

**The Response of Peregrine Falcons
(*Falco peregrinus*) to
Aircraft and Human Disturbance**

March 1977

by
Jim Windsor



Canadian Wildlife Service
Mackenzie Valley Pipeline Investigations

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THE RESPONSE OF PEREGRINE FALCONS (*Falco peregrinus*)

TO AIRCRAFT AND HUMAN DISTURBANCE

MARCH, 1977

Jim Windsor

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The data for this report were obtained as a result of investigations carried out in 1972-73 under the Environmental-Social Program, Northern Pipelines, of the Task Force on Northern Oil Development, Government of Canada. While the studies and investigations were initiated to provide information necessary for the assessment of pipeline proposals, the knowledge gained is equally useful in planning and assessing other development projects.

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1. INTRODUCTION

Increased accessibility and aircraft activity associated with development of Canada's arctic and sub-arctic regions have the potential to adversely affect nesting populations of several avian species. Recent short-term studies conducted by LGL Limited (Gunn and Livingston 1974) have shown that aircraft and human activity can disrupt the daily patterns of behavior and reproductive success of some passerine, waterfowl and larid species. Although there has been much empirical evidence to indicate that raptors are particularly sensitive to disturbance near the nest site (Fyfe and Olendorff 1976; Platt 1974), few studies have attempted to experimentally define the distance at which the disturbance is realized. Junemann *et al.* (1972, cited in Snow 1973 and Jacobson 1974) found that the reproductive success of bald eagles was inversely related to the amount of disturbance occurring within 1 mi (1500 m) of the nest site. Gerrard *et al.* (1973) and Ellis (1973) showed that disturbance originating closer to the nest site may not affect the apparent reproductive success but can cause the adults to be less attentive to eggs and young, thereby resulting in altered growth rates, and possibly, increased post-fledgling mortality. During experimental aircraft disturbance of gyrfalcons (*Falco rusticolus*), Platt (1974) observed that the birds "...attempted to flee from overflights conducted at 500 feet [150 m] to alter their normal behavioral patterns for

short periods after these overflights and to adopt stress postures during overflights conducted at 1000 feet [300 m]"

Following Platt's (*Ibid.*) general experimental design, a population of peregrine falcons (*Falco peregrinus*) in the Campbell Lake Hills area, Northwest Territories was subjected to disturbance from hikers and low-flying aircraft. An attempt was made to determine the amount of disturbance caused by these activities and to define the minimum distances at which no disturbance occurs.

2. STUDY AREA

The Campbell Lake Hills (68°08' - 68°19'N and 133°18' - 133°50'W) is a rocky upland area (Fig. 1) which reaches elevations of over 120 m and stands out as a prominent feature above the flat Mackenzie Delta to the south and west, and Campbell Lake to the east. Extensive faulting, folding, and fluting of the dolomitic limestone has led to the development of several, and in some cases hundreds, of meltwater ridges, rocky outcrops, steep scarp slopes and winding canyons. Small clear-water lakes occupy the faulted valleys or are perched in steep-sided rocky basins. Shallow closed depressions on the upland plateau are covered with sedge meadows and black spruce (*Picea mariana*) - muskeg communities. Terraced slopes and dry plateaus are dominated by an open woodland of white spruce (*Picea glauca*), black spruce, larch (*Larix laricina*), paper birch (*Betula papyrifera*) and a discontinuous mat of lichens and ericaceous shrubs.

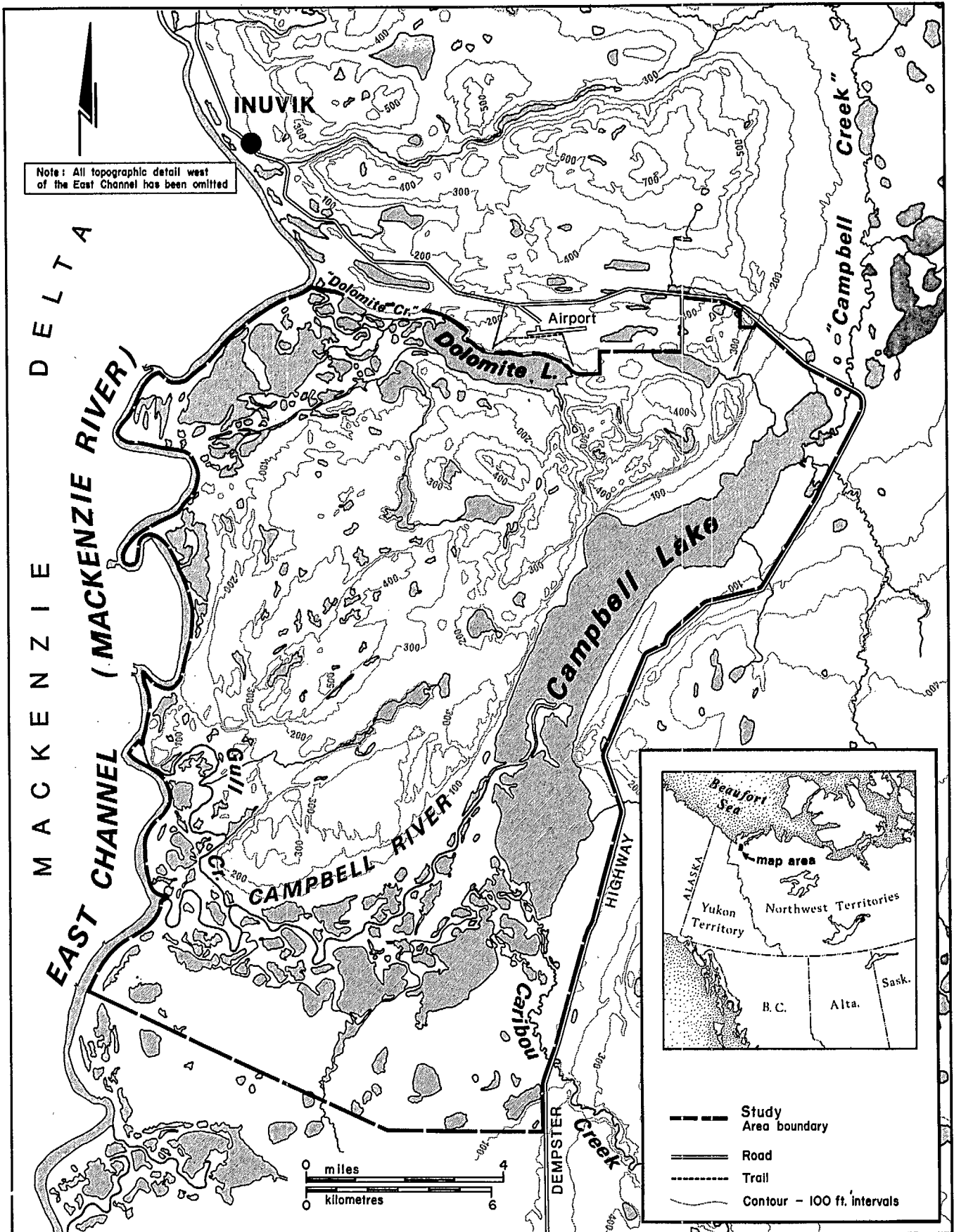


Fig. 1. Location of the Campbell Lake Hills study area.

3. DISTURBANCE BACKGROUND

In 1974, the area provided nesting habitat for nine breeding pairs, one lone female, and two (possibly three) non-breeding pairs of peregrine falcons. This population is potentially exposed to much disturbance from low-flying aircraft because the Inuvik Airport borders the north end of the study area. Four pairs of falcons nest within the Inuvik Air Traffic Control Zone and two other pairs nest within 800 m of its boundaries. The number of aircraft movements in the control zone during the summer months of 1974 were: May, 3776; June, 3883; July, 3970; August, 4974; and September, 4818 (Lamoureux personal communication). Aircraft, especially small helicopters, frequently fly low over the area when there is a low cloud ceiling or heavy Aeradio traffic (Laurie personal communication).

Human disturbance is mainly associated with recreational and quarrying activities. Recreation is generally confined to the north end of the study area. Canoeing, fishing and picnicing are the main summer recreational activities while cross-country skiing and snowmobiling occur during the winter and spring months. Hunters frequent the surrounding delta area in the fall, but few people actually hunt in the hills themselves. Eight cabins on the shore of Dolomite Lake are estimated to have a combined total of more than 250 man-days use per summer month, and one recreational cabin on the west shore of Campbell Lake is located less than 180 m from an active peregrine

eyrie. Although human disturbance has been somewhat subdued in past years, one adult peregrine was shot at Longcliff Eyrie in 1972, two young were taken from Cabin Eyrie in 1969 and, recreational and quarrying activities caused (what appears to be) permanent abandonment of an eyrie in 1970 (Canadian Wildlife Service raptor nest record files - Campbell Lake Hills Area, Inuvik, N.W.T.). Human disturbance is expected to increase several fold during the summer of 1975. A boat dock has recently been constructed near the junction of "Campbell Creek"¹ and the Dempster Highway. This will afford easy access to the area and is bound to encourage short-term recreational use.

¹Vernacular name only.

4. METHODS

By observing a nest site for 2 days (31 May and 1 June), it was determined that both adult birds were likely to be present between 10:00 and 14:30 hours MDT. Whenever possible, disturbance tests were conducted during this time period.

A Cessna 185 fixed-wing airplane (Fig. 2) and a Bell 206B Jetranger helicopter (Fig. 3) were flown 140 m in front of, and parallel to, the cliff face at altitudes of 300, 150 and 75 m above the nest. Airspeeds for fixed-wings and helicopters were approximately 160 - 180 kph and 145 - 160 kph, respectively. A 20-minute time interval was allotted between successive overflights at different altitudes and at least a 1-day interval was allotted between fixed-wing and helicopter overflights. The birds' reactions to overflights were observed from a blind positioned 60 - 150 m from the nest site. Tape recorders and spotting telescopes facilitated recording of observations.

Human disturbance tests consisted of a straight-line approach by foot towards the eyrie¹ and at right angles to the cliff face.² Behavioral observations were recorded by the person approaching the

¹Eyrie (or aerie) refers to the cliff nest of a predatory bird.

²The nature of the topography surrounding Bearskull Eyrie precluded such an approach. Approaching hikers walked parallel to the cliff face.



Fig. 2. Float-equipped Cessna 185 airplane.



Fig. 3. Bell 206B Jetranger helicopter.

nest, or by an observer pre-positioned in a blind. In the latter instances, two-way radios were used to communicate to the observer the distance of the hiker from the cliff base.

Controlled disturbance activities were conducted during mid-incubation and early post-hatching periods, and just prior to fledging of the young. During each of these periods, two different eyries were tested; however, observations were also made of non-controlled overflights resulting from normal air traffic associated with the nearby Inuvik Airport.

The birds' reactions to aircraft overflights were rated on a one-to-five scale as described below:

- 1) The bird completely ignored the aircraft.
- 2) The bird occasionally glanced at the aircraft.
- 3) The bird stretched its neck and cocked its head as it listened to and searched for the approaching aircraft, or moved its head from side to side, or continuously stared at the aircraft.
- 4) The bird rapidly jerked its head from side to side, or gave intention movements of flight - crouching with chest lowered, tail raised, tarsi bent and wings slightly unfolded - or bobbed its head up and down, or cacked, or changed perches, or quietly flew away.
- 5) The bird rapidly flushed off the perch or nest ledge.

These criteria only represent general guidelines on which the

observer can quantify the amount of stress observed; they do not make a distinction between stress expressed as fearful or aggressive behavior.¹ Although cackling vocalizations and pursuit of an aircraft can be considered to function in an aggressive context, aggressive and fright components of behavior cannot be readily assigned to "incomplete actions" such as intention movements of flight or various head movements.² Therefore, the actual ratings assigned to a given response were based on the author's interpretation of the intensity and duration of the reactions and their relation to the behavior observed prior to the approach of the aircraft.

Because of the rare and endangered status of peregrine falcons and because of their known sensitivity to human disturbance, caution was exercised in carrying out disturbance tests. Visits to nest sites and scheduled overflights were avoided during the early stages of the reproductive cycle when abandonment is most likely to occur. Disturbance tests were not conducted during unusually hot or cold weather in order to prevent desiccation or chilling of eggs and young. The duration of disturbance tests were kept to a bare

¹Aggressive behavior is a function of the progressive buildup of territoriality and tends to override the fear response as the reproductive cycle progresses. It appears that aggression becomes readily expressed following the initiation of egg laying, wanes slightly during the hatching period, and reaches a peak during the late nestling period.

²Under normal conditions, side to side and cocking movements of the head are associated with visual parallax localization and auditory directional discrimination (Pumphrey 1961; Welty 1962).

minimum to avoid possible alterations in daily behavior patterns, although such alterations may have occurred. Aircraft used in experimental overflights and hikers (exception - hiker at Cabin Eyrie on 27 June) were prevented from approaching an eyrie from above and behind the cliff face.¹ Hikers were advised to terminate their approach if the behavior of the young suggested a possible premature flight attempt.

Observations made before and after disturbance tests were short-term (usually less than 1 hour). The experimental design of this study therefore precludes the detection of possible alterations in daily behavioral patterns and is based upon the more obvious observable characteristics of disturbed behavior.

¹Because peregrine falcons often position eggs and small young on their feet during incubation and brooding, the sudden appearance of a person, aircraft or predator can cause an incubating or brooding bird to flush from the nest, resulting in eggs and young being thrown off the nest ledge (Cade 1960; Nelson 1970, White *et al.* 1973; Fyfe personal communication).

5. RESULTS

The results of all overflights are presented in tabular form in Appendix A and in note form in Appendix B. Only those overflights which conformed to the altitudinal and horizontal distances prescribed for controlled overflights (see methods) are presented in Table 1.

Although several falcons exhibited stressful behavior during overflights, there was only a 2% to 8% difference in the hatching success and a 0% to 8% difference in the fledging success between eyries subjected to controlled disturbance and those which were not (Table 2). The only nest abandoned was the one considered to be the most exposed to aircraft movements and weather conditions.¹ Analysis of an addled egg from the abandoned nest revealed very high pesticide residue levels.

Eighteen percent of the controlled overflights which occurred during the incubation period resulted in substantial disturbance to the birds.² This occurred only at the 150 m level tested. Later on in the season, during the nestling period, a similar amount of

¹The birds at this eyrie were even disturbed by aircraft taking off from the Inuvik Airport located 5.5 km away (overflight #26). Abandonment occurred within a 2-week period following a week of wet, snowy weather. This nest was located on an exposed rock chimney which jutted out from the main cliff face.

²The author considers a value of 3.5 or greater to denote substantial disturbance.

TABLE 1. Peregrine falcon response to selected aircraft disturbance*.

Eyrie Name	Aircraft Type & Altitude						Stage of Reproductive Cycle
	Bell 206 Jet Helicopter		Cessna 185 Airplane				
	300	150	75	300	150	75	
Catwalk				F2p**, F1p			early incubation
Catwalk	F3i	F3.5i		M2p, F1i			mid-incubation
North End	M1i	M1i	M1i	M1i, F3p	M1i, F2p	M1i	mid-incubation
Catwalk				F2i	F3.5p	F3i	late incubation
Bearskull	M3p, F1i	M4p, F2i, F3i	F1i				late incubation
Bearskull	M3p, F3p	F5p	F3p	F2p	F2p	F5p	1 - 7 days after hatching
Hole	F3.5p	M3.5p, F4p		F4b	F3b	F4b	1 - 10 days after hatching
Arid	M3.5p, F1.5p	F4p	F5p	M3p, F3.5b	M5p, F3.5b	M3p	2/3 fledged
Fortress		F2.5p	F2.5p	F3p	F2.5p	F3.5p	1 - 7 days before fledging
Arid	Yng3.5		Yng2.5p F5p	Yng4.5p	Yng4.5p	Yng4.5p	1 - 7 days before fledging

* Refers to overflights which conformed to the altitudinal and horizontal distances prescribed for controlled overflights (see methods).

** See methods (page 9) for response ratings.

i Bird incubating at beginning of test.

p Bird perched at beginning of test.

b Bird brooding at beginning of test.

Yng Young

M Adult male.

F Adult female.

TABLE 2. Reproductive success versus exposure to controlled aircraft disturbance.

Exposure to Controlled Overflights	Eyrie Name	Number of Eggs Laid	Number of Eggs Hatched	Number of Young Fledged
Yes	North End	4	3 or 4	3
Yes	Fortress	2	2	2
Yes	Bearskull	4	4	4
Yes	Hole	4	4	4
Yes	Arid	2	2	2
Yes	Catwalk	<u>2</u>	<u>0 (Eyrie Abandoned)</u>	<u>0</u>
		18	15 or 16	15
			% of eggs that hatched 83 or 89	% of young that fledged 94 or 100
No	Longcliff	3	3	3
No	Cabin	4	4	4
No	Big Hump	<u>4</u>	<u>3</u>	<u>3</u>
		11	10	10
			% of eggs that hatched 91	% of young that fledged 100

disturbance was observed during 63% of the controlled overflights and at all altitudes tested.

The distance at which the birds exhibited stressful behavior in response to approaching hikers varied from the eyrie cliff base itself to 1500 m from the cliff base and was generally the greatest during the nestling period (Appendix c).

6. DISCUSSION

Missing values for planned overflights and the inconsistent reactions of the birds provide no basis on which to predict the amount of disturbance that might be caused by aircraft at a given altitude or, to define the minimum altitudes at which no disturbance occurs. For instance, on two different occasions during 31 May, a Cessna 185 airplane at 300 m above and 140 m in front of the nest (overflights #9 & #11) elicited only a slight response from the perched adult male at Catwalk Eyrie. On 1 June, a Twin Otter flying 60 m directly above the nest yielded similar results; however, on the same day, a Cessna 185 at 300 m above and 2500 m away from the eyrie (overflight #2) caused substantial disturbance to the SAME perched bird. Similar examples of this apparently inconsistent behavior can be seen from the results in Appendix A and by comparing overflights 14, 15 and 19; and, 33, 34 and 35.

Factors which might account for the variability observed during overflights and human disturbance tests are described below:

- 1) Individual differences in the disposition of the birds were obvious. Adult females were usually the first birds to initiate diving on an intruder and were generally more aggressive than their mates.

The adult female at Bearskull Eyrie was consistently the most aggressive bird towards human intruders and was

the only bird which attempted to attack the aircraft. Most birds would terminate aggressive behavior once an intruder took a few dozen steps away from the nest site. However, the adult female at Bearskull would continue to dive upon an intruder until he was several hundred metres from the eyrie. On one occasion, this bird followed the author for approximately 800 to 1200 m before she quit diving.

- 2) The nature of the topography around the nest site and the aspect of aircraft approach were also suspected to be responsible for some of the observed variability.

Several high scarps surrounding Bearskull Eyrie made it possible for a person to approach the nest site from the north without (apparently) being detected until one was within 55 - 60 m of the cliff base. On the other hand, Longcliff Eyrie was positioned on an escarpment which afforded the birds an unobstructed view of several square kilometres. Early in the reproductive cycle, a person standing directly below the eyrie at the base of the cliff had to make loud noises before the birds would leave their perch or nest ledge (Appendix C - 4 June). However, later in the season, when territoriality was obviously well-developed, these birds reacted strongly to hikers more than a kilometre away (Appendix C - 23 July).

It was observed at most eyries that the cliffs greatly amplified the aircraft noise. During some overflights the observer had the impression that the greatest amount of disturbance occurred when an approaching aircraft could (apparently) be heard but not seen by the birds. Whereas, in other instances, the cliffs were suspected to increase the "Doppler Effect", and consequently reduce the noise level of aircraft which suddenly appeared over the top of a cliff ledge.

During a controlled overflight (#48), interference from a Cessna 180 fixedwing flying at 300 m above and 2500 m away from the eyrie was suspected to be responsible for most of the observed disturbance. This aircraft was undergoing a pitch transition during descent and was very noisy. A similar noise level was later simulated with a Cessna 185 (overflight #'s 80, 81 & 82). Substantial disturbance occurred at the 150 m and 75 m altitudes tested.

- 3) It was found that birds which were perched during the beginning of the test were more likely to be disturbed than those which were incubating, and that perched males were more susceptible to disturbance than perched females (Table 3).
- 4) While searching for nest sites, the author found that

TABLE 3. Comparison of the response of adult peregrine falcons to aircraft overflights**.

Overflight Number	Incubating Male	Perched Male	Incubating Female	Perched Female
5	1			3
6	1			2
8		3.5		3
12		2		1
13		1		2.5
16		3	1	
17		1	1	
19		3.5	1	
20		2	1	
27		1	1	
28		2	1	
32		1	2	
33		3.5	2	
45		3.5	3.5	
46		3	1	
47		2	1	
48		4	2	
58		3		3
62		3		3.5
63		5		3.5
65		3.5		1.5
74		3.5		4
Total	2	56.5	17.5	28.0
Mean	1	2.7	1.4	2.5

* Response varies from 1 to 5 from the lowest to greatest amount of disturbance.

+ Refers only to overflights where both birds were present and clearly in view.

rough-legged hawks were less likely to flush off the nest during cold, windy weather. Perhaps this is also true of peregrines.

- 5) The time interval between successive overflights at different altitudes may not have been long enough. During successive overflights, the birds occasionally showed a greater response to aircraft flying at higher altitudes than lower altitudes (compare overflight #35, 36 and 38; and, 76, 77 and 78).
- 6) Observations by a person pre-positioned in a blind were suspected to detect disturbance from hikers at far greater distances than that which was recorded by the person approaching the eyrie. For instance, a person approaching North End Eyrie on 12 August (Appendix C) would probably not have noted any disturbance until the bird cacked when the hiker was approximately 350 m from the base of the cliff. Through the use of an observer in a blind, however, disturbance was detected when the hiker was approximately 600 m from the base of the cliff. At Arid Eyrie (20 August) however, the detection distance for the two methods was the same since the bird never showed any sign of disturbance until it started cacking.
- 7) Variations in the amount of previous exposure to low-flying air traffic may account for some behavioral differences

between birds at different eyries. From conversations with Inuvik Airport personnel, it was determined that North End, Longcliff, Cabin, Fortress and Catwalk eyries were probably subjected to more air traffic in general and much more low-flying air traffic than other eyries.

With the exception of Bearskull and Longcliff eyries (on 16 June and 23 July, respectively), the birds did not react to hikers which were more than 600 m from the base of the cliff. Therefore, if hiking trails are to be established in the area, they should be kept approximately 1600 m from the eyrie if visible from the nest site and be no closer than 800 m from the eyrie when not visible from the nest site.¹

Analyzing behavior in terms of the distance at which birds reacted to hikers and the quantification of the response to aircraft disturbance may be somewhat ambiguous. The fact that the birds consistently showed a greater reaction to disturbance activities later in the reproductive cycle suggests that the observed response is, at least in part, an expression of the progressive buildup of territoriality. If the birds are exposed to disturbing activities early in the reproductive cycle when attachment to the nest site and pair-bond formations are still weak, abandonment of nesting

¹The distance at which birds react to hikers should not be equated with the distance at which camping activities cause disturbance.

activities could occur when there is little observable evidence of disturbance.¹ Even if substantial disturbance is repeatedly observed during a given season, and the reproductive success of the disturbed birds varies little from that of the undisturbed birds, there may be a threshold level of disturbance at which the birds do not attempt to nest, choose alternate nest sites, or have reduced success in the following season. Therefore, the minimum distances that potentially disturbing activities should maintain from peregrine falcon nests should be based (from at least 2-year data) on the maximum distances at which they elicit stressful behavior in the birds. It appears that the greatest response will be observed during the late nestling period when territoriality is strongest. The detection of disturbance should not be based entirely on short-term behavioral observations as was done in this study. Quantifiable aspects of behavior observed before and after disturbance tests should be compared to the daily patterns of behavior observed at nest sites not subjected to experimental disturbance.

¹Stress on the pair-bond was evident during a human disturbance test at North End Eyrie on 6 June. The adult female tried to land on the same perch as the male and displaced him with obvious redirected aggression.

7. CONCLUSIONS

Based on the facts that the Campbell Lake peregrine falcon population has been previously exposed to aircraft and human activity and that disturbance tests were carried out in such a manner as not to jeopardize the success of the birds, the following conclusions can be drawn from this study:

- 1) There was no significant difference between the reproductive success of birds exposed to controlled overflights and those which were not.
- 2) The birds were usually not disturbed by low-flying aircraft during the stages of the incubation period tested, but substantial disturbance did occasionally occur at the 150 m level.
- 3) During the nestling period, substantial disturbance occurred at all altitudes tested and during 63% of the controlled overflights.
- 4) It was not possible to define the minimum distances at which low-flying aircraft caused disturbance. Similar disturbance tests in other areas of the arctic (with slight revisions in methods) are needed (see recommendations).
- 5) The distance at which the birds first exhibited stressful behavior in response to approaching hikers varied from the cliff base itself to 1500 m from the cliff base and was generally greatest during the nestling period.

- 6) Birds that were perched during the beginning of the test flights were more likely to be disturbed than those which were incubating. Perched males were more susceptible to disturbance than perched females. Other factors which may have contributed to the marked variability observed during the disturbance tests include; the nature of the topography surrounding the nest site, individual differences in the disposition of the birds, the aspect of aircraft approach, weather conditions and variations in the amount of previous exposure to human and aircraft disturbance.

8. RECOMMENDATIONS

- 1) Liason should be established with the Ministry of Transport in an effort to minimize disturbance to peregrine falcons by low-flying aircraft. Tentatively, whenever it is FEASIBLE and SAFE to do so, low-flying aircraft should be rerouted around the area and all other aircraft - especially jet and turbo-jet fixedwings - should maintain an altitude of 750 m above sea-level over the area. Pending further research and the successful definition of a minimum altitude at which disturbance does not occur, aircraft could fly lower over the area.
- 2) Hiking trails could be established in the area provided they are kept approximately 1500 m from the eyrie if visible from the nest site and be no closer than 800 m from the eyrie when not visible from the nest site.
- 3) Whereas interference from nonscheduled aircraft was encountered during controlled overflights, and whereas the Campbell Lake peregrine falcon population may be at least partially habituated to aircraft and human activities, it is proposed that further comparative tests be conducted in other areas of the arctic.
- 4) Whereas substantial disturbance occurs from normal air-traffic movements in the area¹, and whereas it was not possible to

¹There were a number of uncontrolled overflights which were equal to (Appendix A), and in some cases, closer than (Appendix B), the distances prescribed for controlled overflights.

define the minimum altitudes at which no disturbance occurs, it is proposed that future studies be conducted in the Campbell Lake Hills area.

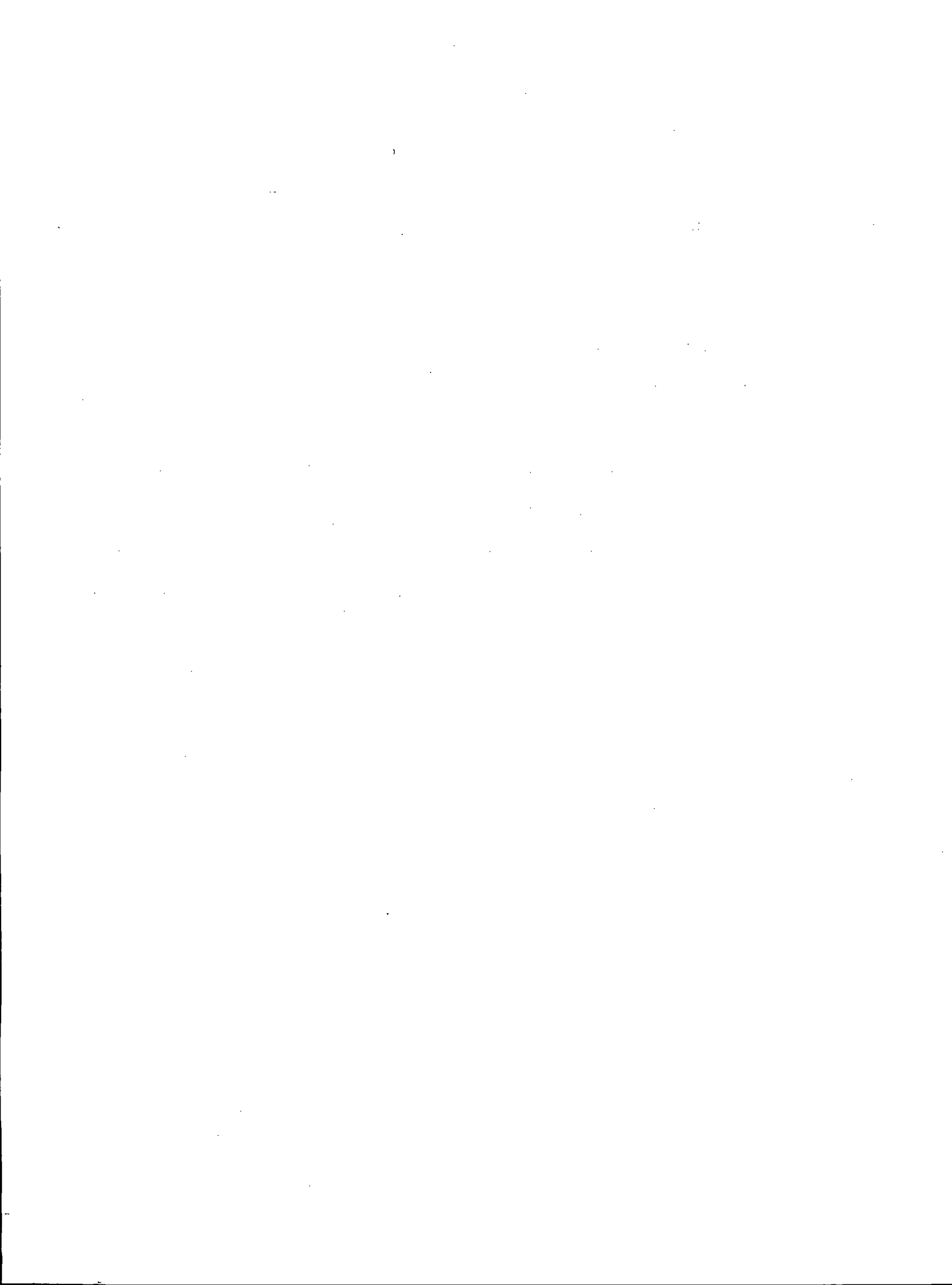
In order to eliminate biases arising from potential differences in habituation between eyries, records of air-traffic movements over the study area should be analyzed prior to selection of nest sites to be exposed to overflights.¹ Quantifiable aspects of behavior observed before and after disturbance tests should be compared to the daily patterns of behavior observed where no disturbance occurs.

- 5) More time should be allotted between successive overflights and/or the sequence of the various altitudes tested should be altered.
- 6) Because disturbance occurred at all altitudes tested, experimental overflights should be done at higher altitudes.
- 7) Because it was difficult for one person to approach an eyrie and at the same time observe and record detailed behavior, future human disturbance tests should always be conducted with two people - one person to approach the eyrie and one person to record observations from a blind.
- 8) The distance at which birds respond to hikers should not be equated with the distance at which camping activities cause

¹This data is available from the Inuvik Airport, pending approval of its release by the Ministry of Transport.

disturbance. In order to test the latter possibility, camps should be established at approximately 1500, 1200 and 900 m from the base of the cliff during the nestling period. The activities of the birds should be compared to controlled situations with no camps (Ellis 1973; Gerrard *et al.* 1973).

- 9) Whereas several overflights occurred when no birds were present at the nest site, more time should be spent at each eyrie to determine at what times both birds are likely to be present. In addition, aircraft overflights should be regulated with the use of two-way radios. Although this system, when tried on two occasions, was found to be unreliable, overflights should be scheduled for a predetermined time with the option of possible modification via two-way radio communication. Delaying of aircraft may result in additional cost, but this will probably be offset by reducing the number of overflights which occur when no birds are present or when the pilot follows the wrong flight path.



9. REFERENCES CITED

- Cade, T.J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. Univ. Calif. Publ. Zool. 63(3):151-290.
- Ellis, D.H. 1973. Behavior of the golden eagle: An ontogenic study. Unpubl. Ph.D. Thesis, Univ. Montana.
- Fyfe, R.W. & R.R. Olendorff. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. Can. Wildl. Serv. Occas. Pap. no. 23.
- Gerrard, J.M., P.N. Gerrard, D.W.A. Whitfield & W.J. Maher. 1973. Bald eagle behavior study: part II. Unpubl. types. Can. Wildl. Serv.
- Gunn, W.W.H. & J.A. Livingston (eds.). 1974. Disturbance to birds by gas compressor noise simulators, aircraft and human activity in the Mackenzie Valley and the North Slope, 1972. Arct. Gas Biol. Rep. Ser. vol. 14.
- Jacobson, J.O. 1974. Potential impact of the Mackenzie Gas Pipeline on bird populations in the Yukon and Northwest Territories. Chapter 6 *in* Environmental impact assessment of the portion of the Mackenzie Gas Pipeline from Alaska to Canada. Environ. Prot. Board, Winnipeg, Manitoba.

- Junemann, B.C. & L.B. Frenzel. 1972. Habitat evaluations of selected bald eagle nest sites in the Chippewa National Forest. Paper presented at the 34th Annual Midwest Fish and Wildlife Conference, Dec. 10-13, 1972, Des Moines, Iowa.
- Nelson, R.W. 1970. Breeding behavior of peregrine falcons. Unpubl. M.Sc. Thesis. Univ. Calgary.
- Platt, J.B. 1974. A study of diurnal raptors that nest on the Yukon North Slope with special emphasis on the behavior of gyrfalcons during experimental overflights by aircraft. Chapter II in W.W. Gunn *et al.* (ed.) Ornithological studies conducted in the area of the proposed gas pipeline route: Northwest Territories, Yukon Territory and Alaska, 1974. Arct. Gas Biol. Rep. Ser. vol. 30.
- Pumphrey, R.J. 1961. Sensory organs: vision. Chapter 15 in A.J. Marshall (ed.). Biology and comparative physiology of birds. Vol. 2.
- Snow, G. 1973. Habitat management series of endangered species. Report no. 5: southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) and northern bald eagle (*Haliaeetus leucocephalus alaseanus*). Tech. Note, U.S. Dept. Inter., Bur. Land Manage.
- Welty, J.C. 1962. The life of birds. W.B. Saunders Co., Philadelphia.
- White, C.M. & S.K. Sherrod. 1973. Advantages and disadvantages of the use of rotor-winged aircraft in raptor surveys. Raptor Res. 7(3/4):97-104.

APPENDIX A. Tabular Description of the Response of Peregrine
Falcons to all Observed Overflights

APPENDIX A. Peregrine Falcon Response to all Observed Overflights.

Overflight Number	Eyrie Name	Date	Type of Aircraft	Aircraft Altitude and Distance	Time (Mt. Dst.)	Observed Male	Response* Female	Stage of Reproductive Cycle
1	North End	11 June	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	12:56	1I	NP	mid-incubation
2	North End	11 June	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	13:11	1I	NP	mid-incubation
3	North End	11 June	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	13:40	1I	Perched out of view	mid-incubation
4	North End	12 June	Cessna 337 Airplane	150 m above & 200 to 400 m away from eyrie (aircraft suddenly appeared over scarp from behind nest)	14:23	NP	3I	mid-incubation
5	North End	12 June	Cessna 185 Airplane	300 m above & 140 m in front of eyrie	14:59	1I	3P	mid-incubation
6	North End	12 June	Cessna 185 Airplane	150 m above & 140 m in front of eyrie	15:32	1I	2P	mid-incubation
7	North End	12 June	Cessna 185 Airplane	75 m above & 140 m in front of eyrie		1I	Perched out of view	mid-incubation
8	Catwalk	31 May	Bell 206 Helicopter	30 m above & 30 m behind eyrie	14:30	3.5P	3P	early incubation
9	Catwalk	31 May	Cessna 185 Fixed-wing	300 m above & 140 m in front of eyrie		NP	2P	early incubation
10	Catwalk	31 May	Cessna 185 Fixed-wing	300 m above & 2000 m in front of eyrie	17:05	NP	2P	early incubation
11	Catwalk	31 May	Cessna 185 Fixed-wing	300 m above & 140 m in front of eyrie	17:09	NP	1P	early incubation
12	Catwalk	31 May	Cessna 185 Fixed-wing	450 m above & 140 m in front of eyrie	18:15	2P	1P	early incubation
13	Catwalk	31 May	Twin Otter Fixed-wing	not recorded	18:24	1P	1P	early incubation
14	Catwalk	31 May	P.W.A. Jet	450 - 600 m above eyrie (horizontal distance not recorded)	18:40	5P (May have been normal behavior)	7P	early incubation
15	Catwalk	1 June	P.W.A. Jet	450 - 600 m above eyrie (horizontal distance not recorded)	12:47	2.5P	2.5P	early incubation
16	Catwalk	1 June	Two airplanes (size not noted)	800 m west of eyrie (altitude not given)	14:32	3P	1I	early incubation
17	Catwalk	1 June	Cessna 185 fixed-wing	300 m above & 2000 m west of eyrie	14:55	1P	1I	early incubation
18	Catwalk	1 June	Bell 206 Helicopter	300 m above & 2000 m west of eyrie	16:45	2I	NP	early incubation

* See methods section for response ratings.

P. Bird perched at beginning of test.

I. Bird incubating at beginning of test.

NP. Bird not present.

APPENDIX A. (Continued).

Overflight Number	Eyrie Name	Date	Type of Aircraft	Aircraft Altitude and distance	Time (Mt. Dst.)	Observed Male	Response* Female	Stage of Reproductive Cycle
19	Catwalk	1 June	P.W.A. Jet	>300 m above eyrie (horizontal distance not given)	18:56	3.5P	11	early incubation
20	Catwalk	1 June	Twin Otter Fixed-wing	60 m above nest (horizontal distance unknown)	19:45	2P	11	early incubation
21	Catwalk	1 June	Cessna 185 Fixed-wing	300 m above & 2000 m from eyrie	22:03	NP	11	early incubation
22	Catwalk	1 June	Cessna 185 Fixed-wing	300 m above & 800 m from eyrie	22:31	4P	-1 reaction not recorded	early incubation
23	Catwalk	11 June	Bell 206 Helicopter	300 m above & 140 m in front of eyrie		NP	31	mid-incubation
24	Catwalk	11 June	Bell 206 Helicopter	150 m above & 140 m in front of eyrie		NP	3.51	mid-incubation
25	Catwalk	11 June	Bell 206 Helicopter	landing 800 m away and in front of eyrie		NP	4.51	mid-incubation
26	Catwalk	11 June	Large Turbo-prop Fixed-wing	taking off from airport 5.5 km from and out of view of eyrie		NP	41	mid-incubation
27	Catwalk	13 June	Cessna 185 Fixed-wing	300 m above & 800 m from eyrie	14:34	1P	11	mid-incubation
28	Catwalk	13 June	Cessna 185 Fixed-wing	300 m above & 140 m in front of eyrie	14:35	2P	11	mid-incubation
29	Catwalk	13 June	Cessna 185 Fixed-wing	150 m above & 800 m in front of eyrie		P - reaction not recorded	31	mid-incubation
30	Catwalk	13 June	Cessna 185 Fixed-wing	15 m below & 800 m in front of eyrie		P - reaction not recorded	21	mid-incubation
31	Catwalk	13 June	Electra Turbo-Jet Fixed-wing	150 m above & 140 m in front of eyrie		P - reaction not recorded	1P	mid-incubation
32	Catwalk	23 June	Cessna 185 Fixed-wing	taking off from lake 1200 m away from & in view of eyrie	11:00	1P	21	late incubation
33	Catwalk	23 June	Cessna 185 Fixed-wing	300 m above & 800 m in front of eyrie		3.5P	21	late incubation
34	Catwalk	23 June	Twin Otter Fixed-wing	300 m above & 800 m in front of eyrie		P - reaction not recorded	11	late incubation
35	Catwalk	23 June	Cessna 185 Fixed-wing	300 m above & 140 m in front of eyrie		P - reaction not recorded	21	late incubation
36	Catwalk	23 June	Cessna 185 Fixed-wing	150 m above & 140 m in front of eyrie	12:00	P - reaction not recorded	3.5P	late incubation
37	Catwalk	23 June	Cessna 185 Fixed-wing	landing 800 m away from & in view of eyrie		NP	1P	late incubation
38	Catwalk	23 June	Cessna 185 Fixed-wing	75 m above & 140 m in front of eyrie	13:00	NP	31	late incubation

* See methods section for response ratings.
P. Bird perched at beginning of test.
1. Bird incubating at beginning of test.
NP. Bird not present.

APPENDIX A. (Continued).

Overflight Number	Eyrie Name	Date	Type of Aircraft	Aircraft Altitude and Distance	Time (Mt. Dst.)	Observed Male	Response* Female	Stage of Reproductive Cycle
39	Fortress	**12 August	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	15:55	NP	NP (young not in view)	1 - 7 days before fledging
40	Fortress	12 August	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	16:25	NP	2.5P	1 - 7 days before fledging
41	Fortress	12 August	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	16:48	NP	2.5P	1 - 7 days before fledging
42	Fortress	14 August	Cessna 185 Fixed-wing	300 m above & 140 m in front of eyrie	09:05		3P	1 - 7 days before fledging
43	Fortress	14 August	Cessna 185 Fixed-wing	150 m above & 140 m in front of eyrie	09:22		2.5P	1 - 7 days before fledging
44	Fortress	14 August	Cessna 185 Fixed-wing	75 m above & 140 m in front of eyrie	09:40		3.5P	1 - 7 days before fledging
45	Bearskull	20 June	Bell 206 Helicopter	taking off 800 m from & in view of eyrie	10:21.5	3.5P	3.5I	late incubation
46	Bearskull	20 June	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	10:25	3P	1I	late incubation
47	Bearskull	20 June	Bell 206 Helicopter	landing 2400-3200 m from & out of view of eyrie	10:29	2P	1I	late incubation
48	Bearskull	20 June	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	10:46	4P	2I	late incubation
49	Bearskull	20 June	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	11:05	NP	1I	late incubation
50	Bearskull	20 June	D.C.3 Airplane	900 m above & 1200 m from & in front of eyrie	11:45	NP	1I	late incubation
51	Bearskull	23 June	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	11:58	NP	3I	late incubation
52	Bearskull	23 June	Cessna 185 Airplane	300 m above & 140 m in front of eyrie	12:20	NP	NP	late incubation
53	Bearskull	23 June	Cessna 185 Airplane	150 m above & 140 m in front of eyrie	13:00	NP	NP	late incubation
54	Bearskull	23 June	Cessna 185 Airplane	75 m above & 140 m in front of eyrie	13:45	NP	NP	late incubation
55	Bearskull	8 July	Cessna 185 Airplane	300 m above & 140 m in front of eyrie		NP	2P	1 - 7 days after hatching
56	Bearskull	8 July	Cessna 185 Airplane	150 m above & 140 m in front of eyrie		NP	2P	1 - 7 days after hatching
57	Bearskull	8 July	Cessna 185 Airplane	75 m above & 140 m in front of eyrie		NP	5P	1 - 7 days after hatching
58	Bearskull	11 July	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	12:04	3P	3P	1 - 7 days after hatching

* See methods section for response ratings.

P. Bird perched at beginning of test.
I. Bird incubating at beginning of test.
NP. Bird not present.

** One of the two young already flying.

Overflight Number	Eyrie Name	Date	Type of Aircraft	Aircraft Altitude and distance	Time (Mt. Dst.)	Observed Male	Response* Female	Stage of Reproductive Cycle
59	Bearskull	11 July	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	12:31	Perched out of sight	5P	1 - 7 days after hatching
60	Bearskull	11 July	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	12:59	Perched out of sight	3P	1 - 7 days after hatching
61	Arid	6 August	Twin Otter Airplane	300 m above directly above eyrie (aircraft suddenly appeared over scarp from behind nest)		Soaring above eyrie reaction not recorded	5P	2/3 fledged
62	Arid	6 August	Cessna 185 Airplane	300 m above & 140 m in front of eyrie	14:07	3P	3.5P	2/3 fledged
63	Arid	6 August	Cessna 185 Airplane	150 m above & 140 m in front of eyrie	14:37	5P	3.5P	2/3 fledged
64	Arid	6 August	Cessna 185 Airplane	75 m above & 140 m in front of eyrie	15:00	P - reaction not recorded	3P	2/3 fledged
65	Arid	9 August	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	16:45	3.5P	3.5P	2/3 fledged
66	Arid	9 August	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	17:09	NP	4P	2/3 fledged
67	Arid	9 August	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	17:35	NP	5P	2/3 fledged
68	Arid	19 August	Cessna 185 Airplane	300 m above & 140 m in front of eyrie		NP Yng	Perched out of view 4.5P	1 - 7 days before fledging
69	Arid	19 August	Cessna 185 Airplane	150 m above & 140 m in front of eyrie		NP Yng	Perched out of view 4.5P	1 - 7 days before fledging
70	Arid	19 August	Cessna 185 Airplane	75 m above & 140 m in front of eyrie		NP Yng	Perched out of view 4.5P	1 - 7 days before fledging
71	Arid	20 August	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	13:15	NP Yng	Perched out of view 3.5P	1 - 7 days before fledging
72	Arid	20 August	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	14:00	NP Yng	5P 2.5P	1 - 7 days before fledging
73	Hole	1 July	Bell 206 Helicopter	300 m above & 140 m in front of eyrie	12:00	NP	3.5I	1 - 7 days after hatching
74	Hole	1 July	Bell 206 Helicopter	150 m above & 140 m in front of eyrie	12:35	3.5P	4P	1 - 7 days after hatching
75	Hole	1 July	Bell 206 Helicopter	75 m above & 140 m in front of eyrie	13:00	NP	NP	1 - 7 days after hatching
76	Hole	8 July	Cessna 185 Airplane	300 m above & 140 m in front of eyrie	10:56	Perched out of view	4 - Brooding	8 - 10 days after hatching

* See methods section for response ratings.
P. Bird perched at beginning of test.
I. Bird incubating at beginning of test.
NP. Bird not present.

APPENDIX A. (Continued).

Overflight Number	Eyrie Name	Date	Type of Aircraft	Aircraft Altitude and Distance	Time (Mt. Dst.)	Observed Male	Response* Female	Stage of Reproductive Cycle
77	Hole	8 July	Cessna 185 Airplane	150 m above & 140 m in front of eyrie	11:23	Perched out of view	3 - Brooding	8 - 10 days after hatching
78	Hole	8 July	Cessna 185 Airplane	75 m above & 140 m in front of eyrie	11:52	Perched out of view	4 - Brooding	8 - 10 days after hatching
79	Hole	10 July	Cessna 185 Airplane	aircraft suddenly appears over edge of cliff directly above eyrie at an altitude of 150 m	13:53	NP	3 - Brooding	8 - 10 days after hatching
80	Hole	10 July	Cessna 185 Airplane	300 m above & 140 m in front of eyrie rpm change from 2200-2700 over 3-5 sec	14:10	NP	3 - Brooding	8 - 10 days after hatching
81	Hole	10 July	Cessna 185 Airplane	150 m above & 140 m in front of eyrie rpm change from 2200-2700 over 3-5 sec	14:33	NP Yng	NP 4P	8 - 10 days after hatching
82	Hole	10 July	Cessna 185 Airplane	75 m above & 140 m in front of eyrie rpm change from 2200-2700 over 3-5 sec	15:00	NP	4 - Brooding	8 - 10 days after hatching
83	Hole	10 July	Sikorski 62 Helicopter	150 m above & 800 m in front of eyrie	15:05	NP	3 - Brooding	8 - 10 days after hatching
84	Cabin	5 June	Six Tutor Jet Fighter Planes (CT 14) flying in formation	flying at right angles to scarp & directly towards eyrie 150 m above & 45 m to left of eyrie - airspeed probably greater than 500 kph		Perched out of view - did not flush	Perched out of view - did not flush	early incubation

* See methods section for response ratings.

- P. Bird perched at beginning of test.
I. Bird incubating at beginning of test.
NP. Bird not present.

APPENDIX B. Note Description of the Birds' Reactions to Overflights

NORTH END EYRIE

11 June
(Mid-incubation)

- 11:45 - female incubating, male prominently perched
- 11:48 - male changes perch
- 12:45 - nest exchange, male incubating, female perched
- Overflight #1
Bell 206 Helicopter
300 m above & 140 m in front of eyrie
- 12:56 - male incubating, male ignored aircraft, female not present
- Overflight #2
Bell 206 Helicopter
150 m above & 140 m in front of eyrie
- 13:11 - male incubating, male ignored aircraft, female not present
- 13:21 - male incubating female arrives and perches near eyrie, large jet flies over (no altitude or horizontal distance recorded), female alternates preening while looking at plane, female chin feathers remain fluffed
- 13:29 - female still preening, perched on one foot with chin feathers fluffed
- Overflight #3
Bell 206 Helicopter
75 m above & 140 m in front of eyrie
- 13:30 - helicopter heard in the distance, female stops preening and looks from side to side slowly with head very slightly cocked
- 13:31 - female preening and frequently looking towards helicopter noise, female remains perched on one foot
- 13:34 - female stops preening, looking from side to side, but still perched on one foot

NORTH END EYRIE (*Continued*)

11 June - Mid-incubation

- 13:38 - approaching helicopter now visible, perched female gives intention movements of flight (tarsus bent, tail up, wings unfolded slightly, body in horizontal position)
- 13:39 - female flies out of sight
- 13:40 - as helicopter flies by, incubating male ignored aircraft, female out of sight
- 13:43 - male chipping, still incubating, female out of sight

12 June
(mid-incubation)

Overflight #4
Cessna 337 Airplane
150 - 225 m above eyrie
and 200 to 400 m away.
aircraft suddenly appeared
over scarp

- 14:00 - female incubating, male not present
- 14:10 - aircraft heard in distance, incubating female raises head slightly and looks in direction of noise
- 14:23 - incubating female raised head, looked up at aircraft and then settled back down on eggs
- 14:58 - nest exchange, male now incubating and female perched near eyrie and preening

Overflight #5
Cessna 185 Airplane
300 m above and 140
m in front of eyrie

- 14:59 - aircraft approaching eyrie, perched female just watches plane intently, incubating male ignores aircraft
- 14:60 - as aircraft passes eyrie, perched female watches it intently with head cocked, incubating male ignores plane

NORTH END EYRIE (*Continued*)

- 12 June - Mid-incubation
- 15:04 - male incubating, motionless on nest, female perched and occasionally preening, most of the time she is perched on one foot
- Overflight #6
Cessna 185 Airplane
.150 m above & 140 m
in front of eyrie
- 15:09 - approaching aircraft can be heard in the distance, perched female looking in direction of noise, incubating male shows no movement
- 15:10 - female dozing, male motionless on nest
- 15:10 - female looking towards approaching aircraft, still in upright perched position with chin feathers fluffed, occasionally cocking head
- 15:10.5 female looking very intently towards approaching plane, incubating male still motionless
- Overflight #7
Cessna 185 Airplane
75 m above and 140
m in front of eyrie
- 15:32 - as plane flies by incubating male remained motionless, female is out of view

CATWALK EYRIE

31 May
(Early incubation)

Overflight #8
Bell 206 Helicopter
30 m above and
30 m behind eyrie

14:30 - male and female perched 45 m north of eyrie
- sporadic wailing
- male could not see approaching aircraft and grew very nervous (not described in notes) and made intention movements for flight
- female just watched intently

16:29 - mutual ledge display, then male flies out of sight and female perches on nest ledge near eggs

16:37 - male returns, directs two mock attacks at female, lands on nest ledge, food transfer occurs, female flies to perch with prey, male flies out of sight, female gives soft wails as male disappears, female begins preening, then warbles, then begins incubating
- female just watches intently as plane goes by

Overflight #9
Cessna 185 Airplane
300 m above and
140 m in front of eyrie

Overflight #10
Cessna 185 Airplane
300 m above and
2000 m in front of eyrie

17:05 - female just watched intently as plane flew by

Overflight #11
Cessna 185 Airplane
300 m above and
140 m in front of eyrie

17:09 - female ignored aircraft

17:11 - female changes perch, male arrives carrying prey, female attempts unsuccessful food transfer, then lands on perch, female then returns to nest ledge and begins incubating, male flies out of sight

CATWALK EYRIE (*Continued*)

31 May - Early incubation

17:33 - male returns mock attack on female, then prominently perches near nest ledge

Overflight #12

Cessna 185 Airplane
450 m above and
140 m in front of eyrie

18:15 - incubating female ignores aircraft, perched male watches intently

Overflight #13

Twin Otter Airplane
altitude and distance
not recorded

18:24 - both birds ignored aircraft

Overflight #14

P.W.A. Jet Airplane
450 to 600 m above
eyrie (horizontal distance
not recorded)

18:40 - male flushes off perch, circles a few times and then flies to nest ledge
- nest exchange takes place, female flies to perch and male begins incubating

18:48 - male flies to perch, male and female both begin mutual scalling and power diving, then both birds perch

1 June

(Early incubation)

12:35 - female incubating, male prominently perched,
- female flies from nest, returns to eyrie, perches, male flies then returns to perch

Overflight #15

P.W.A. Jet Airplane
450 to 600 m above
eyrie (horizontal distance
not given)

12:47 - both perched female and male watch aircraft intently, both retained ruffled chin feathers

12:58 - female chips, walks to scrape, bobs etc., adjusts eggs, begins to incubate

13:29 - perched male stretches, warbles preens
- incubating female dozing

CATWALK EYRIE (*Continued*)

1 June - Early incubation

Overflight #16

TWO PLANES (size not noted)
800 m west (altitude not
noted)

14:03 - plane heard in distance, male becomes nervous (no description given) then changes perch

14:32 - incubating female ignores aircraft
- perched male changes perch, then begins to preen

14:40 - perched male dozing, incubating female occasionally glancing around

Overflight #17

Cessna 185 Airplane
300 m above and
2000 m west

14:55 - both perched male and incubating female ignore aircraft (male now awake)

15:07 - male prominently perching, female incubating

15:45 - female adjusts eggs, then continues incubating, male prominently perched

16:22 - male flies off perch, female flies to food cache, (nest exchange, male now incubates)

Overflight #18

Bell 206 Helicopter
300 m above and
2000 m west

16:45 - female out of sight, incubating male just glanced at aircraft

17:20 - male still incubating, female still out of sight

18:15 - female arrives, nest exchange, female begins incubating, male flies to perch and prominently perches

18:46 - male changes perch, resumes prominent perching, then preens, and prominently perches, female still incubating

CATWALK EYRIE (*Continued*)

1 June - Early incubation

- Overflight #19
P.W.A. Jet Airplane
greater than 900 m above
eyrie. (horizontal distance
not given)
- 18:56 - perched male watched intently,
much head movement (not
described), female ignored
aircraft
- 19:00 - male in prominent perch position
and on one foot and dozing
- female incubating
- Overflight #20
Twin Otter Airplane
60 m above nest
(horizontal distance
unknown)
- 19:45 - perched male watched silently
incubating female ignored
- 20:30 - female incubating, male
perched, gleaning, warbles,
preening
- 20:36 - male leaves perch and begins
scalling
- 20:51 - female rolls eggs, continues
incubating
- 21:11 - male returns, soars in front
of eyrie
- 21:25 - mutual flight display, then
female returns to nest, male
perches
- 21:45 - male changes perch and begins
preening
- 21:53 - male changes perch
- Overflight #21
Cessna 180 Airplane
300 m above and
2000 m away
- 22:03 - female ignored aircraft,
male's reaction not recorded
- 22:07 - food transfer (male to female),
then male perches and female
adjusts eggs
- 22:08 - male keeps looking towards
blind and then over to female

CATWALK EYRIE (*Continued*)

1 June - early incubation

Overflight #22

Cessna 185 Airplane
300 m above and
2000 m away

22:31 - male flushes off of perch,
and flies out of sight, female's
reaction not recorded

22:41 - female incubating, male
returns to perch

11 June (times not recorded)

Mid-incubation

Overflight #23

Bell 206 Helicopter
300 m above and
140 m in front of eyrie

- female incubating, male not
present

- female watches approach of
chopper intently, then just
glances at aircraft as it
goes by

Between
overflights

- female glancing at blind
occasionally
- female turns to face direction
of airport whenever aircraft
can be heard, otherwise female
just incubating and glancing
around

Overflight #24

Bell 206 Helicopter
150 m above and
140 m in front of eyrie

- female incubating, male not
present

- female watches approach of
chopper when it is still
1500 m away

- female occasionally glancing
at blind

- helicopter now 1200 m away,
female watching it intently,
slowly moving her head as she
follows its progress

- helicopter now directly in
front of nest, female has head
tilted back so her nape is
touching her back, looking
straight up, pulls head down
quickly

CATWALK EYRIE (*Continued*)

11 June - Mid-incubation

Overflight #25

Bell 206 Helicopter
landing 800 m away

- female watches intently as helicopter circles and lands, as it is landing, she jerks her head down, then side to side
- as helicopter shuts down, female just watches intently

Overflight #26

Large Turbo-prop Airplane
taking off from airport
5.5 km away

- female incubating, as aircraft takes off from airport, female jerks head towards direction of sound and then looks away several times
- then a Twin Otter flies directly above eyrie at 750 m, female looks towards airport and ignores Twin Otter, female stays low on nest and looks away from airport, then looks at Twin Otter which is now in distance, then female bobs down quickly and just "casually" glances around

13 June

(Mid-incubation)

12:45 - nest exchange, female now incubating, male flies out of sight

13:20 - male returns, does aerial display, perches

14:17 - female incubating and dozing, male still perched

Overflight #27

Cessna 185 Airplane
300 m above and
800 m away from eyrie

14:34 - both birds ignored aircraft

Overflight #28

Cessna 185 Airplane
300 m above and
140 m in front of eyrie

14:35 - incubating female ignores aircraft, perched male just glances at aircraft

CATWALK EYRIE (*Continued*)

13 June - Mid-incubation

Overflight #29

Cessna 185 Airplane
 150 m above and
 800 m away from eyrie

INTERFERENCE FROM EAGLE

- 14:38 - aircraft now out of sight, female adjusts eggs, resumes incubating
- male is prominently perched on one foot, feathers fluffed, "calmly looking around"
 - female incubating, male perched
 - female raises head, looks side to side (aircraft out of her view)
 - female raises 2.5 cm up off nest, looks side to side and then in direction of approaching aircraft
 - then female notices eagle circling 150 m above nest, female bobs head up and down, begins cacking, holds head high, gets off nest, continuous strong cacking, female looks towards perched male, female begins bobbing, looks towards aircraft which has now passed and is flying away in the distance, looks down at eggs, quits cacking, resumes cacking, crouches, raises head, continuous cacking now very loud, eagle begins to gain altitude and soars in tighter circles, female quiets down, walks towards scrape, settles on eggs, gets up, adjusts egg, settles on eggs, gets up again, starts bobbing and cacking continuously for about a minute, then quits cacking slowly, then settles down on eggs
 - the whole time, male just watched intently from his perch and never made a sound

CATWALK EYRIE (*Continuous*)

13 June - Mid-incubation

Overflight #30

Cessna 185 Airplane
15 m below and
800 m in front of eyrie

- female incubating, male perched
- female watches plane intently
- male's reaction not recorded
- as plane disappears both birds begin wailing for a few minutes, then both become quiet

Overflight #31

Electra Turbo-prop Airplane
at 150 m above and 140 m
in front of eyrie

- male perched out of sight, his reaction not recorded
- female standing at edge of nest ledge ignores aircraft

23 June

(Late-incubation)

Overflight #32

Cessna 185 Airplane
taking off from lake
800 m away from and
in view of eyrie

- 11:00 - male perched, female incubating
- male ignores aircraft and female lifts her head and "casually" watches plane

Overflight #33

Cessna 185 Airplane
300 m above and
800 m in front of eyrie

- as plane approaches, the male flies from his perch near the eyrie "screaming" and then lands back on perch, female ignores aircraft until it is almost out of sight, then she lifts her head and watches intently

Overflight #34

Twin Otter Airplane
300 m above and
800 m in front of eyrie
(extremely noisy)

- incubating female ignores aircraft, reaction of perched male not recorded

Overflight #35

Cessna 185 Airplane
300 m above and
140 m in front of eyrie

- female incubating, male perched
- female ignores plane until it is directly in front of eyrie, then female glances at it and then glances at blind, then up at plane again and follows its progress

CATWALK EYRIE (*Continued*)

23 June - Late incubation

- plane still in sight but now female just "casually" looking around (not at plane)
- reaction of male not recorded

Overflight #36

Cessna 185 Airplane
150 m above and
140 m in front of eyrie

- 12:00 - female perched on ledge near eyrie, male not present
- female lifts head, looks at plane, looks down at blind, up at plane, down at blind, up at plane, she continues this as plane flies by
 - female stayed in low perch position with feathers fluffed

Overflight #37

Cessna 185 Airplane
landing 800 m away and
in view of eyrie

- perched female ignores aircraft, after about 5 minutes, female leaves perch and flies out of sight; after 5 more minutes, female returns to area and lands at eyrie and begins incubating

Overflight #38

Cessna 185 Airplane
75 m above and
140 m in front of eyrie

- 13:00 - when approaching aircraft is approximately 800 m away, incubating female begins to watch it intently and continues to do so until it is directly in front of eyrie; then she ignores it
- a few minutes later, incubating female is dozing

FORTRESS EYRIE

12 August (1 to 7 days before fledging)

15:25 - no birds present

15:55 - no birds present

Overflight #39

Bell 206 Helicopter
300 m above and
140 m in front of eyrie

16:16 - female discovered perched to on nest ledge

16:25 - female preening, every few minutes she looks up and cocks head

Overflight #40

Bell 206 Helicopter
150 m. above and
140 m in front of eyrie

16:25 - female still preening, stops frequently to listen and cock head as helicopter approaches, then she raises up on tarsi and intently watches helicopter go by, then she settles back down into normal position and watches helicopter in distance

16:45 - female still perched on nest ledge, but now perched on one foot with chin feathers relaxed

16:47 - female still perched, now scratching bill

Overflight #41

Bell 206 Helicopter
75 m above and
140 m in front of eyrie

16:48 - female stops scratching and watches approaching aircraft, female continues to intently watch chopper as it goes by but still remains perched on one foot (observer did not notice if chin feathers remained fluffed)

16:49 - female remains perched and to preening

17:00

14 August (1 to 7 days before fledging)

08:50 - one adult flies from perch as observer approaches blind, young can be heard wailing

FORTRESS EYRIE (*Continued*)

14 August - 1 to 7 days
before fledging

Overflight #42
Cessna 185 Airplane
300 m above and
140 m in front of eyrie

- 09:01 - female flies past ledge and drops food to young, young raises wings over back, flaps hard, then hops with head in lowered position towards prey
- female lands at top of cliff about 30 m to left of nest
- young continues hopping until out of sight (no longer wailing)
- 09:05 - female approaching, adult preening, looks over back, looks at young, cocks head, looks side to side, then watches plane intently as it comes into view and goes by
- 09:08 - female just perched and looking around
- 09:09 - female preening chest feathers
- 09:11 - as above
- 09:12 - female preening wing and nape, occasionally stopping to look around
- 09:13 - as above
- 09:14 - female preening tail then glances in direction of observer, bobs head once, 5 second pause, bobs head again, resumes preening
- 09:15 - female preening chest and ventral part of right wing
- 09:16 - female still preening, young still out of view and remaining silent
- 09:20 - female still preening

FORTRESS EYRIE (*Continued*)

14 August - 1 to 7 days before
fledging

Overflight # 43

Cessna 185 Airplane
150 m above and
140 m in front of eyrie

- 09:22 - female stops preening, looks over back, moves head side to side, scratches bill with foot lifts right foot up and down rapidly, then fluffs chest, sits back on both feet and looks up with chest feathers fluffed as it watches the plane go by
- 09:23 - female just perched and occasionally looking around slowly when not dozing
- 09:24 - dozing
- 09:25 - looks up occasionally, then back dozing
- 09:28 - young seen flapping on ground as it awkwardly tears at prey
- adult dozing
- 09:29 - female still perched, chest fluffed and watching young
- young flapping, trying to perch on and tear pieces off of prey
- 09:30 - young still on prey
- female dozing
- 09:32 - female just perched, motionless except for occasional looking around
- 09:33 - young finished eating and now is perched with back to observer, adult dozing
- 09:36 - young as above, adult perched motionless except for occasionally looking around
- 09:38 - as above except now female begins glancing at young quite often

FORTRESS EYRIE (*Continued*)

14 August - 1 to 7 days before
fledging

Overflight #44
Cessna 185 Airplane
75 m above and
140 m in front of eyrie

- 09:39 - as above, plane approaching
- 09:40 - female looks over back, flicks tail, breast feathers flatten to normal (not extreme sleeking) position,
- female changes perch (30 m to R)
 - young wails
- 09:41 - plane circling to land on lake about 800 m away, young motionless, just perched and starting at female
- 09:42 - can't see female, young now wailing
- 09:42.75
- young stopped wailing, female perched quietly (? - not in view)
- 09:43 - young wailing
- 09:43.5
- young stops wailing
- 09:44 - young wailing as plane touches down on lake 800 m away
- 09:45 - young quiet

BEARSKULL EYRIE

20 June
(Late incubation)

- 10:05 - observer enters blind, opens drawstring, female raises up off of nest, looks towards blind and then settles back down, male not in sight
- 10:14 - female incubating, male noticed perched 15 m above and 15 m to right of nest ledge, male wailing
- 10:18 - male perched in upright position, looking around occasionally, chin feathers relaxed

10:21 - male wailing

Overflight #45
Bell 206 Helicopter
taking off 800 m away

- 10:21.5 - female raises up off of nest, looks in direction of sound, and then slowly settles back down on eggs
- male gives intention movements of flight and then settles back down into horizontal (normal) perch position

Overflight #46
Bell 206 Helicopter
300 m above and
140 m in front of eyrie

- 10:25 - helicopter approaching, male watching it intently, and cocking head
- female never even looked up as it flew by

10:28 - female still incubating, male preening back

Overflight #47
Bell 206 Helicopter
landing 2400 - 3200 m
and out of view of birds

- 10:29 - perched male cocks head for a few seconds and listens intently, then resumes preening
- female ignored

10:33 - male just perched and occasionally glancing around, chin feathers fluffed, most of the time he appears to be dozing

BEARSKULL EYRIE (Continued)

- 20 June - Late incubation
- 10:33.5 - male warbles
- 10:41 - plane in distance, male cocking head, female no movement
- Overflight #48
Bell 206 Helicopter
150 m and
140 m in front of eyrie
- 10:44 - observer can hear helicopter warming up 2400 to 3200 m away. female motionless on eggs, male stretching and preening
- 10:46 - male looking intently in direction of approaching helicopter, but glances away once or twice
- Interference from Cessna 180
Airplane 2400 to 3200 m away at
200 - 300 m, changing RPM
as it descends for landing
at Inuvik airport
- 10:46.5 - male flies off of perch (observer was too late to see if he made any intention movements or not)
- female looked in direction of sound
- 10:46.75
- helicopter flies by, male out of sight, female ignores
- Overflight #49
Bell 206 Helicopter
75 m above and
140 m in front of eyrie
- 11:04 - observer can hear chopper getting into position, male not in sight, female never even looked up, no movement at all
- Overflight #50
D.C. 3 Airplane
900 m above and
1200 m from and
in front of eyrie
- 11:45 - male not in sight, incubating
female ignored aircraft
- 11:46 - male not in sight, female still incubating
- 23 June
(Late incubation)
- 11:45 - female incubating, male perched
- Overflight #51
Bell 206 Helicopter
150 m above and
140 m in front of eyrie
- 11:58 - female wails, raises off of nest, still standing amongst eggs when she begins bobbing, finally she walks away from eggs to edge of ledge and then bobs and flies out of sight

BEARSKULL EYRIE (*Continued*)

- 23 June - Late Incubation
- 12:00 - female returns to nest, wails approaches nest on foot, wails then settles on eggs
- 12:03 - female wails, raises up off of eggs, walks to edge of nest ledge and then flies out of sight
- Overflight #52
Cessna 185 Airplane
300 m above and
140 m in front of eyrie
- 12:20 - no birds present
- Overflight #53
Cessna 185 Airplane
150 m above and
140 m in front of eyrie
- 13:00 - no birds present
- Overflight #54
Cessna 185 Airplane
75 m above and
140 m in front of eyrie
- 13:45 - no birds present
- 8 July
(1 to 7 days after hatching)
- Overflight #55
Cessna 185 Airplane
300 m above and
140 m in front of eyrie
- female perched on tree about 30 m above eyrie, female turns to face aircraft as it lifts off of lake about 2400 m to 3200 m away, female watches approaching aircraft intently, as plane goes overhead she raises her wing and 2 seconds later flies south just ahead of plane, she stoops towards observer, then returns to perch and quits cacking
- Overflight #56
Cessna 185 Airplane
150 m above and
140 m in front of eyrie
- female perched across from eyrie about 30 m above eyrie
- female continues cacking as aircraft takes off from lake about 2400 to 3200 m away, female keeps glancing down towards eyrie as plane approaches,

BEARSKULL EYRIE (*Continued*)

8 July - 1 to 7 days after hatching as plane goes by, stops cacking and just watches it intently until it is about 400 m past eyrie

Overflight #57

Cessna 185 Airplane
75 m above and
140 m in front of eyrie

- female watches approach of plane intently, when aircraft is about 450 m from cliff, female flies (no intention movements recorded) and rises to about 45 m above eyrie, as plane goes by eyrie, female pursues aircraft for about 800 m then she rises abruptly, (continuously cacking) and returns to perch near eyrie
- female still cacking about 10 minutes later when observer leaves

11 July

(1 to 7 days after hatching)

- 11:45 - male perched across from eyrie about 30 m above eyrie
- female on tree about 30 m to right and 15 m higher than eyrie
- 11:45 - male and female cacks off and on to (female does most of cacking)
- 11:50 - (observer can also hear cacking 1 or 2 valleys over - 800 to 400 m away - possibly lone female from Fortress Eyrie in the area)
- 11:54 - female cacking off and on for about 5 seconds and then silent for about 4 seconds, male silent
- 11:54 - male silently perched, female to cacking and wailing about one-third of the time
- 12:00 - female cacks for about 5 seconds, to
- 12:04 - approaching helicopter, as helicopter goes by, female watches helicopter intently

Overflight #58

Bell 206 Helicopter
300 m above and
140 m in front of eyrie

BEARSKULL EYRIE (*Continued*)

- 11 July - 1 - 7 days after hatching - male looked at helicopter intently with head cocked, and then resumed normal head position and followed progress of helicopter as it flew by
 - (male's reactions not nearly as obvious as female's)
- 12:05 - male silently perched, female to perched cacking occasionally
 12:31 but wailing about one-third of the time
- Overflight #59
 Bell 206 Helicopter
 150 m above and
 140 m in front of eyrie
- 12:31 - helicopter approaching, female begins to cack, cacking very hard, as helicopter goes over, female's feathers undergo extreme sleeking, she looks straight up at helicopter, with tarsis bent and chest lowered, she is still cacking incessantly and very loud - she looks terrified - noise of helicopter is extremely loud (probably about 6 times louder than at 300 m
 - reaction of male not seen
- 12:35 - female in upright perch position, to wailing about one-third of the time
 12:59 dozes for a few seconds once, and cacks a few times for about 5 seconds
 - male silently perched in upright position with chin feathers fluffed (male perched on one foot), occasionally preening
- Overflight #60
 Bell 206 Helicopter
 75 m above and
 140 m in front of eyrie
- 12:59 - observer can hear helicopter getting into position, male jerks head sideways very rapidly and held body upright
 - male looks over back and cocks head as helicopter goes over
 - female just looks up as helicopter goes overhead and begins cacking, female doesn't show any intention movements for flight and doesn't look at all as frightened as the previous overflight (#59)

ARID EYRIE

6 August
(2/3 fledged)

- Overflight #61
Twin Otter Airplane
300 m directly above eyrie,
(aircraft suddenly appeared
over scarp from behind eyrie)
- 13:37 - female flushed off of perch
about 180 m north of eyrie
and joined soaring male, both
birds cacked for about 4 minutes
as they soared above eyrie
- 13:45 - female returns to perch, male
continues soaring
- 14:03 - female perched quietly, male
still soaring and begins cack-
ing
- Overflight #62
Cessna 185 Airplane
300 m above and
140 m in front of eyrie
- 14:07 - both birds very noisy, but
quieted down as the plane
passed. The female wailed
after and changed perch to
140 m east of the scarp
and perched quietly. The male
who had perched just before
overflight, was quiet until the
female flew, and then he also
flew and began to soar above
eyrie cacking. The female
then flew to perch 90 m to
the west.
- 14:37 - male and female both perched
quietly, male begins cacking
- Overflight #63
Cessna 185 Airplane
150 m above and
140 m in front of eyrie
- 14:37 - perched male cacking, female
perched quietly, aircraft lifts
off from lake about 5 km away
and out of sight of birds, male
instantly quits cacking, as
plane approaches, the female
stands very high, mutes and
then watches plane with her
head lowered. Female remains
in this position as plane goes
over. The male flushed from
his perch and began to cack.

ARID EYRIE (*Continued*)

6 August - 2/3 fledged

- 14:44 - male perched and quiet (when he landed to perch was not recorded)
 - female perched and giving periodic wails

14:47 - both birds perched quietly

Overflight #64

Cessna 185 Fixed-wing
 75 m above and
 140 m in front of eyrie

- 15:00 - plane lifts off from lake about 5 km away (plane out of view of birds). The female watched the plane from a crouched position on the eyrie ledge and the male remained quietly perched (his reactions not recorded)

9 August

(2/3 fledged)

- male soaring above eyrie, female perched quietly and then flies to scarp and begins brooding

Overflight #65

Bell 206 Helicopter
 300 m above and
 140 m in front of eyrie

- 16:45 - as helicopter approaches soaring male begins cacking and then abruptly quits and looks up frequently as helicopter goes over, as soon as helicopter has passed, male begins cacking again
 - female quiet before, during and after helicopter goes by, she crouched a little and watched helicopter intently

17:15 - male flies to perch 180 m west of eyrie and perches quietly

Overflight #66

Bell 206 Helicopter
 150 m above and
 140 m in front of eyrie

- 17:09 - female perched beside young, as helicopter approaches she held head and body very high, gives side to side movements of head
 - as helicopter goes over female bobs deeply 3 times and then watches intently as helicopter continues on
 - male reaction not observed

ARID EYRIE (*Continued*)

9 August - 2/3 fledged

Overflight #67

Bell 206 Helicopter
75 m above and 140
m in front of eyrie

17:35 - female perched quietly, glances once at helicopter as it approaches, glances again for a few seconds, then again quickly, then flushes off of perch, then female flies and wails very loudly and keeps on dropping feet (an intention movement of attack), then perched male leaves perch and begins to circle above eyrie
- female has now flown out of sight

17:45 - observer leaves blind, male is still soaring above eyrie and cacking incessantly, female out of sight

19 August

(1 to 7 days before fledging)

Overflight #68

Cessna 185 Airplane
300 m above and
140 m in front of eyrie

- as observer approaches blind the female is seen flying towards eyrie
- aircraft approaching, female out of view, young moving head from side to side rapidly a few times, young in low crouch position
- aircraft turning to get in proper position for overflight, young looks towards plane then quickly glances back towards blind
- young then lowers head down ("withdrawn into neck"), then opens mouth and begins cacking (can't actually hear any sound from young because of aircraft noise)
- young then looks straight up rapidly as plane goes over and then watches plane intently as it flies into the distance
- young fairly motionless, in low sitting position and huddled against rocks out of the driving

Between overflights

ARID EYRIE (*Continued*)

19 August - 1 - 7 days before fledging

wind and snow which has just started a few minutes ago

- young occasionally looking around, most head movements are slow, but the odd one is jerky, young appears to be feeding on prey
- he looks up rapidly between lowering his head to tear off pieces

Overflight #69

Cessna 185 Airplane

150 m above and

140 m in front of eyrie

- young turns and faces direction of where aircraft landed, young jerks head sideways a few times, and then bobs
- young returns to upright perched position, turns head sideways, cocks head, looks up (aircraft can be heard taxiing for take-off)
- sudden gust of wind starts to blow snow so that young can hardly be seen by observer, young lowers head, raises wings over his back
- aircraft now approaching eyrie, young cocks head, jerks head sideways to look in direction of noise and watches plane intently
- young lowers head and body and bends tarsus in intention movement of flight
- young then turns and faces in one direction and then turns rapidly to face the opposite direction
- young then walks 1 m to the left, cocks head and looks up at plane overhead, young then walks 1 m more to left and downslope and then starts feeding on prey remains
- young feeds on prey for about 5 minutes, young looks up, down, to side, up and then jerks head rapidly from side to side, then starts to preen back, chest and wing

Between overflights

ARID EYRIE (*Continued*)

19 August - 1 - 7 days before fledging

Overflight #70

Cessna 185 Airplane
75 m above and
140 m in front of eyrie

- young looks down intently at prey remains near feet, with head twisted and slightly cocked, then young looks in direction of airplane taxiing for take-off 5.5 km away, young then preens wing, looks around, preens chest, picks at prey remains, then sits huddled against rock with head low
- approaching aircraft now visible, young still huddled against rock, young looks over its back and watches plane as it goes by. Plane landing on lake 1200 m away and directly in front of eyrie
- young cocks head, jerks head back and forth rapidly, then huddles against rock, plane taxiing, young cocks head

20 August

(1 to 7 days before fledging)

Overflight #71

Bell 206 Helicopter
300 m above and
140 m in front of eyrie

- 13:00 - observer enters blind, one young perched in upright position and is motionless, adult not in sight
- 13:15 - young looks from side to side rapidly, cocks head, moves head side to side rapidly, cocks head and watches intently as helicopter goes over
- 13:20 - female flies past ledge with food, one already fledged young is following female and wailing, female circles in front of eyrie and then lands about 30 m to left of nest
- 13:20 - lost sight of female and other to
- 13:25 wailing, when female flew by unfledged young, he made intention

ARID EYRIE (*Continued*)

20 August - 1 - 7 days before fledging

movements of flight several times and then jumped down to ledge (a few metres below and out of sight)

13:25 - aircraft flies over when no birds are in sight - altitude 150 m and 140 m in front of eyrie

Overflight #72

Bell 206 Helicopter
75 m above and
140 m in front of eyrie

14:00 - young has now walked back up to nest ledge, it sits in exaggerated upright perch position, stretches neck, cocks head, watches as helicopter goes by
- female flushes rapidly from perch 150 m to left of nest ledge just before helicopter goes by, she flies in straight line but is soon out of sight when she flies in front of rock of same color

HOLE EYRIE

1 July

(1 to 10 days after hatching)

Overflight #73

Bell 206 Helicopter

300 m above and

140 m. in front of eyrie

12:00 - aircraft flies from east to west and is therefore originating from the "blind side of the eyrie"
 - female showed intention movements, head bobs, and then held head very high and jerked head from side to side. She also fluttered one wing

12:12 - female flew from eyrie

12:16 - the male (wailing) landed at eyrie with prey

12:28 - the male flew from the eyrie

12:31 - the female returned flying and flew past the eyrie wailing

12:35 - the male joined female in a display of cliff racing (both birds wailing constantly)
 - both birds then perch near top of cliff about 30 m above eyrie

Overflight #74

Bell 206 Helicopter

150 m above and

140 m in front of eyrie

12:35 - (continued) - both birds begin to wail as aircraft approaches
 - female watches helicopter intently and then changes perch twice, both birds continually wailing
 - the male flew off of ledge and began thermo-soaring and scalling to the southwest about 800 to 400 m away

12:39 - female arrives at ledge with prey male now out of sight

Overflight #75

Bell 206 Helicopter

75 m above and

140 m in front of eyrie

13:00 - no adults present, can't see into nest clearly enough to see young

HOLE EYRIE (Continued)

8 July

(8 to 10 days after hatching)

Overflight #76

Cessna 185 Airplane

300 m above and

140 m. in front of eyrie

- 10:56 - Due to pilot error the aircraft circled over the eyrie and then flew by parallel to cliff as planned
- both movements were at the proper altitude
 - when the plane circled in front of eyrie by mistake, the female just sat in the brooding position and watched it intently
 - as the aircraft approached during the scheduled overflight, the female watched it intently and raised up off nest slightly and gave exaggerated neck stretch, then she bent chest low with tarsus bent and held one wing down and out to side, then bobbed 3 times then watched plane over her back as it flew away, she then ruffled her tail feathers and settled back down on the nest
- 11:05 - female turns on nest, male (out of view) wails, female settles back down on nest
- 11:10 - female shifts position on nest then raises trills, ruffles feathers and settles back down on nest
- 11:11 - female moves head up and down as if attempting to keep young under her with her beak
- 11:12 - female stretches left wing
- 11:20 - female shifts position on nest 180 degrees

HOLE EYRIE (*Continued*)

8 July - 8 - 10 days after hatching

- Overflight #77
Cessna 185 Airplane
150 m above and
140 m in front of eyrie
- 11:23 - female facing direction of approaching plane
- plane approximately 800 to 1200 m mi away, female watching approaching aircraft intently
- 11:23.5 plane passing overhead, female lifts head and watches intently, then she stretches her neck and looks over her back as plane goes into distance, she watches plane until it is approximately 1500 m away, female then "withdraws" head into neck, female then quickly looks down and "checks welfare of young"
- 11:26 - female stands up and warbles, then turns and settles back down on nest in low brooding position
- 11:37 - female still in brooding position
- male (which is not in sight) gives 3 or 4 wails
- 11:37 - female brooding and occasionally to looking around
- 11:42 - female still in brooding position, male (still not in sight) gives 3 or 4 wails
- 11:42 - female brooding, occasionally to looking around
- 11:47
- 11:50 - male wails, male flies off perch (was perched approximately 30 m west of eyrie), male glides over valley and is looking down as if hunting, glides around corner of rock out of sight

HOLE EYRIE (*Continued*)

8 July - 8 - 10 days after hatching

Overflight #78

Cessna 185 Airplane

75 m above and

140 m in front of eyrie

11:52 - female jerks head back and forth approximately 4 times and nervously looks over shoulder 3 times (seems very disturbed - female is facing towards cliff with back towards plane as it flies over)

11:52 - female brooding with occasionally to looking around

11:58

11:58 - female echips, gets up off nest, to flies approximately 90 m to left of nest, lands, bends low, bobs head 3 times, echips, flies away echipping and gaining altitude, echips repeatedly and very strongly while gliding in circle approximately 150 m in diameter

- then she lands on ledge about 270 m to right and 15 m higher than eyrie, echips about 20 times, flies off of ledge again, glides back to nest, echips twice after landing, assumes brooding position

12:02 - female still in low brooding to position, occasionally looking

12:10 around, male still not in sight

10 July

(approximately 10 days after hatching)

13:36 - female on nest brooding young
- 2 young visible (male not in sight)

13:48 - female rises up to preen
- 3 young now visible, one young is crawling about occasionally, female just looks at young and then continues to preen

HOLE EYRIE (*Continued*)

- 10 July - approximately 10 days after hatching
- 13:53 - female looks from one side to other very quickly, then I hear a rumble, then a sharp crack, and I see rock falling about 800 m to the south of the eyrie
- Overflight #79
Cessna 185 Airplane suddenly appears over edge of cliff directly above eyrie at an altitude of 150 m
- 13:54 - female cocks head twice and watches plane intently
- 13:56 - female just sitting brooding (in upright position) and looking around
- 13:58 - 3 live young now visible (one under female, two others crawling around on tarsi just in front of, but shielded from sun by female)
- 14:02 - female left nest (I was looking away and didn't see her leave)
- 14:02.5 I hear cack and then see more rock falling
- Overflight #80
Cessna 185 Airplane 300 m above and 140 m. in front of eyrie RPM change from 2200 - 2700 over 3 - 5 seconds
- 14:07 - I hear aircraft lifting off from lake about 3200 m
- female seen flying very fast in direct line towards eyrie
- female lands on cliff in very upright posture and cocks head and starts moving head from side to side
- 14:10 - female cocks head as plane approaches, she seems to "freeze" in this position and looks at plane intently
- one young assumed a very upright posture with neck stretched upwards

HOLE EYRIE (Continued)

10 July - approximately 10
days after hatching

14:14 - one young laying flat, one young crawling around on tarsi, and one young under female, female in protective brooding position shielding young from sun and moving head side to side often

14:18 - I just looked away for a few seconds and female flew off of nest ledge and is no longer in sight [I think she may have left due to hunger because she was paying an unusual amount of attention (evident in side to side movement) to songbird singing]

14:22 - female seen scalling 2500 m south
- male seen flying past female towards Gull Creek
- lose sight of male when he is far out over delta

14:27 - young are still unattended at nest
- four young are now visible, two are sitting high on their tarsi and billing with each other

Overflight #81
Cessna 185 Airplane
150 m above and 140
m in front of eyrie
RPM change from 2200 -
2700 over 3 - 5 seconds

14:33 - when aircraft flew by two young moved their heads quickly from side to side and then froze in a flat crouch position, the other two young were lying down and remained motionless

14:34 - female seen flying very fast in direct flight towards eyrie
- female arrives at nest, perches at edge of nest for about 30 seconds and then assumes an upright brooding position, but is constantly looking from side to side with head held very high

HOLE EYRIE (Continued)

- 10 July - approximately 10 days after hatching
- 14:42 - female assumes lower brooding position
- 14:50 - as above but female is also preening
- Overflight #82
Cessna 185 Airplane
75 m above and 140 m in front of eyrie
RPM change from 2200 - 2700 over 3 - 5 seconds
- 15:00 - aircraft heard in distance, female stops preening and assumes a horizontal position with neck stretched out
- 15:00.5 female occasionally raises head and moves it from side to side then freezes in horizontal position for a few seconds, then cocks head, chest feathers flatten, jerks head from side to side rapidly, looks down at young, looks up at plane with her head cocked and then just watches it intently as it flies into distance
- Overflight #83
Sikorski 62 Helicopter
150 m above and 800 m from eyrie
- 15:05 - female looks down at nest, bobs head slightly, then freezes in brooding position with head lowered for a few seconds, then moves head from side to side, then watches helicopter intently
- 15:06 - female in upright brooding position occasionally looking around
- 15:10 - female flies to perch about 30 m above and 270 m to one side of eyrie
- 15:13 - female flies off of perch and begins alternating flapping with gliding and begins to wail
- 15:13.5 female joins male arriving with prey, male lands at eyrie, female almost lands on male's back and then flies to perch male feeds young

HOLE EYRIE (*Continued*)

- 10 July - approximately 10 days after hatching
- 15:14 - female wails occasionally while male is feeding young
- 15:30 - feeding over
- 15:35 - male wails and leaves to perch
- 15:35.25 - female returns to nest
- 15:43 - male flies out over delta hunting
- 15:50 - observer leaves

CABIN EYRIE

1 June

(early incubation)

Overflight #84

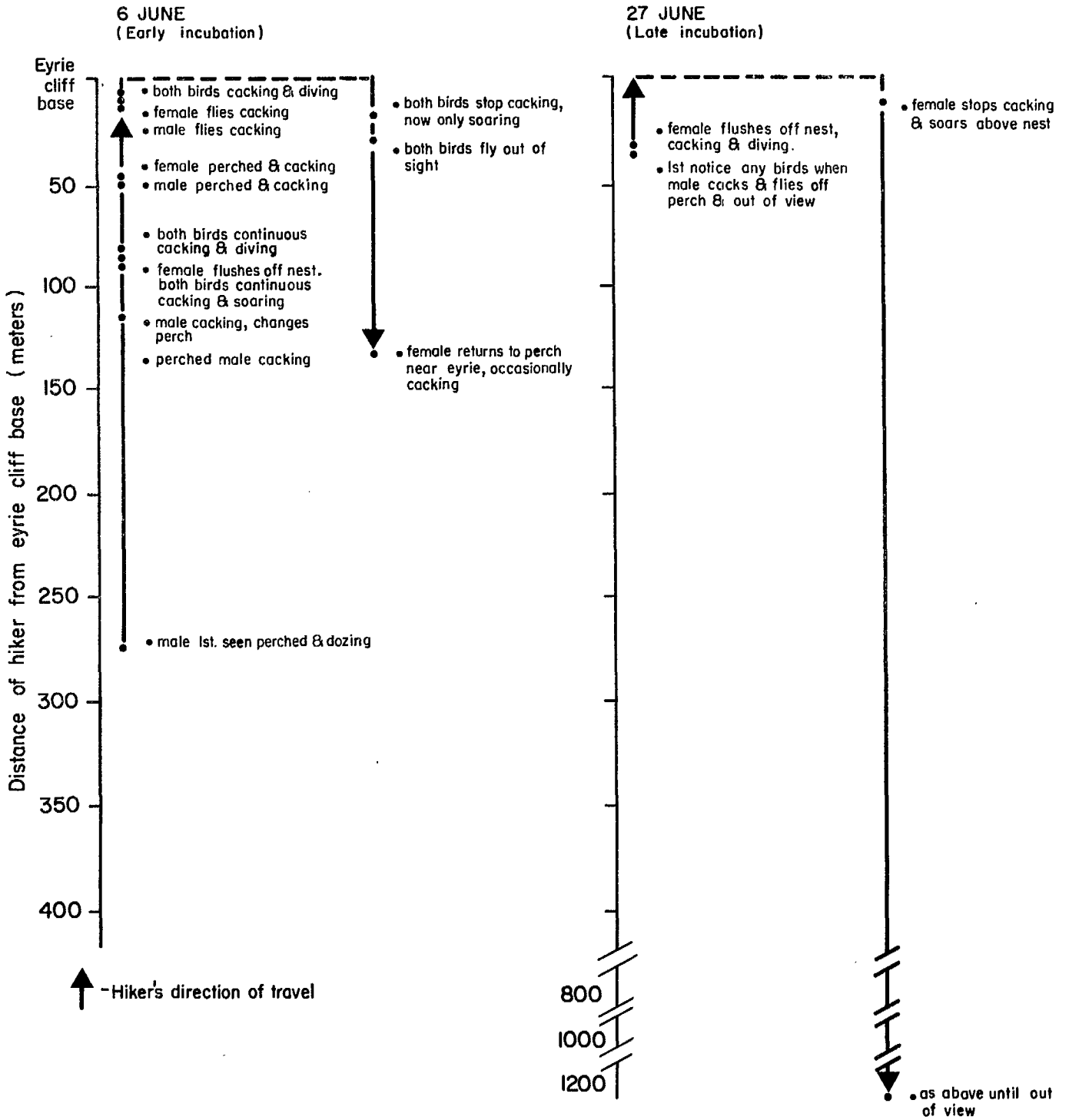
Six Tutor Jet Planes (CT14)
flying directly towards eyrie in
formation 150 m above eyrie
and 45 m to left of eyrie
airspeed probably greater
than 480 kph

- both male and female were
perched out of view, the birds
did not fly, after aircraft
flew by, there was much
eechipping

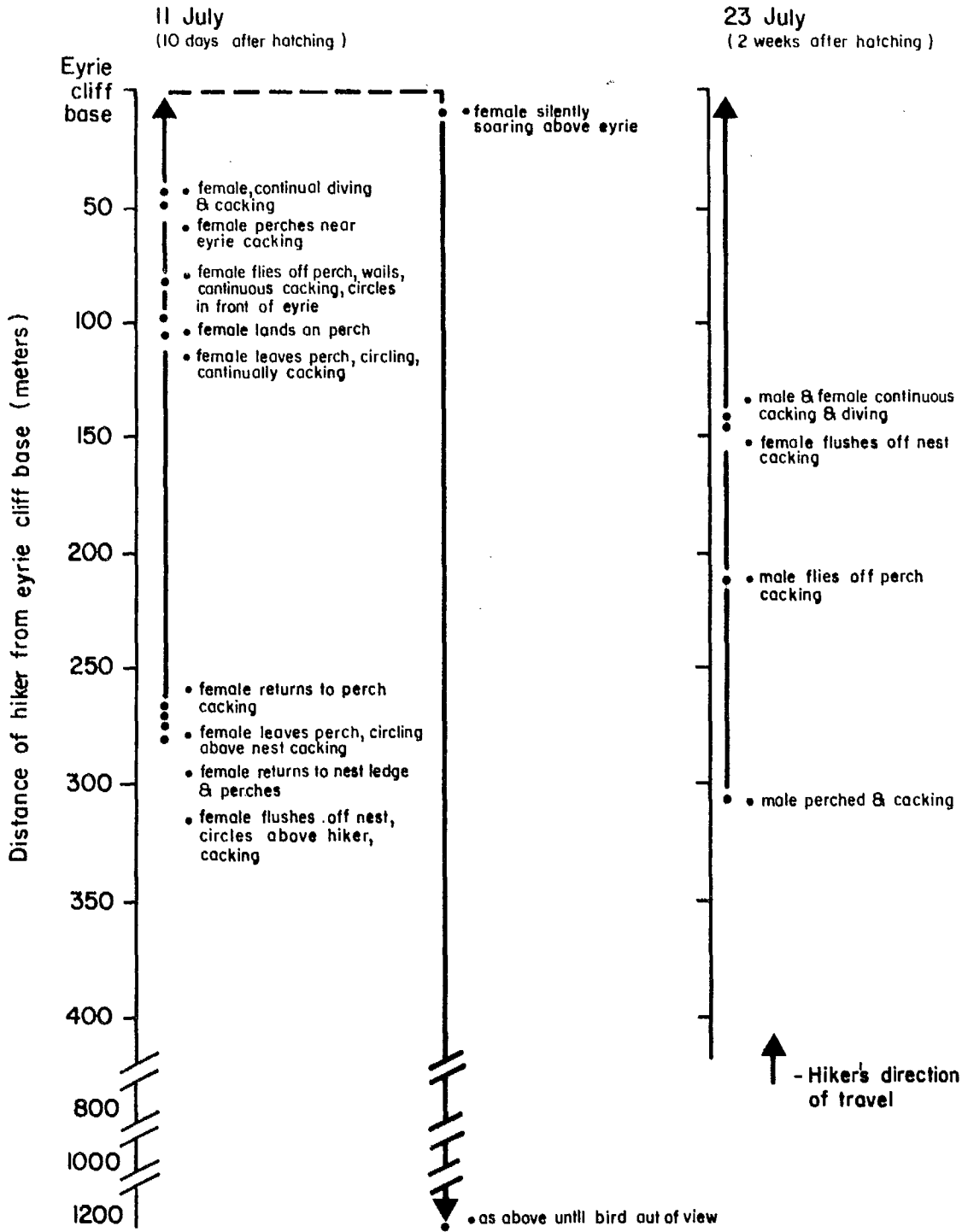


APPENDIX C: Graphical and Note Description of the Birds'
Reactions to Approaching Hikers

North End Eyrie

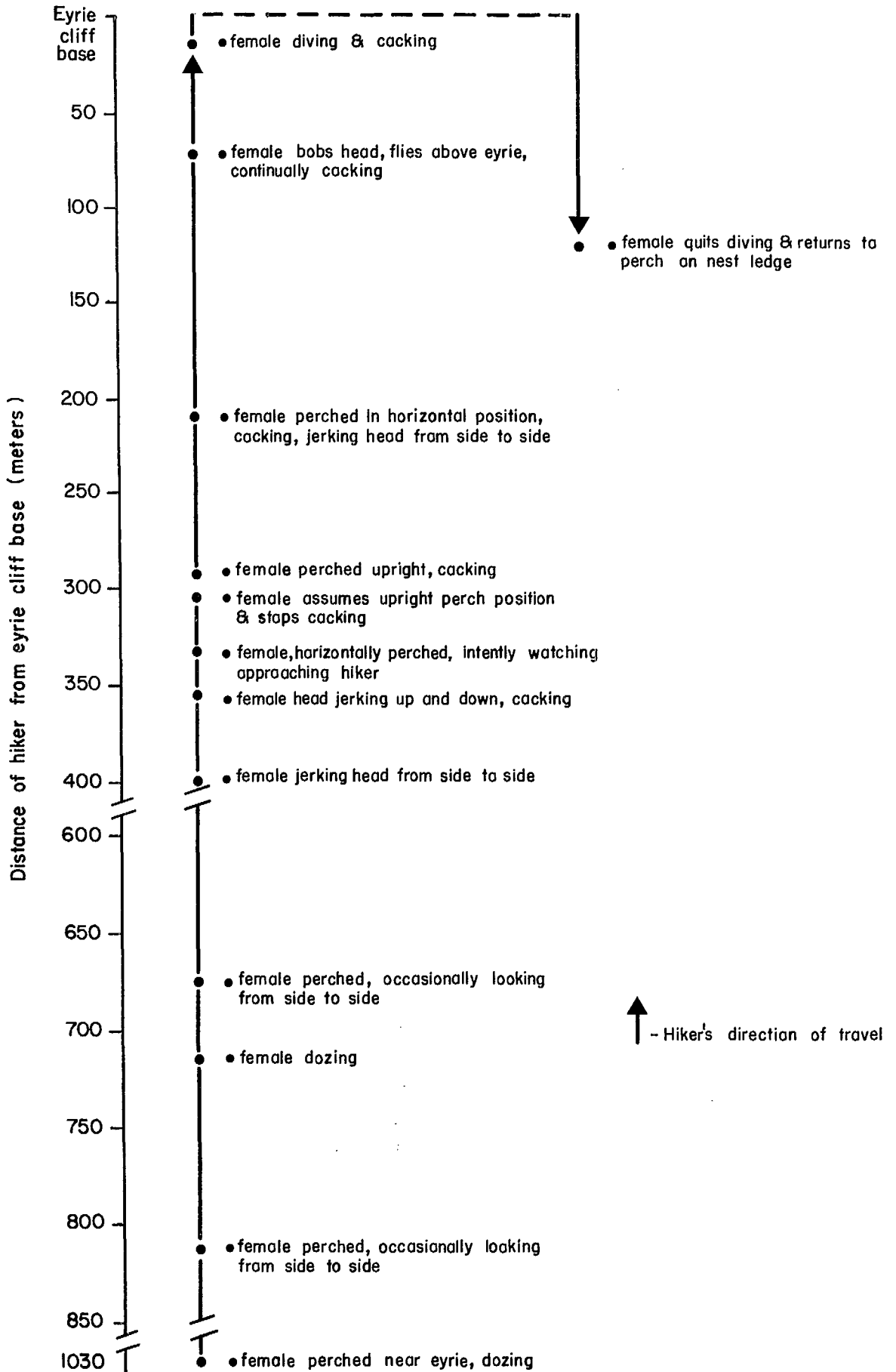


North End Eyrie

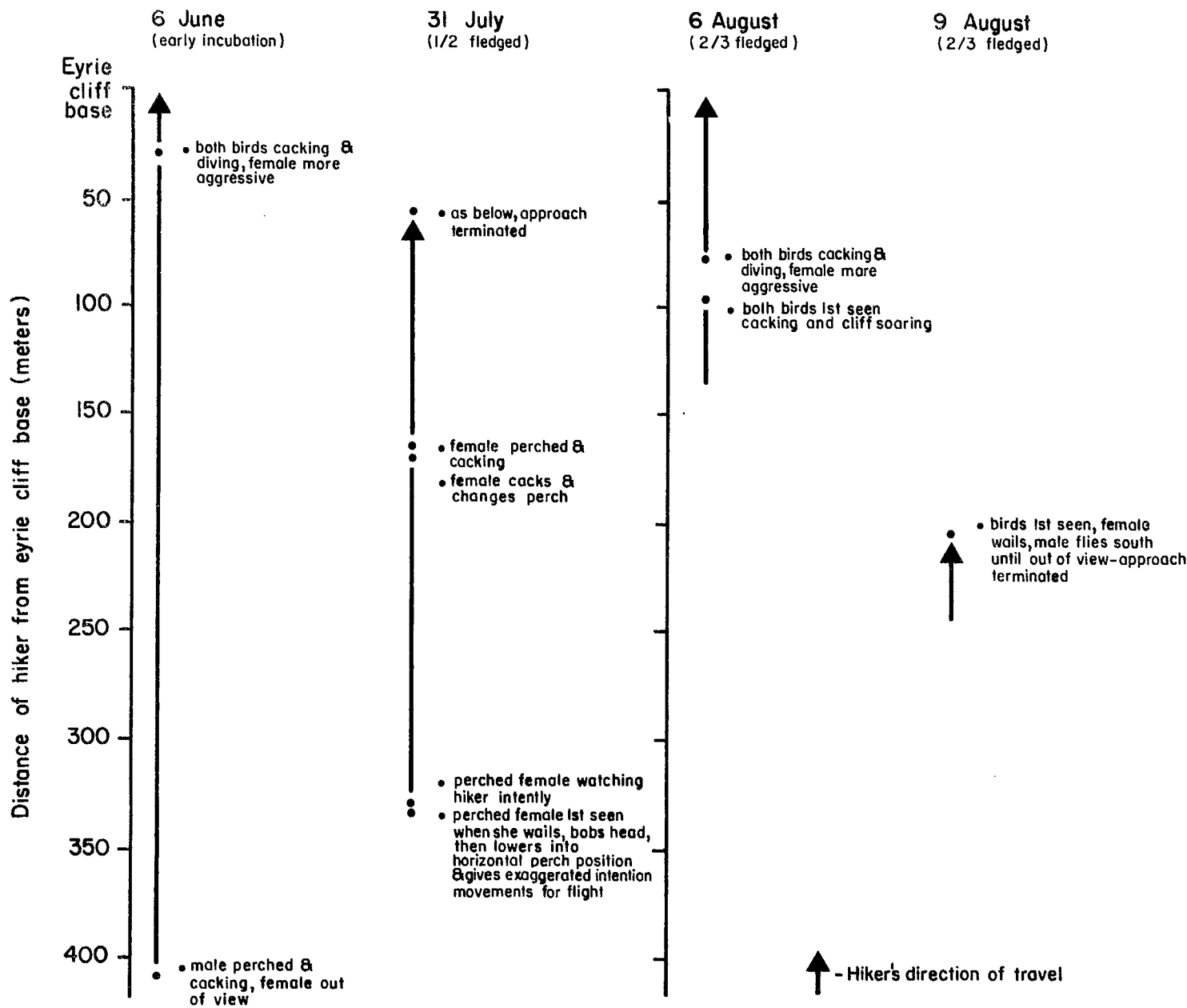


North End Eyrie

12 August
(2/3 fledged)

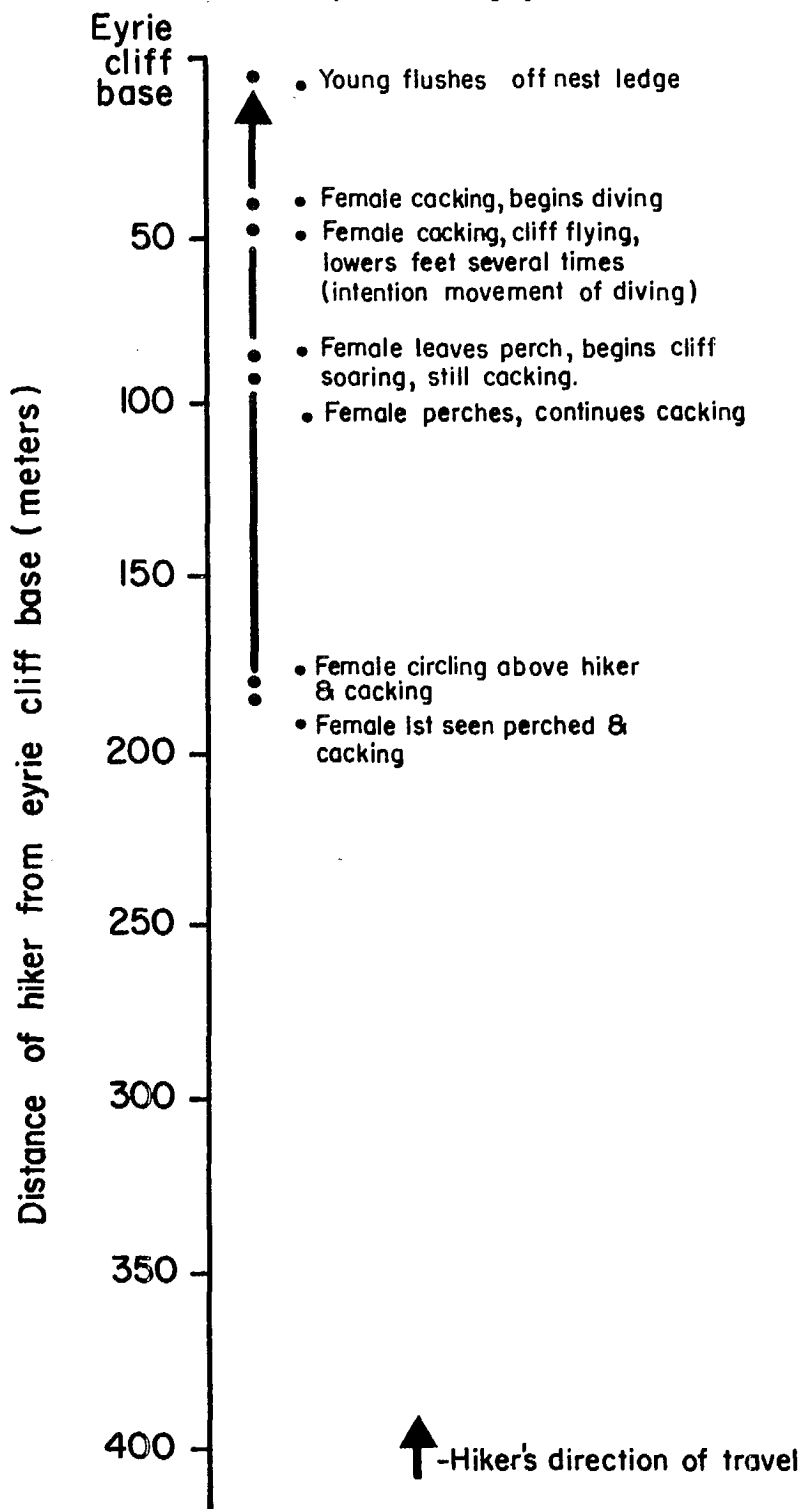


Arid Eyrie

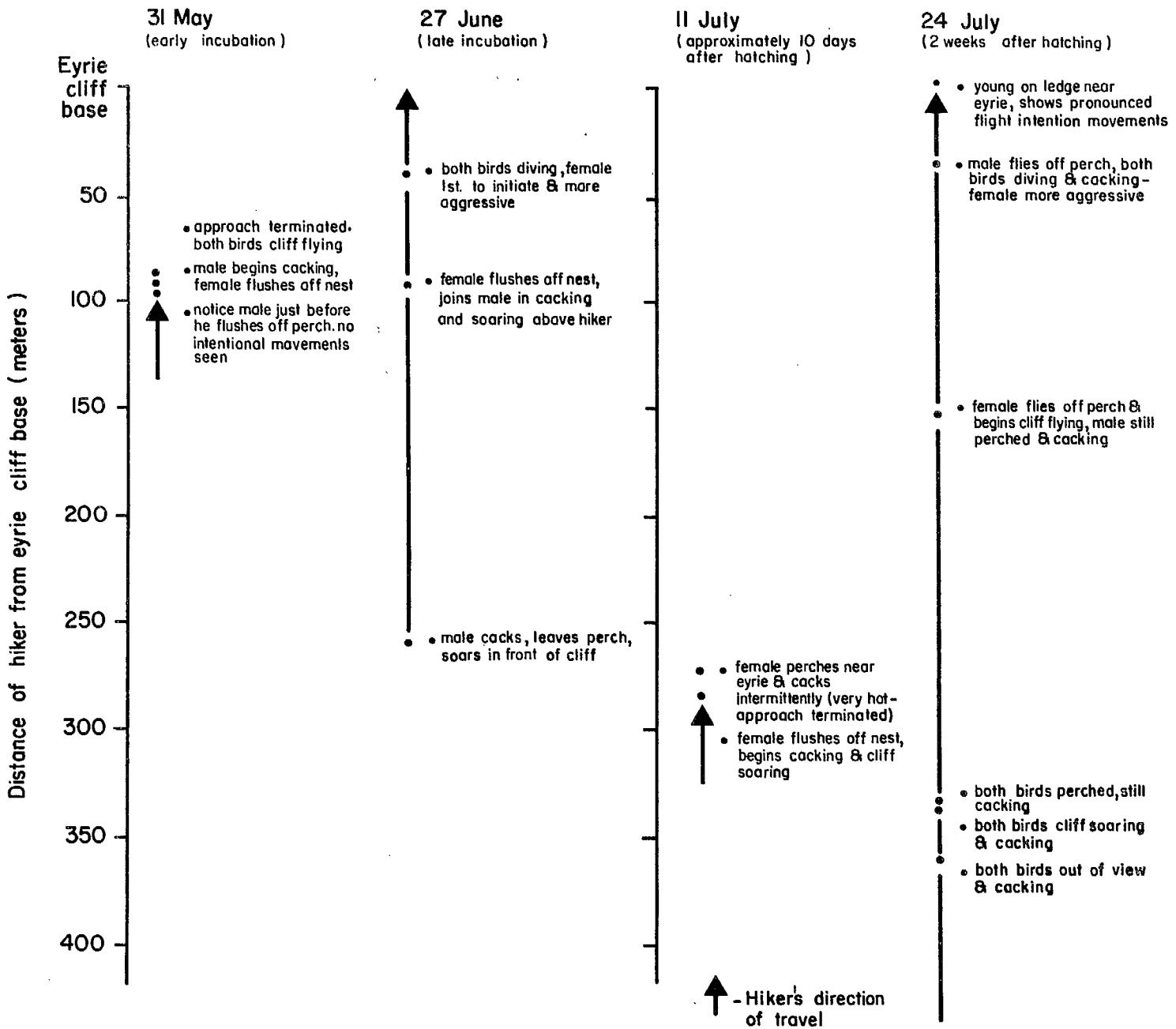


Arid Eyrie

20 August
(1 to 7 days before fledging)



Fortress Eyrie



BEARSKULL EYRIE

- 15 June
(Mid-incubating)
- (Hiker approaching eyrie from north and not in full view of eyrie, the maximum distance at which the hiker is in view of birds at eyrie or perched near nest ledge is 58 - 60 m)
- 57 m from eyrie - both birds begin cacking
- 50 m from eyrie - both birds begin diving and continue to do so as hiker continues to eyrie cliff base
- 16 June
(Mid-incubation)
- (Hiker approaching eyrie from south and in full view of eyrie)
- 1500 m from eyrie cliff base - male flies from nest area towards hiker and begins cacking and diving
- 1475 m from eyrie cliff base - male returns to perch near eyrie
- 270 m from eyrie - female flies off perch cacking
- 180 m from eyrie cliff base - perched male shows intention movements for flight
- 140 m from eyrie cliff base - perched male begins cacking, approach terminated
- 20 Sept
(post-fledging)
- 45 m from eyrie cliff base - adult female & 1 young appear flying above eyrie
- young chasing female food begging and wailing
- female cliff-flying and continually cacking

BEARSKULL EYRIE (*Continued*)

(20 Sept.)

- female does not dive but lowers feet in intention movements of diving

11 August

(1 week before fledging)

- both adults & 2 young perched near eyrie
- no distances at which the birds responded to the approaching hiker were recorded
- the adult female followed the retreating hiker for approximately 1200 m while continually cacking and diving

LONGCLIFF EYRIE

4 June

(Early incubation)

- perched male just watches intently as hiker arrives at base of cliff
- hiker begins to clap hands for approximately 5 minutes (at first softly and then louder and louder)
- finally female flies from nest ledge cacking
- perched male begins cacking right after female
- female does cliff flying
- female displaces male off of perch with obvious re-directed aggression
- male then begins cliff flying

LONGCLIFF EYRIE (*Continued*)

(4 June)

- female leaves perch and circles in front of eyrie twice
- male perches in tree, female perches just below him
- male begins to eechip strongly, then both birds quit cacking
- hiker remains at base of cliff for 10 minutes during which time both birds stopped and started cacking 3 times (female first to initiate)
- both birds silently watch intently as hiker leaves

27 June

(Late-incubation)

(Banding)

base of cliff

- female appears flying, male not in sight
- female silently soars above eyrie

270 m
from & on
same level
as nest

- male flushes off nest and begins cacking while cliff flying, female now begins cacking and cliff flying

900 m
from & on
same level
as nest

- both birds begin constant diving and cacking

nest

- as above

15 m from
nest, hiker
leaving

- both birds quit cacking

LONGCLIFF EYRIE (*Continued*)

- | | | |
|--|-------------------------------------|--|
| 23 July
(2 to 3 weeks after hatching) | 1449 m
from eyrie | <ul style="list-style-type: none"> - both adults begin cacking circling above and occasionally diving at observer - this continues all the way to eyrie cliff base |
| 9 Sept.
(Post-fledging) | 300 m
from eyrie | <ul style="list-style-type: none"> - perched male (first seen) watches hiker intently |
| | 90 m
from eyrie
to cliff base | <ul style="list-style-type: none"> - male begins cacking for approximately 1 minute - male wails and then silently watches hiker intently |
| 23 Sept.
(Post-fledging) | 87 m
from eyrie | <ul style="list-style-type: none"> - both perched adults begin cacking |
| | cliff base | <ul style="list-style-type: none"> - male stops cacking, female continues cacking, both birds remain perched as observer leaves |

HOLE EYRIE

- | | | |
|-----------------------------|------------------------------|--|
| 19 June
(Mid-incubation) | hiker at
base of
cliff | <ul style="list-style-type: none"> - no birds present - finally male arrives cacking and flying - male lands near eyrie, perches for 3 seconds, changes perch and stops cacking - 2 minutes later, female arrives flying and cacking - female perches near male - both birds immediately stop cacking and watch hiker intently |
|-----------------------------|------------------------------|--|

HOLE EYRIE (*Continued*)

20 Sept.
(Post-fledging)

hiker at
base of
cliff

- 1 adult (male?) seen hunting 400 m south eyrie, young chasing male food begging and wailing
- young arrives at eyrie, perches and wails for 25 minutes
- hiker leaves, young continues wailing

CABIN EYRIE

3 June
(Early incubation)

90 to 30
m from eyrie
cliff base

- male watches hiker intently
- male flies from perch cacking and occasionally eechipping

eyrie cliff
base

- female flies from nest ledge cacking
- male and female begin cliff soaring
- 3 minutes later, male returns to perch, then female perches
- both birds still cacking continuously

6 m from
eyrie cliff
base (hiker
leaving)

- both birds stop cacking and watch hiker intently

27 June
(Late incubation)

base of cliff
half-way up
hiker climbs
half-way up
cliff

- no birds seen
- no birds seen

CABIN EYRIE (*Continued*)

(27 June)

approach from
above eyrie

9 m from nest - male appears cacking and flying, female appears cacking and diving

nest - both birds cacking and diving, female more aggressive

3 m from nest (hiker leaving) - female stops cacking and diving

5 m from nest (hiker leaving) - male stops cacking and diving

90 m from nest (hiker leaving) - both birds out of hiker's view

- 10 minutes later female back on nest, male out of sight

QL The response of peregrine
696 falcons (*Falco peregrinus*)
.F34 to aircraft and human
W55 disturbance
1977
c.1

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