



Reproductive success and post-fledging behavior of red-tailed hawks (*Buteo jamaicensis*) in the Gallatin Valley, Montana
by Sara Jane Johnson

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY in Zoology
Montana State University
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Abstract:

A study was made on reproductive success and post-fledging behavior of the red-tailed hawk in the Gallatin Valley, Montana, during springs and summers of 1971 and 1972, Non-breeding pairs comprised 11.6 per cent of 146 observed pairs and 53 per cent of the breeding pairs were successful in fledging at least one young.

An average of 2.34 young were fledged per successful nest. Losses in production due to infertility and nestling mortality were 3.7 and 5.9 per cent, respectively. The number of young fledged per total nesting attempts indicated that the observed population was maintaining itself. The highest density of pairs in the study area was one per three square kilometers. Nine territories ranged in size from 2.6 to 4.6 square kilometers. The number of pairs and distribution of territories throughout the study area were similar both years. No mortality was observed during the 30 to 70 days after fledging that young remained with the parent birds. After fledging the young remained within post-nesting areas for an average of 22 days. Upon leaving the post-nesting areas young used all parts of the parental territories and possibly the surrounding areas. Temporary flights into the surrounding areas were made by young from zero to five times, and young were gone from several hours to seven days and traveled maximum distances of 1.6 to 35 kilometers from the parental territories. Three radio-tagged young migrated at known ages of 35 to 70 days after fledging, leaving both the parental territories and the Gallatin Valley on the same days. Within the parental territories young limited most of their hunting activity to one to five well-defined hunting areas. Young gradually increased their hunting efficiency as the post-fledging period progressed by increasing the number of hunting flights, decreasing time intervals between hunting attempts and increasing the areas hunted by using higher perches and quartering over the ground.

Young were fed by the parent birds until at least 34 days after fledging, and young stole food from the parent birds until at least 48 days after fledging. Hunting success of young during the post-fledging period was observed to be low.

Social behavior between sibling young, non-sibling young, parent birds and their young, and non-parental adult birds and young are discussed, and play behavior by young is described.

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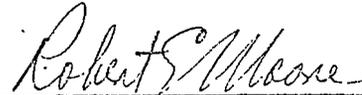
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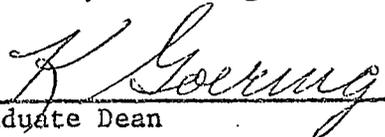
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ABSTRACT

A study was made on reproductive success and post-fledging behavior of the red-tailed hawk in the Gallatin Valley, Montana, during springs and summers of 1971 and 1972. Non-breeding pairs comprised 11.6 per cent of 146 observed pairs and 53 per cent of the breeding pairs were successful in fledging at least one young. An average of 2.34 young were fledged per successful nest. Losses in production due to infertility and nestling mortality were 3.7 and 5.9 per cent, respectively. The number of young fledged per total nesting attempts indicated that the observed population was maintaining itself. The highest density of pairs in the study area was one per three square kilometers. Nine territories ranged in size from 2.6 to 4.6 square kilometers. The number of pairs and distribution of territories throughout the study area were similar both years.

No mortality was observed during the 30 to 70 days after fledging that young remained with the parent birds. After fledging the young remained within post-nesting areas for an average of 22 days. Upon leaving the post-nesting areas young used all parts of the parental territories and possibly the surrounding areas. Temporary flights into the surrounding areas were made by young from zero to five times, and young were gone from several hours to seven days and traveled maximum distances of 1.6 to 35 kilometers from the parental territories. Three radio-tagged young migrated at known ages of 35 to 70 days after fledging, leaving both the parental territories and the Gallatin Valley on the same days. Within the parental territories young limited most of their hunting activity to one to five well-defined hunting areas. Young gradually increased their hunting efficiency as the post-fledging period progressed by increasing the number of hunting flights, decreasing time intervals between hunting attempts and increasing the areas hunted by using higher perches and quartering over the ground. Young were fed by the parent birds until at least 34 days after fledging, and young stole food from the parent birds until at least 48 days after fledging. Hunting success of young during the post-fledging period was observed to be low.

Social behavior between sibling young, non-sibling young, parent birds and their young, and non-parental adult birds and young are discussed, and play behavior by young is described.

INTRODUCTION

A study was made on reproductive success and post-fledging behavior of the red-tailed hawk (*Buteo jamaicensis*) in the Gallatin Valley, Gallatin County, Montana, during the springs and summers of 1971 and 1972. Between 1946 and 1970 the reproductive success of various red-tailed hawk populations in the United States has been measured (Fitch, Swenson and Tillotson, 1946; Orians and Kuhlman, 1956; Craighead and Craighead, 1956; and Hagar, 1957). Although these studies have shown that various aspects of reproductive performance such as clutch size and the number of young hatching and surviving to fledging are variable from area to area, no attempts were made to determine if these populations were stable. Recently two studies have been made on the stability of red-tail populations in Alberta (Luttich, Keith and Stephenson, 1971) and south-central Montana (Seidensticker and Reynolds, 1971), and both have indicated the observed populations were declining. Thus an attempt was made to determine if the Gallatin Valley population was declining or at least maintaining itself.

The post-fledging period extends from the time the young leave the nest until they become independent of the adults. For raptors in general, very little research has been done on this period of the bird's life. I know of only three studies where post-fledging

behavior was systematically studied. These include work on the tawny owl (*Strix aluco*) by Southern, *et al.* (1954), the African crowned eagle (*Stephanoaetus coronatus*) by Brown (1966) and the great horned owl (*Bubo virginianus*) by Dunstan (1970). No in-depth studies have been made on the post-fledging period of the red-tailed hawk although observations have been made on a few unmarked individuals during the early part of the post-fledging period by Fitch, *et al.* (1946).

The post-fledging period has been difficult to study because once the young become older and more active they become increasingly difficult to observe. To overcome this problem I used a radio-tagging technique to aid in the location of fledged young. The first reported use of transmitters on raptors was by Southern (1964) on the bald eagle (*Haliaeetus leucocephalus*). By 1972 radios had been used on at least 17 different species of raptors (Dunstan, 1972), including the osprey (*Pandion haliaetus*), the bald eagles, the marsh hawk (*Circus cyaneus*), the sparrow hawk (*Falco sparverius*), and several species of owls, accipiters and buteos. The transmitters used ranged in field life from 31 to 510 days and were placed on birds ranging in average weight from 109 grams for the male sparrow hawk to 6300 grams for the female bald eagle (Brown and Amadon, 1968).

Objectives of the post-fledging study were to determine the length of time the young are dependent upon the adults, length of time the young remain within the parental territory, the manner of termination of the young-parent relationship, movements of the young both inside and outside the parental territories, mortality, social behavior and the development of hunting behavior.

METHODS

Reproduction

Nesting pairs of birds were located in March and April each year by driving section roads and walking to inaccessible areas before the trees leafed out. Observations were begun early in the breeding season to detect all nest failures, as otherwise there would be an apparently higher success of the breeding population and larger number of non-breeding birds than actually occurred. An attempt was made both years to locate the majority of nesting birds in the study area by checking both old and new nest sites and checking some sites several times to locate late nesters. Non-breeding birds were located by searching areas where available nesting sites were not being used.

Once active nest sites were located, they were not visited again until May. Climbing to nests was avoided during the incubation period, due to reported desertions by adults caused by this disturbance (Luttich, Keith and Stephenson, 1971). All active nests were checked twice from May to July, first when the young were one to two weeks old to determine the number of young per nest, and later when the young were five to six weeks old to determine nestling survival. Most nests were checked at close range by climbing the tree. During the second check young were banded with Fish and Wildlife Service bands. Forty-nine young

were banded in 1971 and 70 in 1972. Nests which could not be reached by climbing were also observed to determine if young fledged. Nest locations accessible by road were checked when the young were between six and seven weeks of age to determine dates of fledging.

Color-marking and Radio-tagging

Non-toxic enamel spray paint was used to color-mark young for identification after fledging. The undersurfaces of the wing and tail feathers were marked, with markings on the wings used to denote the nest of origin and markings on the tail to identify the individuals from one nest. A variety of colors and combinations were tested in 1971, and most of the young in nests which were reached by climbing were marked. This was done at the same time they were banded in 1971, but in 1972 young were marked when they were older, at approximately seven weeks when the wing and tail feathers were longer. In 1972 both the total number of nests in which young were marked and the number of colors used were reduced to prevent confusion in identification of marked young. Young in only eight nests were marked and only two colors were used, with the exception of three colors being used to mark four young from one nest.

Both years radio-transmitters were placed on the birds in the field when the young were approximately seven weeks old. The transmitters were held on the bird by a harness. The harness was constructed with 0.3 centimeter polyethylene tubing. The transmitter was carried on the bird's back with the harness running forward forming a loop around the bird's head and then running down the breast and behind each wing. The antenna extended down the bird's back. Dissolvable gut-suture was used to fasten the harness.

In 1971 the radio-tagging was experimental. Transmitters were placed on two fledged young from one nest. These transmitters, built by Coy Miller of Dugway, Utah, had a frequency of 104 megacycles. They weighed 34 and 40 grams including the harness. No adequate receiving system was devised, and the transmitters were used only to determine the effects extra weight and the harness had on the young. No adverse effects were observed during the 53 days both young remained within the parental territory after fledging.

In 1972 10 transmitters were purchased from the AVM Instrument Company of Champaign, Illinois. A 12-channel AVM receiver and an antenna, both portable and easily carried in the field, were rented from William Cochran of Champaign, Illinois.

The four-element yagi antenna was directional and no triangulation was needed to locate birds. The transmitters weighed between 32 and 41 grams, including the harness. They functioned at frequencies between 150.892 and 151.117 megacycles and had an estimated field life of three months. Transmitting distance was approximately 0.4 kilometer from the ground, 1.6 kilometers from a tree, and up to 25 kilometers higher in the air.

These transmitters were placed on 10 young from seven nests. Three territories had two radio-tagged young, and four had a single radio-tagged young. The locations of these territories are given in Figure 1. Two radio-tagged young from one nest died from entanglement of the harness on a branch and a fence, and the radios were then placed on two young from another nest. These were the only observed mortalities resulting from the radio-tag.

Observations of Post-fledging Behavior

In 1971, color-marked young from eight nests were observed until the young became too active to be easily located, and then only young from three nests were observed to the end of the post-fledging period. In 1972 all radio-tagged young were observed until they either migrated out of the valley or were lost due to unknown causes. Untagged nestmates were occasionally

located. The seven territories containing the radio-tagged young were observed on a three-day cycle. The first day was spent completely at one territory, number 34, to obtain detailed data on behavior. All 10 radio-tagged young were located three times daily on the second and third days of the cycle to obtain data on movements and length of time the young remained within the parental territory. Distance covered to check all seven territories once was approximately 40 kilometers. The pattern of observation frequently broke down later in the post-fledging period when individual radio-tagged young were followed for extensive periods of time.

DESCRIPTION OF THE STUDY AREA

The study area encompasses approximately 674 square kilometers in the southeastern half of the Gallatin Valley, and ranges in elevation from 1289 to 1634 meters. This area extends from the Bridger Mountain Range at the east end of the valley to the dry hilly terrain west of Manhattan. The southern and northern boundaries are the Gallatin Mountain Range and the Horseshoe Hills. The towns and cities of Bozeman, Belgrade, Manhattan, Church Hill and Amsterdam are located within the study area. The terrain varies from generally flat on the valley floor, to gently rolling along the foothills. The area is predominantly open, with most trees occurring along natural and artificial waterways. The black cottonwood (*Populus trichocarpa*) is the dominant tree, with quaking aspen (*Populus tremuloides*) and willow (*Salix sp.*) occurring with less frequency. The land is used for both grazing and agriculture, with the main crops being forage and small grains.

