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MIGRATIONS OF THE YELLOW-BELLIED FLYCATCHER IN SOUTHERN ONTARIO

By David J. T. Hussell

Studies of the migration and molt of the Least Flycatcher (*Empidonax minimus*) have demonstrated several peculiar features: (1) in the fall adults migrate as much as a month before the young-of-the-year (Hussell et al. 1967, Ely 1970, Hussell 1980, 1981); (2) adults molt the flight feathers in the winter quarters following the fall migration (Dwight 1900, Johnson 1963, Hussell 1980); (3) adults spend an average of no more than about 64 days on the breeding grounds (Hussell 1981). The Yellow-bellied Flycatcher (*Empidonax flaviventris*) also shows some of these features in its migration and molt. In adults the postnuptial molt of the flight feathers also occurs in the wintering area (Dwight 1900, Johnson 1963) and adults apparently precede the young in the fall migration (Hussell 1982).

In 1966–1968 an intensive study of the spring and fall migrations of *Empidonax* flycatchers was undertaken at the Long Point Bird Observatory to document the timing of migration and molt in four species (Hussell 1981). Here I report results for the Yellow-bellied Flycatcher from the 1966–1968 study together with a summary of other banding data from Long Point for the years 1966–1980. Museum specimens taken in southern Ontario and Michigan are used to document sexual differences in the timing of spring migration.

METHODS

Field methods are briefly described here; further details may be found in Hussell (1981). Flycatcher migration was studied at the Long Point Bird Observatory's field station at the eastern end of Long Point, on the north shore of Lake Erie during April–October, 1966–1968. Yellow-bellied Flycatchers do not breed on Long Point or the adjacent mainland (Godfrey 1966), so we can safely assume that all individuals found on the point are migrants. Each day during the migration seasons (15 April–15 June and 1 July–31 October) migrants were captured in Heligoland traps and/or mist nets. In addition the numbers of each species (and "unidentified" *Empidonax*) present in a defined area (covering approximately the easternmost 1 km of land on Long Point) were estimated. Captured birds were banded, wing chord measured to the nearest 0.1 mm, the skull was examined for pneumatization, and the bird was weighed. A sample of birds was examined for body molt each season and a composite body molt score with a possible range of 0 (none)–3 (heavy) was determined. Birds hatched in the current calender year are called "immatures" while all older birds are "adults." Following banding terminology, "second year" birds are adults in their second calendar year. As in the Least Flycatcher, adult Yellow-bellied Flycatchers molt the flight feathers in the winter quarters (Dwight 1900), although the

details of the timing of molt differ between the species (Johnson 1963). After 1 July, birds with worn flight feathers, narrow whitish or whitish-yellow wing bars, and completely or almost completely pneumatized skulls were classified as adults; those with little or no wear on the flight feathers, broad buffy-yellow wing bars, and substantially unpneumatized skulls were called immatures. Although the plumage characters for separating adults and immatures were often less clear-cut in the Yellow-bellied than in the Least Flycatcher, most birds readily fell into one of the two age categories. Estimated totals of Yellow-bellied Flycatchers present in the sample area each day in the spring and of adult and immature Yellow-bellied Flycatchers present each day in the fall were calculated by prorating the daily estimated totals of all identified and unidentified *Empidonax* in proportion to the numbers of each species and age class in the banded sample.

Numbers of Yellow-bellied Flycatchers banded in the years 1969–1980 at the same location as the 1966–1968 study (station No. 1) and at a second station (No. 2), 19 km west of station No. 1, in the years 1966–1980 are also presented. Because trapping and netting coverage during the migration seasons was incomplete at one or both stations in many years, the average number of Yellow-bellied Flycatchers (divided into age classes in fall) per day of coverage was calculated for each station for arbitrary 5-day periods.

Yellow-bellied Flycatcher specimens taken in spring south of latitude 46°N (approximately the southern limit of the breeding range) in Ontario and Michigan were examined in the collections of the Royal Ontario Museum and the University of Michigan Museum of Zoology. Specimens were identified and measured in the same way as for banded birds. Sex determinations were those of the collector.

RESULTS

Spring Migration

Numbers of Yellow-bellied Flycatchers at Long Point during the spring each year 1966–1968 are shown in Fig. 1a–c. The earliest date was 15 May, but few birds were recorded until after 24 May, and median dates for bird-days (estimated daily totals) in the 3 years 1966–1968 were 3 June, 8 June, and 1 June, respectively. By 10 June the migration was essentially complete in all years, but late individuals occurred on 14 and 15 June.

The seasonal pattern of migration for the 3 years combined is shown in Fig. 1d. Based on estimated daily totals, the spring migration averages 15 days later (median 2 June) than for the Least Flycatcher (Hussell 1981), but it is only slightly more compressed. Ninety percent of Yellow-bellied Flycatcher bird-days occurred in a 19-day period (22 May–9 June) compared with a 22-day period for Leasts. Yellow-bellied Flycatchers were much less abundant than Leasts. Bird-days recorded in the years 1966–1968 were 117.9, 46.3, and 91.2, respectively, which is 20% of the total for Least Flycatchers.

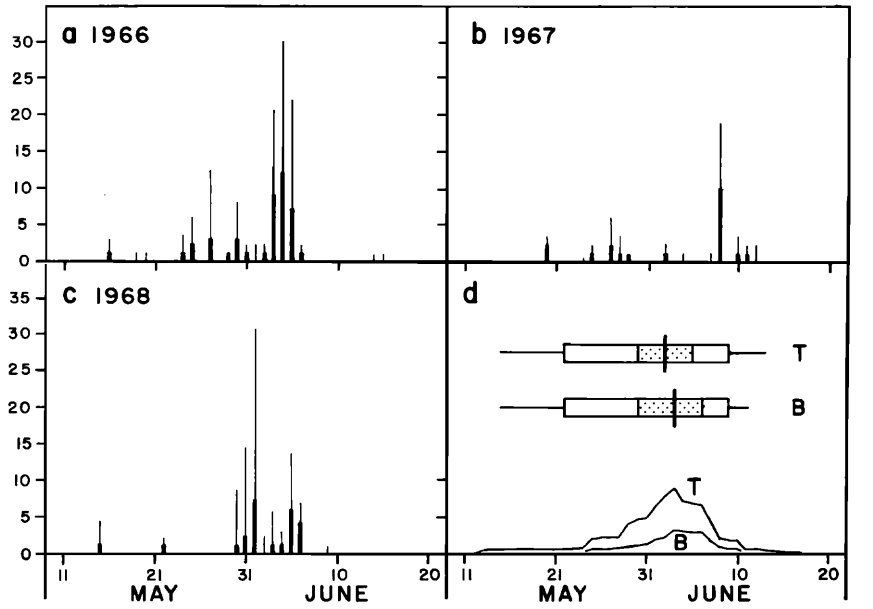

FIGURE 1. a–c. Spring migration of Yellow-bellied Flycatchers at Long Point, 1966–1968. Narrow and broad columns represent daily estimated totals and banded samples, respectively. d. Seasonal pattern of spring migration, 1966–1968. The continuous lines in the lower section of the figure are five-day moving averages of the daily estimated totals (T) and banded samples (B). The upper section shows median dates (vertical bars), middle 50% and 90% (stippled and open sections of horizontal bars), and middle 98% (horizontal lines) of the daily estimated totals (T) and banded samples (B).

Timing of migration, based on banding data alone in 1966–1968, is in general agreement with that from the daily estimated totals but the median is one day later on 3 June (Fig. 1d—"B"). Other banding data (Fig. 2) show a similar pattern with medians on 3 June and 28 May at stations Nos. 1 and 2, respectively. An exceptional late concentration of migrant Yellow-bellied Flycatchers occurred on 7 June 1980, when 16 were banded at station No. 1.

Evidence from Long Point data and museum specimens indicates that males tend to migrate earlier than females. Figure 3 shows change in the distribution of wing lengths at Long Point during spring migration together with comparable data from sexed specimens from southern Ontario and Michigan. Wing lengths of male specimens average longer than those of females with a wide overlap range: males 62–71 mm (but mostly 65–71 mm); females 62–69 mm. At Huntington (Long Island), New York in the fall, 14 immature males and 22 immature females had wing lengths of 65–69 mm and 60–66 mm, respectively (Phillips et al. 1966). The narrower ranges and smaller overlap in wing lengths be-

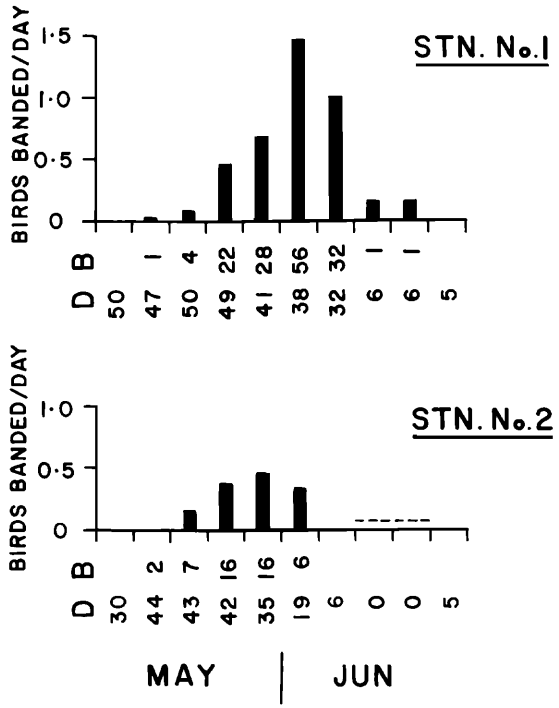

FIGURE 2. Average numbers of Yellow-bellied Flycatchers banded per day during spring migration at Long Point in successive 5-day periods from 7–11 May through 21–25 June. Upper: station No. 1, 1969–1980. Lower: station No. 2, 1966–1980. Broken horizontal line = no data. D = days of coverage, B = Yellow-bellied Flycatchers banded for each 5-day period.

tween sexes in the fall sample is probably due to inclusion of only immatures, whereas the spring sample presumably consists of a wider range of age classes.

Twenty-two percent of the male specimens were taken before 21 May, the date for the first female. Median dates for male and female specimens are 24 and 28 May, respectively. Males predominate in all of the specimen samples (55 males, 17 females), but only 2 specimens were taken after 2 June (Fig. 3). Seventy-three percent of specimens taken by 2 June had wing lengths of 65.5 mm or more. Birds with wing lengths of 65.5 mm or greater also predominate (71%) in the banded sample for the same period, but those with wing lengths of 64.4 mm or less form the overwhelming majority in the samples banded later. This provides supporting evidence that males migrate earlier than females in the spring.

The median date for all specimens is 26 May, whereas for bird-days and banded birds at station No. 1 on Long Point it was 2 and 3 June, respectively, in 1966–1968 (see above).

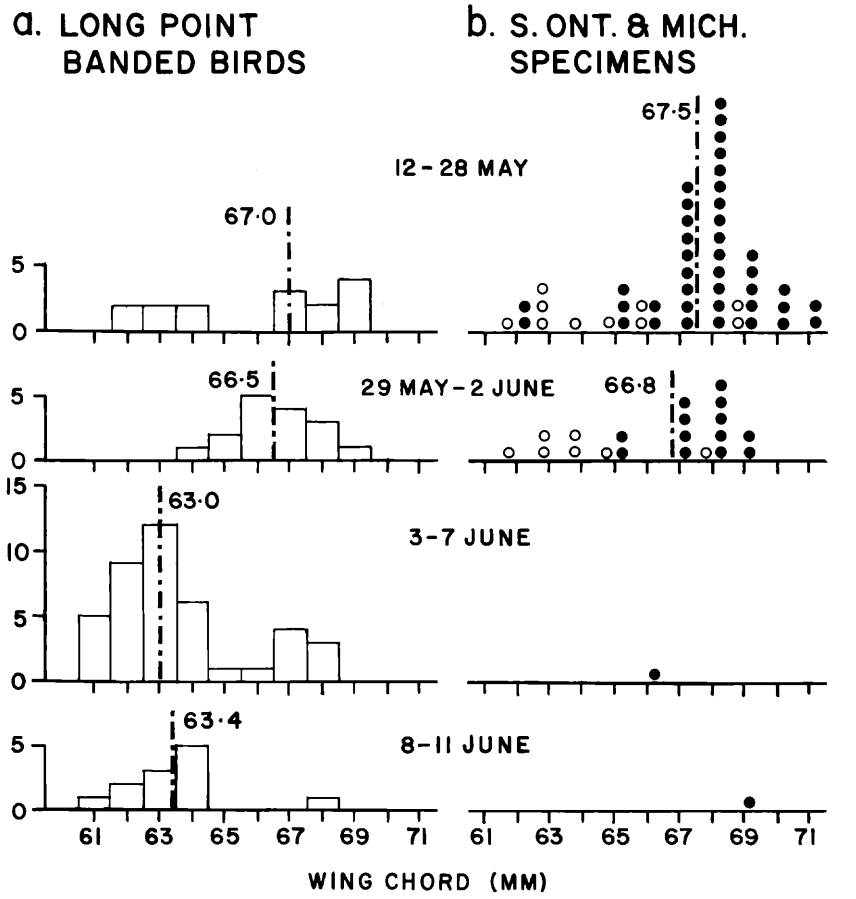

FIGURE 3. Distribution of wing lengths of banded birds and specimens in relation to date during spring migration. a. Long Point banded sample, 1966–1968. b. Southern Ontario and Michigan specimens; open circles = females, solid circles = males. Wing chords are grouped as 60.5–61.4 mm, 61.5–62.4 mm, etc. Vertical broken lines indicate median wing lengths.

The lack of late migrants among the specimens is mystifying. I speculate that it is due to collectors turning their attentions elsewhere in early June, resulting in biases towards early migrants and males. This is consistent with the greater skew in the sex ratio (3.2M:1F) in the Yellow-bellied Flycatcher, a late migrant, than in the Least Flycatcher (1.9M:1F), a relatively early migrant (Hussell 1981). I conclude, therefore, that the second half of the migration of the Yellow-bellied Flycatcher is essentially unrepresented among the specimens. Moreover, the 4-day difference between the median dates for male and female specimens and consideration of the wing length distributions in Fig. 3,

lead me to suggest that the median dates for males and females were about 1 and 5 June, respectively, at Long Point in 1966–1968.

As in the Least Flycatcher (Hussell 1981) and other *Empidonax* that have been examined in greater detail (Johnson 1965, 1973), second year (=first year sensu Johnson) Yellow-bellied Flycatchers probably migrate later than older adults. This is indicated by the presence of males with wing lengths longer than 69.4 mm and females with wing lengths longer than 68.4 mm only in the earliest sample (12–28 May). Long-winged birds (>68.4 mm) also occur predominantly in the 12–28 May banded sample.

Six of 69 birds examined (8.7%) had small unpneumatized areas in the skull. Their median wing length and date of occurrence were 62.2 mm and 6 June, respectively, compared with 64.0 mm and 4 June for 63 birds with completely pneumatized skulls. As in the Least Flycatcher (Hussell 1981), shorter wing lengths and later occurrence indicate that birds with incompletely pneumatized skulls are probably mainly in their second year.

Among 39 Yellow-bellied Flycatchers examined for molt between 20 May and 11 June (1967 and 1968), only 3 had growing feathers. Two had light molt on the abdomen and one had a single feather growing on the head (composite body molt scores of 0.1 in all cases).

Fall Migration

The fall migration of adult and immature Yellow-bellied Flycatchers at Long Point in the years 1966–1968 is shown in Fig. 4a–d. As with the Least Flycatcher (Hussell 1981), the migration of adults averages substantially earlier than that of immatures. Numbers of adult Yellow-bellieds at Long Point, however, were relatively small and we have to rely on a total of only 92.5 bird-days in the 3 years to determine the pattern. The earliest adult arrived on 18 July 1968 and the latest was found on 31 August 1968. Median dates for adult bird-days in the 3 years were 29 July 1966, 21 August 1967, and 6 August 1968. For the 3 years combined, the middle 90% of adults occurred in a 33-day period 25 July–26 August, with the median on 8 August.

Immatures arrived in the second or third week of August. In 1966 and 1967, their migration peaked in the second half of August, but in 1968, when few immatures were recorded, the largest numbers appeared in the second week of September. Median dates for immatures were 27 August 1966, 26 August 1967, and 7 September 1968, dates that are 29, 5, and 32 days later (average 22 days) than median dates for adults in the same years. For the 3 years combined (Fig. 4d), the median date for immatures was 28 August, 20 days later than for adults and the middle 90% occurred in a 28-day period, 18 August–15 September.

Median fall dates of adults and immatures in the banded samples in 1966–1968 are in close agreement with those based on daily estimated totals (Fig. 4d); the medians for immatures are identical, but for adults the median is one day earlier in the banded sample. Other Long Point

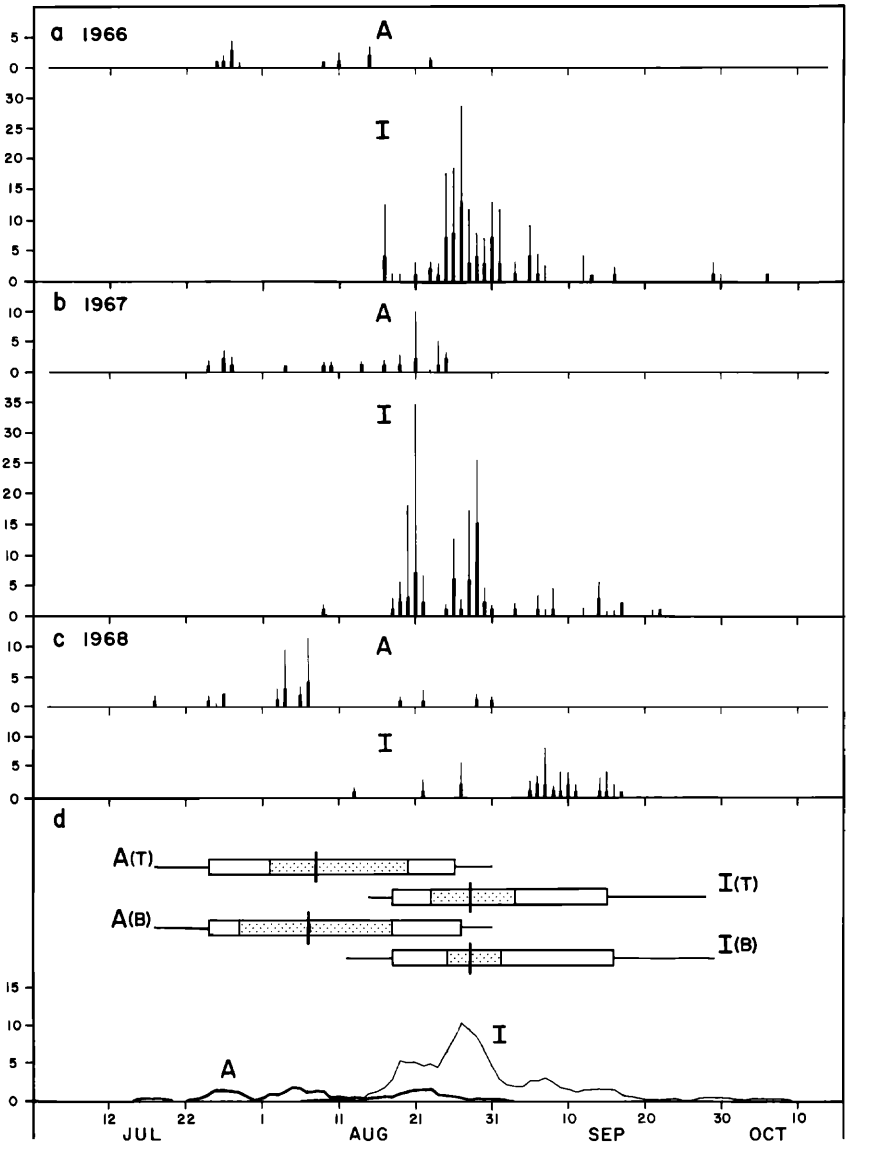

FIGURE 4. a–c. Fall migration of Yellow-bellied Flycatchers at Long Point, 1966–1968. d. Seasonal pattern of fall migration, 1966–1968. The continuous lines in the lower section are five-day moving averages of the daily estimated totals. A = adult, I = immature. See Fig. 1 for further explanation.

banding data (Fig. 5) show a similar pattern and give median dates for adults of 8 and 13 August and for immatures of 27 and 29 August at stations Nos. 1 and 2, respectively. The largest concentration of adults recorded occurred on 7 August 1977, when 11 were banded at station No. 1.

Wing lengths gave no evidence of differential timing of migration of sexes within age groups, which is consistent with the findings of Phillips et al. (1966) for immatures. Four adults aged by plumage color and feather wear had small unpneumatized areas in the skull. This is 9.8% of the 41 adults examined. An additional 3 birds were assigned unknown age because of presence of small unpneumatized areas and uncertainty regarding their plumage characteristics, but they were probably also adults.

As with the Least Flycatcher, proportions and total numbers of adults and immatures varied considerably from year to year. Adults represented 19.7% of the total bird-days and 23.7% of the birds captured (Table 1). Other Long Point banding data (Fig. 5), give 23.2% adults at station No. 1 and 11.3% at station No. 2. As in the Least Flycatcher (Hussell 1981) and several species of warblers (Dunn and Nol 1980), the lower percentage of adults at station No. 2 is probably site-related. Nevertheless, the adult/immature ratio for Yellow-bellied Flycatchers at both sites is substantially lower than in the Least Flycatchers, for which the comparable figures for "other banding data" are 41.4% adults at station No. 1 and 16.3% at station No. 2.

Both adults and immatures showed considerably less evidence of body molt than in the Least Flycatcher, but again nearly every individual had some growing feathers. Late migrating individuals tended to have fewer growing feathers than early ones. Among adults, mean body molt scores, ranges, and sample sizes (n) for the two periods 18 July–8 August and 9–31 August, each of which represent about 50% of the migration, were, respectively: 0.68 (0–1.9, n = 18) and 0.27 (0–0.7, n = 14). The equivalent figures for immatures for the periods 7–28 August and 29 August–22 September were 0.59 (0–1.4, n = 47) and 0.26 (0–0.8, n = 29), respectively.

DISCUSSION

The migrations of the Yellow-bellied Flycatcher in southern Ontario closely parallel those of the Least Flycatcher (Hussell 1981). The spring migration averages about 2 weeks later in the Yellow-bellied, however, and the fall passage of adults is some 17 days later. In spite of these differences, which are undoubtedly related to a later breeding season in the Yellow-bellied Flycatcher, immature Yellow-bellied and Least Flycatchers migrate essentially simultaneously in the fall. The patterns of timing of fall migration in adults and immatures in these two species are confirmed by data from museum specimens (Table 2). Notably, it appears that essentially the same temporal sequence of species and age

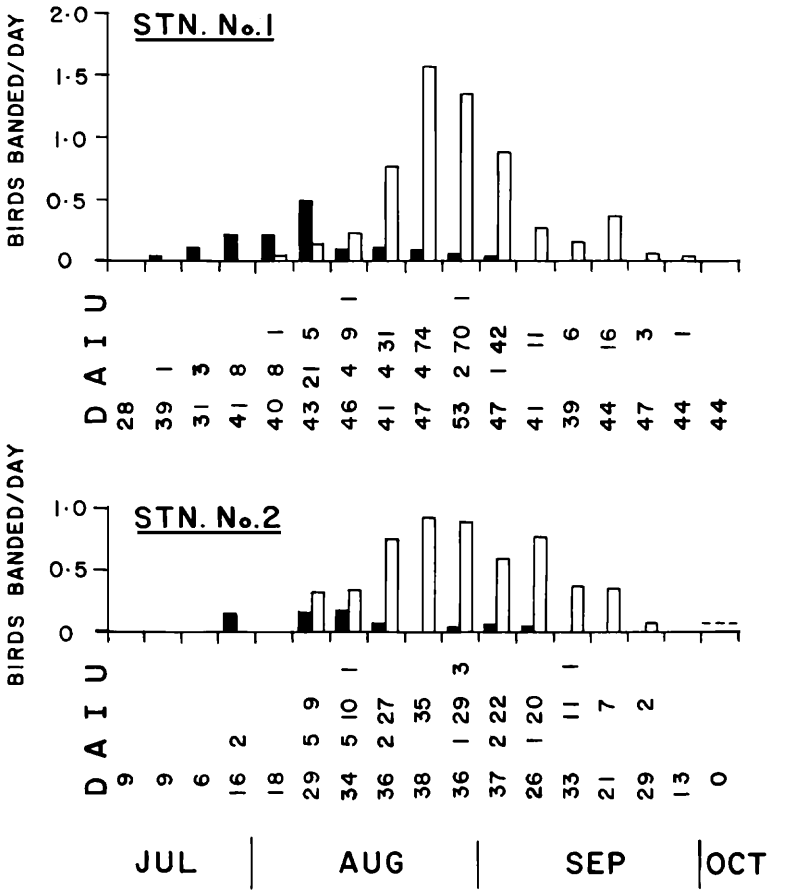

FIGURE 5. Average numbers of adult and immature Yellow-bellied Flycatchers banded per day during fall migration at Long Point in successive 5-day periods from 13–17 July through 1–5 October. Upper: station No. 1, 1969–1980. Lower: station No. 2, 1966–1980. Solid columns = adults. Open columns = immatures. Broken horizontal lines = no data. D = days of coverage, A = adults banded, I = immatures banded, U = unaged birds banded, for each 5-day period. (Data for days with 50% or more unaged *Empidonax* at any station were excluded. The remaining unaged birds were assigned to age classes in proportion to the known age birds before calculating averages for each 5-day period.)

classes is maintained at least to the southern United States. The southward flight of adult Yellow-bellied Flycatchers, however, may be somewhat more rapid than that of the other species-age groups, but this must be regarded as a tentative conclusion since it is based on small sample sizes.

Further discussion of age-related differences in timing of migration

TABLE 1. Numbers of adult and immature Yellow-bellied Flycatchers in fall at Long Point, 1966–1968.

	Number of bird-days				Number of banded birds			
Year	Total	Adult	Imm.	% Ad.	Total	Adult	Imm.	% Ad.
1966	188.5	16.4	172.1	8.7	74	10	64	13.5
1967	193.9	36.1	157.8	18.6	70	15	55	21.4
1968	86.1	40.0	46.1	46.5	33	17	16	51.5
1966–1968	468.5	92.5	376.0	19.7	177	42	135	23.7

and year-to-year variability in abundance of flycatchers at Long Point may be found in Hussell (1981).

If we assume that Long Point is a 1-day flight to and from the breeding grounds, then Yellow-bellied Flycatchers must spend no more than 66 days on the breeding grounds (based on the timing of the 1966–1968 migrations). The equivalent figure for the Least Flycatcher is 64 days (Hussell 1981). Assumption of a 1-day flight may be unrealistically conservative for the Yellow-bellied Flycatcher, whose breeding range averages farther north than that of the Least Flycatcher, and we are safe in concluding that the breeding cycle is completed in essentially the same number of days in both species. Early departure of adults of both species is related to the post-migratory timing of the molt of the flight feathers (Dwight 1900, Johnson 1963, Hussell 1980, 1982).

According to Johnson (1963), postjuvenal molt of the body feathers occurs on or near the breeding grounds prior to fall migration. Postnuptial molt of the adults occurs on the wintering grounds following fall migration. The Long Point data provide information on the extent of active molt and not on the stage of body molt; they serve merely to confirm that little molt is in progress during the migration periods.

SUMMARY

Spring migration of Yellow-bellied Flycatchers at Long Point, Ontario, in 1966–1968 peaked in early June with a median date of 2 June and fifth and ninety-fifth percentiles on 22 May and 9 June. Males preceded females by about 4 days in the spring, but there was no evidence of differences in the timing of migration between the sexes in the fall.

Fall migration of adults took place in late July and August, with the median in 1966–68 on 8 August and the middle 90% of migrants occurring between 25 July and 26 August. Adults spent an average of no more than 66 days on the breeding grounds.

The peak fall migration of immatures was in the second half of August or first half of September. In 1966–1968 the median date for immatures was 28 August and the fifth and ninety-fifth percentiles were on 18 August and 15 September. Fall migration of immatures in south-

TABLE 2. Median migration dates for Yellow-bellied and Least flycatchers.

Species	Locality	Median date			Ad.-imm. difference in days
		Spring	Fall adult	Fall imm.	
Yellow-bellied	Long Point[1]	2 Jun	8 Aug	28 Aug	20
	Southern U.S.[2]	—	16 Aug	9 Sep	24
Least	Long Point[1]	18 May	22 Jul	29 Aug	38
	Southern U.S.[2]	—	3 Aug	9 Sep	37

[1] Based on "bird-days," 1966–1968, this paper and Hussell (1981).
[2] From Hussell 1982.

ern Ontario averaged about 3 weeks later than that of the adults; it was 20 days later in 1966–1968.

The pattern of migration closely parallels that of the Least Flycatcher, but adult Yellow-bellied Flycatchers migrate about 2–2½ weeks later in both spring and fall. The timing of fall migration of immatures is essentially identical in the two species. The temporal sequence of fall migration among species-age classes in these two species is maintained at least as far south as the southern United States.

There was negligible molt of body plumage in Yellow-bellied Flycatchers during spring migration. Many adult and immature fall migrants were molting body feathers, but molt was less extensive than in the Least Flycatcher.

ACKNOWLEDGMENTS

This paper is a contribution of the Long Point Bird Observatory. I wish to repeat my acknowledgment and thanks to those individuals and institutions mentioned in Hussell (1981) who also supported or assisted me with this study. Thanks are also extended to Mr. and Mrs. R. B. Dunn, Mr. and Mrs. W. J. Wasserfall, Mr. and Mrs. J. Woodford, and Mr. and Mrs. R. Zimmerman for providing places to work and write.

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NOTES AND NEWS

EBBA and WBBA Research Grants.—The Eastern Bird Banding Association and the Western Bird Banding Association each offer a grant of $250 in aid of research using bird-banding techniques or bird-banding data. Applicants should submit a resumé of his or her banding or ornithological background, a project plan, and a budget to the joint selection committee chairman: Robert C. Leberman, Powdermill Nature Reserve, Star Route South, Rector, PA 15677. No formal application forms are available; the amount requested should not exceed $250. Deadline for receipt of applications is 15 March 1983.

Request for Assistance: Green Jays.—Green Jays in Santa Ana National Wildlife Refuge are being banded with colored plastic leg bands to study their social system. Reports of sightings *outside* of Santa Ana NWR are requested. Please report date and location of observations, positions of aluminum and color-bands, and the number of color-banded birds sighted. Send reports to the Bird-Banding Laboratory and Douglas Gayou, 204 Tucker Hall, University of Missouri, Columbia, MO 65211.

Honorary Members of NEBBA.—In the Spring 1982 issue it was erroneously reported that Leon Kelso was our *only* honorary member. Betty Downs was also elected to that position (in 1979).