The Severn Estuary Gull Group

The Primary Moult of the Lesser Black-backed Gull *L.fuscus*

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THE PRIMARY MOULT OF THE LESSER BLACK-BACKED GULL

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1. INTRODUCTION

This paper deals with the primary moult of the Lesser Black-backed Gull *Larus fuscus*. It is based on moult scores obtained from birds trapped by the Severn Estuary Gull Group in Gloucestershire, Herefordshire and Worcestershire and personal observations by the author.

Though a number of papers on the primary moult of Lesser Black-backed Gulls of the subspecies *L.f. graellsii* already exist, including those by Ingolfsson (1970), Harris (1971), Stresemann (1973), Verbeek (1977) and de Wijs (1978), these mainly involve adult birds at breeding grounds and lack information on the latter stages of moult when birds have departed for their wintering areas. In addition, different authors have given varying dates for the onset of primary moult and none mentions suspended moult.

Ingolfsson only briefly mentions Lesser Black-backed Gull primary moult in his paper and states "the moult of the primaries starts at about the same time that the first eggs are laid". According to Stresemann the onset of moult in gulls on Walney Island is the beginning of June. Based on living and dead material, examined between 1962 and 1969 from Skokholm and Skomer Islands, Harris concluded that adult Lesser Black-backed Gulls "commence their moult when they have large young and field observations suggest this is about the second week in July". Based on his own examination of 79 Lesser Black-backed Gulls from Walney Island, Verbeek states that 'moult occurred when the eggs hatched in mid-May.'

In more recent literature Cramp & Simmons (1983), Ginn & Melville (1983) and Baker (1993) provide much more information on adult primary moult, including suspended moult, but details of primary moult for other age groups is lacking. Therefore, in addition to what has already been established for adult primary moult, this paper provides comprehensive details of primary moult for a further three age groups; 1st, 2nd and 3rd-summer birds.

No definite conclusions on any ecological or geographical differences can be drawn from the data for birds obtained during this study because, during the long period of moult, passage birds from elsewhere in the UK and from abroad join local breeders. Therefore, this paper covers the whole period of primary moult for Lesser Black-backed Gull of the subspecies *L.f. graellsii*.

SUBSPECIES *L.f. intermedius*

Identified mainly by their darker mantles individuals of the subspecies *L.f. intermedius* also occurs in the study area as passage migrants and winter visitors (Plates 1,8 & 9). Some also summer, mostly immature birds, but a few adult birds are observed, mainly at the landfill sites. Only 126 birds have been trapped, 115 of these adult birds. However, it is likely that many immature *intermedius* have been overlooked in the catches and a number of birds described as 'darkish' could also have been *intermedius*.

Three birds ringed as adult *intermedius* have since been recovered in Norway and 12 *intermedius* ringed in Norway have been controlled.

Barth (1975), who collected 99 *intermedius* from breeding grounds in Norway from May 15 to August 12, found that moulting might start in the middle of May, with the mean date in the middle of June. One bird collected on July 18 had not started moult. He also states, "That the Norwegian material demonstrates that the date of initiation of primary moult in *L.f. intermedius* corresponds rather closely with that of *L.f. graellsii*..."

Because little material exists on the primary moult of *intermedius* after they leave breeding grounds, the findings obtained during this study are included in this paper.

MATERIALS and METHODS

During the period February 1986 to October 2005 a total of 14339 Lesser Black-backed Gulls were caught by the Severn Estuary Gull Group using cannon-nets and from this total 7389 primary moult scores (PMS) were recorded (the primary moult scores being those most readily and easily taken when large gull catches are made). Where time did not permit for a full examination to be made only the number of old primaries present was recorded. This involved an additional 202 birds and the data from these individuals are included in the results.

In addition to being a member the Severn Estuary Gull Group, the author has independently studied the Lesser Black-backed Gull in the field since 1984. These observations were made mostly at landfill sites, but also at breeding sites in Gloucestershire and Worcestershire. Observations for moult were made on 2680 birds from March to July. Those in March and May were carried out primarily to establish the earliest dates for the onset of primary moult, while those in June and July to count the number of old primaries present. However, it soon became clear that some birds observed with no gaps in the wings, particularly adult birds, may have been in suspended moult and unless birds are observed closely, and in the right light conditions, new feathers are not clearly distinguishable from old. Therefore, field observations made on adults in June and July, are unreliable, particularly on those that are full-winged. Photographs taken during these two months were also helpful in establishing the numbers of old feathers present, but only in a few cases was moult-scoring possible. Only where significant, have the authors own observations been mentioned in this report

All biometrics and moult scores from captured birds, and used in this study, were taken by a single observer. Birds were aged according to the British Trust for Ornithology Ringing Schedule Instruction Manual (BTO, 1997) and for this study were separated into the following four age groups: 1s = 1st-summer (EURING Age code 5), 2s = 2nd-summer (EURING Age code 7), 3s = 3rd-summer (EURING Age code 9) and Adults (>Age 9). Some 4th-summer birds are not always identifiable and likely to have been aged as adults. For this reason all birds aged as 4th-summer during this study have been treated as adults in this paper. Following Harris & Hope Jones (1969) and Coulson *et al.* (1983) birds were sexed mainly by the bill measurement criteria which had been established for birds breeding in the UK. The sample on which this paper is based includes many birds who breed outside the UK, so these criteria must be used with caution. Accordingly, for the main analysis presented in this paper, the moult scores for males and females have been treated together throughout. However, if the bill measurement criteria are applied to the sample on which this paper is based, then it is apparent that there is some difference between the mean PMS of adult male and female *graellsii*, as shown in Figure 5. The significance of this difference is not clear at the present time, due to various uncertainties, primarily associated with the populations from which the birds have been drawn. The first major uncertainty relates to the sexing criteria, as noted above. The second concerns the moult strategy of individual populations, and whether the latitude of the breeding grounds has any significant effect. Comparison of Figures 5 and 9 would appear to show that the difference is small compared to the variation found across the whole sample. Notwithstanding these uncertainties, presentation of this data is considered valuable, since previous papers make no mention of any difference between the sexes.

PRIMARY MOULT SEQUENCE

'The 'basic sequence' of moult normally begins with the dropping of the innermost primary (P1) followed by the adjacent primary (P2) and so on in a fairly regular order outwards towards the wing tip. The new feather is partly grown before the next in sequence is dropped so that there are feathers of various lengths in the 'growth band' which progresses across the wing with old feathers ahead of it and new ones behind. The number of feathers in growth at any one time depends on: (i) the rate of growth of the individual feathers (ii) the length of the feathers (iii) the length of the interval between the start of growth of adjacent feathers (Ginn & Melville 1983). This study established while some birds, particularly 1st-summer birds, follow the 'basic sequence' of moult, many others do not, and birds in suspended moult are regularly encountered.

Using methods described in Ginn & Melville (1983) primaries were numbered from proximal (1) to distal (10), the minute 11th primary being ignored for this study. The moult pattern was recorded by giving to each primary an integral score using the following system: 0 (= Old feather), 1 (= Old feather missing or new feather completely in pin), 2 (= New feather just emerging from the sheath or up to one third grown), 3 (= New feather between one and two thirds grown), 4 (= New feather more than two thirds grown and with remains of waxy sheath at its base), 5 (= New, fully grown feather). The scores for all 10 primaries of one wing were then added to give a primary moult score with a maximum of 50. As the moult in the two wings is normally symmetrical, only where unusual moulting birds were encountered were both wings examined. Where individual primary feather scores are given in the text they are listed from the inner to outer, e.g., NN43100000, representing a bird with two new inner primaries, P1&P2, fully grown, three primaries P3-P5 in moult and five, P6-P10, unmoulted old primaries; the 'moult score' would be 18 for that pattern.

Suspended moult, first recorded in British birds by Spence (1984), can readily be discerned during the early stages of moult and during the breeding season, as are those individuals which had resumed moult after suspension because of the sharp discontinuity between the innermost fully grown new primary and adjacent short growing primary. Typical moult pattern for a bird in suspended moult would be NN00000000, indicating two inner primaries fully renewed and eight old primaries still in place. The pattern for the same individual resuming moult with P3 after suspension would be NN10000000. Birds in suspended or resuming after suspension are encountered on passage, but these are less obvious. Suspended moult is dealt with more fully under each age group section.

Table 1 summarises the results of 3802 measurements of primary moult patterns for the four specified age groups of bird. For each moult score, many different patterns are recorded; a total of 207 in this study, with adults showing the greater number of different patterns (189), although it is not until the latter stages of moult that one or two patterns predominate for each age group.

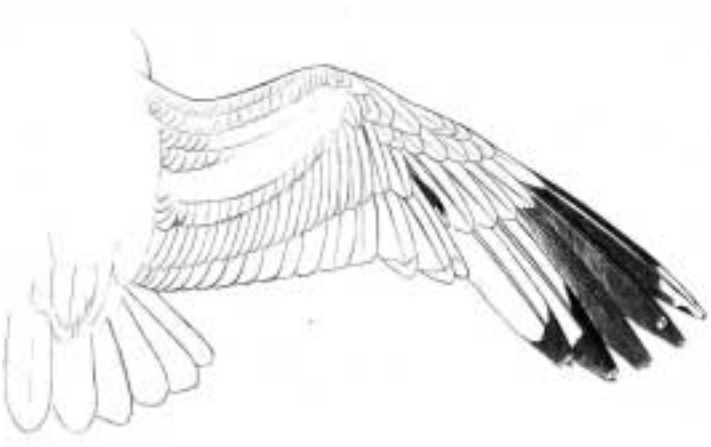


Table 1. *The sequence of primary moult in the Lesser Black-backed Gull. All recorded patterns are shown, including unusual types, with numbers of birds sampled for each age group.*

Moult Score	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*	*Moult Score*	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*
1	1000000000	27	5	13	11	9 (cont)	4320000000	3	-	2	1
							4311000000	2	-	-	1
2	2000000000	4	1	-	-		4221000000	1	-	-	-
	1100000000	20	7	19	32		4211100000	1	-	-	-
							3321000000	1	-	-	1
3	3000000000	1	1	-	-						
	2100000000	10	8	11	10	10	NN00000000	44	3	1	-
	1110000000	1	-	1	5		N000N00000	1	-	-	-
							N410000000	6	4	4	1
4	4000000000	8	-	-	-		N320000000	2	-	-	-
	3100000000	7	2	3	-		N211100000	1	-	-	-
	2200000000	4	1	5	-		4420000000	4	-	2	1
	2110000000	-	-	1	8		4411000000	-	1	-	-
							4321000000	4	-	1	12
5	N000000000	20	1	-	-		4221100000	1	-	-	-
	4100000000	1	-	-	-						
	3200000000	7	4	4	-	11	NN10000000	14	2	3	1
	2210000000	5	-	7	16		N420000000	4	1	1	-
							N411000000	2	-	-	-
6	N100000000	8	1	-	-		N321000000	2	-	-	-
	4200000000	3	1	-	-		4421000000	1	-	-	1
	4110000000	-	-	1	-		4322000000	-	-	-	1
	3300000000	1	-	-	-		4321100000	1	-	-	-
	3210000000	7	1	6	7		3322100000	1	-	-	2
	2220000000	1	-	-	1						
	2211000000	3	1	-	-	12	NN20000000	6	1	1	-
							NN11000000	2	-	-	-
7	N200000000	3	-	-	-		N421000000	7	-	2	8
	N110000000	2	1	-	-		4431000000	1	-	1	1
	4300000000	6	-	-	-		3332100000	1	-	-	1
	4210000000	-	-	1	-						
	3310000000	-	-	4	2	13	NN30000000	10	3	-	-
	3220000000	-	-	-	1		NN21000000	17	2	-	5
	3211000000	-	-	-	3		N431000000	2	-	2	1
	2221000000	1	-	-	1		N421100000	2	-	-	-
							N322100000	1	-	-	-
8	N300000000	2	-	1	-						
	N210000000	-	-	-	1	14	NN40000000	3	-	1	-
	4400000000	2	-	-	-		NN31000000	10	6	6	5
	4310000000	6	1	3	2		NN21100000	4	-	-	-
	4211000000	1	-	-	-		N422100000	-	-	-	1
	3320000000	1	1	1	2		4432100000	2	-	1	5
	3221000000	-	-	-	1						
	2221100000	1	-	-	-	15	NNN0000000	7	1	-	-
							NN41000000	26	7	12	1
9	N400000000	15	1	1	-		NN32000000	2	-	-	-
	N310000000	4	-	2	-		NN31100000	2	-	-	-
	N211000000	1	-	1	-		NN22100000	1	-	-	1
	4410000000	2	1	2	-		N432100000	2	-	-	1

Moult Score	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*	*Moult Score*	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*
16	NNN1000000	2	2	-	-	25	NNNN410000	8	2	7	-
	NN42000000	6	2	5	4		NNNN320000	4	-	3	3
	NN41100000	1	-	-	-		NNN4321000	23	-	-	-
	NN32100000	7	-	-	6						
	4443100000	1	-	-	-	26	NNNN420000	30	1	17	3
	4432210000	1	-	-	1		NNNN321000	1	-	-	-
							NNN4421000	1	-	-	-
17	NNN2000000	7	2	2	-						
	NN43000000	1	-	-	-	27	NNNNN20000	2	-	-	-
	NN42100000	32	4	4	13		NNNN430000	5	1	-	1
	NN23200000	1	-	-	-		NNNN421000	24	3	3	5
	4433210000	1	-	-	-						
						28	NNNNN30000	1	1	1	-
18	NNN3000000	6	-	-	-		NNNN431000	36	2	12	12
	NNN2100000	3	1	1	-		NNN4432000	2	-	-	-
	NN43100000	12	2	2	13						
	NN42110000	1	-	-	-	29	NNNNN40000	-	-	1	-
	N433210000	1	-	-	-		NNNNN31000	6	2	5	2
							NNNN432000	17	3	4	1
19	NNN4000000	1	-	1	-						
	NNN3100000	17	6	6	1	30	NNNNN41000	9	3	6	1
	NN43200000	10	1	2	8		NNNNN32000	2	2	3	2
	NN33210000	2	-	-	-		NNNN442000	1	-	-	-
							NNNN441100	-	-	1	-
20	NNN4100000	9	4	5	-		NNNN432100	3	1	1	-
	NNN3200000	4	2	-	-						
	NN43210000	18	2	1	7	31	NNNNN42000	63	11	14	4
							NNNNN41100	-	-	-	1
21	NNNN100000	2	-	-	-		NNNNN32100	2	-	-	-
	NNN4200000	13	4	8	1		NNNN432110	1	-	-	-
	NNN4110000	1	-	-	-						
	NNN3210000	4	1	-	-	32	NNNNNN2000	4	-	-	-
	NN44300000	1	-	-	-		NNNNN43000	11	2	4	-
	NN44210000	1	-	-	-		NNNNN42100	17	3	5	7
22	NNNN200000	1	2	2	-	33	NNNNNN3000	9	-	2	-
	NNN4300000	-	1	2	-		NNNNNN2100	1	-	1	-
	NNN4210000	32	6	4	6		NNNNN43100	42	2	4	8
	NN44310000	-	-	1	-						
						34	NNNNNN4000	4	-	-	-
23	NNNN300000	1	-	3	-		NNNNNN3100	9	1	10	3
	NNNN210000	1	-	2	-		NNNNN43200	8	-	1	5
	NNN4310000	13	2	4	11						
	NNN4211000	1	-	-	-	35	NNNNNN4100	18	1	5	2
							NNNNNN3200	9	2	1	2
24	NNNN310000	10	8	5	1		NNNNN43210	6	-	-	2
	NNN4410000	-	-	1	-						
	NNN4320000	19	1	-	7	36	NNNNNNN100	1	1	-	-
	NN44321000	1	-	-	-		NNNNNN4200	64	8	17	17
							NNNNNN3210	1	-	-	-
							NNNNN43211	1	-	-	-

Moult Score	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*	*Moult Score*	*Primary Moult Pattern*	*Adults*	*3s*	*2s*	*1s*
37	NNNNNNN200	2	-	-	-	42 (con)	NNNNNNN421	55	5	8	22
	NNNNNN4300	7	-	-	1		NNNNNNN322	1	-	-	-
	NNNNNN4210	25	2	2	6						
						43	NNNNNNNN30	2	1	1	-
38	NNNNNNN300	7	1	2	-		NNNNNNNN21	-	-	-	1
	NNNNNNN210	1	-	-	-		NNNNNNN431	12	-	1	6
	NNNNNN4310	27	1	5	11		NNNNNNN422	40	1	3	1
	NNNNNN4211	6	-	-	1						
	NNNNNN3311	1	-	-	-	44	NNNNNNNN40	2	-	-	-
							NNNNNNNN31	7	1	1	-
39	NNNNNNN400	9	1	-	1		NNNNNNN441	1	-	-	1
	NNNNNNN310	4	-	1	3		NNNNNNN432	142	4	3	21
	NNNNNN4320	2	1	-	-						
	NNNNNN4311	7	-	-	-	45	NNNNNNNN41	2	-	-	1
							NNNNNNNN32	38	3	3	8
40	NNNNNNN410	21	1	3	3		NNNNNNN433	23	-	1	1
	NNNNNNN320	1	1	-	-						
	NNNNNN4321	23	-	1	5	46	NNNNNNNN42	27	2	2	9
							NNNNNNNN33	3	-	-	-
41	NNNNNNNN10	1	-	-	-						
	NNNNNNN420	43	2	3	7	47	NNNNNNNNN2	1	-	-	-
	NNNNNNN411	1	-	-	-		NNNNNNNN43	330	11	-	-
	NNNNNNN321	7	2	1	-						
	NNNNNN4322	4	-	-	-	48	NNNNNNNNN3	3	1	-	-
							NNNNNNNN44	164	10	7	12
42	NNNNNNNN20	4	2	-	1						
	NNNNNNN430	2	-	-	-	49	NNNNNNNNN4	489	24	30	31
							Sample size	2627	252	421	502
							Number of different patterns recorded	189	89	99	92

NUMBERS OF MOULTING PRIMARIES

The number of primaries growing concurrently in relation to moult score for all age groups is shown in Table 2 and Figure 2. On average the mean number of primaries moulting during the various stages of moult is highest for 1st-summer birds than for the other three age groups. This is particularly obvious in the early stages of moult, and during the breeding season, when many adults, and a few 2nd and 3rd-summer birds are in suspended moult, or resuming moult after suspension. A further trend line for adults only, adults (b), has been added to Figure 2, in order to show the increase gained (0.6) in the mean number of primaries growing concurrently when adults in suspended moult or resuming moult after suspension are removed from the figures (PMS 1-20) during the early stages of moult and the breeding season.

Less obvious in the figures are those adults on passage, or arriving to winter, resuming moult after suspension, and caught between late August and early November with moult scores of 31-40.

Table 2. *The number of primary feathers growing concurrently in relation to moult score for all age groups. Given in the form: mean (range) sample size. PMS = primary moult score.*

Age	*Adult*	*3s*	*2s*	*1s*
PMS				
1-5	1.4 (0-3) 115	1.7 (0-2) 30	1.9 (1-3) 64	2.2 (1-3) 82
6-10	1.6 (0-5) 141	2.0 (0-4) 17	2.6 (1-4) 33	3.4 (2-4) 38
11-15	2.0 (0-5) 133	1.7 (0-2) 23	2.1 (1-5) 30	3.2 (2-5) 35
16-20	2.7 (1-6) 144	2.3 (1-4) 28	2.2 (1-4) 29	3.1 (2-6) 53
21-25	2.9 (1-5) 136	2.3 (1-3) 27	2.1 (1-4) 42	2.8 (2-3) 29
26-30	2.6 (1-4) 140	2.5 (1-3) 19	2.4 (1-4) 54	2.7 (2-3) 27
31-35	2.3 (1-5) 204	2.2 (2-3) 22	2.2 (1-3) 47	2.7 (2-4) 34
36-40	2.5 (1-5) 210	2.1 (1-3) 17	2.2 (1-4) 31	2.6 (1-4) 48
41-45	2.7 (1-4) 387	2.4 (1-3) 21	2.6 (1-3) 25	2.7 (1-3) 70
46-49	1.5 (1-2) 1017	1.5 (1-2) 48	1.5 (1-2) 66	1.6 (1-2) 86
Totals	2.1 (0-6) 2627	2.0 (0-4) 252	2.1 (1-5) 421	2.6 (1-6) 502

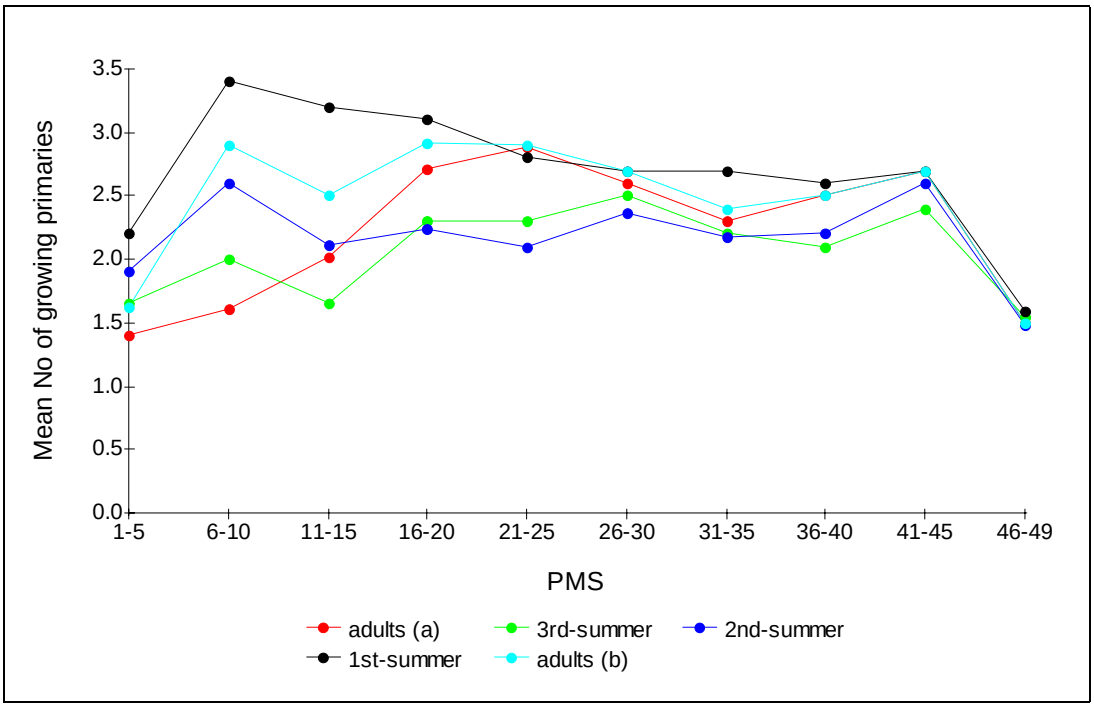


Figure 2. *The mean number of primaries growing concurrently in relation to moult score.*

THE NUMBERS OF OLD PRIMARIES PRESENT

The numbers of old primaries present during the moulting season for each age group, at half monthly intervals, are shown in Table 3 and Figure 3. As few 1st-summer birds were trapped during April, figures for this month include field records.

Table 3. *The number of old primaries present during the moulting season for all age groups. Given in the form: mean (range) sample size.*

Aged	*Adult*	*3s*	*2s*	*1s*
Time interval				
Mar.16-31	9.9 (8-10) 104	10 (10) 8	10 (10) 10	10 (10) 1
Apr. 1-15	9.9 (8-10) 216	10 (10) 8	10 (10) 11	10 (10) 10
Apr. 16-30	10 (10) 197	10 (10) 27	9.9 (10) 31	9.9 (8-10) 136
May 1-15	9.9 (8-10) 167	10 (10) 14	9.9 (9-10) 40	8.8 (7-10) 33
May 16-31	9.5 (7-10) 76	9.7 (8-10) 36	9.4 (7-10) 61	8.4 (7-10) 57
Jun. 1-15	8.6 (7-10) 33	8.0 (7-9) 14	7.8 (6-10) 39	6.2 (4-8) 72
Jun. 16-30	8.2 (6-10) 65	8.0 (6-10) 19	6.7 (4-10) 74	5.0 (3-8) 112
Jul. 1-15	7.4 (5-10) 176	6.5 (5-9) 35	5.6 (3-8) 28	3.3 (2-5) 22
Jul. 16-31	6.4 (4-8) 44	5.0 (4-8) 9	4.1 (2-7) 34	2.1 (0-4) 41
Aug. 1-15	5.2 (3-10) 165	4.5 (1-7) 40	3.6 (0-7) 66	1.1 (0-4) 62
Aug. 16-31	4.6 (3-8) 127	3.5 (2-6) 24	2.8 (0-4) 51	0.4 (0-2) 33
Sep. 1-15	3.3 (0-7) 234	2.3 (0-5) 32	1.4 (0-4) 41	0.1 (0-2) 53
Sep. 16-30	2.1 (0-7) 173	1.2 (0-3) 23	1.3 (0-4) 20	0 (0-2) 25
Oct. 1-15	0.9 (0-4) 328	0.4 (0-3) 23	0.3 (0-2) 40	0 (0) 43
Oct. 16-31	0.3 (0-3) 244	0.1 (0-2) 28	0 (0-1) 47	0 (0) 88
Nov. 1-15	0.1 (0-3) 604	0 (0-1) 39	0 (0) 47	0 (0-1) 64
Nov. 16-30	0 (0-1) 341	0 (0) 32	0 (0) 27	0 (0) 33
Dec. 1-15	0 (0-2) 400	0 (0) 12	0 (0) 21	0 (0) 26
Dec. 16-31	0 (0-1) 587	0 (0) 41	0 (0) 29	0 (0) 45
Jan. 1-15	0 (0) 325	-	-	-
Jan. 16-31	0 (0) 98	-	-	-

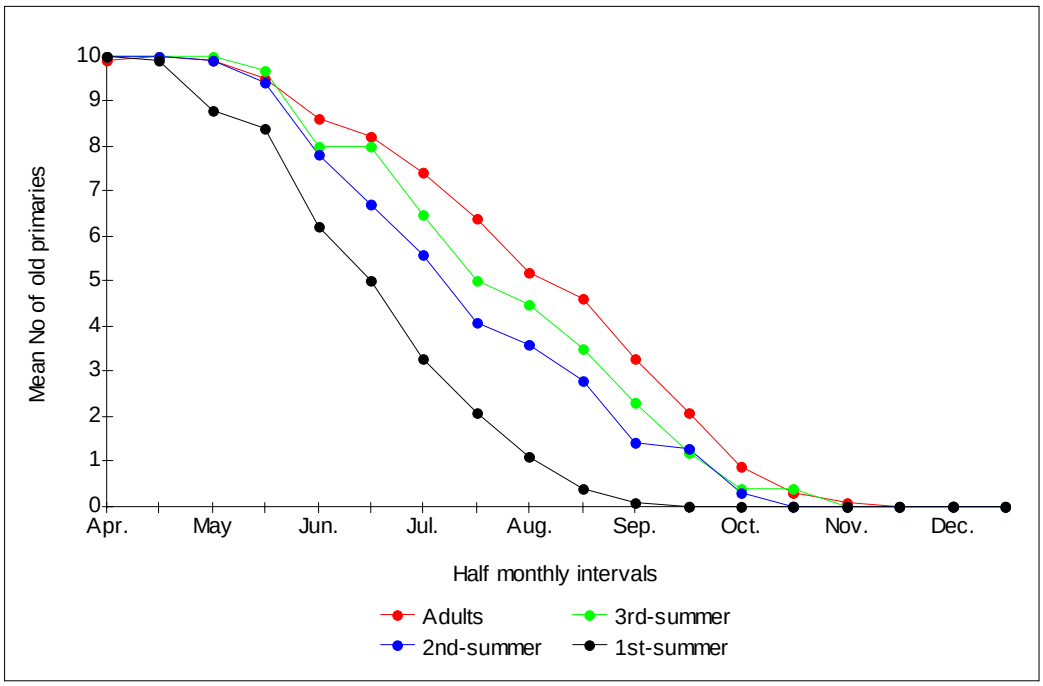


Figure 3. *The mean number of old primaries present during the moulting season for all age groups.*

TIMING OF MOULT

Figure 4 shows the mean PMS at half monthly intervals for all age groups and adult *intermedius* over the whole study period, and Figure 5 the mean PMS for adult males and females over the same period.

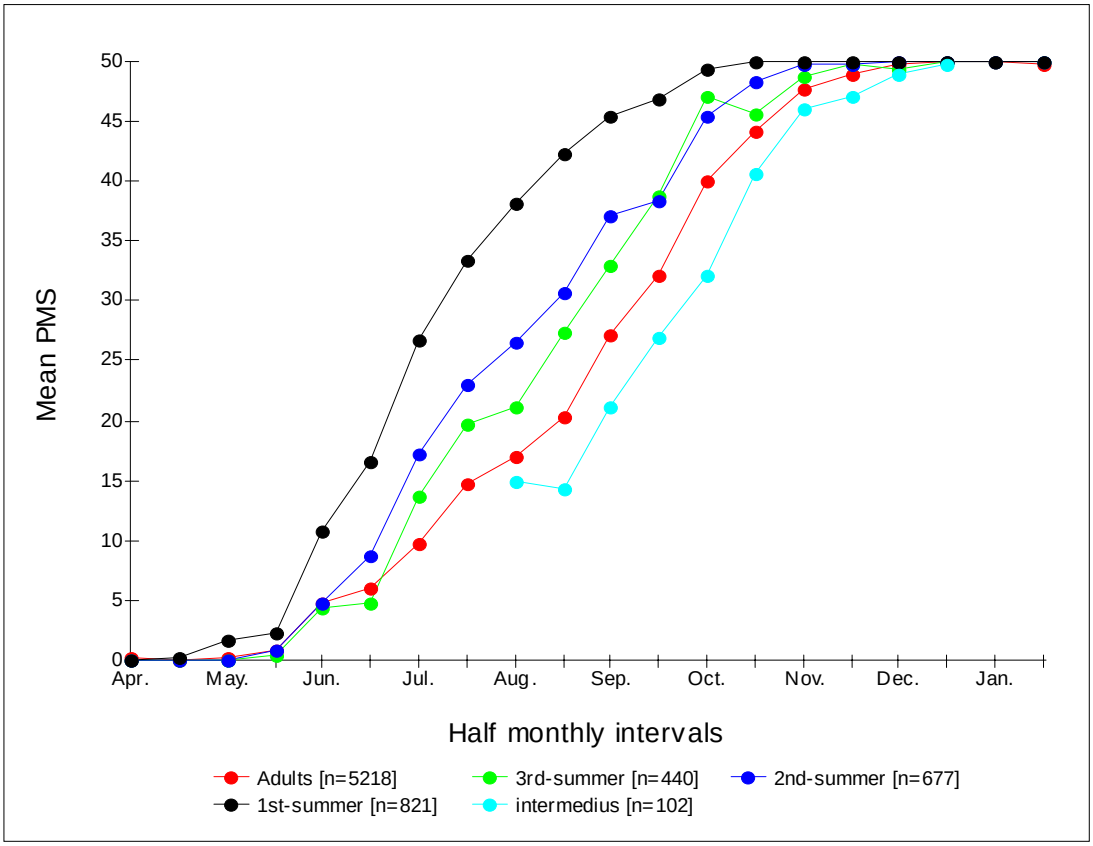


Figure 4. *The mean PMS for all age groups of L.f. graellsii and adult L.f. intermedius. Sample size in brackets.*

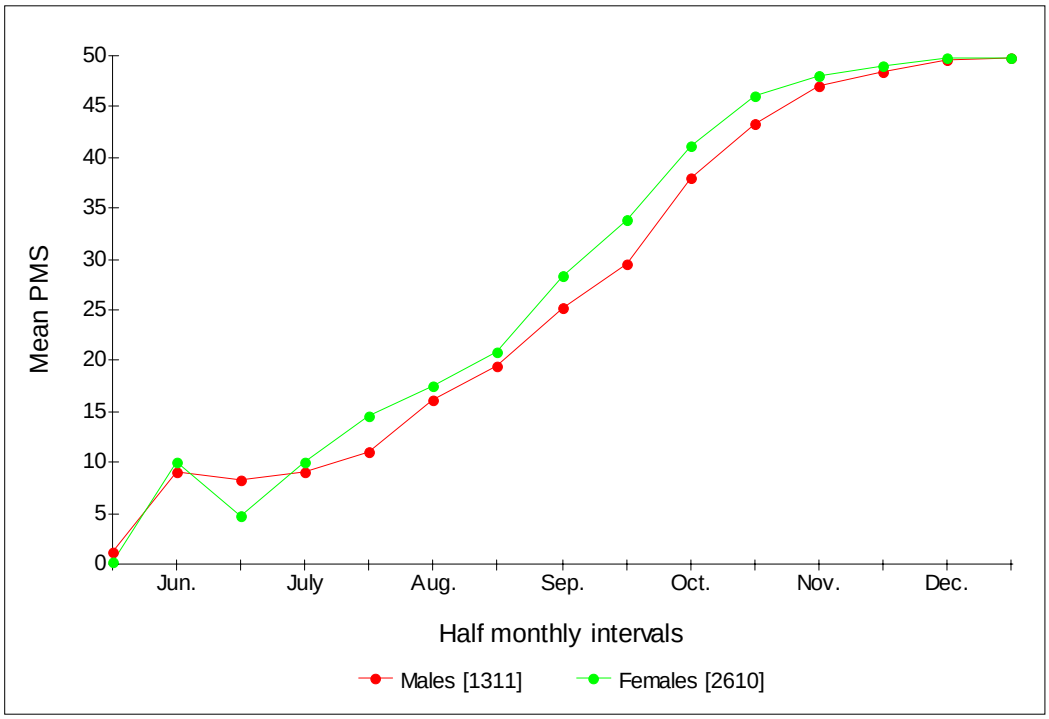


Figure 5. *The mean PMS of adult male and female L.f. graellsii. Sample size in brackets.*

GROWTH RATES OF INDIVIDUAL PRIMARIES

In his paper on moult Ingolfsson estimated the growth rates of the ten large primaries of the Great Black-backed Gull *L. marinus* and Glaucous Gull *L. hyperboreus* by first determining the average PMS at which a particular feather is shed and the average PMS at which it is fully-grown. By using the line describing the relationship between PMS and time, the time interval between the two stages was 'roughly' determined. The growth rates were then determined by dividing each primary length by the time interval figure obtained for that primary. Ingolfsson figures were obviously based on a static population and he did not have the problem of birds in suspended moult, as using data obtained for adults in this study, to determine primary growth rates, resulted in excessively low figures, in particularly for the larger outer primaries. The results were the same when using data from 1st-summer birds only, where all birds were found to be moulting normally. It was then decided to remain with the 1st-summer birds and find the mean dates at which each primary was dropped and the mean date at which the replacement completed growth. The result (Table 4) though rough, appear more acceptable, though there are no published figures of primary growth rates for this gull species for comparison. The figures, however, do compare reasonably well with those shown by Ingolfsson for other large gulls, *Larus marinus* (mean growing time 36.5 days, mean growth rate 8.7 mm/day) and *Larus hyperboreus* (mean growing time 37.8 days, mean growth rate 7.8 mm/day).

Table 4. *Estimated growth rates of the primaries of Lesser Black-backed Gull.*

Primary	Length of primary (mm)*	Estimated growing time (days)	Growth rate (mm/day)
P1	183	28	6.5
P2	198	29	6.8
P3	218	29	7.5
P4	238	32	7.4
P5	255	43	5.9
P6	274	44	6.2
P7	287	42	6.8
P8	315	41	7.7
P9	322	48	6.7
P10	317	55	5.8
Average	260.7	39.1	6.7

** Average of ten males and ten females*

RETRAPS

A total of 574 birds of all age groups were retrapped, but many of these were either not examined for moult, or not moulting when caught. Others had completed their moult when caught and subsequently retrapped. Only 27 adult birds were in the process of moult when caught and retrapped. Of these, 11 were caught in the same moulting season, and 16 in subsequent years. Of those individuals caught in the same month in subsequent years, little difference in moult scores were noted, thus this evidence, and examination of moult scores of birds caught by another scheme during the period 1976 - 1980, does not support the statement that "onset of P moult may be getting earlier" (Ginn & Melville).

INDIVIDUAL AGE GROUPS

1st-SUMMER BIRDS

The first trapped moulting bird was not found until April 29, with a moult score of two (1100000000). As only 11 birds have been trapped in the second half of April, it was not surprising that from a total of 125 field records of 1st-summer birds over the same period, 18 birds were found moulting, all having shed just the first primary. The earliest moulting bird observed with P1 absent was observed on April 17, 1998. The last date recorded for shedding P1 was May 21, thus a time lapse of 34 days between the first and last record. No birds found in suspended moult, however a bird examined on May 23, 2005 had resumed moult after suspension with a moult score of 11 (NN10000000). All birds examined between June 5 and September 27 were in active primary moult. The first bird with complete primary moult was found on September 29, though seven birds with scores of 49 were caught in early September.

The last moulting bird, with a score of 49, was trapped on November 8, 1999, and the last bird with old feather, P10, still present and with a score of just 42 (NNNNNNNN20) was found on November 2, 1999. These two records are exceptionally late, as the previous last moulting bird recorded was on October 24, 1994 and the last bird found with old feather P10 still present, was on September 27, 1993. The maximum number of growing primaries found for this age group was six, but involving only one individual. This bird was caught on June 16, 1998.

A summary of the PMS, at half monthly intervals, for 1st-summer birds is given in Table 5, and the PMS for individual birds, in scatter diagram form, are shown in Figure 6. The numbers of birds with different numbers of growing primaries in various stages of moult is shown in Table 9 and the percentages of birds with different numbers of old primaries present at half-monthly intervals is shown in Table 13.

2nd-SUMMER BIRDS

The first and last dates recorded for the shedding of P1 are April 18 and June 18; a period of 57 days. All birds examined from June 26 to October 3 were found to be in active primary moult. Though no birds were found in suspended moult, three birds caught, in late June (one) and early July (two) had obviously resumed moult after suspension. The first bird with complete primary moult was found on October 7, and the last moulting bird with a score of 49 was caught on November 29. The last bird with old feather P10 still present and with a score of 41 (NNNNNNN420) was found on October 24. The maximum number of growing primaries found for this age group was five.

A summary of the PMS, at half monthly intervals is given in Table 6, and the PMS for individual birds, in scatter diagram form, is shown in Figure 7. The numbers of birds with different numbers of growing primaries in various stages of moult is shown in Table 10 and the percentages of birds with different numbers of old primaries present at half-monthly intervals is shown in Table 14.

3rd-SUMMER BIRDS

The first and last dates for the onset of primary moult are April 26 and June 18, therefore a period of 53 days for the onset of moult. Five birds in suspended moult were found on June 4 (P1&P2), July 3 (P1&P2) and July 8 (P1, P1&P2, P1-P3). All other birds examined from June 27 to October 15 were in active primary moult. The first bird with complete primary moult was found on October 17, and the last moulting bird with a score of 45 (NNNNNNNN32) was caught on December 7, and likely to finish moult in January. The last bird with old feather P10 still present and a score of 42 (NNNNNNNN20) was caught on November 11. The maximum number of growing primaries found for this age group was five. A summary of PMS, at half monthly intervals is given in Table 7, and the PMS for individual birds, in scatter diagram form, is shown in Figure 8. The numbers of birds with different numbers of growing primaries in various stages of moult is shown in Table 11 and the percentages of birds with different numbers of old primaries present at half-monthly intervals is shown in Table 15.

The bird shown in Plate 2 was trapped on August 21, 2004 and shows three generations of primaries in

each wing. It appears to have only partially completed the full moult cycle the previous season. Although it is not exactly known what moult sequence this bird had in its 2nd-summer, the photograph suggests that only P1-P6 were renewed as P7-P10 are previous generation feathers. This bird has recently replaced P1-P4 with P5 still in growth.

ADULT BIRDS.

Two birds that had replaced P1 and P1&P2 in each wing were caught on March 26, 2005 (123 examined), and a bird with P1 absent in each wing was observed in Cheltenham on March 17, 2005. These are the earliest recorded moulting birds in this study. Prior to 2005 no adult birds have been found actively moulting (501 examined) from February 14 to the end of March. However in early April 2000 a close examination of 87 adults revealed that four birds (4.6%) had replaced P1, including one bird with P2 absent, and it is most likely that birds with suspended primaries have been overlooked in the past and involve migrants returning from winter quarters. Lars Jonsson found one Lesser Black-backed Gull actively moulting in Spain in late February (pers comm). Usually the first normal moulting birds, with P1 absent in each wing, are not observed until the second week of May, and of 77 birds trapped between the 16-21 May, 22 (28%) were found moulting with PMS of one to six. The onset of moult for these birds therefore coinciding with the hatching of eggs (May 18-20, 1993 -1998) of local breeding birds (Denley 1999) and supporting the findings of Verbeek (1977), for Walney Island birds. The last date recorded for the shedding of P1 was August 13. Therefore, in adults, this indicates a minimum spread of 94 days for the onset of primary moult.

In addition to the four April birds mentioned above, a further 62 birds in suspended moult, up to P3 (Plates 3-5), have been recorded during this study, both males and females, and found from June 12 to the end of July. The period and timing of suspension therefore occurring when adults are feeding young, and energy requirements are at their highest. These birds appear to replace one primary at a time, only dropping the next primary, when the preceding feather is fully-grown. The time interval between suspending and shedding the next primary is not known. As shown in Table 1 (PMS 5-15) some do not suspend but adopt other slow moulting strategies during the breeding season. The patterns also show that some adults moult normally, but whether these are breeding is not known, as one usually associates suspended, or slow moult, at this time only with breeding birds. It is therefore interesting to note here a reverse situation, of three non-breeding captive adult birds, examined on 10 July 10, 1998; two were in suspended moult and the third resuming moult after suspension. These birds, with permanent injuries, have been in captivity at a local animal rescue centre for more than three years. The PMS for these birds are not included in this report.

It was not until after August 13 that all birds examined were in active primary moult, with only four out of 321 birds (<3%) found between July 3 and 13 August 13 that had yet to commence moult. The latest two were found on August 9 & 13. Verbeck (1977) handled birds as late as August 5 on Walney Island “that had not yet started to moult”. As mentioned elsewhere in this paper, some birds in suspended moult can be easily overlooked as non-moulting birds, particularly if old feathers are showing little wear and tear. However, in this study, birds in suspended moult have been observed up to the middle of September, when passage birds are more evident, and one trapped on September 17 had resumed moult after suspension with the absence of P3 and a low moult score of 11 (NN10000000)

The first fully moulted bird was found on October 14 and the last moulting birds, four in total were found in January, the last with a score of 45 (NNNNNNNN32) on January 30, therefore this late individual would have continued moult into February. Of 76 birds still found moulting in December, 70 would have completed moult by the end of the month while the remaining six would not complete moult until January. A summary of PMS at half monthly intervals for adult birds is given in Table 8, and the PMS for individual birds plotted against day of capture, in scatter diagram form, are shown in Figure 9.

The maximum number of primaries found growing for adults was six, and involved only two individuals. Both were caught in the month of September. Table 12 shows the numbers of birds with different numbers of growing primaries in various stages of primary moult. The last bird with old feather P10 still present and with a PMS of 43 (NNNNNNNN30) was caught on December 30. Table 16 shows the percentages of birds with different numbers of old primaries present during the moulting season at half-monthly intervals.

An adult bird caught on January 15, 2001 (Plate 6) was interesting in that it showed P1-P3 not fully grown in both wings and had clearly undergone some form of stress, possibly associated with breeding during this period of moult. The three feathers were pale with obvious horizontal fault lines. In the same catch other birds showed similar lines across most of the inner primaries, but all feathers were of normal colour and length. Another adult bird caught on March 26, 2005 showed worn P1 & P2 (Plate 7) indicative that this bird commenced moult on the breeding ground in the previous season, suspended for migration to wintering grounds, where moult commenced again with P3.

SUMMARY TABLES AND FIGURES FOR INDIVIDUAL AGE GROUPS

TABLES SHOWING THE PMS FOR ALL AGE GROUPS AT HALF-MONTHLY INTERVALS

(*n* = number of birds examined, *m* =number of birds in moult. Sample size in brackets).

Table 5. *1st-summer (821)*

Time interval	*Range*	*Mean*	*n*	*m*	*% Moulting*
Apr. 1-15	0	0	0	0	0
Apr. 16-30	0-2	0.2	11	1	9.1
May 1-15	0-6	1.6	33	17	51.5
May 16-31	0-11	2.3	66	49	74.2
Jun. 1-15	2-26	10.7	72	72	100
Jun. 16-30	2-29	16.7	93	93	100
Jul. 1-15	18-34	26.7	22	22	100
Jul. 16-31	23-44	33.3	41	41	100
Aug. 1-15	22-46	38.1	62	62	100
Aug. 16-31	34-47	42.3	36	36	100
Sep. 1-15	32-49	45.5	71	71	100
Sep. 16-30	44-50	46.9	14	13	92.9
Oct. 1-15	47-50	49.4	44	18	41.0
Oct. 16-31	48-50	49.9	88	5	5.7
Nov. 1-15	42-50	49.9	64	2	3.1
Nov. 16-30	50	50	33	0	0
Dec. 1-15	50	50	26	0	0
Dec. 16-31	50	50	45	0	0

Table 6. *2nd-summer (677)*

Time interval	*Range*	*Mean*	*n*	*m*	*% Moulting*
Apr. 1-15	0	0	11	0	0
Apr. 16-30	0-1	0	31	1	3
May 1-15	0-1	0.1	40	2	5.0
May 16-31	0-4	0.8	61	21	34.4
Jun. 1-15	0-16	4.8	39	34	87.2
Jun. 16-30	0-20	8.7	62	61	98.4
Jul. 1-15	8-28	17.3	28	28	100
Jul. 16-31	4-33	23.1	34	34	100
Aug. 1-15	9-36	26.5	66	66	100
Aug. 16-31	22-44	30.8	45	45	100
Sep. 1-15	22-47	37.1	41	41	100
Sep. 16-30	26-47	38.4	11	11	100
Oct. 1-15	35-50	45.5	37	34	91.9
Oct. 16-30	41-50	48.4	47	27	57.4
Nov. 1-15	47-50	49.7	47	11	23.4
Nov. 16-30	47-50	49.7	27	5	18.5
Dec. 1-15	50	50	21	0	0
Dec. 16-31	50	50	29	0	0

Table 7. *3rd-summer (440)*

Time interval	*Range*	*Mean*	*n*	*m*	*% Moulting*
Apr. 1-15	0	0	8	0	0
Apr. 16-30	0	0	27	0	0
May 1-15	0	0	14	0	0
May 16-31	0-6	0.4	36	6	16.7
Jun. 1-15	1-11	4.4	14	14	100.0
Jun. 16-30	0-15	4.7	19	17	89.5
Jul. 1-15	3-21	13.7	35	35	100
Jul. 16-31	6-25	19.7	9	9	100
Aug. 1-15	6-40	21.1	40	40	100
Aug. 16-31	17-36	27.3	22	22	100
Sep. 1-15	18-47	33.0	32	32	100
Sep. 16-30	31-47	38.9	13	13	100
Oct. 1-15	30-49	47.0	19	18	95
Oct. 16-30	36-50	45.7	28	22	78.6
Nov. 1-15	42-50	48.7	39	16	41.0
Nov. 16-30	49-50	49.8	32	5	15.6
Dec. 1-15	45-50	49.4	12	3	25.0
Dec. 16-31	50	50	41	0	0

Table 8. *Adults (5218)*

Time interval	*Range*	*Mean*	*n*	*m*	*% Moulting*
Mar.16-31	0-10	0.1	104	2	1.9
Apr. 1-15	0-10	0.1	216	5	2.3
Apr.16-30	0	0	194	0	0
May 1-15	0-6	0.2	53	3	5.7
May 16-31	0-7	0.8	86	25	29.1
Jun. 1-15	0-11	4.7	33	26	79.0
Jun. 16-30	0-15	6.1	65	54	83.1
Jul. 1-15	0-20	9.7	170	166	97.6
Jul. 16-31	6-26	14.7	26	26	100.0
Aug. 1-15	0-32	17.1	165	163	98.8
Aug. 16-31	3-32	20.4	140	140	100
Sep. 1-15	6-44	27.1	257	257	100
Sep. 16-30	11-47	32.1	107	107	100
Oct. 1-15	21-50	40.0	373	372	99.7
Oct. 16-31	28-50	44.2	433	423	97.7
Nov. 1-15	32-50	47.8	681	515	75.6
Nov 16-30	36-50	48.9	473	259	54.7
Dec. 1-15	38-50	49.7	402	50	12.4
Dec. 16-31	38-50	49.9	703	30	4.3
Jan. 1-15	44-50	49.9	362	3	0.8
Jan. 16-31	45-50	49.7	175	1	0.6

PMS FOR ALL AGE GROUPS PLOTTED AGAINST DAY OF CAPTURE
(Each dot represents one bird. Sample size in brackets)

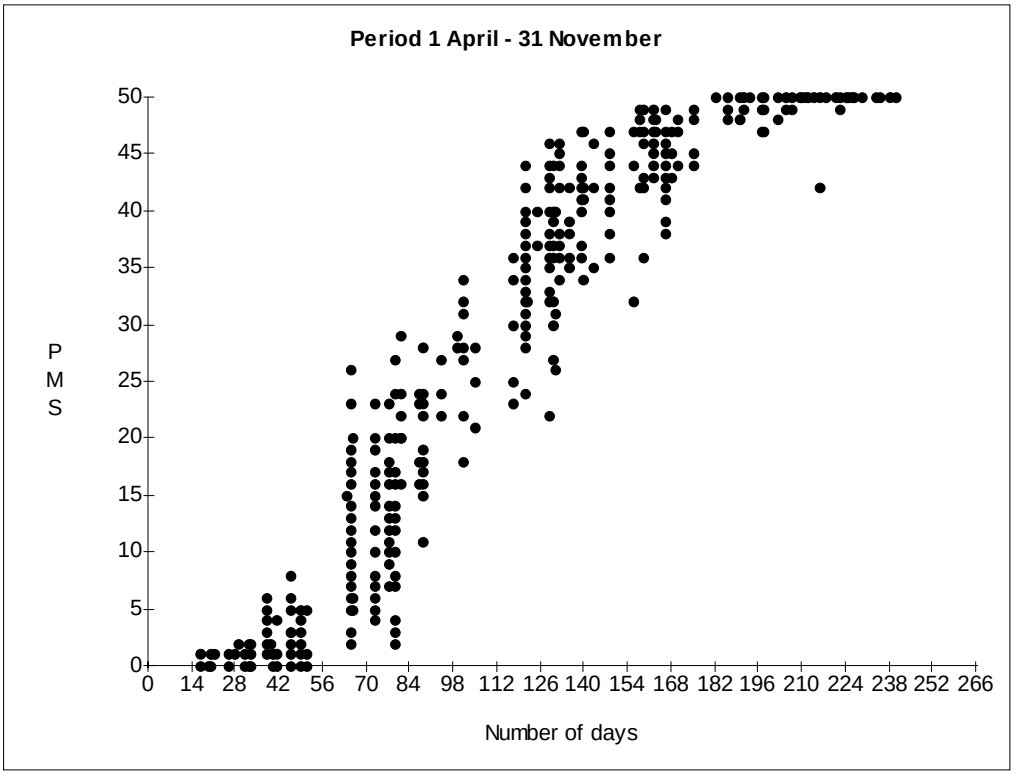


Figure 6. *1st-summer (325)*

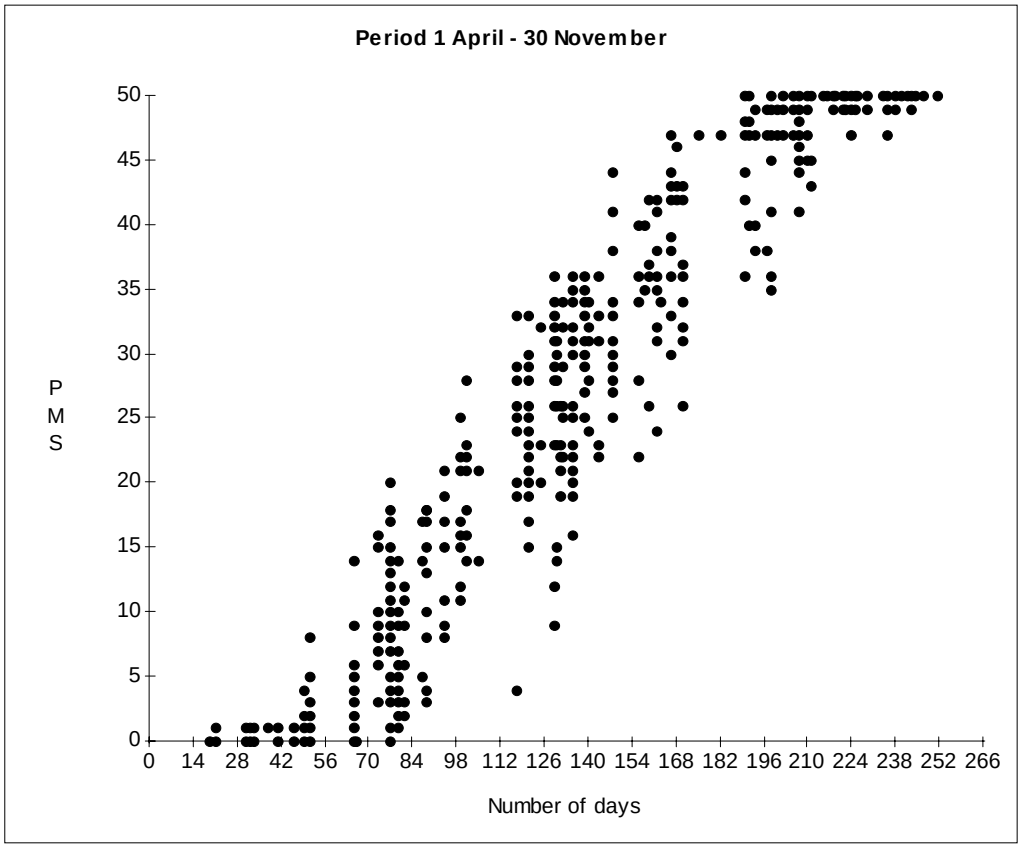


Figure 7. *2nd-summer (351)*

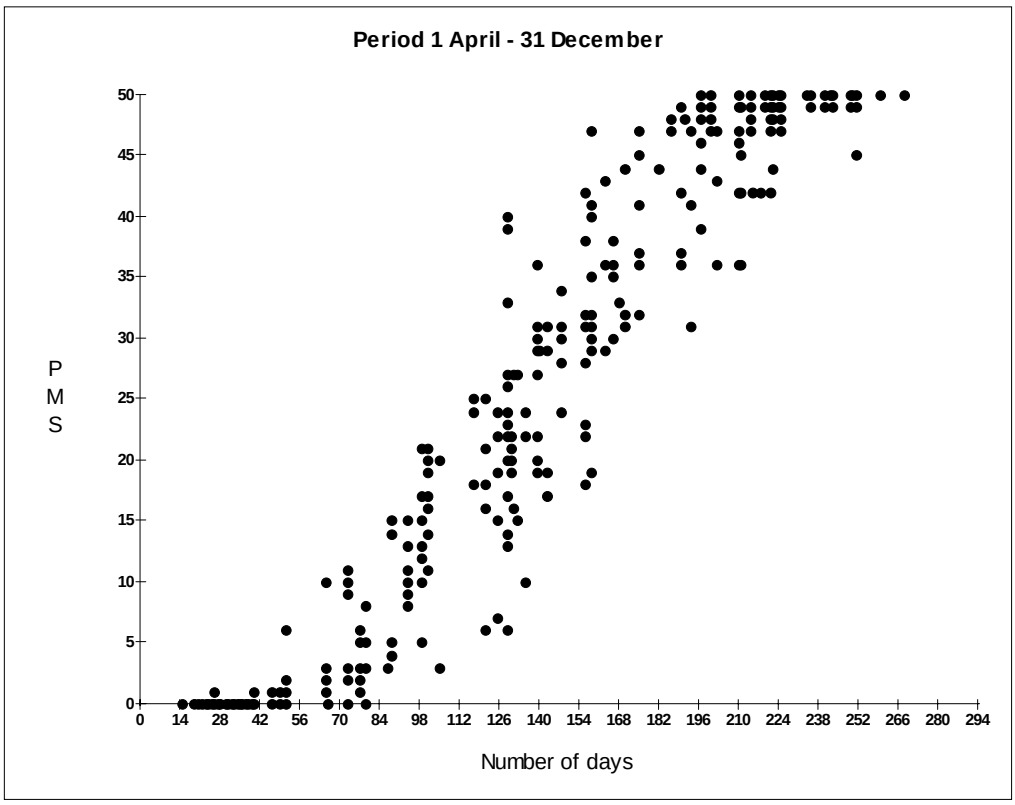


Figure 8. *3rd-summer (245)*

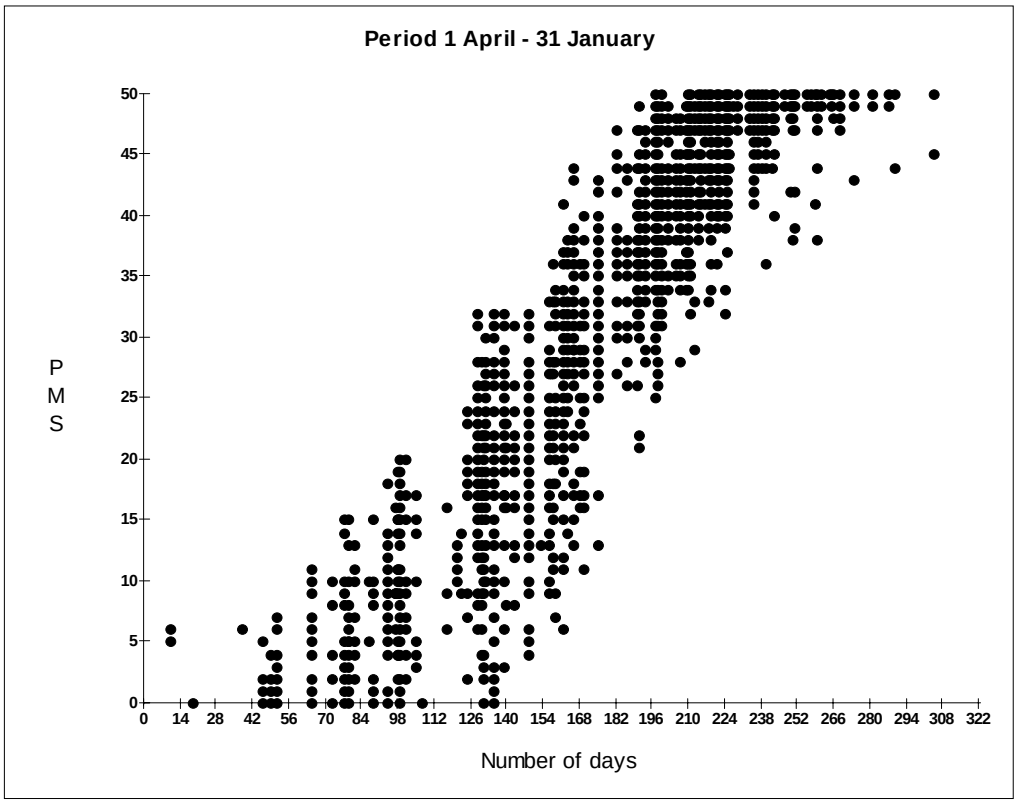


Figure 9. *Adults (902) Two birds in March with PMS of 5 & 10 are not shown*

THE DIFFERENT NUMBERS OF GROWING PRIMARIES IN VARIOUS STAGES OF MOULT
(*n* = sample size, *r* = range of growing primaries, *m* = the mean number of growing primaries)

Table 9. *1st-summer*

No. of growing primaries	1	2	3	4	5	6	*n*	*r*	*m*
Moult score									
1-5	11	42	29	0	0	0	82	1-3	2.2
6-10	0	2	17	19	0	0	38	2-4	3.4
11-15	1	11	10	5	8	0	35	2-5	3.2
16-20	0	5	40	7	0	1	53	2-6	3.1
21-25	0	5	24	0	0	0	29	2-3	2.8
26-30	0	9	18	0	0	0	27	2-3	2.7
31-35	0	11	21	2	0	0	34	2-4	2.7
36-40	1	24	17	6	0	0	48	1-4	2.6
41-45	1	17	52	0	0	0	70	1-3	2.7
46-49	31	55	0	0	0	0	86	1-2	1.6
Total	45	181	228	39	8	1	502	1-6	2.6

Table 10. *2nd-summer.*

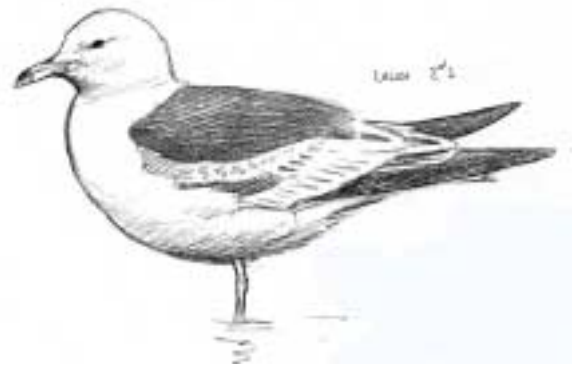
No. of growing primaries	0	1	2	3	4	5	*n*	*r*	*m*
Moult score									
1-5	0	13	42	9	0	0	64	1-3	1.9
6-10	1	2	6	23	1	0	33	1-4	2.6
11-15	0	5	19	4	1	1	30	1-5	2.1
16-20	0	3	17	8	1	0	29	1-4	2.2
21-25	0	5	27	9	1	0	42	1-4	2.1
26-30	0	2	31	19	2	0	54	1-4	2.4
31-35	0	2	35	10	0	0	47	1-3	2.2
36-40	0	2	21	7	1	0	31	1-4	2.2
41-45	0	1	7	17	0	0	25	1-3	2.6
46-49	0	30	36	0	0	0	66	1-2	1.5
Total	1	65	241	106	7	1	421	1-5	2.1

Table 11*. 3rd-summer*

Number of growing primaries	0	1	2	3	4	5	*n*	*r*	*m*
Moult score									
1-5	1	7	22	0	0	0	30	0-2	1.7
6-10	3	2	6	4	2	0	17	0-4	2.0
11-15	1	6	16	0	0	0	23	0-2	1.7
16-20	0	4	15	7	2	0	28	1-4	2.3
21-25	0	2	15	10	0	0	27	1-3	2.3
26-30	0	1	9	8	1	0	19	1-3	2.5
31-35	0	0	17	5	0	0	22	2-3	2.2
36-40	0	3	10	4	0	0	17	1-3	2.1
41-45	0	3	6	12	0	0	21	1-3	2.4
46-49	0	25	23	0	0	0	48	1-2	1.5
Total	5	53	139	50	5	0	252	0-4	2.0

Table 12. *Adult birds*

Number of growing primaries	0	1	2	3	4	5	6	*n*	*r*	*m*
Moult score										
1-5	19	41	49	6	0	0	0	115	0-3	1.4
6-10	44	28	26	25	14	4	0	141	0-5	1.6
11-15	7	33	61	20	7	5	0	133	0-5	2.0
16-20	0	16	40	63	21	2	2	144	1-6	2.7
21-25	0	4	36	70	25	1	0	136	1-5	2.9
26-30	0	3	52	79	6	0	0	140	1-4	2.6
31-35	0	17	110	70	6	1	0	204	1-5	2.3
36-40	0	19	98	55	37	1	0	210	1-5	2.5
41-45	0	9	92	282	4	0	0	387	1-4	2.7
46-49	0	493	524	0	0	0	0	1017	1-2	1.5
Total	70	663	1088	670	120	14	2	2627	0-6	2.1



THE PERCENTAGES OF BIRDS WITH DIFFERENT NUMBERS OF OLD PRIMARIES PRESENT WITHIN EACH TIME INTERVAL DURING THE MOULTING SEASON
(*n* = sample size, *m* = the mean number of old primaries present**)**

Table 13. *1st-summer*

No. of old primaries		0	1	2	3	4	5	6	7	8	9	10	*m*
Time interval	*n*												
Apr.1-15	0	-	-	-	-	-	-	-	-	-	-	-	-
Apr.15-30	0	-	-	-	-	-	-	-	-	-	-	-	-
May 1-15	33	-	-	-	-	-	-	-	18.2	27.3	6.1	48.5	8.8
May 16-31	57	-	-	-	-	-	-	-	25.8	34.8	13.6	25.8	8.4
Jun.1-15	72	-	-	-	-	5.6	22.2	33.3	29.2	9.7	-	-	6.2
Jun.16-30	112	-	-	-	5.3	29.5	36.6	22.3	4.5	1.8	-	-	5.0
Jul.1-15	22	-	-	9.1	59.1	22.7	9.1	-	-	-	-	-	3.3
Jul.16-31	41	9.7	9.7	53.7	17.1	9.8	-	-	-	-	-	-	2.1
Aug.1-15	62	37.1	29.0	25.8	3.2	4.8	-	-	-	-	-	-	1.1
Aug.16-31	33	69.4	16.7	13.9	-	-	-	-	-	-	-	-	0.4
Sep.1-15	53	90.9	6.1	3.0	-	-	-	-	-	-	-	-	0.1
Sep.16-30	25	92.0	4.0	4.0	-	-	-	-	-	-	-	-	0
Oct.1-15	43	100	-	-	-	-	-	-	-	-	-	-	0
Oct.16-31	88	100	-	-	-	-	-	-	-	-	-	-	0
Nov.1-15	64	98.4	1.6	-	-	-	-	-	-	-	-	-	0
Nov.16-30	33	100	-	-	-	-	-	-	-	-	-	-	0
Dec.1-15	26	100	-	-	-	-	-	-	-	-	-	-	0
Dec.16-31	45	100	-	-	-	-	-	-	-	-	-	-	0

Table 14. *2nd-summer.*

No. of old primaries		0	1	2	3	4	5	6	7	8	9	10	*m*
Time interval	*n*												
Apr.1-15	11	-	-	-	-	-	-	-	-	-	-	100	10
Apr.16-30	31	-	-	-	-	-	-	-	-	-	3.2	96.8	9.9
May 1-15	40	-	-	-	-	-	-	-	-	-	5.0	95.0	9.9
May 16-31	61	-	-	-	-	-	-	-	3.3	21.3	9.8	65.6	9.4
Jun.1-15	39	-	-	-	-	-	-	7.7	35.9	38.5	5.1	12.8	7.8
Jun.16-30	74	-	-	-	-	2.7	13.5	27.0	33.8	18.9	2.7	1.4	6.7
Jul.1-15	28	-	-	-	3.6	10.7	32.1	32.1	14.3	7.1	-	-	5.6
Jul.15-31	34	-	-	4.1	16.3	49.0	24.5	4.1	2.0	-	-	-	4.1
Aug.1-15	66	1.5	-	21.2	24.2	30.3	15.2	6.1	1.5	-	-	-	3.6
Aug.16-31	51	1.9	3.9	27.5	52.9	9.8	4.0	-	-	-	-	-	2.8
Sep.1-15	41	34.1	14.6	36.6	4.9	9.8	-	-	-	-	-	-	1.4
Sep.16-30	20	40.0	20.0	20.0	15.0	5.0	-	-	-	-	-	-	1.3
Oct.1-15	40	80.0	10.0	10.0	-	-	-	-	-	-	-	-	0.3
Oct.16-31	47	97.9	2.1	-	-	-	-	-	-	-	-	-	0
Nov.1-15	47	100	-	-	-	-	-	-	-	-	-	-	0
Nov.16-30	27	100	-	-	-	-	-	-	-	-	-	-	0
Dec.1-15	21	100	-	-	-	-	-	-	-	-	-	-	0
Dec.16-31	29	100	-	-	-	-	-	-	-	-	-	-	0

Table 15. *3rd-summer*

No. of old primaries		0	1	2	3	4	5	6	7	8	9	10	*m*
Time interval	*n*												
Apr.1-15	8	-	-	-	-	-	-	-	-	-	-	100	10
Apr.16-30	27	-	-	-	-	-	-	-	-	-	-	100	10
May 1-15	14	-	-	-	-	-	-	-	-	-	-	100	10
May 16-31	36	-	-	-	-	-	-	-	-	11.1	5.6	83.3	9.7
Jun.1-15	14	-	-	-	-	-	-	-	21.4	57.1	21	-	8.0
Jun.16-30	19	-	-	-	-	-	-	10.5	10.5	57.9	10.5	10.5	8.0
Jul.1-15	35	-	-	-	-	-	17.1	37.1	31.4	11.4	2.9	-	6.5
Jul.15-31	9	-	-	-	-	44.4	33.3	11.1	-	11.1	-	-	5.0
Aug.1-15	40	-	5.0	2.5	5.0	40.0	27.5	17.5	2.5	-	-	-	4.5
Aug.16-31	24	-	-	8.3	58.3	12.5	16.7	4.2	-	-	-	-	3.5
Sep.1-15	32	12.5	9.3	37.5	25.0	6.3	9.4	-	-	-	-	-	2.3
Sep.16-30	23	47.8	13.0	8.7	30.4	-	-	-	-	-	-	-	1.2
Oct.1-15	23	74.0	13.0	8.7	4.3	-	-	-	-	-	-	-	0.4
Oct.16-31	28	82.1	7.1	10.7	-	-	-	-	-	-	-	-	0.1
Nov.1-15	39	97.4	2.6	-	-	-	-	-	-	-	-	-	0
Nov.16-30	32	100	-	-	-	-	-	-	-	-	-	-	0
Dec.1-15	12	100	-	-	-	-	-	-	-	-	-	-	0
Dec.16-31	41	100	-	-	-	-	-	-	-	-	-	-	0

Table 16*. Adults*

No. of old primaries		0	1	2	3	4	5	6	7	8	9	10	*m*
Time interval	*n*												
Mar.16-31	104	-	-	-	-	-	-	-	-	0.95	0.95	98.1	9.9
Apr.1-15	216	-	-	-	-	-	-	-	-	0.9	1.4	97.7	9.9
Apr.16-30	194	-	-	-	-	-	-	-	-	-	-	100	10
May 1-15	53	-	-	-	-	-	-	-	-	1.9	3.8	94.3	9.9
May 16-31	86	-	-	-	-	-	-	-	2.3	16.3	10.5	70.9	9.5
Jun.1-15	33	-	-	-	-	-	-	-	6.1	45.4	27.3	21.2	8.6
Jun.16-30	65	-	-	-	-	-	-	6.2	20.0	36.9	20.0	16.9	8.2
Jul.1-15	170	-	-	-	-	-	2.4	19.4	27.0	36.5	12.3	2.4	7.4
Jul.16-31	26	-	-	-	-	11.5	26.9	38.5	15.4	7.7	-	-	5.8
Aug.1-15	165	-	-	-	7.9	23.6	33.3	21.2	4.9	6.7	1.2	1.2	5.2
Aug.16-31	157	-	-	-	17.2	33.1	30.0	10.8	7.0	1.9	-	-	4.6
Sep. 1-15	270	1.5	4.1	18.5	42.2	19.3	10.0	3.3	1.1	-	-	-	3.2
Sep.16-30	174	19.5	10.3	32.2	26.4	8.0	1.7	1.1	0.6	-	-	-	2.1
Oct.1-15	394	52.8	17.5	18.8	9.4	1.5	-	-	-	-	-	-	0.9
Oct.16-31	433	84.8	6.7	6.9	1.6	-	-	-	-	-	-	-	0.3
Nov.1-15	682	95.3	3.1	1.3	0.3	-	-	-	-	-	-	-	0.1
Nov.16-30	473	99.2	0.6	0.2	-	-	-	-	-	-	-	-	0
Dec.1-15	402	99.0	0.7	0.3	-	-	-	-	-	-	-	-	0
Dec.16-31	703	99.8	0.1	0.1	-	-	-	-	-	-	-	-	0
Jan. 1-15	362	100	-	-	-	-	-	-	-	-	-	-	0
Jan. 16-31	175	100	-	-	-	-	-	-	-	-	-	-	0

SUBSPECIES *L.f. intermedius.*

Clearly with such a small sample the results shown here remain inconclusive. Compared to *graellsii*, no differences in the sequence of moult or in moult patterns (Table 1) were observed for *intermedius*. However, the PMS obtained for adult *intermedius*, from August to November fell mainly between the mean and lowest moult scores obtained for adult *graellsii* (Figure 3). The higher moult scores obtained for the adult *graellsii* during this period is attributed to the presence the much larger sample of birds that have moulted normally, and are as advanced as 1st-summer birds. That some *intermedius* are also well advanced is obvious with the capture of a bird with a high score 33 (NNNNNNN111) on the 26 August. It was not until some two months later, on the 15 October that another *intermedius* with the same moult score and pattern was encountered. This same moult score and pattern was also found in *graellsii* over the same period.

The first moulting adult bird was caught on the 13 August. This bird had a low moult score of 6 (3210000000) and undergoing normal moult. Another bird that had recently shed the three inner primaries, and scoring just three (1110000000) was caught on the 17 August (Plate 7). This is only the second adult bird encountered exhibiting this score and pattern in August. The first bird was a *graellsii*, and like the *intermedius*, probably a recently arrived immigrant that had suspended the start of moult until arrival at its stop-over/winter quarters. A bird caught on the 21 August 2004 had not started moult, the latest date for a non-moulting birds caught during this study.

Two birds trapped in October with scores of 31 (NNNNN42000) and 40 (5555555420), had been ringed in Norway, and another trapped in early September, with a moult score of 16 (NN32100000), was later recovered in Norway. The last moulting bird, with a score of 48 (NNNNNNNNN3), was caught on the 21 December, the latest December date for a trapped *intermedius* during this study. Six birds only, trapped between the 12 - 14 January, had completed moult.

No differences between the moult scores, patterns and period of moult, between immature *graellsii* and *intermedius* have so far been recorded during this study. Though only seven immature *intermedius* are considered here. Four 3rd-summer birds observed on the 27 May had not started moult, one trapped on the 22 October scored 36, and one caught on the 16 December had completed moult. A 2nd-summer bird scored 35 on the 9 September and another scored 49 on the 4 November.

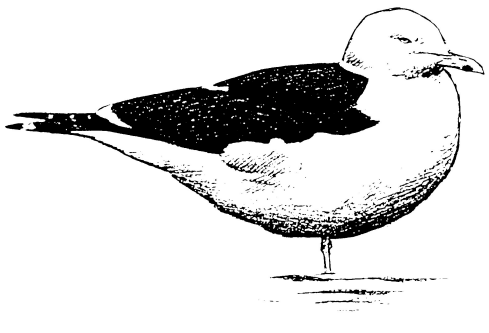
A summary of PMS, at half monthly intervals, for adult birds is given in Table 17. The percentages of birds with different numbers of old primaries present at different time intervals are shown in Table 18.

Table 17. *Summary of PMS for 102 adult L.f. intermedius. n = number of birds examined, m = number of birds in moult.*

Time interval	*Range*	*Mean*	*n*	*m*	*% Moulting*
Apr. 1-15	0	0	3	0	0
Apr. 16-30	0	0	3	0	0
May 1-15	0	0	0	0	0
May 16-30	0	0	1	0	0
Jun. 1-15	0	0	0	0	0
Jun. 16-30	0	0	0	0	0
Jul. 1-15	0	0	0	0	0
Jul. 16-31	0	0	0	0	0
Aug. 1-15	6-24	15	3	3	100
Aug. 16-31	0-33	14.3	7	6	85.7
Sep. 1-15	12-28	21.1	10	10	100
Sep. 16-31	27	27	1	1	100
Oct. 1-15	19-40	32.2	19	19	100
Oct. 16-31	28-47	40.6	7	7	100
Nov. 1-15	38-49	46.1	22	22	100
Nov. 16-30	42-50	47.1	6	5	71.4
Dec. 1-15	44-50	48.92	10	2	20.0
Dec. 16-31	48-50	49.8	10	1	10.0

Table 18. *The percentages of adult intermedius with different numbers of old primaries present within each time interval during the moulting season. n = number of birds examined; m = mean number of old primaries present.*

No. of old primaries		0	1	2	3	4	5	6	7	8	9	10	*m*
Time interval	*n*												
Apr.1-15	3	-	-	-	-	-	-	-	-	-	-	100	10
Apr.15-30	3	-	-	-	-	-	-	-	-	-	-	100	10
May 1-15	0	-	-	-	-	-	-	-		-	-	-	-
May 16-31	1	-	-	-	-	-	-	-	-	-	-	100	10
Jun.1-15	0	-	-	-	-	-	-	-	-	-	-	-	-
Jun.16-30	0	-	-	-	-	-	-	-	-	-	-	-	-
Jul.1-15	0	-	-	-	-	-	-	-	-	-	-	-	-
Jul.16-31	0	-	-	-	-	-	-	-	-	-	-	-	-
Aug.1-15	3	-	-	-	-	33.3	33.3	-	33.3	-	-	-	4.6
Aug.16-31	7	-	-	-	14.3	14.3	14.3	14.3	28.5	-	-	14.3	6.0
Sep.1-15	10	-	-	-	20.0	40.0	30.0	10.0	-	-	-	-	4.3
Sep.16-30	1	-	-	-	-	100	-	-	-	-	-	-	4
Oct.1-15	19	-	21.0	26.3	26.3	15.8	5.3	5.3	-	-	-	-	2.7
Oct.16-31	7	57.1	14.3	14.3	-	14.3	-	-	-	-	-	-	1.0
Nov.1-15	22	86.4	9.1	4.5	-	-	-	-	-	-	-	-	0.1
Nov.16-30	6	100	-	-	-	-	-	-	-	-	-	-	0
Dec.1-15	10	100	-	-	-	-	-	-	-	-	-	-	0
Dec.16-31	10	100	-	-	-	-	-	-	-	-	-	-	0



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