Egg size of the Dotterel *Charadrius morinellus* in Finland

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Received 18 November 1991, accepted 9 April 1992

Introduction

In many wader species the egg size increases as the climate becomes more maritime, the mean usually being lowest at high arctic latitudes and in such areas as the interior of Fennoscandia, and highest in Iceland, the Faroes and Scotland (see Väisänen 1977). This was also evident in the case of the Whimbrel *Numenius phaeopus* (E. Pulliainen & L. Saari, unpubl.). In our study area at the Värriö Subarctic Research Station (67°44′N, 29°37′E) the Whimbrel and Dotterel *Charadrius morinellus* breed side by side on the alpine heaths of the Värriötunturi fell, which raises the question whether similar geographical trends exist in the two species. In this report the differences in the egg dimensions of the Dotterel are considered in relation to the laying sequence, date of clutch commencement and breeding season.

Material and methods

Our Dotterel studies were carried out in 1968–1990, being most intensive in 1969–1974 (see Pulliainen & Saari 1992a); most of the egg measurements were carried out during the latter period. The maximum length and breadth were measured with sliding calipers to the nearest 0.05 mm. From this the volume was calculated according to Byrkjedal & Kålås (1985): length × breadth^2/1000. The total number of eggs measured was 114. Clutch means were calculated for 34 c/3s (the clutch size of the Dotterel is three). A total of 39 eggs (including 11 completed clutches, not all included in the material above) were weighed to the nearest 0.1 g with a 30 g Pesola spring balance, usually within a few hours after laying.

Results

The mean ± SD for all the eggs measured was 40.30 ± 1.64 × 27.99 ± 0.69 mm (n = 114). The clutch means were identical: 40.29 ± 1.51 × 28.01 ± 0.62 mm (n = 34). The CV% for individual eggs was 4.07 for the length and 2.47 for the breadth, and the corresponding values for clutches were 3.75 and 2.21, respectively. The maxima for individual eggs were 43.65 × 28.85 and 37.7 × 29.4, the minima 36.9 × 27.0 and 37.85 × 26.25 mm. The egg size did not vary according to the laying sequence (Table 1). There was only a 0.8% difference in the volume between the biggest (first) and the smallest (third) egg.

The annual variations in mean egg size for individual eggs are shown in Table 2. Application of ANOVA to the 1969–1974 data (data lacking for 1972) showed no significant varia-

Table 1. Egg length, breadth, and volume index according to the laying sequence.

	Length	Breadth	Volume index	N
1st egg	40.21 ± 1.63	28.32 ± 0.82	32.28 ± 2.62	10
2nd egg	39.92 ± 2.01	28.40 ± 0.77	32.24 ± 2.67	9
3rd egg	40.37 ± 1.91	28.15 ± 0.73	32.01 ± 2.43	10

Table 2. Annual means ± SD for egg length and breadth. N = individual eggs.

Year	Length	Breadth	N
1968	40.53 ± 0.15	27.67 ± 0.68	3
1969	41.14 ±1.32	28.32 ± 0.50	15
1970	39.91 ± 1.56	28.13 ± 0.88	18
1971	39.67 ± 1.79	27.99 ± 0.62	9
1973	40.32 ± 1.81	27.71 ± 0.77	32
1974	40.45 ± 1.55	28.07 ± 0.50	31
1975	36.90	27.00	1
1977	39.76 ± 1.32	28.04 ± 0.21	5

tion in egg length (individual eggs $F_{4,100} = 1.306$, ns; clutches $F_{4,27} = 0.805$, ns), or in egg breadth (individual eggs $F_{4,100} = 1.896$, ns; clutches $F_{4,27} = 2.381$, ns). The volume increased slightly as the season progressed in the 27 clutches for which the date of commencement was known, but not significantly ($r = 0.309$, $df = 25$, $t = 1.62$).

The mean egg mass at laying in 11 completed clutches was 16.8 ± 1.3 g. For the 39 individual eggs the mean was 16.7 ± 1.3 g. The egg mass did not differ according to the laying sequence: the means for the first, second and third eggs were 17.0 ± 1.2 (n = 14), 16.8 ± 1.3 (n = 11) and 16.7 ± 1.3 g (n = 11), respectively. The mass ranged between 13.4 and 18.8 g, the clutch means between 14.1 and 18.2 g. In seven of the clutches the mean was between 17.2 and 18.2 g.

Discussion

The mean egg size at Värriö was somewhat lower than in Austria, the British Isles, Norway and elsewhere in Finland, but the same as in Waigatsch, former USSR (Table 3). Owing to the manner in which the results are presented in the literature, the statistical significance of the differences could not be tested. The volume at Värriö was 89% of that in Austria, but the egg size in Austria has varied since Hable (in Glutz von Blotzheim et al. 1975) reported a mean of only 40.0 × 28.4 mm (n = 53) for the first part of his studies. No significant annual differences in egg dimensions were recorded at Värriö, and Byrkjedal & Kålås (1985) did not record any annual variation in volume in Norway.

At Värriö there was a slight but non-significant increase in volume with the progress of the season ($r = 0.31$); in southern Norway the correlation was $r = 0.07$ (Byrkjedal & Kålås 1985). The mean egg mass at laying was 16.7 g, but the difficulty of weighing with a spring balance in the field, sometimes in windy conditions, renders these results less exact than the egg dimensions. The mean was close to the calculated mean fresh egg mass of 17.0 g (Schönwetter in Glutz von Blotzheim et al. 1975), and the Austrian mean of 16.5 g (n = 98, Hable & Präsent 1990). The egg mass did not change with the laying order, in contrast with that of e. g. Temminck's Stint *Calidris temminckii*, in which the egg size increases continuously from the first to the last egg (see Väisänen et al. 1972).

The present results show the tendency found for several other wader species in the western Palearctic for the eggs to be smaller in the north and northeast (see Väisänen 1977). The extent of geographical variation in the egg size of the Dotterel falls well within the range of the species studied so far (Table 4). What causes this variation in the Dotterel is not clear. Small egg size may be merely the consequence of small body size, or females in poorer physical condition may lay smaller eggs.

Little has been published on Dotterel measurements, but the data available indicate only limited geographical variation. Glutz von Blotzheim et al. (1975) and Cramp & Simmons (1983) give the mean wing lengths of females as 154 and 155 mm, respectively. At Värriö the

Table 3. Dimensions of Dotterel eggs in different parts of the range.

Region	Length × breadth	Volume	N	Reference
Austria	42.2 × 29.0	35.5	98	Hable & Präsent 1990
British Isles	41.1 × 28.9	34.3	100	Glutz von Blotzheim et al. 1975
Norway	40.6 × 29.1	34.1	131	Byrkjedal & Kålås 1985, I. Byrkjedal *pers. comm.*
Finland	41.2 × 28.7	33.9	?	von Haartman et al. 1963–1972
Waigatsch, Russia	40.3 × 28.0	31.6	15	Glutz von Blotzheim et al. 1975
Värriö	40.3 × 28.0	31.6	114	This study

Table 4. Geographical variation in mean egg size in different population of waders (minimum volume as percentage of maximum). Calculated from Väisänen (1977), except for *N. phaeopus* (E. Pulliainen & L. Saari, unpubl.) and *Ch. morinellus* (this study).

Species	%
Numenius phaeopus	83.9
Charadrius hiaticula	84.5
Charadrius morinellus	89.0
Arenaria interpres	89.1
Haematopus ostralegus	90.1
Phalaropus lobatus	91.1
Gallinago gallinago	91.7
Tringa totanus	92.4
Calidris alpina	93.0

mean was identical: 154.6 ± 5.3 mm (n = 10; E. Pulliainen & L. Saari, unpubl.). Thus the females laying smaller eggs at Värriö do not seem to be smaller themselves.

Even less has been published on the physical condition of breeding Dotterels. However, a comparison between the south Norwegian data (Kålås & Byrkjedal 1984) and those at Värriö indicate that the mass of the incubating males decreases more rapidly at Värriö and thus the males seem to be in poorer physical condition when the eggs hatch (see Pulliainen & Saari 1992b). This perhaps indicates poorer productivity at Värriö, and, together with the more demanding migratory journey to Lapland, may be one of the reasons for the smaller egg size.

Acknowledgements. Our manuscript was read by Ingvar Byrkjedal, Hannu Pietiäinen, Paavo S. Tunkkari and Risto A. Väisänen, who made many suggestions for its improvement. Their help is gratefully acknowledged. This paper constitutes Report No. 206 from the Värriö Subarctic Research Station, University of Helsinki.

Selostus: **Keräkurmitsan munakoosta Suomessa**

Värriön tutkimusasemalla Itä-Lapissa mitattiin 114 ja punnittiin 39 vastamunittua keräkurmitsan munaa. Keskimääräiseksi munakooksi saatiin 40.3 × 28.0 mm. Munimisjärjestys ei vaikuttanut munien kokoon tai painoon. Pesinnän aloitusajankohta ei myöskään vaikuttanut munien kokoon. Munamitoissa ei esiintynyt vuosittaista vaihtelua. Keräkurmitsan munakoon maantieteellinen vaihtelu on samaa suuruusluokkaa kuin muilla kahlaajilla. Pieni munakoko johtunee ankarista luonnonoloista.

References

Byrkjedal, I. & Kålås, J. A. 1985: Seasonal variation in egg size in Golder Plover Pluvialis apricaria and Dotterel Charadrius morinellus populations. — Ornis Scand. 16:108–112.

Cramp, S. & Simmons, K. E. L. (eds.) 1983: The birds of the western Palearctic 3. — Oxford University Press, Oxford. 913 pp.

Glutz von Blotzheim, U. N., Bauer, K. M. & Bezzel, E. 1975: Handbuch der Vögel Mitteleuropas 6. — Akademische Verlagsgesellschaft, Wiesbaden. 840 pp.

von Haartman, L., Hildén, O., Linkola, P., Suomalainen, P. & Tenovuo, R. 1963–1972: Pohjolan linnut värikuvin. — Otava, Helsinki. 1092 pp.

Hable, E. & Präsent, I. 1990: Die Forschungsstätte "Pater Blasius Hanf" am Furtnerteich. — Schwarzenbergischer Almanach 38:181–257.

Kålås, J. A. & Byrkjedal, I. 1984: Breeding chronology and mating system of the Eurasian Dotterel. — Auk 101:838–847.

Pulliainen, E. & Saari, L. 1992a: Breeding biology of the Dotterel, Charadrius morinellus, in eastern Finnish Lapland. — Ornis Fennica 69:101–107.

— 1992b: Body mass and physical condition of the breeding Dotterel (Charadrius morinellus) in Finland. — Ecologia Montana (in press).

Väisänen, R. A. 1977: Geographic variation in timing of breeding and egg size in eight European species of waders. — Ann. Zool. Fennici 14:1–25.

Väisänen, R. A., Hildén, O., Soikkeli, M. & Vuolanto, S. 1972: Egg dimension variation in five wader species: the role of heredity. — Ornis Fennica 49:25–44.