The primary moult of breeding Dunlins *Calidris alpina* in the central Taymyr in 1989

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A total of 14 incubating Dunlins were caught at the mouth of Malaja Logata, central Taymyr, in July 1989. All were moulting the primaries, starting with the simultaneous loss of the first three, four or five primaries. Primary moult lasts probably *c.*50 days, considerably less than the primary moult period reported for post-breeding Dunlins.

Introduction

In some populations Dunlins moult while they are breeding (Kozlova 1962, Gromadzka 1989). Moulting at breeding sites has been found east of the Urals (Greenwood 1983, Danilov *et al.* 1984, Gromadzka 1989), although in the Yamal Peninsula only a small fraction of the breeding birds was involved (Ryabitsev *in litt.*, cited by Gromadzka 1989).

Kozlova, Greenwood and Gromadzka based their statements on only a few observations (Greenwood for the area from Yenisey to Kamchatka – 11 cases, Gromadzka for Taymyr – 8 cases) from various years. These were mainly from museum specimens, and some specimens examined by each author were often the same. This paper reports data on primary moult collected during the breeding season in Taymyr in 1989. The sample size is not much bigger than those of earlier studies, but the data has the advantage of being gathered at one site and during one season.

This paper is one of the results of an ornithological investigation organised by the Soviet Academy of Sciences, and carried out jointly by the WWF-Watten-meerstelle Schleswig-Holstein, the Ukrainian Black/Azov Seas Ornithological Station and the Gdansk Ornithological Station (Polish Academy of Sciences).

Materials and study area

The material consists of 17 moult records and sets of measurements for 14 Dunlins caught, while incubating, at nine nests at the mouth of the Malaja Logata (73°25'N, 98°25'E) in the Taymyr tundra, in July 1989. According to members of the staff of the "Taymyrskiy" Nature Reserve, the summer of 1989 began 10–15 days later than usual.

Methods

Dunlins were caught at their nests, using walk-in traps. Sex was determined according to the presence (male) or absence (female) of contrast between the greyish hindneck and brownish cap (Soikkeli 1966). Measurements of males and females (Table 1) placed in a bivariate plot of bill versus wing length, form separate clusters that confirm sex determination – males being smaller than females. Wing-length was measured using the maximum chord method to 1 mm. Bill-length was measured as exposed culmen from the feather base. This and head and bill length was usually taken to 0.1 mm.

Moult score (Ashmole 1962) was noted for all 10 main primaries (Table 1).

To illustrate the moult process (Figure 1), I estimated the amount of new feather mass produced (Underhill & Zucchini 1988). Moult score for each bird was recalculated for feather mass by the formula:

$$y = \sum_{i=1}^{10} m_i p_s$$

where y is the proportion of total mass of ten primaries in relation to their hypothetical mass when fully grown, m_i is the mass of the i-th primary relative to the total mass of all the primaries, p_s is the mass of a primary with score s relative to its mass when it is fully grown (0, 0.125, 0.375, 0.625, 0.875, 1 for successive scores 0, 1, . . . , 5; after Underhill & Zucchini 1988, with a little simplified notation). Data for the primary feather masses of Dunlins were taken from measurements on five birds caught in Poland during autumn migration (Table 2).

Results and discussion

All breeding Dunlins found at the mouth of the Malaja Logata in 1989 moulted their primaries during incubation. They started to moult at the end of June or the beginning of July (Figure 1).

The beginning of the moult in relation to the start of breeding can be assessed for four Dunlins caught at two nests with known hatching dates (Table 1). In *C. alpina schinzii* in Finland incubation lasts *c.*22 days (Soikkeli 1967). In a more severe climate it may take a few days more, as Tomkovich (1988) found for Temminck's Stint *Calidris temminckii*. In these four Dunlins the beginning of the moult coincided more or less with egg laying, which is in agreement with the Kozlova's (1962) statement.

Almost all Dunlins had the first three, four or five (usually four) primaries in the same stage of development. In all cases the inner primaries with the same score were of equal length. In Dunlin no. 10, the vanes of the second and third primaries were just emerging from the sheath. This points to the fact that corresponding old feathers were lost simultane-

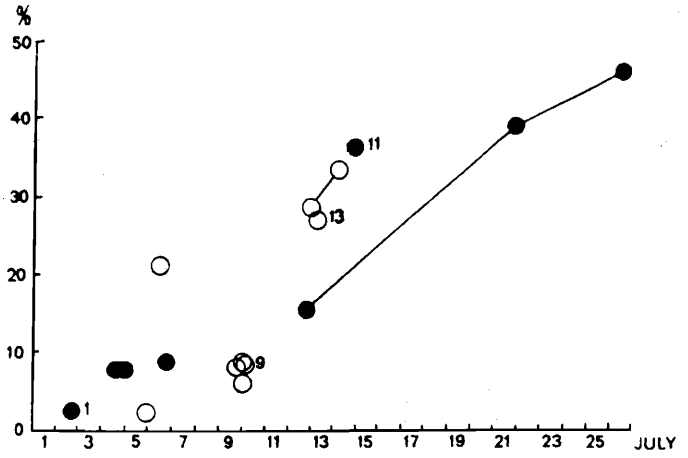

Figure 1. Primary moult of incubating Dunlins at the mouth of the Malaja Logata, Taymyr, 1989 in relation to date. Moult stage expressed as a percentage of total mass of ten fully grown primaries (see text). Shaded circles are males; open circles are females. Multiple records of the same individual are joined by a line. The code numbers (Table 1) of the birds caught on the nest with known hatching date are given.

Table 1. Primary mounlt scores and measurements of breeding Dunlins at the mouth of the Malaja Logata, Taymyr, 1989.

Specific no. of		Sex	Length of			Weight	Date in	Hour	Total	Moult score for individual feathers										Hatching date in
bird	nest		wing	bill[1]	head & bill		July			1	2	3	4	5	6	7	8	9	10	July
1	1	M	119	30.3	54.4	46	2	16	4	1	1	1	1							20
2	2	M	121	31.7	56.5	54	4	15	8	2	2	2	2							
3	3	M	119	31.8	55.5	51	4	23	8	2	2	2	2							
4	4	F	119	34.9	58.3	53	5	23	4	1	1	1	1							
5	4	M	114	32.3	57.4	41	6	15	9	2	2	2	2	1						
6	5	F	119	33.5	58.3	48	6	11	18	4	4	4	3	2	1		Old feathers			
7	6	F	124	37.2	61.1	60	9	17	9	3	3	2	1							
8	3	F	118	34.1	58.6	53	9	18	9	2	2	2	2	1						
9	7	F	120	33.3	57.5	58	9	21	9	2	2	2	2	1						26
10	8	F	121	36.6	61.4	55	9	23	7	1	2	2	1	1						
11	7	M	119	32	56.0	49	12	17	14	3	3	3	2	2	1					26
11						47	21	22	29	5	5	5	5	4	4	1				
11						52	26	14	32	5	5	5	5	5	4	3				
12	9	F	120	32	57.6	52	12	22	22	4	4	4	4	3	2	1				
12							14	3	24	4	4	4	4	4	3	1				
13	1	F	124	36.6	61.3	59	13	4	21	4	4	4	4	3	2	1				20
14	9	M	114	33	57.2	49	14	20	28	5	5	5	5	4	3	1				

[1]correct to 0.1 mm or 1 mm

Table 2. Mass of the fresh primaries of five specimens of Dunlins in unworn plumage caught at the Vistula mouth, Poland, in July or August.

Primary number (*i*)		1	2	3	4	5	6	7	8	9	10	1–10
Mass (mg)	minimum	6.5	7.6	9.1	11.1	13.4	16.4	19.7	23.4	26.6	31.9	165.7
	maximum	8.3	10.3	11.6	14.2	17.5	20.5	23.8	27.6	32.5	36.9	203.2
Mean percentage of the primary mass (m_i)		4.0	4.9	5.7	6.9	8.5	10.2	11.8	13.7	15.8	18.4	100.0
sd (mg)		0.10	0.23	0.18	0.22	0.24	0.24	0.09	0.18	0.34	0.46	

ously. Kozlova (1962) claimed simultaneous moult usually for the first three or four primaries, but sometimes the first five or six. Such a rapid start of primary moult has never been recorded in migrating Dunlins caught in the first stages of moult at the Vistula mouth in Poland (J. Gromadzka pers. comm.).

The moult progressed very quickly in the Dunlins in the Taymyr which were studied in 1989. It is not known if moult was suspended after the end of incubation. If moult continues at a similar rate in the second part of the moult period, the primary moult would take *c.*50 days. This is a markedly shorter period than the 59–94 days reported for primary moult in post-breeding Dunlins (Ginn & Melville 1983).

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Relative masses of primary feathers in waders

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Summers *et al.* (1983) showed that moult scores of retrapped Redshanks *Tringa totanus* tended to increase more slowly towards the end of primary mount than near the beginning. This was partly because the outer primaries are longer and heavier than the inner primaries. Therefore, by converting moult scores to percentage feather mass grown (PFMG) one can make the pattern of increase with time more linear (Summers 1980). A "moult index" that increases linearly with time is one of the underpinning assumptions of the moult model of Underhill & Zucchini (1988), and PFMG is undoubtedly more closely linear with time than the traditional moult score. In order to compute PFMG, the relative masses of the primary feathers for the species under consideration need to be known.

One of the purposes of this note is to point out that, for those wader species for which the relative masses of the primaries are known, there is sufficiently little variation to suggest that a set of average values might suffice for all (or at least most) wader species. The other purpose of this note is to suggest a standard procedure for determining the relative masses and for computing PFMG. Improved standardisation of methods will facilitate comparisons between species and between areas in the timing and duration of moult.

To date, the relative masses of the primaries have been determined for 13 wader species (Table 1). For these species and each primary, the maximum difference between the average relative masses and the relative masses for the individual species was 1.3%. The consistent differences were for Grey Plover *Pluvialls squatarola,* which appears to have relatively lighter inner and heavier outer primaries than average, and Redshank for which the opposite pattern occurs (Table 1).

The recommended procedure for finding relative masses was described by Summers *et al.* (1980), and is repeated