Dunlin *Calidris alpina* migration across Tiligul Liman, Ukraine

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INTRODUCTION

The north Black Sea region is an important stop-over area for shorebirds migrating in spring (Chernichko *et al.* 1991) from as far as west and south Africa to their breeding grounds in northern Europe and Asia (Hale 1980). Tiligul Liman in Ukraine is one of several staging sites in the north-west Black Sea Region used by migrating shorebirds for 'refuelling' and concurrently completing moult. Dunlin *Calidris alpina* is the most numerous wader species using the area.

The nominate subspecies comprise the main bulk of the Dunlin population migrating across Tiligul. *Calidris a. schinzii*, which principally use the east Atlantic flyway for migration (Pienkowski & Dick 1975) occur in the NW Black Sea region only accidentally (Gromadzka 1989). The eastern subspecies (*sakhalina* Dunlin), which are accidentally found elsewhere in Europe (Cramp & Simmons 1983) and in the Mediterranean Region (Mullie & Meininger 1981) also may appear sporadically at Tiligul as well (Chernichko *pers. comm.*). Finally, birds known as *centralis* Dunlin (intermediates between *alpina* and *sakhalina* (Hale 1980) whose breeding grounds lie on the Taymyr Peninsula) and known to migrate to Europe (Meininger & van Swelm 1989) also use the Black Sea-Mediterranean Flyway in spring.

In this paper data on the Dunlin spring migration across Tiligul Liman are analysed and an attempt is made to suggest the final destination and migration route of the birds based on biometrics, departure body mass and the timing of migration.

STUDY AREA AND METHODS

The study was conducted from the beginning of May (the end of April in 1990) to mid June 1990 - 1992 at the lower part of Tiligul Liman (46° 45' N, 31° 10' E) (Figures 1 & 2). The term "liman" refers to a usually land-locked salt water pond which was formerly a river mouth flooded by the sea. Such water bodies are characteristic of the NW Black Sea region. Tiligul is one of the largest limans of this type. It is 55-80 km long (depending on the annual amount of precipitation) and up to 4.5 km wide. Salinity at the lower part of the liman is close to that of the north-western Black Sea (0.012-0.013%) while at the upper part it drops to 0.004%. Currently the liman is separated from the Black Sea by a natural sand spit some 4 km long and 5-7 km wide. This area has many interconnected shallow water ponds which quickly warm up in spring and are extensively used by migrant and resident waders and waterfowl as feeding and resting sites.

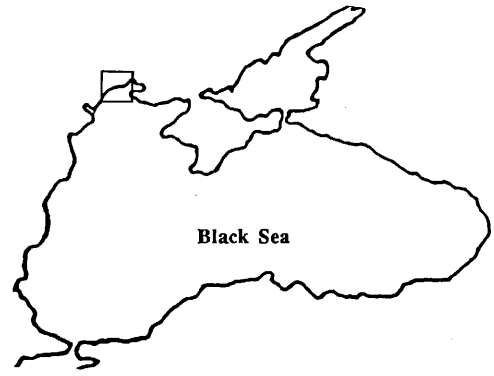

Figure 1. The Black Sea and the area of the study site.

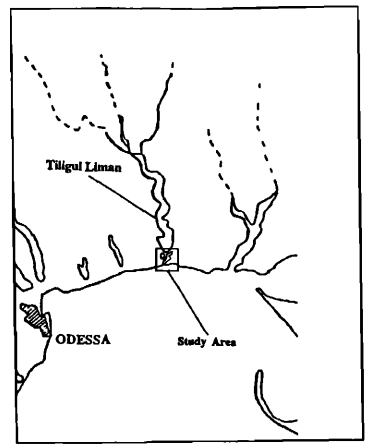

Figure 2. Tiligul Liman.

In 1990, the field season started two weeks earlier than in both 1991 and 1992. The first birds were captured in 1990 on 20 April, on 10 May in 1991 and on 9 May in 1992. During the three field seasons a total of 207 Dunlin were captured using walk-in traps adapted to the local conditions (Chernichko 1984). Nine traps were used in 1990 and 1991 and seven in 1992.

In all three years captured birds were classified as either second year or older than second year (see Prater *et al.* 1977). Only in 1992 were birds sexed on the basis of their breeding plumage (Ferns & Green 1979).

Biometric data presented in this paper are from all captured birds. Bill length (exposed culmen) was measured with callipers to the nearest 0.1 mm. Wing length (maximum cord) was measured with a ruler to the nearest 1.0 mm. Weight was measured to the nearest 0.5 with balance scales. Minitab software package was used for statistical analysis of the data. Fat load was estimated by the equation:

$$FM = 0.548*BM - 0.572*B - 2.11$$

where FM = fat mass (g), BM = body mass (g) and B = bill length (mm), developed for Dunlin departing from NW Africa in spring (Piersma & van Brederode 1990; Piersma *pers. comm.*).

RESULTS

Timing of migration

Even though Chernichko (1992) reported that the first Dunlin arrive to Tiligul as early as the end of March, the majority of the migrating population arrives at the beginning of May. This coincides with general departure of shorebirds breeding in northern Siberia from the Mediterranean Region (Piersma & van De Sant 1992). Usually by the second week of May, the number of birds reaches its maximum, and stays at this level until around 25 May. (In 1994 the first flock of approximately 200 Dunlin departed on 29 May). After that Dunlin numbers decline quickly and the last individuals leave by 10 June.

Counts made in previous years suggest that *c.* 4,000 Dunlin may be present at Tiligul at one time (Chernichko *pers. comm.*) (in late May 1994 *c.* 3,500 Dunlin were counted in the area). However, turnover of the birds remains unknown and the total size of the population using the site has therefore not been estimated.

Departing flocks left around or after sunset and flew in easterly (along the coast line) and north-easterly directions but it was not clear whether this corresponded with their ultimate destination.

Moult

Upon their arrival to Tiligul most (over 90%) of the Dunlin were moulting their contour feathers, with less than 10% still in winter plumage. By 25 May more than 95% of the staging population had finished moult and were in full breeding plumage.

Recoveries

A bird (first winter) ringed at Tiligul (46° 45' N, 31° 10' E) on 30 May 1991 was recovered at the Vistula Mouth, Poland (54° 20' N, 18° 56' E) on 24 July 1991 during autumn migration. On 12 May 1992 an adult bird ringed at the Vistula Mouth, Poland on 31 July 1991 was recovered at Tiligul.

Bill and wing length

The average bill length of Dunlin for the three years was 33.6 mm (n = 197; SD = 2.4; 95% C.I. 33.3 - 34.0).

No significant difference (ANOVA p = 0.576) in bill length was observed between three years (frequency distribution of the bill lengths is shown in Figure 3). Average bill length of Dunlin staging at Tiligul did not seem to change significantly during the stopover period in 1990 (ANOVA p = 0.983) and 1992 (ANOVA p = 0.438) (Table 1). However, in 1991 it seemed to increase in late May compared with the beginning of the month (ANOVA p = 0.004).

Table 1. Seasonal changes in bill length (mm) of Dunlin *Calidris alpina* captured at Tiligul Liman in spring 1990-1992. Months in Roman numerals (IV = April, V = May *etc.*).

Year	Period	n	Mean	SD	Range
1990	20.IV-30.IV	14	33.4	1.6	29.5 - 36.5
	1.V-10.V	6	33.1	1.2	31.7 - 35.2
	11.V-20.V	17	33.7	2.0	29.9 - 36.8
	21.V-30.V	29	33.6	1.9	31.1 - 35.5
	>30.V	4	33.5	1.9	31.1 - 35.5
TOTAL	1990	70	33.5	2.2	29.5 - 37.6
1991	10.V-20.V	13	31.7	2.2	28.0 - 36.4
	21.V-30.V	54	34.3	2.5	28.5 - 40.4
	>30.V	9	34.5	2.5	30.2 - 37.1
TOTAL	1991	76	33.9	2.6	28.0 - 40.4
1992	10.V-20.V	8	34.1	2.8	29.0 - 37.3
	21.V-30.V	23	33.1	2.4	29.6 - 37.6
	>30.V	20	33.7	1.8	30.6 - 38.1
TOTAL	1992	51	33.5	2.2	29.0 - 38.1

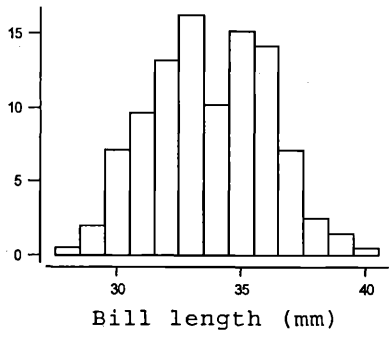

Figure 3. Percent frequency distribution of bill length (mm) of Dunlin *Calidris alpina* captured at Tiligul Liman in spring 1990-1992 (n = 197).

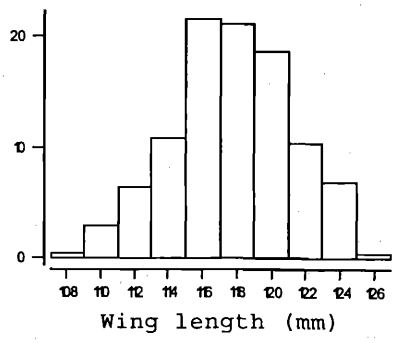

Figure 4. Percentage frequency distribution of Dunlin *Calidris alpina* wing length (mm) caught in spring 1990-92 (n = 203).

The average wing length for the three years was 117.2 mm (n = 203; SD = 3.5; 95% C.I. 116.7 - 117.6) (see also Figure 4). The estimated average bill and wing lengths were 32.2 mm and 114.9 m for males and 35.2 mm and 116.6 mm for females respectively (Table 2).

Table 2. Mean bill and wing lengths (mm) in male and female Dunlin *Calidris alpina* captured at Tiligul Liman in spring 1992.

Sex	n	Bill	SD	CV	Wing	SD	CV
Male	27	32.2	1.9	5.9	114.9	2.8	2.3
Female	20	35.1	1.7	4.8	116.6	3.4	2.9

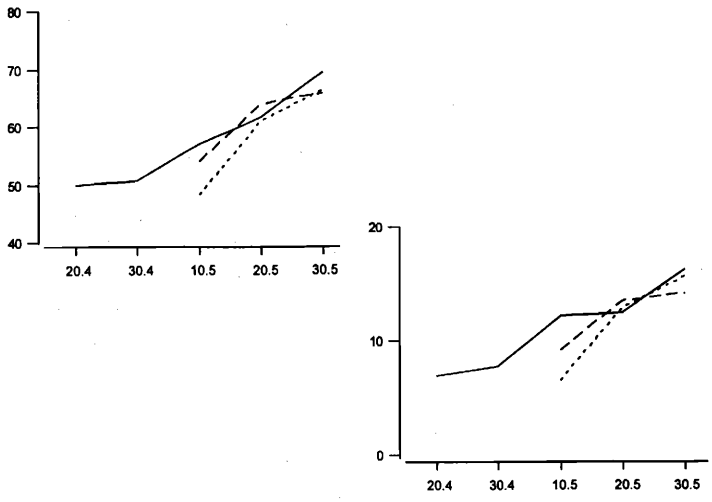

Figure 5. Seasonal changes in (above) weight (g) and (below) estimated fat load (g) (see Methods) of Dunlin *Calidris alpina* captured at Tiligul Liman in spring 1990-1992.
Solid line: 1990 (weight: r = 0.664, p = 0.000, and n = 70; fat load: r = 0.732, p = 0.000, and n = 67)
Dashed line: 1991 (weight: r = 0.396, p = 0.000, and n = 76; fat load: r = 0.342, p = 0.003, and n = 74)
Dotted line: 1992 (weight: r = 0.371, p = 0.007, and n = 51; fat load: r = 0.444, p = 0.001, and n = 49).

Body weight

Body mass in Dunlin captured at the end of April and in the beginning of May on average was *c.* 55 g. Further, the increase in body mass and estimated fat load of the Dunlin followed (Figure 5). By 25 May when Dunlin started departing, the birds' body weight in the sample ranged from 50 g to 75 g with slightly over 40% of those weighing more than 68 g. Approximately 40% of Dunlin had a body weight between 58 g and 68 g and 20% of Dunlin had body weight less than 58 g (Figure 6).

DISCUSSION

The fact that the Dunlin population staging at Tiligul arrive and depart almost simultaneously and simultaneously finish their moult implies that birds not only arrive from the same place (which may be Tunisia (Gromadzka 1989; Chernichko *pers. comm.*) and/or elsewhere in the southern and south-eastern Mediterranean Region (Mullie & Meininger 1981)) but also originate from the same breeding area (presumably central Siberia). Previous studies conducted at Tiligul demonstrated that at the end of April and the beginning of May up to 96% of Dunlin at Tiligul are already in the process of moulting contour feathers and only 33% are still moulting in the second half of May (Bukovetskaya 1992). In this study more than 95% of Dunlin were in their full breeding plumage after 25 May. The completion of moult seemed to be followed by a rapid increase in the body weight (Figure 5).

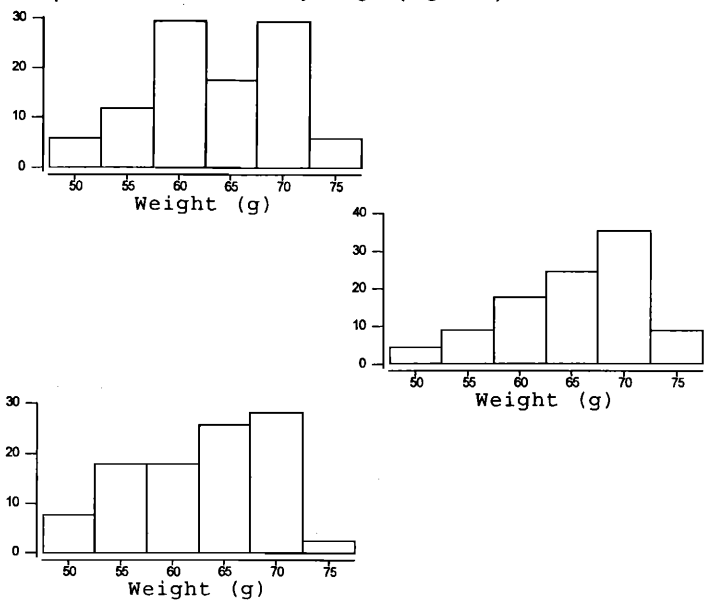

Figure 6. Percent frequency distribution of body weight (g) of Dunlin *Calidris alpina* captured at Tiligul Liman after 25 May: Figure 6.1 in 1990 (n = 17); Figure 6.2 in 1991 (n = 45), and Figure 6.3 in 1992 (n = 40).

The homogeneity of the population is further indicated by the constant average bill length of captured Dunlin through the staging period (except maybe for 1991). This is unlike the expected situation if mixed breeding populations were present (Goede *et al.* 1990). It also indicates that male and female Dunlin arrive at Tiligul together - consistent with the conclusion of Chernichko (1992). The estimated sex ratio of males and females was 1.4 : 1 in this study (1992) and 2:1 according to Chernichko (1992). He believed that the majority (but not all) of the birds (61%) belong to the population breeding to the east of the Ob River possibly as far as western Taymyr Peninsula (Gromadzka & Ryabitsev, WSG 1992 Odessa Conference), attributing the rest to *alpina* Dunlin of north-western Siberia (Yamal Peninsula).

According to Cramp & Simmons (1983) the bill lengths of both male and female Dunlin captured at Tiligul were similar to those of subspecies *sakhalina* (32.0 mm and 35.1 mm for males and females respectively). These are also close to measurements of Dunlin from the central Taymyr (31.9 mm and 34.8 mm (Kania 1990)), and Tunisian wintering population (34.2 mm and 33.0 mm (combined sexes at two different locations (Dijk 1986)).

Mean wing length was 117.2 mm (see also Table 2) close to the measurements for *Calidris a. alpina* given by Cramp & Simmons (1983).

During the last week of May/beginning of June, after having completed moult Dunlin quickly increase their body weight by depositing lipids for the final part of their northward migration. If upon arrival at Tiligul some birds may carry as little as estimated 2-3 g of fat, in those Dunlin which are ready to depart the fat load may exceed 18 g (Figure 5b).

Though rather similar in their moult, timing and body measurements, Dunlin found at Tiligul in spring seem to show considerable variation in their departure body mass (Figure 6). Thus birds may have accumulated different amounts of fat on different migration routes. Heavy birds (70-75 g and more) can probably cover the distance to their proposed breeding grounds in north-west - central Siberia in 'one giant hop' (Meltofte 1991); their estimated flight range being 3,200 km (Castro & Myers 1989). The lighter birds which comprise 20% of Tiligul staging population may use two possible longer ways which however will allow them to feed en route. The first option may be to fly northwards to the White Sea coast (2,100 km) and then migrate along the coast (Meltofte 1991). Alternatively they may fly eastwards to the Volga River (1,100-1,200 km) and then move to the north along the Volga-Kama Basin (Chernichko *pers. comm.*). In both cases some of these migrants will not be in time to breed but are nevertheless known to arrive on their breeding grounds (Chernichko *pers. comm.*).

Overall Dunlin departure from Tiligul at the end of May - beginning of June seems to fit the general timing of breeding for the Dunlin from north Siberia (polar climatic zone) where they start breeding from the second/third week of June (Danilov *et al.* 1984). Their measurements were similar to those of eastern *Calidris a. alpina* (*Calidris a. centralis* (Stepanyan 1990)). Their estimated flight range may allow them to reach areas from Yamal Peninsula and to the east. These not very solid facts may nevertheless suggest that Dunlin found at Tiligul in spring breed as far to the east as the Yenisey Delta.

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