Breeding ecology of ferruginous hawks at the Kevin Rim in northern Montana
by James Richard Zelenak

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

Abstract:
In 1993-94,I investigated factors influencing nest survival and productivity of ferruginous hawks in northern Montana and I estimated juvenile post-fledging survival using radio telemetry. A 170.9 km2 area at the Kevin Rim Key Raptor Area (BLM) contained 24 occupied ferruginous hawk territories in both 1993 and 1994; a breeding density of 7.12 km2/pair. Nest survival was 0.75 from occupancy to egg-laying (SE = 0.06, n = 48), 0.86 from egg-laying to hatching (SE = 0.06, n = 36), and 0.65 from hatching to fledging (SE = 0.09, n = 31). Sixty-five percent of occupied nests survived to hatching (SE = 0.07, n = 48), and 42% survived to fledging (SE = 0.07, n = 48). Mean productivity values for the 2 years combined were 2.10 eggs (SE = 0.21), 1.75 nestlings (SE = 0.21), and 0.96 young fledged (SE = 0.19) per occupied territory (n = 48). Mean clutch and brood sizes were 2.81 (SE = 0.16, n - 36) and 2.71 (SE = 0.16, n = 31), respectively, and mean number of young fledged/successful nest was 2.30 (SE = 0.21, n = 20). Twenty-three of 27 radio-marked juveniles survived to disperse from the study area (S = 0.85, SE = 0.07). Univariate and multivariate analyses indicated that ferruginous hawk nest survival and productivity were related to proximity of nests to cultivated fields, active oil wells, secondary roads, and other breeding raptors, as well as to the number/intensity of these variables within 1.6 km of occupied nests. Human disturbance related to mineral development and agricultural activities did not appear to negatively impact breeding ferruginous hawks. However, increases in these activities could pose a potential threat and should be discouraged. There is reason to believe that the ferruginous hawk population at the Kevin Rim has had inadequate productivity to sustain itself during the past 5 years. Low prey availability may be responsible for poor reproductive success. Further research is needed to determine if the population's growth rate remains negative over a longer period. If reproductive rates remain low, management plans to increase prey populations may be necessary.

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APPROVAL

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James Richard Zelenak

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

In 1993-94, I investigated factors influencing nest survival and productivity of ferruginous hawks in northern Montana and I estimated juvenile post-fledging survival using radio telemetry. A 170.9 km^2 area at the Kevin Rim Key Raptor Area (BLM) contained 24 occupied ferruginous hawk territories in both 1993 and 1994; a breeding density of 7.12 km^2/pair. Nest survival was 0.75 from occupancy to egg-laying (SE = 0.06, n = 48), 0.86 from egg-laying to hatching (SE = 0.06, n = 36), and 0.65 from hatching to fledging (SE = 0.09, n = 31). Sixty-five percent of occupied nests survived to hatching (SE = 0.07, n = 48), and 42% survived to fledging (SE = 0.07, n = 48). Mean productivity values for the 2 years combined were 2.10 eggs (SE = 0.21), 1.75 nestlings (SE = 0.21), and 0.96 young fledged (SE = 0.19) per occupied territory (n = 48). Mean clutch and brood sizes were 2.81 (SE = 0.16, n = 36) and 2.71 (SE = 0.16, n = 31), respectively, and mean number of young fledged/successful nest was 2.30 (SE = 0.21, n = 20). Twenty-three of 27 radio-marked juveniles survived to disperse from the study area ($\hat{S}$ = 0.85, SE = 0.07). Univariate and multivariate analyses indicated that ferruginous hawk nest survival and productivity were related to proximity of nests to cultivated fields, active oil wells, secondary roads, and other breeding raptors, as well as to the number/intensity of these variables within 1.6 km of occupied nests. Human disturbance related to mineral development and agricultural activities did not appear to negatively impact breeding ferruginous hawks. However, increases in these activities could pose a potential threat and should be discouraged. There is reason to believe that the ferruginous hawk population at the Kevin Rim has had inadequate productivity to sustain itself during the past 5 years. Low prey availability may be responsible for poor reproductive success. Further research is needed to determine if the population's growth rate remains negative over a longer period. If reproductive rates remain low, management plans to increase prey populations may be necessary.

INTRODUCTION

Distribution and Status

The ferruginous hawk (Buteo regalis), the largest North American *Buteo* or soaring hawk, is associated with open, dry grassland and shrubsteppe habitats in the western U.S. and southern Canada (Bendire 1892, Cameron 1914, Bent 1937, Brown and Amadon 1968). Slightly larger than red-tailed hawks (B. jamaicensis), ferruginous hawks occur in 2 color phases; the more common light phase, and a dark morph that usually represents 1 to 10% of breeding populations (Schmutz and Schmutz 1981, Olendorff 1993). The species breeds in 17 states and 3 Canadian provinces (Olendorff et al. 1989, Olendorff 1993). The breeding range extends from North Dakota south to northwest Texas, west to eastern Oregon and Washington, and north into the prairie provinces of Alberta, Saskatchewan, and southwest Manitoba (Fig. 1). Ferruginous hawks winter in the southwestern U.S. and northern Mexico (Salt 1939, Harmata 1981, Gilmer et al. 1985, Schmutz and Fyfe 1987, Warkentin and James 1988) but may remain year-round on some southern portions of the breeding range (Smith and Murphy 1978, Schmutz and Fyfe 1987, Johnsgard 1990: 248).

Ferruginous hawks are protected under the federal Migratory Bird Treaty Act and are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS 1992). The Bureau of Land Management (BLM) and other federal agencies are mandated to manage public lands for multiple-use, including the protection of raptor habitat and breeding

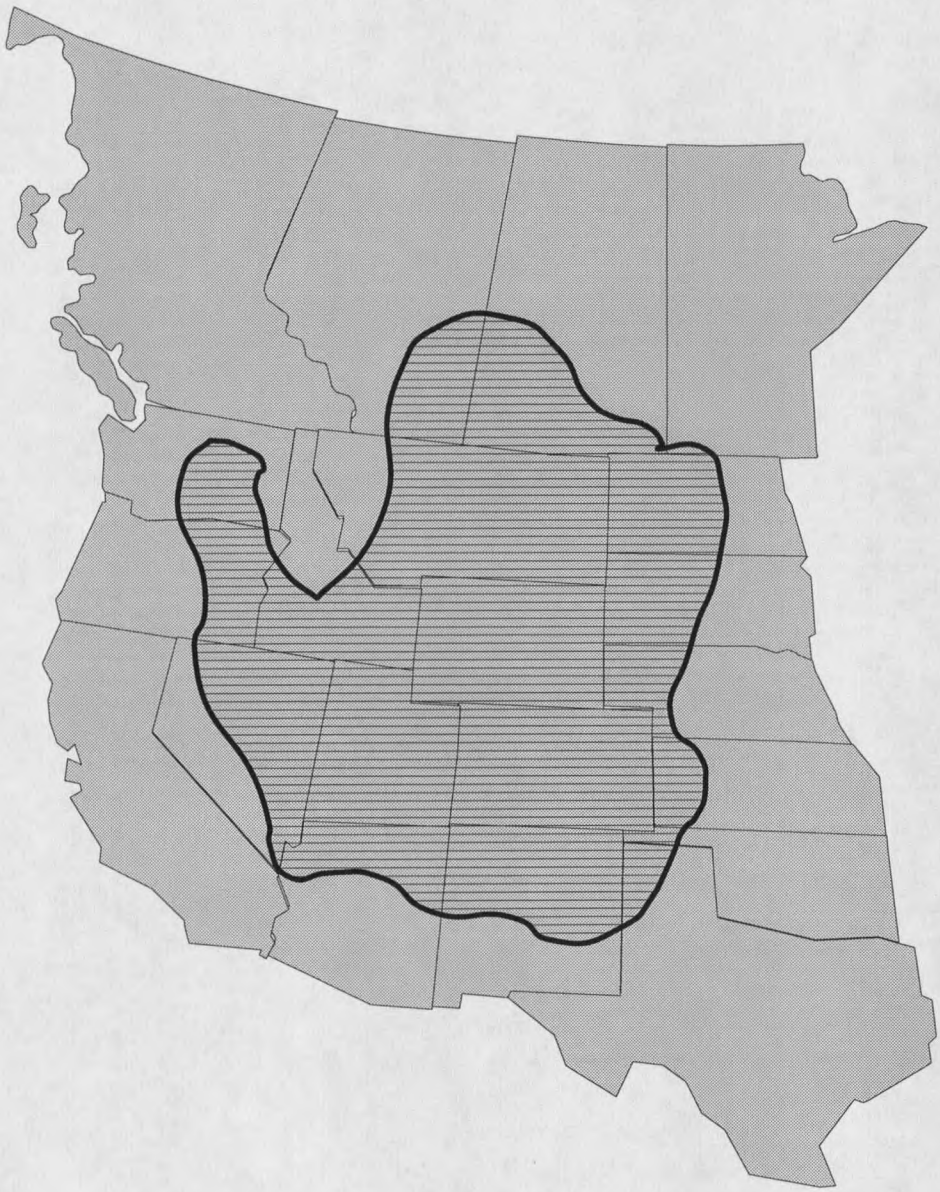

Figure 1. Breeding range of ferruginous hawks (after Olendorff 1993).

populations (Olendorff et al. 1989). A petition to list the ferruginous hawk as endangered (Ure et al. 1991) was rescinded by the USFWS (1992), however, the species remains a Category II Candidate for listing under the Endangered Species Act.

Some breeding populations of ferruginous hawks appear to be stable or increasing (Schmutz et al. 1984, Schmutz 1987b, Schmutz and Hungle 1989, USFWS 1992, Olendorff 1993), but others have declined, often dramatically (Powers and Craig 1976; Woffinden and Murphy 1977, 1989; Bechard 1981; Houston and Bechard 1984; Zelenak and Rotella 1994). Houston and Bechard (1984) believed that ferruginous hawks in Saskatchewan had declined to 10 to 20% of pre-settlement levels by 1960 and that as much as 40% of the species' original range was no longer occupied. Conversely, Warkentin and James (1988) reported a significant increase in the number of ferruginous hawks recorded during Christmas bird counts between 1952 and 1984, with the largest increase occurring between 1973 and 1984. Current estimates of total population size range from approximately 5,800 to 15,000 individuals (Ure et al. 1991, USFWS 1992, Olendorff 1993). In Montana, 175 to 250 pairs are estimated to breed (Olendorff 1993), but many areas of potentially suitable habitat within the state have not yet been surveyed (Atkinson 1995). The Montana Department of Fish, Wildlife, and Parks has classified the ferruginous hawk as a Species of Special Concern (Flath 1991).

Factors Affecting Breeding Success

Several researchers have proposed that the breeding range and the number of breeding pairs of ferruginous hawks have declined (Fyfe 1976, Bechard 1981, Houston

and Bechard 1984, Woffinden and Murphy 1989, Ure et al. 1991). A combination of factors, including loss of grassland habitat to large-scale cultivation, invasion of aspens (Populus sp.) into prairies due to fire suppression, range improvement practices, energy development, urbanization, and other human activities are thought to be responsible for declines (Lokemoen and Duebbert 1976; Blair and Schitoskey 1982; Houston and Bechard 1984; Schmutz 1984, 1987a, 1989; Olendorff 1993). Remaining suitable habitat may be threatened by increases in such activities (Howard and Wolfe 1976, Gilmer and Stewart 1983, Olendorff et al. 1989, Andersen et al. 1990).

Ferruginous hawks rarely nest in areas dominated by croplands (Howard and Wolfe 1976; Lokemoen and Duebbert 1976; Cottrell 1981; Blair and Schitoskey 1982; Gilmer and Stewart 1983; Schmutz 1984, 1987a, 1989; Olendorff et al. 1989). They are also sensitive to disturbances related to human activities near nest sites (Weston 1969, Blair and Schitoskey 1982, Ensign 1983, Gaines 1985, White and Thurow 1985, Andersen et al. 1990) and may abandon nests after a single disturbance if eggs have not yet hatched (Snow 1974, Howard 1975, Fyfe and Olendorff 1976, Fitzner et al. 1977, Blair 1978, Call 1979, Olendorff et al. 1989). Because the species is not known to renest after a clutch is lost (Woffinden and Murphy 1977), disturbances near nest sites during territory establishment or incubation could remove potential breeders from the breeding population.

Numbers of breeding pairs of ferruginous hawks fluctuate in response to changes in prey populations (Powers and Craig 1976; Woffinden and Murphy 1977, 1989; Smith et al. 1981; Schmutz and Hungle 1989). Because breeding ferruginous hawks often depend primarily upon a single prey species, usually jackrabbits (Lepus sp.) (Howard and Wolfe

1976; Woffinden and Murphy 1977, 1989; Smith et al. 1981) or ground squirrels (Spermophilus sp.) (Lardy 1980, Schmutz et al. 1980, Cottrell 1981, Gilmer and Stewart 1983, Schmutz and Hungle 1989), reductions in these key prey species can result in decreased nesting success and lowered reproductive rates (Howard and Wolfe 1976; Woffinden and Murphy 1977, 1983, 1989; Ensign 1983; Olendorff 1993).

Justification and Objectives

The Kevin Rim (Fig. 2), a series of sandstone cliffs in northern Montana, supports one of the highest concentrations of breeding raptors in the U.S. (DuBois 1988). Because of the unusually high diversity and density of breeding raptors supported by the Rim and surrounding grasslands, the BLM, which manages a portion of the area, has designated the Rim a Key Raptor Area (Olendorff et al. 1989) and an Area of Critical Environmental Concern (Williams and Campbell 1988). In addition to ferruginous hawks, the Rim and adjacent badlands and grasslands support breeding prairie falcons (Falco mexicanus), American kestrels (F. sparverius), red-tailed hawks, Swainson's hawks (B. swainsonii), golden eagles (Aquila chrysaetos), great-horned owls (Bubo virginianus), and burrowing owls (Athene cunicularia). Northern harriers (Circus cyaneus) and short-eared owls (Asio flammeus) also occur on the area.

DuBois (1988) first documented the Kevin Rim as an important breeding area for ferruginous hawks and other raptor species. She located, mapped, and photographed ferruginous hawk nest sites, noted productivity when possible, and estimated breeding densities on BLM lands surrounding the Rim. In 1990, Harmata (1991) estimated