MOLT OF FLIGHT AND TAIL FEATHERS OF THE LEAST SANDPIPER IN SURINAM, SOUTH AMERICA

By Arie L. Spaans

This paper deals with the remige and rectrix molt of the Least Sandpiper (*Calidris minutilla*) in Surinam, northeastern South America. Although I examined a small number of birds, my data show that the timing and the duration of the Least Sandpiper's flight feather molt in Surinam differ from that described by Page (1974) for the species in California.

In Surinam the Least Sandpiper is a numerous migrant and wintering bird that occurs in peak numbers from mid-August to early May. The first fall migrants arrive in mid-July and the last spring migrants leave by mid-June. Throughout the northern breeding season the species is present in small numbers (Spaans, in prep.).

The first influx of fall migrants consists of adults only. Immatures were not recorded until the last 10 days in August when they made up 20% of the 25 birds trapped. Ten birds netted during the first 10 days of August were all adults. In September, October-November, and December, the percentages of immature birds were 44%, 56%, and 33% respectively for equal catches of nine birds.

MATERIALS AND METHODS

The study is based on 88 birds (of which 6 were examined twice) mist-netted in the afternoon in a coastal mangrove swamp ca 10 km northwest of Paramaribo between December 1970 and March 1973, and three specimens collected near Wageningen and Nickerie in western Surinam in December 1971 and November 1972. Birds were processed as soon as possible after capture. They were aged on the basis of the abrasion of the flight and tail feathers. From August to December a bird with heavy abraded feathers was classified as adult, one with feathers not or little abraded as immature. After December this method was unreliable and the age of all birds, except retrapped ones originally banded prior to January, was recorded as unknown. In this paper immature describes birds in their first year of life and adult birds at least one year old. Bill lengths (from tip to the point where the feathers meet the upper mandible) were measured to the nearest 0.1 mm and weights were taken to the nearest 0.5 g. Each right wing primary was scored as follows: 0 for an old feather, 1 for a missing feather or one in pin stage, 2 for a feather in brush stage to 1/3 of its final length, 3 for a feather 1/3–2/3 grown, 4 for a feather 2/3 to just short of fully grown, and 5 for a new, fully grown feather that has lost the sheath. I further noted whether each feather of the 10 secondaries on the right wing and on the right half of the tail was old, molting, or new. I ignored the reduced, outermost 11th primary. Thus, primary molt score may range from 0 (all feathers old) to 50 (all feathers new and fully grown).

Some birds apparently had a partial primary and secondary molt, involving a varying number of outer primaries and inner secondaries. In order to compare the progress of primary molt in these birds with that in birds having a complete molt, molt scores of the former were calculated as if the inner feathers had been replaced.

In the Least Sandpiper, as in many other waders, females are larger than males (Jehl, 1970; Page, 1974). Page (1974) considered Least Sandpipers in California with bill lengths $\leq$17.4 mm to be primarily males, and $\geq$18.7 mm, females. Using these criteria and ignoring the birds of unknown sex (bill lengths 17.5–18.6 mm), as did Page, females outnumbered males by about 6:1 in the birds I trapped (Table 1).

TABLE 1

Distribution of bill lengths in Least Sandpipers from Surinam. Classification of bill lengths according to Page (1974).

	Bill lengths (mm)		
	$\leq$17.4 ("♂")	17.5-18.6	$\geq$18.7 ("♀")
Adults	4	16	18
Immatures	1	8	6
Age unknown	1	7	9
All birds	6	31	33

MOLT

Primaries

Primary molt in adults started with the replacement of the innermost feather and proceeded outwards until all primaries had been replaced. The first bird with molting primaries was noticed on 10 August, the first with all feathers replaced on 19 December. The last adult with all feathers still old was captured on 9 September. Between mid-September and the end of December only a few adults were processed. Therefore, a few birds may have started their primary molt well after 9 September and the first birds may have completed it well before 19 December. Figure 1 shows that primary molt score increased rapidly in August and early September and progressed more leisurely later in the season.

All immatures processed between August and December had a molt score of 0. After December all birds of unknown age had a molt score of 30 or higher. This group must have included both adults and immatures, since it is unlikely that all immatures were gone after December. The lack of molt scores in the lower range (1-30) from mid-November through April (Fig. 1) indicates that immatures have a partial primary molt with a replacement of the outer feathers only. In fact three of 33 birds of unknown age trapped between January and April clearly had started their primary molt at the fifth, seventh, and eighth primary, respectively.

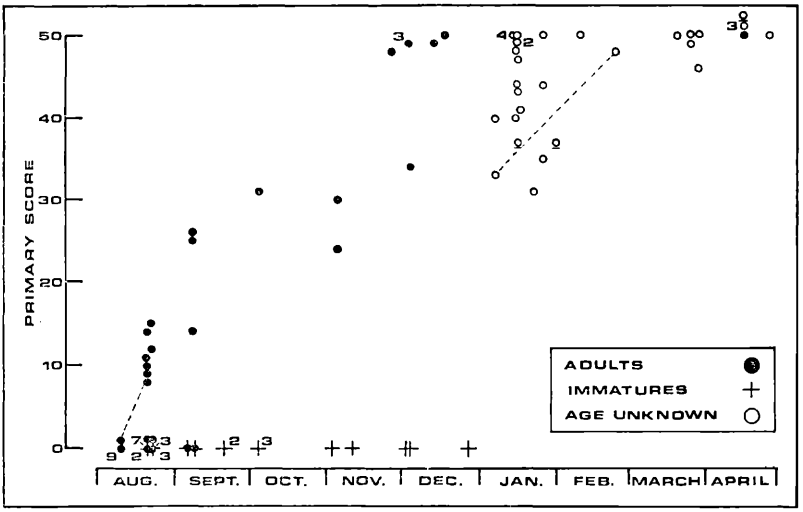

FIGURE 1. Primary molt scores plotted against date. Retraps of birds in active molt are indicated by a broken line. Underlined symbols refer to birds in partial molt. Molt scores of these birds were calculated as if inner primaries had been replaced.

The percentage of birds identified as having a partial molt is lower than the 46% immatures in the catches between September and December, indicating either that the difference between old and new feathers was overlooked in some birds or that the percentage of young birds was much lower in samples after December.

Secondaries

Secondary molt in adults started with the replacement of the outermost feather and proceeded inwards up to and including the 7th or 8th secondary, after which the tenth secondary was replaced, followed by the feather(s) in between.

Two spring birds of unknown age had replaced only the two or three innermost secondaries. One unusual bird had started its secondary molt at the third secondary. In addition, several fall adults had inner secondaries that were much less abraded than outer ones, indicating that during the preceding winter and spring only the former had been replaced. I suggest that the birds that replaced only the innermost of their secondaries were immatures.

The secondary molt in birds having a complete flight feather molt began at primary scores from 25–30 and was completed before all primaries were fully grown. The few data on birds having a partial molt of the flight feathers indicate that these birds also finish molting their inner secondaries before the outer primaries are fully grown.

Tail

The few available data indicate that the molt of the six pairs of rectrices usually starts with the replacement of the central pair and proceeds outwards. In some cases the outermost pair is replaced just after the two or three central pairs.

Tail molt in birds having a complete primary molt started at primary scores from 15–30. Most birds completed tail molt before the primary molt. Two birds in partial primary molt scored at "37" had only old rectrices, indicating that in birds having an incomplete primary molt tail feather replacement may start a little later than in birds having a complete molt.

During the prenuptial molt some birds replaced the central one or two pair(s) of tail feathers again.

WEIGHT IN RELATION TO MOLT

In Figure 2 body weight is plotted against primary molt score. For calculation of the correlation between these, only birds in active molt have been used, since birds with primary scores of 0 and 50 may have included transients with fat depots for migration. There is a significant negative correlation between primary molt score and weight ($P < .001$ for adults and $P < .05$ for birds of unknown age, excluding the 2 birds in partial molt with primary

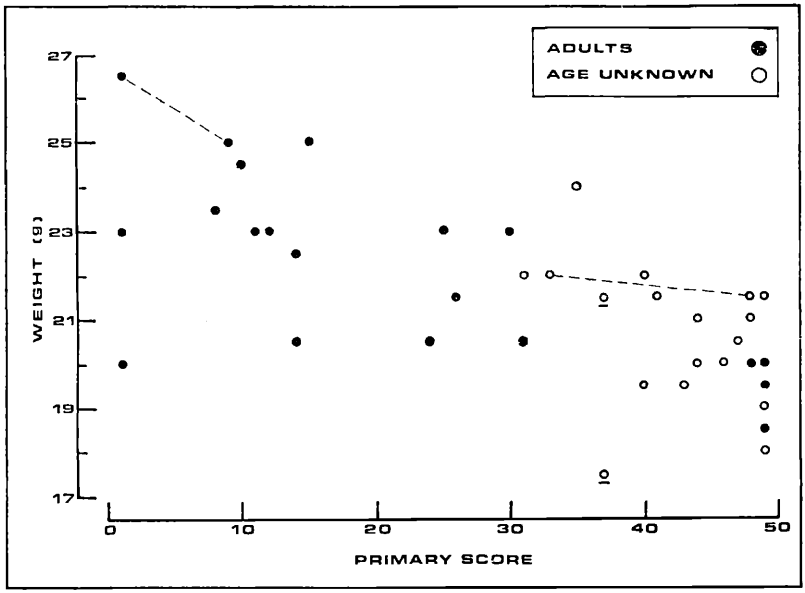

FIGURE 2. Weight plotted against primary molt score. Retraps of birds in active molt are indicated by a broken line. Underlined symbols refer to birds in partial molt. Molt scores of these birds were calculated as if inner primaries had been replaced.

scores of "37", using the Kendall rank correlation test), suggesting that the species may be subjected to physiological strain when actively molting flight and tail feathers.

DISCUSSION

Adult primary molt started between early August and mid-September, a few weeks after the birds' arrival from the north, and in some birds was probably not completed before January. Since trapping intensity was low in October and November, the data are not suitable for an estimate of the minimum period of primary replacement for an individual. For the entire adult population primary molt lasts about five months, a much longer period than in California, where it begins in early July and lasts until mid-October (Page, 1974). An extension of primary replacement into the northern winter months is also known from other waders wintering in Surinam (Spaans, unpubl. data), in east and southern Africa (Pearson, 1974; Tree, 1974) and in Tasmania (Thomas and Dartnall, 1971a, 1971b).

In Surinam, immature Least Sandpipers may undergo a remige molt during the northern winter months, involving a varying number of outer primaries and perhaps inner secondaries. This is quite different from the situation in California where no immatures were reported molting primary and secondary remiges (Page, 1974). Replacement of the primaries during the first winter has also been found in other waders wintering in Surinam (Spaans, unpubl. data) and in east and southern Africa (Pearson, 1974; Tree, 1974). The phenomenon has also been recorded by Stresemann and Stresemann (1966). In most species studied by Pearson, Tree, and myself, only the outer primaries are molted.

An extension of the postnuptial flight feather molt into the northern winter months and a replacement of some juvenal flight feathers during the first winter seem to be confined to birds wintering in the tropics and in the temperate areas of the Southern Hemisphere. Both phenomena are unknown for waders wintering in the temperate areas of the Northern Hemisphere. The latitudinal differences in timing and duration of the adult flight feather molt may lie in the different environmental conditions which the birds encounter in the wintering areas. Birds wintering in the temperate areas of the Southern Hemisphere do so during the austral summer, a period without climatic stress when feeding conditions may be assumed to be optimal. In the tropics, birds encounter rather uniform daily temperatures and, especially in estuarine habitats, an abundant food supply throughout the year. Birds wintering in the temperate areas of the Northern Hemisphere must tolerate less favorable weather, sometimes with temperatures below the freezing-point, and, consequently, less favorable feeding conditions. This may have forced these populations to complete their flight feather molt well before the onset of the winter.

The replacement of flight feathers during the first winter in some species of waders wintering from the tropics southward may be an adaptation related to the long migrations of these birds. One could suspect that these birds would have a greater chance

of surviving the journey to the north and back if they had renewed some of their worn juvenal flight feathers prior to spring migration, than if they had retained these feathers until their return to the wintering areas.

SUMMARY

Primary molt in adult Least Sandpipers trapped in Surinam started between early August and mid-September. For the entire population the period of primary replacement lasted about five months. Secondary molt began when the primary score was between 25–30 and tail molt when the primary score was between 15–30. Before all primaries were replaced secondary molt was completed in all, and tail molt in most birds.

All immatures underwent a flight feather molt, involving a varying number of outer primaries and in some instances perhaps inner secondaries.

There was a negative correlation between primary molt score and weight, indicating that the species may be subjected to physiological strain during the molt of the flight and tail feathers.

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Surinam Forest Service, Paramaribo, Surinam, and *Institute for Ecological Research, Arnhem, The Netherlands.* (*Mailing address: P.O. Box 436, Paramaribo, Surinam.*) Received 30 May 1976, accepted 23 September 1976.