Fall Migration of Land Birds at Fort Fisher, New Hanover County, N.C.

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Abstract. Fall migration of land birds at Fort Fisher, New Hanover County, N.C., was studied during August, September, October, and November 1978, to determine species occurrence and abundance as well as habitat usage for the four major habitats covered on 38 censuses. The Fort Fisher area is described and findings are compared to Paul Sykes' (1968) work on fall migration on the Outer Banks of North Carolina. Warblers, finches, and sparrows were most common among the 107 species of birds recorded. The heaviest passage was on 7 October, although some birds were moving throughout the period of study. Heaviest usage was of the shrub-thicket habitat with the fewest birds using the marsh habitats. Relationships between migratory concentrations, weather, and local geography are discussed.

Many workers have studied the fall migration of birds, particularly the phenomenon of coastal migration. Extensive observations have been made at many sites in the eastern and northeastern coastal states, with Long Island, New York, Cape May, New Jersey, and Cape Charles, Virginia, being the best known.

Fall migration work on the coast of the Carolinas has been limited, with a major exception being the detailed study by Sykes (1968) on the Outer Banks of northeastern North Carolina. His work documented the species diversity, abundance, and duration of fall migration on the coast. Sykes found large numbers of fall migrants and gave evidence for a notable passage of land birds south of the Virginia capes.

The Fort Fisher area (Fig. 1) at the southern tip of New Hanover County, N.C., has only recently been noted in the ornithological literature. The earliest published material came from *Auk* and *Wilson Bulletin* in the 1920s and 1930s. These first reports were generally short comments on isolated sightings of unusual species. By the 1950s brief notes began appearing in *Chat* and *Audubon Field Notes* (later *American Birds*). Since the 1960s there has been a steady flow of published sightings, and Fort Fisher has become a very popular site for bird watching. Most of the published material continues to be brief notes on uncommon species.

The present study was prompted by these early published reports and by preliminary field work during the fall of 1976 and 1977 when it was found that there was a definite concentration of migrants at Fort Fisher. The purpose of this paper is to document the concentration of land birds at Fort Fisher during the fall migration season and to compare the results with Sykes' (1968) findings in northeastern North Carolina.

HABITATS

Fort Fisher is the site of a Civil War fort. Field work began at the fort and included the peninsula south to the parking lot at the termination of US 421 (Fig. 1). There are five primary habitats in the study area: forest, shrub thicket, herb-shrub, short grass, and salt marsh (Fig. 2). Of these only the forest is not present to a significant extent in the study

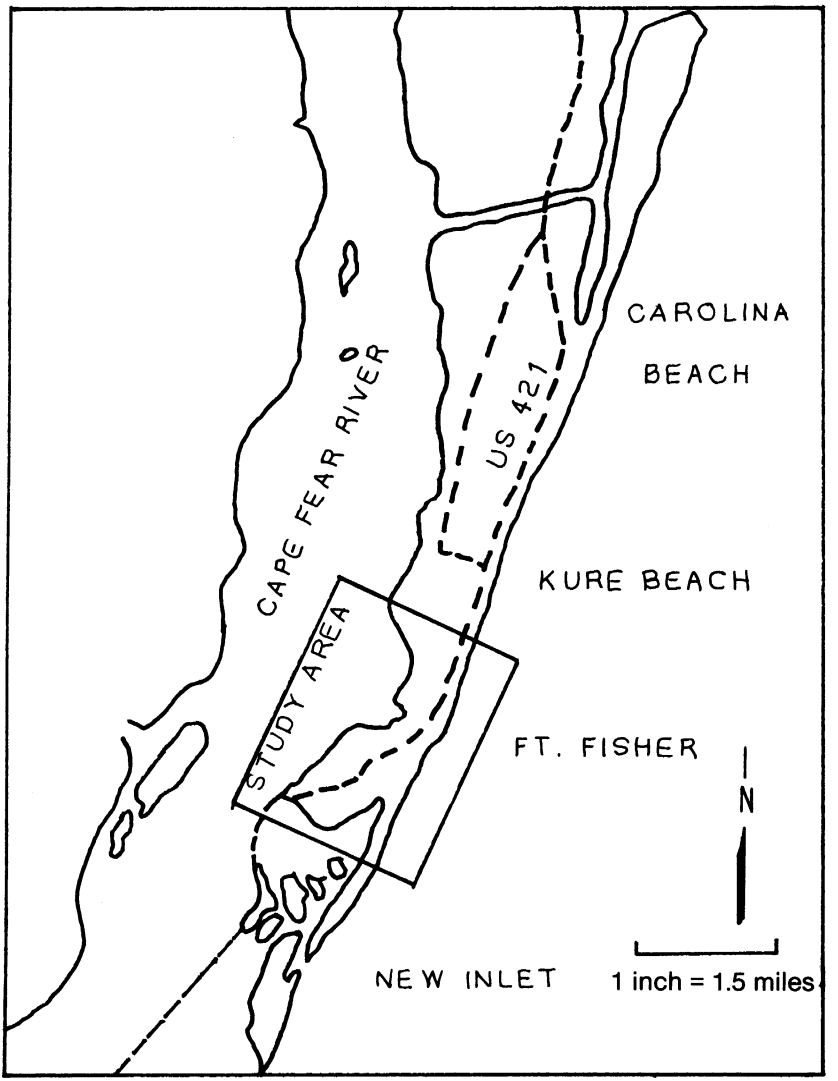

Fig. I. Location of Fort Fisher, N.C., and the study area.

area. Shrub-thicket and salt-marsh habitats are extensive, but short grass and herb-shrub are localized. Short grass covers cleared and regularly mowed lanes at the ferry slip and at the fort site. Herb-shrub habitat is found along the northern side of the ferry-slip fence. Adjacent to this fence is a diked dredged-material disposal site, which is the only extensive herb-shrub area.

The shrub-thicket habitat covered about 36% of the study region, and the average height of the vegetation was 13 feet. The dominant plants were Wax Myrtle (*Myrica*

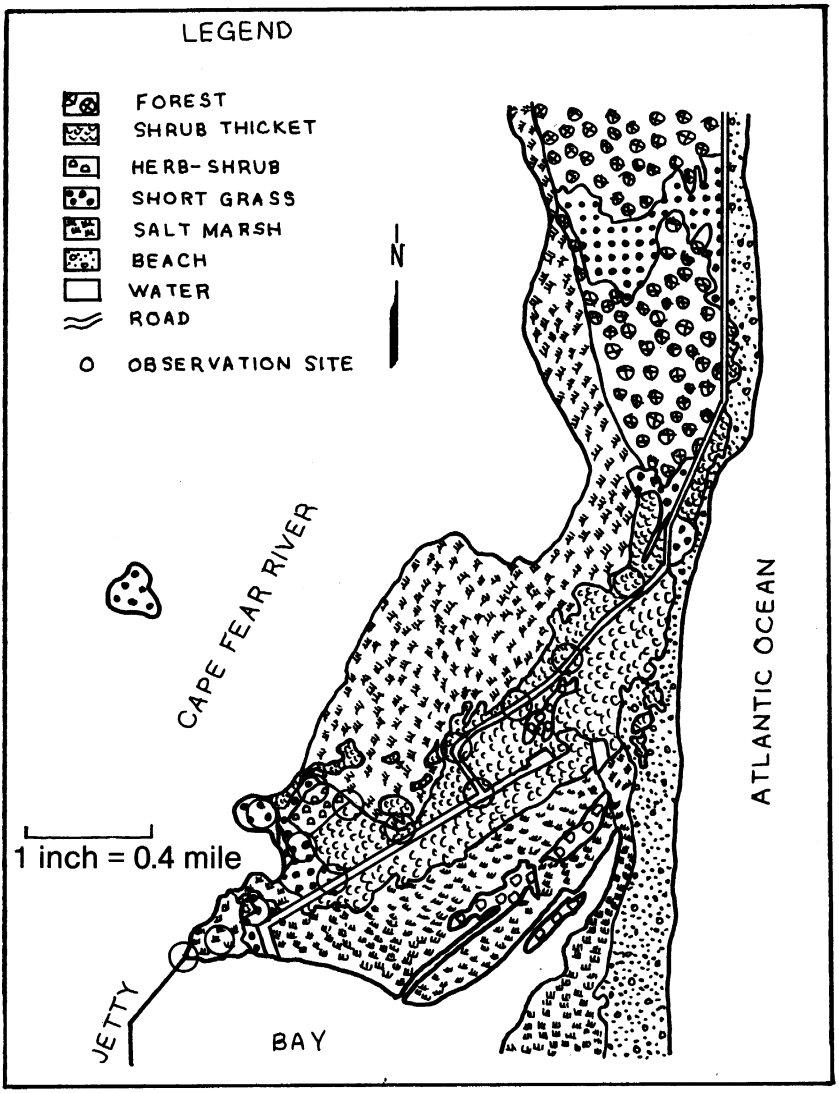

Fig. 2. Habitats surveyed within the Fort Fisher study area.

cerifera), Yaupon (*Ilex vomitoria*), Groundsel-tree (*Baccharis halimifolia*), Red Cedar (*Juniperus virginiana*), and Marsh Elder (*Iva frutescens*).

The herb-shrub habitat covered about 8% of the study area, and the average height of the vegetation was 5 feet. The dominant plants were Salt-meadow Cordgrass (*Spartina patens*), Sand Grass (*Triplasis purpurea*), Camphorweed (*Heterotheca subaxillaris*), Horseweed (*Erigeron canadensis*), Seaside Goldenrod (*Solidago sempervirens*), Common Reed (*Phragmites communis*), Pokeweed (*Phytolacca americana*), Marsh Elder, Iva (*Iva*

imbricata), Groundsel-tree, False Willow (*Baccharis angustifolia*), and Sea Oxeye (*Borrichia frutescens*).

The salt-marsh habitat covered about 48% of the study area, and the average height of the plants was 4 feet. The dominant plants were Black Needlerush (*Juncus roemerianus*) and Smooth Cordgrass (*Spartina alterniflora*).

The short-grass habitat covered about 8% of the region, and the average height of the vegetation was 1 foot. The dominant plants were Sandspur (*Cenchrus tribuloides*), Bermuda Grass (*Cynodon dactylon*), Crab Grass (*Digitaria sanguinalis*), and Sand Grass.

The primary observation sites were scattered in all major habitats (Fig. 2). Sites 1, 2, 3, 7, and 8 were predominantly marsh. Sites 7 and 8 also had a mixture of grasses, weeds, and shrubs. Sites 4, 5, 6, and 10 were thickets and short grass. Sites 9, 11, 12, 13, and 14 were primarily covered with shrub thickets.

METHODS

The study period extended from 1 August to 16 November 1978. Censuses were terminated in mid-November owing to time limitations of the study. Each census lasted as long as was needed to cover all habitats, and most were done between 0700 and 1200.

The study area extended from the fort area south to the bay and included samples of all habitats from the beach to the river. Figure 2 shows the major habitat areas and the primary observation sites.

The census method used involved recording the number of individuals seen or heard within each habitat as the observer moved along a fixed route. A 7 X 35 binocular and a 30X spotting scope were used in identification. A standardized field data sheet was used for recording observations. It provided space for noting species by habitat and a column for birds overhead. Also, there were spaces to record the date, weather, total species, total individuals, comments, time in the field, and time in each habitat.

Davis did all the field work except during a 3-week period of illness when several observers filled in as available. On two occasions members of Parnell's ornithology class were present.

The map of the study region (Fig. 2) was adapted from an aerial photograph provided by the U.S. Army Corp of Engineers. The location map (Fig. 1) was reproduced from a N.C. Highway Commission county road map. Plant names follow Radford et al. (1968), and bird names follow the A.O.U. *Check-List of North American Birds* (1957) and its Thirty-fourth Supplement (A.O.U. 1982).

RESULTS AND DISCUSSION

Table 1 gives individual totals for each species during each month and for the entire study period. Table 2 gives individual totals for each habitat during each month and the entire study period.

Birds-per-hour values in Tables 1 and 2 were calculated by dividing the individual totals by the number of hours spent in each habitat. The number of hours are exact except in the case of birds recorded overhead. Birds overhead were counted at all times in all habitats. On a few occasions, while stationed at one area, time was spent counting only overhead migrants. Therefore, overhead hour values are totals of both observation times and are identical to the total time spent in the field each month.

Between 1 August and 16 November 1978, 16,151 individuals of 107 species of birds were recorded on 38 censuses at Fort Fisher. The 107 species represent 30 families of 9 orders. Members of the order Passeriformes (perching birds) were most numerous, with warblers, finches, and sparrows being common.

The most abundant species was the Yellow-rumped (Myrtle) Warbler followed closely by the Tree Swallow, Fish Crow, and Northern Flicker. The Yellow-rumped Warbler and Tree Swallow normally winter in southeastern North Carolina in large numbers, whereas the Fish Crow and Common Flicker are common permanent residents. Abundance and conspicuousness help to account for the large numbers recorded.

The total abundance figures for the fall range from 0.01 birds-per-hour to 16.69 birds-per-hour. Only slightly more than one-fourth of the species recorded show abundance figures of more than 1.00 birds-per-hour. Some birds no doubt passed through in larger numbers, but, owing to their secrecy, were missed. Many of the thrushes and some of the warblers were most likely overlooked. Data for the larger, more conspicuous birds such as the Eastern Kingbird, Northern Mockingbird, and blackbirds, probably represent more closely their actual abundance.

Sykes (1968), in his study on the North Carolina Outer Banks, had rather similar results, with the same groups of species being most common. One exception is that he reported a higher incidence of thrushes. Another difference is that Sykes had more individuals of the late-migrating birds such as Golden-crowned Kinglet, Brown Creeper, Dark-eyed (Slate-colored) Junco, and several species of sparrows. This may be a result of erratic field work at Fort Fisher from mid-October until the completion of the study on 16 November. There were more accipiters (Sharp-shinned and Cooper's Hawks), Eastern Kingbirds, Bobolinks, and Indigo Buntings recorded at Fort Fisher than on the Outer Banks. The reasons for this are not clear because these birds are fairly easy to see. Slight changes in their normal migration routes may account for these differences.

Many earlier studies have reported on the effects of weather on migratory birds, with cold fronts seeming to be especially influential on fall movements. During this study, the heaviest movement of birds was on 7 October. There was a marked drop in temperature and slight wind change from the previous day. A cold front had passed the day before and the migratory movement noted on the 7th appeared to be associated with the front's passage.

There was a substantial difference in habitat usage by migrating birds. The most heavily used habitat was the shrub thicket, which averaged 118.49 birds-per-hour. Next was 79.44 birds-per-hour seen overhead. This was followed by short-grass habitats with 36.96 birds-per-hour, herb-shrub habitats with 23.02 birds-per-hour, and marsh habitats with 19.51 birds-per-hour. This pattern was similar for each month, except that herb-shrub decreased steadily in usage until November and marsh and short-grass habitats increased in usage up until November. Sykes (1968) also found that shrub thickets were the most heavily used habitats on the Outer Banks. As in the present study, the marsh habitats studied by Sykes were used much less frequently than other habitats.

There was a definite sequence in the migration at Fort Fisher. Some birds were moving even before the study actually began on 1 August. Birds continued to migrate after the study ended in November. From observations by the authors at Fort Fisher in previous years, it has been found that some land birds are migrating through southeastern North Carolina from mid-July through November. Early migrants include the flycatchers,

TABLE 1. Total numbers and relative abundance of birds at Fort Fisher, New Hanover County, N.C., during the fall of 1978.

Species	*August*	*September*	*October*	*November*	*Fall*
Turkey Vulture	0	10(.28)	24(.72)	3(.16)	37(.35)
Osprey	10(.54)	17(.47)	14(.42)	3(.16)	44(.41)
Northern Harrier	0	14(.39)	10(.30)	14(.73)	38(.35)
Sharp-shinned Hawk	0	31(.86)	17(.51)	31(1.61)	79(.74)
Cooper's Hawk	0	3(.08)	4(.12)	3(.16)	10(.09)
Accipiter sp.	0	0	0	1(.05)	1(.01)
Northern Goshawk	0	1(.03)	0	0	1(.01)
Red-tailed Hawk	0	0	0	2(.10)	2(.02)
American Kestrel	0	61(1.69)	17(.51)	14(.73)	92(.86)
Merlin	0	7(.19)	6(.18)	0	13(.12)
Peregrine Falcon	0	0	1(.03)	0	1(.01)
Northern Bobwhite	29(1.58)	36(1.00)	9(.27)	0	74(.69)
Rock Dove	29(1.58)	0	0	0	29(.27)
Mourning Dove	116(6.30)	106(2.93)	65(1.95)	18(.94)	305(2.85)
Common Ground-Dove	8(.43)	24(.66)	4(.12)	3(.16)	39(.36)
Yellow-billed Cuckoo	22(1.20)	1(.03)	0	0	23(.21)
Common Nighthawk	0	1(.03)	0	0	1(.01)
Chimney Swift	3(.16)	1(.03)	0	0	4(.04)
Ruby-throated Hummingbird	11(.60)	0	0	0	11(.10)
Belted Kingfisher	1(.05)	38(1.05)	21(.63)	10(.52)	70(.65)
Red-headed Woodpecker	0	4(.11)	1(.03)	0	5(.05)
Red-bellied Woodpecker	1(.05)	1(.03)	0	0	2(.02)
Yellow-bellied Sapsucker	0	1(.03)	6(.18)	1(.05)	8(.07)
Downy Woodpecker	1(.05)	3(.08)	0	2(.10)	6(.06)
Northern Flicker	5(.27)	503(13.91)	723(21.74)	74(3.84)	1,305(12.19)
Pileated Woodpecker	0	1(.03)	0	0	1(.01)
Eastern Wood-Pewee	0	2(.06)	6(.18)	0	8(.07)
Empidonax sp.	0	5(.14)	1(.03)	0	6(.06)
Eastern Phoebe	0	3(.08)	49(1.47)	0	52(.49)
Great Crested Flycatcher	1(.05)	0	0	0	1(.01)

Eastern Kingbird	149(8.10)	601(16.62)	75(2.26)	0	825(7.71)
Purple Martin	43(2.34)	36(1.00)	0	0	79(.74)
Tree Swallow	0	802(22.18)	699(21.02)	0	1,501(14.02)
Northern Rough-winged Swallow	0	5(.14)	0	0	5(.05)
Bank Swallow	0	8(.22)	1(.03)	0	9(.08)
Barn Swallow	125(6.79)	224(6.19)	5(.15)	0	354(3.31)
Blue Jay	3(.16)	50(1.38)	48(1.44)	22(1.14)	123(1.15)
American Crow	4(.22)	39(1.08)	15(.45)	25(1.30)	83(.78)
Fish Crow	42(2.28)	269(7.44)	251(7.55)	829(43.06)	1,391(12.99)
Carolina Chickadee	10(.54)	23(.64)	4(.12)	24(1.25)	61(.57)
Red-breasted Nuthatch	0	1(.03)	25(.75)	0	26(.24)
Carolina Wren	59(3.21)	99(2.74)	53(1.59)	35(1.82)	246(2.30)
House Wren	2(.11)	17(.47)	40(1.20)	62(3.22)	121(1.13)
Sedge Wren	0	0	0	6(.31)	6(.06)
Marsh Wren	0	0	0	17(.88)	17(.16)
Ruby-crowned Kinglet	0	1(.03)	49(1.47)	37(1.92)	87(.81)
Blue-gray Gnatcatcher	1(.05)	9(.25)	4(.12)	0	14(.13)
Veery	0	1(.03)	0	0	1(.01)
Swainson's Thrush	0	0	2(.06)	0	2(.02)
Hermit Thrush	0	0	0	1(.05)	1(.01)
American Robin	0	0	0	132(6.86)	132(1.83)
Gray Catbird	4(.22)	25(.69)	76(2.89)	50(2.60)	155(1.45)
Northern Mockingbird	126(6.85)	202(5.59)	127(3.82)	37(1.92)	492(4.60)
Brown Thrasher	18(.98)	21(.58)	38(1.14)	12(.62)	89(.83)
Water Pipit	0	0	0	4(.21)	4(.04)
Cedar Waxwing	0	1(.03)	3(.09)	10(.52)	14(.13)
European Starling	105(5.71)	292(8.08)	122(3.67)	157(8.16)	676(6.31)
White-eyed Vireo	16(.87)	9(.25)	1(.03)	0	26(.24)
Yellow-throated Vireo	0	0	1(.03)	0	1(.01)
Red-eyed Vireo	1(.05)	2(.06)	3(.09)	0	6(.06)
Tennessee Warbler	0	2(.06)	0	0	2(.02)
Orange-crowned Warbler	0	3(.08)	1(.03)	16(.83)	20(.19)
Nashville Warbler	0	1(.03)	0	0	1(.01)

TABLE 1. Continued.

Species	*August*	*September*	*October*	*November*	*Fall*
Northern Parula	0	1(.03)	18(.54)	0	19(.18)
Yellow Warbler	31(1.68)	82(2.27)	7(.21)	0	120(1.12)
Magnolia Warbler	0	8(.22)	4(.12)	0	12(.11)
Cape May Warbler	0	19(.53)	28(.84)	0	47(.44)
Black-throated Blue Warbler	0	1(.03)	7(.21)	0	8(.07)
Yellow-rumped Warbler	0	2(.06)	91(.274)	1,694(88.00)	1,787(16.69)
Black-throated Green Warbler	0	0	1(.03)	0	1(.01)
Pine Warbler	0	0	3(.09)	0	3(.03)
Prairie Warbler	76(4.13)	151(4.18)	75(2.26)	3(.16)	305(2.85)
Palm Warbler	0	183(5.06)	445(13.38)	43(2.23)	671(6.27)
Blackpoll Warbler	0	2(.06)	0	0	2(.02)
Black-and-white Warbler	2(.11)	2(.06)	5(.15)	0	9(.08)
American Redstart	17(.92)	115(3.18)	157(4.72)	0	289(2.70)
Prothonotary Warbler	73(3.97)	0	0	0	73(.68)
Northern Waterthrush	16(.87)	66(1.83)	23(.69)	0	105(.98)
Common Yellowthroat	4(.22)	112(3.10)	68(2.05)	8(.42)	192(1.79)
Wilson's Warbler	0	1(.03)	0	0	1(.01)
Yellow-breasted Chat	3(.16)	3(.08)	2(.06)	0	8(.07)
Summer Tanager	2(.11)	2(.06)	0	0	4(.04)
Northern Cardinal	89(4.84)	115(3.18)	70(2.11)	48(2.49)	322(3.01)
Rose-breasted Grosbeak	0	0	1(.03)	0	1(.01)
Blue Grosbeak	11(.60)	6(.17)	4(.12)	2(.10)	23(.21)
Indigo Bunting	25(1.36)	45(1.24)	136(4.09)	8(.42)	214(2.00)
Painted Bunting	58(3.15)	45(1.24)	25(.75)	0	128(1.20)
Dickcissel	0	0	2(.06)	0	2(.02)
Rufous-sided Towhee	41(2.23)	16(.44)	21(.63)	46(2.39)	124(1.16)
Chipping Sparrow	0	0	0	10(.52)	10(.09)
Clay-colored Sparrow	0	0	1(.03)	0	1(.01)

Field Sparrow	0	0	3(.09)	9(.47)	12(.11)
Savannah Sparrow	0	32(.88)	93(2.80)	110(5.71)	235(2.20)
Sharp-tailed Sparrow	0	2(.06)	4(.12)	21(1.09)	27(.25)
Seaside Sparrow	1(.05)	10(.28)	8(.24)	14(.73)	33(.31)
Song Sparrow	0	0	18(.54)	190(9.87)	208(1.94)
Swamp Sparrow	0	0	12(.36)	84(4.36)	96(.90)
White-throated Sparrow	0	0	11(.33)	84(4.36)	95(.89)
Dark-eyed Junco	0	0	3(.09)	2(.10)	5(.05)
Bobolink	4(.22)	508(14.05)	78(2.35)	0	590(5.51)
Red-winged Blackbird	241(13.10)	90(2.49)	105(3.16)	121(6.29)	557(5.20)
Eastern Meadowlark	0	0	18(.54)	16(.83)	34(.32)
Boat-tailed Grackle	73(3.97)	191(5.28)	46(1.38)	46(2.39)	356(3.33)
Common Grackle	10(.54)	15(.41)	2(.06)	320(16.62)	347(3.24)
Brown-headed Cowbird	3(.16)	3(.08)	0	0	6(.06)
Orchard Oriole	38(2.07)	0	0	0	38(.35)
Northern Oriole	1(.05)	79(2.18)	28(.84)	0	108(1.01)
American Goldfinch	0	0	0	8(.42)	8(.07)
House Sparrow	10(.54)	6(.17)	28(.84)	33(1.71)	77(.72)
TOTALS	1,774	5,530	4,272	4,575	16,151

TABLE 2. Abundance of birds in primary habitats at Fort Fisher during the fall migration, with birds-per-hour given in parentheses.

Habitat	*August*	*September*	*October*	*November*	*Fall*
Thicket	954(88.09)	1,945(99.74)	1,967(115.71)	1,709(209.44)	6,575(118.49)
Herb-shrub	201(43.04)	94(15.04)	39(9.54)	69(27.60)	403(23.02)
Marsh	32(11.03)	51(14.96)	49(14.67)	105(42.00)	237(19.51)
Short grass	0(0.00)	64(32.00)	285(53.57)	82(18.89)	431(36.96)
Overhead	587(31.90)	3,376(93.96)	1,932(58.11)	2,610(135.58)	8,505(79.44)
TOTALS	1,774(96.41)	5,530(152.93)	4,272(128.48)	4,575(237.66)	16,151(150.86)

Ruby-throated Hummingbird, Prothonotary Warbler, and the Orchard Oriole. Late migrants include Marsh and Sedge Wrens, American Robin, Yellow-rumped Warbler, and most of the sparrows. There are also many birds like the woodpeckers, House Wren, mimic thrushes, some warblers, and some of the blackbirds that are seen throughout the period. Most of the hawks migrated from mid-September to early November.

One interesting aspect of the migration was the diurnal hawk movement along the coast. Sykes' Outer Banks numbers were lower than ours from Fort Fisher for accipiters, though higher for falcons. One noted difference was a lack of buteos recorded at Fort Fisher, which could have been a result of ending censuses before noon, when these birds normally peak in numbers. Further hawk watches should be conducted at Fort Fisher to determine more accurately the magnitude of the hawk migration there.

Disorientation of migrant birds was frequently noted at Fort Fisher. Birds circled high overhead at the tip of the peninsula and then either flew in a westerly direction across the Cape Fear River or, more commonly, headed up the river shoreline in a northwesterly direction. Presumably the birds were attempting to reorient themselves to their preferred migratory pathways (Baird and Nisbet 1960).

Disorientation also results when birds are blown out over the ocean during the night. They can be seen flying toward the shore early in the morning (Stone 1937). This was observed on two occasions during the study at Fort Fisher and usually involved small passerines such as warblers. Stone surmised that this disorientation was caused by northwest winds taking birds out to sea during nocturnal migration. Apparently this was also the case at Fort Fisher. Baird and Nisbet (1960) conducted studies on coastal islands in the Northeast, and they give similar reasons for this occurrence, terming it "offshore drift."

One factor apparently influencing migration at Fort Fisher is the general shape of the peninsula. The peninsula acts as a "funnel" and tends to concentrate southbound migrants. Birds following river and ocean shorelines would certainly follow a narrowing path in the Fort Fisher area. This concept was also noted by Sykes (1968) on the Outer Banks. He indicated that the "small land mass" was one of the factors responsible for concentrating the migrants. It can also be said that northwest winds blow migrants to the coast where they then proceed to follow the coastline (Baird and Nisbet 1960). This probably also influences the concentrations of birds at Fort Fisher.

Local landform, northwest wind drift and the disorientation often associated with it, and cold-front weather patterns thus appear to make the Fort Fisher area a place for concentrations of migrants durng the fall season. The numbers and kinds of birds found in this study are similar to those of Sykes (1968), clearly indicating a significant passage of migrating land birds.

Further work needs to be done in the field of migration and its controlling influences related to concentrations of migrants. Not only do studies of species diversity and abundance need to be done, but the sequence of migration needs further documentation. It is hoped that additional work at Fort Fisher will be initiated as a result of this study.

ACKNOWLEDGMENTS

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CORRECTION

If you are wondering why Volume 47 of *The Chat* has two Fall issues, the explanation is very simple: The Editor suffered a mental lapse. Issue Number 3 should have been designated as "Summer 1983," instead of "Fall 1983." To get us back on schedule, the present issue is also designated as "Fall 1983." The Editor regrets any inconvenience this duplication may cause readers and researchers.—EFP