeding population of peregrine falcons (*Falco peregrinus*) of the *tundrius* subspecies, with evidence reaching as far back as 1885 (Fyfe 1969). Subsequent to the discovery of eggshell thinning in the population due to DDT contamination (Berger et al. 1970), the region was monitored on a regular basis and reported on in nationwide peregrine falcon surveys at 5-year intervals from 1970 through 1990 (Cade and Fyfe 1970; Fyfe et al. 1976; White et al. 1990; Murphy 1990; Holroyd and Banasch 1996). Observed nest productivity of the Ungava Bay peregrines was extremely low through the 1970's before undergoing an apparent rebound in the 1980's, eventually reaching some of the highest levels among all monitored populations in Canada. Bird and Weaver (1988) deemed the population to be demographically healthy and productive, and after 1990 the region was no longer included in the national 5-year censusing programme. Thus, the most recent record of this important breeding population – one of the largest *tundrius* populations in Canada with over 60 known breeding sites – now goes back almost two decades.

During this time, other *tundrius* populations – including North Slope (YT), Rankin Inlet (NU) and Tuktut Nogait National Park (NWT) – have shown no evident trends (Banasch and Holroyd *In press*), though the Committee on the Status of Endangered Wildlife in Canada continues to list the subspecies, which has now been amalgamated with the *anatum* subspecies, under "Special Concern" (COSEWIC 2007). In addition, there has been renewed interest in contaminant levels and their effects in peregrine falcons with the recent emergence of brominated flame retardants (BFRs) as environmental pollutants of concern, already detected in a number of European and North American peregrine populations (e.g. Lindberg et al. 2004; Herzke et al. 2005; Vorkamp et al. 2005; Chen et al. 2008; Holden et al. 2009).

In 2007, a survey of peregrine falcons breeding in the Ungava Bay region was undertaken with the aims of bringing the population's status up to date as well as collecting blood samples from nestlings in order to measure BFR levels.

Methods

The survey took place from 4 – 11 August 2007, inclusively, and covered 2 main areas in the greater Ungava Bay region: 1) the Koksoak River north of Kuujjuaq and into the False River mouth; 2) the Tasiujaq and Leaf Bay area. Due to time and budget constraints, the latter area was not surveyed as thoroughly as in past years, and thus the Gyrfalcon Islands and certain other farther-reaching locations known to contain peregrine nests were excluded from the census. Likewise, the previously surveyed Payne River area was also excluded from the 2007 census. However, some inland scouting was conducted for the first time around the outskirts of Tasiujaq. The major part of the survey in both areas was carried out by boat with the exception of inland scouting which was performed by truck, by ATV and on foot.

Known historic breeding sites were visited systematically while remaining watchful for any new sites by scanning cliffs for whitewash along the route. When feasible, active nests were accessed directly using climbing gear and nestlings were removed and taken to a safe location to be aged, weighed, sexed, banded and blood-sampled. At least 2 young per nest – one of each sex, when possible – were blood-sampled (3 ml from brachial artery) depending on time constraints and field conditions. Samples were temporarily stored in an ice-filled thermos while young were returned to the nest, and as soon as possible spun in a centrifuge powered by a portable gas generator. Isolated plasma samples for pollutant analyses were finally stored in a portable vapour nitrogen dewar while red blood cells were preserved on ice in case they eventually prove useful for other analyses. Unhatched eggs, eggshell fragments, feathers and food items were also opportunistically collected from nests for potential analysis.

The terminology used in this report aims to be consistent with past surveys, based on the definitions originally put forward by Murphy (1990) and further elucidated by Holroyd and Banash (1996), Rowell et al. (2003) and Banash and Holroyd (2004): *sites* refer to discrete locations of past or current nests or sightings of territorial adults; an *occupied site* is one which appears to be attended by at least one territorial adult; a *known* or *historic site* is one which had at least one record of occupancy by peregrines prior to 2007; a *new site* is one which was found occupied for the first time in 2007; a *territorial pair* or *lone adult* is one which appears to defend or consistently remain at a site; an *active* or *successful pair* is one which had at least one young in the nest at the time of the survey, which may or may not have successfully fledged. Any lone adults sighted but not displaying any territorial behaviour were not considered as occupants. It should also be noted that the term *breeding pair* has previously referred to pairs that produced at least one egg, while *successful pair* has referred to those known or assumed to have fledged at least one young. While the timing of the 2007 survey (3 – 4 weeks into the nestling stage) made any such assumptions questionable, the latter term was nevertheless used – for lack of an alternate expression and for the sake of continuity with previous survey results – to categorize nests containing young.

Results

Nest site occupancy results are presented and compared with past censuses in Table 3. A total of 11 sites was checked along the Koksoak River and False River mouth

(Table 1), of which 4 were occupied, all by active pairs. Three of these were in previously undocumented locations. A total of 17 sites was visited in the Tasiujaq and Leaf Bay area (Table 2), of which 9 were occupied, totalling 6 active pairs, 2 unsuccessful territorial pairs and one lone territorial adult. Among these, 6 sites were in previously undocumented locations for peregrines.

Inland scouting around the outskirts of Tasiujaq uncovered an active pair as well as the 2 apparently unsuccessful territorial pairs. The latter exhibited noticeably reduced defensive behaviour, and while scouring of the area failed to uncover nests, a dead chick was found on the ground near the first sighting, perhaps carried there by the parents or by a nest predator.

Of the 10 active nests found in both survey areas combined, all but one were accessible by climbing, though it was still possible to count from a distance the number of young in the inaccessible nest. Thus, a total of 32 nestlings was counted for an average of 3.2 young per successful pair. Results related to reproductive performance are presented and compared with past censuses in Table 4. Retrieved nestlings ranged from 23 – 27 days old. Blood samples were obtained from a total of 20 chicks in 9 different nests, though laboratory analyses are still pending.

Discussion

Sound interpretation of past and present survey results, in particular with respect to site occupancy, requires commenting. An admittedly striking result in the 2007 survey is the almost oddly low percent occupancy despite nest productivity figures being as high as ever. There are several plausible explanations for this finding. The most straightforward interpretation is that fewer pairs are nesting in the region but that those present are still producing high numbers of young. However, it could also be that those farther-reaching areas excluded from the survey contained active nests that may have raised the occupancy rate had they been censused. Moreover, it is possible that a certain number of nesting pairs went undetected during the survey, either because they were in previously undocumented locations that the surveyors failed to discover, because they happened to be absent from the immediate area when sites were visited, or because these were not sufficiently scoured. However, the latter reason would seem unlikely as the survey team, including an investigator with extensive prior experience in the region, did carry out thorough searches of each visited site and highly defensive parents do not usually take long to reveal themselves. A final possibility, particularly suspected by the current authors, is that the seemingly low percent occupancy is purely an artefact generated by the classical method of computing this statistic.

Tallies of total known breeding sites and number of checked sites have been kept over the course of past surveys, though there was general lack of clarity in defining what exactly constitutes a site until Murphy (1990) began to address the issue by proposing standard definitions for survey terminology. These were further elucidated by Holroyd and Banasch (1996), Rowell et al. (2003) and Banasch and Holroyd (2004). Nevertheless, to this day the accepted definition of a site still contains some degree of ambiguity with respect to the way in which so-called “alternate” sites within same breeding territories

should be treated. After Murphy (1990) stated that it is left to surveyors to decide whether or not to record use of a novel site within a known territory as a new site, subsequent reports have made do with a simple remark to the effect that the exact location of a site may vary from year to year. However, there still appears to be no strict standard for recognizing and categorizing alternate sites, and in truth, it may be inherently challenging to do so. While these are generally regarded as being in close proximity to each other – such as on the same cliff or directly across a river from each other – average spacing of pairs appears to vary widely from place to place and alternate sites can sometimes be located several kilometres apart (Ratcliffe 1980). Furthermore, recognized alternate sites may not always be so clear-cut. For instance, two sites directly across the Koksoak River mouth from each other were long labelled as alternates before they were both found occupied by active pairs in 1990. Incidentally, neither of them was occupied in 2007.

Bird and Weaver (1988) offered an example of how alternate sites might be treated in presenting survey results and clearly highlighted the potential importance of considering this notion when dealing with occupancy statistics. The underlying issue is that pairs, for reasons that could be related to food availability or purely behavioural, may not nest within a certain minimum proximity of each other (White et al. 2002; Wightman and Fuller 2005; Rodriguez et al. 2007). Therefore, a given area might only support a certain maximum number of breeding pairs regardless of its total abundance of suitable nesting sites. Pairs in the area may then alternate from year to year between any available "surplus" sites. The reason for such alternation is not yet fully understood, though speculative explanations include factors related to disturbance, territoriality, nesting success and hygiene (Bird and Weaver 1988; Ontiveros et al. 2008). If these sites are tallied separately in spite of the assumption that they may never all be occupied simultaneously, it could lead to a false impression of low occupancy, and cumulatively so with the continual discovery of new alternate sites within previously known territories.

In the current authors' opinion, there is a distinct likelihood that this explains the relatively low percent occupancy in 2007. Six out of the 10 active nests found were in previously undocumented locations, as well as 2 unsuccessful pairs and a lone adult. Thus, a total of 9 new sites was added to the running inventory, representing one third of all nest sites checked. With the exception of 4 new sites found in areas not previously surveyed, the remaining 6 were within sensible range of historic breeding territories. If these simply represent newly discovered alternate sites within areas that may only support a certain maximum number of pairs, it then becomes evident that the percent occupancy is artificially decreased by the ongoing discovery of alternate sites when these are recorded separately. To further illustrate this point, Bird and Weaver (1988) stated that during no survey from 1980 onwards were there more than 3 active peregrine nests on the Koksoak River north of Kuujjuaq. This is the exact number found in 2007, though since 2 of them were in new locations, the number of known sites on the river has increased and consequently the calculated percent occupancy has decreased.

Given the lingering ambiguity over how alternate sites should be treated and the strong possibility that their method of categorization could lead to bias in the calculation of percent occupancy, the current authors are inclined to echo the remarks of Cade and

Fyfe (1970) and Bird and Weaver (1988) and advise readers to interpret this statistic cautiously. It would perhaps be more prudent and meaningful to base one's assessment of population health on simple comparison of the total numbers of pairs found in a given region or nest productivity results, which are not affected by subjective classification of nest sites. From these perspectives, the results of the 2007 survey still appear to indicate the presence of a large and productive peregrine falcon population in the Ungava Bay region.

The very fact that such a large proportion of active pairs found in the 2007 were in previously undocumented locations may in itself be regarded as striking. This has led the authors to speculate that the Ungava Bay region, as originally suggested by Bird and Weaver (1988), constitutes a decidedly prime breeding habitat in terms of suitable nest site abundance, to the extent that the number of potential sites may far exceed the maximum number of pairs the area can support due to other limiting factors. While the number of known sites continued to grow steadily from 1970 – 1990, these still may have represented but a fraction of the total number of potential sites in the region. The unusually large proportion of new sites found after a 17-year gap in the dataset may simply be evidence of an ongoing natural cycle of alternation between multitudes of available sites, and it may take more time still before they are all discovered. Furthermore, whereas past surveys found little evidence of inland nests (Bird and Weaver 1988), the 3 new sites found around the outskirts of Tasiujaq and several accounts from locals of additional inland nests in both Tasiujaq and Kuujjuaq may be indicative of an expanded inland population. There is historical evidence suggestive of an important inland population prior to the 1960's (Fyfe 1969).

Finally, some concern was expressed in the past regarding the potential disturbance of breeding peregrines by increased boat traffic and a continuing multiplication of cabins constructed along the Koksoak River (e.g. Bird and Weaver 1988; Holroyd and Banasch 1996). McNicoll et al. (1991) reported that in recent years peregrines had only been using sites near the mouth of the river. As the population of Kuujjuaq has grown considerably since 1990, cabins now heavily abound along the river nearly all the way to its mouth and traffic has further increased with the recent construction of a new boat harbour. However, the 3 active pairs found along the river in 2007 was consistent with past surveys, and moreover, all of them were situated upriver from the mouth. If peregrines appeared to be exhibiting an aversion to expanding human activities in past surveys, it would now seem that they have become habituated. Nevertheless, evidence of direct human interference with peregrine breeding was still present as word surfaced during the course of the survey that a chick had been taken from the inland nest near Tasiujaq by some locals. When the nest was subsequently checked a second time, there was indeed one nestling fewer.

Conclusion

Despite certain peculiar results, the 2007 survey of peregrine falcons breeding in the Ungava Bay region of Quebec has painted an overall positive picture of the population. The number of pairs found in relation to the area covered as well as their nest productivity was consistent with the high figures found in 1985 and 1990. In addition,

there was evidence of pairs habituating to human disturbance, of a larger than previously thought abundance of potential nest sites in the region, including inland locations, and of the population having reached a point of saturation in historically surveyed areas.

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Table 1 – List of sites checked in chronological order in the Koksoak River / False River mouth area in 2007. Coordinates are generally approximate. * Denotes presumed new sites found in 2007. Superscript indicates sites in proximity to each other.

Site	Date	Latitude	Longitude	Status	Comments
1. Koksoak West Inlet[9]	08/04	58˚ 17.2' N	68˚ 16.7' W	Unoccupied	
2. Camp Saamanniavik[6,7,8]	08/04	58˚ 26.1' N	68˚ 12.1' W	Active pair	4 young (23 d)
3. Beacon Point[5]	08/04	58˚ 30.6' N	68˚ 12.2' W	Unoccupied	
4. False River Mouth*	08/04	58˚ 20.7' N	67˚ 49.3' W	Active pair	3 young (24 d)
5. Crack Cliff[3]	08/05	58˚ 30.0' N	68˚ 09.3' W	Unoccupied	Located slightly inland
6. North Face[2,7]	08/05	58˚ 27.9' N	68˚ 10.3' W	Unoccupied	
7. Sandy Gordon's camp[2,6,8]	08/05	58˚ 26.3' N	68˚ 09.9' W	Unoccupied	
8. Sandy's dad's camp[2,7]	08/05	58˚ 24.5' N	68˚ 10.3' W	Unoccupied	
9. East of Hendry Island*[1]	08/05	58˚ 16.9' N	68˚ 14.0' W	Active pair	3 young (25 d)
10. Orange Cliff	08/05	58˚ 10.4' N	68˚ 18.0' W	Unoccupied	
11. Little Elbow Island*	08/06	58˚ 06.4' N	68˚ 19.4' W	Active pair	4 young (27 d)

Table 2 - List of sites checked in chronological order in the Tasiujaq / Leaf Bay area in 2007. Coordinates are generally approximate. * Denotes presumed new sites found in 2007. Superscript indicates sites in proximity to each other.

Site	Date	Latitude	Longitude	Status	Comments
1. Tasiujaq inland SW*	08/07	58˚ 41.4’ N	69˚ 59.6’ W	Active pair	3 young (24 d); site subject to human disturbance
2. Mandarin Islet*[3]	08/08	58˚ 47.1’ N	69˚ 53.4’ W	Active pair	3 young (26 d)
3. Copter Island[4]	08/08	58˚ 45.7’ N	69˚ 49.2’ W	Unoccupied	
4. First Island[3]	08/08	58˚ 44.5’ N	69˚ 50.7’ W	Active pair	4 young (24 d)
5. Tasiujaq Inland NW*[6]	08/09	58˚ 43.8’ N	69˚ 58.1’ W	Territorial pair	Dead chick found nearby
6. Tasiujaq Inland N*[5]	08/09	58˚ 44.6’ N	69˚ 56.7’ W	Territorial pair	
7. Algerine Passage[15]	08/09	58˚ 48.1’ N	69˚ 35.0’ W	Unoccupied	Lone adult sighted nearby, not territorial
8. Cape Halfway	08/10	58˚ 51.2’ N	69˚ 24.7’ W	Unoccupied	
9. Wedgehead Point[10]	08/10	58˚ 54.0’ N	69˚ 13.8’ W	Unoccupied	Site occupied by rough-legged hawks
10. Leaf Passage Island[9,11]	08/10	58˚ 54.2’ N	69˚ 09.1’ W	Unoccupied	
11. Flat Point*[10]	08/10	58˚ 54.1’ N	69˚ 05.1’ W	Active pair	2 young (25 d)
12. Peregrine Sound[13]	08/10	58˚ 58.1’ N	68˚ 12.8’ W	Active pair	4 young (25 d); unable to retrieve chicks
13. Henderson Point[12]	08/10	58° 57.0’ N	69˚ 13.7’ W	Unoccupied	
14. Garry Point	08/11	58˚ 48.4’ N	69˚ 26.4’ W	Active pair	2 young (25 d)
15. Reef Point*[7]	08/11	58˚ 47.2’ N	69˚ 32.1’ W	Lone adult	Historic golden eagle site
16. Radisson Islands[17]	08/11	58˚ 44.3’ N	69˚ 40.5’ W	Unoccupied	
17. Copper Point[16]	08/11	58˚ 42.0’ N	69˚ 42.2’ W	Unoccupied	

Table 3 - Occupancy of nest sites by Ungava Bay peregrine falcons, 1970 - 2007. Data for 1970 - 1985 are from Bird and Weaver (1988). Data for 1990 are from Bird (1997). % occupancy = No. occupied (lone adults + pairs) / No. of nest sites checked x 100.

Year	Total known sites	Sites checked	Unoccupied	Lone adults	Territorial pairs	% occupancy
1970	15	15	3	3	9	80
1975	27	25	14	2	9	44
1980	28	21	11	0	10	48
1981	28	14	4	2	8	71
1982	28	22	8	1	13	64
1985	36	28	5	0	23	82
1990	63	62	24	5	33	61
2007	72*	28	15	1	12	46

* 9 new sites presumed to have been found in 2007, though due to missing data in 1990 site inventory, some of these purely based on personal recollection of 2007 field investigator with prior experience (1980 – 1990) and could not be fully verified. Total also includes areas not surveyed in 2007, e.g. Payne River. Finally, it is unclear whether certain "alternate" sites were historically considered separately or combined. It would be of interest to attempt to re-establish the actual total over the course of future surveys of the region or by locating and consolidating all past inventory data.

Table 4 - Reproductive performance of Ungava Bay peregrine falcons, 1970 - 2007. Data for 1970 - 1985 are from Bird and Weaver (1988). Data for 1990 are from Bird (1997).

Year	Territorial pairs	Successful pairs	% pairs with young	Total young	No. young / pair	No. young / successful pair
1970	9	7	78	12	1.33	1.71
1975	9	9	100	16	1.78	1.78
1980	10	10	100	27	2.70	2.70
1981	8	8	100	19	2.36	2.36
1982	13	12	92	30	2.32	2.50
1985	23	19	83	61	2.85	3.21
1990	33	32	97	100	3.03	3.13
2007	12	10	83	32	2.67	3.20