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Ferruginous Hawk Productivity In Saskatchewan, 1969 - 2004

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ABSTRACT

We banded 4,034 nestlings in 1,433 successful Ferruginous Hawk (*Buteo regalis*) nests in Saskatchewan between 1969 and 2005. The unexplained but sudden and prolonged drop in ground squirrel numbers, 1987 - 1996, had a less detrimental effect on Ferruginous Hawk productivity in grassland regions over ten consecutive years than was experienced by the Swainson's Hawk (*Buteo swainsoni*; Houston and Zazelenchuk 2004, Houston 2005).

INTRODUCTION

The world's first egg specimens of the Ferruginous Hawk (*Buteo regalis*; FEHA) were collected near present Dinsmore, Saskatchewan, on 29 Apr 1858 by Captain Thomas Blakiston (Houston 1976). This species' range in western Canada decreased appreciably with Caucasian settlement, as grasslands were increasingly cultivated throughout the 20th century (Houston and Bechard 1984).

In Saskatchewan, long-term banding efforts have contributed to our knowledge of this species' productivity and of its migration pathways to Oklahoma, Texas and northern Mexico (Houston et al. 1998). Declines in Ferruginous Hawk populations due to habitat loss have to some extent been countered through the construction of nest platforms, which have been especially useful in substituting for decaying domestic trees in deserted farmsteads (Houston 1982, 1985).

In Alberta and Saskatchewan, the main prey item of the Ferruginous Hawk has been Richardson's ground squirrel (*Spermophilus richardsonii*; whereas west of the Rocky Mountains, the chief

prey is the black-tailed jackrabbit (*Lepus californicus*; Smith and Murphy 1978). We have followed hawk productivity over 37 years through periods of high and low prey abundance. We address the changes in productivity in relation to an unexplained sudden crash in its main prey item and the subsequent gradual and patchy recovery in ground squirrel numbers in grassland areas over subsequent years.

Productivity of the Ferruginous Hawk in Saskatchewan, measured by numbers of fledglings per occupied nest, in good prey years has been higher (2.9 young/nest) than in other North American jurisdictions (Bechard and Schmutz 1995). When prey numbers crashed on a hawk study area in Utah, hawk fledglings per occupied nest dropped from 2.9 to 1.4 young/nest (Smith and Murphy 1978).

METHODS

Since 1969, we have concentrated on banding Ferruginous Hawks on and near nine large Prairie Farm Rehabilitation Administration (PFRA) pastures in west-central Saskatchewan between Rosetown and the Alberta boundary. These pastures host beef cattle and are without feed lots. A map of the main banding area, with plots of percent natural grassland remaining, can be found in Schmutz et al. (2001). Our study area was not completely searched and had no well-defined boundaries. Over the years, we have increased search and banding efforts with the help of pasture managers and local resident birdwatchers.

Records of ground squirrel numbers in western Canada are close to non-existent. Our visual, somewhat anecdotal, observations of ground squirrel abundance and their inverse relation to fox

and coyote numbers are given in Schmutz et al. (2001) and in Houston and Zazelenchuk (2004). Although we did not quantify ground squirrel numbers, we were able to make good assumptions concerning relative abundance for comparison purposes.

We documented dramatic changes in Richardson's ground squirrel numbers during our study. As a result, we divided the overall study into four periods: 1969 - 1987, with large numbers of Richardson's ground squirrels; 1988 - 1996, with less than ten percent of the previous numbers of ground squirrels; 1997 - 2002, years of gradual recovery with slowly increasing ground squirrels in patchy distribution; and 2003 - 2005, when ground squirrel populations rebounded.

Early experience with nest desertions following visits during incubation caused us, in subsequent years, to avoid flushing a female from her nest before the young had hatched (Houston 1974); nests were not climbed during incubation and most nests were not visited until June. For these reasons, we have no data on clutch size and we underestimate the nest failure rate, since an unknown number of nest failures doubtless occurred each year prior to our first visit. A few examples of brood reduction from cannibalism were encountered, especially in years of low ground squirrel numbers.

Productivity is presented as number of young/nest and represent number of nestlings banded per successful nest.

RESULTS

We banded 4,034 nestlings in 1,433 successful nests (Table 1). At least 229 other nests were initiated but were known to have failed. Not included in the table are 25 fledglings out of the nest, where the number of siblings was not known, as well as two adults.

From 1969 through 1987, Richardson's ground squirrels were abundant and Ferruginous Hawks raised a yearly average of 3.1 young/nest (Tables 1, 2). During this period, nests with four and five young accounted for 32% and 4%, respectively, of

the nests; more young were fledged from four-year nests (464) than from three-year nests (393). Only in one year, 1980, did productivity drop below 2.6 young/nest.

From 1988 through 1996, when ground squirrels were strikingly uncommon on grasslands, average productivity per successful nest dropped to 2.7 young/nest. The percent of nests with four and five young dropped more drastically—to 18% and 1%, respectively. In 1996, we encountered the highest-ever number of nest failures (24 of 79, or 30%) and the lowest-ever productivity (2.2 young/nest); that was the only year when more pairs (14) fledged only one young than pairs (13) that fledged three young. Cold, wet weather in late May 1996 may have contributed to this poor showing. Minimum failure rates of 15% or more of pairs also occurred in 1973 (with a small sample size), in all but two of the years between 1988 and 1996, and again in 1999, 2002 and 2003.

From 1997 through 2002, ground squirrels slowly and irregularly increased in grassland throughout the Kindersley map sheet region. By 2003 they had reached, by a very rough estimate, half of their initial numbers in grasslands. The only year of high productivity in the third period was 1997, when we found an unprecedented number of meadow voles (*Microtus pennsylvanicus*) throughout southern Saskatchewan (Houston and Zazelenchuk 2004). Apart from that exceptional year, average yearly productivity otherwise remained low at 2.7 young/nest. Finally, during the fourth period, 2003 - 2005, productivity returned to levels (3.0 young/nest) close to those seen during the first period, 1969 - 1987.

Over all 37 years, the most common brood size at the banding visit was three; 547 nests with three young (38% of the successful nests) produced 1,641 or 41% of the young. The 358 nests (25%) with two young produced only 18% of the young, while the 339 nests (24%) with four young produced 1,356 (34%) of the young. Comparing the first years, 1969 - 1987, with all subsequent years, the decrease in productivity coincident with a drop in ground squirrel numbers is highly significant by a Student's t-test ($p = 0.0027$).

Table 1. Ferruginous Hawks banded in Saskatchewan by C. S. Houston (1969-2004). Includes banding by Dan Zazelenchuk (2004-2005) and M.J. Stoffel (2005). Bold indicates "very poor years" (<2.6 young/nest); *italics show "very good year"* (>3.2 young/nest).

| Year | Nests Under Scrutiny | Min. Nests Failed | Successful Nests | | | | | Total | | Young/ Successful Nest |
|-------------|----------------------|-------------------|------------------|-----------|-----------|----------|----------|---------------|--------------|------------------------|
| | | | 1 yg | 2 yg | 3 yg | 4 yg | 5 yg | Success Nests | Young Banded | |
| 1969 | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 4 | 18 | 4.50 |
| 1970 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 5 | 15 | 3.00 |
| 1971 | 10 | 1 | 2 | 1 | 5 | 1 | 0 | 9 | 23 | 2.56 |
| 1972 | 10 | 0 | 0 | 3 | 1 | 6 | 0 | 10 | 33 | 3.30 |
| 1973 | 14 | 7 | 1 | 1 | 4 | 0 | 1 | 7 | 20 | 2.86 |
| 1974 | 15 | 3 | 1 | 1 | 4 | 5 | 1 | 12 | 40 | 3.33 |
| 1975 | 11 | 1 | 0 | 3 | 4 | 2 | 1 | 10 | 31 | 3.10 |
| 1976 | 12 | 4 | 0 | 0 | 5 | 3 | 0 | 8 | 27 | 3.38 |
| 1977 | 18 | 2 | 2 | 1 | 6 | 6 | 1 | 16 | 51 | 3.19 |
| 1978 | 19 | 2 | 1 | 1 | 9 | 6 | 0 | 17 | 54 | 3.18 |
| 1979 | 17 | 2 | 1 | 4 | 4 | 5 | 1 | 15 | 46 | 3.07 |
| 1980 | 21 | 0 | 3 | 8 | 6 | 4 | 0 | 21 | 53 | 2.52 |
| 1981 | 17 | 0 | 2 | 6 | 3 | 5 | 1 | 17 | 48 | 2.82 |
| 1982 | 22 | 1 | 3 | 2 | 10 | 6 | 0 | 21 | 61 | 2.90 |
| 1983 | 33 | 3 | 1 | 7 | 12 | 9 | 1 | 30 | 92 | 3.07 |
| 1984 | 51 | 14 | 1 | 10 | 16 | 9 | 1 | 37 | 110 | 2.97 |
| 1985 | 42 | 4 | 6 | 6 | 12 | 13 | 1 | 38 | 111 | 2.92 |
| 1986 | 38 | 2 | 3 | 7 | 11 | 13 | 2 | 36 | 112 | 3.11 |
| 1987 | 57 | 4 | 5 | 9 | 18 | 20 | 1 | 53 | 162 | 3.06 |
| 1988 | 57 | 11 | 5 | 12 | 18 | 10 | 1 | 46 | 128 | 2.78 |
| 1989 | 55 | 9 | 4 | 15 | 19 | 8 | 0 | 46 | 123 | 2.67 |
| 1990 | 58 | 4 | 5 | 12 | 24 | 11 | 2 | 54 | 155 | 2.87 |
| 1991 | 62 | 10 | 9 | 15 | 20 | 7 | 1 | 52 | 132 | 2.54 |
| 1992 | 62 | 11 | 7 | 10 | 20 | 13 | 1 | 51 | 144 | 2.82 |
| 1993 | 59 | 9 | 7 | 13 | 21 | 9 | 0 | 50 | 132 | 2.64 |
| 1994 | 69 | 12 | 7 | 11 | 27 | 12 | 0 | 57 | 158 | 2.77 |
| 1995 | 81 | 9 | 7 | 23 | 32 | 10 | 0 | 72 | 189 | 2.63 |
| 1996 | 79 | 24 | 14 | 21 | 13 | 7 | 0 | 55 | 123 | 2.24 |
| 1997 | 77 | 7 | 2 | 11 | 25 | 29 | 3 | 70 | 230 | 3.29 |
| 1998 | 73 | 10 | 13 | 23 | 21 | 6 | 0 | 63 | 146 | 2.32 |
| 1999 | 85 | 13 | 5 | 21 | 36 | 10 | 0 | 72 | 195 | 2.71 |
| 2000 | 83 | 8 | 7 | 20 | 31 | 15 | 2 | 75 | 210 | 2.80 |
| 2001 | 80 | 9 | 5 | 23 | 26 | 16 | 1 | 71 | 198 | 2.79 |
| 2002 | 62 | 12 | 12 | 12 | 20 | 5 | 0 | 49 | 116 | 2.37 |
| 2003 | 64 | 10 | 4 | 12 | 21 | 16 | 1 | 54 | 160 | 2.96 |
| 2004 | 63 | 5 | 5 | 16 | 15 | 20 | 2 | 58 | 172 | 2.97 |
| 2005 | 78 | 6 | 5 | 17 | 27 | 19 | 4 | 72 | 216 | 3.00 |
| Total Nests | 1663 | 229 | 156 | 358 | 547 | 339 | 33 | 1433 | 4034 | 2.82 |

Note: In 1996, Richardson's ground squirrels remained very scarce, though slightly increased from 1995. Foxes and coyotes remained unusually common. Cold, wet weather in late May could have had adverse effects on hunting and on exposure of young. Note increasing effort expended on nest-finding since 1987 and 1995, respectively. In 1996, four long-term Ferruginous Hawk sites were taken over by the (declining) Swainson's Hawk. 1997 was like old times, presumably directly or indirectly due to high vole numbers. The second lowest productivity ever was in 1998, though nest failure rate was average.

| Table 2. Summary of Ferruginous Hawk Productivity for Successful Nests in Saskatchewan | | | | | | | | | | |
|--|----------------------|-------------------|------------------|-------|-------|-------|-------|------------------------|------------------|-------------|
| Years | Nests Under Scrutiny | Min. Nests Failed | Successful Nests | | | | | Total Successful Nests | Nestlings Banded | Young/ Nest |
| | | | 1 Yg. | 2 Yg. | 3 Yg. | 4 Yg. | 5 Yg. | | | |
| 1969-1987 | 416 | 50 | 33 | 71 | 131 | 116 | 15 | 366 | 1107 | 3.02 |
| | | | 9% | 19% | 36% | 32% | | 4% | | |
| 1988-1996 | 582 | 99 | 65 | 132 | 194 | 87 | 5 | 483 | 1284 | 2.66 |
| | | | 13% | 27% | 40% | 18% | 1% | | | |
| 1997-2002 | 460 | 59 | 44 | 110 | 159 | 81 | 6 | 400 | 1095 | 2.74 |
| | | | 11% | 28% | 40% | 20% | 2% | | | |
| 2003-2005 | 205 | 21 | 14 | 45 | 63 | 55 | 7 | 184 | 548 | 2.98 |
| | | | 8% | 24% | 34% | 30% | 4% | | | |
| Total | 1663 | 229 | 156 | 358 | 547 | 339 | 33 | 1433 | 4034 | 2.82 |
| | | | 11% | 25% | 38% | 24% | 2% | | | |
| Total Nestlings Banded | | | 156 | 716 | 1641 | 1356 | 165 | | | |

DISCUSSION

The longevity of Ferruginous Hawks and the propensity for successful pairs to return to the same nest, year after year, combined to facilitate our studies. A Saskatchewan hawk, carrying a bell around its neck rather than a standard aluminum band, currently holds the record for longevity, 20-plus years, for a Ferruginous Hawk in the wild (Houston 1983). At one of our Ferruginous nest sites, a slow succession of different parents raised young successfully every year for 32 consecutive years (Houston 1995), a duration not known to have been equaled at any other published raptor nest.

Our results support Ian Newton's (1979: 290) oft-quoted statement that "almost every aspect of the natural population ecology of a given raptor species can be explained in terms of food."

In Saskatchewan and Alberta, the preferred food of the Ferruginous Hawk is the Richardson's ground squirrel. When this prey item was abundant, years with three or more young per nest were more the rule than the exception. Although food remains in

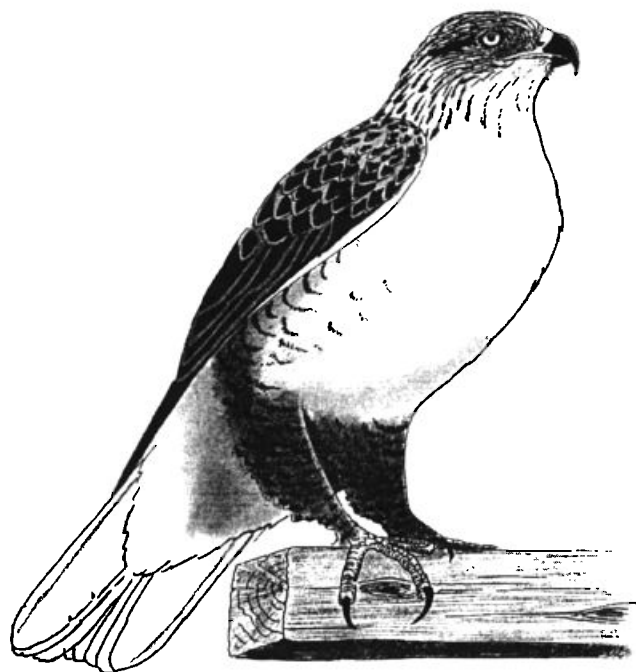
nests suggest that Ferruginous Hawks are even more dependent on Richardson's ground squirrels than are Swainson's Hawks, our data nevertheless suggest that a shortage of this main prey item caused a smaller change in productivity than it did with the Swainson's Hawk. As was the case with the Swainson's Hawk (Houston and Zazelenchuk 2004), the year of vole superabundance, 1997, caused a one-summer reversion to high success rates.

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by George West