

## PRAIRIE FALCONS QUIT NESTING IN RESPONSE TO SPRING SNOWSTORM

JOHN R. SQUIRES

Wyoming Cooperative Fish and Wildlife Research Unit  
P.O. Box 3166 University Station  
Laramie, Wyoming 82071 USA

STANLEY H. ANDERSON

Wyoming Cooperative Fish and Wildlife Research Unit  
P.O. Box 3166 University Station  
Laramie, Wyoming 82071 USA

ROBERT OAKLEAF

Wyoming Game and Fish Department  
260 Buena Vista  
Lander, Wyoming 82520 USA

**Abstract.**—A small population of Prairie Falcons (*Falco mexicanus*) (mean = 6 pairs/year) nesting in northcentral Wyoming quit nesting in response to a severe spring snowstorm in 1984. Temperatures during the April storm were similar to years when the falcons reproduced successfully, but the monthly snowfall was 89.2 cm as compared to the 30-yr monthly average of 29.92 cm (90% CI = 21.44–38.40 cm). Analysis of prey abundance suggested that significantly fewer prey-sized birds were present on the study area in 1984 than in 1985, possibly as a result of the storm. The nesting failure may have been in response to reductions in avian prey populations.

### INDIVIDUOS DE *FALCO MEXICANUS* ABANDONAN EL ANIDAMIENTO A CAUSA DE UNA TORMENTA DE NIEVE PRIMAVERAL

**Sinopsis.**—Una pequeña población de *Falco mexicanus* (promedio de 6 pares/año) que reside en la parte norcentral de Wyoming, abandonaron sus nidos en respuesta a una severa tormenta de nieve primaveral ocurrida en 1984. Las temperaturas durante la tormenta ocurrida en abril, fueron similares a las de años en donde los falcones se reprodujeron normalmente. Sin embargo, la precipitación de nieve en ese mes resultó ser de 89.2 cm, mayor al promedio mensual (de 29.92 cm) informado en el periodo de 30 años entre 1951–1980 (90% CI 21.44–38.4 cm). Un análisis de abundancia de presas durante 1984 y 1985 sugiere menos aves del tamaño adecuado como presas durante el 1984, probablemente como resultado de la tormenta. El fracaso reproductivo puede haber sido una respuesta a la reducción en el número de aves que usa el halcón usualmente como presas.

A small, remote population of Prairie Falcons (*Falco mexicanus*) (mean = 6 pairs/year) has nested on the Pumpkin Butte formation in northcentral Wyoming. This formation consisted of five buttes surrounded by sagebrush (*Artemisia tridentata*) steppes and open grasslands. We studied Prairie Falcon movements and habitat-use patterns from 1982 through 1985. The data presented in this paper were collected as part of this larger study.

In April 1984, a severe snowstorm caused all five pairs of Prairie Falcons on the study area to stop nesting. Falcons nesting on both east and west cliff exposures failed regardless of nest site orientation. Four of

TABLE 1. Prairie Falcon productivity summary, Pumpkin Buttes, Campbell County, Wyoming, 1982-1985.

	1982	1983	1984	1985	Total (mean)
Occupied sites* (A)	7	7	5	5	24 (6)
Active sites (B)	4	7	4	4	19 (4.8)
Successful sites	4	4	0	4	12 (3)
Young fledged (C)	14	15	0	19	48 (12)
Productivity (active (C/B))	3.5	2.14	0	4.75	(2.6)
Productivity (occupied (C/A))	2.0	2.14	0	3.8	(2.0)

\* For breeding terminology, refer to Postupalsky (1974).

the five pairs produced eggs (4.8 eggs/active site). One of these sites hatched young but later failed. Therefore, no young were produced in 1984 compared to a 3-yr (1982, 1983, 1985) population average of 16 fledglings per year (Table 1). The storm appeared to affect only the 1984 breeding season. The highest productivity observed was in 1985, the year following the storm (Table 1).

The storm could have caused the nesting failures in at least two ways: (1) by increasing daily energy expenditure of adults to a high level or (2) by decreasing prey abundance. Springs that are exceptionally cold, moist and windy have delayed Prairie Falcon nesting 2-3 wk (Pulkrabek 1976). Climatic conditions can affect nest initiation, laying dates, clutch sizes, incubation behaviors and parenting behaviors (Elkins 1983). In addition, food shortages are often a pre-disposing factor in nest failures and desertion (Newton 1979). In an effort to document the effects of these factors, both weather and prey abundance data were analyzed.

April 1984 weather data (precipitation and temperature) were compared to 30-yr averages (1951-1980). Wind speed data were not available from a weather station approximately 48 km north of the study area. It was not possible to enter the study area during or immediately following the storm due to road closures. We assumed the weather at the weather station was similar to conditions on the study area.

April 1984 temperatures were only 1.6 C lower than average. The average high and low temperatures for this month were 22.2 C and -11.7 C, respectively. These temperatures were similar to April temperatures in 1982, 1983 and 1985, years when falcons nested successfully.

The April precipitation was 8.3 cm above average due to the high snowfall. During April, the area received 89.2 cm of snow compared to the 30-yr monthly average of 29.92 cm (90% CI = 21.44-38.40 cm). During the actual storm (25-27 April), approximately 64 cm of snow accumulated. The ground was covered with at least 20 cm of snow for 10 d.

During 1984 and 1985, birds and small mammals were sampled on transects in areas frequently used by foraging falcons (Squires et al. 1989). These transects were used as indices of the relative prey abundance between years. These analyses suggest that significantly ( $t = -2.80$ ,  $P$

< 0.05) more prey-sized birds were present on study area in 1985 than in 1984, possibly as a result of the storm. However, there were no significant differences ( $t = -0.29$ ,  $P > 0.785$ ) in small mammal numbers between these years.

Thirteen-lined Ground Squirrels (*Spermophilus tridecemlineatus*) were present in 91% of pellets (1982–1985) suggesting they were the most important prey species for this falcon population (Squires et al. 1989). In 1984, the frequency of Thirteen-lined Ground Squirrels in the falcons' diet was lower (75%) than in 1982, 1983 and 1985 (3-yr mean = 96%).

Possibly, the lower pellet frequency of Thirteen-lined Ground Squirrels in 1984 might have been caused by lower squirrel availability. Even though Thirteen-lined Ground Squirrels typically become active above ground from late March to early April (Jones et al. 1983, Lechleitner 1969), the exact timing of ground squirrel emergence varies with environmental conditions and also differs between populations and years (Murie and Michener 1984). For example, Belding's Ground Squirrels (*Spermophilus beldingi*) delay emergence in response to spring snowstorms (Morton and Sherman 1978). If Thirteen-lined Ground Squirrels behaved similarly, they would have been unavailable to foraging falcons during the snowstorm, forcing falcons to depend solely on avian prey during the food shortage.

Eighty nine percent of pellets contained avian remains, suggesting falcons fed extensively on avian prey (Squires et al. 1989). Avian prey such as Horned Larks (*Eremophila alpestris*) and Western Meadowlarks (*Sturnella neglecta*), which were present on the study area during early incubation, may have been more critical to these falcons early in nesting than were mammalian prey. Enderson (1962) noted that during late February numerous Horned Larks were available to nesting falcons. After an early March snowstorm, all nest sites were abandoned, and Horned Larks were no longer present near nest sites.

In summary, we feel the 1984 snowstorm caused all Prairie Falcons to stop nesting, possibly due to reductions in avian prey populations. The storm appeared to affect only the 1984 production year.

#### ACKNOWLEDGMENTS

This project was funded by the Wyoming Game and Fish Department with assistance from the Wyoming Cooperative Fish and Wildlife Research Unit. J. Deppershmidt, S. Irvine and M. Fowler provided valuable assistance with field data collections.

#### LITERATURE CITED

- ELKINS, N. 1983. Weather and bird behavior. T. and A. D. Poyser Ltd., Staffordshire, England. 239 pp.
- ENDERSON, J. H. 1962. Ecology of the Prairie Falcon (*Falco mexicanus*) in the central Rocky Mountain Region. Ph.D. thesis, Univ. Wyoming, Laramie, Wyoming.
- JONES, J. K., D. M. ARMSTRONG, R. S. HOFFMANN, AND C. JONES. 1983. Mammals of the northern Great Plains. Univ. Nebraska Press, Lincoln, Nebraska. 379 pp.
- LECHLEITNER, R. R. 1969. Wild mammals of Colorado. Pruett Publishing, Boulder, Colorado. 254 pp.

- MORTON, M. L., AND P. W. SHERMAN. 1978. Effects of a spring snowstorm on behavior, reproduction and survival of Belding's ground squirrels. *Can. J. Zool.* 56:2578-2590.
- MURIE, J. O., AND G. R. MICHENER. 1984. *The Biology of Ground-dwelling Squirrels.* Univ. Nebraska Press, Lincoln, Nebraska. 459 pp.
- NEWTON, I. 1979. *Population Ecology of Raptors.* Buteo Books, Vermillion, South Dakota. 399 pp.
- POSTUPALSKY, S. 1974. Raptor reproductive success: some problems with methods, criteria, and terminology. *Raptor Res. Rep.* 2:21-31.
- PULKRABEK, M. 1976. An inventory of raptor nesting in South Dakota, 1976. Unpubl. Prog. Rep. South Dakota Dept. Game, Fish and Parks. Rapid City, South Dakota. W-95-R-10. 7 pp.
- SQUIRES, J. R., S. H. ANDERSON, R. OAKLEAF. 1989. Food habits of nesting Prairie Falcons in Campbell County, Wyoming. *J. Raptor Res.* 23:157-161.

Received 12 Apr. 1990; accepted 2 Aug. 1990.