

SOME ASPECTS OF THE BREEDING ECOLOGY OF THE YELLOW-BREASTED CHAT

(*Icteria virens*)

BY JOHN V. DENNIS

INTRODUCTION

During the breeding season Yellow-breasted Chats range throughout most of the United States and northern Mexico, parts of southern Ontario, southwestern Saskatchewan, and southern British Columbia. The winter range is defined as from southern Baja California and southern Texas south to western Panama. However, recent observations (to be reviewed in a second paper) indicate a growing tendency to winter in the eastern half of the United States.

Two races are recognized. The eastern race, *virens*, occurs as far west as northeastern South Dakota, eastern Nebraska, eastern Kansas, and eastern Texas. To the west of this rather vague boundary the eastern race is replaced by *auricollis*, a western race distinguished mainly by longer tail, wing, and bill measurements.

The present paper is not an attempt to cover every aspect of the chat's life history, nor does it embrace in scope the whole of the chat's range. The main purpose is to assemble information bearing upon the periodic appearance of the chat during the fall beyond its breeding range in parts of New England and the Maritime Provinces of Canada. In recent years extralimital appearance of the chat in this region has been on such a scale that it no longer suggests the occasional type of vagrancy that is seen in many other southern species at this season. While much of this movement is still shrouded in mystery, certain facts have emerged which tell us something about the timing, scope, direction, and duration of these flights. Presentation of this material, it is felt, should serve to stimulate further investigation. By banding more chats and recording information pertaining to weight, sex, molt, and other topics, bird-banders can add enough knowledge to bring the eventual solution within attainable limits.

I feel that only about one-half the solution lies in migrational investigations.* Of equal importance are studies on the breeding range which take into account a variety of life history topics, and which answer the highly important question of when late summer and fall departure takes place. It is surprising how little life history work has been done on this species. Most writers, of necessity, fill their chat accounts with descriptions of the bird's eccentricities—its clownish behavior, peculiar vocalizations, twilight chorus, ventriloquistic attributes, and odd courtship flight—all matters of interest but scarcely helpful when it comes to questions of distribution and migration.

Because so little is known about the bird on its breeding grounds, emphasis in this study, which was conducted in northern Virginia during the summer of 1957, was upon any factors that might enter into a solution of the chat's appearance northward in the fall. Little at-

* A separate paper dealing with the migration of the chat in the Northeast is under preparation.

tion could be paid to most nesting habits and raising of young, however important these topics may be. Rather, answers were sought to the following questions, all of which conceivably have a bearing upon the chat's northward movement in the fall and methods of studying it: (1) How abundant is the chat in comparison with other nesting species? (2) Were all suitable chat habitats filled to capacity? (3) Was there any evidence of colonial nesting? (4) Was there a notably unbalanced sex ratio? (5) Can the sexes be distinguished throughout the breeding season? And, if so, how long afterwards? (6) When does molt take place? (7) What were the average weights for each sex? (8) When does departure from the breeding grounds take place?

Acknowledgements

This study is one of several made possible through a grant to the writer from the Old Dominion Foundation. I am deeply grateful for the opportunity afforded by this generosity. I am grateful to Dr. Herbert Friedmann for advice and allowing me access to the collections at the U. S. National Museum. For favors extended while making census studies in Virginia, I am indebted to Arthur H. Fast, Ralph Lawrence, and Leslie W. King. I am indebted to Dr. Maurice Brooks for reading the manuscript and offering suggestions. Special thanks go to Chandler S. Robbins, James Baird, and Aaron M. Bagg; each has taken a personal interest in the study, read and corrected the manuscript, and offered invaluable advice.

HABITAT AND ABUNDANCE

Roadside Counts in Virginia

As part of the breeding range study in Virginia, roadside counts were initiated to obtain an idea of the distribution and abundance of the chat in the region around Leesburg in the northeastern part of the state.

The countryside in this part of Virginia is gently rolling and contains much open country in addition to numerous small woodlots. In stream valleys and along ridges fairly large wooded tracts occur. The region is well within the Piedmont plateau and about fifteen miles east of the Blue Ridge Range. Altitudes vary from about 200 feet above sea level along the Potomac River, which flows just to the east of Leesburg, to 600 feet in the Catocin Ridge a mile to the west.

Wherever fields and orchards have been abandoned for a few years excellent chat habitat exists. Red cedar (*Juniperus virginiana*) is generally the first tree to make its appearance in abandoned land. But flowering dogwood (*Cornus florida*), persimmon (*Diospyros virginiana*), black locust (*Robinia pseudoacacia*), scrub pine (*Pinus virginiana*), sumac (*Sumac spp.*), and sassafras (*Sassafras albidum*) appear almost as quickly. At the same time blackberry (*Rubus spp.*), poison ivy (*Rhus radicans*), and Japanese honeysuckle (*Lonicera japonica*) form immense tangles which are ideal for nesting chats. The same process that envelops fields applies to gullies, fencerows, roadsides, and wet places. The vegetation may vary somewhat, it is true,

but for many years the growth is of a type that provides cover and food suitable to maintain a chat population.

The methods used and results obtained on the roadside censuses have already been summarized (Dennis, 1957). But, in view of appropriateness here, it seems worthwhile to review some of this material and add certain information on the chat not contained in the original report.

Back country roads around Leesburg were cruised by car on six different dates, June 9 through June 29, 1957. Stops lasting five minutes were made every 0.4 mile. These were primarily listening stops as few birds could be detected visually in such a short time. If the presence of a species was detected, it was simply checked off for that stop. Numbers of any one species at a stop were not recorded. Counts were made in the morning, and a different route was followed each time. A total of 87 stops were made in all. Sixty species were recorded.

The Yellow-breasted Chat was recorded on 29 percent of the stops. Eleven other species were recorded with the same or greater frequency: Field Sparrow (*Spizella pusilla*), 66; Indigo Bunting (*Passerina cyanea*), 52; Common Crow (*Corvus brachyrhynchos*), 48; Eastern Meadowlark (*Sturnella magna*), 46; Bobwhite (*Colinus virginiana*), 46; Cardinal (*Richmondia cardinalis*), 44; American Goldfinch (*Spinus tristis*), 41; Mockingbird (*Mimus polyglottos*), 40; Mourning Dove (*Zenaidura macroura*), 33; Brown-headed Cowbird (*Molothrus ater*), 31; and House Wren (*Troglodytes aedon*), 29.

Censusing methods favored higher frequency ratings for conspicuous and highly vocal species. Lower ratings went to inconspicuous species with faint or only occasional song. The chat is close to the bottom of the list as far as conspicuousness is concerned. But its vocal activities, while not so persistent as those of the Indigo Bunting and several others, more than make up for its retiring disposition. It might be said that census methods favored the recording of chats wherever present, but did not unduly exaggerate their presence at the expense of other species.

In addition to obtaining an idea of the chat's place in the summer resident avifauna, the roadside counts served to establish certain facts in regard to habitat. Wherever seemingly unsuitable habitat existed—dense woodland, cultivated fields, open pasture, relatively clean fence-rows and roadsides—chats were not recorded. But almost invariably habitat such as a long-neglected field produced one or more chats. However, where there were small isolated tracts of suitable chat habitat, totalling three acres or less, chats were not recorded. But small areas, even a narrow overgrown fencerow, did frequently produce chats if larger areas of suitable habitat were nearby.

An observation, not always confirmed during the brief roadside stops, was that whenever one chat was present there were likely to be many more. Habitats, on the whole, seemed to be filled to capacity. This observation is made with the assumption that not every acre in good habitat is included within nesting territories. Adjacent areas may be essential for feeding purposes, or for reasons less obvious.

BANDING STUDY

During June and July of 1957 an intensive banding program was conducted in suitable chat habitat in an area about three miles east of Leesburg and bordered on the north by the Potomac River. It was hoped that by the use of Japanese mist nets nearly all the chats in three study areas could be banded. Success in this would provide exact information on the number of chats present, sex ratios, size of territories, and other matters.

Immediate success was had in taking chats in nets placed within nesting territories. The ease with which they were taken compensated for difficulties in hacking net lanes through dense brush and poison ivy. Generally four or five nets (each net about 30 feet long and containing four shelves) were placed in an area during the day's banding operations. But ordinarily one net would catch all the chats. There was never any guide as to why one net should be so much more productive. Chats repeated fairly readily, but tended to become somewhat "net shy" as the season progressed. To counteract this tendency netting activities were seldom carried on at one site for more than two consecutive days. Netting operations were conducted along overgrown fencerows and gullies, in long-abandoned fields, and in open woodland bordering fields. Approximately sixty-five acres of habitat of this kind are in the study area; of this total about three-fourths supported chat populations.

Area A consists of two distinct habitats. Section 1, consisting of about ten acres, is a strip of woodland along a stream bottom which borders open country to the east and mature deciduous woodland to the west. Trees, for the most part, are far enough apart to permit a dense understory of shrubs, vines, and herbaceous plants below. Typical trees are elm (*Ulmus* sp.), black walnut (*Juglans nigra*), ash (*Fraxinus* sp.), willow (*Salix* sp.), and silver maple (*Acer saccharinum*). Chats were not equally distributed in this area and were found least often in the most shaded portions.

Section 2 consists of about five-sixths of an abandoned field of 27 acres and is that portion occupied by chats. This field has not been in cultivation for nearly thirty years, but has been grazed at various times and has been subjected to Christmas tree cutting. Despite long idleness most of the field is open to the extent that it is covered with broom grass (*Andropogon* sp.) and stands of poison ivy and Japanese honeysuckle. Red cedar is well distributed through the field while there are a number of dense stands of scrub pine. Other woody plants in the field include sumac, flowering dogwood, sassafras, persimmon, and blackberry.

Between June 7 and July 25 approximately 325 net-hours were devoted to Area A. Ten adult males and eight adult females were banded. It is probable that the entire adult population was banded. On the other hand, only four young of the year were banded. All were taken in nets and judging from the advanced stage of their postjuvenile molt, they had been out of the nest four or five weeks. The four juveniles were all taken on different dates, June 30, July 1, 15, and 17. Population densities in Section 1 and Section 2 were about the same.

Despite the fact that this was my first experience in sampling nesting populations by the use of mist nets, I was surprised that more young were not taken. It had been a relatively dry, warm summer and seemed conducive to good nesting success. Retrospectively, I can now see that juveniles just out of the nest, even up to a period of several weeks, are not as susceptible to capture by nets as adults. Adults, it is to be expected, lead more active lives. In food finding and territorial defense, they are frequently on the wing and hence more apt to be caught in nets. Juveniles recently out of the nest appear to do little moving about. One bird, a few days out of the nest, remained perched within a foot of a net during most of a day without being caught! Then, too, there is the factor that, in some cases, young were not out of the nest and thus unavailable for capture.

The ratio of juvenile to adult chats caught in nets was 23 percent; in Catbirds (*Dumetella carolinensis*) caught and banded during the same period, it was 25 percent. Thirty-five Catbirds were caught as compared with forty-one chats.

Only one chat nest was found in Area A, and this after the young had left. The nest was discovered on June 16 in a site overlooking a net lane where I had previously caught 2 adult females and 1 adult male. The nest was 3½ feet up in a wild plum (*Prunus* sp.). This scraggly bush, bordering an opening, was about 10 feet tall and heavily overgrown with Japanese honeysuckle.

Area B consisted of wooded areas separated by an opening. Open fields bordered on the south and woodland to the north. The amount of woodland occupied by chats was only about 2.5 acres. Adjacent woodland was somewhat more dense, and this may have explained the absence of chats in surrounding woodland. Dominant trees are black walnut, ailanthus (*Ailanthus altissima*), persimmon, black locust, elm, hackberry (*Celtis occidentalis*), redbud (*Cercis canadensis*), and oaks (*Quercus* spp.). The understory is heavily matted with Japanese honeysuckle.

Between June 15 and July 25 approximately 175 net-hours were devoted to Area B. Two adult males and 1 adult female were banded. Three juveniles, representing 2 different broods, were captured in nets and banded. In view of the fact that Area B is isolated from other chat populations by extensive tracts of unfavorable habitat, it seems likely that the males taken were restricted to this one territory. Both were detected in close proximity to each other on several occasions. It is of interest to speculate upon the conjugal relationships that may have existed to produce 2 broods with only 1 female and 2 males!

On July 14 2 young of the latest brood were taken at the same time and in the same net with the female. On the same date a much older juvenile was taken in the same net with one of the males. These events suggested that one of the males was caring for the first brood at a time when the female was caring for the second. Not enough information is available, however, to decide whether a polyandrous situation existed or whether one of the males was simply unmated. In view of the intensive banding conducted here, it seems highly unlikely that a second female was present and escaped capture.

Area C consists of broad field borders with fencerows and in Section 3 a gully or ravine. The fencerows, having not been cleared for many years, contain a dense growth of shrubs, trees, and vines. Red cedar is the most common tree but wild cherry (*Prunus virginiana*), osage orange (*Maclura pomifera*), mulberry (*Morus* sp.), persimmon, flowering dogwood, sassafras, sumac, white oak (*Quercus alba*), black oak (*Quercus velutina*), redbud, and black walnut are well represented. And as in most good chat territory, poison ivy and Japanese honeysuckle grow luxuriantly. The main chat population in this area was centered in Section 1. Not far removed, but separated by little frequented but similar habitat, were family groups in Sections 2 and 3.

Between June 11 and July 26 approximately 235 net-hours were given to banding in this area. Six adult males and 4 females were banded. Section 1, although containing only $3\frac{1}{4}$ acres, accounted for 4 males and 2 females. Extremely dense growth with many thorny shrubs defeated efforts to find nests here. Nor were any young taken in nets.

Section 2, only $1\frac{1}{2}$ acres of fencerow vegetation, supported 1 nesting pair. Inconclusive evidence is available that this pair nested twice. On July 26 a nest was found in a small sumac not over $3\frac{1}{2}$ feet high which contained 3 young at the point of leaving. The nest itself, well constructed of leaves, grasses, and stems, was only $2\frac{1}{2}$ feet from the ground but firmly lodged in the tiny sumac. A heavy matting of honeysuckle surrounded the nesting site and partially shaded the nest as well. The nesting location was close to the outer side of a broad belt of fencerow vegetation and was relatively exposed for a chat's nest.

July 26 seemed to be a late date for young to be in the nest. In contrast, a juvenile out of the nest was discovered in another section as early as June 13. It seems more than probable, therefore, that this was a second nesting. This view was strengthened by the presence in a net in this area on July 26 of a bird that was almost certainly a young of the year and probably an offspring of a first nesting. Unfortunately the bird escaped from the net before it could be retrieved for banding and examination.

A single nesting pair also occupied Section 3 which contained the usual overgrown fencerows and also a gully some fifteen to twenty feet deep and filled with dense growth. This territory occupied only about $1\frac{1}{4}$ acres. On June 17 2 young with stubby tails were located by the subdued "clucking" notes they uttered. They were easily captured and banded. Although both were detected in the area at later dates neither entered a banding net.

POPULATION COMPARISONS

The region near Leesburg was not chosen because of its high chat population but because of convenience. In fact, prior to banding operations so few chats had been seen or heard here that I had planned to seek more productive study areas elsewhere. But once netting was started it was surprising to find how many chats there actually were. Netting in this case produced probably three times the number of males that would have been counted through visual and auditory methods. The difference with females would have been even more striking.

Within a fifteen mile radius of Leesburg several habitats were visited that had much higher population densities. Unfortunately there wasn't time available to sample these populations through mist netting. One of the most crowded habitats was a wooded bottomland along the Potomac near Seneca, Maryland, and about ten miles southeast of Leesburg. On July 13, I visited this area in company with two ornithologists, Ralph Lawrence and Arthur H. Fast. Both, although no more interested in chats than other birds, had been impressed by the large numbers they had found here on previous visits. By the time of our visit the season was advanced to the point where chats had all but ceased singing around Leesburg. In addition, it was a very hot day, a factor that would tend to lessen vocal activity. Notwithstanding, from one spot in the Seneca area we heard an estimated ten chats singing or calling!

The region that supported this large population was a heavily wooded, partly swampy, flood-plain broken here and there by openings which for the most part contained luxuriant herbaceous growth. Except for swampy areas, most of the region at one time had been devoted to agriculture. Now trees that have reclaimed the fields are thirty to forty or more feet high. One gets the impression from the closing canopy overhead that the woodland is past its peak as chat habitat. Nevertheless chats were extremely plentiful in the woods as well as the openings.

Along the Catoctin Ridge to the west of Leesburg another heavily populated district was found. Here, at an elevation of 600 feet, chats inhabit overgrown apple orchards and brushy hillsides. Densities in either habitat were probably quite similar to those in bottomlands along the Potomac.

SPECIAL TOPICS

Territory

Griscom (1923), writing of the chat in the northeastern portion of its range, says: "It tends to gather into small colonies . . . several pairs will inhabit a bushy hillside on the edge of a swamp, and miles of similar situations will be untenanted."

The term "colony," as used here by Griscom, seems highly appropriate. It was my experience in Virginia that a number of pairs tended to congregate in a fairly restricted area while surrounding habitat, identical in nature, was left unoccupied. My experience differs from Griscom's, however, in that unoccupied habitat was rather limited in extent. As already mentioned, almost all suitable habitat did contain chats unless the habitat was small and isolated.

On the other hand "colony," in referring to chats, should not be interpreted to mean a condition whereby territorial limits do not exist. Although living in close proximity to each other, the chat seems to defend its nesting territory against invasion by other chats. A probable instance was noted on July 3rd when I was putting up a net in Section 2 of Area C. I had heard no song or other vocal activity. But before I had finished putting up the net, a male was heard singing at the northern end of the nesting territory in which I was working. At the same instance, the rightful owner of the territory, a bird I had caught several times before, dashed toward the intruder and in so doing was caught

in the partially erected net. Under most circumstances my presence would have been enough to keep the bird from this vicinity.

Mist netting revealed that territorial intrusion was the rule and not the exception. Not infrequently a net placed well within the territory of a nesting pair caught not only the rightful owners but birds from surrounding areas as well. Narrow strips of habitat that contained nesting pairs were often used as travel lanes. The middle part of Section 1 in Area A was an example. Here I caught not only 2 pairs that had nesting territories in Section 1, but also 2 males that had territory well within Section 2. One of them, in fact, was about one-third of a mile from its normal territory. Both of these birds may have been unmated males, but this was not verified.

Travel, it should be mentioned, was not always confined to favorable habitat. I witnessed perhaps four or five occasions in which lone birds were seen to strike out across open fields (pasture or cropland) in order to gain distant sections of habitat similar to those in which they held territory. Sometimes the objective was an isolated clump of shrubs along a fencerow. Flight was always direct, about four or five feet above the ground, and stronger and swifter than I had suspected for this species. Thus in addition to occupying their own territories—which ranged in size between $1\frac{1}{4}$ and $2\frac{1}{2}$ acres—chats take in a great deal of neighboring habitat as well.

Individual holdings are well advertised, at least early in the season, by the song of the male. Both mated and unmated males spend the day alternating between various song perches. Toward dusk, a typical feature of the breeding season routine begins—the twilight chorus. A similar performance gets under way about daybreak.

While most evidence seems to place the chat among the territorial nesters, there are just enough differences to imply a tendency toward colonial nesting. Among these we have noted the communal type of song activity at dawn and twilight, tendency to locate nesting territories adjacent to each other and in loose colonies, and frequent invasion of each other's territory.

Sex Ratios and Sex Determination

Out of a total of 31 adult birds caught and banded in the study areas, 18 (58 percent) were males and 13 (42 percent) were females. This is about the expected sex ratio for songbirds where males generally outnumber females (Lack 1954: 107).

Difficulty was expected in distinguishing the sexes since very little information is available on this topic in recent literature. For example, Bent (1953) merely states: "Females have the same molts and similar plumages, the colors being only lighter or duller."

Fortunately it soon became apparent in handling birds during the breeding season that there are a number of good characters for distinguishing the sexes. The problem becomes more difficult in fall and winter, but even then the situation is not hopeless. The following are the most helpful in determining birds in the hand: color of bill and mouth, amount of contrast between dark and light areas of the side of the head, and wing measurements.

During the breeding season the bill of the male is solid black except in some cases where there are small light stripes or dots on either side of the lower mandible and next to the commissure toward the base of the bill. Toward the end of the breeding season these stripes widen and eventually the lighter color replaces the black. Similarly, after the lower mandible has lost much of its blackness, a light area appears on the lower edges of the upper mandible and toward the base; this widens and finally replaces the black. The inside of the mouth in the male during the early breeding season is jet black. This secondary sexual character, like the bill color, begins to fade toward the end of the breeding season. It is replaced by a flesh color similar to the inside of the mouth in the female.

Audubon (1842) mentions the black bill but calls the female "scarcely different from the male." Wilson and Bonaparte (1871: 213) mention the inside of the mouth calling it a "dirty flesh color" in the female and black in the male. They do not mention any change taking place in the male, nor do they mention external differences. I find first reference to seasonal change in bill color in Baird, Brewer, and Ridgeway (1874), who call attention to the fact that the female does not have a pure black lower mandible and that both sexes in winter "apparently have the base of the lower mandible light-colored."

A somewhat less ephemeral criterion in separating sexes involves the amount of contrast between light and dark areas on the forehead and side of head. In full-plumaged males the forehead, lores, suborbital region, auriculars, and postocular stripe are largely black; the posterior portions of the facial markings behind the eye fade to gray (amounts of gray and black varying with individuals). The dark areas present a sharp contrast to the white of the incomplete eye ring, the superciliary line, and the malar stripe. The female is marked similarly to the male but has only a suggestion of black and this generally in the loreal area. Otherwise the darker sections are gray and are less extensive than in the male.

During the breeding season differences in facial contrast offer a quick and accurate determination of sex. Unfortunately as the season progresses the males lose much of the vividness of their facial coloration. In some males enough contrast remains to make reasonably positive fall determinations; in others there is not enough difference to provide a safe distinction between adult males, the quite similar adult females, and the immatures.

Of 160 skins of adult male and female chats taken in spring or summer examined by me in the U. S. National Museum, sex could readily be distinguished on the basis of facial markings in 158 cases. In one of the two cases where birds marked *male* had light facial markings, I highly suspected wrong sex designation by the collector. This bird taken May 7, 1936 in West Virginia also had light mandibles.

Wing measurements were taken both of museum specimens of known sex and live birds during the summer whose sex was safely ascertainable. Wing length was considered to be the chord of the distance from the bend of the wing to the tip of the longest primary; measurements were taken in millimeters with dividers.

Of live birds measured during the banding operations near Leesburg, wing length of 7 males averaged 77.7 (minimum 74, maximum 81). Of 8 females the average was 73.6 (minimum 72, maximum 76). Of museum specimens 67 males averaged 77.7 (minimum 74, maximum 82). Fifty females averaged 75 (minimum 69, maximum 78). All museum specimens examined were of the eastern race, *virens*. It is readily seen that there is an overlap; measurements 74 to 77 are not diagnostic. With many measurements falling into this questionable category, as is the case, it might be asked if the wing measurements have much value. On the basis of the samples just mentioned the range 69-73 may be regarded as a safe indication of female sex; and the range 79-82 of male sex. Also where there are other clues, extremes in the intermediate range may be helpful in deciding sex.

Other plumage characteristics such as color of breast and back seem to be of no value in sex determination. For instance, I found no evidence that brighter breast coloring is a male character. To be sure there is much individual variation in breast plumage. Many individuals have a darkish suffusion of green or grayish-green across the breast or a portion of it. In some cases the darker breast coloring is due entirely to dirt; but, as far as I could see, it is not a sex or age character.

There was considerable individual variation among males as to when they began to lose certain of their breeding season characters. In some birds light patches appeared on the lower mandible toward the end of June. In one individual the blackness of the mouth was somewhat faded by June 29. Toward the end of July black mouth color had largely disappeared in most birds. By mid-July most males showed less blackness on the lower mandible, and, in some cases, light patches had appeared on the upper mandible. By late August of the same year when I began to band chats on Nantucket Island in Massachusetts, I could find no evidence of blackness on the bill. Between August 27 and October 10, twelve Nantucket chats out of twenty-seven banded were sexed as probable adult males on the basis of darkish facial markings or relatively long wing measurements, or a combination of the two. In three of the individuals banded in late August or early September there was some suggestion of black remaining inside the mouth.

Weights

Little weight difference was found between sexes. Nineteen males and 11 females were weighed during the banding operations near Leesburg. Whenever more than one weight was available for an individual the average was taken and used in arriving at totals for that sex. Nineteen males averaged 26.6 grams (minimum 22.2, maximum 29.5). Eleven females averaged 25.4 grams (minimum 22.6, maximum 30.9).

The over-all average for several localities is summarized in Table 1. The average for the 30 chats weighed at Leesburg during the summer of 1957 was 26.2. This compares with an average of 25.5 for 20 chats weighed at Nantucket during fall and late August of 1956. During the same period in 1957, 20 chats were also weighed at Nantucket. The average was 24.5.

It is seen then that average fall weights on Nantucket were below

breeding season weights in Virginia. This is a condition that was anticipated in view of possible lengthy over-water flights and subsequent weight loss in migrants reaching Nantucket. On the other hand, Chandler S. Robbins (MS.) in weighing 27 chats at Ocean City, Maryland, during September 1957, found an average of 26.69. Here the element of over-water flight does not exist, or would probably be of minor importance.

TABLE I WEIGHTS

Locality	Year	Season	No. Weighed	Average Weight
Nantucket, Mass.	1956	Fall	20	25.5
Middletown, R. I.	1957	Fall	12	27.1
Nantucket, Mass.	1957	Fall	20	24.5
Boston, Mass. (T.V. casualties)	1957	Fall	5	24.7
Ocean City, Md.	1957	Fall	27	26.7
Leesburg, Va.	1957	Summer	30	26.2

Molt

Contrary to Dwight (1899), and the same assertion in Bent (ibid), the Yellow-breasted Chat is not the only warbler having a complete postjuvenile molt. The authorities just mentioned indicate that the young chat is unique among North American wood warblers in replacing wing and tail feathers in the postjuvenile molt. However, Stewart (1952) states that a complete molt also takes place in young Yellowthroats (*Geothlypis trichas*). And Norris (1952) found evidence of tail molt in two juvenile Pine Warblers (*Dendroica pinus*).

During the banding operations near Leesburg, nine juveniles and three nestlings were banded and examined. Juveniles, according to how long they had been out of the nest, had varying amounts of olive-gray, white, and yellow on the throat and breast. Birds, probably out of the nest four to six weeks, had obtained yellow breasts but still had white on the throat. This first plumage is described by Brewster (1878). However, no information seems to be available on how long the postjuvenile molt takes or the sequence of changes as they affect different parts of the plumage. My observations indicated that postjuvenile molt, even for the early season hatch, was not complete at the end of July. A juvenile in the U. S. National Museum collection, taken August 29, 1947 in Georgia, still retained a mottled white and yellow breast. This bird had probably come from a late nest. A juvenile male in the same collection, taken August 12, 1929 in Maryland, had nearly completed the tail molt, but wing primaries and secondaries, head, breast, back, and abdomen were still in molt. Of 62 migrants banded on Nantucket during the course of three fall seasons, not one had a trace of white on the throat or breast. I do not know what percentage of these birds were young of the year. Chats begin arriving on the island as early as August 20.

Turning to postnuptial molt, there was no evidence that this was completed by the end of July either. Indeed of the many adults caught and examined at Leesburg, there was no sign of molt taking place at all.

Through July adult plumage, particularly the rectrices, became progressively more and more frayed and worn. Body plumage became worn and dirty, and, altogether, by the time observations ceased at the end of July, the adults presented a most bedraggled appearance. But by August 27, when the first transients were caught on Nantucket in 1957, plumage had assumed a fresh appearance. Only the tail molt seemed to be incomplete. Birds with a mixture of old and new rectrices were seen through much of September.

Unfortunately I have no observations for the first three weeks in August. This is apparently the period of greatest plumage change in the adults.

Cessation of Song

As early as June 27, I noted a substantial reduction in daylight singing in Area A. The twilight chorus, a regular evening feature which began about 5:00 P.M. (EST) and lasted until dark or later, was also much reduced. On July 1, I found much less daylight singing in Area C. By July 5 only occasional outbursts were heard in Area A. On July 14 the woods in Area B were so silent that I could easily have assumed that the population had departed. Eventually I heard the characteristic nasal "cheow" note given by both sexes when guarding young. And the same day by means of mist nets I caught five chats, several already banded, in this same area that could easily have been passed up as unoccupied. The next day I had a similar experience when catching three chats in Section I of Area A where song had all but ended.

All song and vocal activity, however, does not come to an abrupt end at any given date. There are occasional renewals of song after a general cessation has set in. For example on July 18, I witnessed a renewal of daylight song and twilight chorus in Area A. Where large populations are involved I suspect that song lasts longer. The surprising amount of song at Seneca on July 13 has already been mentioned.

Saunders (1948), in reporting upon cessation of song by chats in Fairfield County, Connecticut, provides earliest, average, and latest dates of "beginning of cessation" and "general cessation" which, except for averaging a bit later, correspond quite well with my observations.

Departure from the Breeding Grounds

In view of the Chat's retiring disposition and early cessation of song, it is difficult to ascertain departure dates by the usual visual and auditory methods. There are numerous regional references to the time of departure in the literature. But it is not always possible to tell from these accounts whether the observer's information is based upon careful investigation or whether he is simply recording the fact that Chats are no longer obvious and visible. In some cases I suspect that the observer has faithfully recorded the departure of the bulk of his breeding population, but we are not sure if he has been alert to the occasional lingerer or new arrivals from other areas. In other cases, it is possible that the main departure was unnoticed and that departure dates refer to late season birds only.

However this may be, it is worth looking at a sampling of observations from different areas. Writing of Indiana, Butler (1897) says:

"They usually leave in September . . . but occasionally remain much later." Wood (1951), quoting L. W. Campbell regarding departure time in the Toledo-Erie marsh area, gives the average date of departure as July 28. Trautman (1940) noted that males at Buckeye Lake in Ohio became silent about July 15. During the first two weeks in August he was surprised to find a good many present. He located birds by their scolding notes whenever he gave an imitation screech owl call in good habitat. But he goes on to say that the Chat was "undoubtedly among the first of the summer residents to disappear." He was able to find only an occasional bird in late August. Cruickshank (1942), reporting upon fall migration in New York, says: "Southbound birds begin to pass through the first week in August . . ." Stone (1937) advances the opinion that Chats may move south before they molt. He says they were rarely seen after the middle of August in the Cape May, New Jersey, region.* Sprunt (1947) gives the departure time for coastal South Carolina as "late August."

One of the prime objectives of the mist netting studies at Leesburg was to pin-point early departure dates. The Chat proved to be an excellent subject for such a study. Inhabiting, as they do, narrow strips of cover, it is almost impossible not to catch resident birds in properly placed nets. Therefore, if after several intensive days of netting, together with listening and watching, no Chats are discovered, it is a fairly safe assumption that the birds have departed. Additional observation and mist netting are desirable for positive confirmation.

The following departure schedule was noted beginning with Area A: Up until termination of the study on July 28, there was no indication of departure by Chats inhabiting Section 1, but about half the population of Section 2 had gone by July 25. By the same date, no Chats at all remained in Area B. Reduced net take indicated a partial exodus from Section 1 of Area C in early July; this section was almost deserted at the end of the study period. The pair in Section 2 had young in the nest at the end of the period. By July 16, the family in Section 3 had departed.

The results of this study show that there is no general movement out of the breeding area. Rather one small area is deserted at a time, generally, it would appear, on the basis of departure by family groups. In some cases families with young of the year had departed before other pairs had finished nesting. Departure began during the first week in July and about half the population had gone by the end of the month.

SUMMARY AND CONCLUSIONS

1. June roadside counts in diversified habitat around Leesburg, Virginia, in 1957 placed the Yellow-breasted Chat with the House Wren in tenth rank among nesting species so far as wideness of distribution and conspicuousness (not numerical abundance) were concerned.
2. Types of habitat containing chats are defined. Although populations were not evenly distributed in any one habitat, the general

*Eighteen were banded here by Seth Low and party in mist netting operations Sept. 7-9, 15-21, 1956.

- impression was that populations were high and that good habitat was filled to capacity.
3. Three areas containing chat populations were found in a region of farming country and woodland near Leesburg. Intensive mist netting operations were conducted on these three tracts during June and July of 1957.
 4. During the course of these operations 19 adult males and 13 adult females were banded; also 9 juveniles, and 3 nestlings.
 5. While netting operations were highly effective in taking adults, it was felt that only a small proportion of the juveniles were caught. Possible reasons for this are advanced.
 6. Chats were often found to nest in small colonies, but, within the colony, nesting pairs maintained sizable territories. Signs of territorial defense were noted but it is not known whether a vigorous defense is maintained throughout the nesting season.
 7. 58 percent of the adults banded were males and 42 percent females.
 8. Methods of distinguishing sexes are discussed; bill and mouth color, degree of facial contrast, and wing measurements provide important criteria. Certain male characters are distinguishable only during the breeding season.
 9. Males weighed slightly more than females. Breeding season weights in Virginia are compared with fall weights from other areas.
 10. Postjuvenile molt in young from early broods was in progress through July, but probably is not completed until mid-August or later. No sign of postnuptial molt was noted in July in Virginia, but late August adults on Nantucket had all but completed the postnuptial molt.
 11. As early as June 27 a reduction in amount of daylight singing was noted. A substantial reduction was noted during the first week in July, but with occasional periods of renewal well into the month.
 12. Departure from nesting territories was well underway by mid-July and about half the population on the breeding areas was gone by the end of the month.

LITERATURE CITED

- AUDUBON, J. J. 1842. *The birds of America*. Vol. IV, New York and Phila., viii + 2-321.
- BAIRD, S. F., BREWER, T. M., and RIDGWAY, R. 1874. *A history of North American birds*. Vol. I, Boston, xxviii + 596, i-vi, plates i-xxvi.
- BENT, A. C. 1953. *Life histories of North American wood warblers*, U. S. Natl. Mus. Bull. 203, Wash. D. C., xi + 734, plates 1-83.
- BREWSTER, W. 1878. Descriptions of the first plumage in various species of North American birds. *Bull. Nuttall Ornith. Club*, 3(1) : 56.
- BUTLER, A. W. 1897. *Birds of Indiana*. Dept. Geo. and Nat. Res., 22nd Annual Report, 515-1187.
- CRUICKSHANK, A. D. 1942. *Birds around New York City, where and when to find them*. Am. Mus. Nat. Hist. Handbook Series No. 13, xvii + 489, plates 1-35.
- DENNIS, J. V. 1957. June roadside census in Loudoun County. *The Raven*, 28(7 & 8) : 62-65.
- DWIGHT, J. 1900. The sequence of plumages and moults of the passerine birds of New York. *Annals N. Y. Acad. Sci.*, 13 : 73-360, 7 plates.
- GRISCOM, L. 1923. *Birds of the New York City region*. Am. Mus. Nat. Hist. Handbook Series No. 9, 400 pp., plates 1-6, fig. 1-30, map.
- LACK, D. 1954. *The natural regulation of animal numbers*. Oxford, viii + 343.
- NORRIS, R. A. 1952. Postjuvenile molt of tail feathers in the pine warbler. *The Oriole*, 17(3) : 29-31.

- SAUNDERS, A. A. 1948. The seasons of bird song—the cessation of song after the nesting season. *Auk*, **65**: 19-30.
- SPRUNT, A. 1947. First winter observation of the yellow-breasted chat in South Carolina. *Auk*, **64**: 467-468.
- STEWART, R. E. 1952. Molting of northern yellow-throat in southern Michigan. *Auk*, **69**: 50-59.
- STONE, W. 1937. Bird studies at Old Cape May. Vol. II, 521-941. plates 47-117. Del. Valley Orn. Club, Phila.
- TRAUTMAN, M. B. 1940. The birds of Buckeye Lake, Ohio. Univ. Mich. Mus. Zool. Misc. Pub. No. 44, 1-466. Ann Arbor.
- WILSON, A., and BONAPARTE, C. L. 1871. American ornithology or the natural history of the birds of the United States. Vol. II viii + 9-390. Phila.
- WOOD, N. A. 1951. The birds of Michigan. Univ. Mich. Mus. of Zool. Misc. Pub. No. 75, 1-559. Ann Arbor.
- 17 Liberty St., Nantucket, Mass.

GENERAL NOTES

Returns of salt-marsh sparrows (*Ammospiza* sp.).—While studying the behavior of salt-marsh sparrows, genus *Ammospiza*, in 1955, I banded 40 Seaside Sparrows (*A. maritima*) and 85 Sharp-tailed Sparrows (*A. caudacuta*) near Chadwick and Lavallette, Ocean County, New Jersey (Woolfenden, *Univ. Kans. Publ. Mus. Nat. Hist.*, **10**(2): 45-75). In 1956 I returned to the Lavallette banding site on 30 July for approximately 1 hour. In this short time I saw three banded birds and identified two of them by the color combinations of their bands. One was a Seaside Sparrow, 21-148425, banded and sexed as a male by cloacal examination 18 July 1955. The other was a Sharp-tailed Sparrow, 57-45317, banded and sexed as a female on 20 July 1955. The individual that was not identified was also a Sharp-tailed Sparrow.

In 1957 I was able to visit the Lavallette banding site on two consecutive mornings. On the first morning, 26 August, I sighted Seaside Sparrow 21-148425 again. On the next morning, 27 August, with assistance from Joe Jehl, I netted on the area and captured three banded birds. Two Seaside Sparrows, 21-148425, and 21-148427 which was banded and sexed as a female 27 July 1955, and one Sharp-tailed Sparrow, 57-45330, banded and sexed as a female 3 August 1955.

Bird Banding Notes (4)(3): 22) issued by the Fish and Wildlife Service lists 156 Sharp-tailed Sparrows and 142 Seaside Sparrows banded through 1949. A letter from Allen J. Duvall, dated 18 September 1957, informs me that the service files then contained one record for the Sharp-tailed Sparrow: number C-163905, banded as immature on 11 August 1933 at Bay Head, New Jersey, by Henry P. Bailey was reported found about 1 January 1934 at South Creek, New Jersey, by J. Lupton. There were no return or recovery records for the Seaside Sparrow.

The birds here recorded as captured in August 1957 were all banded as adults in 1955, therefore they must have been at least 3 years old. These returns also provide evidence that the semicolonial, nonterritorial Sharp-tailed Sparrow and the territorial Seaside Sparrow (Woolfenden, *op. cit.*, pp. 52-58) return to the same area to breed. All three birds netted in 1957 were observed carrying on nesting activities in 1955. Not only did the male Seaside Sparrow, 21-148425, return to the same small island 2 years in succession, but also it was seen on the same portion of the marsh where it had maintained a territory in 1955.—Glen E. Woolfenden, Department of Biology, University of Florida, Gainesville, Florida.

A Dickcissel Recovery. On October 28, 1957 an adult Dickcissel was banded (24-189611) at the Norman Bird Sanctuary, Middletown, Newport County, Rhode Island. In addition to the aluminum Fish and Wildlife Service band, a red plastic band was placed on the other leg so that the bird's movements around the sanctuary and the town could be followed by sight observations—the bird was not seen again after banding. On December 5, 1957, this same Dickcissel (complete with red plastic band) was trapped at Rockaway, Morris County, New Jersey, and released. The bird remained at Rockaway throughout the winter and was last seen on March 11, 1958.

According to information received from the Banding Office, this is the first time that a Dickcissel has been reported subsequent to the original banding.—James Baird, Norman Bird Sanctuary, Middletown, Rhode Island, and Mrs. Gail C. Cannon, Rockaway, New Jersey.