

## THESIS ABSTRACTS

### FACTORS INFLUENCING LOCAL VARIATION OF BALD EAGLE DENSITY IN NORTH-CENTRAL SASKATCHEWAN

The influence of nesting habitat, prey resources and human activity on local variations of Bald Eagle (*Haliaeetus leucocephalus*) density was examined in 1986 and 1987 on Besnard and Nemeiben Lakes in north-central Saskatchewan. Eagle density and the number of active breeding areas on Besnard Lake was two to three times greater than on Nemeiben Lake. Differences in water area or area of forest within 200 m of shore accounts for a factor of 1.14 of the variation in eagle numbers, leaving the majority of the density differences to be explained by other factors.

Bald Eagles preferred to nest in large trees close to shore in mixed-wood stands dominated by coniferous trees. Treed rock, muskeg and even-aged coniferous stands were avoided. Trembling aspen (*Populus tremuloides*) was the preferred species for nesting on the mainland, while white spruce (*Picea glauca*) was preferred on islands. Percent of suitable forest habitat within the zone in which most eagles nest (200 m from shore) was almost identical on Besnard (35%) and Nemeiben (36%) Lakes and thus forest nesting habitat was not likely a factor limiting eagle numbers.

I investigated food resource levels by netting fish in both lakes, and examining records on commercial/sports-fisheries, and biological surveys. Cisco (*Coregonus artedii*), an important prey species for eagles, were more numerous and larger on Besnard Lake. Other indices of aquatic fauna and fish populations portray Besnard Lake as much more productive. Differences in the prey base was the most likely factor limiting eagle density on Nemeiben Lake.

I compared eaglet growth and hatching order of the sexes on Nemeiben Lake to that on Besnard Lake. Inflection points in growth curves and feather emergence were earlier in males than females. Second-hatched females, in mixed-sex broods, on Nemeiben Lake gained weight slower than males on both lakes, and had inflection points which were much later than those of females on Besnard Lake. Mixed-sex broods, with females hatching second, were rare on Besnard Lake, but common on Nemeiben Lake; the production of such broods may be an adaptive response to lower food levels.

I investigated human activity on the lakes through questionnaires distributed to cottage owners and analysis of campground occupancy. Human activity has been more intense on Nemeiben Lake for a longer period than on Besnard Lake. Human activity may have influenced the eagle populations, but did not account for all of the variation. **Elston H. Dzus, 1988. M.Sc. thesis, Department of Zoology, University of Manitoba, Winnipeg, MB, Canada. Present address: Department of Biology, University of Saskatchewan, Saskatoon, SK, Canada S7N 0W0.**

### PRE-INCUBATION BEHAVIOR AND PATERNITY ASSURANCE IN THE COOPER'S HAWK (*Accipiter cooperii*)

Male Cooper's Hawks (*Accipiter cooperii*) provide most of the food for their mates during the prezygotic period, hunt prey away from the nest site, and thus must leave females unattended for part of the day. Unattended females could be inseminated by other males ("cuckoldry"). Mated males should thus attempt to assure paternity because, as in other monogamous bird species in which both parents help to rear young, cuckolded males would waste their reproductive investment and lose individual fitness.

As part of a ten-year study of the nesting ecology of the Cooper's Hawk in Wisconsin, I obtained data on pre-incubation behavior during 1986-89. I investigated paternity assurance through a quantitative analysis of copulatory behavior and related activities during the prezygotic period.

Forty-seven mated pairs of Cooper's Hawks at 28 nesting areas were observed during 84 observational episodes ( $\bar{X} = 87$  min/episode). Observation periods were stratified such that most (69 or 82%) ended before 0830 H; observations also were conducted throughout the day until 1820 H. During a prezygotic period of about 30 days, males were more likely to be present during the early morning hours than at other times of the day. Copulations ( $N = 20$ ) occurred throughout the prezygotic period with (as with nest building) a peak of such activity in early morning. I estimated 372 copulations per pair for each clutch. Copulations were strongly associated with nest visits (nest building) by males. Seventy percent of 102 copulations were immediately preceded by nest visits by males. Males made significantly more nest visits and delivered significantly more twigs to nests than did females.

I suggest that the high number of copulations relative to other bird species is an attempt to assure paternity, and that male Cooper's Hawks help assure paternity by being present and copulating frequently with their mates in the morning—the most likely time of fertilization. I also suggest that nest building by males serves as a pre-coital display that induces females to copulate and thus acts to assure paternity. Building of alternate nests, as is common, may serve the same display function among males. **Robert N. Rosenfield. 1990. Ph.D. thesis, Department of Zoology, North Dakota State University, Fargo, ND 58105.**