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MOULT OF THE LONG-TAILED NIGHTJAR *CAPRIMULGUS CLIMACURUS* VIEILLOT

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## INTRODUCTION

This species is the commonest nightjar of the dry northern savanna belt; it is solitary, or in East Africa frequently in small parties; Jackson (1938) reported groups up to 12. At Mbane (16°16'N, 15°48'W) on the east coast of Lac-de-Guiers, northwest Senegal, Long-tailed Nightjars *Caprimulgus climacurus climacurus* were found wintering in 1979/1980. Numbers had also been noted at Mbane in December 1978 and 1980 and in April 1978 (D. Thys van den Audenaerde, B. Goddeeris, J. Paulussen, T. De Meulenaer, K. Verschoore, L. Janssens and A. Vrijdaghs, pers. comm.). About 70 birds were present in January 1980. By day they rested on the ground in the shade of trees and hedges around the main, closed garden of the village; after being caught, many sat on roofs.

On 31 December 1979 and 1 January 1980, 20 individuals (called "Mbane 79") were mistnetted or trapped by "flicking". On 23 December 1980 K. Verschoore, L. Janssens and A. Vrijdaghs sampled another 20 birds (called "Mbane 80") in the same garden. In both years measurements and characteristics of age, sex and moult were noted. All birds were then released; the December 1980 ones were ringed.

Later, moult was studied further in 34 alcohol specimens of *C. c. climacurus* and 2 of *C. c. sclateri* (all from Cameroon and Togo) in the Koninklijk Museum voor Midden Afrika (KIMA), and in another 123 skins, mainly *C. c. sclateri*, from Zaïre (but only selected specimens were examined in detail, especially for the tail). M. Louette studied five more skins from the British Museum (Natural History) (BMNH), including three of the race *leoninus* (lumped with *sclateri* by White, 1965).

## METHODS

At Mbane, maximum wing length and length of the outermost and innermost tail feathers were measured by the method of Svensson (1975). In "Mbane 79" the breadth of the pale wing patch was measured along the quill on the outer web of the fourth outermost primary. Birds of both samples were weighed.

Primaries are numbered descendently ( $P_1$ - $P_{10}$ ), secondaries ascendently ( $S_1$ - $S_{12/14}$ ) and tail feathers from the centre outwards ( $T_1$ - $T_5$ ). Moult was coded as follows: 0 = old feather, 1 = lacking, 2 = pin stage, 3 = brush stage, 4 = estimated tenths of fullgrown length, N = new feather, p = feather present but not aged, - = feather not traced.

For sexing we used plumage features: brightness and size of the wing patch, colour of the wing edge, and pattern and shape of the whole tail.

(Reichenow 1902; Bannerman 1933, 1953; Jackson 1938; Mackworth-Praed & Grant 1970; Serle & Morel 1977) (see Figs. 1-3).

Ageing was also based on plumage features. Juveniles were easily recognised by the softer plumage and the smaller, duller remiges and rectrices (compare Fig. 1 to Figs. 2 and 3 (as in e.g. *Caprimulgus europaeus*, Pieckocki 1966 and *C. carolinensis*, Rohwer 1971). Old feathers were obvious by wear and bleaching. The wing chord being determined by P<sub>8</sub> (and/or P<sub>9</sub>), a bird was considered adult only once P<sub>8</sub> had been renewed and became full grown (Fig. 1). Each tail feather was judged independently and consequently ascribed either to "males", "females" or to "juveniles". The wing patch, measured on P<sub>7</sub>, is necessarily of a "male" or a "female"-type, because unmoulted (juvenile) P<sub>7</sub>'s lack such a pale patch. In some particular cases, characteristics of a moulting juvenile bird can belong to different categories: e.g. the wing patch can be that of a "juvenile" (P<sub>8</sub>-P<sub>10</sub> old), the innermost (T<sub>1</sub>) and second innermost (T<sub>2</sub>) rectrices, when moulted and full grown, belong to the "adult male"-type and the outermost, still unmoulted rectrix will have juvenile characteristics. Weight-data fall either in the "male" or "female" category, because sexing was possible even in juveniles, all having renewed at least one remex or rectrix.

#### MEASUREMENTS

Table 1 lists some characteristics measured at Mbane. Sample size was not constant partly because rectrices are easily lost by "flicking". In Table 2, levels of significance for differences in means between the categories are indicated (Student t-test). Wing length is somewhat less in juveniles than in adults and it could average somewhat higher in males than in females. Tail feathers are very much different in length between all groups, but only the length of the innermost pair of rectrices is reliable as a sexing and ageing character. Another good key to sexing is the breadth of the wing patch.

No difference in weight appears between males and females (Table 3a). Between both winters, in contrast, the difference is noteworthy (Table 3b) (a single-eyed female, weighing only 34 g, is excluded).

#### ARRESTED MOULT

Table 4 lists moult stages of primaries and secondaries from the "Mbane 79"-sample; in all, moult had been either arrested or completed. There was great variation in the number of new feathers. The second Mbane sample gave the same general pattern, but growing feathers were found in three birds. It seems very unlikely that what we interpret as "arrested moult" (Table 4) could be merely a coincidence or from a population with extremely protracted moult, in which the next feather is only dropped after the previous one is full grown (as in some resident African passerines, Stresemann & Stresemann 1966).

Arrested moult was apparent in several of the Cameroon and Togo specimens (Table 5); all specimens of *C. c. climacurus* in active moult were characterized by a strikingly slow, protracted moult (Table 5). Some specimens of *C. c. sclateri* were found in arrested moult but most of them were moulting quite protractedly; a few were moulting very rapidly (e.g.

KMMA 228, Table 6).

Arrested moult is not really exceptional; it seems to occur rather frequently, for instance in birds with unfavourable migration timing and especially in dry country birds (e.g. Keast 1968; Payne 1972). In some migratory nightjars in the southern tropics, arrested moult is already well known: it is the rule in *C. rufigena* and in *Macrodipteryx vexillarius* (Stresemann & Stresemann 1966).

*C. c. sclateri*, on the contrary, seems to be a resident or short distance migrant of the wooded savannas and forest belt of the northern tropics (Elgood, Fry & Dowsett 1973). The nominate *C. c. climacurus* breeds in the northern dry savanna belt during the rainy season and goes as far south as the forest edge and its clearings in the dry season. But part of the population remains resident in the north, and Morel (1968) even noted it as resident and breeding in the dry season in northern Senegal. As Elgood *et al.* (1973) put it: "The movements of this nightjar are far from adequately understood, ... and it seems to breed practically throughout the year".

Although the species is said to breed as far north as the desert edge (Bannerman 1953), Serle & Morel (1977) limit the breeding area north to 17°N and in Snow (1978) the most northern locations in western Africa are found in the Senegal river valley, only a few km north of Mbane. Consequently, the flock wintering at Mbane can hardly be considered long-distance migrants; the suspension of moult is unlikely to be caused by migration, but is probably related to food scarcity, caused by drought.

This seems to hold with the fact that *C. c. sclateri*, generally known from more luxuriant habitats, appears to moult somewhat faster.

Because rainfall varies considerably from year to year in the Sahel, it seems probable that moult of nightjars at Mbane does not progress at the same speed each year. Indeed, among the 20 birds of "Mbane 80", one was still moulting actively in a "regular" sequence (Table 5, 4X29518) and two others irregularly (though presumably not by accident). 1980 was a wetter year than 1979 (Thys van den Audenaerde, pers. comm.)\*. Indeed, the birds average significantly heavier in 1980 than in 1979 (Table 3), which indicates a better general condition in 1980. In this view, one could expect that moult on the average should have been further advanced before suspension in 1980 than in 1979. However, no difference in moult scores was found between the years, neither in primaries ( $\chi^2_{df=2} = 1.96$ ;  $P > 0.25$ ) nor secondaries ( $\chi^2_{df=2} = 0.57$ ;  $P > 0.5$ ), denying the supposed relation.

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\* Pluviometric data (supported by the National Direction of Meteorology and ORSTOM, Senegal) from relatively nearby stations (St Louis, Dagana, Podor, Kébémér) only partly support the view of a generally wetter year 1980, presumably due to the quite local and erratic nature of precipitation in the Sahel (mainly thunderstorms). Moreover, general humidity will be influenced by the surroundings because Mbane is close to Lac-de-Guiers, which is part of the inundation zone of the Senegal river.

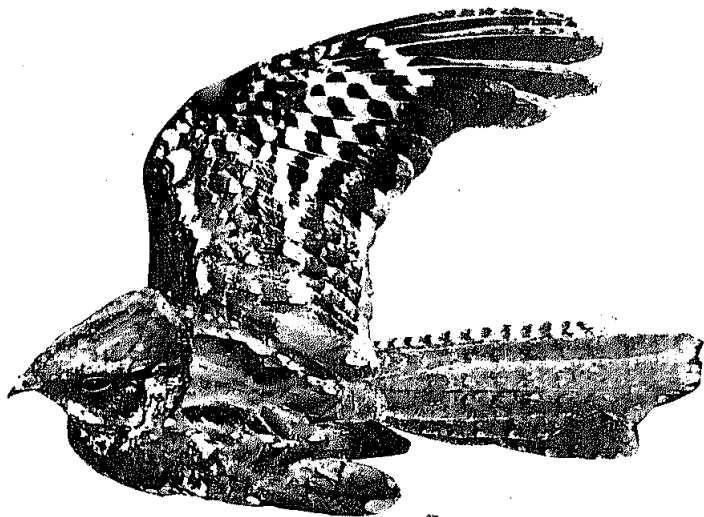


Figure 1 *Caprimulgus c. climacurus*,  
juvenile female in arrested moult  
( $P_1$ - $P_6$  renewed,  $S_1$  renewed, tail old)

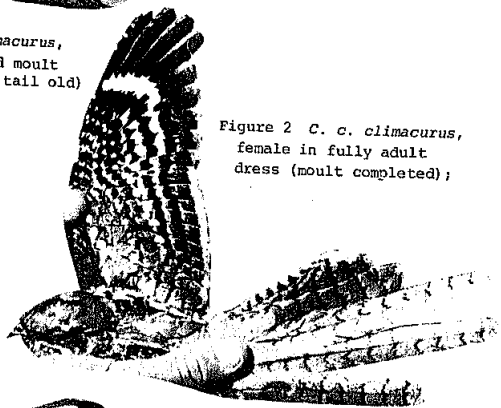


Figure 2 *C. c. climacurus*,  
female in fully adult  
dress (moult completed);



Figure 3 *C. c. climacurus*, male in fully adult dress (moult completed);  
Mbane 1 January 1980

Table 1 Measurements (in mm) of long-tailed nightjars at Mbane (Senegal)

|   |           | juveniles | ♀♀        | ♂♂        |
|---|-----------|-----------|-----------|-----------|
| Maximum wing length                     | n         | 7         | 13        | 11        |
|   | range     | 136.5-144 | 139-151   | 139-150   |
|   | $\bar{x}$ | 139.5     | 142.9     | 145.4     |
|   | s         | 2.8       | 3.8       | 3.5       |
| Length innermost tail feather ( $T_1$ ) | n         | 3         | 16        | 11        |
|   | range     | 113-119   | 124-183   | 195-245   |
|   | $\bar{x}$ | 116       | 152.2     | 216.8     |
|   | s         | 3.0       | 19.5      | 19.8      |
| Length $T_2$                            | n         | 4         | 15        | 9         |
|   | range     | 101-107   | 108-134   | 134-153   |
|   | $\bar{x}$ | 103.5     | 119.7     | 140       |
|   | s         | 2.5       | 8.5       | 6.3       |
| Length $T_5$                            | n         | 6         | 16        | 9         |
|   | range     | 85-96     | 90-110    | 97-115    |
|   | $\bar{x}$ | 91.3      | 97.7      | 105.2     |
|   | s         | 4.1       | 5.6       | 6.2       |
| Breadth of wing patch                   | n         |           | 10        | 7         |
|   | range     |           | 10.3-14.2 | 15.8-21.2 |
|   | $\bar{x}$ |           | 12.5      | 18.4      |
|   | s         |           | 1.2       | 1.5       |

Table 2 Levels of significance for difference in means

|                     | juv. / ♀♀ | ♀♀ / ♂♂      | juv. / ♂♂   |
|---------------------|-----------|--------------|-------------|
| Maximum wing length | P < 0.05  | NS (P ~ 0.1) | P < 0.002   |
| Length $T_1$        | P < 0.001 | P << 0.001   | P <<< 0.001 |
| Length $T_2$        | P < 0.001 | P < 0.001    | P <<< 0.001 |
| Length $T_5$        | P ~ 0.01  | P < 0.01     | P < 0.001   |
| Breadth wing patch  | -         | P < 0.001    | -           |



Table 5 Wing moult patterns of Long-tailed Nightjars *C. c. climacurus*

|            |   | P R I M A R I E S |   |   |   |   |   |   |   | S E C O N D A R I E S |   |   |   |   |   |   |   |   |   |   |    |    |    |    |
|------------|---|-------------------|---|---|---|---|---|---|---|-----------------------|---|---|---|---|---|---|---|---|---|---|----|----|----|----|
|            |   | 10                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2                     | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 2292       |   | O                 | O | O | O | O | O | O | O | O                     | O | O | O | O | O | O | O | O | O | O | O  | O  | O  | O  |
| 114.961    |   | O                 | O | 7 | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | -  | -  |    |
| 1.1329     | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | 7 | O | -  | -  |    |    |
|            | l | N                 | N | N | N | O | N | N | N | N                     | N | N | N | N | N | N | N | N | p | p | -  | -  |    |    |
| 970        | r | O                 | O | O | 2 | B | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | 3  |    |
|            | l | 8                 | 1 | O | O | O | O | O | O | 3                     | N | N | N | N | N | N | N | N | N | N | N  | N  | 3  |    |
| 1.1328     | r | O                 | O | O | O | O | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | -  | -  |    |
|            | l | 8                 | O | O | O | O | O | O | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1325     | r | O                 | 1 | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | 1 | O | O | O | N | O | 1 | N                     | N | N | - | - | - |   |   |   |   |   |    |    |    |    |
| V.2001     |   | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | N  |    |
| 1.1704     | r | O                 | 2 | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | O                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | p  |    |
| 1523       | r | O                 | O | 3 | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | 9 | 1 | O | O | O | 2 | N | N                     | N | N | 2 | p | - |   |   |   |   |   |    |    |    |    |
| 1.1552     |   | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.697      |   | O                 | O | O | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | -  | -  |    |
| 4 x 29518° |   | O                 | O | 9 | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 3952       |   | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1437     | r | 7                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | N  |    |
|            | l | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1801     | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | 3 | O | N  | N  | N  |    |
|            | l | N                 | N | N | N | 3 | O | O | 3 | N                     | N | O | p | p | - |   |   |   |   |   |    |    |    |    |
| 1.837      | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | N | N | O | 1 | O | O | N | N                     | N | N | N | N | - | - |   |   |   |   |    |    |    |    |
| 2613       | r | 5                 | 9 | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | 9 | p  | p  | p  |    |
|            | l | N                 | N | N | 3 | O | 8 | N | N | N                     | N | N | 1 | p | - |   |   |   |   |   |    |    |    |    |
| 3544       | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | N | N | N | O | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| L.75479    |   | O                 | O | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | 2 | O | N  | N  | N  |    |
|            |   | N                 | N | N | 2 | O | N | N | N | N                     | N | 2 | p | p | - |   |   |   |   |   |    |    |    |    |
| 1.1757     | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | N | N | N | N | - | - | - | -                     | - | - | - | - | - | - | - | - | - | - | -  | -  | -  |    |
| 1.1706     | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | 1 | p  | -  | -  |    |
|            | l | N                 | N | N | N | O | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1326     |   | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1637     | r | N                 | N | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | N                 | N | N | N | O | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
| 1.1638     | r | O                 | 6 | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | N | N  | N  | -  |    |
|            | l | O                 | 1 | N | N | N | N | N | N | N                     | N | N | N | N | N | N | N | N | N | 2 | O  | -  | -  |    |

cont./



|        |   |            |             |      |     |
|--------|---|------------|-------------|------|-----|
| 1.1327 | r | NNNNNNNNNN | NNNN6NNNN   | NNNN | -   |
|        | l |            | NNNN6NNNN   | NNNN | -   |
| 3266   | r | NNNNNNNNNN | NNNNNNNNNN6 | 0 4  | p p |
|        | l |            | NNNNNNNNNN9 | p p  | p p |
| 3559   | r | NNNNNNNNNN | NNNNNNNNNN  | N 9  | p - |
|        | l |            | NNNNNNNNNN  | NNNN | -   |
| 3951   | r | NNNNNNNNNN | NNNNNNNNNN  | NNNN | 3   |
|        | l |            | NNNNNNNNNN  | NNNN | -   |
| 1.721  |   | ONNNNNNNNN | NNNNNNNNNN  | NNNN | -   |

° specimen from "Mbane 80"

Table 6 Wing moult patterns of Long-tailed Nightjars *C. c. sclateri*

|              | P R I M A R I E S |   |   |   |   |   |   |   |   |   | S E C O N D A R I E S |   |   |   |   |   |   |   |   |    |    |    |    |   |
|--------------|-------------------|---|---|---|---|---|---|---|---|---|-----------------------|---|---|---|---|---|---|---|---|----|----|----|----|---|
|              | 10                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1                     | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |   |
| 69.383       |                   |   |   |   | 0 | 0 | 0 | 0 | 1 | 6 | N                     | N | N | N |   |   |   |   |   | 0  | 0  | 0  | -  |   |
| 34.075       |                   |   |   |   | 0 | 0 | 0 | 0 | 0 | 1 | 6                     | N | N |   |   |   |   |   |   | 0  | 5  | N  | N  | - |
| 35.064       |                   |   |   | 0 | 0 | 7 | N | N | N | N | N                     | N | N |   |   |   |   |   | 0 | 0  | 0  | 0  | -  |   |
| 58.504       |                   |   |   | 0 | 0 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | N  | N  | -  |   |
| 1951.34.278° | r                 |   |   | 1 | 4 | 9 | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | 2  | 0  | 0  | - |
|              | l                 |   |   | 0 | 4 | 9 | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | -  | -  | -  | - |
| 228          | r                 |   |   | 0 | 0 | 4 | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | 7  | 0  | 0  | - |
|              | l                 |   |   | N | N | 9 | 0 | 0 | 2 | 3 | 7                     | N | 6 | 7 | 3 | p |   |   |   |    |    |    |    |   |
| 76.812       |                   |   |   | 3 | 9 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | 7  | 2  | 0  | - |
| 1904.65.172° |                   |   |   | 1 | 7 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | -  | -  | -  | -  |   |
| 31.415       |                   |   |   | 4 | 8 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | N  | N  | N  | - |
| 1953.2.41°   |                   |   |   | 0 | 5 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | N  | N  | N  | - |
| 1951.34.276° |                   |   |   | 4 | 9 | N | N | N | N | N | N                     | N | N |   |   |   |   |   | N | N  | N  | N  | N  | - |

° specimens from BMNH

#### MOULT STRATEGY

A single bird in arrested moult is normally useless when studying the exact progress of moult, but comparison of moult-patterns of a series can sometimes be very helpful in understanding this process. To confirm results of the Mbane samples, active moult was studied on alcohol specimens and skins.

#### Primaries

The ten primaries are renewed descendently (Tables 4-6), as in other nightjars (Stresemann & Stresemann 1966, Rohwer 1971).

Table 7 Tail moult patterns of Long-tailed Nightjars

|              | left |   |   |   |   | right |   |   |   |   |
|--------------|------|---|---|---|---|-------|---|---|---|---|
|              | 5    | 4 | 3 | 2 | 1 | 1     | 2 | 3 | 4 | 5 |
| 69.383       | 0    | 0 | 0 | 0 | 6 | 0     | 0 | 0 | 0 | 0 |
| 107.507      | 0    | 0 | 1 | 4 | 6 | 6     | 4 | 1 | 0 | 1 |
| 76.799       | 1    | 0 | 6 | N | N | N     | N | 6 | 1 | 1 |
| 73.43A.473   | 4    | 0 | 9 | N | N | N     | N | 9 | 0 | 4 |
| 94.618       | 5    | 3 | p | p | p | p     | p | p | 3 | 5 |
| 76.708       | 0    | 1 | N | N | N | N     | N | 0 | 0 | 0 |
| 96.621       | 3    | 4 | 7 | N | N | N     | N | 7 | 4 | 3 |
| 35.064       | 0    | 0 | 0 | 7 | 0 | 0     | 7 | 0 | 0 | 0 |
| 4 X 29518    | 0    | 0 | 0 | N | 1 | 1     | N | 0 | 0 | 0 |
| 31.415       | 1    | 1 | 4 | 6 | 0 | 1     | 6 | 4 | 1 | 1 |
| 1951.34.278° | 3    | 4 | 7 | 9 | 7 | 7     | 9 | 5 | 3 | 3 |
| 42.797       | 0    | 0 | 0 | 4 | 5 | 0     | 4 | 0 | 0 | 0 |
| 58.504       | 0    | 0 | 0 | 9 | 6 | 6     | 0 | 0 | 0 | 0 |
| 1953.2.40°   | N    | 0 | 0 | N | 9 | 9     | N | 0 | 0 | 0 |
| 76.399       | 0    | 0 | 0 | 9 | 8 | 8     | 1 | 1 | 2 | 0 |
| 1953.2.41°   | N    | 4 | N | N | 1 | 2     | 1 | N | 3 | 4 |
| 76.812       | -    | - | - | - | - | N     | 7 | N | 0 | 1 |
| 1951.34.276° | 9    | 9 | N | N | 6 | 6     | N | N | 9 | 9 |

° specimens from BMNH

### Secondaries

There are usually twelve secondaries; in some alcohol specimens (Tables 5, 6 and KMMA 3.925) thirteen were found (at least at one side) as has also happened in *C. carolinensis* (Rohrer 1971) and *M. vexillarius* (Stresemann & Stresemann 1966). Two specimens (KMMA 2292 and V1940) even had 14 secondaries, both only in the right wing. In other cases the thirteenth and fourteenth secondary could have been overlooked or mistaken for a covert, as they are very small.  $S_{10}$ - $S_{14}$  are quite unreliable in moult study, for their age is sometimes difficult to judge.

Two different moult strategies are known in the secondaries of Caprimulgidae (Fig. 4a: general pattern, after Stresemann & Stresemann 1966; Fig. 4b: particular one in *C. carolinensis*, after Rohrer 1971). For the Long-tailed Nightjar, a new strategy is evident (Fig. 4c). Molt of secondaries occurs in two units: an inner one starting around secondary

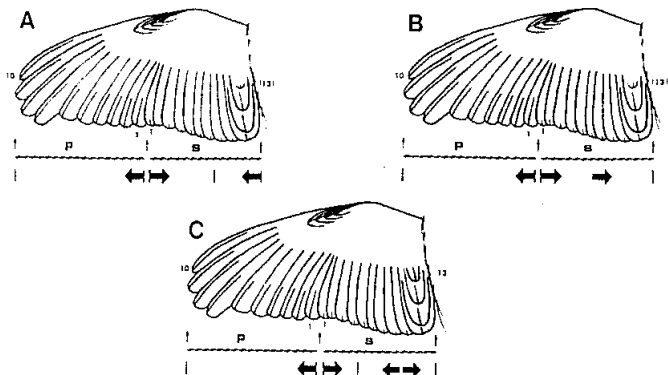


Figure 4 Wing-moult strategies in Caprimulgidae. A - general pattern (after Stresemann & Stresemann, 1966), B - particular one in *C. carolinensis* (after Rohwer, 1971), C - particular one in *C. climacurus*

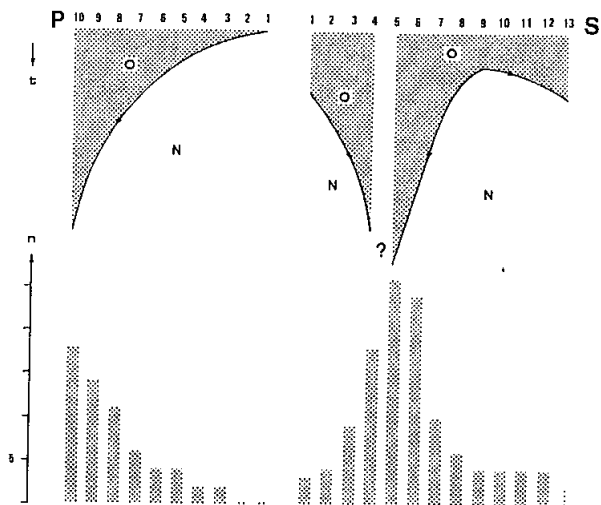


Figure 5 Above: average model for moult in *C. climacurus*. Below: frequency of unmoulted remiges in birds showing arrested moult (P - primaries, S - secondaries, O - old feather, N - new feather, n - number of remiges, t - time)

nine and progressing with two divergent foci, and an outer unit, starting with the outermost secondary and moulting ascendently. The fifth secondary is the last to be renewed (whether as part of the descendent or of the ascendent focus is not yet clear). If  $S_5$  belongs to the descendent focus, moult converges into the diastataxic point, which should be exceptional among nightjars. Stresemann & Stresemann (1966) stated: "However, there exists also diastataxic species in which the moult-wave crosses this interface, e.g. ..., *Caprimulgi*". Convergence of moult towards the diastataxic point could be a characteristic of *C. climacurus*, a species not mentioned by Stresemann & Stresemann.

Many moult-patterns in Tables 4-6 agree with Fig. 4c, but could also be attributed to one or both of the other strategies. Especially birds in arrested moult and birds moulting very slowly fit into one or the other patterns. However, the schemes of Tables 4-6 should be convincing for the proposed pattern. Irregularities are to be found rather frequently and there seems to be a marked variation in the relative progress of the different foci: in the secondaries there is apparently variation between some modes as

$$\frac{1-2}{9} - \frac{3/8}{10-11} - \frac{4/7}{12-(13-14)} - 6 - 5, \text{ and}$$

$9 - 10 - 11 - \frac{12-(13-14)}{1/8} - \frac{7}{2} - \frac{6}{3} - \frac{5}{4}$ , in which the outer and the inner units are emphasized respectively. In the inner unit, it appears as if some feathers around  $S_9$  are most frequently renewed rather simultaneously.

In Fig. 5 (top), an average model is proposed for the moult of remiges. The lower part of the figure illustrates the frequency of remaining remiges in birds showing arrested moult (based on both samples of Mbane and 34 alcohol specimens in KMMA).

### Rectrices

Moult patterns of the ten rectrices are not yet very clear, at least as there seems to be a marked variation on this point. Table 7 lists recorded moult patterns (mainly of skins). Some patterns indicate a sequence  $T_1-T_2-T_3-T_5-T_4$ , which agrees with Stresemann & Stresemann (1966) and Rohwer (1971) for other nightjars. A few patterns appear divergent (e.g. KMMA 76.708, 96.621), as once proposed by Verheyen (1965). In several birds a tendency of  $T_2$  being properly renewed before  $T_1$  is noted (e.g. KMMA 35.064, 31.415; BMNH 1951; 34.278; 4X29518). Some cases even suggest that  $T_3$  may be renewed before  $T_2$  and  $T_1$  (KMMA 76.812; BMNH 1953.2.41, 1951.34.276). Other patterns appear to be completely irregular.

### SUMMARY

During winters 1979/80 and 1980/81 samples Long-tailed Nightjars, *C. c. climacurus*, were studied in northwest Senegal; investigations were completed with museum material.

Of 40 mid-winter birds only three were in active moult; 9 had completed moult and the others were in arrested moult. Birds from Togo and Cameroon were either in arrested moult or moulting very protractedly. Some *C. c.*

*sclateri* (from more luxuriant vegetation) were in arrested or protracted moult; others are fast moulters.

The ten primaries are renewed descendently. Molt of secondaries is aberrant: an ascendent outer focus, and the descendent focus of a divergent inner unit, converge to the fifth secondary (or maybe to the diastataxic point  $S_4/S_5$ ). The divergent inner unit starts apparently simultaneously with molt around  $S_9$ . Several birds had 13-14 secondaries. Tail molt was variable with some aberrations: e.g. replacement of the second innermost before the innermost pair.

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