AN AVIFAUNAL STRIP CENSUS ON GRANDFATHER MOUNTAIN

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I. INTRODUCTION

The strip census is one of many methods that can be used to indicate both the number of species and the abundance of each species in an area. Such a method makes it possible to survey a large rough area without the expenditure of excessive amounts of time. The strip census lends itself well to altitudinal distributional surveys of birds since an established trail can be used as the line of travel.

The specific objectives of this survey were:

1. To determine which species of birds were present in the study area.
2. To determine which types of habitats were occupied by each species.
3. To determine the relative abundance of each species of bird observed.
4. To determine the month, or months, in which each species was most abundant.

This study was conducted on Grandfather Mountain in northwestern North Carolina at 36°6'30" North latitude and 81°50' West longitude. Grandfather Mountain is composed of a series of peaks which extend in a northeasterly-southwesterly line along the Eastern Continental Divide of the Blue Ridge Range. The greatest elevation found among these peaks is 5,964 feet above mean sea level. The strip selected for this survey extends in an easterly direction from Linville Gap (where State Highways

105 and 184 intersect) up the side of the mountain to the crest of the Eastern Continental Divide.

The actual strip used for observation extends along a trail from an altitude of 4,045 feet to 5,800 feet, a vertical rise of 1,755 feet. The length of the area surveyed was 9,500 feet and the width was approximately 150 feet, i. e., about 75 feet on each side of the trail.

The amount of precipitation and the range of temperature are major factors in determining the distribution of birds (Welty, 1962). Table I shows the average monthly temperature and average monthly precipitation on Grandfather Mountain for the period 1965-1969 (U. S. Weather Bureau, 1965-1969).

TABLE I. AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION FOR GRANDFATHER MOUNTAIN, N. C., DURING THE PERIOD OF 1965-1969

	Temperature	Precipitation
January	28.7	3.93
February	25.6	4.79
March	35.3	4.89
April	46.5	5.13
May	52.8	5.19
June	59.2	5.50
July	61.9	5.24
August	61.3	6.53
September	54.5	6.12

	Temperature	Precipitation
October	46.6	6.25
November	36.7	4.45
December	30.0	3.87

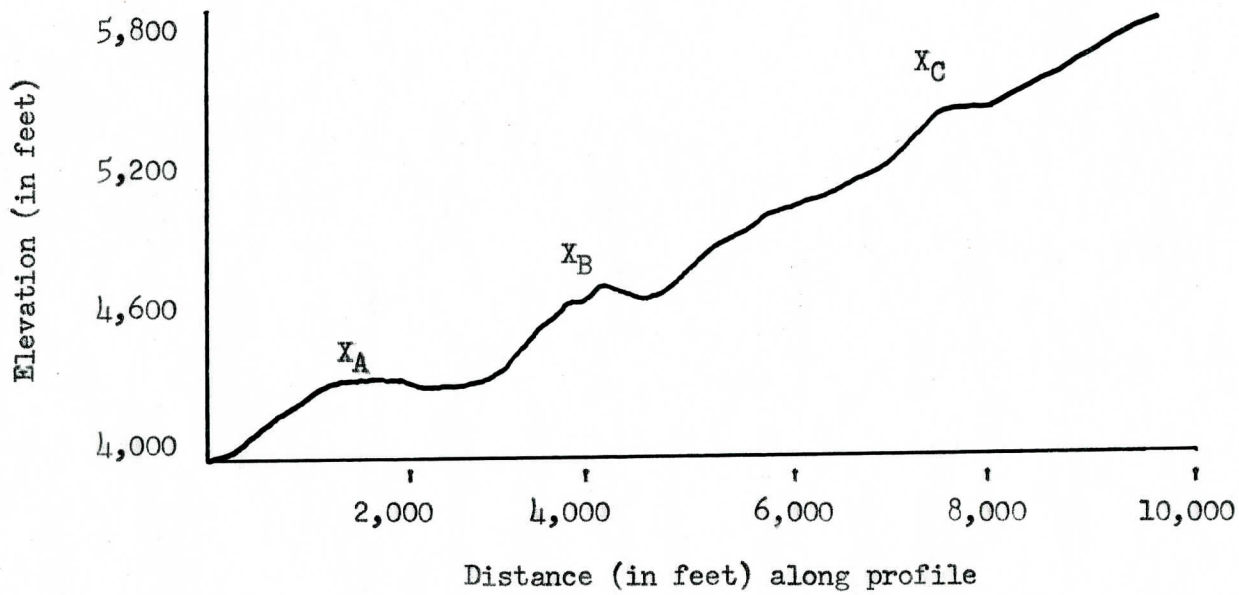
NOTE: Temperature is given °F and precipitation is given in inches.

The study area was divided into five natural habitats based on the flora present. These five habitats listed in order from lowest elevation to highest elevation are: mixed mesophytic forest (4,045-4,400 feet), hemlock-rhododendron forest (4,400-4,700 feet), transitional forest having affinities with the hemlock-rhododendron forest below it (4,700-5,000 feet), transitional forest having affinities with the spruce-fir forest above it (5,000-5,400 feet), and the spruce-fir forest near and on the summit of the mountain (5,400-5,800 feet). The relative steepness of the various habitats can be seen in the topographic profile (Figure 1, p. 4).

The most abundant trees of the mixed mesophytic forest habitat (4,045-4,400 feet) are yellow birch (Betula lutea), sugar maple (Acer saccharum), beech (Fagus grandifolia), wild cherry (Prunus serotina), fire cherry (Prunus pensylvanica), white ash (Fraxinus americana), cucumber tree (Magnolia acuminata), yellow chestnut oak (Quercus muhlenbergii), hop hornbeam (Ostrya virginiana), Canadian hemlock (Tsuga canadensis), and striped maple (Acer pensylvanicum). Scattered between the trees are lycopodium (Lycopodium spp.), cinnamon fern (Osmunda cinnamomea), and

FIGURE 1

TOPOGRAPHIC PROFILE OF THE CENSUS AREA



NOTE:

This profile contains three flexions:

X_A - Strip bears to the left.

X_B - Strip bears to the right.

X_C - Strip bears to the right.

the Christmas fern (Polystichum acrostichoides). The lower end of this habitat borders on a cleared area beside State Highway 105.

The hemlock-rhododendron habitat (4,400-4,700 feet) consists mainly of Canadian hemlock (Tsuga canadensis) and great laurel (Rhododendron maximum). There are a few other species scattered in this area consisting of red spruce (Picea rubens), black locust (Robinia pseudo-acacia), umbrella tree (Magnolia fraseri), serviceberry (Amelanchier canadensis), and cherry birch (Betula lenta).

The first transition area (4,700-5,000 feet) is quite open with various kinds of trees scattered throughout. Though many of these trees are different, some of them can be found in the previous habitat. There is not an abundance of any one species in this area. Trees found here are scattered Canadian hemlock (Tsuga canadensis), red oak (Quercus rubra), white ash (Fraxinus americana), red spruce (Picea rubens), fire cherry (Prunus pensylvanica), and a few beech (Fagus grandifolia). Grass almost completely covers the forest floor in this habitat.

The second transition area (5,000-5,400 feet) is also somewhat open, having little or no undergrowth of shrubs and herbaceous plants. This habitat has definite affinities with the spruce-fir forest above it. The most abundant species of trees in this area are beech (Fagus grandifolia), yellow birch (Betula lutea), wild cherry (Prunus serotina), striped maple (Acer pensylvanicum), sugar maple (Acer saccharum), serviceberry (Amelanchier canadensis), red spruce (Picea rubens), and Fraser's fir (Abies fraseri). The fir and spruce become quite abundant toward the upper reaches of this habitat.

The spruce-fir forest (5,400-5,800 feet) has two main trees dominating the area: Fraser's fir (Abies fraseri) and red spruce (Picea rubens). Other trees which are found are yellow birch (Betula lutea), red-berried elder (Sambucus pubens), and mountain ash (Sorbus americana). The major undergrowth plants are purple rhododendron (Rhododendron catawbiense), sand myrtle (Leiophyllum buxifolium), resurrection fern (Polypodium polypodioides), and spineless blackberry (Rubus canadensis).

II. PROCEDURE

To prepare for the systematic observation of birds within the strip, 19 stations were established at 100-foot vertical intervals on 11 April 1969 by using a Taylor altimeter and a Tennessee Valley Authority topographic map (Grandfather Mountain Quadrangle). These reference points were used on all subsequent trips in recording the location of all birds which were observed.

Weekly trips covering the entire strip from 7:30 A. M. to 12:30 P. M. were made. There were 28 observational trips taken from 11 April 1969 to 25 November 1969. During each trip all birds which were observed within the strip area were recorded according to their altitude, abundance, and natural habitat. Field equipment used on each trip consisted of binoculars (7 x 50), a field notebook, and an illustrated field guide to the birds (Peterson, 1947). In determining the bird species, and in some case the subspecies, a Check-List of North American Birds was used (American Ornithologist Union, 1957). Plant names conform to the Guide to the Vascular Flora of the Carolinas (Radford, Ahles, and Bell, 1964).

III. CENSUS DATA

The distributions of the birds observed during this survey are considered from five standpoints: (1) all of the species observed within the whole area, (2) the altitudinal range of each species within the whole area, (3) the habitat or habitats occupied by each species, (4) the times when each species was most abundant, and (5) the earliest and latest dates each species was recorded.

A complete list of species observed over the whole strip is given in Table II.

TABLE II. SPECIES OBSERVED DURING THE CENSUS

1. American Bittern - Botaurus lentiginosus (Rackett)
2. Red-tailed Hawk - Buteo jamaicensis (Gmelin)
3. Ruffed Grouse - Bonasa umbellus (Linnaeus)
4. Yellow-shafted Flicker - Colaptes auratus luteus Bangs
5. Yellow-bellied Sapsucker - Sphyrapicus varius (Linnaeus)
6. Hairy Woodpecker - Dendrocopos villosus (Linnaeus)
7. Downy Woodpecker - Dendrocopos pubescens medianus (Swainson)
8. Least Flycatcher - Empidonax minimus (Baird and Baird)
9. Eastern Wood Pewee - Contopus virens (Linnaeus)
10. Blue Jay - Cyanocitta cristata (Linnaeus)
11. Common Raven - Corvus corax principalis Ridgway
12. Common Crow - Corvus brachyrhynchos Brehm
13. Black-capped Chickadee - Parus atricapillus Linnaeus

14. Tufted Titmouse - Parus bicolor Linnaeus

15. White-breasted Nuthatch - Sitta carolinensis cookei Oberholser

16. Red-breasted Nuthatch - Sitta canadensis Linnaeus

17. Winter Wren - Troglodytes troglodytes pullus (Burleigh)

18. Catbird - Dumetella carolinensis (Linnaeus)

19. Brown Thrasher - Toxostoma rufum (Linnaeus)

20. Robin - Turdus migratorius Linnaeus

21. Wood Thrush - Hylocichla mustelina (Gmelin)

22. Hermit Thrush - Hylocichla guttata faxoni Bangs and Penard

23. Gray-cheeked Thrush - Hylocichla minima (Lafresnaye)

24. Veery - Hylocichla fuscenscens (Stephens)

25. Golden-crowned Kinglet - Regulus satrapa satrapa Lichtenstein

26. Ruby-crowned Kinglet - Regulus calendula calendula (Linnaeus)

27. White-eyed Vireo - Vireo griseus (Boddaert)

28. Yellow-throated Vireo - Vireo flavifrons Vieillot

29. Solitary Vireo - Vireo solitarius alticola Brewster

30. Red-eyed Vireo - Vireo olivaceus (Linnaeus)

31. Warbling Vireo - Vireo gilvus gilvus (Vieillot)

32. Black-and-white Warbler - Mniotilta varia (Linnaeus)

33. Black-throated Blue Warbler - Dendroica caerulescens cairnsi Coves

34. Black-throated Green Warbler - Dendroica virens virens (Gmelin)

35. Blackburnian Warbler - Dendroica fusca (Muller)

36. Chestnut-sided Warbler - Dendroica pensylvanica (Linnaeus)

37. Ovenbird - Seiurus aurocapillus (Linnaeus)

38. Yellow-throat - Geothlypis trichas brachidactylus (Swainson)

39. Canada Warbler - Wilsonia canadensis (Linnaeus)

40. Common Grackle - Quiscalus quiscula (Linnaeus)

41. Brown-headed Cowbird - Molothrus ater ater (Boddaert)

42. Scarlet Tanager - Piranga olivacea (Gmelin)

43. Rose-breasted Grosbeak - Pheucticus ludovicianus (Linnaeus)

44. Purple Finch - Carpodacus purpureus (Gmelin)

45. American Goldfinch - Spinus tristis (Linnaeus)

46. Rufous-sided Towhee - Pipilo erythrophthalmus erythrophthalmus (Linnaeus)

47. Slate-colored Junco - Junco hyemalis carolinensis Brewster

48. Song Sparrow - Melospiza melodia euphonia Wetmore

Some birds were observed in a variety of habitats, while others were seen in only one or two habitats. The relative abundance of each species varied from one habitat to another. A means of indicating the species abundance in a total study area can be calculated in birds per trip (Kendeigh, 1961). A summary of the species abundance by habitat and trip is recorded in Table III. Weekly observational trips were made (a total of 28 trips) and the total number of birds of each species was recorded. Values for birds per trip were determined by dividing the total number of birds of each species observed by the total number of trips made. The presence of a species in a certain habitat, or habitats, is indicated by a "+." The absence of a species from a habitat, or habitats, is indicated by a "-." The numbers after the "+" marks indicate what percentage of the total number of birds of that particular species was found in that specific habitat.

TABLE III. ABUNDANCE OF SPECIES BY TRIP, HABITAT, AND ALTITUDE

Species	Birds Per Trip	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
American Bittern	0.04	-	-	-	-	+ (100)
Red-tailed Hawk	0.04	+ (100)	-	-	-	-
Ruffed Grouse	0.64	+ (6)	-	+ (28)	+ (33)	+ (33)
Yellow-shafted Flicker	0.14	-	-	+ (100)	-	-
Yellow-bellied Sapsucker	0.07	-	+ (50)	-	+ (50)	-
Hairy Woodpecker	0.29	-	+ (38)	+ (50)	+ (12)	-
Downy Woodpecker	0.57	+ (63)	+ (25)	+ (6)	-	+ (6)
Least Flycatcher	0.50	+ (100)	-	-	-	-
Eastern Wood Pewee	0.07	+ (100)	-	-	-	-
Blue Jay	4.54	+ (9)	+ (28)	+ (24)	+ (21)	+ (18)
Common Raven	0.36	-	-	-	-	+ (100)
Common Crow	1.61	+ (38)	+ (18)	+ (38)	+ (4)	+ (2)
Black-capped Chickadee	1.36	+ (45)	+ (24)	+ (13)	+ (18)	-

Species	Birds Per Trip	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
Tufted Titmouse	0.39	+ (45.5)	+ (9)	+ (45.5)	-	-
White-breasted Nuthatch	0.69	+ (21)	+ (5)	+ (53)	+ (21)	-
Red-breasted Nuthatch	12.96	+ (.3)	+ (4.7)	+ (5)	+ (24)	+ (66)
Winter Wren	1.21	-	+ (23)	+ (9)	+ (9)	+ (59)
Catbird	0.11	+ (33.3)	+ (33.3)	-	+ (33.3)	-
Brown Thrasher	0.04	-	+ (100)	-	-	-
Robin	8.60	+ (2)	+ (1)	+ (1)	+ (10)	+ (86)
Wood Thrush	1.65	+ (46)	+ (46)	+ (8)	-	-
Hermit Thrush	0.46	-	+ (46)	+ (31)	+ (23)	-
Gray-cheeked Thrush	0.07	-	+ (50)	-	-	+ (50)
Veery	3.14	+ (42)	+ (22)	+ (15)	+ (10)	+ (11)
Golden-crowned Kinglet	11.18	+ (12)	+ (19)	+ (31)	+ (15)	+ (23)
Ruby-crowned Kinglet	0.04	-	-	-	+ (100)	-
White-eyed Vireo	1.00	+ (29)	+ (36)	+ (25)	+ (7)	+ (3)

Species	Birds Per Trip	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
Yellow-throated Vireo	0.18	+ (100)	-	-	-	-
Solitary Vireo	1.65	+ (24)	+ (13)	+ (37)	+ (24)	+ (2)
Red-eyed Vireo	0.25	+ (86)	+ (14)	-	-	-
Warbling Vireo	0.04	+ (100)	-	-	-	-
Black-and-white Warbler	0.25	+ (14)	+ (72)	-	+ (14)	-
Black-throated Blue Warbler	2.32	+ (32)	+ (25)	+ (15)	+ (25)	+ (3)
Black-throated Green Warbler	1.39	+ (18)	+ (31)	+ (36)	+ (15)	-
Blackburnian Warbler	0.14	-	+ (25)	+ (25)	+ (50)	-
Chestnut-sided Warbler	0.18	+ (80)	-	-	-	+ (20)
Ovenbird	2.00	+ (50)	+ (14)	+ (36)	-	-
Yellow-throat	0.04	+ (100)	-	-	-	-
Canada Warbler	1.89	-	+ (44)	+ (9)	+ (26)	+ (21)
Common Grackle	0.04	+ (100)	-	-	-	-

Species	Birds Per Trip	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
Brown-headed Cowbird	0.11	+ (100)	-	-	-	-
Scarlet Tanager	0.32	+ (22)	+ (56)	+ (22)	-	-
Rose-breasted Grosbeak	1.68	+ (30)	+ (32)	+ (15)	+ (23)	-
Purple Finch	0.32	-	-	+ (11)	+ (56)	+ (33)
American Goldfinch	0.32	+ (45)	+ (11)	-	+ (33)	+ (11)
Rufous-sided Towhee	1.43	+ (17)	+ (5)	+ (23)	+ (25)	+ (30)
Slate-colored Junco	11.36	+ (4)	+ (23)	+ (21)	+ (23)	+ (29)
Song Sparrow	0.18	+ (100)	-	-	-	-

There were fluctuations in the abundance of particular species at different times during the observational period; furthermore, some species were observed in the study area on almost every trip while others were rarely seen. Table IV gives the month or months in which each species was most abundant and the first and last dates when each species was observed.

TABLE IV. TIMES WHEN SPECIES WERE FIRST OBSERVED, LAST OBSERVED, AND OBSERVED IN GREATEST ABUNDANCE

Species	Times when most abundant	First date observed	Last date observed
American Bittern	October	October 16	October 16
Red-tailed Hawk	November	November 9	November 9
Ruffed Grouse	June-July	April 11	October 30
Yellow-shafted Flicker	May	May 3	September 27
Yellow-bellied Sapsucker	April & October	April 11	October 19
Hairy Woodpecker	May & July	April 19	October 5
Downy Woodpecker	October-November	April 11	November 20
Least Flycatcher	May-June	May 15	June 29
Eastern Wood Pewee	July	July 21	July 27
Blue Jay	May-June, September-November	May 3	November 25
Common Raven	May	April 11	November 9
Common Crow	May-October	May 3	November 9
Black-capped Chickadee	September-October	May 3	November 25
Tufted Titmouse	October-November	May 27	November 20

Species	Times when most abundant	First date observed	Last date observed
White-breasted Nuthatch	June, October-November	June 14	November 20
* Red-breasted Nuthatch	May-November	April 11	November 20
Winter Wren	May-September	May 25	September 23
Catbird	July	June 1	July 27
Brown Thrasher	September	September 23	September 23
* Robin	May-June, October-November	May 3	November 20
Wood Thrush	June-September	May 1	October 16
Hermit Thrush	May-June	May 1	June 29
Gray-cheeked Thrush	September-October	September 11	October 19
Veery	June-October	June 1	October 16
* Golden-crowned Kinglet	May-October	April 11	October 30
Ruby-crowned Kinglet	October	October 19	October 19
White-eyed Vireo	May-June	April 11	June 14
Yellow-throated Vireo	May	May 1	September 16
Solitary Vireo	June-July	April 11	October 5
Red-eyed Vireo	July	July 21	July 29
Warbling Vireo	May	May 8	May 8
Black-and-white Warbler	May	May 20	July 27
Black-throated Blue Warbler	May-September	May 1	October 7
Black-throated Green Warbler	May-July	April 19	July 27
Blackburnian Warbler	May	April 19	May 27
Chestnut-sided Warbler	June	June 21	July 27

Species	Times when most abundant	First date observed	Last date observed
Ovenbird	May-June	April 19	July 13
Yellowthroat	June	June 1	June 1
Canada Warbler	May-July	May 8	July 27
Common Grackle	October	October 19	October 19
Brown-headed Cowbird	May-July	May 15	July 5
Scarlet Tanager	May	May 1	July 27
Rose-breasted Grosbeak	May & September	May 1	October 16
Purple Finch	November	October 30	November 20
American Goldfinch	September	May 1	November 20
Rufous-sided Towhee	May-June, October	May 3	October 19
*Slate-colored Junco	May-November	April 11	November 25
Song Sparrow	June-October	April 11	October 30

*NOTE: These birds were found in great abundance during the period September-November.

The actual number of birds of each species is listed in Table V according to habitat and altitude.

TABLE V. TOTAL COUNT BY HABITAT OF BIRD SPECIES IN THE STUDY AREA

Species	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
American Bittern	-	-	-	-	1
Red-tailed Hawk	1	-	-	-	-
Ruffed Grouse	1	-	5	6	6
Yellow-shafted Flicker	-	-	4	-	-
Yellow-bellied Sapsucker	-	1	-	1	-
Hairy Woodpecker	-	3	4	1	-
Downy Woodpecker	10	4	1	-	1
Least Flycatcher	14	-	-	-	-
Eastern Wood Pewee	2	-	-	-	-
Blue Jay	11	36	30	27	23
Common Raven	-	-	-	-	10
Common Crow	17	8	17	2	1
Black-capped Chickadee	17	9	5	7	-
Tufted Titmouse	5	1	5	-	-

Species	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
White-breasted Nuthatch	4	1	10	4	-
Red-breasted Nuthatch	1	17	19	86	240
Winter Wren	-	8	3	3	20
Catbird	1	1	-	1	-
Brown Thrasher	-	1	-	-	-
Robin	5	3	2	25	206
Wood Thrush	21	21	4	-	-
Hermit Thrush	-	6	4	3	-
Gray-cheeked Thrush	-	1	-	-	1
Veery	37	19	13	9	10
Golden-crowned Kinglet	36	61	97	48	71
Ruby-crowned Kinglet	-	-	-	1	-
White-eyed Vireo	8	10	7	2	1
Yellow-throated Vireo	5	-	-	-	-
Solitary Vireo	11	6	17	11	1
Red-eyed Vireo	6	1	-	-	-
Warbling Vireo	1	-	-	-	-

Species	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
Black-and-white Warbler	1	5	-	1	-
Black-throated Blue Warbler	21	16	10	16	2
Black-throated Green Warbler	7	12	14	6	-
Blackburnian Warbler	-	1	1	2	-
Chestnut-sided Warbler	4	-	-	-	1
Ovenbird	28	8	20	-	-
Yellow-throat	1	-	-	-	-
Canada Warbler	-	23	5	14	11
Common Grackle	1	-	-	-	-
Brown-headed Cowbird	3	-	-	-	-
Scarlet Tanager	2	5	2	-	-
Rose-breasted Grosbeak	14	15	7	11	-
Purple Finch	-	-	1	5	3
American Goldfinch	4	1	-	3	1
Rufous-sided Towhee	7	2	9	10	12

Species	Mixed Mesophytic Forest (4,045-4,400)	Hemlock-Rhododendron Habitat (4,400-4,700)	Transition Area (4,700-5,000)	Transition Area (5,000-5,400)	Spruce-Fir Habitat (5,400-5,800)
Slate-colored Junco	14	72	68	73	91
Song Sparrow	5	-	-	-	-
Totals	326	378	384	378	713
Grand Total	2,179				

IV. DISCUSSION

This study shows that a minimum of 48 species of birds inhabited the northwestern slope of Grandfather Mountain sometime during the inclusive period April to November, 1969. These represent 5 orders, 17 families, 33 genera, and 48 species. Some indication of the variety of birds which inhabit the northwestern slope of Grandfather Mountain can be gained by comparing the number of orders, families, genera, and species listed in the American Ornithologists' Union's Check-List of North American Birds with the ones found on Grandfather Mountain. This check-list contains 20 orders, 75 families, 362 genera, and 1,683 species.

The observation, on October 16, 1969, of an American Bittern perching in a tree at an elevation of 5,500 feet is of special interest. This bird was apparently lost in the blanket of fog which was covering the higher elevations of Grandfather Mountain at the time. This species would be considered an accidental for the study area since it is usually found in lowland swamps and marshes.

Some species were observed in only one habitat. When all of these species from all the habitats are added together, the total is 29% of the 48 species observed in the entire area. One may conclude from this data that several species of the birds observed have rather specific habitat requirements. Of the species observed in the study area, 23% were found in all five habitats. These more widely distributed species appear to have more generalized habitat requirements.

During the course of this study 2,179 birds were observed and recorded. Since this total count was accumulated from 28 separate trips some of these birds were probably counted more than once. The abundance of birds observed by hatitat shows that there was a very even distribution in all habitats, except the spruce-fir forest where there were almost twice as many birds as in any other habitat. The observations of many of the birds found in the spruce-fir habitat occurred in September, October, and November. One may conclude from this data that the majority of these birds were in migration and were not summer residents of the area.

No evidence was found in this study which would indicate that altitude alone influenced the distribution of birds within the study area. However, altitude does determine to some extent the distribution of plants by influencing such factors as temperature, humidity, and precipitation (Kendeigh, 1961). Further research is needed on the local distribution of birds in the higher mountains of Western North Carolina to more accurately determine the influence of such factors as temperature, humidity, precipitation, season, and insolation.

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