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MOLT AND WEIGHT OF SOME LAND-BIRDS ON DOMINICA, WEST INDIES

By R. P. Prŷs-Jones

Documentation of the basic biology of even the common land-birds in many parts of the West Indies is largely lacking, and comparative studies of annual cycles and weight fluctuations have been published only for the large islands of Jamaica and Trinidad (Diamond 1974, Snow and Snow 1963, 1964). The aim of this paper is to contribute towards filling this void by providing information on the molt and weights of a number of species on Dominica, obtained during 1978. Studies of molt have particular value in delimiting the annual cycles of tropical and subtropical land-birds, as molt tends to occur at a more or less fixed time each year; by contrast, timing of breeding frequently varies greatly among years in relation to unpredictable environmental factors, and may show regularity only in that for most passerines it ceases during the period of molt (Snow and Snow 1964, Snow 1976).

STUDY AREA AND METHODS

I was present on Dominica from 27 June until 10 August 1978, being based at the Bayac Estate at an altitude of just over 500 m off the Roseau-Laudat road on the west side of the island. All mist-netting was conducted there although additional field observations were made elsewhere. Mist nets were erected in an area of fruit orchards and garden surrounded by extensive secondary forest. Netting was concentrated in 3 periods: between 4 and 12 July (referred to below as "early July"), on 30 July ("late July"), and on 6 and 7 August ("early August"). A breakdown by species of the 222 individuals caught during the study is given in Table 1. All except the swifts were colormarked prior to release; only 7 birds were recaptured (3 Bananaquits, 3 Bullfinches, 1 Grassquit).

The following data were recorded from netted birds: (1) Weight—using a Pesola balance accurate to .1 g; (2) Wing length—maximum chord method (Spencer 1972); (3) Presence of a brood patch—either old or new; (4) Molt—remex, rectrix, and body; (5) Visible fat—in furculum and on abdomen.

Remex and rectrix molt were recorded according to the system used by Evans (1966), in which each feather is scored on a scale from 0 to 5. In general only the right wing of each bird was examined as remex molt was normally symmetrical; total primary scores throughout the paper are based on the right wing alone. Except where otherwise stated, the sequence of feather molt within the primaries, secondaries, and rectrices followed the typical passerine pattern, i.e., primaries, together with their corresponding coverts, were molted from the inside outwards (descendantly), the secondaries (not including tertials) ascendantly, and the rectrices, centrifugally (although odd tail feathers were often lost out of sequence).

TABLE 1. Species breakdown and mensural data for birds caught at Bayac Estate, Dominica.

Species	No. of individuals	% of total	Wing length mm	Weight g
Lesser Antillean Swift (*Chaetura martinica*)	6	3	112.5 ± 1.76	12.7 ± 1.15
Purple-throated Carib (*Eulampis jugularis*)	30	14	76.9 ± 2.77	8.8 ± 1.34
Green-throated Carib (*Sericotes holosericeus*)	18	8	63.5 ± 2.29	6.2 ± 0.85
Antillean Crested Hummingbird (*Orthorhyncus cristatus*)	5	2	50.9 ± 1.24	3.0 ± 0.26
Stolid Flycatcher (*Myiarchus stolidus*)	1	<1	83	21.3
Caribbean Elaenia (*Elaenia martinica*)	24	11	81.8 ± 3.09	21.3 ± 2.13
Scaly-breasted Thrasher (*Margarops fuscus*)	3	1	120.0 ± 1.73	67.3 ± 9.34
Yellow Warbler (*Dendroica petechia*)	1	<1	58	8.9
Bananaquit (*Coereba flaveola*)	39	18	60.6 ± 3.18	11.1 ± 1.10
Lesser Antillean Bullfinch (*Loxigilla noctis*)	81	36	72.4 ± 2.66	18.4 ± 1.57
Black-faced Grassquit (*Tiaris bicolor*)	14	6	53.0 ± 1.11	10.2 ± 0.64
Total:	222			

Visible fat was classified following the system of Helms and Drury (1960), with slight modification aimed at easier standardization. The overall fat score for any individual was obtained by adding the fat classes for furculum and abdomen, giving a minimum score of 0 and a maximum of 10.

Sample sizes vary as not all information was obtained from every individual; for the hummingbirds, only weight and wing length were noted on a systematic basis. Means are given ± one standard deviation. Scientific names of all species caught are given in Table 1.

RESULTS

1. Bananaquit

Adult molt.—Only a single adult from 10 caught in early July had initiated primary replacement, but 89% had begun by late July (n = 9, median primary score = 17), and 100% by early August (n = 3, median primary score = 25). Assuming a constant rate of molt, extrapolation of the data suggested that the first birds would have finished their primary molt during the second half of August, although others would have

continued into September. An individual which had yet to begin molt on 10 July was recaptured with a primary score of 18 on 30 July, indicating that complete replacement of an individual's primaries may be possible within 50 days. Individuals in mid-molt had an average of 3.0 ± .58 primaries growing at one time (n = 7).

Onset of molt in the tertials preceded that of the secondaries, beginning at around the same time as the primary molt and being completed when the primary score had reached 20. Except for the 1st secondary, which was shed at about primary score 15, molt of the secondaries followed that of the tertials. Tail molt began when primary molt was half complete, and growth of new feathers in both the tail and the secondaries would appear to have been completed concurrently with that of the primaries. Onset of molt in the greater coverts coincided with that of the primaries, and the growth of new feathers was completed by primary score 20. Alula replacement occurred during the second half of primary molt. Renewal of body feathers began on the head prior to the loss of the 1st primary, and continued throughout the primary molt.

Juvenile molt.—All juveniles caught showed some body molt, but only limited evidence of other molt was found. Four individuals, all caught in late July/early August, were renewing their greater coverts. More surprisingly, 2 individuals were undergoing remex molt, although 1 of these, caught in early July, had merely lost its 1st primary. The other, caught in late July, had completed replacement of its first 3 primaries, and had lost the 4th; however, all other primaries, secondaries, and tertials remained unmolted so the remex molt departed from the adult pattern.

Weight.—Weights of Bananaquits varied considerably, with extremes of 8.2 and 13.2 g. Differences among individuals in both size and body condition might be predicted to contribute to this variation. Considering size first, wing length alone "explains" 40% of the observed variation in weight (Fig. 1). Adults were both significantly larger and heavier than juveniles, but the correlation between wing length and weight is also significant for juveniles considered alone ($r = .56$, n = 20, $P \approx .01$) and approaches significance for adults ($r = .45$, n = 18, $.05 < P < .1$). When the relationship with wing length is excluded, there is a further significant partial correlation between weight and fat score ($r = .54$, n = 35, $P \approx 0.001$), indicating that among birds of equal size, those of greater weight tended to be carrying more fat. Median fat score of birds examined was 6/7 (range = 3–9, n = 36).

Juvenile Bananaquits increased significantly in weight during the course of the study ($r = .49$, n = 21, $P < .05$). This increase appears to have reflected increased fat deposition, as fat score showed a similar correlation with day of capture ($r = .63$, n = 19, $P < .01$). Adults showed no evidence of significant weight change during the study in relation to either day of capture or primary score.

Other information.—Sexing of Bananaquits on plumage characteristics was not possible, but it is known that males tend to have longer wings

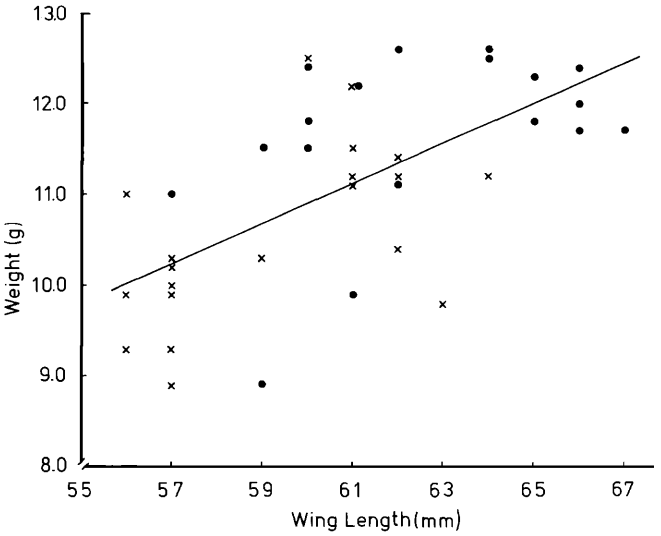

FIGURE 1. Relationship between weight and wing length among Bananaquits. × = juveniles, ● = adults. Line shows overall regression ($y = .216x - 2.02$, $r = .63$, $n = 38$, $P < .001$).

than females (Diamond 1973). Among adults caught in the present study, 89% of those with wing lengths less than the median of 62 mm had obvious signs of a brood patch, as opposed to none of those with wing lengths equal to or greater than the median. The adult : juvenile ratio of individuals caught implies that each pair had produced 2.1 independent young during the preceding breeding season, assuming that all adults breed in their first year and that mist-netting sampled adults and juveniles equally efficiently.

2. Lesser Antillean Bullfinch

Molt of full-grown birds.—Adult male bullfinches have a predominantly black plumage, very different from the brown plumage of females, but do not obtain this distinctive coloring until their 2nd year of life. Three groups of full-grown birds could thus be distinguished: adult males, immature males, and females. The progress of primary molt in all these groups is shown in Fig. 2. The most extensive and homogeneous data are those referring to the adult males, for which a regression of primary score on day of capture gives a mean duration of primary molt in the population of 89 ± 4.2 days, beginning in the second half of June and extending until mid-September. No adult males were retrapped during the study, but an estimate of 60 days for the average duration of molt in an individual was calculated by regressing day of capture on primary score (cf. Pimm 1976). Only 3 immature males, molting from brown to

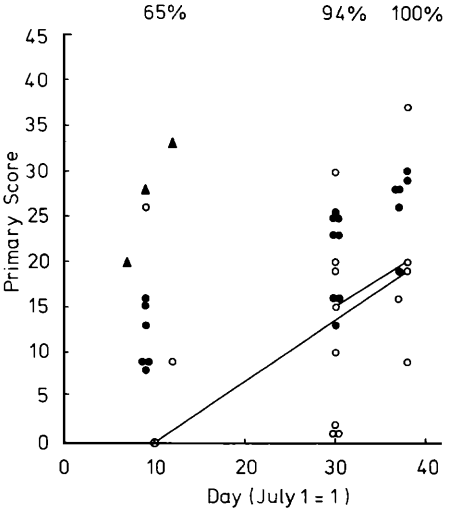

FIGURE 2. Relationship between primary score and day of capture among full-grown Lesser Antillean Bullfinches. ▲ = immature males, ● = adult males, ○ = females. Only birds in which primary molt had begun are shown, except that retrapped individuals have each capture joined by a line. Percentages show the proportions of all full-grown birds captured in early July, late July, and early August which had begun primary molt.

black plumage, were caught, and the primary molt of all these was 2 to 3 weeks in advance of the adult males. The timing of primary molt in the female population resembled that of the adult males but, possibly because 1st year and adult females could not be separated, showed greater variability among individuals. Extrapolation from data on the 2 retrapped birds suggested that individual females resembled adult males in having a primary molt lasting ca 60 days. Bullfinches in mid-molt had 2.7 ± .69 primaries growing together, with no significant differences among the 3 groups of birds.

The timing of secondary, tertial, and rectrix molt relative to primary molt closely resembled that described for the Bananaquit, and the same was also true for molt of the greater coverts, alula, and body feathers.

Juvenile molt.—Molt in juveniles was almost entirely confined to the body feathers and greater coverts. All but 1 of 34 examined showed signs of body molt, and 10 were replacing some or all of their greater coverts. Signs of molt in the remiges and rectrices were limited to 5 individuals which were each replacing tertial feathers, and 1 which was growing new central rectrices.

Weight.—Wing length "explained" 29% of the variation in Bullfinch weights ($r = .54$, $n = 77$, $P < .001$). This relationship between wing length and weight was also significant for both juveniles and full-grown

birds considered independently, but the full-grown birds averaged ca 1 g heavier than juveniles of the same wing length (Fig. 3). Weight was not correlated significantly with fat score in full-grown birds, juveniles, or the combined data; overall, juveniles had a median fat score of 4 (range = 3–6, n = 24), higher than that of the full-grown birds (median = 3, range = 2–5, n = 30) despite their lower mean weight. There was no significant correlation between weight and day of capture in either juveniles or full-grown birds, or between weight and primary score in full-grown birds.

Other information.—During the study 36 juveniles and 45 full-grown birds were caught, giving a ratio of 1.6 juveniles for every 2 older individuals. However, assuming that mist-netting gives an accurate idea of population structure, the actual number of independent young produced by each breeding pair must have exceeded this figure, as immature males presumably do not breed. Whether all females breed is unknown; brood patches were noted only on 71% of females, but this evidence is inconclusive as those birds lacking brood patches were also the most advanced in their molt. All males lacked brood patches.

3. Other Species

Data on the mean weights and wing lengths of all other species caught at the Bayac Estate are listed in Table 1.

Lesser Antillean Swift.—None of 3 individuals caught in early July showed any evidence of molt, whereas all 3 caught in late July had molted their inner 1 or 2 primaries.

Hummingbirds.—An unquantified proportion of both the Purple-throated and Green-throated caribs were engaged in primary molt. All 5 Antillean Crested Hummingbirds (all adult males) were likewise molting their primaries, as was a single female Blue-headed Hummingbird (*Cyanophaia bicolor*) trapped at Freshwater Lake (altitude ca 850 m).

Caribbean Elaenia.—Primary molt was just beginning in early July. The highest primary score of any individual handled was 15, and none had begun molting its secondaries or rectrices by the first week of August. Weights of all but 1 of the 24 birds netted were between 18.3 and 24.0 g; the exception weighed 28.5 g, and also had a fat score of 8, far greater than the median of 3 (range = 1–4, n = 19) recorded for other individuals examined.

Scaly-breasted Thrasher.—Two adults, both caught in early August, were well advanced in their molt, having primary scores of 35 and 39 respectively. Their weights (71.8 and 73.6 g) greatly exceeded that of the 1 juvenile netted (56.6 g).

Black-faced Grassquit.—Of 14 grassquits caught, all were molting their body feathers and 13 were also replacing their remiges. Their molt diverged in a number of respects from that noted in the other species. Tertials were replaced sooner relative to primaries, the 6th secondary was replaced at about the same time as the 1st secondary, and there was no discernible pattern in the order of rectrix replacement. Most notable,

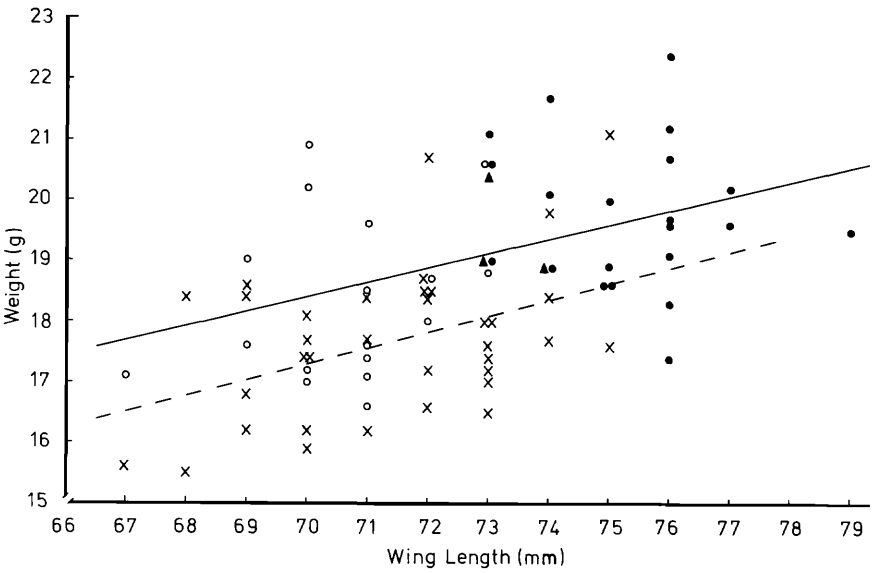

FIGURE 3. Relationship between weight and wing length among Lesser Antillean Bullfinches. × = juveniles, ▲ = immature males, ● = adult males, ○ = females. Uninterrupted line shows regression of weight on wing length for full-grown birds ($y = .232x + 2.17$, $r = .44$, $n = 42$, $P < .01$). Dashed line shows regression of weight on wing length for juveniles ($y = .264x - 1.18$, $r = .43$, $n = 35$, $P \approx .01$).

however, was the unusual progression of primary molt exhibited by 3 individuals (Table 2). For 2 of these (nos. 2 and 3) the pattern is consistent with the occurrence of a previously interrupted molt, but the remex molt of bird no. 1, both of whose wings were inspected, defies any simple explanation.

DISCUSSION

Molt and the annual cycle.—The information presented above shows that the Bananaquit and Lesser Antillean Bullfinch each had a relatively synchronized molt, beginning in June/July and extending until at least September. A similar timing of molt was also indicated for the other species examined, and may well be general among the smaller landbirds on Dominica. During our stay on the island, the only evidences of breeding that I or my colleagues found were single active nests of the Gray Kingbird (*Tyrannus dominicensis*) and the House Wren (*Troglodytes aedon*). However, we noted family parties of the Gray Kingbird, Caribbean Elaenia, Scaly-breasted Thrasher, Rufous-throated Solitaire (*Myadestes genibarbis*), Bananaquit, Carib Grackle (*Quiscalus lugubris*), Black-faced Grassquit, and Streaked Saltator (*Saltator albicollis*), indicating that many species had bred during the immediately preceding months. This is further corroborated by a review of available literature which shows

TABLE 2. Aberrant remex molt in 3 Black-faced Grassquits caught in early August on Dominica.

Bird no.	Distal edge of wing: Primaries	Proximal edge of wing: Secondaries	Proximal edge of wing: Tertials
1	5 5 5 5 0 0 0 0 5 0 1 4 0 0 1 5 5 5	5 0 0 0 0 5 5 5 5 5 5 5	4 5 5 left wing 4 0 0 right wing
2	0 0 0 0 2 5 0 0 0	0 0 0 0 0 0	5 5 5 right wing
3	0 0 0 0 3 4 2 0 0	0 0 0 0 0 4	5 5 5 right wing

that the great majority of land-birds on Dominica appear to be seasonal breeders, with peak nesting occurring between March and June (Prŷs-Jones 1982). The Black-faced Grassquit may be exceptional in that, although the great majority of the population was molting in July and early August, the evidence of interrupted molt in a few individuals may imply that breeding and molt in this species are to some extent opportunistic.

The results of this study may usefully be compared with those of Diamond (1974) for land-birds on Jamaica, where many of the genera, and some species, are the same as those found on Dominica. In particular, the Bananaquit and Black-faced Grassquit occur on both islands, and the Lesser Antillean Bullfinch and Caribbean Elaenia are replaced on Jamaica by counterparts, the Greater Antillean Bullfinch (*Loxigilla violacea*) and the Greater Antillean Elaenia (*Elaenia fallax*) respectively. On both islands the climate is generally similar, with temperatures remaining high throughout the year, and rainfall on average greatest from July to November on Dominica (Wolf and Wolf 1971) and August to November on Jamaica (Diamond 1974).

Overall the pattern of breeding and molt on the 2 islands appears similar, with breeding occurring largely during the drier first half of the year, and molt taking place during the period of heaviest rainfall. However, there is evidence that molt within populations of particular species/genera is less synchronized on Jamaica than on Dominica. Among full-grown Greater Antillean Bullfinches, Diamond found that a maximum of ca 50% of the population was in primary molt during the peak month of August, whereas in late July and early August 96% of Lesser Antillean Bullfinches were replacing their primaries (Fig. 2). The duration of primary molt in individual Lesser Antillean Bullfinches (ca 60 days) is less than that in Greater Antillean Bullfinches (ca 70 days), and the number of primaries growing at one time averages greater in the Lesser Antillean species (mean = 2.7) as Diamond states that few individuals on Jamaica had more than 2 primaries growing at once. Unfortunately, direct comparisons of the progress of molt by age or sex are precluded as adult female plumage resembles that of adult males in

the Greater Antillean Bullfinch, resulting in different groupings of data in the 2 studies.

Among Bananaquits, the progress of primary molt in individuals is similarly rapid (50–55 days) on both Dominica and Jamaica, but the mean duration of molt in the Jamaican population (ca 7 months) is over twice that on Dominica. Much of this difference may be a consequence of interrupted molt, which appears to be more widespread in Jamaica than in Dominica; considering the 4 species pairs mentioned above, evidence of interrupted molt has been found for 3 (all except Bullfinch) on Jamaica but only for 1 (Grassquit) on Dominica. Caution is necessary in drawing conclusions from the limited data available, but the combination of reduced synchrony of molt with a higher incidence of interrupted molt may indicate that the Jamaican environment requires a more opportunistic breeding strategy than is appropriate on Dominica.

Weight and fat.—Weight changes among Bananaquits on Dominica were a sensitive indicator of variations in the fat carried by different individuals, once size differences had been allowed for, but this was not true for Lesser Antillean Bullfinches. The higher median fat score of Bananaquits relative to other species on Dominica parallels the situation found by Diamond (1974) on Jamaica. As fat scores of smaller passerines tend to be highly correlated with their true fat content expressed as a percentage of body weight (Diamond 1974), this suggests that the lifestyle of Bananaquits is such as to require a relatively greater short-term energy store than that needed by other small passerines which share their environment.

Distribution and abundance.—The only quantitative published information on the distribution and relative abundance of birds on Dominica of which I am aware is that of Lack (1976, appendix 4), derived from line transects, and that of Terborgh et al. (1978) and the present study (Table 1), derived from mist-netting. All these studies were of very limited duration, and the results obtained suffer from the inevitable biases inherent in the techniques used. In view of this paucity of information, the restrictive classification by habitat of certain species by Terborgh et al. seems unwarranted, especially where such assignations conflict with what data are available. Thus the Green-throated Carib, Antillean Crested Hummingbird, and Gray Kingbird, classified as "coastal scrub" species, may all be found in most areas outside of dense forest, and the Green-throated Carib overlaps widely with its "montane forest" counterpart, the Purple-throated Carib. Even more strikingly, the Caribbean Elaenia is classified as an "exclusively coastal scrub" species on Dominica by Terborgh et al. (1978, Table 4), whereas I and my colleagues found it to be common over much of the island, and the data of Lack (1976) indicate that it reaches peak abundance in montane thicket. Comparative study of available records reveals gross disagreement among workers on the distribution and/or abundance of certain species (e.g., the Stolid Flycatcher and the Lesser Antillean Pewee, *Contopus latirostris*),

and it seems possible that seasonal habitat shifts (e.g., for the Red-legged Thrush, *Mimocichla plumbea*), year-to-year changes in abundance, and even partial migration may pose further complications (Prŷs-Jones 1982). Detailed long-term studies are required to ascertain the distribution and ecology of the species present on Dominica before any firm conclusions can be drawn regarding the way in which competitive interactions may have shaped such distributional patterns as exist.

SUMMARY

Data are presented on land-birds mist-netted in a cultivated area (altitude ca 500 m) on the west side of Dominica during July and August 1978. The progress of molt and the relationship of weight with size and fat condition are analysed in detail for the 2 most frequently captured species, the Bananaquit and the Lesser Antillean Bullfinch. Results indicate a relatively synchronized molt, beginning in June/July and extending until at least September, and this may be general for most small land-birds on the island. Caution in classifying species by habitat is suggested as distributional patterns are imperfectly understood.

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NOTES AND NEWS

In memoriam: Leon Hugh Kelso.—Leon Kelso was born in Gretna, Kansas on 4 September 1907 and passed away in Arlington, Virginia on 9 May 1982. He received a baccalaureate degree in biology (botany major) from the University of Denver on 7 June 1929 and a Master of Science from Cornell University in September 1938. Throughout his life Leon was deeply interested in owls. He published extensively on owls and named the Bare-shanked Screech Owl (*Otus clarkii*) after a Brethren minister who lived in Gretna, Kansas. The Reverend Clark befriended Leon and turned his interest towards birds by loaning him a Reed Bird Guide. Leon was a member of the Wilson Ornithological Society since 1930 and in 1978 became the first Honorary Member to be elected to the Northeastern Bird-Banding Association, an honor bestowed upon Leon for his outstanding contributions to the Recent Literature section of *Bird-Banding*. A quick count shows that in 17 years he published over 900 reviews, many of them from Russian ornithology. He was an important connection between American and Russian ornithology and as such will certainly be missed.