

old and new feathers. The napes were invariably still worn and dull, and apparently were the last region to be affected, as in the young also. Tails and wings were incomplete.

There is a gap in my Tree Sparrow records between my departure from Churchill on the 21st of August and the arrival of the first birds in Ithaca the 28th of October, at which time the young and old are alike resplendent in their fresh plumage of chestnut, buff, and black.

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## SEASONAL AND INDIVIDUAL VARIATIONS IN HOUSE SPARROWS

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THE sequence of plumages in the House Sparrow (*Passer d. domesticus*) by molt and wear, and the fact that the bill of the male is black in summer, are well and generally known. But in banding a good many individuals, this or that variation in bill-color or plumage has caught my interest, and I have some two hundred and seventy-five more or less fragmentary memoranda concerning the subject. Arranging and studying this material, I find three things: that the series of observations bearing on a given point is usually regrettably small, that I am in a better position to make further observations of interest, and that I am in the possession of some details and suggestions that seem worth recording.

### BILL-COLOR OF ADULT HOUSE SPARROWS

I find no color difference in October between the bill of the male and that of the female. The upper mandible is brownish gray, sometimes lighter and sometimes darker. The lower mandible is variously pale, sometimes quite pale to the tip, sometimes merely paler at its base. There is almost always yellowish on the base of the bill adjacent to the rictus, which varies from a restricted faint tinge of yellowish to an appreciable area of yellow. This is a lemon yellow, to my eye identical with that of the conspicuous yellow skin of the rictus of a young bird, with which it possibly has some biological correlation, and quite unlike the more buffy yellow of the lower mandible of some juvenals. No yellow noted in one of twelve memoranda on males and in two of twelve on females. The bill of this aberrant male approached the summer color somewhat, being dark gray only slightly paler on base of lower mandible. To match it there is an October female with nearly uniform gray bill with a very slight yellowish touch near the corner of the mouth.

In November, three out of eleven males had uniformly dark gray

or blackish bills; one on November 23d was uniformly blackish. But taking November and December together, seventeen out of twenty-two had gray and pale bills, with the yellow near rictus if anything better developed than in October, only one of these seventeen without yellow or yellowish—gray, base of lower mandible 'somewhat paler.' The change to a black bill color seems to consist of gradual and general deepening of the gray and restriction of the pale base of the lower mandible.

The earliest male examined with a solid-black bill was on December 3d, and in December two out of eleven had such, and the remainder had bills approximating those of fall birds. In January to February 3d, when the last without a solid-black bill was examined, on the other hand, three out of eight had black bills, and in the other five the bill varied from uniform blackish or grayish black to dark gray with base of lower mandible somewhat paler; none with any yellowish.

From February 7th to June 15th the bill of males is solid black. This is based on six memoranda of birds handled in February, twelve in March, seventeen in April, sixteen in May, and five in June, and on continued casual observation in spring and summer.

Whereas the bill of the male turns black in late fall and winter, there is no noticeable seasonal difference in that of the female, which is equally variable throughout the year. There may be a slight tendency for it to darken, however, for eleven out of sixty unusually dark-billed females have been noted from February 7th to June 15th, when bills of all the males examined were black, as against one out of twelve in October.

One of the oldest birds, so proved by definite return data, is a female banded as an adult on May 13, 1930, and collected on May 14, 1932, at least three years old in 1932, when it had dark throat-patch faintly indicated, bill gray, lower mandible pale except tip, base of bill pale, very slightly yellowish, marked off in front by a dark area on upper mandible and dark sub-basal streak across lower mandible. It had a broken leg, was in good flesh, with ovaries moderate, but was non-breeding. A pale area on base of bill in the female well defined in front, or else delimited there by a dark bar, seems to be correlated with age. It has been noted in nine cases including the above, all from May 1st to June 10th, six with the bar and three without. Two without, returns A189562 and A189519 of May 1st and 9th, 1931, banded respectively on May 25th and May 13th, 1930 as adults, were at least two years old in 1931. Two with the bar (on the lower mandible), and pale area behind delimited by it not otherwise well defined—repeats B139630 and B139618 of May 24th and June 10th, 1931—were banded respectively as adults on May 11th and April 24th when the bar, if present, was at least overlooked in describing their bills.

First-year females may have somewhat paler bills than older birds, as two or three such retaken from November 14th to May 13th

following the summer they were juvenals, had bills paler than normal. Many females with such paler bills may be in their first adult summer, but not all, as a female banded as an adult on May 31st had a rather pale bill on June 10th of the succeeding year. A male juvenal of May had a black bill the following February 7th and one of August had a black bill the following April 5th.

Four males with normal gray, pale, and yellowish fall bills from October 3d to November 6th were retaken as follows: two the following February 26th to March 7th with black bills; one on January 11th (a year later) with an entirely blackish bill; and one the following February 3d with a grayish-black bill, the base of lower mandible being somewhat paler. No black-billed male has so far been retaken with a pale bill, though two such have returned in late January, when all males did not yet have black bills. There is no question in my mind that bills regularly turn from black to pale in late summer or early fall, and I therefore take this as evidence, which is not lacking from other sources, that males are trapped with less difficulty when in nuptial condition. No adult male House Sparrows whatever have been trapped between June 19th and September 29th, 1931-34, on which latter date many or most of the birds of the year are indistinguishable from their elders.

#### VARIATION IN YOUNG HOUSE SPARROWS

Individual variation in the plumages of adult House Sparrows is relatively slight or infrequent. I have, however, noted a male in which the chestnut markings were unusually noticeable and the legs reddish, a female with a dark smoky suffusion of color which may have been natural, but perhaps was acquired, as it is by sparrows which frequent smoky London roofs.

Young birds in fresh, soft juvenal plumage are comparatively variable. At least three types of these are distinctive and of frequent occurrence:

A. A considerable proportion—just how large is uncertain, as for the most part no record was made of them—have plumage not noticeably different from the adult female, most of lower mandible varying from pale (like the female) to strong buffy yellowish.

B. The second type is characterized by a slight mark which is yet distinctive when attention is called to it, a narrow, sharply defined pale or whitish arched streak from the eye to the bill (nostrilward). This was more or less regularly correlated with whiter under parts than usual, the whitish extending onto the cheeks, and a faint but evident dusky chin-and-throat patch, and noted in six or seven young birds out of sixteen trapped from June 9th to 17th, 1932. It was thought at the time to be the plumage of the juvenal male, but it probably has not that significance. A bird examined on July 19, 1934, had this same pale streak before the eye, the upper mandible light gray, lower pale, soles of feet not yellowish, and the pale band behind eye conspicuous.

C. Three young birds on June 22d, and two others on June 24, 1932, all of which may reasonably have belonged to one brood, were of a quite different type, the most conspicuous character of which was having dark color more or less restricting the yellowish of the lower mandible, especially on the middle of its sides. Correlated with this was a triangular area in front of eye uniform palish gray contrasting with the dark forehead, yellowish soles of the feet, never a suggestion of a dusky throat, and sometimes, at least, with gray cheeks and a pale mark below eye giving a slight eye-ring effect. Two birds examined June 29, 1932, one of which had also been trapped on June 23d, showed some tendency toward this type. Four birds in the trap together June 15, 1934, were all of this type, top and sides of bill dusky, its tip pale, lores pale grayish and with a slight "eye-ring" expression, tip of bill and soles of feet varying yellowish, yellower in two than in the other two. Three out of four young birds in the trap together on June 20th and three out of five taken on June 21, 1934, were of this type. One of the former with sides of bill particularly dark had its tip whitish. One of the latter was a dark bird with smoky head and breast contrasting with whitish belly, and another had the dusky area on sides of bill restricted. The two other birds on June 21st had gray upper and yellowish lower mandibles placing them in type A, one with very yellow lower mandible and soles of feet also yellowish. There is doubtless a correlation between color of mandible and soles of feet, but birds of type A with yellowish mandibles certainly do not always, and probably do not usually, have yellowish soles of feet. Such type-A birds are pretty surely connected by intermediate stages with type C.

The bunching of birds of types B and C in time lends plausibility to the hypothesis that each type represents a strain of relationship and is shared by brood-mates. With this hypothesis in mind let us suppose five young birds taken August 1st and 2d, 1934, to have been brood mates. All are more or less aberrant; they conform to no type and have but one, not very notable variant character running through all five—gray lores and a well marked pale post-ocular band—yet each shows resemblances to some other probably more than if it were taken at random. Is this to be interpreted as an exceptional heterozygous brood? The birds are: F113967, F113968, F113970, F113971, F113972. The most striking aberrant character, a dark breast contrasting with whitish belly, is noted in three—F113968, F113970, F113972. Two have type-C bill, but no yellowish on soles of feet, F113971 and F113972; neither has F113967 (a type-A bird with yellowish lower mandible) yellowish soles of feet. F113970 has a pale lower mandible, a trace of yellowish on base of bill which is almost unique in so young a bird, and a dusky chin; F113972 has a pale chin.

Two particularly aberrant birds examined are unique, though each is easily assignable to a type. The first of type A foreshadows the male plumage in that of the juvenal. It had a throat-patch quite

dusky and rather sharply defined, even spreading a little on breast; cheeks whitish; crown and a line back from eye dark with a conspicuous whitish mark above it, the latter passing backward into a broader short buffy band; no pale streak before eye; lower mandible particularly yellow. A type-C bird of August 23, 1934, had upper mandible and sides of lower mandible gray, lower mandible and tip of upper whitish; soles of feet somewhat yellowish; breast dark, throat a little paler, belly abruptly whitish, top and sides of head including lores dark with a small gray spot behind the nostrils.

The aberrant type-A bird foreshadowing the male plumage may be called a juvenal with 'progressive plumage,' but other variants do not seem to fall into the 'progressive' or 'retarded' plumage explanation (Mayr, 1933, *Amer. Mus. Novitates*, No. 666). They suggest several potential more or less complete and unlike patterns in House Sparrow heredity which crop out in young birds, less standardized than adults. Strangely enough, I find a white streak from eye to bill, obviously homologous with that in type-B birds, in normal males of *Passer jagoensis* from the Cape Verde Islands and its race *rufocinctus* of the South and East African mainland (specimens in the American Museum of Natural History).

#### ACQUISITION OF MALE PLUMAGE

Two birds banded as juvenals on July 6th and August 21st were retaken in male plumage on the October 21st and October 25th following. A third, thought to be an adult female when banded on August 14th was retaken as a male the following April 5th.

Six birds molting into male from juvenal plumage are noted from August 2d to September 27th. The chestnut shoulders seem to be the first conspicuously male plumage to appear (August 2d and 17th and September 2d); black feathers come in on the breast early. A bird on August 29th was in active molt with unequal tail, chestnut shoulders, black blotch on breast, and some male plumage about head. The black breast feathers are at first unveiled and into October one sees young males as conspicuously unlike more advanced birds in the black breast patch which may approach in completeness that of the summer adult, as in their juvenal plumage which persists elsewhere. By or before November 1st the molt seems to be completed and young and old are indistinguishable.

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