

## THE ANNUAL POST-NUPTIAL MOLT IN THE WHEATEAR (*Oenanthe oenanthe*)

BY KENNETH WILLIAMSON

In those migratory passerines which undergo a complete post-nuptial molt the change proceeds with greater rapidity than in sedentary species, an adaptation to the need to assume a full set of remiges and rectrices in time for the fall migration. The Wheatear (*Oenanthe oenanthe*) affords an excellent example. It is a common summer visitor to Fair Isle<sup>1</sup>, where it is single-brooded between the middle of May and early July, though a few late pairs may still be attending young at the beginning of August. The young of the year, which molt only the juvenal contour-feathers and median coverts (sometimes also a few lesser and inner major coverts) when from 5-8 weeks old, leave from the middle of August, the adult birds following at the end of the month and in early September. The first week of September is the peak-period for passage of larger birds which have nested in Greenland and Iceland, *Oenanthe oe. leucorhoa* and *schipleri*. The data on which this note is based have been collected during laboratory examination of local birds trapped at Fair Isle Bird Observatory over the past 8 years, and incorporate observations on some 80 individuals, a few of which have been captured on more than one occasion during the period of the molt.

The molt commences about the time the young leave the nest, during the last week of June, and before they achieve independence of their parents in the second week of July. Some birds have already finished by mid-August. A ♀ "A 62.580" which had just started on June 29, 1956 had to all intents and purposes finished by August 17, the ninth primary and innermost secondaries being a little short of their full length. The period occupied by the change is therefore of the order of 7-8 weeks.

The sequence of the molt is the same as in other ten-primaried oscines studied at Fair Isle<sup>2</sup>, beginning with the innermost primary and its covert, the change proceeding outwards<sup>3</sup>. The tertiaries (which Witherby *et al.* (1941) call the "long innermost secondaries," but which molt as a distinct group and should be separately identified) and the mid-wing coverts are the next in turn. Here the outermost greater or major coverts are a little ahead of the inner ones as a rule; they are succeeded by the lesser or minor coverts, and finally the median group. The replacement of each primary covert is linked with that of the corresponding remex. In many the under wing-coverts are still in sheath when the uppers have finished and the wing-molt is far advanced.

When the replacement of primaries is well under way, molt of the secondaries begins—also in mid-wing, the succession being inwards towards the renewed tertiaries. The bastard-wing (alula) and short tenth primary are replaced during the growth of the ninth primary,

<sup>1</sup>Fair Isle is at Latitude 59 32' N., Longitude 1 37' W., off northern Scotland midway between the island-groups of Orkney and Shetland.

and these are normally complete before the innermost secondaries are fully extended. The tail-molt commences early, together with upper and under tail-coverts, shortly after the innermost primaries have begun. Completion of the tailmolt occupies 3-4 weeks: a ♀ without any tail on July 25, but with the new feathers in pin, had a full tail by August 17; and a ♂ with the tail in pin on August 6 had it very nearly complete (51 mm.) on August 28. Body molt also begins early, usually with the sides of breast and rump, closely followed by scapulars, mantle, flanks, the remainder of the under-parts and head.

In the Starling, which is non-migratory in the Shetland region (though some local movement occurs), it seems to be the rule for the remiges to grow singly, so that one is fairly well developed before the next in succession leaves its sheath. In the Wheatear it is customary for the primaries to be renewed two or even three together, especially in the early stages, so that the whole process is greatly accelerated, and is complete in half the time. A 1st-summer ♂ of July 8 had already renewed primaries 1-4, the fifth was protruding from its sheath and the old sixth had been shed; a ♀ on July 9 had the five innermost primaries growing; and a 1st-summer ♂ of the same date had the four innermost in the left wing and the five innermost in the right wing all partly extended. The birds of July 8 and 9 and a number of others at a similar stage had the whole tail in pin, none of the old feathers remaining—examples can be found on reference to Tables I and II.

Naturally, such severe molt interferes with the birds' capacity for sustained flight, and doubtless renders them more liable to predation. Indeed, one is aware of but little activity on the part of adults at this critical period, and the fact that more are caught in the traps sited along the dry-stone walls at this time than earlier in the summer suggests that they keep very much to cover and are less sprightly in avoiding capture. The history of ♀ "A62.580," who was recaptured 9 times between June 29 and August 17, always in the same trap, shows that adults remain on their territories during the period of the molt. Other adults, ♂ and ♀, have been taken twice or thrice over much the same period under similar circumstances.

It would be reasonable to suppose that a rapid physiological process of this nature puts a severe strain on the bird, particularly as it must restrict the normal feeding routine to some extent. Yet there is little evidence of the marked decrease in weight which one might expect to accompany this process, especially during the early period of heavy molt. Such data as we have been able to gather suggest the probability of a gain on "normal" weight before the onset of molt, maintained during this first exacting fortnight, with a slight fall later. Repeat weighings of various individuals gives these results. A ♂ at 25.7 gm. when in molt on July 19 was 2 gm. heavier than in the evening of May 26, a time of day when optimum weight is attained; and a ♀

<sup>2</sup>Starling (*Sturnus vulgaris*), Meadow Pipit (*Anthus pratensis*), Rock Pipit (*A. spinoletta*), Twite (*Carduelis flavirostris*) and House Sparrow (*Passer domesticus*).

<sup>3</sup>The American notation, in which the first primary is the innermost and the tenth (if present) is the minute outer feather, is therefore the more logical, and it is adhered to in the present paper.

at 24.6 gm. in the early morning of July 25 was 2 gm. better than in mid-afternoon of May 29. Another ♂, only 22.8 gm. in mid-morning of June 4, was 2.6 gm. heavier when in molt at 0415 hrs. on July 13. Less conclusive is a ♀ whose early morning weight of 24.8 gm. on July 16 was a fraction (0.3 gm.) below a mid-day figure for April 28—though if due allowance is made for diurnal variation, this may well represent a real gain. Her mid-morning weight on August 24, with the molt over, was 25.3 gm.

The only long series of weighings is for ♀ "A62.580," who was 30 gm. (a high value for a Fair Isle Wheatear) in mid-morning of June 30 with the change just begun; 29.6 gm. and 28.8 gm. in mid-afternoon of July 14 and 15 respectively; 26.9 gm. in the early morning of July 25; and 26.7 gm. in mid-morning of August 17 with the molt virtually over. A ♂ showed a similar fall from 27.1 gm. on July 11 to 24.5 gm. on August 23, both weighings late in the day. This same bird had shown virtually no change between July 2 and August 3 in the previous year, 1955.

In addition to losing the whole tail and several remiges at once early in the proceedings, it appears to be fairly general in the Wheatear for at least the three innermost secondaries (and sometimes all these feathers) to be dropped at a later stage. Thus, a ♂ on August 3 had a new first secondary and the remaining five partly extended or in pin, while another on this date was without a single secondary in either wing. This condition occasionally leads to an irregular sequence in the development of the new feathers. Most of the records available for the third week of July show completion of the growth of primaries 1-5, following which the birds' incapacity for sustained flight may be less, since it appears to be usual for the remaining four functional primaries to grow in pairs, so that the sixth and seventh are about half-grown when the eighth and ninth emerge from their sheaths.

A curious fact is that at this stage the wing-length increases noticeably. This is due presumably to the loosening of the old eighth and ninth primaries before they finally drop away. Our ♀ "A62.580," starting molt with a wing of 100 mm. at the end of June, gradually increased to 103 mm. on July 20, when the inner primaries were fully grown. At the next examination on July 23 the old distal remiges had fallen out and the wing-length, 86 mm., was that of the fifth primary. When taken again 25 days later, with the eighth primary fully grown, the wing-length was again 100 mm. In two days, July 23-25, the seventh primary increased its length by 9 mm. and the longer sixth by only 6 mm., suggesting that growth may be most rapid just after protrusion from the sheath. During the 9 days August 19-28 ♀ "JB 582" extended the ninth primary from the sheath to half its length and the eighth to about three-quarters, whilst the second and third secondaries practically completed their growth.

Molt of the tail is often irregular, sometimes the outermost and sometimes the middle pair taking precedence; once, on August 7, we have "outers half-grown, penultimate pair three-quarters, the rest new"; and once, on August 4, "outers and 2 middle feathers old, rest missing." Molt of the remiges is very rarely asynchronous, but there is a ♀ of





July 16 with primaries 1-5 in sheath in the right wing, and with 4-5 only in pin, 3 half-grown, and 1-2 practically finished in the right. The most striking instance was a 1st-summer ♂ on May 18 with primaries 6-7, all secondaries and the third greater covert new in the left wing and the inner greater coverts missing from the right, and median and lesser coverts new in both wings. This is the only instance of irregular spring molt in over 300 birds examined.

I have no note of the short tenth primary and alula in molt prior to August 1; being a minute feather, the tenth primary is nearly always complete before the ninth, and this and the alula have often finished when secondaries 5-7 are still half-grown. A ♂ with the tenth primary in pin on August 1 had this feather fully extended on August 4; the bastard-wing, partly extended on the first occasion, was by then complete. From August 17 and 18 we have occasionally trapped adults in which the change was complete, and most have finished by the end of the month. The very late records are almost certainly individuals which, through loss of an early clutch, have nested a second time. A ♂ which up to a week previously had attended flying young in the vicinity of one of the traps was caught on August 23 with the old primaries 7-10 remaining, the sixth in pin, and 1-5 not more than half-grown, a stage most birds have passed a month before. The tail was little more than half grown. One of the juveniles of this family, captured on August 29, had the body-molt only just begun on mantle, scapulars, sides of breast and flanks. By that date most of the year's birds have left the isle.

Occasionally birds on passage from farther north-west (Faeroe Islands, Iceland, Greenland) show signs of uncompleted molt, but this is normally confined to the ninth primary and innermost secondaries being a few millimeters short of their full length.

A final comment might be made on the severity of the molt in its early stages. It is highly improbable that birds in the condition described for early July could find an adequate supply of food for themselves and several nestlings or non-independent juveniles (which are attended for about 10 days after leaving the nest); and, as suggested above, it is probable that the onset is deferred until breeding is at an end. Nevertheless, the bird must have 7 or 8 clear weeks in which to prepare for the fall migration. The severity of wing and tail molt, combined with the lateness of the breeding season at Fair Isle and farther north, restricts the Wheatear to a single brood. Witherby *et al.* (1941) state that the species is double-brooded in Shetland as in parts of England, but the Venables (1955) and our own observations over the past 6 years show that this is not so. Furthermore, Witherby gives "double-brooded" for the Greenland race *leucorrhoa*, and Salomonsen (1951) quotes Fencker to the effect that a second brood can probably be reared in very mild years under ideal conditions. Nicholson (1930) in Greenland and Wynne-Edwards (1952) in Baffin Island have also suggested that *leucorrhoa* can be double-brooded. That any can breed twice, successfully, in the one season seems to me an exceedingly remote possibility; and there is nothing in the cases these authors give of presumed first-brood juveniles assisting to feed "second-brood" nestlings which is inconsistent with the more likely alternative that independent juveniles, attracted out of curiosity, were taking a sporadic part in

"helping" a late-nesting pair. Nicholson's paper lays stress on their inquisitiveness, and at Fair Isle we have watched young Wheatears showing keen interest in a nestful of Twites; the fact that in his case the "helpers" were in different stages of molt to first-winter plumage, and thus almost certainly of different ages, supports this alternative.

#### SUMMARY

The progress of the complete post-nuptial molt in the Wheatear (*Oenanthe oenanthe*) is described from examination of over 80 specimens trapped at Fair Isle Bird Observatory.

Molt commences in late June, unless delayed by late nesting, and occupies 7-8 weeks, finishing in the third week of August.

Juveniles molt the contour feathers, median and occasionally some greater and lesser coverts when between 5-8 weeks old.

Wing and tail molt are very severe in the early stages, and the birds inactive. The few weight records from "repeat" trappings suggest a gain on normal weight at the onset and a slight loss towards the end of the period.

The severity of wing and tail molt restricts the Wheatear to a single brood at Fair Isle and farther north (Faeroe Islands, Iceland, Greenland).

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## SOME TUFTED TITMOUSE LIFE HISTORY

BY AMELIA R. LASKEY

The Tufted Titmouse (*Parus bicolor*) is a common permanent resident in Tennessee, particularly in wooded areas. They are regular visitors at feeding stations in many residence sections of Nashville from early autumn until spring if sunflower seeds, nutmeats, peanut butter or suet are provided. Most of them go to the woods in spring to nest. They often return to my home banding station in May, June or July, bringing their nearly mature fledglings.

#### AGE

From 1931 to 1956, I have banding records for 327 individuals at my home and substations in the south-western section of Nashville. As this species enters banding traps rather freely, it is possible to gather