SOME ASPECTS OF HAWK AND SMALL MAMMAL ECOLOGY IN SOUTHEAST ALABAMA

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ABSTRACT

A study was conducted on 1050 ha (2592 acres) of the Lower Piedmont Plateau of Alabama to determine if a correlation existed between the number of small mammals present in various habitats and the number of hawks. Although the number of small mammals did tend to vary in the different habitat types, no correlation was found to show that an increase in small mammal numbers resulted in an increase in hawks.

INTRODUCTION

Most hawk research in North America has been conducted in the northeast, north-central, and western United States and Canada, but published reports about birds of prey and their ecology in the southern United States are scarce. The deficiency is surprising when one considers the number of migratory raptors present in this region during the fall and winter.

Hawk predation on cyclic populations of small mammals in the northern latitudes has been thoroughly documented (Fitch et al. 1946, Southern 1959, Mueller 1967, Galushin 1974, and Newton 1979). However, very little has been documented concerning the relationship between hawk and small mammal numbers and agricultural and other land management practices in the southeast.

For this study I hypothesized that a correlation existed between the number of hawks (as predators) and small mammal numbers (as prey) in certain defined habitats.

MATERIALS AND METHODS

The study area of 1050 ha (2592 acres) was located on the lower Piedmont Plateau ten kilometers (six miles) north of Auburn University in Lee County, Alabama. Pasture, oldfield and cultivated agricultural

land contributed almost 50% of the total study area. The area was divided into ten subareas (labeled A-K) and their covertypes were noted as follows: subareas A, B, E, F, I, and K were of oldfield successional vegetation while subareas C and D were active agricultural fields. Subareas H and J were managed pasture land.

Trapping techniques used for capturing small mammals are found in Drennen (1982). Small mammal data were expressed as total individuals captured and as small mammals captured per trap night. The small mammal per trap night designation represented the number of captured individuals divided by the product of the number of traps and the number of nights trapping occurred.

Hawks were monitored by a strip count method (Emlin 1971). All hawks sighted were identified to species and their locations were mapped per subarea habitat. Morphological characters, direction of travel, and behavior were used to minimize duplication in counting. Counting occurred over 140 days between November 1979 and May 1981. Hawk numbers were expressed as Red-tailed Hawks per count day, other hawks per count day, and total hawks per count day.

RESULTS AND DISCUSSION

Pearson's and Spearman's correlation coefficient was used to determine if there was any relationships between hawks and small mammals within the same subarea habitat. Correlation analyses were conducted according to procedures outlined by Zar (1974), pages 236-245. Duncan's multiple range test was used to locate any significant differences ($P<0.05$) among small mammal numbers per trap night and mean hawk numbers per season. These procedures may also be found in Zar, pages 151-153.

Total hawk numbers and total Red-tailed numbers were highest during the winter and fall months of 1980 (Table 1). As expected, fall migration of hawks was more visibly counted than in the spring. Heintzelman (1975) reported that the bulk of fall migrating hawks generally departed from the northeastern states between 10 September and 20 October, but Red-tailed Hawks migrated later, usually between 10 October and 20 November. If migrant Red-tailed Hawks were from the northeast, then it took approximately one month for them to journey to the study area. Monthly trends are illustrated graphically in Figure 1.

The number of hawk species on these subareas varied seasonally. The predominant hawks observed, listed in descending order of abundance, were the Red-tailed (*Buteo jamaicensis*), American Kestrel (*Falco sparverius*), Northern Harrier (*Circus cyaneus*), Broad-winged (*Buteo*

platypterus), Red-shouldered (*Buteo lineatus*), Sharp-shinned (*Accipiter striatus*), and Cooper's (*Accipiter cooperii*).

Small mammal species within the study area included the cotton rat (*Sigmodon hispidus*), cotton mouse (*Peromyscus gossypinus*), harvest mouse (*Reithrodontomys humulis*), house mouse (*Mus musculus*), wood rat (*Neotoma floridana*), Eastern chipmunk (*Tamia striatus*), gray squirrel (*Sciurus carolinensis*), short-tailed shrew (*Blarina brevicauda* and *B. carolinensis*), least shrew (*Cryptotis parva*), and the Eastern cottontail (*Sylvilagus floridanus*).

The cotton rat was the most frequently caught small mammal on the study area. Nine different species of small mammals were captured during a total of 4200 trap nights. Interestingly, the total number of small mammals captured was highest in subarea B, an oldfield successional habitat, during the summer of 1980 (Table 2). In subareas F and K, which were also oldfield successional areas, small mammals captured per trap night were lowest during spring 1981. As expected, throughout this study, it appeared that small mammals seemed to prefer this type of habitat. The subareas of the study consisted of various cover types that were managed differently (See Materials and Methods section). This consistent disturbance of habitat appeared to have affected the number of small mammals. However, no significant statistical difference was found by using Duncan's multiple range test when small mammal numbers per trap night were compared among subareas. But, when the number of small mammals captured per trap night was compared between seasons using Duncan's multiple range test, a slight significant difference ($p<0.05$) existed.

No correlation was found between total hawk numbers, Red-tailed Hawks and small mammals per trap night for season and subarea. No significant difference ($p<0.05$) between hawk numbers and numbers of small mammals per trap night occurred throughout the seasons. Monthly total numbers of hawks per count day and seasonal totals of small mammal capture numbers per trap night graphically illustrate trends not emphasized by the Pearson's and Spearman's correlation test (Figure 1).

The different habitat types influenced the number of small mammals and hawks on the study area. During the spring of 1980, the oldfield successional areas A and B contained an abundance of small mammals (0.185 and 0.049 small mammals per trap night respectively) but seemed to attract few raptors. The agricultural subareas C and D consisted of corn stubble habitat and supported an apparent abundance of small mammals and hawks (Tables 2 and 3). As expected, during the summer

TABLE 1

HAWK NUMBERS PER COUNT DAY BETWEEN SEPTEMBER 1979 AND MAY 1981

	Month	Hawk Numbers per Count Day Red-tailed	Other	Total
1979	S	0.3	2.7	3.0
	O	1.3	2.7	4.0
	N	1.4	0.6	2.0
	D	3.3	2.0	5.3
1980	J	3.0	1.0	4.0
	F	5.5	0.5	6.0
	M	5.7	0.3	6.0
	A	1.0	0.0	1.0
	M	-	-	-
	J	0.8	0.0	0.8
	J	0.3	0.0	0.3
	A	0.7	0.0	0.7
	S	1.2	0.5	1.7
	O	2.9	1.9	4.8
	N	5.5	2.8	8.3
	D	3.1	1.7	4.9
1981	J	4.1	0.9	5.0
	F	2.4	1.5	3.9
	M	2.6	0.7	3.3
	A	0.9	0.4	1.4
	M	1.0	0.0	1.0

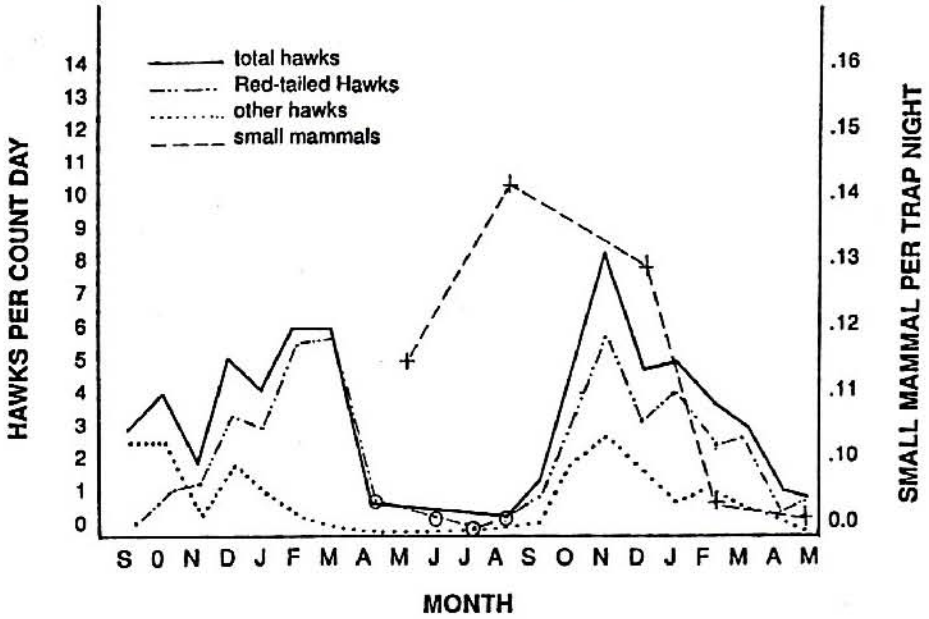

Figure 1. Hawks per count day vs.small mammals captured per trap night during 1980 and 1981.

TABLE 2

SMALL MAMMALS CAPTURED PER SUBAREA EXPRESSED SEASONALLY BETWEEN SPRING 1980 AND SPRING 1981

Subarea		Total Captured	Small Mammal [1] Per Trapnight	Subarea		Total Captured	Small Mammal Per Trapnight
A				F			
	S	37	0.185		S	-	-
	Su	28	0.140		Su	26	0.149
	F	22	0.110		F	18	0.103
	W	16	0.071		W	2	0.100
	S	3	0.020		S	0	0
B				H			
	S	11	0.049		S	-	-
	Su	45	0.180		Su	19	0.103
	F	30	0.171		F	18	0.040
	W	12	0.060		W	7	0.080
	S	4	0.020		S	5	0.033
C				I			
	S	28	0.112		S	-	-
	Su	43	0.287		Su	-	-
	F	12	0.096		F	36	0.160
	W	11	0.110		W	15	0.067
	S	3	0.017		S	10	0.050
D				J			
	S	27	0.120		S	-	-
	Su	32	0.128		Su	-	-
	F	17	0.136		F	28	0.160
	W	10	0.057		W	8	0.046
	S	8	0.053		S	2	0.013
E				K			
	S	-	-		S	-	-
	Su	23	0.092		Su	-	-
	F	28	0.160		F	28	0.140
	W	5	0.029		W	4	0.020
	S	7	0.400		S	0	0.000

[1]During spring 1980 a total of 1000 trapnights (TN) occurred in subareas A-D. During summer 1980 there were 1450 TN (subareas A-H) while between fall 1980 and spring 1981 (all subareas) there were 4200 TN.

TABLE 3

MEAN YEARLY HAWK NUMBERS*
PER SUBAREA DURING 1980 AND 1981

Subarea	HAWK NUMBERS Total	Red-tailed	Other
A (Oldfield)	5.4	4.0	1.4
B (Oldfield)	4.3	3.0	1.3
C (Agricultural field)	11.5	8.3	3.2
D (Agricultural field)	8.4	7.7	0.7
E (Oldfield)	14.2	7.2	7.0
F (Oldfield)	5.7	5.2	0.5
H (Pasture)	6.2	3.7	2.5
I (Oldfield)	2.5	1.8	0.7
J (Pasture)	5.4	3.6	1.8
K (Oldfield)	14.3	10.1	4.2

* Hawk numbers per subarea per season at times were very low so the mean yearly hawk number per subarea was used as an index of usage for that subarea when comparisons were made in the text.

the overall numbers of hawks declined (Figure 1). The oldfield habitats (subareas E, F, and I) and the managed pasture habitats (subareas H and J) tended to have had similar numbers of small mammals captured per trap night throughout the different seasons. As expected during the fall season, when corn was harvested in the agricultural habitats (subareas C and D), small mammal captures per trap night decreased because of habitat destruction, while hawk numbers in these same subareas increased because of the immigration of northern hawks. Also expected, was the general decline of small mammal numbers captured per trap night in all subarea habitats during the late fall and winter. At times during the fall, winter and early spring, in certain oldfield and agricultural field habitats (subareas B, D, and F), the numbers of hawks slowly increased (number counted per time in a particular subarea). These areas were not disturbed during these seasons. Increase usage by hawks in these areas may be because of their importance for hunting. However, no statistical relationship was found to support this hypothesis.

Table 3 presents the mean yearly numbers of hawks per subarea. The oldfield subareas E and K attracted the greatest numbers of hawks during the study. Oldfield and agricultural field subareas C and D also attracted birds of prey in contrast to the low hawk numbers encountered in oldfield subareas B and I and pasture subareas H and J.

Even though agricultural subarea C attracted an abundant amount of

both hawks and small mammals, the oldfield subareas A, B, I and J did not demonstrate an abundant amount of hawks that corresponded to an abundance of small mammals. Since no statistical evidence was found to support the initial hypothesis that a correlation existed between the number of hawks and the number of small mammals utilizing a specific subarea habitat, it was rejected.

There were, however, many other food sources available to the hawks besides the small mammals. At times, during the milder days of winter, many species of orthroptera, lepidoptera and other insects were observed in the area. Also, on occasions small reptiles and amphibians were visible during milder, sunny, winter days. The abundance of spilled and wasted grain that was allowed to remain in the field attracted many granivorous birds such as the Bobwhite Quail (*Colinus virginianus*), Mourning Doves (*Zenaidura macroura*), and many species of Icterids. When these prey sources were available, hawks were observed feeding on these species. During stressful periods, when small mammals are not readily available, this additional prey base may lessen the hawks' direct dependence on small mammals.

SUMMARY

Hawks and small mammals were counted on a 1050 ha (2592 acres) study area in the lower Alabama Piedmont Plateau. The hypothesis that a statistical correlation and/or difference existed between the number of hawks and small mammals in certain defined subarea habitats was tested. Seasonal relationships between the number of hawks and small mammals were also tested for significance. Pearson's and Spearman's correlation coefficient and Duncan's Multiple Range test were used to analyze the data.

Nine different species of small mammals were captured with the cotton rat being the most frequently trapped. Old field habitat seemed to be preferred by the small mammals.

Duncan's Multiple Range test demonstrated no significant statistical difference among small mammals captured per trap night and their different subarea habitats. A slight difference ($P<0.05$) was found between small mammals captured per trap night when compared between seasons. No correlation was found between hawk numbers and small mammal numbers per trap night across the season.

Habitat types seemed to influence the numbers of small mammals captured and hawks counted on the study area. However, no correlation was found to show that an increase in small mammal numbers resulted in an increase of hawk numbers.

LITERATURE CITED

Drennen, D.J. 1982. A comparison of diurnal raptor densities and small mammal populations in land management areas of north Auburn. M. S. Thesis, Auburn University, Auburn, Alabama.

Emlen, J.T. 1971. Population densities of birds derived from transect counts. *Auk, 88*: 323-341.

Fitch, J.S., F. Swenson and D.F. Tillolson. 1946. Behavior and food habits of the red-tailed hawk. *Condor, 48*: 205-237.

Galushin, V.M. 1974. Synchronous fluctuations in populations of some raptors and their prey. *Ibis, 116*: 127-132.

Heintzelman, D.S. 1975. *Autumn Hawk Flights and Their Migration in Eastern North America*. Rutgers University Press, New Jersey.

Mueller, H.C. 1967. Some observations and comments on the periodic invasions of goshawks. *Auk, 84*: 183-190.

Newton, I. 1979. *Population Ecology of Raptors*. Buteo Books. Vermillion, S.D.

Southern, H.N. 1959. Mortality and population control. *Ibis, 101*: 429-436.

Zar, Jerrold H. 1974. *Biostatistical Analysis*. Prentice-Hall. Englewood Cliffs, N.J.