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POPULATION STATUS OF THE PEREGRINE FALCON
IN THE YUKON TERRITORY, 2000

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1.0 INTRODUCTION

Survey of the birds of prey of the Yukon Territory dates from the mid-1960's when a large population of the interior race of peregrine falcon (Falco peregrinus anatum) was found breeding on the riparian cliffs of the rivers draining the central Yukon (Cade and Fyfe 1970). Systematic regular surveys date from later in the 1970's when the Yukon Government began funding a small non-game wildlife management program. A valuable database spanning three decades now exists which follows the progress of the peregrine falcon populations in this part of the Canadian Northwest.

Five sub-populations of peregrine falcon are recognized in the territory. This recognizes the peregrines in the Yukon as a classic 'metapopulation' (McCullough, 1996). The groups, in part based on geographic separation (Figure 1), are mostly a result of recognizing that the various regional groups have performed differently demographically over time. These findings have been detailed in a series of reports dating from the early 1970's (Cade & Fyfe 1970, Hayes & Mossop 1982, Mossop & Baird, 1985, Mossop 1986, Mossop & Hayes 1980, Mossop & Mowat 1990, Mossop, 1995).

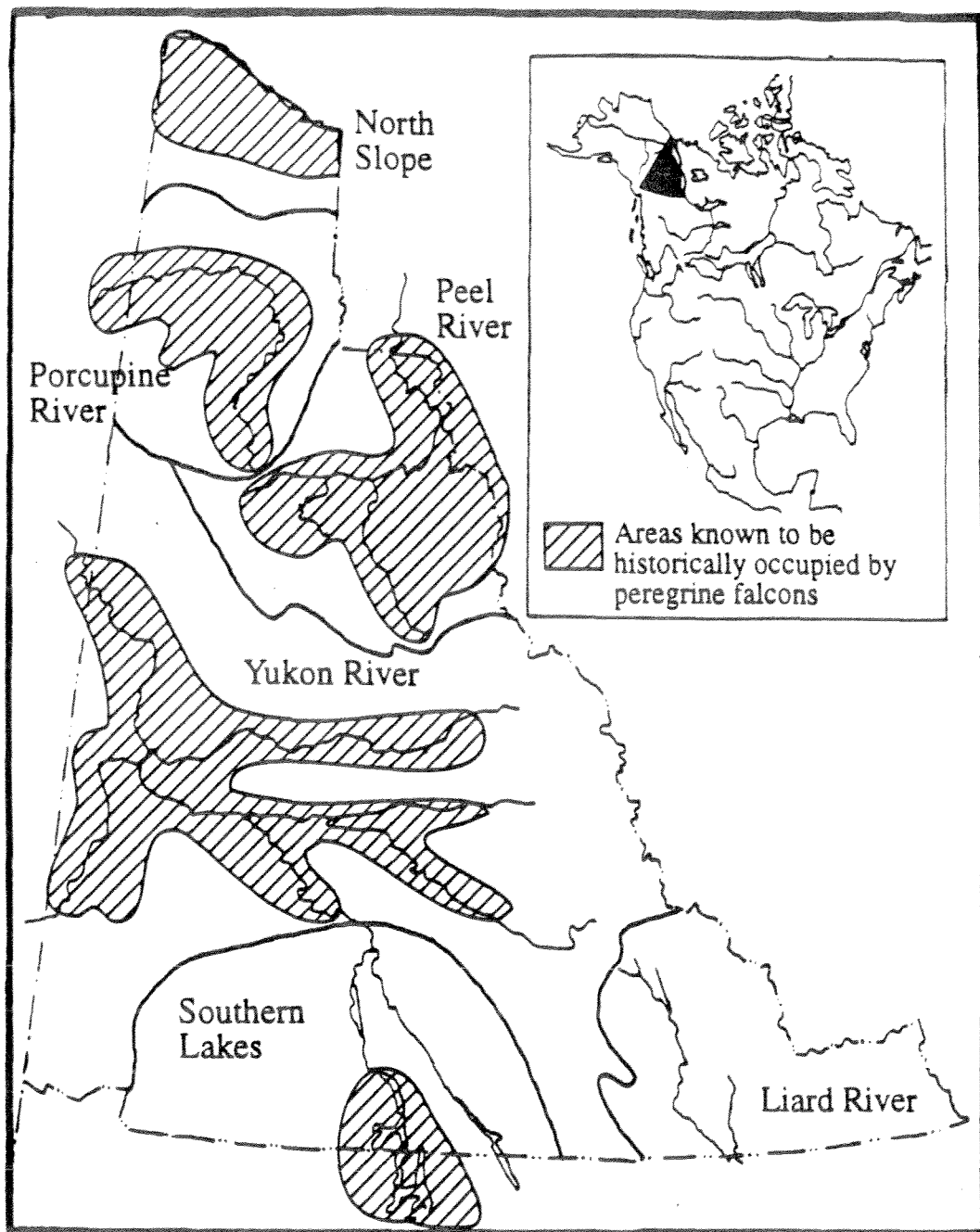


Figure 1. The Yukon Territory showing the major drainage basins and the five Peregrine Falcon sub-populations covered by the 2000 survey.

Summary of the demographic history of yukon peregrine falcon metapopulation groups

Subpopulation and race	demographic history
1. North Slope: <u>F.p. tundrius</u>	- locally extinct by 1980 - captive bred young reintroduction 1983-85 - one pair in 1990, 4 in 1995
2. Porcupine River drainage: <u>anatum</u>	- declined in the late 1960's but retained a remnant - first to begin recovery (Hayes and Mossop 1982). - still increasing in 1995 (6% annually) - about 45 pairs in 1995
3. Peel River drainage: <u>anatum</u>	- declined in the 1960's but retained a remnant - slowly increased to 1990 - then doubled by 1995 - about 48 pairs in 1995
4. Yukon River drainage: <u>anatum</u>	- declined through the early 1970's, by 1978 only one known occupied nest site - captive young fostered 1978-92 - a strong and sustained recovery since that time - by 1990 well above historic, - in 1995 still increasing (at 10% annually) - about 57 pairs
5. Southern lakes: <u>anatum</u>	- the few known breeders disappeared in the 1970's - in 1990 thought to be extinct - by 1995, one pair was found - the B.C. portion has never been surveyed.

2.0 SURVEY METHOD

The 2000 survey was a sample survey of 4 of the 5 known occupied regions. The Objective was to visit at least 100 known nest sites in total. (The Southern Lakes group was visited only on its periphery; the survey there only included one nest site.) Only one small area in the upper Peel drainage of central Yukon (a sample of 6 nest sites) has been monitored annually since the last reporting (Mossop 1995). Their data give a valuable picture of annual variations since the last major survey.

All survey was a systematic search of riparian cliffs. By far the majority of survey was conducted from the ground by boat, supported where necessary by helicopter. On the arctic slope, all survey was conducted with helicopter. Although designed to depend on the fidelity of peregrines to former nest sites, the survey also attempted to cover all habitat between established pairs. (This was most important on the North Slope where the area of Ivvavik National Park was part of the survey for the first time since 1985). Most nest sites were visited only once, in the brood rearing period. Survey began in late June in the southern populations and ended in the first week of August on the north slope.

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 and from search for fresh 'wash' at perches. Normally a spotting scope was used to closely follow occupying adults and to locate any nest ledge. Young were counted, aged and if possible, banded with tarsal bands. Additionally if the nest was visited, a search was made for unhatched eggs or egg shell fragments, and a prey remains sample was taken.

3.0 ACKNOWLEDGEMENTS

Thirty-nine mostly volunteer field crew members, carried out the survey. The assistance of this body of help was absolutely essential to the task of covering the over 3,000 km of Yukon waterways surveyed. Their individual and collective contribution is gratefully acknowledged:

North Slope:

Nichole Speiss (STEP)
Gabe Boros (Parks Canada)
Jerome Gordon (Aklavik)
Dale Simpson (pilot)

Porcupine Drainage:

a) Upstream:

Jocelyn McDowell (data)
Kirsten Madsen
Colin McDowell
Dave Heath

Anthony McDowell
Angela McAlistair

b) Old Crow river section:

Rhonda Markel (Parks Can)
Brian Farkas (Old Crow)
c) Downstream: Fran Mauer (A.N.W.R).
Barbara Boyle Wild.

Yukon Drainage:

a) White River

Dan Drummond (data)
Russell Osborne

b) Main Valley

Nichole Speiss
Leslie Kerr-Wedge
Tanis Davey (CBC)
Kirby Meister (logistics)

Peel Drainage: a) Ogilvie River

Nichole Speiss
Remy Rodden and
Sourdough CAT members
Tanis Davey (CBC)

a) Wind River

The Dempster naturalists
Marlene Jennings (data)
Clint Sawicki
Marty Strachan
Stacey Brown
Randy Mulder
Bruce Bennett

b) Snake River & Main valley:

Bob Jickling (data)
John Fyke
Douglas Gilbert
Linda Hamilton
Hannah Jickling
Jeff O'Farrell

The Polar Continental Shelf project (Ottawa) provided the helicopter support to conduct the northern portion of the survey and the Yukon Department of Renewable Resources provided field support and finances to hire a student Nichole

Speiss who worked to provide technical support for the project.

4.0 RESULTS, CURRENT POPULATION STATUS

4.1 GENERAL OVERVIEW: Tundrius race

One of the more exciting results of the 1995 survey was the recovery clearly in its initial stages on the Yukon arctic slope. The 1990 survey showed this group had only one breeding pair (Mossop & Mowat 1990). The population was visited annually between 1990 and 1995; by then, 5 nesting pairs were present. Three were producing young (table 2a).

The 2000 survey suggests this slow trend has continued. In the same area of the slope covered in 1995, two new nesting pairs were located and one pair disappeared (an increase of 20%). Added to this, (but complicating the interpretation of the current survey), is an area of new search in Ivvavik National Park where 3 new pairs were located. The new area surveyed includes all the drainages of the arctic slope and the northern foothills

of the British Mountains. This area had not been surveyed since 1885; (a partial survey was carried out in 1990). Beginning with the current work, Parks Canada staff plan to include the park in the surveyed area which will give a much broader picture of the status of the species on the slope in future efforts.

The total breeding pairs now known is 9. Seven (78%) produced young in 2000 (Table 2a). This productivity (just over 1.5 young per pair) is the highest of any of the subgroups monitored in the Yukon

4.2 GENERAL OVERVIEW: Anatum Race

Adequate coverage was obtained in all 4 of the regional groups that were targeted. The visited sample of nest sites averaged well over 80% of the known sites. In total 132 nest sites were visited, - 117 'previously known' sites. (This compares well with the 124 sites visited in 1995 when the objective was complete coverage.)

Based on finding 15 new nesting pairs, population numbers in the area surveyed seem to have increased by about 13%

over the 1990 survey. However, a definite slowing has occurred since the last major survey, (when a 30% increase over the previous 5 years was indicated). Most of the subgroups now contain many more breeding pairs than were known before the decline, and those original numbers now seem almost irrelevant. In total the numbers of Peregrines is in the order of two to three times the known 'historic' population and numbers apparently continue to climb (at about 2.5% annually).

Estimating from the 'known' breeders, in our sample results, a known population of 175 pairs is suggested (Figure 2). Further expanding these estimates by the amount of known occupied but unsurveyed habitats, (in particular the large Pelly and Stewart river watersheds) suggests that at least 230-50 pairs may now occupy Yukon breeding habitats. A non-breeding segment of at least that number probably also exists.

Tempering these conclusions is the finding that in 2000 overall population performance seems to have faltered significantly. Both occupancy at 'established' nest sites and production of young were apparently lower than the long term. Occupancy by adults was below that seen in

the past: 75% compared to 93% in 1995 and 82% in 1990. In particular, productivity was well below what was expected. Just over 60% of nest sites visited produced no young, up about 10% since 1995. Total annual production of young may be as low as 0.9 per breeding pair, a value usually seen as borderline to poor in a stable population, (Ratcliff, 1980). Neither of these findings are consistent with the conclusion that the population has apparently been increasing steadily since the last survey.

The optimistic assumption is that the missing adults are simply there but 'invisible' to our survey techniques, a seemingly reasonable assumption based on known behavior of non-productive pairs. Unfortunately, an equally valid conclusion would be that the 'missing' pairs are indeed gone from the population. Alarming, the depressed productivity performance may also be signaling a non-sustaining population and a return to catastrophic decline. A middle-ground conclusion from the same observations would be that what we are seeing is simply a population readjusting to a more stable state after decades of increase. In order to sort out the confusion,

a much more detailed assessment of these birds' demographics seems warranted.

4.3 ANATUM POPULATION SUB-GROUP SUMMARIES:

2. Porcupine drainage (anatum race): This group for the last decade has been well above its known pre-decline size. No monitoring survey was conducted in this drainage since the last national survey. In the 2000 survey, nine newly established breeding pairs were discovered suggesting the population is still expanding. (However our 'observed' occupancy at historic sites was only 72%, which means the observed population may have in fact remained exactly stable since the last survey.) Only 32% of known sites were producing young (table 2b). Just under one aeyas per pair is apparently being produced annually in this population.

3. Peel River drainage (anatum race): This subpopulation exhibited the strongest increase in the 1995 survey. In the 2000 survey again newly established pairs (3) were discovered. However, only 68% of known sites were occupied by adults, and only approximately 28% of pairs were producing young (table 2c). If our observed occupancy rate accurately measured the breeding

population, it may in fact have declined slightly. The productivity of this group was the lowest of all the subpopulations in 2000.

The Peel group contains the only sample of peregrines that has been monitored annually since 1995. This sample of 6-7 pairs accessible from the Dempster highway, gives a valuable look at population performance between the major surveys (Table 1). The sample group seems to show that over the last 5 years, a true long-term decline in productivity may have been in fact occurring. (Only about 31% of pairs produced young in the average year compared

Table 1. Peel River drainage Peregrines near the Dempster highway corridor:

Year	Number Checked	Number Occupied	Number Productive
1996	6	5 (83%)	2 (33%)
1997	6	5 (83%)	3 (50%)
1998	6	5 (83%)	1 (16%)
1999	7	6 (86%)	3 (43%)
2000	7	6 (86%)	3 (43%)
5-year average:		84%	31.5%

to 50% producing young in the previous 5 year period, Mossop, 1995.) Interestingly, (Figure 2) it also clearly shows that occupancy by adults has meanwhile remained stable and high, a support for the idea that in 'single visit' surveys like the major every-5-year efforts, may miss adults that are unsuccessful in raising young.

With 31% of adults producing young and an average clutch size of $3(+0.9)$, the group was still producing an average of about 6.5 young annually. If estimates of yearling survival to breeding are somewhere between 30 and 50% (Ratcliffe, 1980), and adult mortality in the group likewise is removing about one adult a year (opp cit), the group was still producing ample young to replace its losses.

4. Yukon River drainage (anatum race): This breeding group has been monitored the most intensively over the years. The number of adults in this group in 1995 far exceeded those known pre-decline. The current year's survey turned up three newly established breeding pairs. Overall pairs were occupying about 81% of previously known sites (down from 91% in 1995); 41% were producing young (down from 53% in 1995), (table 2d). At one eyes

per territorial pair, the group had the best observed production of the anatum subgroups.

5. Southern lakes (anatum race): The exciting find of the 1995 survey was reoccupancy within this region. One pair was found reoccupying an historic sited and successfully fledged three young. In 2000 the group was not targeted for survey. Because only a few breeding pairs were originally known scattered over a very large area in the southern Yukon and because the northern B.C. segment of this habitat has never been surveyed properly, the strategy for assessing this group's status will require a concerted, dedicated effort far different from the monitoring effort sufficient for the rest of the groups.

Table 2. Peregrine Falcon in the Yukon Territory, 1995 and 2000 territory-wide surveys

Year	pairs known fr. previous survey:	known checked	New sites	*Occupied	*Productive	Young/ Productive nest (+S.D.)
2a) North Slope (<u>tundrius</u>): sites known pre-decline: 15						
1995	18	13	1	4 (n=13)	3 (n=13)	2.3+1.2
2000	19	16	4	5 (n=16)	4 (n=16)	2.1+0.7
						yn/terr.pair: 1.6+1.1
2b) Porcupine River (<u>anatum</u>): sites known pre-decline: 21						
1995	40	24	5	24 (n=24)	14 (n=24)	2.3+0.8
2000	45	36	9	26 (n=36)	14 (n=36)	2.1+0.9
						yn/terr.pair: 0.9+1.1
2c) Peel River (<u>anatum</u>): sites known pre-decline: 12						
1995	32	24	16	21 (n=24)	8 (n=24)	2.1+0.8
2000	48	36	3	19 (n=28)	10 (n=28)	1.2+0.6
						yn/terr.pair: 0.9+0.7
2d) Yukon River (<u>anatum</u>): sites known pre-decline: 13						
1995	50	43	7	39 (n=43)	23 (n=43)	2.7+0.8
2000	57	53	3	43 (n=53)	22 (n=53)	3.1+1.0
						yn/terr.pair: 1.0+1.2
2e) S. Lakes (<u>anatum</u>): sites known pre-decline: 3						
1995	3	3	1	1 (n=3)	1 (n=3)	3 yn
2000	3	1	0	0 (n=1)	0	--
TOTALS 2000 <u>anatum</u> only:						
			150	15	88 (75%)	46 (39%)
						2.3+1.5
						yn/terr.pair: 0.9+1.6

* Sample sizes shown and rates calculated do not include newly discovered nesting pairs from that year's survey.

5.0 CONCLUSIONS, NEXT STEPS

5.1 Tundra Race: The status of the population of tundrius in the Yukon must clearly remain of concern. From a potential population of perhaps 20 pairs, only 9 exist. It is however performing increasingly well and of course infinitely better than in 1990 (figure 2). The nine established pairs seem to be producing young at a rate higher than the more southerly populations.

The best strategy for effecting the eventual recovery of this group will probably be simply a combination of complete protection and careful monitoring. The re-establishing pairs as noted elsewhere (Mossop, 1995) are occupying very accessible sea and stream side cliffs. These sites could potentially be heavily impacted by people. Public control and education are essential. Careful monitoring of the habitat on Yukon's north slope, in particular where this can be done incidentally along with other activities in the area, will be essential to further document the fate of the population (See Mossop et al, 1986).

5.2 Anatum Race: In spite of some confusion about what its demographics may mean, overall, the anatum race in the territory has to be considered as faring extremely well and it perhaps even continue to increase. Clearly the long series of data on these birds and the apparent changes we are seeing in its population performance offers opportunity as well as some warning. The number of these birds is now two-and-a-half times the number 'known' historically, a classic case of recovery after drastic intervention in human-caused environmental degradation. Learning about that recovery is still not over, and already the obvious changes we are seeing in productivity could be 'telling us something' that bodes ill for the future.

1. **The Monitoring effort:** The bird has emerged as perhaps the best known 'mine canary' -- in 'harm's way' where persistent pesticides in large continental food webs are concerned. (Peregrines because they are so extremely migratory, probably shouldn't be considered regional or local indicators.) Its population performance, relatively easy to monitor, is undoubtedly equally sensitive to other global changes.

One of these changes is likely global warming. It makes intuitive sense that a sub-arctic breeder like the peregrine will have strategies finely tuned to dealing with the northern weather. Changes in climate could be disastrous depending on what those strategies entail. The work that needs to be done in tracking these changes will depend ultimately on a good continuing database. Monitoring in support of this work will probably have to be a) annual, b) include a reasonable sample (several times the small 'Dempster group') and c) be part of a concerted research effort to determine the effects of environmental changes on the species' demographics.

2. **Population research:** The changes we think we are seeing offers an opportunity. Building on the good database the Yukon has, postgraduate-level research could very easily contribute substantially to understanding about environmental problems like climate change. It is proposed that the Yukon seek immediately to engage the scientific community in this work. Key ideas of female condition and nest parasite ecology could be tested. The eternal

problem of estimating yearling survival could also be a major contribution.

3. **The Southern Lakes group:** This group's reappearance in 1995 was exciting and makes survey of its habitats important. Of all the pieces to the metapopulation of peregrines in our area this group is of most concern. The interior B.C. habitats are a high priority for field work. The work is different from the monitoring and established baseline-supported research possible with the other groups.

It is proposed that a separately funded B.C.-Yukon partnership be established to look at these birds. Graduate level scholarly research is probably the best option. A valuable contribution would be made simply with a inventory phase accompanied by a basic ecological reconnaissance. These birds seem to be using nesting strategies on the big lakes of the ecoregion that may be quite different from the river-nesting groups further north.

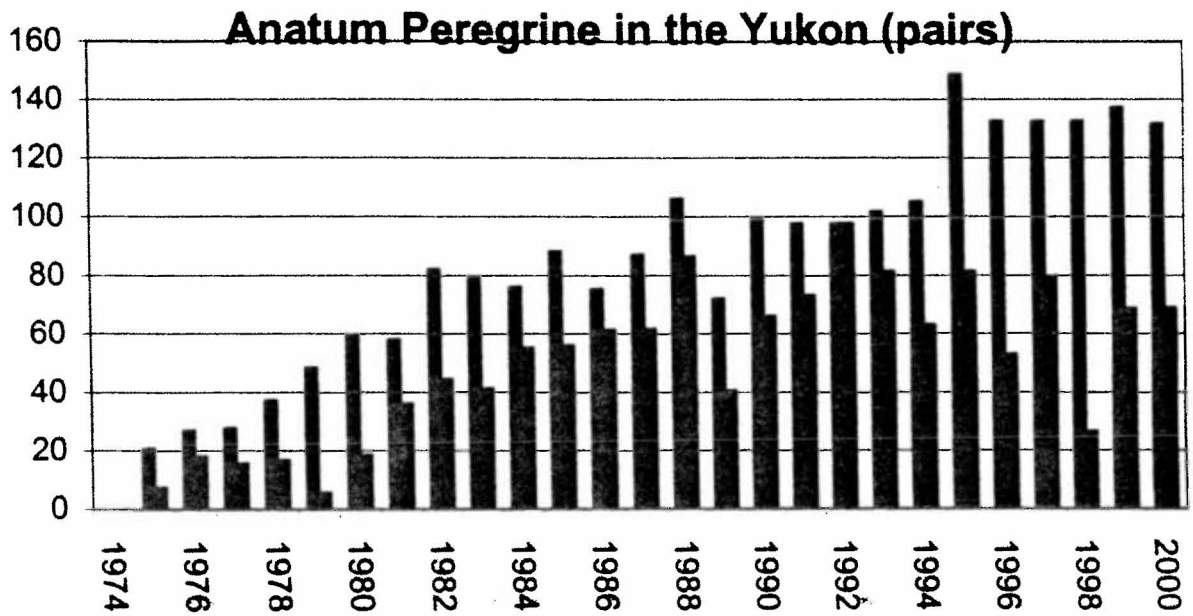
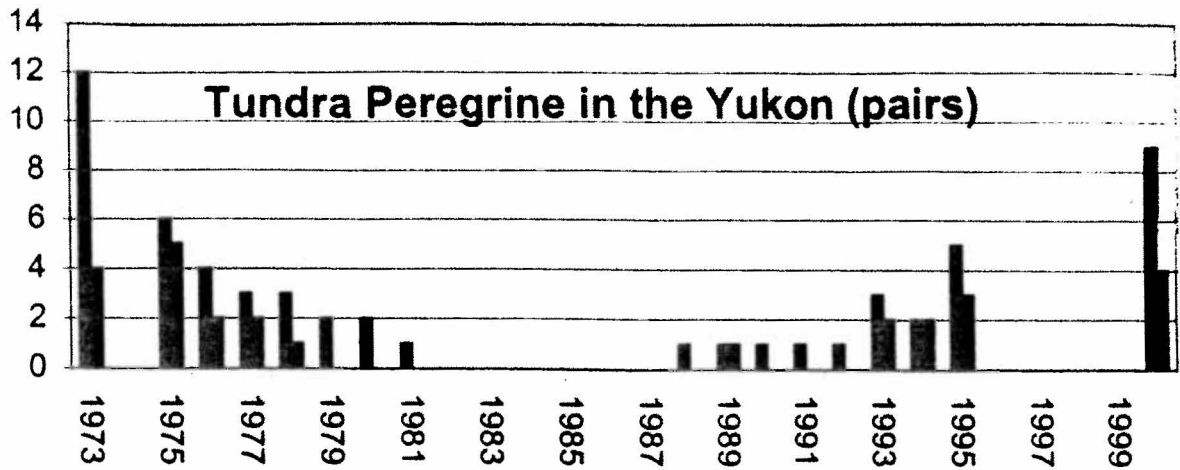


Figure 2. Changes in the size of the known Peregrine Falcon population in the Yukon, 1970-2000. Light bars show the number of breeding pairs known, dark bars show the number of pairs raising young in that year.

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APPENDIX:

Field data, 2000 Peregrine survey, Yukon

	UTM LOCATION	OCCUP?	PRODUCING EGGS	YOUNG
NORTH SLOPE	FG1871	2 AD	--	2
	EH7514	1 AD	1+	0
	EH7624	1 AD	--	3
	EH8419	FR W	--	0
	EG5792	1 AD	--	2+
	EG5689	NIL	--	0
	EH1812	2 AD	--	2
	EH1907	1 AD	--	?1+
	EH4003	NIL	--	0
	EG9759	1 AD	2	0
	EG9253	NIL	--	0
	EG9031	NIL	--	0
	EG9236	NIL	--	0
	LM8117	NIL	--	0
	LM9019	NIL	--	0
	LM9422	NIL	--	0
	MM1134	NIL	--	0
	MM1742	NIL	--	0
	MM1148	1 AD	--	3
	MM2322	NIL	--	0
PORCUPINE DRAINAGE				
EAGLE:				
	MJ2372	FR W	--	0
	MJ1675	2 AD	--	1+
	MJ1182	1 AD	--	0
	MK0938	2 AD	--	0
	MK0756	NIL	--	0
	MK0659	2 AD	--	1+
	MK0465	2 AD	--	4
PORCUPINE MAINSTEM:				
	LK8183	FR W	--	0
	LK7484	1 AD	--	0
	FE2095	2 AD	--	1+
	FE0696	1 AD	--	1+
	EE9998	1 AD	--	1+
	FF0003	1 AD	--	1+
	FF9703	1 AD	--	1+
	EE9299	1 AD	--	1+
	EE8995	2 AD	--	0
	EE7793	1 AD	--	0
	EE7090	2 AD	--	1+

EE6892	NIL	--	0
EE6595	NIL	--	0
EE5997	2 AD	--	1
EE4585	NIL	--	0
EE4191	2 AD	--	0
EE3289	1 AD	--	0
EE2685	2 AD	--	2
EE2580	1 AD	--	0
EE1880	2 AD	--	1+
OLD CROW:			
EF4656	2 AD	--	1+
EF4954	2 AD	--	1
EF4951	2 AD	--	0
EF5950	2 AD	--	0
EF5450	2 AD	--	1+
EF5945	2 AD	--	3
EF5843	NIL	--	0
EF5534	NIL	--	0
EF5230	1 AD	--	1
EF4825	NIL	--	0
EF4523	NIL	--	0
EF5206	NIL	--	0
EF5601	2 AD	--	2
EF5402	2 AD	--	0
EF5300	2 AD	--	2
EF5197	2 AD	--	0

PEEL RIVER DRAINAGE:

OGILIVIE RIVER:

FC2321	FR W	--	0
FC2751	2 AD	1	2
FC2452	2 AD	--	1+
FC2753	FR W	--	0
FC2857	2 AD	--	1
FC2962	NIL	--	0
FC3074	1 AD	--	1+
FC3383	FR W	--	0
WIND RIVER:			
MH8835	2 AD	--	1+
MH7951	--	--	0
MH8265	1 AD	--	2
MH7975	2 AD	--	0
SNAKE RIVE:			
NH7273	2 AD	--	1
NH7279	2 AD	--	0
NH7897	1 AD	--	0
NJ8509	1 AD	--	0
NJ4716	--	--	0

PEEL MAINSTEM:

MJ2502	2 AD	--	2
NJ0414	2	--	0
NJ0614	2	--	0
NJ1519	NIL	--	0
NJ2314	NIL	--	0
NJ2916	2 AD	--	1+
NJ3621	FR W	--	0
NJ4131	NIL	--	0
NJ4546	2 AD	--	1
NJ4957	NIL	--	0
NJ4574	2 AD	--	1
NJ2693	2 AD	--	2
NJ2494	1 AD	--	1+
NJ1694	1 AD	--	2
NK0908	NIL	--	0
NK0414	NIL	--	0
NK0217	NIL	--	0
MK9930	2 AD	--	1
NK0334	2 AD	--	1
NK0737	2 AD	--	1
NK0640	2 AD	--	1

YUKON RIVER DRAINAGE:

DONJEK/WHITE:

EV8110	NIL	--	0
EV5940	2 AD	--	2
EV5242	1 AD	--	0
EV4863	2 AD	--	3
EV4567	2 AD	--	2
EV3879	2 AD	--	2
EV3689	2 AD	--	0
EV3293	2 AD	--	2
EV3298	1 AD	--	0

YUKON MAINSTEM:

MC9728	FR W	--	0
MC5787	2 AD	--	0
ME0143	1 AD	--	0
LE8455	NIL	--	0
LE7567	1 AD	--	0
LE6767	1 AD	--	0
FV2669	1 AD	--	0
EV7593	2 AD	--	0
EA7205	2 AD	--	3
EA7716	2 AD	--	3
EA7623	1 AD	--	2
EA7231	2 AD	--	3
EA6736	1 AD	--	0
EA6239	2 AD	--	0

EA6340	NIL	--	0
EA6446	FR W	--	0
EA6247	NIL	--	0
EA6354	1 AD	--	3
EA6260	1 AD	--	0
EA6364	NIL	--	0
EA6566	2 AD	--	1+
EA6272	2 AD	--	3
EA6175	2 AD	--	3
EA6383	2 AD	--	1+
EA6288	2 AD	--	0
EA6494	NIL	--	0
EB7706	1 AD	--	2
EB7509	1 AD	--	1
EB7511	FR W	--	0
EB7119	1 AD	--	0
EB5129	1 AD	--	0
EB4632	1 AD	--	0
EB4434	NIL	--	0
EB4132	2 AD	--	0
EB3935	1 AD	--	0
EB3536	NIL	--	0
EB3138	1 AD	--	0
EB2538	1 AD	--	2
EB1266	1 AD	--	3
EB1759	FR W	--	0
EB1955	1 AD	--	1+
EB2455	2 AD	--	0
EB6826	2 AD	--	1+
EB5827	1 AD	--	0
EB2755	1 AD	--	1
EB2346	1 AD	--	1

SOUTHERN LAKES:

MC9275	NIL	--	0
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