Onset and pattern of primary moult in the Lesser Black-backed Gull *Larus f. fuscus* — a comparison with the Herring Gull *L. argentatus*

Martti Hario

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By collecting shed primaries on a breeding site in the Gulf of Finland it was established that some *L. f. fuscus* individuals started the primary moult during the period of feeding young, i.e. during about the same breeding phase as in *L. argentatus*. The proportion of the *L. f. fuscus* population that commenced primary moult on the breeding grounds was 12—34 %, and in about 20 % of these cases the previous moult had been a periodic stepwise moult. *L. f. fuscus* interrupted its moult for the migratory period after having replaced 1—3 of the innermost primaries, while *L. argentatus* continued moulting without interruption. *L. f. fuscus* suffered heavy chick mortality; more than 90 % of the chicks were lost before the start of the moult. The timing of the moult in *L. f. fuscus* did not, however, show any immediate response to the "surplus" time resulting from the high chick mortality.

Martti Hario, Game and Fisheries Research Institute, Pitkänsillanranta 3 A, SF-00530 Helsinki 53, Finland

Introduction

In most bird groups, moulting and breeding are mutually exclusive in time, due to the concurrent constraints of energy and time, and the necessity of maintaining flying ability (King 1974, Murton & Westwood 1977). Migrants in temperate regions have to adjust the timing of the moult to accord with migration. The duration of the moult tends to be longest in bird species living in stable environments with minor seasonal changes, as in seabirds (Stresemann & Stresemann 1966). Most large *Larus* species begin to renew the remiges during incubation and extend the moult through the migratory season up till late autumn — early winter. The total duration of the wing moult is 5—7 months (e.g. Ingolfsson 1970, Stresemann 1971, Verbeek 1977, Walters 1978, Coulson et al. 1983).

According to Stresemann & Stresemann (1966) the Lesser Black-backed Gull of the nominate subspecies *L. f. fuscus* forms an exception. This subspecies does not start its wing moult at the breeding site, but after arrival at the wintering grounds. It is a long-distance migrant, whereas the other large Scandinavian gulls are short-distance migrants. On the basis of an investigation of museum skins, Stresemann & Stresemann (1966) concluded that *L. f. fuscus* may have a "periodic stepwise moult" *(periodische Staffelmauser)*, a pattern typical of terns Sternidae. Stepwise moult involves simultaneous replacement of remiges in two or three moult waves during the once-a-year remigal moult. The inner 1—3 primaries are moulted twice in the stepwise moult of *L. f. fuscus,* but only once in the "normal" descendent moult of other *Larus* gulls. The functional significance of a stepwise moult lies in the better aerodynamic quality of wings with evenly worn flight-feathers — a matter of importance for long-distance migrants (Ashmole 1968).

During a long-term population study in a mixed colony of *L. f. fuscus* and *L. argentatus* in the Gulf of Finland, I noticed early commencement of wing moult in *L. f. fuscus*. In this paper I compare the timing and pattern of primary moult in *L. f. fuscus* with that of *L. argentatus* and discuss the role of the moult in relation to breeding.

Material and methods

The study area is situated in the outer archipelago of the Gulf of Finland, in the small island group of Söderskär, 25 km southeast of Helsinki (60°07'N, 25°25'E). The study colony breeds on a treeless islet with dense grass vegetation, 1.3 ha in size. The breeding population has been about 25 pairs of both gull species, but *L. f. fuscus* is steadily declining, as in other areas on the Finnish side of the Gulf of Finland (see Kilpi et al. 1980). I collected shed primaries in this colony during the breeding seasons of 1980—83. Feathers were collected at 2—3 day intervals during egg-laying and incubation, and daily during the feeding period of the young. After unsuccessful nesting the Lesser Black-backed Gulls often moved to roosts on adjacent islets, where further searches were conducted up to September in

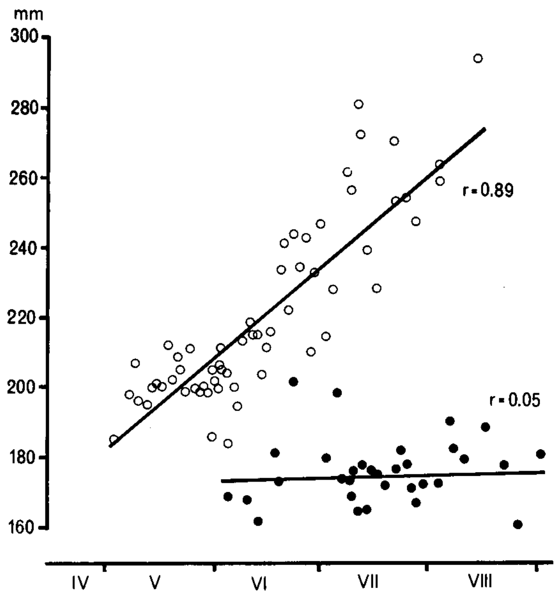

Fig. 1. The lengths of primaries shed by *L. f. fuscus* (filled circles) and *L. argentatus* (open circles) during the breeding periods of 1980—83. Daily means of a total of 137 *L. f. fuscus* and 337 *L. argentatus* feathers are shown.

1980—82. During the visits, the numbers of birds present were noted, and breeding success was studied in detail.

The numbers of newly shed primaries collected are presented in Table 1. The numbers of breeders in the gullery (on average 50 ind. of *L. f. fuscus* and 49 ind. of *L. argentatus)* are presumed to be the number of potential moulters. Primaries of subadult birds, recognizable by their colouring, were discarded.

The method of collecting shed primaries has been applied earlier to at least nine different bird species (for references and applications, see Walters 1978, 1979 and den Blanken et al. 1981).

To obtain additional information on the moult pattern of *L. f. fuscus,* I checked the skins in the collections at the Zoological Museums of the Universities of Helsinki and Copenhagen, and at the British Museum (Natural history), Tring. Altogether 31 specimens of adult *L. f. fuscus* taken from non-wintering grounds in the breeding and postbreeding seasons were examined.

Results

Timing of primary moult. Gulls replace their primaries in a very regular sequence, starting with the innermost, shortest primary and ending with the outermost, longest primary (numbered from 1 to 10, the minute 11th primary is disregarded, see Stresemann & Stresemann 1966). In *L. f. fuscus* only the short inner primaries were shed in the study area, whereas in *L. argentatus* the average length of the primaries shed increased progressively (Fig. 1). Thus *L. argentatus* continued the primary moult further towards the wing tip than *L. f. fuscus,* which either interrupts the moult, or moves outside the area for the later stages of the moult. All the primaries shed by *L. f. fuscus* were uniformly coloured, typical inner primaries; those of *L. argentatus* showed the differences in colouring existing between the inner (1— ~5) and outer primaries (cf. e.g. Coulson et al. 1982).

Adults of *L. argentatus* started to move from the breeding site in July when also the fledglings were leaving the area (Fig. 2, lines E and C; the rising upper part of curve C reflects the fledging). Despite the very poor breeding result, adults of *L. f. fuscus* stayed up to the end of August. This lagging was probably connected with the on-going primary moult. Similar observations have been made on Lågskär, Åland Islands. In the middle of August 1983, birds present in a local colony were commonly in wing moult; the last moulting birds were seen in mid-September, when the colony finally dispersed.

When examining skin collections, Stresemann & Stresemann (1966) failed to find any adult *L. f. fuscus* originating from the breeding or autumn migratory range that was in active wing moult. They concluded that the primary moult takes place entirely on the wintering grounds. Also, adults caught during the autumn migration at the Rossitten bird observatory (now Rybachi, USSR) were not moulting, from which Heinroth (1928, according to Stresemann & Stresemann 1966) drew the same conclusion. Accordingly, migrating

Table 1. Numbers of shed primaries collected in the study area and sizes of breeding gull populations (ind.) in different years.

	L. f. fuscus		*L. argentatus*	
	primaries	breeding birds	primaries	breeding birds
1980	38	62	52	50
1981	11	64	108	50
1982	46	44	114	52
1983	42	30	63	42

Table 2. Proportions of fresh and worn primaries of *L. f. fuscus* and those of intermediate type collected in the study area.

	fresh		worn		interm.		tot.
	n	%	n	%	n	%	
1980	6	16	27	71	5	12	38
1981	5	45	6	55	0	—	11
1982	3	7	42	91	1	2	46
1983	7	17	31	74	4	9	42
$\bar{x}$		21		73		6	

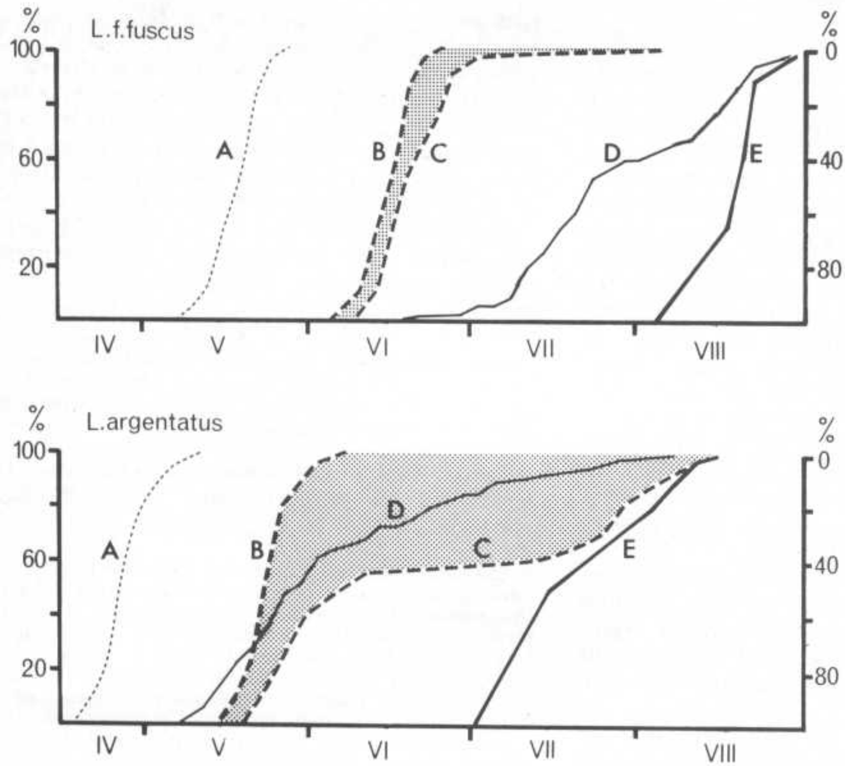

Fig. 2. Reproduction and primary moult in *L. f. fuscus* (for the years 1980 and 1982) and *L. argentatus* (1981 and 1982). Line A = increase of laid eggs (N=70 for *L. f. fuscus* and 116 for *L. argentatus*), *B* = increase of hatched young (N=68 resp. 102), C = increase of perished or fledged young, D = increase of finds of primaries (1—3(—4) innermost) (N=84 resp.215), E = decrease of adults in the study area (N=50 resp. 49). All in cumulative percentages. Shaded area = the period of feeding young.

adults of *L. f. fuscus* either interrupt the primary moult commenced at the breeding site, or do not commence it at all and migrate with the old feathers. The Zoological Museum of Helsinki (not visited by the Stresemanns) has eight skins of adult *L. f. fuscus* showing primary moult in summer — early autumn and 13 which do not. Of the ten specimens from the same period in the Copenhagen and Tring museums only one was in moulting stage.

Pattern of primary moult. A striking feature of the primaries of *L. f. fuscus* collected for this study was that some of them were fresh and some heavily worn (Fig. 3). This suggests a difference in the age of the feathers. Very few intermediates occurred (Table 2). This can be related to Stresemann & Stresemann's (1966) view that a periodic stepwise moult may occur in *L. f. fuscus*. In the "normal" descendent primary moult the age of the innermost primaries in spring is 8—10 months whereas in the stepwise moult it is only 1—2 months (or even less), which is the time interval between arrival at the breeding grounds and completion of the second moult wave in the inner primaries. Thus the fresh primaries belong to birds having moulted stepwise, and the worn ones to those having moulted "normally".

All the primaries of *L. argentatus* were equally worn.

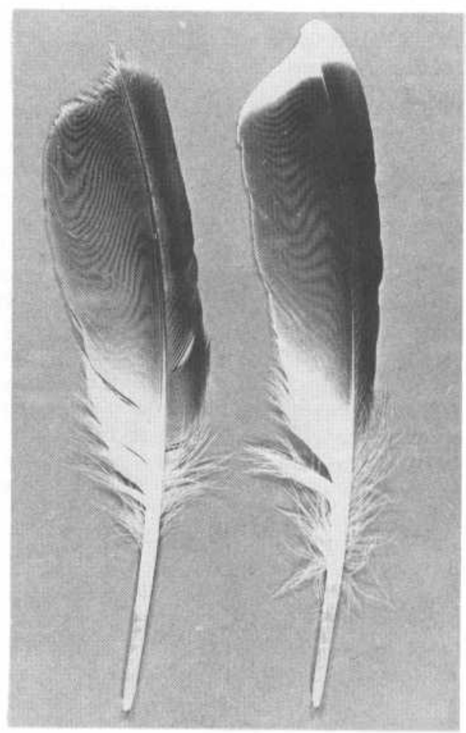

Fig. 3. Examples of worn and fresh inner primaries of *L. f. fuscus*.

Discussion

In this study the ordinal numbers of the shed primaries were not worked out due to the small sample size and lack of reference material (cf. Walters 1978, 1979). However, Figure 1 shows that the shed primaries of *L. f. fuscus* are mainly the short innermost primaries, in my experience numbers 1 and 2 (occasionally 3?). There was no statistical difference in the numbers of primaries (fresh and worn ones) originating from the left and the right wing, which indicates good retrieval of the shed primaries. As one bird sheds 2 or 4 (occasionally 6?) primaries, the average number of birds shedding primaries in the study area would be 17 or 9 (or 6) (according to Table 1), which represents 34 or 18 (or 12) % of the average *L. f. fuscus* population in 1980—83. The moulting birds are thus in the minority, but their occurrence cannot be regarded as occasional or "very rare" (cf. Stresemann 1971).

The proportion of birds moulting stepwise averages 20 % of all the moulting birds in the study area (Table 2). Their proportion of the whole population cannot be evaluated because the moulting pattern of the non-moulting birds is unknown.

Is it possible that the very poor breeding result of *L. f. fuscus* in the study area has some connection with the early commencement of primary moult? The energetic stress of the moult itself is not necessarily very hard (5—30 % of the daily energy demands in most species studied, Payne 1972) but the greater stress of breeding might regulate its timing. Over 90 % of the *L. f. fuscus* chicks had died before the start of the primary moult of the adults (Fig. 2). One might suspect that the high rate of chick loss caused the early onset of the moult ("early" according to the view of Stresemann & Stresemann 1966). Ashmole (1968) has suggested that in some slowly moulting tern species there is no internal stimulus for the moult, but that old feathers are replaced whenever the moult is not inhibited by the presence of hormones related to reproduction or migration. Food is one proximate factor regulating the moult, and malnutrition is among the most common causes of death in *L. f. fuscus* chicks (Hario, unpubl.). However, the timing of the moult shows no immediate response to the "surplus" time (and food?) due to chick losses. The time-lag is over a month (between 50 % chick mortality and 50 % shedding of primaries, see Fig. 2), and the moulting period falls in about the same phase of breeding as in *L. argentatus*. The timing of the moult in *L. f. fuscus* is evidently not comparable to that in the species group described by Ashmole (1968), a moult — breeding overlap being a more common trait among gulls and terns in the Palearctic. Although chick losses are heavy at present and breeding success is poor in *L. f. fuscus*, the timing of the primary moult may well have remained the same as earlier. Most of the skins in the Helsinki Museum are from the beginning of this century. Barth's (1975) report that the primary moult started on average on 10 August in Norway and at the earliest in mid-July is based on wing-sample data from the years 1962—70.

This interpretation does not, however, exclude the possibility that the proportion of birds starting the wing moult on the breeding grounds is increasing.

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Selostus: **Nimirodun selkälokin käsisulkasadon alkamisajankohta ja sulkimistapa — vertailu harmaalokkiin**

Sulkasadon yhteydessä maastoon pudonneet selkä- ja harmaalokin käsisulat poimittiin talteen eräässä sekayhdyskunnassa Suomenlahdella pesimäkausina 1980—83 (taul. 1). Selkälokki uusi pesimäpaikalla vain sisimpiä, lyhyitä käsisulkia, harmaalokki näiden lisäksi myös ulompia (kuva 1). Koska nimirodun selkälokki muuttaa ehjällä siivellä, pesimäpaikoilla aloitettu siipisulkasato keskeytyy muuton ajaksi. Harmaalokki jatkaa siipisulkasatoa keskeytyksettä pesimäkaudelta muuttokauteen. Käsisulkasatonsa pesimäpaikalla aloittaneiden selkälokkien osuus tutkitusta kokonaiskannasta oli keskimäärin enintään 34 % tai vähintään 12 % riippuen siitä, otaksutaanko sulkivien lintujen uusineen 1 vai 3 sisintä käsisulkaa (sulkien keskinäistä järjestystä ei yritetty määrittää niiden ulkonäöstä).

Löydetyistä selkälokin käsisulista osa oli raskaasti kuluneita ja osa tuoreita, ehytkärkisiä (taul. 2, kuva 3). Tuoreet olivat kuuluneet yksilöille, jotka edellisessä sulkasadossa olivat sulkineet ns. porrastetusti. Porrastetussa sulkasadossa sisimpiä käsisulkia uusitaan saman sulkasatokierron aikana kahteen kertaan (joillakin tiiroilla kolmeen). Kevätpuolelle ajoittuva toinen sulkimisaalto vähentää ikä- ja kuluneisuuseroja uloimpien ja sisempien käsisulkien välillä, millä lienee merkitystä pitkänmatkan muuttajille lennon aerodynamiikan osalta. Tämä "jaksottainen porrastettu" sulkasato on ominainen eritoten tiiroille, ja lokeista sellainen on ainoastaan nimirodun selkälokilla, pitkänmatkan muuttaja sekin. Harmaalokki sulkii muiden lokkien tapaan "normaalissa" laskevassa järjestyksessä.

Selkälokin käsisulkasadon alkaminen ajoittui hieman myöhäisempään vaiheeseen poikaskautta kuin harmaalokin (kuva 2, käyrät C ja D). Selkälokin poikastappiot olivat raskaat. Yli 90 % poikasista oli menehtynyt ennen emojen siipisulkasadon alkamista. Yli kuukauden viive poikaskuolemien ja siipisulkasadon yleistymisen välillä sekä sulkasadon ajoittuminen suunnilleen samaan pesimiskierron vaiheeseen kuin harmaalokilla ilmentävät otaksuttavasti sulkimisajankohdan riippumattomuutta pesimätuloksesta.

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Kongresseja

XIX Congressus Internationalis Ornithologicus

Second announcement. The XIX International Ornithological Congress will take place in Ottawa, Canada, from 22 to 29 June 1986. Prof. Dr. Klaus Immelmann (West Germany) is President and Dr. Henri Ouellet (Canada) is Secretary General. The programme is being planned by an international Scientific Programme Committee chaired by Professor J. Bruce Falls (Canada). The programme will include plenary lectures, symposia, contributed papers (spoken and posters), and films. There will be a mid-congress free day. Pre- and post-congress excursions and workshops are planned in various interesting ornithological regions of Canada. Information and requests for application forms should be addressed to: Dr. Henri Ouellet, Secretary General, XIX Congressus Internationalis Ornithologicus, National Museum of Natural Sciences, Ottawa, Ontario, Canada K1A OM8.

5:e Nordiska Ornitologiska Kongressen (NOK 85)

Första meddelandet. NOK 85 organiseras på uppdrag av Sveriges ornitologiska förening av Göteborgs ornitologiska förening och Zoologiska institutionen vid Göteborgs universitet i samarbete.

Kongressen kommer att äga rum den 5—9 augusti 1985 på Gottskärs Kursgård, Onsala, vid Kungsbackafjorden ca 35 km söder om Göteborg.

Preliminär anmälan om deltagande kan när som helst insändas under adress NOK 85, Zoologiska institutionen, Box 250 59, 400 31 Göteborg. Lämna gärna samtidigt synpunkter och förslag på ämnesområden som anses värda att särskilt uppmärksammas på kongressen.

Nästa meddelande med mer information planeras utsändas tidigt hösten 1984. Formulär för definitiv anmälan kommer att tillställas de preliminärt anmälda under första kvartalet 1985. Kongresskommittén.