DISTRIBUTION, SIZE AND MOULT OF MIGRANT WARBLERS IN THE SOUTHERN TRANSVAAL

PART TWO

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Migrant warblers are well represented in the southern Transvaal in contrast with common belief and most of the warblers are much more common than sightings really suggest. Eight of these species of warblers are regularly caught in mistnetting sessions.

The purpose of this paper is to make some of the data, collected over the past seven years, available to interested people. There are very little data available on warblers for South Africa and most publications have incorporated very little or no data for South Africa.

The area in which the study was undertaken is approximately 180 km long and 30 km wide, falling between the coordinates 26°30'S to 26°45'S and 27°30'E and 29°15'E. This is from Secunda in the east to Vanderbijlpark in the west. A total of 13 ringing sites were visited at fairly regular intervals.

Of the eight species of warblers, seven are Palearctic migrants whilst the African Marsh Warbler is an Afrotropical migrant.

Four of these warblers were discussed in Part One of this two part paper, which appeared in *Safring News* 23(2) 1994 pp. 65-71. The remaining four warblers are:

European Marsh Warbler *A. palustris*
European Sedge Warbler *A. schoenabaenus*
African Marsh Warbler *A. baeticatus*
Willow Warbler *Phylloscopus trochilus*

All the data used in this paper were recorded by the authors, although the moult data were compared with the moult cards on record at SAFRING.

Wing measurements were all done according to the longest chord method and culmen measurements are from bill tip to union with skull.

All length measurements are in mm and mass is in grams. A new measurement, the head length in mm from bill tip to the rear of the skull, was also introduced. This measurement is more repeatable than the culmen length.

All the warblers have 10 primaries with the outermost very much reduced or minute and this was not *taken into account* in the moult study.

5. AFRICAN MARSH WARBLER *ACROCEPHALUS BAETICATUS*

5.1. Distribution

The African Marsh Warbler is the most common of all the warblers in the area and occurs wherever suitable habitat exists. It is very common in reedbeds and vlei areas covered with sedge or weeds. Also occurs in gardens and wooded areas.

The African Marsh Warbler is the only summer visitor warbler that also breeds here. It occurs between September and May with

Table 5.1. Mensural data for African Marsh Warbler.

	Wing	Tail	Tarsus	Culmen	Head	Mass
Min	53,0	42,0	19,5	15,6	30,7	7,0
Max	64,0	58,0	24,6	18,6	34,9	15,5
Mean	58,9	51,1	22,2	16,9	32,5	10,2
SD	1,92	2,45	1,02	0,61	0,83	1,12
n	375	353	357	289	192	387

Table 5.2. Monthly average wing length for African Marsh Warbler.

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Min	56,0	57,0	55,0	54,0	53,0	55,0	54,0	56,0
Max	62,0	64,0	63,0	64,0	63,0	62,0	62,0	62,0
Mean	58,9	60,4	59,1	59,4	58,6	58,4	58,4	59,2
SD	2,17	1,66	1,96	1,95	1,96	1,67	1,69	1,49
n	8	21	68	79	58	44	68	24

the first and last dates being 11 September and 7 May respectively. Some birds overwinter as a few birds were netted in July.

African Marsh Warblers do display site fidelity and 13 birds were retrapped at the original netting site after at least one migration with the longest lapsed time being 35 months. The recapture rate for the African Marsh Warbler is at present 6,9%.

5.2. Mensural Data

A total of 387 African Marsh Warblers was caught, ringed and measured during the study period (Table 5.1). Measurement data compares well with other South African data except for average wing length which is 1,2 mm longer than both Maclean and Komen recorded.

Monthly average wing length (Table 5.2) varies with 2 mm between the minimum and the maximum. No trend such as a gradual monthly increase or decrease in wing length was noticed. The number of birds netted in May was only four and was thus left out of the table.

From Table 5.3 it can be seen that the average monthly mass stays constant for the whole time period. It was found, however, that two birds that were captured in April had gained 3,2 and 3,5 g respectively. Too little data is available at this point to determine whether this kind of mass increase is widespread in African Marsh Warbler.

5.3. Moult

More than 200 birds were examined for moult during this study. Body and head moult are common from February onwards and in March about 30% of the birds caught had active rectrice moult. Wing moult does not actually occur as only two birds with active wing moult were caught during the study. So it would seem that African Marsh Warbler moults in its winter quarters.

Table 5.3. Monthly average mass for the African Marsh Warbler.

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Min	9,2	8,5	8,0	8,0	7,0	7,5	8,8	8,3
Max	12,3	13,0	12,3	12,0	15,5	12,7	13,0	14,8
Mean	10,3	10,6	9,9	10,1	10,6	10,1	10,3	10,4
SD	0,86	1,05	0,83	0,98	1,49	0,99	0,92	1,77
n	11	21	67	78	58	52	72	23

6. EUROPEAN MARSH WARBLER *ACROCEPHALUS PALUSTRIS*

6.1. Distribution

A fairly common bird that occurs in a wide variety of habitats like gardens, tall weeds, herbaceous plants and any bushy or wooded areas.

Recorded from several sites in the Secunda area, the Balfour area and the Vereeniging/ Vanderbijlpark areas.

The earliest recorded arrival monitored by netting is 23 November, while Tarboton & Kemp report 28 November and Dowsett-Lemaire & Dowsett report 3 December as the earliest arrival dates for the Transvaal. The latest recorded date on which the European Marsh Warbler was netted is 3 April.

Ortstreue (site fidelity) does occur in the European Marsh Warbler and we have retrapped six birds that have returned to the original site after their migration. What must be one of the most phenomenal retrap records for a European Marsh Warbler is the individual AB 63317 that was originally ringed in a garden in Vanderbijlpark on 26 March 1988. It was retrapped on 17 March 1990 (24 months), then again on 7 March 1992 (48 months) and finally, the latest record is for 31 January 1993 (58 months). If this was a first year bird when first netted this individual would have been at least 5,5 years old the last time it was retrapped.

Another bird was retrapped again at the original ringing site 3 months and 12 months after being ringed. The other birds that showed site fidelity were recaptured 13, 21, 21 and 24 months respectively, after the original ringing dates.

A European Marsh Warbler ringed at Vehmaa, Turin La Porin Laani, Finland (60°41'N, 21°35'E) on 14 June 1985 was controlled in a garden in Vanderbijlpark (26°43'S, 27°50'E) on 26 February 1987 and again on the 29 March of the same year, a distance of at least 9 735 km away from the original ringing site.

Table 6.1. Mensural data for the European Marsh Warbler.

	Wing	Tail	Tarsus	Culmen	Head	Mass
Min	60,0	46,0	20,8	14,4	32,3	10,0
Max	72,0	59,0	24,0	18,8	34,5	16,0
Mean	67,6	53,3	22,4	16,6	33,2	12,0
SD	2,54	1,77	0,79	0,82	0,80	0,88
n	57	55	62	54	13	58

There were another six birds that were retrapped during the same season that ringing took place. This, along with the records of birds recaptured after migration shows that the local European Marsh Warbler populations are resident from December to March.

The European Marsh Warbler provided the best recapture data of all the warbler species in this study, with a recapture rate of 21%. If multiple recaptures are included this becomes 27%.

6.2. Mensural data

Measurements of the European Marsh Warbler recorded by us (Table 6.1) compare well with those in the European handbooks.

Gain in mass is not very pronounced with an average increase of only 0,5 grams from December to March (Table 6.2). A few individuals, however, showed a substantially higher mass of approximately 15 to 16 grams. Table 6.3 shows the mass increase for individual recaptures.

Table 6.2. Monthly average mass for European Marsh Warbler.

	Dec	Jan	Feb	Mar
Min	10,0	11,0	11,0	11,6
Max	13,0	14,1	15,0	16,0
Mean	11,8	12,1	12,4	12,3
SD	0,77	0,95	1,59	1,21
n	16	22	9	12

Wing lengths showed a substantial increase from December to March with an average increase of 1,29 mm (Table 6.4). Wing length in February and early March can be deceiving as many birds are in moult.

Table 6.4. Monthly average wing length for European Marsh Warbler.

	Dec	Jan	Feb	Mar
Min	64	64	67	65
Max	71	72	72	72
Mean	67,9	68,1	69,0	69,2
SD	2,14	2,29	2,39	2,49
n	16	9	9	10

6.3. Moult

Moult cards for 28 birds in active moult and a further 15 cards for birds that had completed moult were available for this study. Moult starts between mid December and mid January. The earliest bird recorded with moult was on 28 December with a P-score of 3. A bird netted on 9 January having a P-score of 14 would indicate a starting date of 10-14 December. Only two birds fell outside this time period and must have started towards the end of January or early February, one having a P-score of 8 on 9 February and the other a P-score of 22 on 3 March. Moult is completed between the end of February and the end of March. Most birds netted toward the end of March had completed moult. The latest recorded bird in moult was on 29 March with a P-score of 43.

Table 6.3. Mass gain for individual birds.

Ring no.	First date	Mass (g)	Second date	Mass (g)	Mass gain
V272537	26.02.87	15,0	29.03.87	16,0	+ 1,0
AB88926	08.12.90	12,4	23.03.91	14,6	+ 2,2
AB88941	05.01.91	12,7	23.03.91	14,2	+ 1,5
AB88938	05.01.91	14,1	23.03.91	13,6	- 0,5
AB98174	27.02.93	11,5	03.04.93	11,5	0,0
AB98139	09.01.93	11,0	03.04.93	11,5	+ 0,5
AB98137	09.01.93	11,5	03.04.93	12,5	+ 1,0

6.3.1. Wing moult

Wing moult starts with the inner primary and is descendant towards the wing tip in sequence. Moult is fairly rapid with 3 to 5 primaries in various stages of moult. The first secondary dropped is S8 at a P-score between 1 and 5. The secondary moult sequence is S8, S9, S7 and then S1 to S6. S1 is dropped with P-score 15 to 20. The moult of secondaries are normally completed just before that of the primaries.

The greater coverts start moult just before or simultaneous with P1 and are very rapid with all feathers dropping at the same time. The greater covert moult is complete at a P-score between 10 and 20.

The alula starts moult at a P-score between 30 and 35 and all three feathers moult simultaneously. Alula moult is complete just before the primary moult is complete.

6.3.2. Rectrice moult

Rectrices all moult simultaneously and all feathers are normally in the same state of growth. Rectrice moult starts mainly at a P-score of 5 to 15 although one bird started at 25. Rectrice moult is complete just before the primaries.

6.3.3. Body moult

Body and head moult start just before primary moult and are completed together with primary moult.

6.3.4. Moult duration

Moult duration by scatter diagram suggests a moult period of 85 days. The moult period, as determined from a retrapped bird, which moved from a P-score of 28 to a P-score of 43 in 32 days, indicates a time period of 88 days.

7. EUROPEAN SEDGE WARBLER *ACROCEPHALUS SCHOENOBAENUS*

7.1. Distribution

A common to very common summer visitor in suitable habitat. In the study area, this habitat was mostly found to be reedbeds. Also occurs commonly in herbaceous shrubs and weeds surrounding water or vlei areas. Occurs

Table 7.1. Mensural data for European Sedge Warbler.

	Wing	Tail	Tarsus	Culmen	Head	Mass
Min	61,0	44,0	18,6	13,4	29,2	8,0
Max	72,0	56,0	23,5	17,9	32,8	14,7
Mean	67,4	50,0	21,4	15,6	31,5	11,7
SD	2,42	2,55	0,86	0,80	0,69	1,11
n	140	141	146	134	88	158

Table 7.2. Monthly average mass for European Sedge Warbler.

	Dec	Jan	Feb	Mar	Apr
Min	8,5	8,0	10,3	10,5	10,7
Max	14,0	14,7	14,0	14,7	14,3
Mean	11,3	11,5	11,8	11,9	12,7
SD	1,40	1,39	0,79	0,77	1,14
n	26	33	36	57	7

Table 7.3. Mass of individual European Sedge Warblers retrapped in same season.

Ring no.	Ringed	Mass (g)	Retrapped	Mass (g)
AD33636	22.01.94	11,0	19.02.94	11,6
AD56024	29.01.94	12,9	19.03.94	12,9
AD56057	19.02.94	11,6	25.02.94	11,6
AD56062	19.02.94	11,5	05.03.94	12,5
do			13.03.94	12,5
AD32593	28.02.94	11,5	09.04.94	14,3
AD68094	16.04.94	10,7	23.04.94	10,7

in gardens but to a much lesser extent. These warblers are far more common than they appear to be as can be seen from the numbers netted in the study area (in excess of 15 birds in four hours on several occasions). The earliest and latest recorded dates for the area are 25 November and 23 April respectively. The latest date recorded by Tarboton and Kemp was 5 April. The European Sedge Warbler also displays site fidelity as ringed birds were retrapped in the same area in which they were originally ringed the year before.

7.2. Mensural data

A total of 158 European Sedge Warblers was caught, ringed and measured over a period of eight years. Measurements that we recorded did not always correlate with European data but European data varies from region to region (Table 7.1).

The average gain in mass from December to April (Table 7.2) is 1,43 g. Although this is not spectacular, it is significant. We did not record any birds with a mass of above 14,7 g. Birds that we originally ringed in January, February and March and retrapped two to three weeks afterwards showed little or no mass increase, however, birds retrapped towards the end of March and in April did show a mass increase of between 2,3 and 2,9 g.

The wing length range we recorded was 61-72 mm with a mean of 67,4 mm. This range is somewhat smaller than that given by the European workers who record a range of 58-74 mm (Williamson; Svensson and Bub). Wing length, however, differs quite a lot from time of arrival to time of departure (Table 7.4). The months with minimum wing length are December and January, which are the months in which most of the birds start their moult and the primaries are very worn. This event shifts the wing length from a minimum of 61 to 64 mm and from a maximum of 70 to 72 mm. It also changes the measurement for males and females and care should be taken to use European measurement data to sex birds in South Africa.

Table 7.4. Monthly wing length data for European Sedge Warbler.

	Dec	Jan	Feb	Mar	Apr
Min	63,0	61,0	65,0	64,0	64,0
Max	70,0	70,0	72,0	72,0	72,0
Mean	66,9	66,0	67,7	68,2	67,6
SD	2,06	2,51	1,92	2,32	2,94
n	25	33	27	49	7

The range for tail length is 44-56 mm with a mean of 50,0 mm. This range is also somewhat smaller than that given by Williamson of 39-56 mm with a mean of 48,08 mm.

Tarsus length range is 18,6-23,5 mm with a mean of 21,41 mm which corresponds well to that given by Roberts 18,5-23,0 mm with a mean of 21,0 mm. Williamson, however, records a range of 19,5-24,5 mm with a mean of 22,07 mm.

Culmen length is slightly longer than given by Williamson and is 13,4-16,8 mm with a mean of 15,58 mm. Four birds were captured with a culmen length in excess of 17 mm, with two birds reaching 17,9 mm.

7.3. Moult

For this study 85 moult cards, of which 49 were for birds with active wing moult, were available. Moult starts between early December and mid February. The earliest recorded moult was a bird netted on the 5 December with a P-score of 4. The latest starter recorded was a bird with a P-score of 6 on 5 March.

The first birds complete their moult by mid February. On 19 February 1994 13 moult cards were completed. Of these, six birds had just finished primary moult, five were just starting whilst two were about halfway. Birds with a P-score between P4 and P10 on 19 February would suggest a completion date between 10 and 20 April. By the end of March most birds netted had completed primary moult.

Table 7.5. Cumulative number of birds.

	P-score 45	P-score 40-44
10 Feb	0	0
20 Feb	3	3
28 Feb	10	12
10 Mar	18	26
20 Mar	27	31

Table 7.5 shows the cumulative total of birds that had completed (P-score 45) or nearly completed (P-score 40-44) moult at the given dates. This, however, does not correspond to Williamson's findings that birds in southern Africa only complete moult towards the end of April.

Table 7.5 shows that 58 birds had completed or nearly completed moult by 20 March. Only one bird was netted after 1 March with a P-score of less than 40 and that was a bird with a P-score of 6 on the 5 March. This would suggest a completion date of early May.

Williamson, however, states that the start of moult in South Africa appears to be when the birds in northeastern Africa have finished. This is based on a series of records from Potchefstroom where the earliest bird in moult occurs in February and birds have P7-9 growing by 20 and 23 April and a late bird has P6-10 growing by 26 April. Our study shows that most birds complete moult at least one and a half months earlier than Williamson states although we also found birds that completed moult towards the end of April.

7.3.1. Wing moult

Wing moult starts with the inner primary and is descendant towards the wing tip in sequence. Moult is fairly rapid with 3 to 5 primaries growing simultaneously. The first secondary dropped is S8 and this is at a P-score of 3-5. In three out of 16 birds with active moult, S7 dropped before S8. The normal secondary sequence is S8, S7, S9 and then S1 to S6. The moult of secondaries is completed just before the primaries.

The greater coverts start moult simultaneously with the primaries. It is very rapid and all

Table 7.6. Moult duration in days calculated from retrap data.

Ring No.	First date	P-score	Last date	P-score	Moult duration (days)
AD 33636	22.01.94	6	19.02.94	24	69
AD 56024	29.01.94	10	19.03.94	44	66

coverts are usually at the same stage of moult. Alula moult starts at a P-score between 5-10.

7.3.2. Rectrice moult

The onset of rectrice moult is mostly at a P-score between 5 and 20 and is normally completed just before the primary moult is completed. All rectrices moult simultaneously and normally all feathers are in the same state of growth.

7.3.3. Body moult

Body moult starts two to three weeks before primary moult begins and is completed two to three weeks after primary moult is completed.

7.3.4. Moult duration

Moult duration as calculated from a scatter diagram is approximately 75 days. Moult duration as calculated from retraps can be seen in Table 7.6.

8. WILLOW WARBLER *PHYLLOSCOPUS TROCHILUS*

8.1. Distribution

The Willow Warbler is fairly common to common over the whole of the study area wherever there is suitable habitat, such as well-wooded water courses, wooded koppies and urban gardens. It is the most numerous of the Palearctic warblers in the study area. The

Table 8.1. Mensural data for Willow Warbler.

	Wing	Tail	Tarsus	Culmen	Head	Mass
Min	60,0	44,0	18,0	10,0	26,0	5,0
Max	73,0	57,0	21,7	14,5	29,1	11,5
Mean	65,9	49,7	19,3	12,2	27,6	8,3
SD	2,98	2,77	0,89	0,92	0,80	0,99
n	171	182	173	189	38	188

Table 8.2. Comparison of Willow Warbler mensural data.

	Wing			Tail			Tarsus		
	W	H	R	W	H	R	W	H	R
Min	57,0	-	60,0	41,0	-	44,0	18,5	-	18,0
Max	76,0	-	73,0	60,0	-	57,0	22,5	-	21,7
Mean	66,3	65,8	65,9	50,1	50,0	49,7	20,6	22,2	19,3

	Culmen			Mass		
	W	H	R	W	H	R
Min	9,5	-	10,0	6,5	-	5,0
Max	14,0	-	14,5	11,8	-	11,5
Mean	11,7	12,9	12,2	8,7	8,7	8,3

W = Williamson; H = Hopcroft; R = Raijmakers

Table 8.3. Monthly average wing length for Willow Warbler.

	Oct	Nov	Dec	Jan	Feb	Mar
Min	61	61	61	60	61	62
Max	71	71	73	72	68	73
Mean	66,6	66,4	65,6	65,2	64,7	67,4
SD	3,31	3,08	3,06	2,94	2,14	2,86
n	10	28	51	37	19	22

earliest recorded date for the area is 9 October and the last recorded date is 8 April. The Willow Warbler also shows site fidelity and four birds were recaptured after one migration.

8.2. Mensural data

Measurement data for the Willow Warbler (Table 8.1), apart from tarsus, compares well with that of Williamson and wing size compares well with that of Svensson. Most of our data also compares well with that of Hopcroft except for tarsus and culmen (Table 8.2). As Hopcroft does not give ranges, only the mean values could be calculated. The ranges for Williamson are as given in Table 8.2.

Mean wing length for the Willow Warbler decreases from time of arrival until February. In March, when most birds have completed moult, the mean wing length increases to 67,4 mm (Table 8.3). Care should be taken when sexing birds on wing length data.

Our data demonstrate that no dramatic increase in mass took place prior to migration (Table 8.4). There was only an increase in minimum average mass from October to March.

8.3. Moult

For this study 59 moult cards for birds in active wing moult were available. Moult starts between the first week of December and the third week of January. The earliest recorded moult was a bird caught on 17 December with a moult score of 2. However, a bird netted on 2 January with a moult score of 39 would indicate a starting date of approximately 20 November.

The bulk of the birds complete moult between the first week in February and the third week in March. The latest starter was a bird netted on 2 March with a moult score of 23. This would give a starting date of approximately 28 January and a completion date around 3 April.

8.3.1. Wing moult

Wing moult starts with the inner primary and is sequentially descendant towards the wing tip. Moult is fairly rapid with two to four primaries growing simultaneously. The first

Table 8.4. Monthly average mass for Willow Warbler.

	Oct	Nov	Dec	Jan	Feb	Mar
Min	6,1	6,0	5,0	6,0	6,8	7,0
Max	10,5	11,5	9,3	11,0	10,8	10,1
Mean	8,9	8,1	8,0	8,2	8,4	8,6
SD	1,3	1,06	0,85	0,96	0,98	0,78
n	10	27	51	38	34	23

secondary is dropped at a P-score between 10 and 25 and is normally S8 but, in 20%, S9 was dropped before S8. The normal secondary sequence is S8, S9, S1, S7 and S2 to S6.

Moult of secondaries is completed just after completion of primary moult. Greater coverts start moulting simultaneously with the primaries and are completed at a primary score of 15 to 20. The greater coverts are usually all at the same stage of growth.

8.3.2. Rectrice moult

In our study it was found that rectrice moult starts during primary moult when the P-score is between 2 and 15, but mostly before P-score 10. This differs from Hopcroft's findings that rectrice moult started about halfway through primary moult. In 75% of the birds the rectrices were moulted very rapidly with all or nearly all at the same stage of growth. The remaining 25% of the birds underwent the normal centrifugal rectrice moult. Hopcroft states that lateness of moult may account for the rapidity of rectrice moult. In our study, however, this seemed not to be the case as birds in December and early January also displayed this phenomenon. Completion of rectrice moult is between P-score 30 and 40.

8.3.3. Body moult

Body and head moult starts before primary moult and ends after primary moult.

Table 8.5. Distribution of birds per moult category.

P-score	No. of birds
0-15	14
16-30	21
31-45	24

8.3.4. Moult duration

Moult duration as determined by a scatter diagram is approximately 62 days. Data for this determination was reasonably evenly distributed over the moult period (Table 8.5).

REFERENCES

BUB, H. & DORSCH, H. 1988. *Kennzeichen und Mauser Europäischer Singvögel, Teil 4, Cistern-sänger, Seidensänger, Schwirle und Rohrsänger.* Wittenberg Lutherstadt: A. Ziemsen Verlag.

DOWSET-LEMAIRE, F. & DOWSET R.J. 1987. European Reed and Marsh Warblers in Africa: Migration patterns, moult and habitat. *Ostrich* 58: 65-85.

GINN, H.B. & MELVILLE, D.S. 1983. Moult in birds. Tring: *BTO Guide* 19.

GINN, P.J., MCILLERON, W.G. & MILSTEIN, P. LE S. 1989. *Complete book of southern African birds.* Cape Town: Struik Winchester.

HOPCROFT, C. 1984. A study of the Willow Warbler in South Africa. *Safring News* 13: 10-17.

KOMEN, J. 1988. Identity crises: African Marsh, European Reed and European Marsh Warbler. *Bokmakierie* 40(4): 106-110.

MACWORTH-PRAED, C.W. & GRANT, C.H.B. 1963. *Birds of the southern third of Africa.* Vol 2. London: Longmans, Green & Co.

MACLEAN, G.L. 1993. *Roberts' birds of southern Africa.* Cape Town: John Voelcker Bird Book Fund.

NEWMAN, K. 1992. *Newman's birds of southern Africa.* Halfway House: Southern Book Publishers (Pty) Ltd.

SINCLAIR, I. 1984. *Ian Sinclair's fieldguide to the birds of southern Africa.* Cape Town: C. Struik Publishers.

STRESEMANN, E & V. 1968. Winterquartier und Mauser der Dorngrasmucke, *Sylvia communis. J. Orn.* 109(Heft 3): 303-314.

SVENSSON, L. 1984. *Identification guide to European passerines.* Stockholm: BTO.

TARBOTON, W.R., Kemp, M.I. & Kemp, A.C. 1987. *Birds of the Transvaal.* Pretoria: Transvaal Museum.

UNDERHILL, L.G., PRŶS-JONES, R.P., DOWSETT R.J., HERROELEN, D.N., JOHNSON, D.N., LAWN, M.R., NORMAN, S.C., PEARSON, D.J. & TREE, A.J. 1992. The biannual primary moult of Willow Warblers *Phylloscopus trochilus* in Europe and Africa. *Ibis* 134: 286-297.

WILLIAMSON, K. 1983. Identification for Ringers No 1. The Genera Cettia, Locustella, Acrocephalus and Hippolais. Tring: *BTO Guide* 7.

WILLIAMSON, K. 1983. Identification for Ringers No 2. The Genus *Phylloscopus*. Tring: *BTO Guide* 8.

WILLIAMSON, K. 1968. Identification for Ringers No 3. The Genus *Sylvia*. Tring: *BTO Guide* 9.