

# BIRD BANDER

## Moult in the Eastern Silvereye

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*"From an ecological standpoint moult is undoubtedly best studied in wild birds, but since most are caught only once during moult it is often not possible to follow the moult of individuals."*—Newton, 1967.

Consequently this analysis of the results of a moult study of free-flying Eastern Silvereyes *Zosterops lateralis* is a valuable contribution to the subject. It involved over 500 moult records.—Hon. Editor.

The major part of the work was done in the period January 1968 to January 1969, on birds visiting my backyard trap at Five Dock, New South Wales, a Sydney suburb. Supporting data were collected from 1966 to 1971, and 16 samples were recorded in April 1968 from two other places near Sydney. During 1969-70, 82 Australian Bird-banding Scheme (ABBS) moult cards were completed for 72 individuals banded in Cofts Harbour district, N.S.W. and these have been used as supporting data for the sequence of moult.

A guide for the study was taken from a paper by Keast (1953), in which he stated that in first year birds hatched early in the breeding season the first autumn (post juvenile) and spring moults are similar to those of the adults while those hatched late have an incomplete post-juvenile moult, hence retaining a proportion of juvenile feathers (particularly remiges) through to the spring moults. Thus there may be an extensive spring moult in such birds.

A brief description of the area, trapping methods and frequency of retrapping of individual birds for the years 1965 to 1967 was given previously (Swanson, 1968). The present study developed from this work.

The total number of individuals studied in the 1968 autumn moult was 73. Twenty-eight of these were first year birds aged by skull ossification and moult pattern; 15 others were also considered first year birds. The shading on the graphs, Figures 2 to 5 (following Snow, 1965) represents the earliest and latest commencement

and conclusion of moult, the slope indicating the rate. It is based on the records of 18 adult birds at Five Dock; 12 of these were detailed records from multiple retraps. In the spring of 1968, 45 individuals were studied. Nineteen of these were known adults which had been recorded breeding during the previous seasons. Over 400 moult records were made in 1968. As an example Table 1 shows details of the number of moult records made for some individual adult birds in three seasons.

TABLE 1

An example showing details of the number of moult records made for some individual adult birds in three seasons.

Band Number	Sex	Autumn 1968	Spring 1968	Autumn 1969
010-24410	M	4	2	—
010-24431	M	15	4	4
021-39014	F	4	4	—
021-39023	M	8	5	—
021-39030	F	19	4	1
021-39031	F	3	5	2
021-39055	M	19	6	—

As moult details were not significant for birds which were retrapped within three days of the previous recording, none was made except when a major change such as the loss of a flight feather, had occurred.

The method of recording followed the form of the present ABBS Passerine Moult Card (see

COMMON NAME		SCIENTIFIC NAME			SPECIES NO.	OFFICE USE
STATE	LOCALITY	DATE	AGE	SEX	BAND NUMBER	

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OTHER WING COVERTS	UPPER PARTS	UNDERPARTS	HEAD
MEDIAN	NAPE	THROAT	CROWN
LESSER	MANTLE	BREAST	FOREHEAD
UNDER WING	RUMP	BELLY	EAR COVERTS
BASTARD WING	SCAPULARS	FLANKS	MALAR REGION
	UPPER TAIL COVERTS	UNDER TAIL COVERTS	CHIN

WEIGHT (GMS)	ADDITIONAL DATA	OBSERVER
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• Figure 1. The ABBS Passerine Moulting Card. The moulting score is obtained by adding the numbers used to record the moulting, viz. 1 = missing or new feather in pin; 2 = new feather 1/3 grown; 3 = new feather 2/3 grown; 4 = new feather nearly full grown; 5 = new feather fully developed.

Fig. 1). The moulting pattern followed a typical passerine moulting as described by Newton (p. 11) so variations and the more important points only are mentioned here. The moulting score used followed the notations given on the ABBS card and the totals are for one wing, i.e. primary score maximum 45; secondaries 30; tertials were not used in scoring.

**Body Moulting**

Body moulting was recorded in detail as in the ABBS card, it commenced with the primary moulting and spanned the full period of moulting. Moulting in the head region continued after the completion of primary moulting.

**Remiges**

The primary remiges (main flight feathers) are taken here as a scale for other areas of moulting. The first two primaries are lost almost simultaneously. No more than three primaries

and three secondaries are replaced at any time. The replacement is a gradual one, from the first two primaries one feather is shed as each new feather is completed. Primary coverts moulting when the corresponding primary is growing. Before midway in the primary moulting, that is before no. 4 and 5 primaries are full grown, the secondary wing coverts are all shed within a few days, so that the shafts of the old secondaries are exposed. The secondaries commence to moulting about midway through the primary moulting. The last two primaries (no. 8 and no. 9) are usually lost together, and by that stage the most active body moulting is in the head region.

Frequently the last secondaries (no. 5 and no. 6) were not shed until after primaries no. 8 and no. 9 had been shed. In 16 cases, by the time the last primaries were full grown, secondaries no. 5 and no. 6 were not fully emerged. In only two cases the secondaries and primaries were fully emerged about the same time. Supporting

figures from Coffs Harbour, N.S.W. in 1969 were correspondingly 23 to 2. There were three cases where the secondaries no. 5 and no. 6 in each wing were not observed to be replaced and one instance where this occurred in one wing only. These feathers being nearest the body, do not wear to the same extent as the outer feathers. No wing moult was observed in adult birds in spring so presumably if remiges were not replaced they remained till the next autumn moult. An adult bird in spring 1970 was found with secondaries no. 5 and no. 6 noticeably worn while other remiges were in good condition. Tertiials (or secondaries nos. 7, 8 and 9) do not appear to have as regular a pattern as other remiges; there were variations among the individuals studied, though no. 8 was most frequently the first replaced. No more than two of the tertiials were under a third grown at any time and they were replaced during the first half of the primary moult.

As seen in the example in Figure 3, the growth rate of remiges shows a steady increase, slowing towards the end of the moult period.

**Rectrices**

Mishaps between moults or premature loss due to handling, were reasons for some odd tail arrangements being recorded. Moult of the rectrices (tail feathers) commenced midway through the primary moult with the loss of the centrals. Many variations were recorded and two general patterns were defined. One was a gradual loss

from the centrals outwards resulting in an even wedge shape. Another pattern was the dropping of no. 1 followed by no. 2, then a time lapse before the shedding of nos. 3 to 6. This resulted in a stepped pattern.

**Relationship with Breeding**

In the summer of 1967-68 some birds commenced the post nuptial moult in the last days of December; others commenced in January and the latest commenced during the first week of February. Moult may commence while the birds are still feeding fledged young. Fledglings are frequently fed by adults in breeding condition (e.g. males with enlarged tubules) and these adults may have commenced moulting (see Table 2). So far this overlap has been found in the first half of the primary moult, and has not extended beyond the shedding of primary no. 4. At Five Dock silvereyes probably raise two or more broods in a season if conditions are suitable. Having commenced moulting, birds may attempt to raise another brood, in which case the moult is arrested (see Fig. 2). This 'arresting' has always occurred before the shedding of primary no. 6.

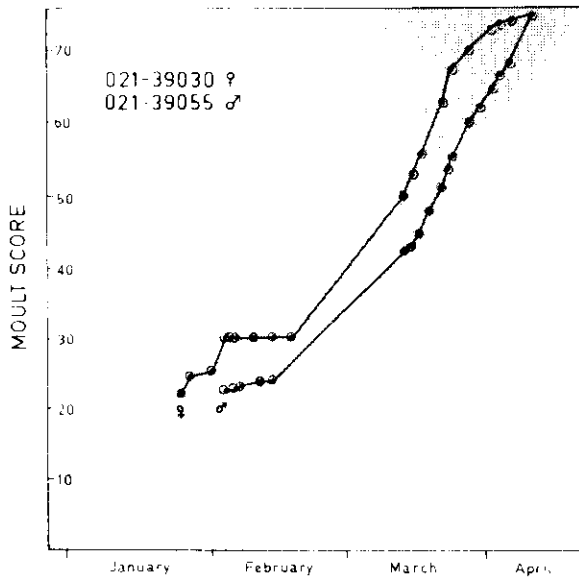
On resumption, the moult has continued at an increased rate, the body moult particularly being more profuse than in adult birds where no interruption occurred. The latter part of the moult was completed at a faster rate as seen in the examples in Figure 2.

TABLE 2

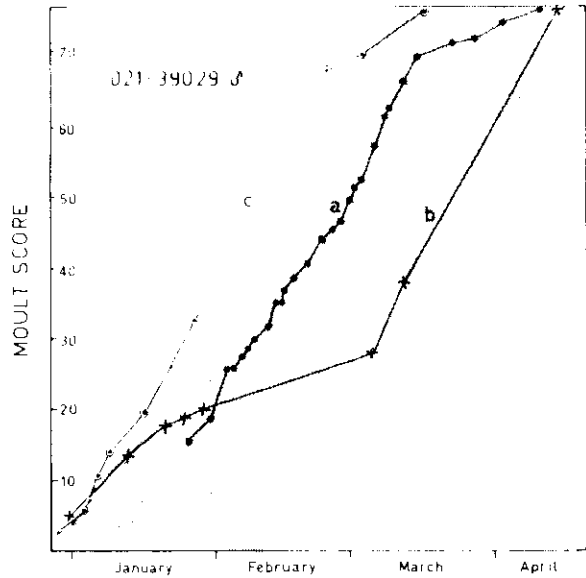
Examples of adult males commencing to moult while still in breeding condition.

Band Number	Date	Moult Score	Body Moult	Tubules	Remarks
010-24410	7. 1.70	5	slight	very obvious	
012-14615	29.12.69	2	slight to active	very obvious	
	6. 1.70	5	slight	obvious	
	16. 1.70	6	nil	obvious	Feeding fledglings
	20. 1.70	9	nil	obvious	Feeding fledglings
012-14686	24.12.69	4	nil	very obvious	Feeding fledglings
	18. 1.70	8	active	obvious	
021-39029	28.12.69	2	active	very obvious	
	3. 1.70	7	active	very obvious	
	6. 1.70	11	active	very obvious	

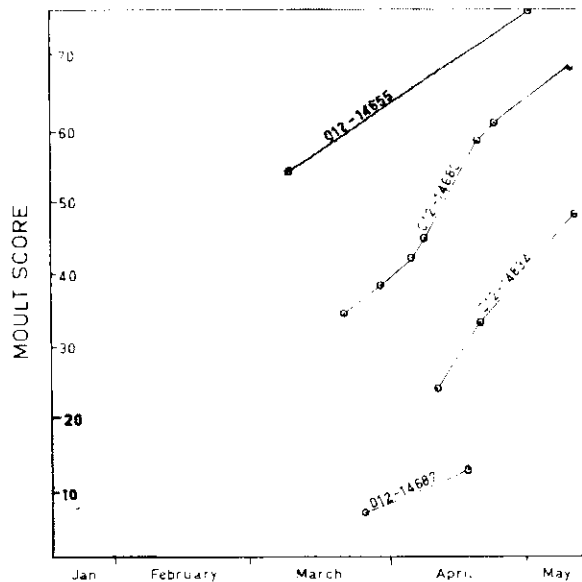
**Figures 2 to 5.** The shaded portions of the graphs represent the earliest and latest commencement and completion of moult in 1968 from records of 18 adults; the slope indicates the rate. The moult score is of primaries and secondaries only; the tertials are excluded.



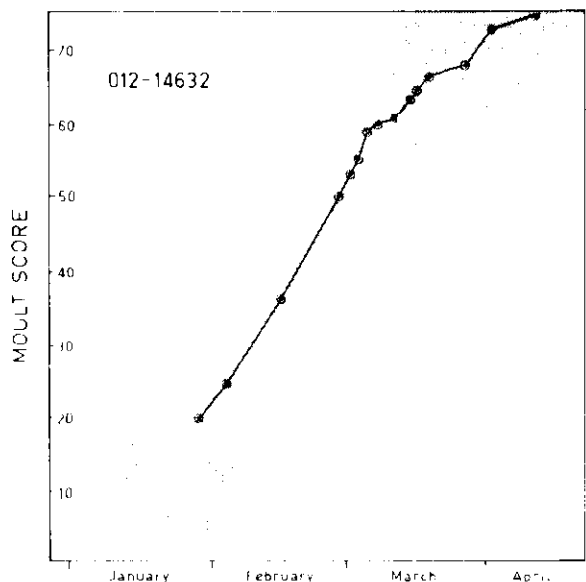
● Figure 2. Example of the 'arrested' moult pattern of a breeding pair.



● Figure 3. Example showing the pattern of juvenile moult for a bird hatched early in the breeding season, showing the similarity to the adult pattern.



● Figure 4. Example of the moult pattern of four juveniles, hatched late in the breeding season and aged by skull ossification.



● Figure 5. The pattern of post breeding moult for the same adult male in three seasons:  
 a. January 1968 to April 1968 (28 records)  
 b. December 1968 to April 1969 (8 records)  
 c. December 1969 to March 1970 (9 records)

### **Moult Period**

In the autumn moult in 1968 the 18 adults being studied completed the moult in about three months as shown by the shaded portion on the graphs (Figs. 2 to 5); body moult extended beyond the completion of the remiges in eight cases examined, by 10 to 14 days. The time taken for the completion of the remiges ranged from 75 days to a maximum 100 days for a bird with interrupted moult; the overall average of the 18 adult birds was 83 days. This period seemed to vary with seasonal conditions; for example one bird (021-39029) took 90 days in 1968, 114 days in 1969 when the moult was retarded by breeding, and 84 days in 1970 (Fig. 5). In 1971, of five adults studied all appeared to be raising late broods and the range was 90 to 130 days, the wing moult was completed in the latter part of April. In 1968 all adults had completed wing moult by mid April.

The commencement and pattern of moult for birds hatched by early December was the same as the adults (see Fig. 3). Remiges were moulted in 85 to 90 days, comparable with the adult rate. Birds which hatched later (December to February) moulted remiges, but at a slower rate (see Fig. 4). Such first year birds continued to shed remiges in mild weather; in 1967 there were seven such birds recorded moulting in late April to May and one case into June. A similar number was recorded in 1968. Birds hatched at the very end of the breeding season (February) moulted only body feathers at their first (autumn) moult, the remiges being retained through the winter. In cases where only body moult occurred, it was quicker and more profuse than that of adults which replaced feathers over a longer period. The onset of cold weather brought an abrupt halt to all moult.

### **Spring Pre-nuptial Moult**

The first indications were a few pin feathers on the head. This occurred while the days were still cool in mid August. The new feathers of the eye ring became noticeable, feathers around the head, chin and cloaca were replaced. With adult birds the time taken and the intensity varied. In 1968 the time taken for those recorded spanned about 65 days; it was at a peak in September and tapered off early in October. Four cases were studied of birds from late hatchings of the previous season; three had been recorded with body moult before the winter.

An interesting example was a first year pair, male (012-14680), immature when banded on 23 March 1968, and a female (012-14821), juvenile when banded on 1 April 1968. These two birds were retrapped together constantly throughout the winter. The older bird (the male) completed a moult before the winter (see Fig. 4); the younger (the female) moulted body feathers only before the winter. On 10, 17 and 22 August the male had slight head moult only, and the female slight head and body moult. The female commenced wing moult early in September while the male continued with more profuse body and head moult than adults prior to breeding. The two presumably paired off during the winter and commenced to breed later than other known and established pairs. The female was noted as egg laying on 9 and 12 November. The recently fledged young were observed being fed at the trap on 4 January 1969. The study was upset on 6 January when a cat killed the male which had just commenced to moult its first primaries. Up to that date the only moult noted for the female was the loss of the two tail centrals on 30 December 1969.

### **Conclusion**

Moult in free-flying birds was difficult to analyse, but a large number of individual birds with few moult records confirmed a pattern defined from studying a few individuals regularly in detail, throughout a complete moult and over several seasons. Most breeding adult silvereyes appear to commence moult soon after the fledglings of the last brood become independent. From observations of male silvereyes in early stages of primary moult, still with enlarged tubules, I would agree with Keast (1953) and Middleton (1969) that completion of breeding is not an activator of moult, and that the two cycles can and do in some cases overlap. Birds which commence to moult, and then commence another brood, appear to arrest moult; the body moult ceases and only remiges already shed are completed. The post nuptial moult spans about three months from January to April. Adults which commence late may retain the last two secondary remiges. Advanced juvenile birds moult at a similar time and in a similar pattern to adult birds (Fig. 3). Juveniles from late in the season may commence moult of body feathers and remiges, but when 'arrested' by the onset of winter, complete the moult before breeding in the following spring. With knowledge of the moult timing in a district it is possible to use

the moult pattern as an aid to determine age. In this district birds with profuse body moult and complete remiges in late autumn, and birds moulting remiges in spring will be first year birds. This was confirmed by using skull ossification checks in the autumn of 1968. In adult birds the pre-nuptial moult is a replacement mainly of head feathers giving a bright new appearance to the bird. This is a partial moult and not profuse for adult birds.

#### Acknowledgements

I wish to thank Messrs H. J. Disney, S. G. Lane and J. Meakins for all their varied encouragement, criticism and advice in the preparation of this work. My thanks are extended also to my mother Mrs M. W. Swanson who assisted

with this work and kept the trap operating at Five Dock during my absence in Coffs Harbour.

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## Silvereye Movement in Eastern Australia

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Numerous recoveries have indicated the extent of movement by Eastern Silvereyes *Zosterops lateralis* but little has been recorded of the manner of such movement. Observations on this latter aspect are set out, and for comparison, some instances of movement by small passerines overseas are discussed.

The recovery in Tasmania of an Eastern Silvereye which had been banded seven months earlier in Sydney, New South Wales (Lane 1962) was the first proof of long-distance movement by this species. There is yet no conclusive evidence to indicate the flight speed of or the time taken by these birds between their breeding and wintering areas.

#### Flight Speed

Two European Swallows *Hirundo rustica* banded in South Africa were captured at the nest in U.S.S.R. 34 days later, having covered a minimum distance of 7,500 miles (Rowan 1968). This represents an average of over 200 miles a day but the daily maximum movement was probably greater as the figures would include resting periods.

Graber (1968) estimated distances that could be travelled on a clear night by migrants, mostly

small passerines, that were tracked by radar from central Illinois, U.S.A. His estimates relied on the migrants continuing on the same track as when under radar surveillance. For flight speeds in the vicinity of 30 knots (about 34 mph), a full night's migration could be 400 miles. Graber's estimates were made for typical clear spring and autumn nights, with about 12 hours of darkness. A similar period of darkness prevails in southern Australia at the time of the main silvereye movement.

On a few occasions one of us (SGL) has had the opportunity to check the speed of silvereye flight by automobile speedometer and found it to be in the region of 30 to 35 miles per hour. Probably silvereyes migrate at such speeds for up to 12 hours of darkness and future evidence may confirm daily or nightly movements of over 200 miles for these and other small passerines in Australia.