

PRODUCTIVITY OF THE RED-TAILED HAWK IN SOUTHWESTERN MONTANA

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DURING the 40-year period up to 1965 Red-tailed Hawk (*Buteo jamaicensis*) populations were estimated as stable throughout their range (Henny and Wight 1970). Studies made since that date on Red-tails in Alberta (Luttich et al. 1971), Wisconsin (Gates 1972), and south central Montana (Seidensticker and Reynolds 1971) have indicated low production relative to population replacement. As it is difficult to determine population status from short-term studies, I collected additional data on Red-tail production in one of the above regions, south central Montana, while doing a study on postfledging behavior of this species in 1971 and 1972.

STUDY AREA AND METHODS

The study area in southwestern Montana (Gallatin County) consisted of approximately 200 square miles in 1971 and 260 square miles in 1972. The topography here varies from generally flat terrain on the valley floor to gently rolling terrain along the foothills, and elevation ranges from 4250 to 5340 feet. The region is essentially open with most trees growing along natural and artificial waterways. The black cottonwood (*Populus trichocarpa*) is the dominant tree, with quaking aspen (*Populus tremuloides*) and willow (*Salix* sp.) less plentiful. The land is used for both grazing and agriculture (forage crops and small grains).

Each year I tried to locate all paired birds within the study area by the early to middle incubation period. Nesting birds were not disturbed (except in a few instances where nests were discovered at close hand) until the estimated hatching period. At this time trees with nests that appeared inactive were not climbed. Nests were considered inactive when either no birds defended the nest, no excrement was observed below the nest, or no greenery was visible on the nest edges. All trees with active nests were climbed when possible to determine number of young and hatching dates (estimated by feather development). A 31-day incubation period (Bent 1937, Hardy 1939) was used for backdating from the estimated hatching date to estimate laying dates.

Active nests were first examined when the young were under 3 weeks of age and a second time when they were 5 to 7 weeks of age. All young in accessible nests were banded with Fish and Wildlife Service bands. Fledging age (defined as the age young first left the nest tree) was determined from nests where continued observations were made on postfledging behavior.

RESULTS AND CONCLUSIONS

Density.—In 1971 and 1972 we located 64 and 73 pairs of Red-tailed Hawks, respectively. Density over the entire study area averaged approximately 1 pair per 3.1 square miles. The highest local density of 1

TABLE 1
FIELD OBSERVATIONS ON BREEDING ACTIVITY OF 136 PAIRS
OF RED-TAILED HAWKS

	1971	1972
Total pairs observed	64	73
Nonbreeding pairs	6	10
Breeding pairs hatching young	37	41
Breeding pairs fledging young	34	39
Nests in which young 0-3 weeks old were counted	29 (66 young) ¹	33 (92 young) ¹
Above nests that fledged young	26 (59 young) ²	31 (85 young) ²
Nests in which young were counted only when 5 weeks of age or older	5 (14 young) ³	0
Nests in which the number of young fledged was unknown	3	8

¹ In 1971 and 1972 respectively, nests containing 1, 2, 3, and 4 young were 5, 12, 11, and 1, and 3, 9, 13, and 8.

² In 1971 all young (7) were lost in 3 unsuccessful nests. In 1972 1 young was lost in each of 2 nests, while 5 young were lost in 2 unsuccessful nests.

³ Four nests had 3 young each, and 1 nest contained 2 young.

pair per 1.2 square miles was along the West Gallatin River. Estimated sizes of 9 Red-tail home ranges varied from 0.99 to 1.8 square miles. The smallest home range was in a primarily (87%) grazed habitat, while the largest occupied largely agricultural country that was 56% cropland.

Reproductive chronology.—Initiation of nest building by both single and paired birds occurred over a month period, and began as early as the first week in March. Estimated laying dates ranged from 15 April to 6 May in 1971 and 5 April to 6 May in 1972. Young fledged from 43 to 48 days after the estimated hatching date.

Production.—Tables 1 and 2 summarize field observations and analyze the reproductive performances of a total 137 pairs of Red-tailed Hawks. Of the total pairs observed, slightly more than 50% succeeded in fledging young both years. The initial loss in production resulted from nonbreeding pairs, those that neither used nor defended a nest. These nonbreeding pairs averaged 12% of the total pairs present for both years of the study. Of the 16 nonbreeding pairs located, at least 6 pairs were in adult plumage.

During the study, nonbreeding pairs occupied home ranges that were suitable for fledging young. Five home ranges were occupied by nonbreeding pairs one year and by breeding pairs the other, four that hatched young and three that fledged young. Four other home ranges were occupied by nonbreeding pairs both years of the study, and three home ranges occupied by nonbreeding pairs were observed only in 1972.

The success of breeding pairs in hatching young was also similar between years, and averaged 65%. The majority of nesting failures

TABLE 2
ANALYSIS OF FIELD OBSERVATIONS ON PRODUCTION

	1971	1972	Both years combined
% nonbreeding pairs	9.1	13.7	11.7
% breeding pairs hatching young	63.8	65.1	64.5
% breeding pairs fledging young	58.6	61.9	60.3
% total observed pairs fledging young	53.1	53.4	53.3
Average number of hatched young per nest	2.28	2.79	2.55
Average number of fledged young per nest	2.35	2.74	2.55
Estimated number of young fledged per total breeding attempts ¹	1.38	1.70	1.57
Estimated number of young fledged per total observed pairs	1.25	1.47	1.36

¹The estimated total number of young fledged each year (80 in 1971 and 107 in 1972) was calculated by assuming that production of young in successful nests was the average number observed for the year if otherwise unknown.

occurred prior to or shortly after the young hatched. Details of early nesting failures were known in only 9 cases: 4 pairs defended nests into June and July without laying eggs, 2 pairs deserted the nest shortly after construction without laying eggs, 2 pairs failed to hatch their eggs (possibly because of insufficient incubation), and 1 pair's eggs were destroyed.

The numbers of young hatched per nest differed significantly ($P = 0.05$), but not the numbers of young produced per breeding attempt or by the total observed pairs.

Nestling mortality.—Known nestling mortality (determined where both newly hatched and nearly fledged young in a nest were observed) was very low in successful nests: none was noted in 1971 and it averaged only 2.3% of the total young hatched in 1972. In 1972 1 young in a nest of 2 disappeared before 3 weeks of age (cause unknown) and 1 young in a nest of 4 may have been deserted by the adults (when first checked in June, this nestling was in down plumage while its 3 nest mates were almost fully feathered).

Known nestling mortality for both successful and unsuccessful nests was 11% in 1971 and 8% in 1972. Causes of failure were known in 3 of the 5 cases: 1 nest blew down and 2 nests were destroyed by mammalian predators when the young were between 3 and 4 weeks of age.

Nestling mortality for all nests that hatched young, including those in which nestling mortality was undetermined, was estimated as 8% in 1971 and 6% in 1972. These estimates assumed that, if otherwise unknown, all successful nests suffered no mortality and produced the average number of young per nest raised in observed nests that year.

DISCUSSION

In comparison with other northern Red-tail populations above 42° north, estimated production of young in southwestern Montana (1.57 young per total breeding attempts) was fairly high. Production of young per total breeding attempts was estimated in Wisconsin as 1.09 (Gates 1972) and 1.41 (Orians and Kuhlman 1956), in New York as 1.1 (Hagar 1957), in Alberta as 1.04 (Luttich et al. 1971), and in south central Montana as 0.85 (Seidensticker and Reynolds 1971).

Henny and Wight (1970) estimated that northern Red-tail populations must produce between 1.33 and 1.38 young per total breeding attempts to maintain a stable population. Assuming their estimate is correct, the production of young in southwestern Montana was adequate for population stability during the 2 years of this study. Thus the low Red-tail production Seidensticker and Reynolds (1971) noted in south central Montana during 1966 and 1967 may have been temporary rather than chronic.

No significant difference was found between the south central and southwestern Montana regions in either success of breeding pairs in hatching young or in the average number of young hatched per nest, but the number of young fledged per nest showed a significant difference ($P = 0.01$ in 1971 and 0.005 in 1972). Thus nestling mortality was the major contributing factor for the difference in production between the two tracts, being approximately 35% in south central Montana (Seidensticker and Reynolds 1971) compared to the estimated average of 7% in southwestern Montana. Wide fluctuations in nestling mortality within a region over a period of years have been noted elsewhere. In California recorded nestling mortality has ranged between 6% in 1973 (Wiley pers. comm.) and 40% in 1941 (Fitch et al. 1946). Although factors responsible for most nestling mortality in south central Montana were undetermined, one difference in mortality between the two places was loss of individual young within successful nests. This occurred in at least 14% of successful nests in south central Montana, versus 4% of successful nests in southwestern Montana.

Seidensticker and Reynolds (1971) felt that chlorinated hydrocarbon pesticide residues may have been a contributing factor in the observed low breeding success (50%), by causing failure of breeding females to lay eggs. The breeding success they estimated was considerably lower than recorded for two other northern Red-tail populations: 71% in Alberta (Luttich et al. 1971) and 74% in Wisconsin (Orians and Kuhlman 1956). As the success of breeding birds in hatching young was not significantly different between the two Montana tracts, low breeding success may be characteristic for these populations during some years.

ACKNOWLEDGMENTS

I would like to express my thanks to T. H. Glorvigen, R. J. Douglass and R. Story for assistance in fieldwork; to J. P. Jenny for use of his climbing gear; and to D. G. Cameron, R. E. Moore, P. D. Skaar and E. Vyze for review of the manuscript. The study was funded by the Society of Sigma Xi, the Chapman Foundation, the Foundation for Environmental Education and Montana State University.

SUMMARY

Production of the Red-tailed Hawk was studied in southwestern Montana to estimate population stability during 1971 and 1972. Of 137 pairs observed, approximately half succeeded in fledging young; 12% of the total pairs were nonbreeders, and of the remaining breeding pairs, an average 65% hatched young and 60% fledged young. An average 2.55 young were fledged per successful nest, with estimated nestling mortality averaging 7%. Estimated production of young was 1.57 per total breeding attempts and 1.36 per total observed pairs. Production was estimated as adequate for population replacement for the years of the study.

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P. O. Box 302, St. Anthony, Idaho 83445. Accepted 3 September 1974.