

# The North American Peregrine Survey, 1970

TOM J. CADE

Cornell Laboratory of Ornithology  
159 Sapsucker Woods Rd.,  
Ithaca, New York 14850

RICHARD FYFE

Canadian Wildlife Service,  
Edmonton 14, Alberta

**Abstract.** Fifteen regions were surveyed in Canada and Alaska in 1970 to assess the current breeding status of the Peregrine (*Falco peregrinus*) in boreal America. About 237 known eyries were examined, 149 in the range of *F. p. anatum*, 56 in the range of *F. p. tundrius*, and 32 in the range of *F. p. pealei*. In the southern parts of the former breeding range in Canada, including the Maritimes, southern Labrador, southern Quebec, Ontario, Alberta, and Saskatchewan, only four pairs were found at 82 former eyries. An examination of 64 eyries in the taiga of Canada and Alaska yielded 34 occupied sites, and similar studies in the Arctic tundra produced 31 occupied eyries out of 53 examined. Of 32 eyries studied in the range of *pealei*, 23 were occupied. Both tundra and taiga populations have declined locally since 1966. Reproductive success among these northern falcons has diminished in association with eggshells that are 15-20% thinner than they were in these populations before 1947. There is a highly significant negative correlation between chlorinated hydrocarbon residue levels in egg contents (or adult tissues) and the thickness of eggshells. At the current rate of decline, the Peregrine may become extinct in North America in this decade.

The dimensions of a continent-wide population crash of the Peregrine Falcon (*Falco peregrinus*) in North America came into focus at the Madison Peregrine Conference in 1965 (see "Peregrine Falcon Populations, their Biology and Decline," edited by J. J. Hickey, Univ. of Wisconsin Press, 1969). By that year the falcon had already disappeared as a breeding species at all observed eyries (146 locations) in the eastern United States from the Mississippi River to the Atlantic Coast, where once there were more than 200 known eyries. It was not clear just how far northward into Canada the decline of the eastern *anatum* population had extended, but evidently southern Ontario, Quebec, and the Maritime Provinces had been seriously affected. In the Rocky Mountains region, including Alberta, only 33% of all known eyries were still occupied, and it was estimated that in the

northwestern states of Washington, Oregon, Idaho, Utah, and the western parts of Wyoming and Montana 80% to 90% of the old, traditional nesting places were abandoned. Although at that time detailed studies had not been made in California, where the Peregrine was once common, enough information was at hand to be certain that a serious reduction in the number of eyries had occurred there too, as well as on the Pacific side of Baja California.

In contrast to these gloomy findings, some studies in Alaska and in northern Canada indicated that the arctic, migrant Peregrines (*F. p. tundrius*) remained vigorous and unaffected by any reduction in numbers, although one local, forest-inhabiting population of *anatum* falcons around Yellowknife had disappeared. The same conclusion appeared to be true for *F. p. pealei*, the maritime population of the Northwest Pacific region.

By 1969 a considerable amount of new fieldwork had been accomplished, and it was obvious that the momentum of the decline had not stopped south of the boreal forests. A second Raptor Research Planning Conference was held at Cornell University on 7-9 November to review the changes that had occurred since 1965.

The reports at this meeting showed that the impact of the decline had extended westward and northward on the continent. Only 20% of 50 eyries in Arizona, New Mexico, Colorado, Wyoming and Montana held falcons, and only 8 pairs were successful in producing young (J. H. Enderson). Only 3 pairs remained in Alberta (R. Fyfe). In California the best information indicated not more than 5 known active eyries and about 3 pairs that laid eggs in a state where there are 91 verified eyries at which Peregrines



used to breed and where possibly as many as 173 sites once existed (S. G. Herman).

Some boreal populations that were thought to be secure in 1965 had also declined. In the Queen Charlottes a local breeding group of *F. p. pealei* had declined from 15 or more pairs in the early 1960's to 5-6 pairs in 1968-69 (W. Nelson). Similarly, a sampled breeding population in the Northwest Territories had decreased by 29% since 1966, and one in the central barrens had declined to 50% of the number present in 1966 (R. Fyfe). In Alaska, a long-studied breeding population of *tundrius* on the Arctic Slope and another of forest-inhabiting *anatum* showed no significant changes in number of occupied eyries, but reproductive success had decreased progressively each year since 1966 and was associated with an increasing percentage of pairs that failed completely (T. Cade).

By the time the Cornell Conference convened in November 1969, the evidence from a variety of sources had become overwhelming that, just as in Britain and Western Europe, the Peregrine Falcons in North America have been victimized by a chemically induced disease caused by hard pesticides of the chlorinated hydrocarbon group, such as DDT and dieldrin, and possibly by other chlorinated pollutants, the polychlorinated biphenyls. While direct adult mortality from lethal levels of residues was probably a factor early in the decline, the most quantifiable symptom of the pesticide disease is the production of thin-shelled eggs. This phenomenon, which is almost entirely unknown in wild bird populations before 1947, has been thoroughly documented for a number of species, including the Peregrine populations of both Great Britain and the United States (D. A. Ratcliffe, *Nature* 215: 208-210, 1967; J. J. Hickey and D. W. Anderson, *Science* 162: 271-273, 1968). The thin eggshells are associated with high residue levels of DDE and other chlorinated hydrocarbons in egg contents or in adult falcons, and shell thinning has been experimentally induced by feeding pesticides to several species of birds. In its extreme expression, shell-thinning is associated with an abnor-

mally high incidence of broken eggs in the nest and with failure of eggs to hatch, and this is probably the main way in which pesticides have effected Peregrine declines.

Faced with these facts, the Cornell conferees concluded that the Peregrine should be officially designated as an endangered species in all of North America, and as previously reported in *The Canadian Field-Naturalist* (vol. 83: 297-299, 1969) letters were sent to the governments of Canada, the United States, and Mexico urging this course of action and to take whatever measures are necessary to preserve the Peregrine from extinction. The petitions were given careful and detailed consideration by both the Canadian and U.S. governments, and recently the U.S. Department of the Interior added *F. p. tundrius* to its list of endangered subspecies along with *F. p. anatum*, but *F. p. pealei* was not included.

The conferees also decided to try to man a continental survey of Peregrine eyries in North America at 5-year intervals beginning in 1970, in order to keep abreast of the continuing changes in population status and reproduction. Cade was asked to organize the surveys, and we divided the continent into study areas, as follows: (1) Greenland, (2) Canada, which was further divided among several field teams under the supervision of R. Fyfe, (3) Alaska, (4) the Rocky Mountains and intermontane western regions of the United States, (5) the Pacific Coast, and (6) Mexico. From the first, funding was a major obstacle. We approached several national and international organizations that should have been interested in the Peregrine. In the end, we were able to mount a dozen field surveys in Canada, primarily through the offices of the Canadian Wildlife Service, five in Alaska, one in California carried out by S. G. Herman with support from the California Department of Fish and Game, one in Mexico by Monte Kirven of the San Diego Natural History Museum, and one in the northeastern United States carried out independently by W. R. Spofford.

It was possible to carry out extensive surveys in 1970 to determine the current status and re-



TABLE 1. — Summary of information on numerical status and reproductive performance of Canadian and Alaskan Peregrine populations in 1970

(a) <i>Falco p. anatum</i>											
Region	Eyries checked			Adult birds present			Reproductive success				
	Previously known	New	Total	Lone	Pairs	Per cent occup.	Pairs with young		Young in nest		
							No.	% total	Total	Per active nest	Per total pairs
Maritime Provinces, & Southern Gaspé	15	0	15	0	0	0	0	0	0	0	0
So. Labrador	0	2	2	0	2	100	2	100	4	2.0	2.0 <sup>1</sup>
So. Quebec	3	0	3	0	0	0	0	0	0	0	0
Ontario	29	0	29	0	0	0	0	0	0	0	0
Alberta & Saskatchewan	32	1	33	1	2	10	1	50	3	3.0	1.5
Mackenzie District	15	1	16	3	6	56	3	60 <sup>2</sup>	6	2.0	1.2 <sup>2</sup>
Yukon Terr.	14	1	15	1	5	40	3	100 <sup>3</sup>	6	2.0	2.0 <sup>3</sup>
Yukon Valley, Alaska	19	0	19	?	12+	63	7	58	18	2.57	1.50
Tanana Valley, Alaska	13	1	14	0	7	50	7	100	20	2.86	2.86
Totals or means	140	6	146	5	34	27	23	68	57	2.48	1.69
(b) <i>F. p. tundrius</i>											
Int. Barrens	11	0	11	0	4	36	3	75	8	2.70	2.0
Ungava	12	3	15	3	9	80	7	78	12	1.70	1.33
So. Baffin	0	7	7	0	5	71	3	60	7	2.33	1.40
No. Alaska	20	0	20	0	10	50	5	50	10	2.00	1.00
Totals or means	43	10	53	3	28	65	18	64	37	2.05	1.32
(c) <i>F. p. pealei</i>											
Queen Charlottes Aleutian Is.	ca. 15 0	0 17 <sup>4</sup>	ca. 15 17	1 2	5 15	40 100	5 11 <sup>5</sup>	100 73	11 15 <sup>5</sup>	2.2 2.14 <sup>5</sup>	2.2 1.36 <sup>5</sup>
Totals or means	15	17	32	3	20	72	16	80	26	2.18	1.62

<sup>1</sup>Total success not known, as only one nest examined; one young seen at second nest from below.  
<sup>2</sup>One nest not examined and not included in calculating productivity.  
<sup>3</sup>Two sites not checked and number of young unknown.  
<sup>4</sup>Data are from 1969 (see text).  
<sup>5</sup>Eleven nests were examined; two others were active, and four pairs failed.

productive success of the Peregrine in Canada, with funds allocated for this by the Canadian Wildlife Service. Priority was given to planning and implementing the surveys throughout Canada. Areas to be surveyed were chosen on the basis of available historical records of Peregrine nesting, together with available information on areas of suitable habitat



within the known breeding range of the three subspecies. On this basis the Canadian surveys can essentially be divided into (i) "*anatum*" Peregrine surveys; (ii) "*tundrius*" Peregrine surveys; and (iii) "*pealei*" Peregrine surveys.

The "*anatum*" surveys were designed to include most of the recorded breeding range of this subspecies in southern Canada and extended from the Maritimes through southern Quebec and Ontario and west to include Alberta and British Columbia. In addition it was decided to extend the survey for "*anatum*" birds into those areas of suitable habitat in the forested regions of Quebec, southern Labrador, the district of Mackenzie, and the Yukon Territory.

Similarly, the surveys to determine the current status of "*tundrius*" were to be carried out in Ungava and the interior barrens of the Northwest Territories, where population data had been previously recorded. Also, based on a limited amount of data and previous Peregrine nesting, reported prey abundance, and information on the extent of suitable habitat, a third survey was conducted on southern Baffin Island.

Although it was our initial intention to carry out similar surveys along the west coast of British Columbia to investigate the populations of *pealei*, on discussing this with that province we were advised that the province intended to carry out independent surveys to determine the current status and nest success of the Peregrine in British Columbia. The province contracted Mr. Joseph Simonyi to do surveys of both the coastal *pealei* and interior *anatum* Peregrine populations. It is our understanding that these surveys were carried out; however the results of the surveys are not yet available. Consequently with the exception of Langara Island where Mr. Wayne Nelson performed an independent study, surveys of the Peregrine populations of British Columbia were carried out by the province.

It was decided that throughout the Canadian surveys investigators were to make every attempt to visit all previously known eyries, each was to be carefully examined for evidence of

falcons, and whenever possible sites were to be climbed and examined for signs of recent or current occupancy. Mode of travel throughout the surveys varied from the use of light aircraft, automobile, trail bike, or boat to walking and was for the most part dictated by conditions in the specific area to be surveyed.

Greenland unfortunately remains an unknown region, but the diminished trapping success and number of sightings of migrant Peregrines on Assateague Island in recent years (R. B. Berry, unpublished report) suggest that all is not well even in this "remote" part of the North American arctic. Further, no systematic surveys were carried out in the intermontane western region of the U.S. this year.

The following series of reports is restricted to the Peregrine populations of Canada and Alaska, the area of North America where most of our remaining Peregrines breed, and includes information on all three subspecies, *F. p. anatum* of southern Canada and the taiga, *F. p. tundrius* in the Arctic, and *F. p. pealei* of the Pacific Northwest coastal regions. Results of other surveys will hopefully appear soon.

Table 1 summarizes the main findings of the Canadian and Alaskan studies. The field teams examined approximately 237 eyries (not all are enumerated in Table 1), 149 in the range of *anatum*, 56 in the range of *tundrius*, and 32 in the range of *pealei*. The surveys clearly confirm the fact that *anatum* is virtually gone as a breeding bird in its more southerly Canadian haunts, just as it is in the United States south of Canada, as pairs occupied only four of 82 eyries in 1970. Even more discouraging for what they portend are the findings from the taiga, where two Canadian and two Alaskan populations, all with well documented historical data, show clear indications of reproductive abnormalities and reductions in the number of occupied eyries in the last three years (Tables 2 and 3). The *tundrius* populations of arctic Canada and Alaska are in a similar, or even more serious, condition (Tables 2 and 5). At least one local *pealei* population in the Queen Charlottes has declined. Of all the populations for which we have assembled data in 1970, only the *pealei*



breeders on Amchitka in the Aleutians give the appearance of normality.

Among the boreal populations, the percentage of known eyries occupied by pairs or adult birds in 1970 ranged from 100% on Amchitka to only 36% in the barrens, and several other populations were down to 50% or less. In order to interpret these figures, we need to know what the percentage occupancy was in pre-DDT times. Unfortunately there is not much information on this point for the regions under consideration. In Britain D. A. Ratcliffe (*Bird Study* 10: 56-59, 1963) provided figures ranging from 84% to 91% for 6 populations in the period 1930-39, while comparable figures for the period 1961-62 ranged from 24% to 88%. At 14 Massachusetts eyries from 1935 to 1942, the occupancy ranged from 71% (10 occupied) to 93% (13 occupied) (A. J. Hagar, in J. J. Hickey, *op. cit.*, 1969). On a stretch of the Colville where 14 distinct "territories" (some including alternate cliffs) were known from 1952 to 1959, Peregrine occupancy ranged from 57% to 71% (T. Cade, *Univ. Calif. Publ. Zool.* 63: 151-290, 1960), while during 1967-69 on a longer portion of river where a total of 44 territories was occupied during the three years, the occupancy ranged from 61% to 75%. Since Peregrine pairs in boreal regions tend to be less site-tenacious than in temperate regions, the percent occupancy of all known eyries is not as meaningful as a simple yearly comparison of the number of pairs present in a given region; but if a survey reveals an occupancy of 50% or less it probably means that the population is declining. The figures summarized in Tables 2, 3 and 5 clearly show downward trends in most of these northern populations, associated with decreased reproductive output of the remaining pairs. The decreased reproduction seems to result mainly from an increase in the number of pairs that fail completely rather than from a decrease in clutch size or brood size of successful pairs.

All surviving North American Peregrine populations that have been examined are affected by the same thin eggshell phenomenon described by Ratcliffe for the depleted population of Britain and by Hickey and Anderson for

the virtually extinct falcons of California and the eastern United States. The percent decrease in thickness since 1946 ranges from about 15 to 20% or more for samples from Ungava, Northwest Territories, northern Alaska, interior Alaska, and Baja California to less than 10% for samples from the *pealei* populations of the Queen Charlottes and the Aleutians (D. W. Anderson and J. J. Hickey, paper presented at XVth International Ornithological Congress, the Hague, 1970; T. J. Cade *et al.*, unpublished; R. W. Risebrough and M. Kirven, unpublished). In all cases the degree of shell-thinning is associated with a corresponding degree of organochlorine residue contamination of egg contents: the thinner the shell, the higher the residue level. A decrease of about 20% seems to be the critical range in which significant reproductive failure begins.

### Newfoundland and The Maritime Provinces

Nelson Hurry, investigator  
(prepared by Richard Fyfe).

An extensive survey of Newfoundland and the Maritime Provinces was carried out by Mr. Nelson Hurry. In particular because of reports of Peregrines in the area during recent years specific emphasis was placed on careful and intensive investigation of the fifteen previously known eyrie locations in New Brunswick, Nova Scotia and the southern Gaspé. In addition the 1970 survey covered most of the potential nesting habitat in the Maritimes and southern Gaspé and included extensive aerial investigation of much of both the east and west coast of Newfoundland, followed by some surface investigation of potential or suspected Peregrine nest sites.

In most instances preliminary aerial reconnaissance was carried out in all areas and was followed by intensive surface investigations by boat and finally spot checks on foot.

The results of the survey were disappointing as no Peregrines were observed, and despite recent reports of the species in the Maritimes no evidence was found of current or recent occupancy at any of the many sites investigated. It therefore appears that the Peregrine is no longer to be found as a breeding bird in the area.



## **Ontario, Southern Quebec and Labrador**

R. S. Gibbon, C. C. Gates, and  
S. M. Teeple, investigators.

Although the surveys in Ontario, Southern Quebec, and Labrador were conducted by one crew of investigators, each area will be dealt with separately because of the availability of historical data prior to the survey and the methods by which the surveys were conducted.

### *Ontario*

Prior to the commencement of the field investigations data on a total of 72 eyrie locations of Peregrine Falcons in Ontario were acquired from Mr. Joseph Simonyi and from the Royal Ontario Museum. The checking of old eyrie sites was essentially restricted to two sections of the province: (1) Southern Ontario, south of the 47th parallel, from Lake Huron east to Ottawa but excluding the extreme southwestern portion (the area lying south of the 43rd parallel and west of the 80th meridian); (2) Northwestern Ontario along the shores of Lake Superior west to Thunder Bay and including many of the off-shore islands. One reported eyrie site was also checked at Smoky Falls on the Mallagimi River, and three others were checked on James Bay by Dr. George Peck of the Royal Ontario Museum.

Initial investigations were carried out by aircraft. It was soon realized that much of the "historical" information was unreliable. Owing to time limitations and the area to be covered only those sites where we felt that Peregrines could feasibly nest, or where there was sufficient historical evidence to indicate that they had nested, were visited by boat, automobile, on foot, or by landing the aircraft. In each case several shots were discharged from a 20 gauge shotgun from below the cliff and the area examined with binoculars for any signs of falcons.

Of the 72 sites checked only 26 can be considered as having reliable historical documentation. The results of this study show that all of these eyries are now abandoned, as no active nests were found, nor were there any individual, non-breeding birds seen during the survey. Three other known eyries reported by Dalton Muir of the National Parks Service were not

checked in this investigation, but are known by him to be vacant. In 1970 none of the 29 known eyries of Peregrine Falcons in Ontario remain active.

### *Southern Quebec*

Unlike the survey in Ontario, we were able to acquire little in the way of historical evidence of Peregrine nesting sites, except that obtained from Reginald Ouellette, who provided us with two known sites and the possibility of a third. These were all south of the St. Lawrence River, west of Riviere du Loup and south of Montreal. These eyries are now abandoned.

The remainder of the survey in Quebec was conducted on the north side of the St. Lawrence River, east of Quebec City in two main areas, chosen because of the abundance of cliffs and the possibility of nesting sites for Peregrines. These were: (1) the Saguenay River which was checked by boat from Tadoussac to Bagotville; (2) a section of land approximately 100 miles wide and extending from Lac Ste. Anne (65 miles east of Sept-Iles) to Harve St. Pierre and including the river valleys of the Moisie, Manitou, Nipisso, St. Marguerete, Toulnoctoac, and Riviere aux Rochers, as well as all of the major lakes. In this region, because the rivers are essentially unnavigable, the investigation was conducted by aircraft.

In spite of the abundance of apparently suitable nesting cliffs for Peregrine Falcons both along the Saguenay River and in the Sept-Iles region, no eyries were found, nor were any birds seen. Although aerial surveys are probably the least suitable method of conducting a census on nesting Peregrines, we believe that if there ever was a population of these falcons in the north shore region of the St. Lawrence River, it has been extirpated.

### *Labrador*

Historical data on the nesting locations of Peregrines in Labrador are fragmentary. Much of our work, then, was essentially an original survey. Aerial surveys were conducted along the coast from Makkovik south to Spotted Island and including the Benedict Mountains. Where possible we landed the aircraft at local fishing



villages and talked with the fishermen, who are familiar with specific areas of the coast and who would perhaps know of the nesting locations of hawks or falcons. All such reports were checked. Approximately 125 miles of the coast line including the off-shore islands were checked.

Two active eyries were located along the coast in this investigation. One contained three eyases and one addled egg, but the total contents of the second were not determined as only one adult and a fledgling were observed.

In general, because of the large area covered in Ontario, Quebec, and Labrador, much of which was done by aircraft, it is quite conceivable that active eyries could have been missed; however, in spite of such a possibility, the population of Peregrines in these regions is extremely low, if not extinct. Along the southern coast of Labrador a few remain and appear to be nesting successfully. We cannot make any conclusions about changes which may have occurred in populations either in southern Quebec or in Labrador, as previous information on the abundance of Peregrines for these areas is insufficient.

We gratefully acknowledge the support of the World Wildlife Fund in the Ontario and Quebec Surveys.

### **Alberta and Saskatchewan**

Richard Fyfe and Keith Hodson, investigators.

As elsewhere in Canada historical data on early Peregrine nest sites in Alberta are fragmentary with a total of only 39 previously known nest sites being obtained through the literature and from personal contact with naturalists, falconers, and egg collectors. These site records do suggest that, with the exception of the southeast corner of Alberta, the species apparently bred wherever suitable nesting habitat was available throughout the remainder of the province. No reliable nest records of Peregrines are available for Saskatchewan.

The 1970 survey consisted of checking out known sites in Alberta, suitable habitat in both Alberta and southern Saskatchewan, and all reported observations of Peregrine Falcons. The

usual survey technique was simply to conduct initial reconnaissance flights using single engine fixed-wing aircraft and to follow these with more intensive surface visits. In all instances the cliffs were visited, an attempt was made to locate birds, and where any evidence of occupancy was noted the site was thoroughly investigated.

It is not possible to estimate the total mileage by aircraft, boat and automobile; however it is sufficient to indicate that all major river systems and areas of suitable habitat in southwestern Saskatchewan and throughout Alberta east of the Rocky Mountains were checked. Specifically 32 previously known sites were investigated in 1970, together with five current reports of observations on individual or nesting Peregrines. In 1969 five additional sites were checked which showed no signs of recent occupancy. These were not rechecked in 1970.

Three sites were found occupied in 1970, two with pairs in attendance and the third occupied by a lone adult female. Of these one pair was not successful having lost their nest and its contents in a rock slide late in the season. The second pair successfully raised and fledged three young in a second nesting. This pair laid 4 eggs early in May which disappeared shortly thereafter. The pair subsequently renested, again laid 4 eggs, and although the nest ledge was partially destroyed the pair continued to incubate and successfully fledged three young.

The results of the 1969 and 1970 surveys clearly indicate that the Peregrine Falcon has all but vanished from the Alberta scene.

### **The District of Mackenzie**

Richard Fyfe, Keith Hodson and R. Semeniuk, investigators.

In 1966 two independent investigations in the District of Mackenzie resulted in the location of thirteen active Peregrine eyries presumably recorded for the first time and in the checking of four previously known eyries, one of which was active. Again in 1969 all seventeen sites were investigated, six were found to be deserted, one was occupied by a lone adult, and of the remaining ten pairs six were successful in raising a total of fifteen young birds.



TABLE 2. — Recent changes in number of occupied eyries and breeding success in three boreal Peregrine populations

(a) District of Mackenzie						
Year	Total sites investigated	Occupied sites	No. of pairs with young	No. young in nests	Production	
					per successful pairs	per total pairs checked
1966	17	14	—	—	—	—
1969	17	11	6	13	2.2	1.2
1970	16	9	3 <sup>1</sup>	6	2.0	1.2
(b) Interior barrens						
1968	11	6	3	5 <sup>2</sup>	—	—
1969	10	5	3	5	1.6	1.25
1970	11	4	3	8	2.7	2.0
(c) Ungava						
1967	14	14	11	23	2.09	1.64
1970	15	12	7	12	1.70	1.33

<sup>1</sup>One site not climbed, therefore success unknown.  
<sup>2</sup>The 1968 survey was too early to determine productivity as some birds were still incubating.

In 1970 fifteen of the seventeen sites were checked and one additional pair was located, although the nest site was not found. Nine sites (including the above mentioned new site) were occupied, three by lone birds and the remaining six by pairs. Of the six sites occupied by pairs, only three were known to have produced young, a fourth eyrie which held eggs early in the season remained occupied by a pair of silent adults and appeared to have been robbed shortly before our visit. The production of the three successful nests was seven young raised to fledging or near fledging.

It appears obvious that the Peregrine population in the District of Mackenzie is declining at a fairly constant rate (Table 2). The absence of pairs and the presence of lone adults at former sites suggest a fairly steady attrition of adult birds with little or no recruitment and may well signify the demise of the Peregrine in this area. It is interesting to note that although production

per occupied eyrie is low the production per successful eyrie is about normal.

**Yukon Territory**  
John Campbell and R. Rafuse, investigators.  
(prepared by R. Fyfe)

Investigations in the Yukon Territory were carried out for the most part by automobile, boat, and on foot. Due to time limitations coverage in the Yukon was restricted for the most part to include known eyrie locations in the southern and central regions of the territory.

As elsewhere all nesting cliffs were visited, examined for signs of use by falcons, and where possible climbed and searched for evidence of recent or current occupancy. In all a total of fourteen known nest sites and one new site were checked. Six of these were found occupied, five by pairs of birds, and one by a lone adult. Of the five successful pairs only three were accessible and were found to contain a total of six nearly fledged or fledging young.



The average of two young per pair indicated good production; however the number of previously known eyries which were deserted suggests a sharp reduction in the Peregrine population in the territory.

**The Upper Yukon Valley of Alaska**

S. A. Temple, J. H. Anderson, and  
L. G. Swartz, investigators.

The Peregrine Falcon population along a stretch of the middle Yukon River has been censused by a number of investigators over the past 20 years. While the population density and reproductivity of these Peregrines have shown yearly fluctuations, a gradual decline in numbers and breeding success has been evident (Table 3). Cade, White and Haugh (*Condor* 70: 170-178, 1968) and Anderson, Roseneau, and Swartz (*Auk* 85: 683-684, 1968) have shown that breeding individuals from this population carry potentially deleterious amounts of chlorinated hydrocarbons in their body tissues. Correlated with this finding is the laying of significantly thinner-shelled eggs than those of Peregrines from this region in pre-pesticide times (Table 4).

During the 1970 nesting season a census of breeding Peregrines along this stretch of river was made in conjunction with an intensive study of Peregrine nesting behavior. Time-lapse cameras which took photographs at two minute intervals were used to monitor the nesting

TABLE 3. — Historical data on Reproductivity of Peregrines along the Upper Yukon River.

Year	1951 <sup>1</sup>	1966 <sup>2</sup>	1967 <sup>3</sup>	1968 <sup>4</sup>	1970
Total no. of pairs	16-19	17	15+	17	12+
Unproductive pairs	ca. 7/19 (36%)	3/17 (18%)	5/15 (33%)	8/17 (47%)	5/12 (42%)
Tot. young fledged	20+	30	21-23	16	18
Fledg. per total pairs	ca. 1.25	1.80	ca. 1.40	0.93	1.50

<sup>1</sup>Data from Cade (Univ. Calif. Publ. Zool. 63:151-290, 1960).  
<sup>2</sup>Data from Cade, White and Haugh (*op. cit.*)  
<sup>3</sup>Data from Anderson *et al.* (unpublished data)  
<sup>4</sup>Data from Cade *et al.* (unpublished report)

TABLE 4. — Eggshell thickness for Peregrines from Interior Alaska and the Upper Yukon River<sup>1</sup>

Pre-1946		Post-1946	
N	Thickness index <sup>2</sup>	N	Thickness index <sup>2</sup>
20	1.79	14	1.48

$t = 8.09, p < .001$

<sup>1</sup>Data from Cade, Lincer, White, Roseneau, and Swartz (in press)  
<sup>2</sup>After Ratcliffe (*Nature* 215:208-210), Index = wgt in mg/length × breadth in cm.

behavior of seven pairs of Peregrines. This camera surveillance was begun on 7 June, about ten days after laying, and terminated on 23 July, about a week before the young fledged. The results of this study will be published separately. Camera surveillance appeared to have no disruptive effect on reproductive success, since eyries with cameras produced young at a rate identical to those without cameras.

The data on reproductivity for Yukon River Peregrines in 1970 are shown in Table 3. This year there were fewer pairs than ever before occupying cliffs along the Yukon. Also the percentage of birds which attempted but failed to raise young was quite high, and our observations indicate that this was primarily owing to loss of eggs and failure of eggs to hatch. Pairs that did raise young were generally quite successful, so that the total production per pair was good. This is perhaps a reflection of the favorable weather conditions during the early part of the nesting season, but only 18 young were presumed to have been fledged, a relatively low level of production for this prime Peregrine nesting area.

Our study was supported by a grant from the National Audubon Society.

**The Tanana Valley, Alaska**

John R. Haugh, investigator.

The following is a report of an investigation conducted along the Tanana River in interior



Alaska. Only casual studies of Peregrines along this river have been made previously.

The Tanana is one of the major tributaries of the Yukon River. It flows over 400 miles through extensive areas of spruce forest in interior Alaska. Brian S. Cade and I made a boat trip over a selected study area of about 300 river miles. Our initial trip was made between 2 and 13 July, and we later checked certain areas of the river a second time between 14 and 20 July. These observations allowed us to gather information at a time when young were in the nests.

All cliffs along the river were checked from below, and rifle shots were fired into inaccessible areas as a means to flush off birds that might be present. Except in the case of small cliffs, where we were confident no falcons were present, we also climbed and walked the top of the cliffs. To reach actual nesting sites, we used a 120 ft. climbing rope and conventional climbing techniques.

Seven pairs of nesting Peregrines were found along the Tanana in 1970 with a total of 20 young, or 2.86 young per pair. One recently dead young was found which had apparently fallen from the eyrie. If this latter is included in the total, the 7 pairs averaged 3.0 young per pair. Working in interior Alaska along the Yukon River in 1951, Cade found the number of advanced young per pair to be 1.67 (*Univ. Calif. Publ. Zool.* 63: 151-290, 1960). Along the Yukon in 1966, the number of advanced young was 2.25 per eyrie for 12 pairs (Cade, *et al.*, *Condor* 70: 170-178, 1968), and the observed numbers in 1967 were similar (Ender-son, *et al.*, *Auk* 85: 683-684, 1968). Although the young along the Tanana ranged in age from about one week to near the point of fledging, and the figures are not entirely comparable, it is apparent that reproductivity of the Tanana Peregrines in 1970 compares well with that previously observed among Peregrines along the Yukon. If anything, the number of young per successful pair in 1970 must be judged to lie on the high side of the mean number that has been observed among other Peregrine populations in North America.

A trip on the river during the incubation period was not made. It is possible that other pairs may have attempted to nest and, having failed, deserted their nesting sites. From experiences along the Yukon and Colville Rivers it seems likely that at least occasional falcons would remain around the Tanana cliffs when nesting attempts failed. I saw no Peregrines along the river other than those at the 7 occupied sites and, therefore, I have no evidence that other pairs attempted to nest along the Tanana in 1970. There is, however, information which indicates that in the past, Peregrines have nested on at least 14 cliffs in the area surveyed. It is not known whether all 14 sites were ever occupied in a single year. For this reason, therefore, I am unable to ascertain whether the 7 pairs observed in 1970 represent a decline in the population along the Tanana.

The Tanana River is considerably more accessible to recreational enthusiasts and river travellers than are the Colville and Yukon Rivers. During the course of its flow, the Tanana makes numerous contacts with highways and access roads. Nevertheless, travel is generally light up-river from Fairbanks because of the braided, shallow nature of the river and because of occasional stretches of rapids. Between Fairbanks and Nenana the river is not braided, and it flows more slowly. In this area traffic is heavy and may be a factor influencing the presence of breeding falcons along this part of the river. Formerly, at least 3 pairs of Peregrines were known to have nested each year between Fairbanks and Nenana (L. G. Swartz, personal communication). In 1970 no Peregrines nested on these river bluffs, but one pair successfully fledged 4 young from a cliff about one mile inland from a former site on the river. The moving of this pair to a less accessible inland location may have been in response to increasing disturbance along the river. Peregrine eyries which do not overlook water are rare in interior Alaska.

In 1970 several nestling falcons were illegally taken by falconers. Because of the accessibility of the river this is likely to be a problem in future years as well, unless state and federal



agencies increase the rigor of their surveillance.

The number of young per successful pair in 1970 indicates that some interior Alaskan Peregrines are still producing well, and this is encouraging. I found fewer pairs of birds than anticipated, but whether this represents a population decline, early nest failures and subsequent site abandonment, or simply overexpectation on my part is not certain. Additional years of observations with early trips during the incubation period would help to answer this question. The trend toward greater use of the Tanana River as a recreational stream, and the continued release of chlorinated hydrocarbons into the environment, especially in the falcon's wintering areas, are both problems faced by the Tanana River Peregrines. The fate of these birds hinges on the rapidity with which men learn to respect their environment and the living things that share it with them.

Our work along the Tanana was supported by the New York Zoological Society. John Burns and Phillip Conner of the Alaska Department of Fish and Game were especially cooperative in helping with the study. I express my thanks to them.

### **The Oil Pipeline and Peregrines in Alaska**

Clayton M. White and James H. Streater, investigators.

There is much concern about the impact of a proposed oil pipeline in Alaska and what the construction of it will do to the wildlife, especially to endangered species such as the Peregrine. We surveyed the route (some 700 miles from Valdez to Prudhoe Bay) for raptorial birds, primarily falcons, from 15 July to 11 August 1970, under contract with the U.S. Bureau of Sport Fisheries and Wildlife. We worked from helicopters. Much of the habitat along the route is not suitable for Peregrines, and only one eyrie was less than two miles from the proposed route. We found six active eyries adjacent to the proposed route, some as much as 5 to 10 miles away. Three unused eyries are also along the route. The Sagavanirktok River furnishes the major Peregrine habitat, and three pairs were found along the

river. Judging from our experience on other rivers on the Arctic Slope, six to eight pairs at most may be able to nest along the Sagavanirktok River. We conclude that no eyrie is likely to be physically disturbed by the actual mechanics of pipeline or road construction; *however*, we are deeply concerned about the results of opening up such habitat. Once one road has been built into the area north of the Brooks Range, there will be no end to disturbance and exploitation. We can foresee the construction of several arterial roads to other areas. Hopefully some policy for prudent action will guide the impending exploitation of the Arctic.

### **Interior Arctic Barrenlands**

Richard Fyfe and R. Semeniuk, investigators.

Of all the Peregrine populations which have been investigated in Canada no other has been studied as closely by biologists or for as long a period of time as those nesting along the rivers and on the lakes of the interior barrens. A few of these sites have been known since the late 1930's, some have subsequently been under observation by biologists of the Canadian Wildlife Service more or less since 1951, and a majority of the sites has been checked annually since 1962.

The current survey was carried out with a single engine float-equipped Beaver aircraft, together with a rubber inflatable boat, which enabled us to visit eyrie locations despite generally low water levels.

Four of the eleven previously known sites were found to be occupied by pairs of birds, three of these successfully raising at least eight young to 3-4 weeks of age. One new site was found with three young. No addled eggs were found.

Table 2 shows that the Peregrine population of the interior barrens has continued to decline during the past three years with 1970 being no exception. As elsewhere production by successful pairs was good, the most obvious trend in the area being the gradual yet steady decline in the number of breeding pairs. In most instances the demise of a specific pair has been announced by a complete nesting failure at the site during the final year of occupancy.



## Ungava

Daniel D. Berger, Robert W. Risebrough, and Robert B. Berry, investigators  
(prepared by T. J. Cade).

A region in northern Ungava has been surveyed by several investigators each year since 1967, when D. D. Berger and J. W. Weaver located 14 active Peregrine sites. The two most intensively worked seasons were 1967 and 1970 (see Table 2). In 1970, 15 sites were checked between 25 July and 15 August; 12 of these were formerly known, 3 were new, while 4 previously known eyries were not examined. Of the 15 eyries visited, 3 were occupied by single adults and 9 were occupied by pairs, of which 7 had a total of 12 young and 9 addled or cracked eggs. The high percentage of bad eggs in these nests is noteworthy and fits the general pattern found in other northern Canadian and Alaskan populations in the last three years. By comparison the 14 nests in 1967 contained 34 eggs or young, of which only 5 were addled or broken eggs (D. D. Berger and J. W. Weaver).

With the exception of a single ptarmigan, prey species were limited to small passerines at the 5 eyries Berry examined. He identified remains of Horned Larks, Snow Buntings, and Water Pipits in all these eyries. These passerines were encountered infrequently in individual family groups. They were never observed to pass over water or to leave the sanctuary of rocks and grasses. Thus, the problems confronting a hunting Peregrine in mid-summer in this region appear formidable; and it may be that the reason most eyries are coastal or insular is that such locations offer both adults and fledged young more frequent encounters with spring and fall migrants, which follow shorelines.

## Southern Baffin Island

James D. Weaver and James W. Grier, investigators.

Several previous reports have indicated the presence of Peregrines on southern Baffin Island (see review by R. Fyfe in *Peregrine Falcon Populations*, J. J. Hickey, ed., 1969), but most of these give only scattered observations with general descriptions of locations, little data on reproductive success, and varying impressions

about the abundance of Peregrines in the region. We surveyed the area for eyrie sites from 1 July through 8 August, 1970, the period when young eyasses are present and the sites likely to be most conspicuous. Our survey was conducted under contract with the Canadian Wildlife Service, with whom a detailed report has been filed.

During approximately 1200 miles of travel by boat, we located and checked seven eyrie sites and saw one additional Peregrine. Adult Peregrines occupied five of the sites. Two of these sites contained healthy young (three at one site and two at the other) approximately four weeks old when last checked. Another site contained two young that died, one at hatching and one just after. The hatching dates of the dead young occurred during a severe storm with heavy rain and winds estimated at over 30 m.p.h. with the eyrie ledge facing directly into the wind. These hatching dates were also approximately three weeks later than at the two sites with healthy young. The female at the site that failed appeared to be only two years old, as she had a few dark feathers on her breast and brown feathers on her back. Of the other two sites with adults present, one had a fresh scrape that the pair only weakly defended, and the other had a fresh scrape with recently molted adult feathers in the vicinity but no adults were actually seen. At the latter site a freshly constructed but unused Raven nest was situated about thirty feet from the Peregrines' main perch and an old scrape.

Weather conditions during June and July 1970 were not favorable to Peregrine reproduction, with means of daily maxima and minima being the lowest on record for June and well below normal in July. Record amounts of snowfall and days with snow occurred for both June and July, and the ice went out over a week later than average. Cloud cover and precipitation were much greater than normal in July, and prevailing winds during July were S.S.E. rather than N.W. (courtesy Frobisher Bay weather office, records since 1946). Hagar (*in* "Peregrine Falcon Populations", J. J. Hickey, ed., 1969) has previously discussed the vulnerability of Peregrines to poor weather. Such conditions



probably accounted for the death of the two young at hatching and may have been involved in the apparent failures at the other two occupied sites. The presence of the young, possibly inexperienced, female at one site and a Raven nest in the immediate vicinity of another site do not help clarify the picture. Any assessment of the effects of contamination from pesticides and other pollutants awaits analysis of eggshell fragments, dead young, and prey that were collected.

An assessment of the *abundance* of Peregrines on southern Baffin Island is extremely difficult. Previous indications are conflicting; e.g., Soper (*Auk*, 63: 224, 1946) described it as rare and only nesting sparingly throughout the region, whereas Macpherson and McLaren (*Canadian Field-Naturalist*, 73: 74, 1959) believed they were more common. We did not find birds at some of the places reported by Macpherson and McLaren (e.g., Dorset Island, Negus Bay), and this could mean a decrease in abundance; however, all of the previous reports are based on only a few observations, and no conclusions on *changes* of abundance can be drawn. It is clear to us that Peregrines were *not* abundant during 1970 in the areas we checked. It is possible that Peregrines are more abundant at the numerous lakes inland from the coast, but significant portions of such areas are logistically impractical, if not impossible, to survey.

In conclusion, the reproductive success of those birds that were found (avg. 1 young/occupied site) is low. In view of the abnormal weather conditions and the small number of observations, this rate may not be alarmingly low; but only a few Peregrines were observed, and regardless of how one views the success rate, the actual number of young added to the population from this region in 1970 was small.

### Northern Alaska

John R. Haugh, investigator.

The following is a report of an investigation conducted along a section of the Colville River on Alaska's Arctic Slope. The study area has previously been described by Cade (*Univ. Calif. Publ. in Zool.* 63: 151-290, 1960).

Logistic support for this survey was provided by the State of Alaska Department of Fish and Game. Mr. Brian S. Cade assisted with the field work and observations.

Along the Colville we found 5 pairs of Peregrines with young. Peregrines were also found on 5 additional cliffs, but these birds either did not nest or had nest failures prior to our arrival. The mean number of young at the active eyries in 1970 was 2.0. This compares with 2.2 in 1967, 2.6 in 1968 and 1.9 in 1969 (T. J. Cade, unpublished reports to AINA). Since the surveys were made at approximately the same times, these figures are reasonably comparable. While the reproductivity per successful pair in 1970 was about the same as in previous years, fewer pairs of birds were successful in 1970, and only 10 young were still in the nests at the time of our survey. This compares with 22 in 1967, 21 in 1968 and 19 in 1969, for the same stretch of river. The number of young produced in 1970 along the surveyed area was lower than expected, based on previous observations, and most of this reduction resulted from fewer successful pairs rather than from a reduction in the number of young per pair.

Table 5 compares the 1970 nesting success of the Colville Peregrines with nesting success along the same stretch of river in 1967, '68 and '69.

The reason for the poor success of the Peregrines along the Colville is not readily apparent. Severe or abnormal meteorological conditions may have influenced reproductivity by delaying the beginning of the nesting period or by increasing mortality among the young. Delayed nesting is also suggested by the fact that most of the young falcons along the Colville were about a week later in their development than in 1967, '68 and '69. Moreover, our observations that other birds (shorebirds, waterfowl, and passerines) seemed to be fewer in numbers in 1970 than in previous years also lend support to the hypothesis that some widespread environmental factor may have influenced avian reproductivity on the Arctic Slope in 1970. Cade (unpublished observations) noted



TABLE 5. — Peregrine Nesting Success along the Colville River 1967 – 1970

Cliff No.	Number of Young Observed in Eyries During Surveys in Late July and Early August			
	1967	1968	1969	1970
1	1	3	0	1
2	2	1	0	—
3	—	—	1	—
4	—	0	—	—
5	—	0	2	3
6	3	3	3	0
7	3	0	2	2
8	0	0	2	0
9	2	0	—	0
10	—	—	2	—
11	0	0	3	—
12	0	1	2	—
13	1	3,0	0,0,0	0
14	—	—	0	—
15	1	0	0	—
16	—	0,0	0,1,0	2
17	3,4,2	3,3,0	0	0
18	0	4	1	2
Totals	22	21	19	10

(—) = cliff unoccupied by Peregrines.  
 (0) = pair present; no young.  
 If more than one pair per cliff, pairs are separated by commas.

large scale mortality among young falcons on the lower Colville in 1969, and he considered a plausible cause to be extended cold weather accompanied by rain and snow during late July and early August.

An alternate explanation for the poor breeding success of the Colville Peregrines in 1970 might lie in the levels of chlorinated hydrocarbon residues which are known to be quite high in arctic falcons (unpublished data collected by Cade and associates). Cade, White and Haugh noted that Alaskan falcons may be perilously balanced near the threshold level of organochlorine residues that initiates dysgenic reproductive behavior and eventual population decline (*Condor* 70: 170-178, 1968). The poor reproductive success of the arctic Peregrines in 1970 may reflect the exceeding of this “threshold level” by a part of the population breeding

along the Colville. Since the arctic Peregrines constitute one of the few substantial breeding populations of this species remaining in North America, the 1970 observations give cause for concern. The Colville falcons certainly should be watched closely over the next few years, for the extinction of this population in the 1970’s cannot be ruled out.

I would like to thank Dr. Tom J. Cade for allowing me to use previous data collected along the Colville and for his advice on this project. This study was also supported by the New York Zoological Society.

### Langara Island, Queen Charlotte Islands

R. Wayne Nelson, investigator

The production of 11 flying young from six occupied sites on Langara Island (an average of 1.83 flying young per occupied site) is probably the greatest number since the early 1960’s (Table 6). With some shifting of the actual cliffs or ledges used, it appears that the same areas have been occupied for a number of years now, at a somewhat stable, reduced level from that observed in the mid-1950’s (F. L. Beebe, *Condor* 62: 145-189; 1960), which was about 15 eyries. The decline on Langara resulted from the disappearance of some breeding pairs in the Cloak Bay area as well as pairs in other areas on the island. The presence of two first-year females in the six pairs in 1969, and the single adult at one site in 1970, are definite suggestions that the turnover rate of adult falcons is rather high, certainly higher than one would expect in a “natural” situation.

In general it can be said the Peregrine Falcons on Langara Island experienced an improved year, especially as concerns their production of young. On the other hand, the seabird situation, which ultimately affects the falcons greatly, does not appear at all good, and some very drastic changes in numbers appear to have occurred in recent years.



TABLE 6. — Occupancy and productivity of Langara Peales Peregrines

Year	Occu- pied sites <sup>1</sup>	No. of success- ful pairs	Young fledged	Prod. per suc- cessful pair	Prod. per total Occu- pied
1968	5	3	6 <sup>1</sup>	2.0	1.2
1969	6	3 <sup>2</sup>	6	2.0	1.0
1970	6 <sup>3</sup>	5	11	2.2	1.8

<sup>1</sup>Total number fledged in doubt, 6 young known to have fledged; 3 believed to have been poached.  
<sup>2</sup>2 pairs contained immature ♀♀ which apparently did not lay.  
<sup>3</sup>1 site occupied by a single adult.  
<sup>4</sup>Based on a survey of all known sites on the island.

The Aleutian Islands

Clayton M. White, investigator.

This report summarizes the first detailed study of Peregrines in the Aleutian Islands, Alaska. The studies were made on Amchitka Island, which is situated in the North Pacific between 51° and 52° N. Lat. and is an island of treeless tundra. I observed nests from May to July in 1969 and from mid-May to mid-June in 1970.

Fifteen pairs and two apparently unmated adults defended shoreline territories in 1969. Mean distance between pairs was about 5.3 straight-line miles. In 7 nests, examined during the incubation period, clutch size averaged 3.14 eggs. Nesting success could be determined at only 11 eyries, which fledged 15 young or about 1.36 per nest. Most observed nestling mortality was apparently caused by human activity.

Young began flying near the end of June, and there was near synchrony in dates of leaving the nests. Where nest loss occurred there were no renesting attempts.

About 75% of the prey, May through July, was small alcids of five or perhaps six species. Land birds became more common as prey shortly before the young flew and during the fall, according to the observations of others.

In 1970, 19 cliffs were occupied by adults although two were being held as territories by apparently single birds. Data on nest contents could be obtained from only 13 nests. At one nest one egg was laid and the nest then deserted. The remaining 12 nests contained an average of 3.41 items (eggs or young) in mid-June. I left the island before fledging success could be determined.

Extrapolations from Amchitka population density, from ecological similarities between Amchitkan and other marine Peregrine populations, and from the physiography of the islands suggest that 300 breeding pairs could inhabit the Aleutian Chain. Whatever the actual figure, there is no doubt that the Aleutian Islands provide one of the last remaining strongholds for this species on the North American Continent.

This study was supported by the Atomic Energy Commission through contract to Batelle Memorial Institute.

Epilogue

Many of us like to think there are vast stretches of Canada and Alaska that are still pristine, undisturbed wilderness, providing a haven in which Peregrines can thrive indefinitely. It is sad and frustrating to come to the realization that for all their magnificent appearance of unspoiled beauty, our boreal forests and tundras are chemically polluted environments, at least as far as the Peregrine is concerned. Indeed, the world is a chemically polluted environment. These persistent chlorinated chemicals, which have a worldwide distribution more ubiquitous than that once enjoyed by the Peregrine itself, constitute a perturbation of the environment to which the falcons cannot make adaptive responses. And so the Peregrine continues to disappear at a rate that could bring it to extinction in North America in this decade.

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