

BREEDING BIOLOGY OF RAPTORS IN THE CENTRAL APPALACHIANS

by

Cynthia A. Janik and

James A. Mosher

Appalachian Environmental Laboratory

University of Maryland

Frostburg, Maryland 21532

Abstract

We have summarized the breeding chronology, productivity and food habits of the principal diurnal raptors of the Central Appalachian region from 1978–1980. Nest success varied from 53% for Red-shouldered (*Buteo lineatus*) to 86% for Broad-winged (*Buteo platypterus*) hawks. The average number of young fledged per nest attempt was 1.4, 1.8, 1.7 and 2.0 for Red-tailed (*Buteo jamaicensis*), Red-shouldered, Broad-winged and Cooper's Hawks (*Accipiter cooperi*), respectively. The principal prey species for this raptor community is the eastern chipmunk.

Introduction

Recent declines of a few raptor species demonstrate their sensitivity to ecosystem perturbations and the need for substantial baseline data.

Little research on raptor populations has been conducted in the Appalachian region. Studies of the breeding biology of populations provide data important for monitoring the future status of these populations and for establishing population norms against which effects of environmental changes may be assessed. In this study, nesting Broad-winged (*Buteo platypterus*), Red-tailed (*B. jamaicensis*), Red-shouldered (*B. lineatus*) and Cooper's (*Accipiter cooperi*) hawks were studied to determine the status of the raptor community in the central Appalachian region and to describe their nesting biology, chronology and food habits.

Study Area and Methods

Ground surveys for nests were conducted on two principal areas: Green Ridge State Forest and Savage River State Forest (Figure 1). Green Ridge State Forest, in eastern Allegany County, encompasses 10,522 ha (26,000 acres) of woodland ranging in elevation from 340 to 485 meters. Tree species include oak (*Quercus* spp.), ash (*Fraxinus* spp.), maple (*Acer* spp.) and hickory (*Carya* spp.). In bottom sites, white pine (*Pinus strobus*), poplar (*Populus* spp.) and mountain ash (*Sorbus americana*) are present. Some forest areas formerly converted to orchard plots now support Virginia pine (*Pinus virginiana*), pitch pine (*P. rigida*), short leaf pine (*P. echinata*) and table pine (*P. pungens*).

Savage River State Forest, in central and eastern Garrett County, totals 21,355 ha (52,770 acres) and ranges from 454 meters on the Savage River to 912 meters. Predominant vegetation is wild cherry (*Prunus serotina*), red (*Acer rubrum*) and sugar maple (*A. saccharum*), black (*Betula lenta*) and yellow birch (*B. lutea*), beech (*Fagus grandifolia*), basswood (*Tilia americana*), white pine and hemlock (*Tsuga canadensis*). Oak, tulip poplar (*Liriodendron tulipifera*) and hickory are characteristic trees of lower elevations.

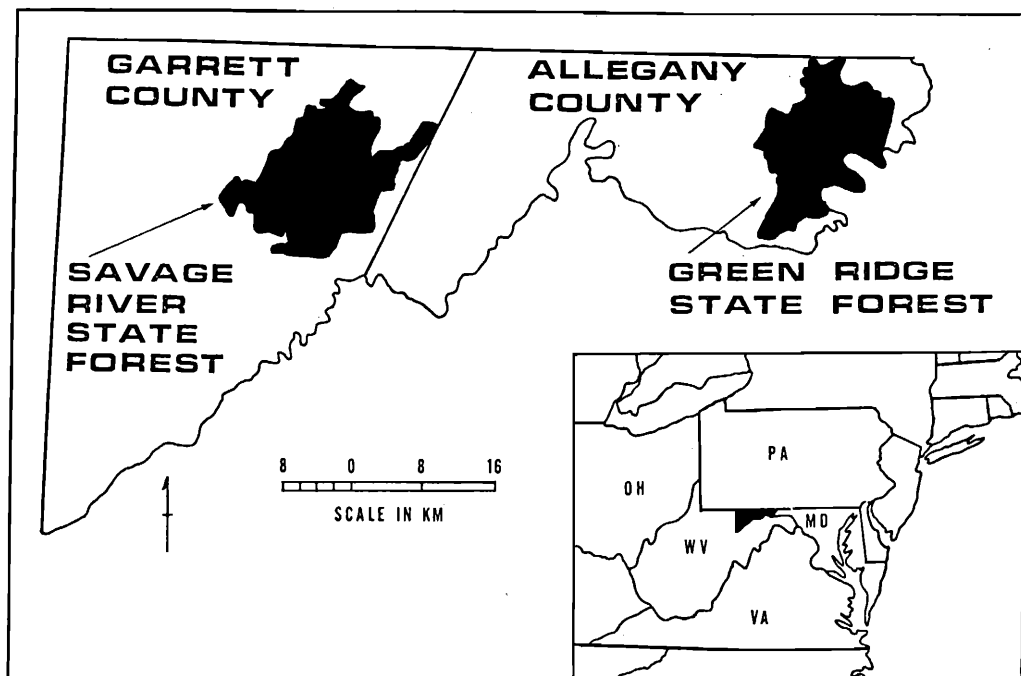


Figure 1. Location of Study Areas in Western Maryland.

Sections of both areas were systematically searched for stick nests during the 1978, 1979 and 1980 breeding seasons. Intensive searches were concentrated in February, March and April when breeding birds arrived and continued through leafing out of the trees. Vocalizations, aerial displays and sighting frequency were used to aid in locating nests. All nests were plotted on 7½ min U.S.G.S. maps. Nests were checked periodically for activity during each spring. Active nests were checked prior to egg hatching and during the first week thereafter to obtain clutch and brood sizes. Nest success was determined about the time of fledging.

Several nests were observed from ground blinds prior to hatching. During the first week after hatching, tree blinds were constructed 20 to 30 meters away at selected nests of each species for intensive observation with a 15-60X spotting scope.

Food habits were determined by observations of items brought to nests and from regurgitated castings found in or near nests. Castings were dissected following the methods of Mathiak (1938), Williams (1938) and Stickel (pers. comm.).

Results and Discussion

Breeding Population

Eighty-four active raptor nests were located in western Maryland during three breeding seasons. Nineteen were used by Red-tailed Hawks, 17 by Red-shouldered Hawks, 36

Table 1. Raptor breeding activity and productivity in the Central Appalachians 1978-1980.

	Red-tailed Hawk	Red-shouldered Hawk	Broad-winged Hawk	Cooper's Hawk
Number of active nests ¹	15	17	36	11
Number of successful nests	10 (67) ²	9 (53)	31 (86)	9 (82)
Clutch size	2 (1) ³	3.1(6)	2.7(15)	3.6(8)
Average number hatched	1.8(12) ³	2.4(8)	2.1(29)	2.9(9)
Average number fledged	1.4(14) ³	1.8(10)	1.7(34)	2.0(11)

¹Includes only those active nests for which the outcome was known, i.e., failed or fledged some number of young.

²Percent of active nests that fledged at least one young.

³Number of nests which contribute to the mean values.

by Broad-winged Hawks and 12 by Cooper's Hawks. Table 1 includes a summary of activity and productivity for those active nests for which the outcome was known.

Nesting Chronology

Nesting chronology is presented in Table 2. The dates presented are generally consistent with those previously published for each species (Burns 1911, Bent 1937, Stewart 1949, Hagar 1957, Rusch and Doerr 1972, Henny et al. 1973, Matray 1974, Portnoy and Dodge 1979). Cooper's Hawks were by far the most variable in the timing of their breeding cycle, with 28 days between the earliest and latest hatching dates for the three years.

Nest Success and Productivity

Raptor reproduction parameters are summarized in Table 1. Of 15 Red-tailed Hawk nests, 67% successfully fledged young. Nestling mortality was greatest during the second and third week after hatching, attributed to inclement weather and predation by Great Horned Owls. A total of 22 nestlings were produced averaging 1.8 young per active nest and 1.4 fledged. This compares to 66% nest success and 1.35 young per nest attempt derived from literature sources reporting a total of 930 nests (Fitch et al. 1946, Orians and Kulhman 1956, Hagar 1957, Roosa 1964, Harris 1971, Luttich et al. 1971, Seidensticker and Reynolds 1971, Gates 1972, Smith and Murphy 1973, Johnson 1973, Wiley 1975, Bohm 1978, Howell et al. 1978, Mader 1978, Adamcik et al. 1979 and Bednarz 1979).

Henny and Wight (1972) estimated that the northern Red-tailed Hawk populations must produce between 1.33 and 1.38 young per breeding attempt to maintain a stable population.

Of 17 Red-shouldered Hawk nests, 53% fledged young. Eggs from two nests were found crushed, and a third nest contained two addled eggs. Reasons for these failures cannot be determined. Human activity was determined to be a principal cause of Red-shoulder nest failure in California (Wiley 1975). Henny et al. (1973) found the most critical period for nestlings to be the first two weeks post hatching which is between late April and early May. A majority of the nestling mortalities in our study occurred during the first three weeks and in most cases involved the smallest nestling of the brood.

Mean clutch size was 3.1 with 1.8 young fledged per nest attempt. This compares to 1.7 young per nest attempt and 2.3 young per successful nest derived from literature sources (Craighead and Craighead 1956, Henny et al. 1973, Portnoy and Dodge 1979, Campbell 1975, Wiley 1975 and Bednarz 1979.)

Thirty-one of 36 Broad-winged hawk nests (86%) successfully produced young. Fifty-nine successfully fledged, averaging 1.7 per active nest (see Table 1). Nestling mortality for Broad-winged hawks was also greatest during the first three weeks.

Of the 11 Cooper's hawk nests, nine (82%) produced young. Twenty-six fledged, averaging 2.0 young per active nest. The number of Cooper's hawks to fledge per nest attempt in Maryland is about the same as that observed in Michigan (Craighead and Craighead 1956) and in Oregon (Reynolds and Wight 1978), but substantially higher than that observed by Hennessy (1978) in Utah.

Table 2. Raptor breeding chronology in the Central Appalachians 1978–1980¹.

	Egg Laying	Hatching	Fledging
Red-tailed Hawk	—0—	4/27 (11) 4/18–5/7	6/9 (3) 6/7–6/10
Red-shouldered Hawk	—0—	5/7 (7) 4/22–5/18	6/16 (5) 6/13–6/20
Broad-winged Hawk	5/1 (1)	6/10 (31) 5/27–6/20	7/13 (13) 7/6–7/24
Cooper's Hawk	5/4 (1)	6/19 (7) 6/7–7/5	7/18 (5) 7/2–7/19

¹Values given are the mean dates (sample size) over the range. Only nests for which these dates are known to be accurate within 1–2 days are included in the table.

Food Habits

We studied food habits in 1978 and 1979. For all species, mammals comprised the largest portion of the hawks' diet (Table 3). The eastern chipmunk (*Tamias striatus*) occurred most frequently in the diet of Cooper's, Red-shouldered and Broad-winged Hawks. Juvenile fox squirrel (*Sciurus niger*) comprised a major portion of the Red-tailed Hawk diet as determined through pellet analyses.

We observed 57 items delivered to nests by adult Cooper's Hawks 70% mammals and 30% small birds. This is quite different from the diet determined for Cooper's Hawks in New York and Pennsylvania (Meng 1959) in which avian species comprised a major portion of the diet. However, small numbers of avian species were also reported by Fitch et al. (1946) in California but in that study, lizards made up a majority of the food items.

Twenty-nine food deliveries were observed at Red-shouldered Hawk nests 79% mammals, 14% amphibians (frogs and salamanders) and 6.9% reptiles. This is similar to the food habits of Red-shoulders found in Massachusetts (Portnoy and Dodge 1979).

A total of 31 items were brought to nests by adult Broad-winged Hawks, 52% mammal, 10% birds and 6% reptiles. These proportions are similar to those found by Rusch and Doerr (1972) in Alberta and by Mosher and Matray (1974) in New York.

Small mammal activity patterns were being monitored on the same principal study areas during the two breeding seasons. Results from this study (Ladino 1980) show an early summer peak in activity of small mammals, particularly the eastern chipmunk and

Table 3. Food habits of raptors in the Central Appalachians 1978-1979¹.

PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Mammal								
<i>Tamias striatus</i>	28	3	6	18	11	4		3
<i>Microtus</i> sp.		2	3	6	2	2		1
<i>Peromyscus</i> sp.		1	1	4				
<i>Blarina brevicauda</i>	1		2	7	1	3		
<i>Sylvilagus floridanus</i>	2				1			
<i>Clethrionomys gapperi</i>					1	3		1
<i>Parascalops breweri</i>					1			
<i>Tamias hudsonicus</i>				1	3			1
<i>Sciurus niger</i>								6
<i>Sciurus carolenensis</i>								3
<i>Soricidae</i> sp.								1
Unidentified	9			4	4			1
Total (%) ²	40 (70)	6 (46)	16 (52)	35 (61)	23 (79)	10 (67)		15 (94)
PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Avian								
<i>Bonasa umbellus</i>			1	2			1	
<i>Melospiza gallopavo</i>	1		2					
<i>Colaptes auratus</i>			2					
<i>Pipilo erythrophthalmus</i>			1					
<i>Dryocopus pileatus</i>					1			
Unidentified	16	7	1	10		1		
Total	17 (30)	7 (54)	3 (10)	15 (26)	1	2 (13)		1 (6)
Reptile								
<i>Thamnophis sirtolisi</i>					2	3		
Unidentified			2	5				
Total			2 (6)	5 (9)	2 (7)	3 (20)		
PREY ITEM	Cooper's Hawk		Broad-winged Hawk		Red-shouldered Hawk		Red-tailed Hawk	
	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet	Observ.	Pellet
Amphibian								
Unidentified frog	-0-	-0-	-0-	-0-	3	-0-	-0-	-0-
Unidentified salamander	-0-	-0-	-0-	-0-	1	-0-	-0-	-0-
Total	-0-	-0-	-0-	-0-	4 (14)	-0-	-0-	-0-
Miscellaneous								
<i>Coleoptera</i>			-0-	1	-0-	-0-	-0-	-0-
Snail			-0-	1	-0-	-0-	-0-	-0-
Unidentified			10	-0-	-0-	-0-	-0-	-0-
Total	-0-	-0-	10 (32)	2 (4)	-0-	-0-	-0-	-0-

¹As determined by nest observation and analysis of casting.²Percent of total diet by observation or pellet analysis.

white-footed mouse (*Peromyscus leucopus*) in June and July for 1978 and 1979. The frequency of hawk predation on these species may be related to their abundance and availability at this particular time of year.

Acknowledgments

We wish to thank the following individuals for their assistance in various aspects of this field research: D. Lyons, F. Presley, M. Presley and K. Titus. This research was supported in part by contracts with the U.S. Fish and Wildlife Service (FWS 14-16-0009-77-960 and 14-16-0009-80-007). This is Contribution Number AEL-1220 of the Appalachian Environmental Laboratory, University of Maryland and Technical Report-4 of the Central Appalachian Raptor Ecology Program.

Literature Cited

- Adamcik, R. S., A. W. Todd and L. B. Keith. 1979. Demographic and dietary responses of Red-tailed hawks during a snowshoe hare fluctuation. *Can. Field Nat.* 93:16-27.
- Bednarz, J. C. 1979. Productivity, nest sites and habitat of Red-shouldered and Red-tailed hawks in Iowa; status of habitat utilization and management of Red-shouldered hawks in Iowa. M.S. Thesis. Iowa State University. 85 pp.
- Bent, A. C. 1937. Life histories of North American birds of prey. Part I. U.S. Natl. Mus. Publ. No. 167. 409 pp.
- Bohm, R. T. 1978. A study of nesting Red-tailed hawks in central Minnesota. *Loon* 59:129-137.
- Burns, F. L. 1911. A monograph of the Broad-winged Hawk (*Buteo platypterus*). *Wilson Bull.* 23:139-320.
- Campbell, C. 1975. Ecology and reproduction of Red-shouldered hawks in the Waterloo region of southern Ontario. *Raptor Res.* 9:12-17.
- Craighead, J. J. and F. C. Craighead, Jr. 1956. Hawks, owls and wildlife. Stackpole Co., Harrisburg, Pennsylvania, and Wildlife Management Institute, Washington, D.C. 443 pp.
- Fitch, H. S., S. Freeman and D. Tillotson. 1946. Behavior and food habits of the Red-tailed hawk. *Condor* 48:205-237.
- Fitch, H. S., B. Glading and V. House. 1946. Observations on Cooper's hawk nesting and predation. *California Fish and Game* 32:144-154.
- Gates, J. M. 1972. Red-tailed hawk populations and ecology in east central Wisconsin. *Wilson Bull.* 84:421-433.
- Hagar, D. 1957. Nesting populations of Red-tailed hawks and Horned owls in central New York state. *Wilson Bull.* 69: 263-271.
- Harris, W. 1971. Red-tailed hawk nesting success. *Blue Jay* 29:203.
- Hennessy, S. 1978. Ecological relationships of accipiters in northern Utah with special emphasis on the effect of human disturbance. M.S. Thesis. Utah State University. 66 pp.
- Henny, C. and H. Wight. 1972. Population ecology and environmental pollution: Red-tailed and Cooper's hawks. In: Population Ecology of Migratory Birds: A Symposium. Patuxent Wildlife Research Center. U.S. Department of Interior. *Wildlife Report* 2:229-250.

- Henny, C., F. Schmid, E. Martin and L. Hood. 1973. Territorial behavior pesticides and the population ecology of the Red-shouldered hawk in central Maryland. 1943-1971. *Ecology* 54:545-554.
- Howell, J., B. Smith, J. Holt and P. R. Osborne. 1978. Habitat structure and productivity in Red-tailed hawks. *Bird Banding* 49:162-171.
- Johnson, S. L. 1973. Post-fledging activity of the Red-tailed hawk. *Raptor Res.* 7:43-48.
- Ladino, A. 1980. Animal utilization of herbaceous and shrubby transmission line corridors and adjacent forest habitats. Unpublished M.S. Thesis, University of Maryland, Appalachian Environmental Laboratory. Forstburg, Maryland.
- Luttich, S. N., L. B. Keith and J. D. Stephenson. 1971. Population dynamics of the Red-tailed hawk in Rochester, Alberta. *Auk* 88:75-87.
- Mader, W. 1978. A comparative nesting study of Red-tailed hawks and Harris hawks in southern Arizona. *Auk* 95:327-337.
- Mathiak, H. 1938. A key to hairs of the mammals of southern Michigan. *J. Wildlife Mgt.* 2:251-268.
- Matray, P. F. 1974. Broad-winged hawk nesting and ecology. *Auk* 91:307-324.
- Meng, H. 1965. Food habits of nesting Cooper's hawks and Goshawks in New York and Pennsylvania. *Wilson Bull.* 71:169-174.
- Mosher, J. A. and P. F. Matray. 1974. Size dimorphism: a factor in energy savings for Broad-winged hawks. *Auk* 91:325-341.
- Orians, G. and F. Kuhlman. 1956. Red-tailed hawk and Horned owl populations in Wisconsin. *Condor* 58:371-385.
- Portnoy, J. W. and W. E. Dodge. 1979. Red-shouldered hawk nesting ecology and behavior. *Wilson Bull.* 91:104-117.
- Reynolds, R. T. and H. M. Wight. 1978. Distribution, density and productivity of accipiter hawks breeding in Oregon. *Wilson Bull.* 90:182-196.
- Roosa, D. M. 1964. Nesting of raptors in western Wright County. *Iowa Bird Life* 34:88-90.
- Rusch, D. and P. Doerr. 1972. Broad-winged hawk nesting and food habits. *Auk* 89:139-145.
- Seidensticker, J. C. and H. V. Reynolds. 1971. The nesting reproductive performance and chlorinated hydrocarbon residues in the Red-tailed hawk and Great Horned owl in south central Montana. *Wilson Bull.* 83:408-418.
- Smith, D. G. and J. R. Murphy. 1973. Breeding ecology of raptors in the eastern Great Basin in Utah. Brigham Young University. *Biol. Sci. Bull.* 18:1-76.
- Stewart, R. E. 1949. Ecology of a nesting Red-shouldered hawk population. *Wilson Bull.* 61:26-35.
- Titus, K. and J. A. Mosher. 1981. Nest site habitat selected by raptors in the central Appalachians. *Auk* 98:270-281.
- Wiley, J. 1975. The nesting and reproductive success of Red-tailed hawks and Red-shouldered hawks in Orange County, California. *Condor* 77:133-139.
- Williams, C. 1938. Aids to the identification of mole and shrew hairs with general comments on hair structure and hair determination. *J. Wildlife Mgt.* 2:239-249.