

MISCELLANEOUS PUBLICATIONS
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 125

**The Breeding Biology
of the
Acadian Flycatcher**

BY
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ANN ARBOR
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN
OCTOBER 7, 1964

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Audiospectrographs of "peel" call note and male advertising song of *Empidonax virescens*.

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FRONTISPIECE

Acadian Flycatcher on nest; Calhoun County, Michigan, 7 August 1954.

Photo by L. H. Walkinshaw.

THE BREEDING BIOLOGY OF THE ACADIAN FLYCATCHER

THE SMALL flycatchers of the genus *Empidonax* present a special problem to ornithologists. The similarity of many of the species and their sympatric distributions have made it difficult for field workers to gather data regarding their breeding biology, behavior, or other phases of their life histories. As a perusal of Bent (1942) reveals, many published notes regarding species of the genus *Empidonax* are of limited use, for one cannot be certain the species were correctly identified. Even the species determination of collected specimens remains a critical problem. The similarity of the sexes presents a further barrier to field investigations. Only one (J. Davis, Fislser, and B. S. Davis, 1963) of the published papers of the past 20 years is the result of following a population through a complete breeding season. In reporting my work with the Acadian Flycatcher (*Empidonax virescens*), I have endeavored to correlate my observations with information on other members of the genus, gathered from a survey of the literature.

Marking a small population of adult Acadian Flycatchers for close study proved rather difficult. Females were captured in mist nets set near nests under construction; hence, it was first necessary to determine the routes most used by a female in approaching or leaving the nest. A few females captured in this manner deserted the particular nest. Most males were caught in nets placed to intercept a frequent flight path. A few males were not captured at all.

Each captured bird was banded with an aluminum United States Fish and Wildlife Service band, plus one or more colored celluloid bands. As a further aid to identification, the tips of the rectrices were painted various colors with "airplane dope." This procedure proved most useful, for the short tarsi of the Acadian Flycatcher are not always visible to the observer, and the paint could easily be seen on incubating and brooding adults.

Data gathered from these marked individuals comprise most of this paper, although some observations of unbanded Acadian Flycatchers have been included. One unforeseen eventuality of my study was the discovery that the study tract was utilized by several nesting pairs of Least Flycatchers (*Empidonax minimus*). The result was that numerous field observations were useless, because it was impossible to determine which species had been involved. In fact, even the fairly abundant Eastern Wood Pewees (*Contopus virens*) at times looked suspiciously like *Empidonax* flycatchers. Most of the recent papers on *Empidonax* are the results of studies of unbanded birds. Only Walkinshaw (1961) seems to have worked previously with banded Acadian Flycatchers. Similar and more detailed investigations of marked populations are much needed.

The period of the study covered the nesting seasons of 1955, 1956, and 1957. A few days were also spent on the study tract just as males were arriving in 1958.

ACKNOWLEDGMENTS

For financial support to conduct this investigation, I am indebted to Irving J. Cantrall, former curator of the Edwin S. George Reserve, under whose guidance I was awarded a grant as a Reserve Scholar. Cantrall also assisted the work in various other ways throughout its course. The study began under the supervision of Josselyn Van Tyne and upon his death was completed under Robert W. Storer. For notes and field observations on Acadian Flycatchers at the George Reserve and elsewhere in southeastern Michigan in former years, I am grateful to George M. Sutton and Andrew J. Berger. Lawrence H. Walkinshaw provided photographs and field notes from other Michigan areas. Evan B. Hazard and Laurence C. Binford assisted me in certain phases of the field work. Ectoparasites were identified through the cooperation of Nixon A. Wilson. Val Nolan, Jr., Robert W. Storer, and Harrison B. Tordoff critically reviewed the manuscript and made numerous constructive comments. Donald J. Borror furnished sonograms of Acadian Flycatcher vocalizations.

THE STUDY AREA

This work was done on the Edwin S. George Reserve, about 4.5 miles west of Pinckney, Livingston County, Michigan. The reserve has a topography of rolling glacial outwash, containing esker- and kamelike formations and numerous kettle holes (more or less conical depressions of small size). Local relief in the Big Woods, the 125-acre tract that was the study area, may exceed 80 feet, and slopes as steep as 60 per cent are present. Within the study tract were two small, temporary ponds and a one-acre bog, known locally as Buck Hollow.

According to Cantrall (1943:31), "many of the larger and better trees were taken from the woodlands about 1900." Edwin S. George purchased and fenced the area as a game preserve in 1927-1928, later giving it to The University of Michigan. Since 1926, fires have not altered the tract, but the browsing of a herd of white-tailed deer (*Odocoileus virginianus*) has probably exerted some influence on the woodland shrubs. Rogers (1942) noted that the wooded areas on the Reserve during the period from 1936 to 1938 were 90 per cent white oak (*Quercus alba*), black oak (*Quercus velutina*), and shagbark hickory (*Carya ovata*). Oak and hickory saplings were generally distributed; sassafras (*Sassafras albidum*) was the most abundant tall-shrub layer species, but witch hazel (*Hamamelis virginiana*) and hazelnut (*Corylus americana*) were common and formed numerous,

small thickets. In the south-central portion of the Big Woods, Cantrall found sassafras saplings sparsely distributed, with occasional clumps, and witch hazel and hazelnut likewise scattered, from 1936 to 1939. Probably the most significant change in the vegetation of the Big Woods between 1939 and 1955, when my study began, was further closure of the tree canopy. Some alteration of the shrub stratum had evidently resulted, for much of the remaining sassafras was dead or dying by 1955. There was little, if any, hazelnut, but witch hazel was the most widely distributed and abundant tall-shrub species. Oak, shagbark hickory, and red maple (*Acer rubrum*) saplings were numerous. Cooper (1960:110) sampled the vegetation of the Big Woods in 1957. He found the leading canopy dominants to be white oak, black oak, shagbark hickory, red maple, red oak (*Quercus rubra*), and black cherry (*Prunus serotina*). The basal areas calculated for these species on 16 sample plots ranged from 18.8 to 30.7 square feet per 900 square meters, and averaged 23.5.

Fortunately, George M. Sutton studied the birds of the George Reserve from 1934 to 1948. He found no Acadian Flycatchers until 1936 (letter of 26 September 1957); thus we probably know when this species first occupied the area.

ARRIVAL ON THE BREEDING GROUNDS

Singing male Acadian Flycatchers were first heard on the study area May 13, 13, 10, and 17, from 1955 to 1958, respectively. None was observed prior to my hearing the first songs each spring. Each season, males were first found on areas later utilized as territories. If first-singing males had newly arrived, they apparently took up territories immediately. Most of the territories were occupied within a week after the first arrival was observed (Table 1).

Data on the arrival of females are few, for females are more difficult to observe at this season than males. The shortest known period between first singing of males and the beginning of nest construction was 11 days. The periods between probable arrivals of females and the deposition of their first eggs, for four territories, were 6 (old nest re-used), 7, 9, and 11 days.

TABLE 1
DATES FIRST SINGING MALES FOUND

Territory	1955	1956	1957	1958
1	May 13	May 15	May 10	May 17
2	May 15	May 15	May 15	
3	May 19	May 15		
4	May 20			
5	May 24	May 13	May 15	
6	June 1	May 29	May 15	

TERRITORY

SIZE.—The 13 measured territories ranged in size from 1.3 to 4.0 acres (average 2.4). The largest were not in contact with others (Table 2).

SONG PERCHES.—Males moved about freely over territories, but seemed not to have any favorite song perch. There were certain branches, however, from which territorial birds sang more or less regularly. Song perches were usually 9 to 12 feet above the ground; of 132 such perches, 76 were from 9 to 20 feet in height. Infrequently birds sang from treetop perches that

TABLE 2
VARIATION IN SIZE OF TERRITORIES

Number of Territories	Size (Acres)	Number of Territories	Size (Acres)
1	1.3	1	2.5
1	1.4	1	2.6
1	1.7	1	3.3
1	2.1	1	3.6
2	2.3	1	4.0
2	2.4		

were at least 75 feet high, or from branches only 18 inches above ground. Of 61 perches for which I recorded data, 39 were dead branches and 22 live branches. The song perch was often just below the bottom of the tree crown and not far from the trunk; sometimes songs were given from perches far out on drooping branches. Perches were changed often, and from 1 to 18 consecutive songs were delivered from a single perch. On three occasions, song perches were utilized 8, 10, and 11 minutes. It was not uncommon for the male to turn about on the perch while singing from it.

INTRASPECIFIC TERRITORIAL DEFENSE.—Acadian Flycatcher territories seldom bordered each other, and I witnessed no undoubted conflicts between males, so I am unable to evaluate the effectiveness of song in territorial defense. However, I have observed two small unidentified flycatchers engaged in pursuits and other conflicts which may have been fights between Acadian Flycatchers.

A. B. Williams (1936:382) stated that pairs of Acadians "each have their own little glen . . . and no other flycatchers in the vicinity," but Dickey (*in Bent*, 1942:185) noted that males chase each other.

MacQueen (1950:199) reported that *Empidonax minimus* maintained territories by "pursuit, threat postures, fighting, and song." Resident males forced intruding males to the ground, where the combatants postured and tumbled about, and the intruder retreated. After resident males chased intruders a few feet beyond the former's territorial boundaries, residents returned to their territories and called *chebec*. D. E. Davis (1959:80) con-

sidered the *chebec* call to be territorial in some cases, but not in others; he stated that "presumably the flight song is territorial." In his study, he found that territorial defense was by active fighting. Males gave *weep-weep* notes during territorial disputes; these same notes were given as part of the flight song. Davis considered the *weep-weep* notes clearly aggressive. Some males he studied also called *chebec* during and after territorial encounters. Bent (1942:214) stated that "Rival males indulge in frequent combats, fighting furiously until the vanquished is driven away."

I watched two, three, and four (once, possibly five) Least Flycatchers in wild pursuit flights. Many *chebec* calls and chatter notes were given. At times, two birds met in the air and fluttered to the ground. In other cases, the participants perched 6 to 12 inches apart, faced each other, and postured with open beaks and slightly drooping wings.

D. E. Davis (1954:167) found occasional, brief fighting among territorial males of *E. hammondi*. Bent (1942:238) reported that *E. wrightii* pairs engaged in little territorial fighting. Johnson (1963:178) found that males of *wrightii* and *oberholseri* defended territories interspecifically. Stein (1958:16) noted that a territorial male *traillii* "tries to drive away the intruder by intimidation . . . through movements and/or sound. . . . Physical contact is probably used only after these methods have failed." King (1955:151) noted that "territorial disputes among *traillii* males are frequent and violent," and occasionally the female assists the territorial male in attacking an intruder. J. Davis, Fisler, and B. S. Davis (1963:342) witnessed territorial chases between presumed males of *E. difficilis*. These authors also gathered considerable information on "intrapair hostility." Some of my observations (under Pre-incubation Behavior) of *virescens* evidently represent hostile behavior between members of a pair.

INTERSPECIFIC TERRITORIAL DEFENSE.—Male Acadian Flycatchers on territory chased Least Flycatchers, Eastern Wood Pewees, Ovenbirds (*Seiurus aurocapillus*), Cerulean Warblers (*Dendroica cerulea*), and Downy Woodpeckers (*Dendrocopos pubescens*). One male Acadian chased a male Cerulean Warbler so vigorously the warbler was forced to alight on the ground. At other times, singing Acadian Flycatcher males paid no attention to other species perched near them in their territories. A male Least Flycatcher sang from a perch directly above and only a few feet from a male Acadian, but was not challenged. On another occasion, a Least Flycatcher within 50 feet of a singing male Acadian later foraged near the latter's song perch without being molested. Two Red-eyed Vireos (*Vireo olivaceus*) and a Least Flycatcher had a noisy squabble within 10 feet of a male Acadian without eliciting any response from the latter. Another male Acadian failed to respond when a Downy Woodpecker perched six feet from him. Finally, a

singing male Acadian allowed an Ovenbird to perch six feet below him without giving chase. The male of a pair of Acadians feeding a young Brown-headed Cowbird (*Molothrus ater*) they had fledged 14 days earlier chased a Cedar Waxwing (*Bombycilla cedrorum*); at the time the flycatchers were beyond their previous territorial boundaries. In southern Indiana, I once saw a territorial male Acadian chase a Cardinal (*Richmondia cardinalis*).

Male Acadian Flycatchers scolded, but did not chase, Blue Jays, (*Cyanocitta cristata*), Common Crows (*Corvus brachyrhynchos*), Screech Owls (*Otus asio*), and Cooper's Hawks (*Accipiter cooperi*).

I found little evidence that female Acadian Flycatchers took an active part in territorial defense, though they defended the nest. Females did join the male in scolding an intruder and one female gathering nesting material gave chase to an Eastern Wood Pewee.

TABLE 3
INTERSPECIFIC PURSUING BY EMPIDONAX FLYCATCHERS

Species	Birds Chased	Authority
<i>E. vivescens</i>	Eastern Wood Pewee	Newman, 1958:131
<i>E. vivescens</i>	"vireos, tanagers, and warblers"	S. S. Dickey, <i>in</i> Bent, 1942:186
<i>E. vivescens</i>	Least Flycatcher, Downy Woodpecker, Eastern Wood Pewee, Ovenbird, Cerulean Warbler, Cedar Waxwing, Cardinal, White-breasted Nuthatch, Brown-headed Cowbird	This study
<i>E. traillii</i>	Red-winged Blackbird	Bendire, 1895
<i>E. traillii</i>	Eastern Kingbird	King, 1955:151
<i>E. minimus</i>	American Redstart, Cerulean Warbler, Magnolia Warbler, Eastern Wood Pewee, Red-eyed Vireo, Acadian Flycatcher, Brown-headed Cowbird	This study
<i>E. minimus</i>	Cedar Waxwing	MacQueen, 1950:197
<i>E. minimus</i>	House Sparrow	DuBois <i>in</i> Bent, 1942:220
<i>E. minimus</i>	Robin, vireos, White-breasted Nuthatch, Cedar Waxwing, Eastern Wood Pewee, Rufous-sided Towhee, warblers	D. E. Davis, 1959:81
<i>E. wrightii</i>	Bewick's Wren	Russell and Woodbury, 1941:35
<i>E. wrightii</i>	Dusky Flycatcher, Red-tailed Hawk	Johnson, 1963:178
<i>E. oberholseri</i>	Gray Flycatcher	Johnson, 1963:178
<i>E. difficilis</i>	Brown Creeper, Oregon Junco, Bewick's Wren	L. Williams, 1942:247
<i>E. difficilis</i>	Hairy Woodpecker, Nuttall Woodpecker, Plain Titmouse, White-breasted Nuthatch, Brown Creeper, House Wren, Bewick's Wren, Blue-gray Gnatcatcher, Warbling Vireo, Orange-crowned Warbler, Yellow Warbler, Lesser Goldfinch, Rufous-sided Towhee, Oregon Junco	J. Davis, Fisler, and B. S. Davis, 1963:340

In most species of *Empidonax* studied, females usually defend the vicinity of the nest, though Stein (1958:16) suggested that female *traillii* took part in territorial defense. D. E. Davis (1959:80) noted that female Least Flycatchers helped the males drive intruding Least Flycatchers from their territories after their young had fledged. MacQueen (1950:199) observed that female *minimus* assisted the male in territorial defense when two intruders entered the pair's territory at the same time. At other times, the female defended an area about 20 feet in radius around the nest. Johnson (1963:178) reported that female *wrightii* and *oberholseri* defended small areas near the nests.

There are several literature references to the pugnacious behavior of empidonaces in interspecific conflicts (Table 3).

VOCALIZATION

Although vocal sounds of birds are usually referred to as songs or call notes, it seems quite impossible to classify all vocalizations of the Acadian Flycatcher as one or the other. Function should certainly be a major criterion for a thorough classification. There has been some discussion in the literature as to what is true territorial song in *Empidonax* flycatchers. D. E. Davis (1954:165) used the term "position note" instead, for the corresponding vocalization in *E. hammondi*. From my work, I think the Acadian Flycatcher has an advertising or territorial song and numerous call notes. I am unable to outline clearly the functions of many vocal sounds given by the species, but where observations warrant, I will discuss some of the probable functions. A more thorough understanding of the complexities involved between vocalizations and related behavior will require further investigation.

MALE

ADVERTISING SONG.—The territorial song of the Acadian Flycatcher has been variously transliterated as *spit chee*, *ha zeeep*, or one of at least 40 other published descriptions. There is much uncertainty, in published accounts, as to whether the song is two-syllabled or three-syllabled. Some authors do not attempt to describe the song, but state that it is characteristic, yet impossible to render accurately by our orthography. There may be local variations in the song, but I have not had the opportunity to compare songs from localities throughout the range of the Acadian Flycatcher.

To my ears, birds in Indiana and southern Michigan utter *tee chup*, with the *chup* the louder and more emphatic syllable (Pl. I lower). Other renditions could be *teech it* or *tee chut*, but I fail to hear the song terminate with a *chee* or *zeeep* sound. The song is snapped out rapidly and accompanied by a jerk of the tail on each syllable. After listening to singing

birds for the three years of this study, I find that my own field notes contain song and call note descriptions that are similar to many gleaned from published works. Indeed, the distance the observer is from the bird, the latter's

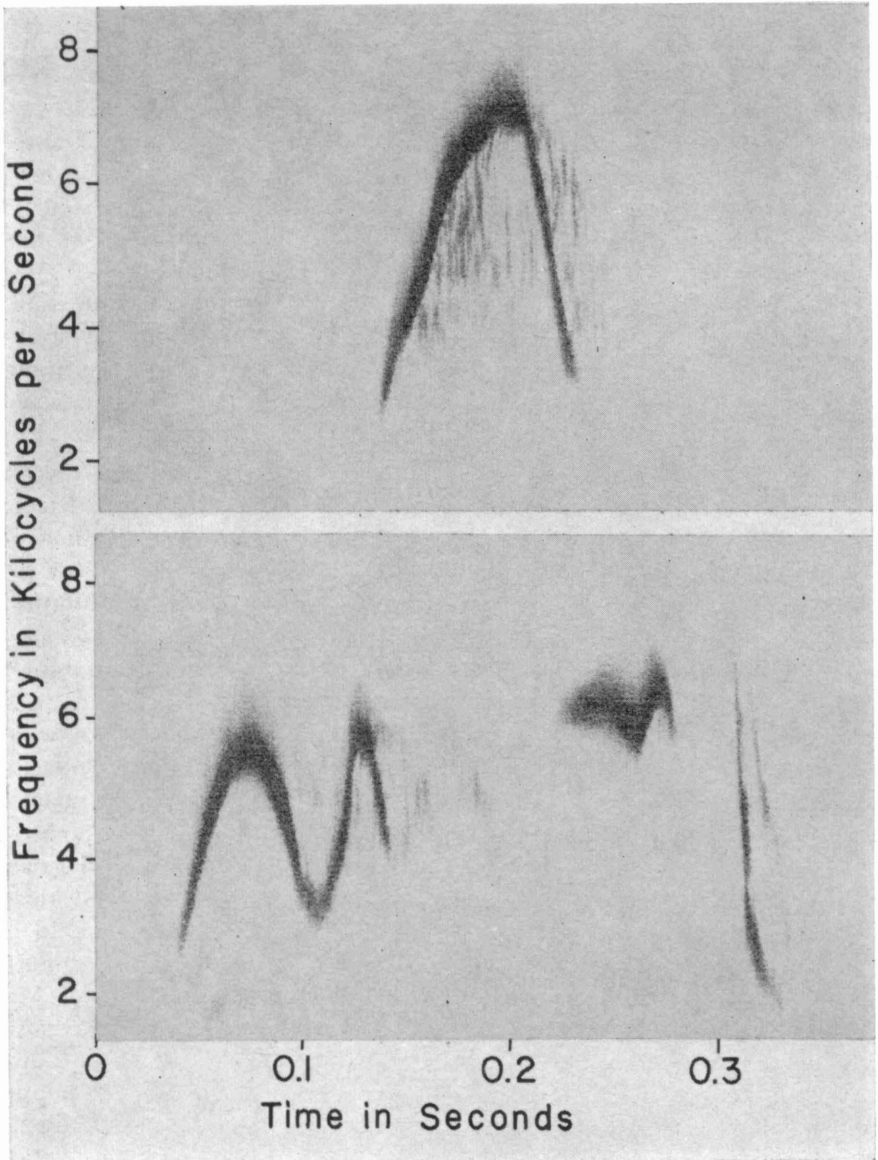


PLATE I

UPPER: The "peel" call note of *E. virescens* recorded at Columbus, Ohio.
 LOWER: Male advertising song of *E. virescens* recorded near Reynoldsburg, Ohio. Tape recordings and audiospectrographs by Donald J. Borror. Figure prepared by Richard D. Alexander and Thomas E. Moore.

perching height, the topography of the area, direction the bird is facing with relation to the observer, emotional state of the bird, wind, and other factors affect the way one hears the singer.

I can see no objection to considering the *tee chup* of the Acadian Flycatcher a territorial song. Males have been observed to give it immediately after driving intruding birds (of other species) from their territories. It is delivered at times when its value as a "position note" is unnecessary; for example, males will sing within sight of the nest tree, or even in the nest tree, while the female is on the nest. It is the common utterance of newly-arrived males on areas they hold as territories later in the season. Not only do these males sing *tee chup* before any female arrives, but unmated males sing *tee chup* throughout the nesting season.

The *tee chup* song is usually given by territorial males at a maximum rate of 2.6 to 3.0 times per minute. One male averaged 3.8 songs per minute for 30 minutes (0818 to 0848) on 6 June and 3.7 songs per minute for 17 minutes (0801 to 0818) on 21 June, both occasions during the incubation period.

Baerg (1930:34) noted that the song period of Acadian Flycatchers in Arkansas was from 1 May to 4 June and 26 July to 28 August. I detected no period during the nesting cycle when males ceased singing, nor did there seem to be any marked decrease in song frequency during any particular period. My birds sang *tee chup* from at least 10 May to 15 August.

FLUTTER CALL.—Several authors refer to a *titter* call or twittered notes sounding like the fluttering of wings. In fact, some early writers thought the sound was made with the wings. Sutton (*in litt.*) described it as *tidd-did-did* uttered "almost in a trill." This is a common vocal utterance, which I have designated the flutter call; it is a series of short notes, like *ti*, *te*, or *we*, rapidly repeated on the same pitch. It is most often given by males as they move short distances between singing perches, sometimes in flight or, more frequently, just after alighting on a new perch. Often the wings and tail quiver while the call is given; sometimes the crown feathers are raised to form a slight crest at the same time. One male (on 16 May) held his wings in a horizontal position, partially extended, and gave a four-noted flutter call. Another male (21 May) gave the call while holding one wing extended outward and backward. On 18 May, a third male perched, raised both wings, and fanned them rapidly several times as he gave the flutter call. At 1855, on 25 May, the flutter call was given by a male as he hopped along a two-inch horizontal branch 45 feet above the ground; he held his tail spread and his wings extended slightly at the time, as if displaying. Males engaged in "symbolic nest building" also gave the flutter call.

The usual duration of the flutter call was one to three seconds, but a male near a mounted White-throated Sparrow (*Zonotrichia albicollis*) decoy

set up in the Acadian's territory gave a seven-second call. The same male later gave a 15-second call (24 May, before his mate arrived). Flutter calls were normally interspersed between the regular, daytime *tee chup* songs. On 16 May, male No. 2 gave the *tee chup* call 229 times and the flutter call 32 times from 0900 to 1002 and 1046 to 1130. This male sang *tee chup* 217 times and gave the flutter call 44 times from 0839 to 1020 on 21 May. During this period, 14 consecutive flutter calls interspersed with *tee chups* were of 2, 2, 3, 2, 1½, 1, 2, 2, 2, 2, 1, 2, and 5 seconds duration (timed with second-hand on watch). Male No. 1 gave 57 *tee chups* and 11 flutter calls from 0604 to 0636 on 21 May, and male No. 4 gave 16 *tee chups* and 8 flutter calls from 1916 to 1922 on 29 May.

Males and females gave a call similar to the flutter notes when at the nest with food; it apparently stimulates the nestlings to gape. Greeting calls given when the male and female meet at the nest or away from the nest are also similar to the flutter notes but may be more like the *whoty-whoty* calls mentioned by Bendire (1895).

DAWN SONG.—Heard almost entirely at dawn, this song consists of metallic *seet*, *speet*, *spake*, or *speak* notes interspersed with *tee chup* phrases. One performing bird sounded quite excited, and the *tee chup* came out as a more metallic *spee deal*, with interspersed *speak* or *spake* notes. The number of *seet* notes given between *tee chups* usually varies from four to nine, rarely one. Often the last of such a series is run together with the following *tee chup*, resulting in a three-syllabled *seet tee chup*.

The most striking characteristics of the dawn song are its unusual length and the almost breathless rapidity with which its notes are given. Male No. 1 gave 222 *seets* and 39 *seet tee chups* from 0430 to 0435 on 4 July; this is an average of 67.8 notes per minute. He began singing at 0423. The next morning, this male began his dawn song at 0413 and ceased at 0456 without having paused longer than a split second between notes. About 30 seconds after 0456, he gave the regular *tee chup* of his daytime song nine times. By 0500 he was giving his regular advertising *tee chup* song 30 to 40 yards from where he sang at dawn. One male gave the dawn song from 0428 to 0515 on 25 June. On 25 July, another sang this song from 0453 to 0506, then switched to his regular daytime song.

Dates on which the dawn song was heard ranged from 13 May to 30 July, but males probably sing it both earlier and later in the season. Males were usually not visible to me while they were singing their dawn songs, but one I watched sang from the same perch for two minutes, turning 180 degrees on this perch three or four times. The *speak* notes were accompanied by a rapid single or double twitch of the wings.

The male singing *speak*, *speak*, *speak spee deal*, etc. on 14 June, gave some of the *speak* notes in flight between perches. Careful listening to this

bird revealed that some of the three-noted *speak spee deal* phrases had a slight pause between the *speak* and *spee deal*, though a shorter pause than between successive *speak* notes. McCabe (1951:91) mentioned similar singing behavior by *Empidonax traillii*, which at times sings "creet—pause—fitz-bew." McCabe did not mention hearing this phrase as part of the early morning song of *traillii*.

Sutton (*in litt.*) described the morning song of *E. virescens* (heard on my own study area) on 23 July as *pitick pitick pitick pee-ee-yuck* given over and over, up to a climax. Borror (1961:66) mentioned the distinctive dawn singing of the Acadian Flycatcher.

The daily dawn song of *E. minimus* is said to decrease as the nesting cycle progresses, and "does not continue all summer" (MacQueen, 1950:201). She further stated that the "male sings no evening twilight song in any way comparable to the morning song." McCabe (1951:96) noticed song flights by *E. traillii* at dawn, but less frequently than at dusk. J. Davis, Fisler, and B. S. Davis (1963:346) noted that dawn song was common in *E. difficilis*.

EVENING SONG.—The most spectacular singing performance of the Acadian Flycatcher is its evening song, part of which is delivered in flight. Evening singing is done, for the most part, in and near the tree tops. When possible, birds sing along a woods border. A male on 18 June 1955 sang briefly from three dead branches 60 feet above the ground; other males sang from 80-foot perches.

In general, the calls given at evening are interspersed *wheel chur*, *weel chudl*, *wheeu*, *queer queep*, *spake*, *weel*, and *kit tee chup* notes and phrases, and often some of these have a metallic sound. For example, the *tee chup* of the daytime seems to become *tee keel* or *spee deal* on occasion in the evening, and the usual daytime *speet* call note becomes *spake* or *speak* (as in the dawn song). Whether atmospheric conditions or height of song perch cause these apparent differences, I do not know, but the notes seem to be given with more ringing emphasis in the evening and at dawn. It is my thought that the more metallic-sounding notes signify a high state of excitement.

Much of the evening song was given 50 to 100 yards from the usual daytime singing sites. Two performing males ranged over areas roughly 40 by 80 yards (18 June 1955) and 75 by 150 yards (2 June 1956). Evening song did not approach the rapid rate of the dawn song but ranged from 5.8 to 44 notes per minute (average about 32). Birds normally began with a series of *wseet* or *pseet* calls, followed by *wheel chur*, *queer queep*, etc. From time to time, the notes came closer together, then built up to a rather frenzied climax, when the flight song frequently was delivered. At this point, males would fly upward from the tree tops in a sort of wavering and gliding movement, then fly about 50 feet, giving *wheel chur* calls several

times. At the cessation of singing in flight, they would plunge downward at an angle of 60 to 75 degrees into the tree crowns to perch 30 to 40 feet from the ground.

On 7 June a male flew nearly 50 yards and gave a series of six *pake wheel chur* phrases, followed by a *pake tee cheek* at the end of the flight; the latter phrase may have been given just after he took a new perch. On 9 June 1956, Paul Slud and I watched a singing male for 20 minutes before collecting it at Brazil, Indiana, as it gave the evening song along a wooded ravine in an overgrown field. This bird flew from tree top to tree top, even flying out over the field to perch in isolated trees; perches used were 40 to 50 feet high and sometimes 50 yards apart. While perched, this bird flicked his wings and twitched and fanned his tail. Once he flew 50 yards from the woods border to an isolated tree and gave a single *spake* note enroute. Immediately after alighting from a flight song, he gave *speak tee chup*. The song area was approximately 50 by 75 yards.

Individual males evidently did not sing the evening song daily and on some evenings I witnessed no song flights, though the remainder of the evening song was given.

The evening song and dawn song were not mirror images, as in the case of the Eastern Wood Pewee (Craig, 1943:176). MacQueen (1950:203) and McCabe (1951:96) suggest that evening and dawn songs of *E. minimus* and *E. traillii*, respectively, are distinctively different. I observed singing in flight only once at dawn, but song flights were nearly always a part of the evening song. Dawn songs were simple in that only three notes made up the entire pattern, while the phrases *weel chur*, *queer queep*, *wheel chudl*, and others helped make up evening performances. Dawn songs appeared to be rendered from perches similar in height to those utilized for daytime singing within the territory. Dawn and evening songs were similar in that both were prolonged, were evidently correlated with light intensity, and sounded frenzied (emotional songs?).

The evening song was heard from 14 May to 6 August, though daily checks were not made to determine its total duration.

McCabe (1951:92) described the evening song of *E. traillii*, which commonly sings in flight. Evening flight songs have been recorded for *E. hammondi* (D. E. Davis, 1954:166), *E. minimus* (Bent, 1942:221; MacQueen, 1950:202; D. E. Davis, 1959:78), *E. flaviventris* (Allen, 1903:121), *E. wrightii* and *E. oberholseri* (Johnson, 1963:152), and *E. virescens* (D. E. Davis, 1954: 170). J. Davis, Fisler, and B. S. Davis (1963:346) found no evidence of evening flight song in *E. difficilis*. It will be most interesting to determine whether other species of *Empidonax* perform song flights.

OTHER CALLS.—In the vicinity of their nests, males commonly called *speet* or *peet* (Pl. I upper) when scolding Blue Jays, cowbirds, Common

Crows, Screech Owls, or Cooper's Hawks. This note was also given by a male that dived over my head as I examined young from his nest. The *peet* note was one of the male's most common calls. While chasing a female Brown-headed Cowbird, which had perched 30 feet from his nest, one male Acadian called *wheeah* and *speeu*. When the cowbird departed from the territory, the flycatcher sang *tee chup* once. Another male called *weel* or *wheel* when two cowbirds came near a flycatcher nest on the second day of its construction.

The notes *whee uh*, *whee chul*, *weel chur*, and *wheel chur* seemed to be scolding calls. Males often spread their tails noticeably when giving *weel* then closed the tail on *chur*. A similar call, *weel chudl*, was likewise accompanied by tail movements. The tail was depressed on the *weel* note, raised and spread on *chudl*; wing twitching accompanied the latter. At times a short flutter call preceded the *weel chudl* (as it sometimes did the *tee chup* song).

As I released a male after banding, he perched, gave a *wseet* note a few times, then sang *tee chup*, all in a few seconds. Another male released after banding called *wseet* many times and flicked his tail. A third male called *wseet* for 10 minutes when I released him after banding.

The *whew* call of one male was "answered" promptly by a *whew* call from his mate on the nest.

Sutton (*in litt.*) recorded *pee-oo* or *see you* notes uttered near the nest. Newman (1958:137) noted that a male called *pee tul* on 18 of 36 visits to the nest to feed young; the call was also given when the male seemed excited whether or not the female was present. These observers were probably referring to the same call. Males that I studied often called *pee tul* or *pee tudl*, which I tentatively interpret as greeting notes. Newman noted a male called *pee-tul* as it flew and fluttered after the female a few feet above the ground and while flying in a small circle. Walkinshaw and Henry (1957:303) refer to a male Acadian that gave a "rapid short-syllabled note" in flight when an observer was near its nest.

D. E. Davis (1954:170) listed *whit* and *peet* as male alarm notes. Longstreet (1937) heard an unsexed Acadian Flycatcher in Florida give 103 single-note calls in four minutes.

I recorded various other calls of male Acadian Flycatchers, but cannot comment on their possible function. These calls include the following: *weaho*, *wheeh swit swit swit*, *wheeh wit wit wit*. In addition, there were calls I could not with certainty assign to one sex or the other.

FEMALE

The most commonly heard call of the female was a simple *peet*, *wseet*, *speet*, or *pseet* note, occasionally given in flight. Females gave the call (1)

as they settled on the nest after an absence, (2) when working at a new nest, (3) when scolding me as I examined the nest or young, (4) when diving on an Eastern Chipmunk (*Tamias striatus*), (5) when scolding a Brown-headed Cowbird, (6) when a Blue Jay was in the vicinity of a flycatcher nest, and (7) at various times when they were away from the nest during all phases of the breeding cycle.

Females gave numerous other calls, however, and seemed to have as many different notes as did males. My notations reveal that males and females possess basically the same repertoire, including the *tee chup* song. Three females frequently gave *tee chup*, either from the nest or from off the nest. One female on a nest containing eggs gave the sound immediately after her mate sang not far from the nest, after he had been in the distance for several minutes. Within 30 seconds after she called, she left the nest and flew toward the male. The next day while this female was on the nest, the male sang and the female sang *tee chup* immediately, the male sang again and the female gave a *weel* call once, the male sang three more times and the female gave a chatter call, but after the fourth song of the male, she gave a *wheel wit wit*. From 0930 to 0942 the following day, this female called *tee up* from the nest three times and *wheer* four times as a Brown-headed Cowbird was heard near the nest. Three minutes later, she gave a *wheeh zee ip* from the nest, and when a female cowbird chattered 50 yards from the nest at 1000, the female flycatcher gave *wheeh tee chup* once. This flycatcher called *wheeh*, *tee chup*, and *chee up* during the next 25 minutes. At 1030 she uttered a *swee zee up* a few moments after returning to and settling on the nest. Other calls given by females from the nest immediately after their mates sang were *kee tee e up* or *peet kee e yuk* (once), *sweet tee chup*, *ti ti ti* or *tee tee tee*, *swee er eet*, *wheel*, *swee*, *weel chur*, or *wheel chur*. Much of the above behavior may represent responsive singing (Van Tyne and Berger, 1959:140).

A *weel chur* or *wheel chur* call was given with other notes when a female Acadian Flycatcher was scolding a Cooper's Hawk and while she was searching for a nest site.

Calls sounding like *wheeh kip kip*, *wheeh seet seet*, and *whee uh wheet* were heard at various times. The *wheeh kip kip* appeared to be a high intensity scolding call and was given by an incubating female when an unmarked Acadian Flycatcher (not her mate) came near the nest. On another occasion, the call was given when she was scolding a nearby Blue Jay.

One female on her nest called *wee weel* softly as she looked in the direction from which I heard a Blue Jay. Another called *wheer* when a Brown-headed Cowbird was near the nest. A sharp *weer weet* was evidently a scolding call, given by a female watching something I could not see near

the nest. Once as two unidentified birds fought near the blind, the incubating female called *weel wheep* from the nest. Another female gave a *speet tee cheel* from the nest.

Infrequently females called in flight as they left the nest. One gave a *pee tul* and another a *pee speet*.

Soft, chattered calls were often given, especially when females were feeding young. These calls were series of rapidly repeated *ti* or *te* notes, given from three to six times, and were evidently used to stimulate the young to gape. A similar chatter was given when male and female met away from the nest or when both were at the nest; this seemed to be a greeting note at these times.

D. E. Davis, (1954:170) mentioned the *whew* call and Walkinshaw and Henry (1957:302) a *queep* call of female *virescens*. Newman (1958:132) recorded female vocalizations of *whit*, *pit*, *wert*, *swert*, and *peet*; he also heard a *suh-ree* call given by a brooding bird.

YOUNG

Newly hatched young in one nest gave a weak, cheeping cry. By nest-leaving time, young called *seet* or *seep*, a somewhat softer call than the *peet* of adults. Young birds out of the nest gradually altered their *seet*, *wheet*, or *peet* calls, so that by the time the young were independent their calls seemed identical to those of adults. Newman (1958:142) noted that fledglings acquired the adult *wert* call by the tenth day out of the nest, but he refers to *tseep* or *seep* calls of younger fledglings. Newman also mentioned a "faint lisping cry" and a "subdued chorus" or buzzing by five-day-old young in the nest.

I found no evidence that young of the year sang the *tee chup* song before departing from the breeding grounds.

PRE-INCUBATION BEHAVIOR

Courtship evidently consisted principally of chasing. Females at times seemed to repulse males. One female flew to a perched male after he called *keedl keedl*. Males would dive on females or hover over them as the latter were working at the nest or searching for nest sites.

Chases were erratic and swift and usually terminated near or on the ground. Once a male chased a female searching for a nest site; he caught her by the nape with his beak and they flew in and out among the under-story, over an area roughly 45 by 125 feet. Their course took many turns and circles and evidently ended on the ground (out of my vision). A shorter chase carried the participants to within three feet of the ground. On two other occasions, I witnessed similar flights. In one case, a banded male

Acadian grasped a second small flycatcher by the nape and flew 30 yards before the birds fluttered almost to the ground and parted. Another time, an Acadian (sex unknown) pursued a small flycatcher; the birds came together 30 feet in the air, dropped fluttering to the ground, and sat there a few seconds, then resumed the chase out of my vision. It is also possible that these last two observations were territorial conflicts.

One minute after a male chased a nest-building female in a wild flight (30 May) to the ground, he perched over the spot where the birds evidently lit and sang a *tee chup* seven times. Twelve minutes later, as the female was back working on the nest, the male perched six to eight feet above her and snapped his beak rapidly three to five times. The female flew to him; he flew to another tree; the female flew to him and I heard a *whceeu* note; both birds were out of my vision by then.

Since little is known about pair bond formation and maintenance and other behavior during the pre-incubation period in the genus *Empidonax*, the following observations are presented in some detail.

On 2 June 1955, as a female returned to work on the nest, a male came and perched six feet above her. The female then flew 50 yards, returned to the nest and perched; the male fluttered about, lit near the female, flew a half circle in front of her, lit on the other side of her, then repeated this performance six times. The female sat squatted on the branch, beak opened slightly, with her body leaning forward and almost horizontal. Her tail was spread and the wings partially extended. She held this position while the male flew about and for a few seconds after he perched, facing her, a foot away. The male then flew and the female followed him.

On 24 June 1955, this same female was approached by the male on three consecutive trips she made to the nest with nesting materials; each time the male would wait until the female was in the nest working, then he would fly to her and hover as close as 10 inches over and about her. When he approached the female, I heard a sharp, short note (far different from the soft chatter usually heard when the sexes came together). Once the female flew from the nest and the male closely followed her. She perched 35 feet up on a horizontal branch, with her beak open and wings slightly drooping. She held this position while the male hovered about her and flew from perch to perch near her, as he had on 5 June. The 24 June observations were made while this pair had its second nest of the season under construction; the first nest had been destroyed.

On 29 May 1956, a female gathering nesting material was watched. She was sitting a foot from the nest at 0902 when the male flew near her (I heard a chattering for a few seconds). She then went to work on the nest; at 0907, after the female had lit in another tree 20 feet above the ground to gather

nesting material, the male came and hovered near her. The female seemed to repulse him and he flew; during the time he hovered near the female, I heard much chattering. The female sat with her tail spread, wings slightly drooping and quivering, and with her beak open.

On 13 June 1957, as a female worked on the nest at 0909, her mate came to the nest. I heard much sharp chattering and I think the female chased the male away. At 0926 the female went to the nest; the male sang, then came and hovered two feet away, chattering. The female left the nest; the male perched 15 inches from the nest briefly, flew two feet away and hovered and chattered then flew and sang twice by 0927. At 0940, he came to the nest while the female was working there; he hovered nearby, giving a chattering call, then flew upward three feet, hovered, and caught a large caterpillar and flew 80 feet. At 0951, when the female came to the nest, the male followed her. He hovered 12 inches from her and I again heard a loud chatter; the male perched 10 feet from the nest and sang twice. At 1003 the male came to the nest when the female did; she went into the nest to work and he perched 10 inches away. I heard a brief chatter, then the male flew.

On 26 June 1957, as I searched for a pair of Acadians that had lost a nest, I found the male singing. As I approached him, he flew to a spot over a dead limb on the ground, hovered, then flew. He did this three times and each time I heard a soft call that I mistook for a fledged Acadian young. I walked toward the limb and a female Acadian flew up and went to a new nest under construction nearby. The male had evidently been hovering over her.

I never observed copulation, and I am unable to say at what stage it may occur. It probably occurs at the time when the female sits, trembling her wings (possibly the solicitation pose), and the male hovers about her. During this hovering, the male takes a position above and behind the female, as though he is going to mount. Johnson (1963:202) is evidently the only author to observe copulation in an *Empidonax* flycatcher—in this case, *wrightii*.

The diving of the male over the female's head may be a form of "pouncing," as discussed by Nice (1943:84). J. Davis, Fisler, and B. S. Davis (1963:342) observed similar behavior in *E. difficilis* and presented other data regarding intrapair hostility and intrapair dominance. One Acadian gave a four-note chatter call as he dived over the female. During the phase of the breeding cycle when I watched for courtship, Least Flycatchers and Eastern Wood Pewees, unfortunately, added much confusion to observations.

Johnson (1963:197) noted pairing flights in *E. wrightii*, *E. oberholseri*,

and *E. hammondi*. J. Davis, Fisler, and B. S. Davis (1963:343) were unable to obtain data on pair formation in *E. difficilis*. King (1955:150) referred to "vigorous sexual chases" in Traill's Flycatchers. Bent (1942:214) mentioned that male Least Flycatchers chased females in pursuit flight, and Nero (1959:56) observed what was undoubtedly courtship display in *E. minimus*. Nero concluded that the behavior he observed might represent "symbolic nest-site selection" or "symbolic nest-building." MacQueen (1950:199) observed the male Least Flycatcher feed the female.

Certain behavior of Acadian Flycatchers that I observed was quite similar to that described for *E. minimus* by Nero, and probably had a similar function (whatever that may be). This behavior is described in the section on Nest-Site Selection.

First eggs were laid in 11 first nests of the season as follows: 30 May (two) 1 June (two); 2 June (two); 4 June (one); 5 June (three); 7 June (one).

POLYGYNY

An unbanded male that I observed closely in 1955 evidently had two mates, both of which I banded. In 1956, I netted and banded the male on this same territory; later he fed the young from nests of two females. This male helped feed young in one nest until the young fledged on 5 July. On 13 July, he fed fledglings from one nest and young in the second nest within a few minutes. I did not see this male feed young of the second brood of one of the above females, but the brood fledged successfully and the male often sang near the nest.

Another banded pair nested in one territory in both 1956 and 1957. In 1957, this male fed nestlings in one territory from 17 to 24 June; he also fed nestlings in another territory from 15 to 27 July. On various dates between, and within, these periods, this bird frequently was observed flying from one territory to the other. The territories were 627 yards (578.5 meters) apart and, depending upon the route the male took, one or two other Acadian territories lay between them.

Polygyny has evidently not been recorded for other empidonaces, possibly because of the few studies of banded populations.

NEST-SITE SELECTION

The female does most (or all) of the searching for a nest site. The male engages in behavior suggestive of nest-site selection (?), but the role of this is little known and is discussed below.

Females go from fork to fork of branches in the territory and let their bodies down into the forks (holding this position for varying lengths of time). One female explored an area 15 by 50 yards in 16 minutes while

inspecting forks; she was silent while doing so. She "lay" in one fork 26 seconds. She spent 10 minutes in one witch hazel, inspecting a particular fork, hopping away, going back to it, etc. Females also called *pseet* and *weel* while looking for a nest site. One female called *weel chur* and a *tee chup* (evidently in answer to her singing mate) as she searched; once she gave a *kit tee chup*, but most of the time she was silent.

Females tested some forks again and again, others only once while under observation. One female even though she finally re-used a nest from a previous year (details of this observation below), spent considerable time inspecting other sites in the territory.

A female on 2 July 1956 was observed looking for a nest site as she fed young fledged from her first nest. Another female began construction of her second nest before her first brood fledged.

Males may assist in selecting the nesting site, for they sit across forks and give a chatter call; they do not let their bodies down into the forks. The discussion below describes the actions of birds I considered to be males. Only one of them was color-banded; the remainder were tentatively sexed by behavior.

The banded male that occupied Territory 1 in 1956 was observed on the same territory 13 May 1957, as he perched on the rim of his first 1956 nest for a few moments. A short time later, he perched on the fork of a witch hazel and gave the chatter call. On 22 May, this same male again was seen sitting across the fork of a witch hazel, and shortly thereafter he flew up to his second 1956 nest, perched on the rim a few moments, peered into the nest, and flew. Both 1956 nests of this male and his mate had successfully fledged broods.

On 31 July 1955, a bird that sang often was observed sitting across the fork of a branch and giving a chatter call; the pair in this territory had fledged young on 28 July. The male of a pair that lost young from their nest on 6 July was found singing on 7 July; he frequently perched, quivered his wings (once also cocked his tail up somewhat at the same time), and gave a chattering call. Later, this bird perched on the fork of a limb and squatted, chattering, down onto the fork. The following day I watched what I believe was the same bird; again, it gave the chattering call while trembling its wings and holding the tail cocked up, then went to the same fork as above and squatted in the fork. This bird sang often, but it seemed to me the song was a shorter *teecup* rather than *tee chup*.

On 27 July 1956, I followed a singing bird, that appeared to be a male, as it perched on several low branches of witch hazels and gave chatter calls. The pair of Acadian Flycatchers on this territory had a nest under construction on 24 July, but it had seemed deserted 25 July. This male would change

position on a perch by turning 180 degrees rapidly. It also hopped or shuffled its feet, so that it moved sidewise along the perch. The tail seemed to be somewhat elevated and the chatter note was given during this period. This bird seemed to be sitting across forks. It flew about 30 yards, then returned to the same clump of witch hazels and repeated, briefly, the above performance, then flew. At the time, I wondered if the above behavior was some sort of displacement activity. It may prove to be male solicitation behavior.

On 2 August 1956, I visited a territory where the nest had been destroyed between 27 July and 2 August. A singing bird, presumed to be the male, flew to a fork in a hickory and sat across it, giving the chatter call. I observed the same behavior on 3 August, when the same (?) bird went to the identical fork.

I fully realize that some of the unbanded birds above could possibly have been females, thus I do not wish to draw hasty conclusions based on my judgment as to the sexes of the birds involved. In the one observation, however, a banded male was shown to take an interest in previous year's nests and to engage in a type of behavior similar to that of the female when searching for a potential nest site. This bird did not let his body down into the fork, as females did, but simply perched across the fork and squatted there.

De Kiriline (1948:150) thought that the female Least Flycatcher selected the nest site, but Mumford (1962:99) and Nero (1959:56) made observations suggesting that male *minus* visit potential nest sites.

NEST CONSTRUCTION

The female alone constructed the nest. The male came to or near it periodically and frequently "harassed" the female at work there. For example, a male lit one foot from a nest in which his mate was working, then perched on the nest rim, so the birds were almost touching heads. He flew around behind the female and she left, whereupon the male got into the nest, sat two to three seconds, then flew. This was a nest from a previous season which the female was repairing. Perhaps the male was attracted primarily to the nest (which could have been his), as another male was observed inspecting both his nests from the previous season (see p. 23).

Few data were compiled on the rate of nest construction (Table 4) but there was an obvious decrease in this rate during the final stages.

The female repairing an old nest worked at the nest from 5 to 72 seconds (average 23) per visit, on 20 consecutive trips. Two other females averaged 22 seconds (9 visits) and 12 seconds (26 visits) at the nest per trip; the latter bird was just beginning a nest, so was bringing only spider silk each time.

One nest was being constructed by a bird also alternately feeding young in a previous nest; from my blind, I could watch both activities. On 3 July, the female worked at the new nest seven times and fed young in the old nest at least eight times from 0833–0950. The next day, she visited the new nest 24 times and fed young in the old nest at least 21 times, from 0734 to 1125; I did not see her at the new nest from 1635 to 1735. She was not observed at the new nest between 0750 and 0920 on 5 July, but two young fledged from her old nest at 0911 and 0914, respectively.

Newman (1958:131) saw a female make 22 trips to a nest in 75 minutes.

NESTING MATERIALS.—Material was usually gathered from near the nest site (once from the nest tree) up to 60 yards away, and from the ground to 40 feet high in trees. Laurence C. Binford saw one female gathering plant

TABLE 4
RATE OF NEST CONSTRUCTION

Nest Number	Date Observed	Date Nest Begun	Time Observed	Number of Visits
1	25 May	24 May*	1225 to 1336	20
	26 May	same	0718 to 0820	27 (none 0805 to 0820)
2	27 May	27 May	0812 to 0912	26
4	31 May	31 May	1500 to 1600	9 (none 1513 to 1533)
9	24 June	ca 21 June	1400 to 1445	14
21	3 July	ca 2 July	0833 to 0950	7 (female alternately feeding young in previous nest)
	4 July	same	0725 to 1125	24
	4 July	same	1635 to 1735	0
27	12 June	ca 10 June	0829 to 0929	22
	12 June	same	1001 to 1112	22 (none 1059 to 1112)
28	13 June	ca 12 June	0925 to 1013	16

* A nest of a previous season being cleaned for re-use.

material 55 feet from the border of the woods, in an overgrown field. Here she perched a foot above the ground on a weed stalk. Another female gathered nesting materials in all directions from her nest. Females often hovered and picked bits of spider silk or other nest constituents from vertical tree trunks.

First nests of the season were usually tan in color and contained many aments of oak and hickories. Second and succeeding nests were more grayish. Wild grape (*Vitis sp.*) bark was often found in nests; one nest was lined entirely with it. Spider silk was the most important nest component for it anchored the nest to the branch and held other nesting materials in place. During initial stages of construction, only spider silk was carried to the nesting site. One nest was composed almost entirely of fall witch-grass (*Leptoloma cognatum*); this particular plant grew abundantly in the fields near the woods, and in the fall deep drifts of dead stems piled up along

fences and in kettle holes within the woods. Various other dried grass stems and narrow strips of bark were utilized in nests. The lining was of finer plant stems.

Few nests were collected (only those that fell), for early in the study I found one pair of Acadian Flycatchers using an old nest from the previous year. One female took material from her deserted third nest and used it in her fourth nest. D. E. Davis (1954:167) reported similar behavior in *E. hammondi*.

As several authors have noted, the nest appears frail and often the eggs show through the bottom. Nevertheless, some old nests found in the early spring of 1955 (thus constructed at least in the summer of 1954) were still in place in the spring of 1957. Nest materials are rather loosely bound together and frequently long, loose plant stems hang down. One side of a nest under my observation pulled loose and allowed the young to fall; I tied it back in place with string and replaced the survivor, which fledged successfully. Another nest pulled loose from its supports the day after young fledged from it and a third nest may have been dislodged by the weight of a female Brown-headed Cowbird when she deposited an egg in it. Almost without exception, nests were constructed in forks of slender twigs. In larger trees or shrubs, the nest was never built at the trunk, but in some small shrubs (in all cases, witch hazel) nests were in the main, terminal fork. Witch hazel was the predominant shrub species of the understory, and 15 of the 37 nests studied were in this plant. The remainder were built in white oak (12), shagbark hickory (6), red maple (2), basswood (1), and black cherry (1).

Choice sites (as borne out by nests constructed later) indicate that an open space below the nest is important. Birds often enter the nest by flying up from beneath it and leave by diving over the rim, so they require space to fly, hover, and maneuver close to the nest. For this reason, many Acadian Flycatcher nests are most easily seen from below.

Heights of nests ranged from 5 feet 3 inches to an estimated 38 feet but averaged 13 feet 1 inch. Nests were usually placed on horizontal or slightly drooping branches of trees growing on the slopes of kettle holes or in the bottom of kettle holes.

The inside nest diameter averaged 48.7 by 52.3 mm (42 by 53 to 55 by 58) and outside diameters ranged from 64 by 69 to 72 by 93 mm (average 71 by 80.5). Inside depth averaged 24.2 mm and outside depth 38.8 mm.

For females that nested in the same territories all three seasons, the following observations on nest placement were made. In 1955, a female used two nests 133 feet apart. She constructed her first 1956 nest 44 feet

from her first 1955 nest and her second 1956 nest 59 feet from her first 1956 nest. In 1957, the first, second, and third nests were about 25, 150, and 150 feet, respectively, from her first 1955 nest. All four nests used in 1955 and 1956 were within an area of 0.08 acre. Two 1957 nests were outside this former area and for the three seasons she had seven nests within 0.35 acre. Another female, present three summers on another territory, constructed ten nests within an area of 0.32 acre. Her first 1955 and 1957 nests were in the same clump of witch hazel (though the 1955 nest tree had fallen); her second 1955 and 1957 nests were on the same branch of a tree 304 feet from the first nests.

The three 1955 nests of a third female were within 0.09 acre and three 1956 nests of a fourth female were within 0.18 acre. In 1956, two females constructed consecutive nests 58 feet and 104 feet apart. Such close placement of nests may have been influenced by the relatively small size of the kettle holes, which were favored nesting habitats.

RE-USE OF NEST FROM PREVIOUS SEASON

Before Acadian Flycatchers returned to the study area in 1955, several nests from previous seasons had been located. On 24 May 1955, Acadians were noted at one of these nests; later the nest was repaired and a brood fledged successfully from it. This happened, unfortunately, during the first two weeks of my study and I was at the time unable to determine the sexes of these unbanded birds with certainty. The following observations describe behavior of the "male" and "female" based only on inferences drawn later from banded individuals.

On 24 May, the female flew to the nest and seemed to pick something from it, then flew. A few minutes later, a bird came and sat in the nest a full minute; a second bird came and perched two feet from the nest. Both birds then departed. A bird came to the nest nearly a half hour later, lit on the nest, fluttered off to a nearby perch, but immediately went back and sat on the nest 45 seconds. While it sat there, a second bird, probably the male, dived once at the bird on the nest, came back, and appeared to make an unsuccessful attempt to alight on the female's back, then both flew. After ten minutes, one bird came back to the nest and stayed ten seconds; it flew about 20 feet, sat briefly and flew 60 feet, then was joined by the second bird. I watched the female as she went from tree to tree testing potential nesting forks for two minutes. A bird returned to the nest 30 minutes later, sat on it for half a minute uttering the chatter call; the second bird came and perched on the nest rim, whereupon the bird on the nest flew. A final visit to the nest by an Acadian lasted only a few moments. The following day I again saw both birds go to the nest.

Bent (1942:249) and L. Williams (1942:240) cite records of *Empidonax difficilis* using the same nest three and four years in succession, but the birds were evidently unbanded. Nests of a previous season were repaired and rebuilt each time.

The length of time from the beginning of nest construction to the laying of the first egg averaged six days and varied from four to nine days for 18 nests; eight of these were first nests, seven second nests, and three were third nests. One nest, being built while the first nest of the season still held young, required at least nine days. It was difficult to determine whether egg laying was delayed after the completion of the nest, for so little lining was added to nests that one could seldom determine when they were complete. For eight nests I judged to be complete, there were periods of 1, 1, 2, 2, 2, 2, 3, and 3 days before first eggs appeared.

CLUTCH SIZE

In accessible nests, I numbered each egg with ink as soon as possible after it was deposited. For nests in which clutches were thought to be complete, 3 held two eggs each, 21 had three eggs each, and 1 contained 4 eggs. One female laid a three-egg clutch in each of her seven nests over the three-year period. Another female laid five clutches of three and one of two for the same period. Clutch size did not differ significantly for first and subsequent nestings.

DESCRIPTION OF EGGS

I measured no eggs and took only cursory notes on color and markings. Bent (1942:190) gives more detailed descriptions of the shape, color, and measurements of Acadian Flycatcher eggs. In four of the nests I studied, the last (third) egg of the clutch had less and more dilute spotting than the previous two of the clutch. In a two-egg clutch, the first egg laid was virtually unspotted, with only a few minute flecks, and the second egg had sparse, small spotting, with two or three tiny flecks at the small end. In a three-egg clutch the first egg was minutely spotted; the other two eggs were more heavily marked.

LAYING

One egg was deposited per day until the clutch was complete. Of six eggs known to have been laid between 0800 and 1200, one was the first egg of the clutch and five were second eggs. All four eggs known to have been deposited between 1220 and 1753 were third eggs of the clutch, three were terminal eggs of three-egg clutches and one the third of a four-egg clutch. The minimum time between successive eggs ranged from

22 to 27.5 hours (average 24). The final egg of a three-egg clutch was laid within 24 hours 37 minutes after the second egg.

COWBIRD PARASITISM

Brown-headed Cowbirds deposited eggs in four Acadian Flycatcher nests; a single egg was laid in each of three nests and two in the other. A fifth nest containing three flycatcher eggs on 19 June held a flycatcher egg on 24 June, when an intact cowbird egg was found on the ground beneath the nest.

One cowbird egg hatched in each of two nests and one cowbird was fledged; the other three nests involving cowbirds were deserted or destroyed. The single cowbird was fledged at the expense of its three flycatcher nest mates. The cowbird egg in this nest hatched by 1535 on 9 July; the first flycatcher egg hatched after 0855 on 11 July; the other two flycatcher eggs hatched between 1735 on 11 July and 1640 on 12 July. On 9 July (the day the cowbird hatched) the female flycatcher fed it eight times and the male nine times from 1810 to 2010. The next day from 0810 to 1138, the female fed it 12 times and the male 7 times. In an hour on 11 July (0756 to 0855), the cowbird was fed seven times by the female and four times by the male. Unfortunately, this nest held its full complement of eggs when found, so I can only guess whether the presence of the cowbird egg lengthened the incubation period of the flycatcher eggs. At 1640 on 12 July, the cowbird nestling weighed 17.5 gm., the flycatchers 1.1, 1.1, and 1.3 gm., respectively. At 0845 on 13 July, only two flycatchers (one dead and weighing 1.0 gm.) and the cowbird were in the nest. The other flycatcher was alive at 1440, but dead at 1640 (weight 1.1 gm.). At this time, the cowbird weighed 23.4 gm. The cowbird nestling was perched on the nest rim at 2200 on 18 July, but gone by 1503 on 19 July. I subsequently observed both flycatcher foster parents feeding it until 5 August—17 days after fledging.

Another nest contained three flycatcher eggs and a cowbird egg on 13 June. At 1345 on 23 June, the cowbird egg had hatched. The first flycatcher egg hatched between 1255 and 1845 on 27 June; one flycatcher egg was on the ground below the nest then. The cowbird weighed 12.5 gm. and the flycatcher 1.3 gm. this day. The cowbird was found dead on the ground below the nest at 0745 on 28 June; two flycatcher nestlings were still in the nest when it was checked last, at 1520 that day. Both were found on the ground, alive, cold, and bloody, on 6 July; the nest supports had given way. I tied the nest in place with string, but later in the day the birds succumbed.

Friedmann (1929:209) considered the Acadian Flycatcher "a generally

uncommon" host of the Brown-headed Cowbird, but cited 22 records of parasitism. Wheaton (1879), Smith (1927:324), Brandt (1947:79), Newman (1955), and Walkinshaw (1961:266) have published additional data. Walkinshaw's work in Michigan revealed that 16 of 67 Acadian nests were parasitised by cowbirds; 15 nests had a single cowbird egg, but one nest contained three. In two nests, cowbird eggs were built into the bottom, as also noted by Bendire (1895). Wheaton recorded up to four cowbird eggs in Acadian Flycatcher nests. Berger (*in litt.*) watched a pair of Acadian Flycatchers feeding a cowbird fledgling and found another nest containing a cowbird egg and two host eggs; seven days earlier this nest held only three flycatcher eggs. I saw a pair of Acadians feeding a fledgling cowbird in Parke County, Indiana, 11 July 1954.

Cowbirds have also been reported as parasitising the nests of *E. trailli*, *E. minimus*, and *E. difficilis*. Of these, the Traill's Flycatcher is known occasionally to embed a cowbird egg in its nest (Berger and Parmalee, 1952:37; Walkinshaw, 1961:267).

INCUBATION

Incubation was performed by the female alone. By painting the tips of the rectrices of banded birds with colored "airplane dope," it was possible to determine which sex incubated (and brooded) at night. The incubation period as here used is the period from the laying of the last egg of the clutch to the hatching of that egg, when all eggs of the clutch hatched.

The incubation periods for eight clutches were 14 (five clutches), 14.5 (one clutch), and 15 (two clutches) days. Bent (1942:190) gave 13 days as the incubation period for one nest, and Newman (1958:133) observed that a clutch required "14 full days" to hatch. Walkinshaw (1961:266) determined the incubation period for seven nests in Michigan to be 13 (two), 14 (four), and 15 (one) days.

Females characteristically remained on the nest for various lengths of time after depositing the penultimate egg of the clutch, and in all cases occupied the nest the night after this egg was laid. At one nest, the night after the second of a four-egg clutch was laid, I found an unsexed Acadian Flycatcher roosting in the nest tree about three feet from the nest at 2130.

Incubating and brooding females were almost constantly alert but occasionally "dozed" with closed eyes for a few seconds. The locations of nests were such that full sunlight frequently struck the nest for short periods. Incubating females usually turned about in the nest and faced away from the direct rays of the sun. Females often appeared uncomfortable while sitting in direct rays of the sun; often their beaks were open,

and they shifted their wings and tails about. Russell and Woodbury (1941:31) observed apparent discomfort in an incubating *E. wrightii* when sunlight illuminated the nest.

Acadian females, while incubating and brooding, preened, watched passing animals, turned the eggs, stood up and probed into the nest, rearranged nesting materials, gaped, and even captured and ate insects. Females on the nest at night were never observed to have their heads tucked under the wing or into the scapulars.

Incubating birds sometimes left the nest when I was approaching but still 25 yards away. Others permitted me to start pulling down the nest limb before they left. In general, females were more reluctant to leave the nest after their eggs hatched than during incubation. On occasion, females allowed me to approach closely, then flew from the nest with snapping beaks and came close to my head.

Males were not observed to bring food to incubating females, though some males visited the nest periodically. At nest No. 5, the male came to the nest containing two eggs (hatched five days later) and seemed to cause the incubating female to fly; then he stood on the nest rim five or six seconds and left. During the three hours prior to the hatching of the first egg, the male came to this nest three times and perched on the nest rim. Twice he probed into the nest; the third time he merely peered into it. The longest period spent at the nest was a full minute. At nest No. 12, the male went to the nest and perched on the rim as the female

TABLE 5
ATTENTIVENESS OF FEMALE ACADIAN FLYCATCHERS
DURING INCUBATION (7 NESTS) — 1955, 1956, 1957

Day of Incubation	Percentage of time on nest and minutes observed				Average
	0431-0830	0831-1230	1231-1630	1631-2030	
1	71.5 (543)	73.6 (314)	71.7 (92)	62.5 (96)	71.3
2		74.3 (132)	82.1 (67)	69.9 (53)	75.4
3		73.6 (72)	62.9 (386)		64.6
4			68.3 (180)	86.1 (173)	77.1
5		82.5 (137)	66.8 (241)		72.5
6			60.5 (337)	78.7 (150)	66.1
8	82.5 (63)	78.6 (70)			80.4
9		96.0 (50)	67.7 (251)		72.4
10	68.1 (162)	78.8 (123)	74.3 (311)		73.9
11	46.7 (60)	77.4 (234)	83.9 (118)		74.7
12	80.5 (82)	70.6 (160)	62.5 (120)		70.2
13	80.0 (65)	78.3 (318)	62.5 (120)		74.7
14	77.7 (157)	75.7 (132)			77.2
		74.0 (127)			74.0
Average	72.3	76.6	67.6	77.1	

Total observation time, 93 hours, 16 minutes

Total attentiveness, 73.4 per cent.

resumed incubation after an inattentive period. This was nine days before the first egg (a cowbird's) hatched.

Attentiveness of females during the daylight hours at seven nests for which I have the most complete records has been summarized (Table 5). In all, females were on these nests 73.4 per cent of the time the nests were under observation (93.5 hours). The number of minutes in 232 attentive periods ranged from 13.0 to 43.7 (avg. 21.1) for 44 different days of observations at 10 nests during various times of the day. Inattentive periods for the same sample ranged from 2.1 to 12.2 (avg. 7.0) minutes.

HATCHING

Of 48 Acadian Flycatcher eggs incubated until normal hatching time, only 3 failed to hatch; this is a hatching success of 93.7 per cent.

Few data were obtained on length of time between the hatching of the first and last eggs of a clutch. At nest No. 24, the first egg hatched between 0712 and 0848, the second between 0848 and 0946, and the third between 1648 and 1928—a span of at least eight hours. Frequently one or more eggs had hatched before my first visit to the nest on hatching day (some eggs probably hatched at night). At other times, the last egg laid hatched between my last visit in late afternoon of hatching day and my first visit the next morning. The last egg laid of a particular clutch was usually the last to hatch. At nest No. 11, however, the first egg was hatched by 0828; the second and third both hatched between 1120 and 1212 the same day. From this and other data, it is suggested that in most cases the entire clutch hatches the same day.

Egg shells were carried away by the female soon after hatching. As this procedure was watched from the blind, it is not known how far she took them or how she disposed of them. At one nest, the female picked at the eggs and appeared to eat some small particles; I examined the nest immediately and one egg had just hatched. One egg, of a three-egg clutch, that failed to hatch remained in the nest for at least seven days.

Of 81 eggs laid in all nests, 45 (55.6 per cent) hatched, 3 failed to hatch, 30 disappeared from nests, and 3 were deserted. Cowbirds undoubtedly removed some of these eggs. Walkinshaw (1961:267) reported the hatching of 101 (60.1 per cent) of 168 eggs laid in 66 Acadian Flycatcher nests. Sixteen of these nests were parasitized by cowbirds.

DESCRIPTION AND BEHAVIOR OF NESTLINGS

Day 0 (hatching day): Eyes closed; skin over eyes bluish; skin dark flesh color; white natal down present in occipital, spinal, and humeral tracts; occipital patch consisted of 8 to 10 feathers; trace of down in area where primaries will break through; feet and legs flesh to yellowish pink, wings the latter; beak, nails, and gape yellow; tarsus of two young

four and five mm.; young out of egg 1 hour 35 minutes gaped when I touched nest; young give weak, cheeping call.

Day 1: Single young examined had eye slit barely open; tarsus six to seven mm.; otherwise, as above.

Day 2: Eye slit barely open; skin darker, more nearly tan; natal down appears grayer; spinal feather tracts dark gray spots; buffy feathers visible in occipital, spinal, and humeral tracts; primary tracts now dark; gape light yellowish pink to pink-flesh; tongue darker yellow; tarsus six to seven mm.; beaks of young seen above nest rim; when fed, young raise posterior and pass fecal sac; young call when handled.

Day 3: Eyes partly open; feather tracts on venter yellow; elsewhere tracts appear dark gray under the skin; primary and secondary quills ready to pierce skin; beak yellow; tarsus seven mm.; young moving about in nest under brooding female.

Day 4: Eyes partly open; feather sheaths breaking skin except rectrices and those on crown; only 10 rectrices visible; young hold heads out from under brooding female.

Day 5: Eye slit open four mm.; ventral tract feathers breaking their sheaths; down still present on greater secondary wing coverts, spinal tract (except cervical region), crural tracts, and superciliary region; primary quills four to six mm. long; rectrices quills (only 10) breaking skin; sheaths of greater upper wing coverts about three mm. long; feather tracts of crown now visible; rictal bristles not evident; tarsus nine mm.; nails curved near tip into hooklike structures; young frequently rest head on nest rim; move about little when female off nest; on hot day young with heads on nest rim and beaks open.

Day 6: Wing-bar feathers buffy and emerged from quills two mm.; sheath of first primary 10 to 11 mm.; sheath of tenth primary 7 mm.; primary sheaths appear ready to break tips; sheaths of secondaries 8 to 10 mm.; ventral sheaths broken through tips two to three mm.; sheaths of rectrices two mm.; tarsus 11 to 12 mm.

Day 7: Eyes open; primary and secondary sheaths opened at tips two to four mm.; rectrices just breaking their sheaths; dorsum olive; feathers with buffy tips; sides of body yellow; lower belly whitish; upper mandible dark; rictal bristles visible, not extending beyond edge of mandible; tarsus 13 mm.; young make peeping sounds; quite active in nest and female has difficulty brooding them.

Day 8: First primary feather (plus quill) 19 to 21 mm. long; tenth primary 13 to 14 mm.; tips of primaries emerged from sheaths two to six mm.; sheaths of secondary feathers opened at tips one to six mm.; quills of rectrices four to eight mm. long; head, back, scapulars olive with buffy feather tips; wing bars two to three mm. wide, buffy; legs and toes pink; young now gape when adult approaches nest.

Day 9: First primary as much as 24 mm. in total length (opened at quill tip 11.5 mm.); tenth primary as much as 16 mm. long (opened 7 mm.); sheaths of secondaries opened as much as 11 mm.; rectrices broken through their sheaths; sheaths of breast feathers opened four mm.; bend of wing yellow; white down still forming almost complete circle in outer and inner supraorbital tracts; head gray; throat whitish; some down clinging to tip of opening wing coverts; tarsus 12 to 15 mm.; lower mandible yellow; rictal bristles not extending beyond sides of mandible; gape possibly darker yellow than before; egg tooth barely visible; young stand up in nest and flap wings, preen, and shift positions; one young opened its beak and oriented it toward a hovering syrphid fly six inches away; young "yawn" or gape; they are quite active and stretch wings frequently.

Day 10: Tenth primary 19 mm. and first primary 28 mm. in total length; primaries emerged from sheaths for about half their length; longest secondary 27 mm.; secondaries open for about half their length; rectrices 8 to 11 mm. in total length, open up to 4 mm.; scattered down feathers on back, rump, and scapulars; remainder in supraorbital tracts; wing bars tan, maximum width of bar four mm.; legs pinkish (bluish laterally; yellowish posteriorly); toes pinkish; soles of feet flesh color; corner of gape yellow; inside of mouth dark, bright yellow; dorsum olive, with buffy feather edges; under tail coverts yellow; possibly a faint eye ring visible; maxilla shows yellow tip otherwise, dark pinkish blue; lower mandible flesh color; rictal bristles emerged three mm. and even with edge of mandibles; egg tooth visible; tarsus 15 mm.; young quite active in nest, preen, flap wings, change positions, etc.

Day 11: Tenth primary with exposed feather 11 to 13 mm.; first primary 19 to 21 mm.; unsheathed portions of primaries range from 14 (10th) to 19.5 mm. (1st); rectrices 13

TABLE 6
WEIGHTS (IN GRAMS) OF NESTLING ACADIAN FLYCATCHERS

Nest No.	Age in Days													
	0	1	2	3	4	5	6	7	8	9	10	11	12	
5	1.5	2.1	2.7	4.2	4.5									
11	1.3	2.35	2.9	4.4	5.5									
	1.7	2.7	3.3	4.5										
8	1.5	2.5	3.2	4.0										
	1.5	2.5	3.3	4.4					10.8	12.4				
1									11.2	12.6				
9	1.9	2.4	3.5	4.9	6.6	7.9	9.0	10.2	10.8	11.3	12.0	11.6	12.2	
	2.0	2.5	3.6	5.0	6.6	8.2	9.4	10.1	11.2	11.2	12.5	11.7	12.5	
15	2.0*	1.9	2.7	3.8	5.5	6.8	8.4	9.2	10.6	11.1	12.4	12.4	12.4	
		1.6	2.3	3.4	4.0	5.5	6.6	8.9	10.0	10.0	12.4	—	—	12.7
16	1.7	2.4	3.6	4.8	5.9	7.3	8.2	9.5	10.6	11.0	12.5	12.2	12.2	
	1.4	2.7	4.5	5.4	6.2	7.3	8.7	9.6	10.9	12.0	11.8	11.7	12.4	12.1
21	1.8	2.2	4.0	5.0	5.8	7.0	8.7	9.4	10.6	12.4	12.4	12.4	12.0	
		2.6	3.8	4.7	6.4	7.7	9.2	10.1	10.5	12.2	12.3	12.0	12.0	
20		3.3	3.8	—	6.2	7.5	9.2	10.2	11.4	12.5	12.3	12.3	12.3	
		2.7	2.7	—	5.2	6.5	7.5	9.0	10.2	11.1	12.3	12.3	12.3	
17		2.5	—	5.3	6.7	7.8	7.9	9.5	11.1	12.0	12.3	12.3	12.3	
		2.4	—	5.2	6.4	8.2	8.3	9.5	11.5	12.4	12.4	12.4	12.4	
24		1.7	—	4.2	5.3	7.0	7.8	9.1	10.9	12.2	12.0	12.0	12.0	
	1.7	2.6	3.7	4.8	6.1	7.9	9.7	10.5	11.1	12.2	12.1	11.7	11.7	
24	1.8	3.0	4.0	4.6	6.0	7.7	9.1	9.5	10.6	11.7	12.2	11.3	11.3	
	1.8	3.0	3.5	5.4	6.4	8.3	9.4	10.0	11.4	12.5	12.2	—	—	
Avg.														
	1.7	2.4	3.3	4.5	5.7	7.3	8.4	9.6	10.9	11.9	12.2	11.9	12.3	

*Weight of piped egg; not in average.

to 16 mm. long; gape yellow; legs dark flesh (bluish anteriorly); trace of egg tooth visible; young can fly short distance; when mirror on pole was raised over them, two young left nest (24 feet high) and glided to ground 20 feet from point under nest; young call from nest, giving *seet* or *psheet* weakly; wag tail; one young, as held in hand, snapped at fly near its head; one picked insect off nest rim and ate it; young "squeal" when handled; two jumped from nest when touched, but remained in nest when replaced; one pecked my finger when I grasped it to remove it from the nest.

Day 12: Iris brown; tenth primary unsheathed 8 mm.; first unsheathed 23 mm.; rectrices emerged five mm. from sheaths; natal down persists in supraorbital tracts, may be few scattered down feathers on back; wing bars four mm. wide; upper mandible dark, lower pinkish; tomia yellowish; corner of gape flesh color; rictal bristles barely extend beyond upper mandible; egg tooth visible; tarsi and feet pinkish flesh; young stand and flap wings rapidly, almost flying; eject fecal sacs over nest rim; now spend practically all their time preening, flapping, stretching their wings, and moving about in nest; two young in one nest opened their beaks and stretched their necks toward the female when she perched five feet away; young get up on nest rim.

Day 13: White down still in supraorbital tracts; young have visible "crest"; they climb incessantly on nest rim, back into nest; one flapped its wings so vigorously it almost flew from the nest; some young fledged on Day 13.

Day 14: Leave nest not later than Day 14.

TABLE 7
RATE OF GROWTH

Day after Hatching	Number in Sample	Average Daily Weight Gain In Grams	Percentage Gain
1	13	1.7 to 2.6 = 0.9	52
2	16	2.4 to 3.4 = 1.0	42
3	19	3.4 to 4.4 = 1.0	29
4	19	4.5 to 5.7 = 1.2	27
5	19	5.8 to 7.3 = 1.5	26
6	19	7.3 to 8.4 = 1.1	15
7	16	8.6 to 9.6 = 1.0	12
8	16	9.6 to 10.8 = 1.2	13
9	17	10.9 to 11.9 = 1.0	9
10	15	11.9 to 12.2 = 0.3	3
11	9	12.2 to 11.9 = -0.3	-2
12	1	12.2 to 12.1 = -0.1	-1

NESTLING PERIOD—Three broods left the nest on Day 13, two broods on Day 14, and one at approximately Day 13 (exact period in nest unknown). Young frightened from the nest on Day 11 survived, but probably were forced to fledge prematurely.

Walkinshaw (1961:266) found the nestling period of eight nests in Michigan to be 12 (one nest), 13 (two nests), and 14 (five nests) days. Newman (1955) observed that one of a brood of three probably left the nest on Day 13; the remainder departed on Day 14 (though they were frightened from the nest by the observer). At another nest (Newman, 1958:140), three young "exploded" from the nest on Day 13 when the observer pulled the nest limb down to examine the nest.

NESTLING WEIGHTS—Nestlings were weighed, when possible, at the same time each day. Weights were obtained from 11 nests (Table 6).

TABLE 8
CORRELATION OF FEEDING AND FECES DISPOSITION, BY
NESTLING AGES AND SEXES OF ADULTS, 1955, 1956, 1957

Nesting Age	Number of Times Fed			Number of Times Feces Removed ¹			Total Observed Minutes
	Male	Female	Unsexed	Male	Female	Unsexed	
Day 0							
Hatching	3	40		2	(2)		898
Day 1	7	15		1	(1)		382
Day 2	61	31	2	12	(12)		914
Day 3	45	29	2	10	(9)		558
Day 4	38	93		20	(8)		1,088
Day 5	28	27	1	8	(2)		350
Day 6	38	27		8	(3)		297
Day 7	18	40	2	5	(0)		463
Day 8	18	19		3			265
Day 9	17	23	36	4	2		301
Day 10	35	44	50	5	3	8	572
Day 11	8	8	3	3			150
Day 12	22	30	21	3	4		300
Day 13	53	49	41	6	3	2	360
Day 14	16	14	14	1			85

¹Total observation time, 116 hours, 23 minutes.

Figures in parentheses indicate number of times feces eaten.

Hatching day is designated as Day 0. From my rather small samples, I have also summarized the rate of daily growth and average weight gains (Table 7).

FEEDING OF YOUNG

Feeding data based on 116.5 hours of observations have been tabulated for each day of nestling life to show how adults shared this duty (Table 8). Numerous feeding trips to the nest were made by unsexed adults; thus these data cannot be analyzed completely. It appears that on hatching day and Day 1, females do most of the feeding, but in general the sexes share feeding duties about equally. More information is needed.

Fecal matter was removed by both parents, in conjunction with feeding. Males carried away fecal matter on 21 per cent of their feeding visits and females carried away fecal matter on 16 per cent of their feeding visits (Table 8). On hatching day and Day 1, all feces were eaten. One (of 20) fecal sac was carried away on Day 2, the number increasing through Day 7, after which no more fecal material was eaten by adults. Fecal sacs were dropped to the ground while the birds were in flight but more often were taken to a perch and then dropped. Accumulations of feces under such perches indicated that certain perches were utilized repeatedly. Birds frequently wiped their beaks, once on each side, on a branch after dropping fecal sacs.

The drive to remove fecal material seemed strong in adults. On several occasions when fecal sacs were passed by the young and dropped toward the ground, the adults would dive after them, frequently catch them in midair, and carry them away. This behavior was most noticeable when the young were quite large, and at the stage at which they often ejected fecal sacs over the nest rim. At another nest where adults performed in this fashion, the nest contained a large hole in one side, and one young frequently passed feces that fell through this hole. One adult fed a nestling, stood waiting for a fecal sac which did not appear, then picked at some dried, two- or three-day-old feces adhering to the nest rim.

On three successive days (young two to four days old), the male at one nest brought food to the nest and passed it to the female. The exchange of food usually took place without the female's leaving the nest. After taking the food, the female always attempted to feed the young. If they refused to gape, she ate the food. Thus, it did not appear that the male brought food for the female. Occasionally, as the male came and perched on the rim, the female left the nest; she then came directly back and took the food from the male (if he had not fed the young in the meantime) and fed the nestlings.

Both sexes often gave soft chattering or twittering calls as they stood

at the nest with food; these calls evidently functioned to cause gaping of the young. Once a female gave this call several seconds before swallowing food she had brought to the nest. During the last few days of nestling life, feeding was accomplished more rapidly than it was earlier for the young often gaped when they heard or saw adults approaching the nest with food.

One female alternately fed her nestlings and worked on her second nest.

Longstreet (1937) made observations in Florida on the feeding rate for one nest containing two young. In eight hours of observation during the last three days of nestling life, the adults brought food at the average rate of 13.5 times per hour. Feces were removed by the parents nine times in 55 trips to the nest. Newman (1958:137) noted that the male of the pair he watched feeding three young in the nest actually fed the nestlings only 18 times in 36 trips to the nest. On 17 trips, the male perched briefly at the nest and flew, but "in one instance he fed his mate." This male was not observed to feed the young until their third day of nest life.

FOODS EATEN

ADULTS—Adult Acadian Flycatchers were seen to eat beetles, moths, many types of larvae, damsel flies, dragonflies, deer flies, harvestmen, mosquitos, horseflies, spiders, and crane flies. A crane fly captured, but dropped, by a male Acadian was identified as *Tipula abdominalis* by Dr. Alan Stone. More dragonflies and damsel flies were eaten by adults (and brought to nestlings) on cool days than on warm or hot days. Many insects were taken as the birds hovered and picked their food from vertical tree trunks, the underside of a leaf, or clusters of dead leaves. Once, prey was taken by a bird hovering a foot above a clump of grass. On cool days, the birds frequently picked insects from leaves and branches without flycatching.

I observed a male capture a relatively large, gray moth, which he hammered against a perch until a wing fell; he then swallowed the moth, wiped each side of his beak on the perch, sang once, and wiped his beak again. A female captured a large larva, beat it on a branch and "worked" it for a full half minute, then ate it. Numerous times I watched birds of one sex or the other engage in similar behavior.

One adult captured a large dragonfly, attempted to swallow it but dropped it, caught it in midair as it fell, returned to the perch, dropped it, again caught it in the air, and perched again to eat it. An adult male Acadian Flycatcher collected at Brazil, Indiana, had a very large, complete (with head and wings) dragonfly in his throat; this insect was three inches long.

YOUNG—Nestlings were fed the same kinds of prey items that adults ate, although in the early stages of nestling life no dragonflies or other large insects were brought to the nest. In fact, the first few days nestlings were often fed unrecognizable items. Food to be fed nestlings was often rolled about in the beak, probably by manipulating the prey with the tongue, until the wings and legs were crumpled and reduced in bulk, as mentioned by Newman (1958:138). Later, whole dragonflies were fed the young; in some cases, the wings of the prey projected out of the nestling's beak briefly after swallowing. Two or more attempts were often necessary before the young could gulp down larger food items.

Beal (1912:58) has reported the most exhaustive analysis of foods eaten by the Acadian Flycatcher.

BROODING

Only the female brooded the young. Time spent in daytime brooding decreased from hatching day until the ninth day of nestling life, after which brooding was not observed. Attentive periods of brooding females are summarized for six nests (Table 9). Young were brooded in one nest

TABLE 9
ATTENTIVENESS OF BROODING FEMALE ACADIAN FLYCATCHERS
(6 NESTS) 1955, 1956, 1957

Nestling Age	Time of day and minutes observed on nest				Average Per Cent
	0431 - 0830	0831 - 1230	1231 - 1630	1631 - 2030	
Hatching					
Day (0)		89 of 120	169 of 226	31 of 51	73
Day 1	158 of 215	72 of 120			69
Day 2	127 of 166	115 of 146	136 of 241	70 of 95	69
Day 3	34 of 61	293 of 429	31 of 88		62
Day 4	46 of 50	217 of 365	104 of 186	102 of 116	65
Day 5	38 of 60		83 of 132	11 of 30	59
Day 6	5 of 18	85 of 167			49
Day 7	69 of 112	0 of 44	67 of 193		39
Day 8	23 of 60	14 of 60		8 of 60	31
Day 9	47 of 136	0 of 71			23
Day 10		0 of 69			0
Day 11			0 of 60		0
Day 12	0 of 40	0 of 80			0
Day 13		0 of 240		0 of 60	0
Day 14	0 of 40	0 of 50			0

Total observation time, 75 hours, 57 minutes.

on the ninth day of nest life; in another nest young were brooded their ninth and tenth nights. A nestling cowbird was also brooded on its ninth night in the nest.

One female stood in the nest with her wings partly outstretched to shade her large young from the sun. Russell and Woodbury (1941:34)

reported similar behavior in *Empidonax wrightii*, and Nice and Collias (1961:147) observed "shading" of nestlings by a female *E. minimus*.

Newman (1958:135) reported that a brooding female left the nest seven times for periods of 30 seconds to 13 minutes, during 167 minutes of observation.

NEST DEFENSE

Territorial male Acadians chased several species of birds, as mentioned earlier. Their attacks on cowbirds were considered to be associated with nest protection rather than territorial defense. One male pursued a female cowbird so vigorously that she alighted on the ground; it appeared that the flycatcher struck her as she lit. The attack occurred during Acadian nest construction and the cowbird was pursued when she was 30 feet from the nest. Such attacks were accompanied by sharp calls and much beak snapping. Male Acadians also dived on Eastern Chipmunks on the ground beneath flycatcher nests; males were not heard to call during such chases, but they snapped their beaks rapidly. Female Acadians likewise dived on chipmunks. In all cases, chipmunks were attacked when flycatcher nests held young or (once) four days after young had left the nest. Most conflicts ensued when chipmunks foraged on the ground 4 to 12 feet below flycatcher nests, but a female Acadian dived on one chipmunk sitting 3 feet above ground in a shrub 15 feet from the flycatcher's nest. One female paid no attention to chipmunks (except to watch them silently) beneath her nest during incubation, but after her eggs hatched she dived on these mammals when they foraged in the same place.

Females evidently played the major role in nest protection. One incubating bird left her nest when a Fox Squirrel (*Sciurus niger*) ran along the nest branch to within four feet of the nest; the flycatcher flew about the squirrel's head and successfully caused the latter to retrace its route. Another female dived on a gray squirrel (*Sciurus carolinensis*) that approached within 25 feet of a young Acadian on the ground; the bird had fledged prematurely and could not fly. The squirrel departed.

Female Acadians chased other species of birds from the vicinity of Acadian nests. One flycatcher attacked a White-breasted Nuthatch (*Sitta carolinensis*) that came down the branch on which the flycatcher's nest, containing large young, was located. The nuthatch was chased when it was within seven inches of the nest. An Ovenbird that perched 18 inches from a flycatcher nest containing nine-day-old young was driven away. An unsexed Acadian was chased when it perched two feet from a nest (not its own) containing three-day-old young. One female Acadian attacked a female Cerulean Warbler that lit two feet from an Acadian nest under construction.

Females also joined males in scolding Blue Jays, cowbirds, Common Crows, owls, and hawks within the territory. When I handled young Acadians and they called, both parents dived over my head with snapping beaks and gave sharp *sweet* notes. On occasion, as I walked up to examine a nest while the female was on it, she would fly off directly over my head, snapping her beak. The females that chased the nuthatch, Cerulean Warbler, and Fox Squirrel gave no calls during the chases, but snapped their beaks. The female that drove the "strange" Acadian from her nest gave a short, sharp call and snapped her beak. A *wseet* note was given by one female as she dived on a chipmunk; she also snapped her beak.

Females on nests gave no response to (1) a male Scarlet Tanager (*Piranga olivacea*) perched five to six feet below a nest, (2) a Least Flycatcher 15-20 feet above a nest, (3) a Yellow-throated Vireo (*Vireo flavifrons*) near the nest, or (4) three White-breasted Nuthatches eight feet from a nest. Newman (1958:131) saw an unsexed Acadian Flycatcher fly at a female cowbird perched in a tree overlooking the attacker's nest.

Several authors have stated that female Acadian Flycatchers are reluctant to leave the nest when an observer approaches. Langille (1884) said females could sometimes be caught by hand. Wood (1905:423) pulled a nest limb down and grasped the incubating bird's tail. Sutton (1927-1928:154) touched a female before she left the nest. Porter (1907:99) mentioned a female that struck the observer's hands when defending her nest and eggs.

I witnessed no injury-feigning in *virescens*, as observed in *wrightii* (Russell and Woodbury, 1941:35). Johnson (1963:207) observed distraction displays in *E. wrightii* and *E. oberholseri*. This behavior has not been reported, to my knowledge, for other species of *Empidonax*.

NEST-LEAVING

Young left the nest by flying directly from it or by hopping out of the nest to a branch, then flying. Nestlings were observed standing in the nest and flapping their wings on the ninth day of nest life; this activity increased up to the 13th day, when some birds departed. Others left the nest on the 14th day. A single young, from a brood of unknown age, left the nest two days before two nest mates; it was unable to fly, but was fed on the ground and reached flying stage successfully. Two young left another nest when I disturbed them on their 11th day; both reached flight stage.

I observed two young for 80 minutes (0750 to 0908) immediately prior to their leaving the nest (seven feet high) and shortly thereafter. Before they left, these birds repeatedly stood and flapped their wings, hopped

onto the nest rim and then back to the nest, and preened vigorously. On two occasions one of them hopped from the nest to a branch a few inches away, then returned to the nest. At 0908, one perched a foot from the nest, called, then moved farther up the branch away from the nest. At 0911 it flew 30 inches horizontally to another branch in the nest tree; two minutes later it flew 12 feet to another tree. At 0914 the second young flew from the nest and alighted in the nest tree, sat one minute, flew two feet to another limb, called *sect*, flew four feet higher and then two feet higher, still in the nest tree. It made two more short flights, each time taking higher perches than before. At 0920 both young were perched side by side, 18 feet above the ground, in a tree 10 feet from the nest tree.

Sutton (*in litt.*) watched a young Acadian fly directly from a nest for 30 yards, and a brood observed by Newman (1958:140) "exploded" and flew from the nest upon the approach of the observer. Berger (*in litt.*) caused one of the two nestlings to fly about 40 feet when he touched the nest limb.

Berger (1956:137) saw a 13-day-old *E. traillii* fly 50 feet from the nest and alight 20 feet up in another tree. D. E. Davis (1959:83) noted that *E. minimus* fledglings were capable of flying "a yard or more," but Nice and Collias (1961:149) observed that young leaving the nest "flew out of sight." L. Williams (1942:239) and J. Davis, Fisler, and B. S. Davis (1963:372) mentioned that *E. difficilis* young flew from the nest.

FLEDGLING BEHAVIOR

Two or three fledglings of a brood were often observed sitting side by side at various heights up to 60 feet. There appeared to be a tendency for fledglings to keep at considerable heights. Young frequently flew about following the adults or siblings. At the second nest of one female, the two fledged young from her first nest persistently followed her about, even coming to the nest and getting into it with her. They also perched on her back, forced her off the nest (after which they would sometimes get onto the nest briefly) and otherwise interfered until at least the 6th day of incubation. These fledglings were evidently only begging for food and the female frequently carried food when she came to the nest to resume incubation; she would feed the young when they came to her. At another nest, one observation indicated the fledgling young from the first nest were driven from the site of the second nest by the adults. Russell and Woodbury (1941:30) mentioned that a female *wrightii* was being harassed by young begging food while she was working on a nest.

Young were seen flycatching their eighth day out of the nest, but were fed by the adults for at least 14 days after fledging. Fledglings are known to have been fed by the male for 12 days and by the female for 14 days

after leaving the nest, but these periods could probably be extended by additional observations. A fledgling cowbird was fed for at least 17 days after it left an Acadian's nest.

Fledglings were observed within the territories of the nests they left for 14, 14, 20, 20, and 21 days, respectively. Newman (1958:141) watched three fledglings that remained within a radius of 350 feet of their nest for 18 days. These birds perched side by side, and on the 10th day out of the nest one captured a caterpillar.

Berger (1956:137) noted that the fledglings of *traillii* also perched side by side, and two captive young became independent of hand feeding at 26 and 27 days of age. Fledglings of *minimus* fed themselves when 16 days out of the nest, though the adults fed them for an additional five days (D. E. Davis, 1959:82). Davis also found that *minimus* broods remained in their respective territories 1, 1, 2, 2, 12 and 13 days after fledging. *E. hammondi* fledglings slept together on a perch and became independent about 20 days after leaving their nest (D. E. Davis, 1954:168). Huddling by fledged *E. difficilis* was reported by J. Davis, Fisler, and B. S. Davis (1963:376).

RENESTING

Acadian Flycatchers renested after fledging young from an earlier nest or after nest destruction. In all cases, a new nest was built for each nesting attempt. All banded pairs that renested retained their former mates.

In 1955, four pairs of Acadian Flycatchers made one, two, two, and two renesting attempts, respectively. One pair fledged a cowbird from a nest; another pair fledged three flycatchers. Renesting was evidently not attempted in 1956; four of the five pairs under observation successfully fledged young from their first nests, and I found no second nest for the remaining pair. Four pairs attempted two, two, three, and four renestings, respectively, in 1957; only one renesting attempt was successful. Of 15 nests constructed or partly constructed in 1957, one fledged young.

Over the three-year period, first eggs were laid in 11 first nests of the season as follows; 30 May (two); 1 June (two); 2 June (two); 4 June (one); 5 June (three); 7 June (one). Renesting occurred at various times later in these seasons, but the latest date I have for the first egg deposited in a nesting attempt (in this case, the third) is 26 July. Two second nestings were successful in fledging young (in one, only a cowbird fledged) and two third nestings fledged young; fourth and fifth nestings failed. Accurate records for the period between nest destruction or desertion and the deposition of the first egg in the next clutch are few. For eight instances, this period was 5 to 8, 6 to 8, 7 to 8, 7 to 10, 7 to 10, 8, 8, and 8 days; it thus appears that about eight days are required.

After the loss of 10 first nests, 8 renestings were attempted. Following

the loss of 10 second nests, 6 renestings were begun. Two pairs lost third nests and built again, one of these pairs subsequently making a fifth nesting attempt in one season; eggs were not laid in two (the second and third) of these five nests.

All nests built by an individual female in a season were within her mate's territory. Distances between unsuccessful first nests and successive nests ranged from 74.5 feet (23 meters) to 304 feet (93.5 meters) and averaged 170 feet (52.3 meters).

NUMBER OF BROODS

There were four attempts made to rear second broods; only one was successful. Lengths of time between the fledging of young and the deposition of the first egg in the next nest were 4 to 5, 7, 9, and 10 days. First broods departed these nests on 27 June, 1 or 2 July, 3 July, and 5 July, respectively. Distances between successful first nests and successive nests ranged from 58 ft. 8 in. (18.1 meters) to 133 ft. 8 in. (41.1 meters) and averaged 81 ft. 5 in. (24 meters).

The length of time required for successfully fledging two broods was approximately 76 days (about 28 May to 11 August), but I do not know exactly on what date the female arrived. She is known to have been on the study area from 28 May to 19 August. Russell and Woodbury (1941:29) estimated that *E. wrightii* required "7 weeks to raise a brood." Walkinshaw (1961:266) studied banded Acadian Flycatchers and found "several instances of . . . raising two broods during one season."

D. E. Davis (1959:84) found no evidence of second brood attempts in *minimus*. Bent (1942:216), however, cited an instance where a successful nest was removed by the observer, who discovered that later a new nest was constructed in the same site. On my study area, I found *minimus* broods present in the same nest on 13 June and 21 July 1955. Detailed notes on this nest are not available. The birds using it were not banded and I do not know the fate of the first brood. Bent reported that 10 days after a brood of *E. hammondi* fledged, another clutch of eggs was found in the same nest, but D. E. Davis (1954:168) found no indication that second broods were attempted in this species. *E. wrightii* may rear a second brood (Russell and Woodbury, 1941:29), as may *E. difficilis* (L. Williams, 1942:240; J. Davis, Fisler, and B. S. Davis, 1963:376).

DEPARTURE FROM THE NESTING GROUNDS

Young of the year were last observed on 19 August 1956, when two fledglings that left the nest 11 August were present. I was unable to make daily checks of the areas in late August and early September, so cannot

say with certainty when Acadian Flycatchers left. My latest date was 4 September, when I heard (but did not see) one bird calling *peet*. One male was singing on 15 August 1957.

A color-banded female that nested in one territory was seen foraging in another territory on 1 August; these areas were 705 yards (647.8 meters) apart. This bird was probably wandering about after nesting and prior to migration.

MISCELLANEOUS

ECTOPARASITES—No parasites were recovered from Acadian Flycatchers on the study area. A nestling Acadian collected from a nest 31 July 1955 in Washtenaw County, Michigan, was infested with the mite *Ornithonyssus sylviarum*. Peters (1936:19) recorded a louse (*Philopterus subflavescens*) from an Acadian Flycatcher, but Hopkins and Clay (1952) consider the name a *nomen nudum*.

BATHING—On 15 May 1956, a few minutes after a light drizzle had begun, I watched an adult bathing along the edge of an open pool of water. The bird dived four times to the water from a perch 10 feet above the water, each time striking the surface quite forcibly with its breast. After the fourth dive, the bird perched about 12 feet high over the water's edge and went through an elaborate wing shaking, tail fanning, and preening maneuver. Once it raised the wings and "fanned" them rapidly for two to three seconds, perhaps to shake off the water; the breast became quite wet during this period. I witnessed similar bathing technique in a singing bird in Lawrence County, Indiana, 22 August 1954; on that occasion the bird dived from a perch six feet above the water.

On three occasions (at 0711, 0808, and 0931) when females returned to the nest to resume incubation or brooding, they had water on the throat, breast or tail. These birds were nesting in territories where no open water was available and I suspect they bathed in dew clinging to leaves.

Two 17-day-old fledglings initiated bathing behavior the moment a light drizzle began; they preened and flitted their wings.

SUN BATHING AND PREENING—Adults were observed preening or sun bathing mostly in late July and early August, but it should be noted that I spent more time out of the blind during this period and had a better opportunity to see such behavior. Preening was accompanied by alternate wing stretching, wing shaking, alternate leg stretching, tail fluttering, and neck scratching (once). Birds frequently appeared to obtain oil from the uropygial gland and dressed their plumage. All July and August observations of sun bathing (11) were of adults perched in full sunlight, usually on dead branches from 35 to 70 feet above the ground. I assumed these birds were sun bathing, though some preening and singing took place also.

Birds would sit motionless for short periods with wings drooping and tail spread. The wingtips were held beneath the tail at these times. A male held one wing straight up and motionless for several seconds.

MOLT—Mengel (1952:273) has studied the molts and plumages of Acadian Flycatchers and called attention to the fact that adults undergo a postnuptial molt while still on their breeding grounds. Although no special effort was made to determine when molt was first observable, I first noted molting in banded adults on 9 August 1955, 3 August 1956, and 31 July 1957. The head in all cases revealed the first indication of molting. On the earliest date, a female showed molt on her forehead. At this time, the entire plumage was usually frayed, dull, and ragged; several rectrices were sometimes missing and those remaining were quite brownish in color and worn. A male watched on 28 August had no rectrices.

HOVERING—The ease with which Acadian Flycatchers hover and the use they make of this type of flight indicates that hovering is important behavior in their lives. They hover to feed, gather nesting material, feed young, and remove fecal sacs. Years ago, Dawson (1903) published a photograph of an Acadian hovering and feeding young in the nest. A. B. Williams (1949:255) mentioned observing the species fly backwards; in feeding from vertical tree trunks, Acadians frequently fly backwards with no difficulty.

REACTION TO MOUNTED SPECIMEN—In 1955, I experimented briefly with a mounted male Acadian Flycatcher skin, which I placed in the territories of two males. The decoy was mounted in the position of a singing male. One male had arrived 15 May. On 19 and 21 May, the decoy was placed on perches known to be visited by him; he gave no reaction to it. I flushed the same male from a singing perch on 23 May and placed the decoy on this perch. The male sang in the vicinity, then 28 minutes later flew to the decoy, hovered over it, mounted it, and remained there about 15 seconds. He hopped off the decoy and perched 10 inches from it, almost immediately got back onto the decoy, seemed to try to copulate with it, then perched motionless on it for 20 seconds. He flew up into a tree 20 feet away and perched 30 feet above the ground, paused a short time, then continued singing. A minute later, he again mounted the decoy and stayed on it 50 seconds (timed), holding to the back of the decoy's head with his beak, fluttering his wings, and uttering a note like *pe peet*; this was a short, soft call. He changed his position on the decoy several times, perched on its head twice, and most of the time appeared to be in a copulatory (?) position.

Another male gave no reaction to the same decoy when it was placed in his territory on two different days.

BEHAVIOR OF ADULTS AT EMPTY NESTS—I frightened two young from

one nest, weighed and banded them, and got into the blind by 0913. At 0914 an adult went to the empty nest with food, stood on the nest rim a few seconds peering in, then flew. By 0919 an adult had made four more trips to the nest, without locating the young, perched 19 feet below the nest in a shrub.

One of two young left another nest at 0908. The male fed the remaining nestling at 0910, then this young left the nest at 0914. An adult (I think the male) went to the nest at 0918, looked in and placed its beak in the nest, sang, and flew up toward the fledglings nearby.

At a third nest, empty when I arrived at 0714, I watched the female bring food at 0725 and stand on the nest rim giving the twittering note. The male lit near the nest, then both adults flew. Evidently the large young had just been removed from the nest and several Blue Jays were nearby when I arrived.

REACTION TO IMITATIONS OF BARRED OWL NOTES—Adult Acadian Flycatchers responded each time I imitated the call of a Barred Owl (*Strix varia*), a species I did not observe on the study area. I attempted to attract a male Acadian singing his evening song 50 feet overhead by hissing but elicited no response; the whistled call of a Screech Owl likewise produced no reaction; but when I hooted an imitation of the Barred Owl's call, this male immediately stopped singing, slanted down to a new perch 50 feet away and 20 feet lower, sat here close to the trunk of a small tree, silent and motionless, for a full minute, then resumed singing.

On four occasions, as I gave the Barred Owl call from a blind from which females on the nest were being watched, the females immediately raised their heads, looked about for a full minute, then relaxed. At another nest where the female was brooding and the male singing nearby, the male began scolding with sharp *speet* notes immediately after I gave the call; the female looked about, but did not call.

OTHER FEMALE RESPONSES—Incubating and brooding females were almost constantly alert and watched other animals about the nest. When a Cooper's Hawk was near the nest, one female watched it intently but made no sound. A female raised her head until her beak pointed straight up and watched a calling Common Crow as it flew overhead; she remained silent, as did another female that watched a crow fly past. A brooding female seemed to lower her body in the nest and stayed motionless when a Blue Jay called nearby. As a Blue Jay came to within 10 to 12 feet of another nest, the female flycatcher left it and soon began to call. Later, this same female left the nest when her mate began scolding; both then appeared to be scolding a Blue Jay perched 35 yards from the nest. When a White-tailed Deer walked within six feet of a nest where the female was incubating, she

called *speet* several times. Five days later, a deer walked directly under this nest and the incubating female stretched out her neck and peered over the nest rim at it, but she did not call. A few minutes later the deer walked back beneath the nest and the flycatcher paid no attention. Shortly after this, an adult buck, adult doe, and a fawn were feeding 15 feet from the nest; the fawn, in playing, suddenly ran beneath the nest. The flycatcher was startled and departed, she remained nearby, calling for eight minutes, then got back on the nest when the deer moved away.

A falling leaf almost struck a female on the nest; she jumped up on the nest rim, perched momentarily, and quickly got back into the nest.

HOMING—Three females, of six adult females and an adult male banded in 1955, returned in both 1956 and 1957. Each of the three seasons they nested in their same kettle holes. Two females retained their same mates for at least two consecutive breeding seasons.

All four adult males banded in 1956 returned in 1957 and at least one of these was observed in 1958. I was on the study area only two days early in the 1958 season, so more banded males might have returned. In each case, males from the previous season returned to their former territories. One failed to secure a mate and left the area; another was apparently replaced by a polygynous male early in the breeding season.

Of five fledglings banded in 1955 and 15 banded in 1956, none was detected in subsequent years on the study area.

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