On the breeding biology of the Dotterel *Charadrius morinellus*[1]

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Since the Second World War increasing attention has been paid to study of the breeding biology of the Dotterel *Charadrius morinellus* in northern Europe (STEINIGER 1953, RITTINGHAUS 1962, HILDÉN 1966).

Inspired by the earlier findings (STEINIGER 1959, KOZLOWA 1961, RITTINGHAUS 1962, HILDÉN 1966) that very complex incubation patterns are to be found in the Dotterel, studies on the breeding biology of this species were begun in the surroundings of the Värriö Subarctic Research Station in the extreme northeast of Finland in 1968. The purpose of the present paper is to provide preliminary records of these studies.

Material and methods

The present studies were carried out at the northernmost peak of the Värriötunturi Fell (67° 45'N, 29° 45'E) in the summers of 1968 and 1969. The height of this fell is 472.6 m. It has a treeless tundra summit (*regio alpina*) and a clear mountain birch forest zone (*regio subalpina*) below it.

In the summer of 1968 one Dotterel nest was found in the study area. The following summer a total of six nests and four broods were found in the same area. In spring, 1969, regular observation was begun in the middle of May. The observation programme this summer was as follows:

Nest	Periods of coinuous observation
I	9—11.6., 23.6., 26.6.—6.7.
II	19—27.6.
III	26.6.—6.7.
IV	—
V	3—7.7.
VI	—

	Periods of regular daily recording
I	6—8.6., 12—22.6., 24—25.6.
II	9—18.6., 28.6.—8.7.
III	13—25.6.
IV	19.6.—11.7.
V	29.6.—2.7.
VI	8.7.

The arrival of the birds, courtship behaviour, egg-laying, incubation, hatching, the movements of broods and the feeding behaviour of adult Dotterels were recorded.

In 1969, nine adult and 25 juvenile Dotterels were colour-ringed for individual recognition. The sexes of the adults were identified during courtship and from mating behaviour. In addition the colour differences between the two sexes were used to aid identification.

Results

Arrival in spring. — In spring 1969 Värriötunturi Fell was visited daily by the staff of the Värriö Subarctic Research Station during the period 14.5.—5.6. On 30.5. the first two Dotterels were observed on the fell. They showed courtship behaviour. By 2.6. snow had completely disappeared from the top of the fell. A total of 23 Dotterels was then found in the study area. Following that date a varying number of these birds was recorded every day.

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Copulation. — The first copulation of Dotterels was recorded in the morning of 5.6.

On 10.6. copulation was followed near nest II. At 09.00—10.15 the female visited the nest, but did not lay any eggs. At 10.15 the male made nest-scraping and building activities at a distance of 50 m from the nest. The female approached the nest and lay down without showing its cloaca. The male immediately copulated with the female.

Egg-laying. — On 6.6.1969 (10.00) egg-laying was followed at nest I. At 10.00 a male Dotterel was found sitting on the nest, throwing small pieces of plants backwards with its bill and occasionally stretching its head and neck backwards, forwards and upwards. A female Dotterel then came to the nest. The male stood up. The female was very nervous and went to a distance of 30 m from the nest. At the same time the male lay down. At last the female came back on the nest. It laid an egg in the nest at 11.15.

In 1969 egg-laying began in the study area within a week of the end of spring migration. Egg-laying took place at following times of the day: 00.30, about 04.00, 08.20, 11.15 and 20.00. In the beginning of June there are 24 hours of daylight in the study area. The intervals recorded between layings were 28.0 hrs., 31.8 hrs. and 32.8 hrs. (mean 30.9± 1.5). RITTINGHAUS (1962) mentioned finding a second egg in a Dotterel nest barely 28 hours after finding the first egg.

Clutch-size. — The final number of eggs in seven Dotterel nests was recorded during the present study. In every case the clutch size was three. HAARTMAN et al. (1966) correspondingly reported 25 nests with three eggs and 4 nests with four eggs.

Nests. — All seven Dotterel nests studied were at the top of Värriötunturi Fell in *regio alpina* or at the border of *regio alpina* and *regio subalpina* where very few bushes (mainly mountain birch and juniper) grew (see also STEINIGER 1953, RITTINGHAUS 1962).

The nests were shallow hollows in the ground. In most cases they were between low stones. At the bottom of the nests there were fresh and especially dry leaves and pieces of *Vaccinium vitis-idaea, Empetrum nigrum* and *Cladonia* sp., among others.

Incubation. — In nests I and II the males began incubation before the third egg was laid by the female. Similar observations were also made by RITTINGHAUS (1962). Incubation was at first sporadic, but soon reached an intensive phase. It is worth mentioning that copulation was still observed after the beginning of intensive incubation.

In each of nests I, II, III, IV and VI only the male was seen incubating during the observation periods, whereas in nest V two adult Dotterels were found.

Nest V was found on 29.6.1969 (14.10). On 2.7. (10.30) a Dotterel was colour-ringed in this nest. On 3.7. (11.15) an unringed Dotterel was found incubating in this nest. On the basis of plumage colouration it can be concluded that the first Dotterel was male and the latter female. On 3.7. (12.05) continuous observation of this nest was begun. The female incubated from 12.08 to 15.24. The male came to the nest at 15.38 and lay down on the eggs. It ended its incubation at 17.53 on 4.7. and at 17.57 the female took its place. The female incubated until the following morning (09.26) and the male took its place at 09.27. The male incubated on 5. and 6.7. Thus the male and the female incubated alternately at the end of the incubation period. The male, however, was present at the moment of hatching.

Earlier it was believed that only male Dotterels incubate (STEINIGER 1953, 1959, KOZLOWA 1961). RITTINGHAUS (1962) observed, however, that the female may also participate in incubation. HILDÉN (1966) observed in Finnish

Lapland that the female may incubate at the end of the incubation period. FRANKE (1953) verified a case of polyandry in the dotterel, i.e., a female laid eggs in the nests of two different males. RITTINGHAUS (1962) also reported that both sexes of the Dotterel have distinct brood patches. Brood patches were also found in the adult Dotterels captured during the present study.

According to the present data the length of the incubation period is 27—28 days. HAARTMAN et al. (1966) reviewed all previous publications and stated that the incubation period of the Dotterel varies between 18 and 27 days.

Hatching. — The hatching of chicks was recorded in all nests studied as exactly as possible. Hatching took place at different times of the day. The intervals between hatching in the different nests were as follows.

Intervals (in hours) between the hatchings of the chicks

Nest	1. chick	2. chick	3. chick
I	5	4.5	
II	6	13.5	
IV	—	8.5	
V	3	2	

The chicks hatched out in the course of 5—19.5. hours. HAARTMAN et al. (1966) mentioned that the chicks hatch more or less simultaneously.

In summer, 1968, the chicks of the only nest found hatched on 8.7. In summer, 1969, the chicks of six nests hatched out during the period 5—8.7. and the chicks of the seventh nest on 11—12.7. Thus there seems to be rather distinct synchrony in the nesting events of Dotterels of the same population (see STEINIGER 1953, RITTINGHAUS 1962).

During the present study a total of 21 Dotterel eggs were studied. All of them appeared to be fertilized. 95 % of the eggs were hatched. The only unhatched egg originated in a nest where the male incubated very irregularly.

Nest departure. — The ages of the Dotterel chicks at the moment of nest departure are presented in the following tabulation.

Nest	Ages (in hours) of the chicks		
	1.	2.	3.
I	20.0	15.0	10.7
III	30.2	24.0	10.6
V	19.5	16.4	14.2

The youngest chicks were on an average 11.3 hours old at the moment of nest departure. Their mobility was very or rather poor, whereas the oldest chicks had no difficulty.

The broods left their nests during the morning and afternoon hours (brood IV in the morning; brood V at 06.00; brood III at 15.08; brood I at 15.10), but not just before night-fall. This is a rather common behaviour pattern among waders in general (see the review by HAARTMAN et al. 1966).

Behaviour of the broods. — The study area and the nearest peaks of Värriötunturi Fell were visited every day during the period 5.7.—15.8.1969. The Dotterel broods found were recognized on the basis of coloured and other rings.

The broods originating in the Dotterel nests recorded in the study area in June and July 1969 were found in different zones of the study area. However, the bulk of the observations were made in the *regio alpina* and the *regio subalpina.* The broods were found on only one fell. This does not, however, exclude the possibility that the broods might also have ranged as far as neighbouring peaks of Värriötunturi Fell. RITTINGHAUS (1962) reported that Dotterel broods move in rather large area, including neighbouring fells (see also HAARTMAN et al. 1966).

There were altogether 10 broods of the Dotterel in the study area in July—August 1969. Rather numerous observations were made on the composition of five broods, whereas rather few observations could be made of the other

five broods. The most interesting observations made on the first five broods are as follows.

Brood I (the adult male from nest I) was found in the study area on 15 days during the period 6.7.—13.8.1969. The changes in the composition of this brood are shown in the following tabulation.

Date	Chicks and adult Dotterels observed with the male
6.7.	Chicks Nos 66, 68 and 69
8.7.	Chicks Nos 66 and 69 and an older unmarked chick (marked with No 89)
11—19.7.	Chicks Nos 66 and 89
26.7.	Chick No 66 and an unmarked adult Dotterel
27.7.—4.8.	Chicks Nos 66 and 89
9.8.	Chicks Nos 66 and 89 and one chick from brood V
11.8.	Two chicks
13.8.	Two chicks and the adult males from broods II and III

Brood II (the adult male from nest II) was found in the study area on 8 days during the period 8.7.—13.8.1969. On 8—18.7. two chicks (Nos 81 and 82) were found in this brood. On 11.8. only one chick was seen in the brood. On 11.7. the adult male was seen driving away a strange adult Dotterel. On 13.8. this male was seen in a flock (see above).

Brood III (the adult male from nest III) was found in the study area on 18 days during the period 6.7.—13.8.1969. On 6—12.7. three chicks (Nos 64, 65 and 67) were seen in this brood, whereas during the period 16.7.—11.8. only two chicks (Nos 64 and 65) were recorded. Three times the adult male was seen driving away strange adult Dotterels.

Brood V (the adult male from nest V) was found in the study area on 11 days during the period 7.7.—13.8.1969. On 7—9.7. and 15—18.7. the brood comprised one adult and three chicks (Nos 70, 71 and 72). On 14.7. the adult male fought an adult Dotterel from brood X. After the fight a chick (No 91) from brood X was adopted by the male of brood V. In addition two chicks (Nos 70 and 72) were seen in this brood. On the following day the strange chick (No 91) had, however, disappeared from this brood. On 22.7. this chick was found in its own brood (X). Thus the 'adoption' of this chick by the male V lasted only a short period. On 19.7. and 25.7. two chicks (Nos 70 and 71) were seen in brood V, whereas on 22.7., 24.7. and 30.7. only one chick (No 72 or No 70) could be found in this brood.

Brood XI was found in the study area on 7 days during the period 7.7.—13.8.1969. On every occasion the brood comprised an adult male and three chicks (Nos 73, 74 and 75). The last observation on this brood was made on 24.7.1969.

These data show that the male, which is mainly responsible for incubation, also takes care of the chicks. In a few cases strange adult Dotterels (females?) were observed with the broods studied. In most cases, however, the male drove away the strange Dotterels. RITTINGHAUS (1962) and STEINIGER (1953), among others, found both two adults and one adult in Dotterel broods.

The present data showed that strange chicks can be accepted and/or adopted by the males which have their own broods. In some cases these chicks went back to the brood of their own father. In one case an adult male was seen showing aggression towards a small chick of a strange brood. In most cases, however, no distinct reactions were observed when two broods met.

In the summer of 1969 Dotterels began to form flocks in the first half of August.

Feeding behaviour of adult Dotterels. — During the nesting period the Dotterels studied fed in the territory close to the nest. In the cases where continuous observations were made the incubating adult did not go outside its rather restricted territory although no water was available.

In the summer of 1969 a number of observations were made on the food items consumed by adult Dotterels. Unfortunately this data has only qualitative value. The following food items were seen to have been picked up by the Dotterels: berries of *Empetrum nigrum,* blossoms of *Trientalis europaea* and *Vaccinium myrtillus,* Coleoptera, Diptera and Lepidoptera.

STEINIGER (1953, 1959) emphasized the importance of Diptera in the diet of the Dotterel in summer. RITTING-

HAUS (1962) reported that Dotterels mainly take their food from the ground. The results of the present study support the findings of RITTINGHAUS (op. cit.). However, besides animal matter blossoms of *Vaccinium myrtillus* and *Trientalis europaea,* and berries of *Empetrum nigrum* appeared to be favourite food items of the Dotterel. The great water content of these parts of the plants can be assumed to be of great importance for the water balance of these birds.

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Selostus: **Keräkurmitsan pesimisbiologiasta**

Kirjoituksessa esitetään alustavia tuloksia niistä tutkimuksista, joita on kesinä 1968—69 suoritettu Koillis-Lapissa sijaitsevalla Värriötunturilla keräkurmitsan pesimisbiologiasta.

Kesällä 1968 löydettiin tunturin laelta yksi keräkurmitsan pesä ja kesällä 1969 kuusi pesää. Lisäksi kesällä 1969 tutkimusalueella liikkui ainakin neljä muuta keräkurmitsan poikuetta. Yhdeksän aikuista ja 25 poikasta merkittiin värirenkailla yksilöllistä tunnistamista varten.

Keväällä 1969 ensimmäiset keräkurmitsat saapuivat muuttomatkaltaan 30.5. Soidinmenoja todettiin välittömästi saapumisen jälkeen. Ensimmäinen kopulaatio nähtiin 5.6.

Ensimmäinen todettu muninta tapahtui 6.6. klo 11.15. Muninta tapahtui 28—33 tunnin välein (keskiarvo 30.9 t). Pesät sijaitsivat tunturin laella alpiinisessa vyöhykkeessä. Kaikissa tutkituissa pesissä oli lopullinen munamäärä kolme.

Koiras aloitti haudonnan ennenkuin naaras oli muninut viimeisen munan pesään. Sekä koirailla että naarailla oli hautomalaikku. Yhdellä pesällä koiras ja naaras hautoivat vuoron perään. Nämä havainnot tehtiin haudonnan loppupuoliskolla. Kaikilla muilla pesillä todettiin kussakn vain koiraan hautovan. Hautomisaika oli 27—28 vrk. Saman populaation eri pesillä kuoriutuminen tapahtui viikon sisällä heinäkuun ensimmäisellä puoliskolla. Saman pesän poikaset kuoriutuivat 5—20 tunnin sisällä. Kaikki tutkitut munat olivat hedelmöittyneitä. Kuoriutumisprosentti oli 95.

Poikueet lähtivät pesästä liikkeelle aamutai iltapäivällä. Nuorimmat poikaset olivat pesästälähtöhetkellä keskimäärin 11.3 t ikäisiä. Poikueet tavattiin myöhemmin samalla tunturilla, jossa pesätkin olivat sijainneet.

Keräkurmitsapoikueitten käyttäytymistä seurattiin. Tavallisesti vain koiras kulki poikueen mukana. Joskus se käyttäytyi agressiivisesti muita aikuisia lintuja vastaan ja kerran myös vieraan poikueen poikasta kohtaan. Toisaalta tehtiin havaintoja lyhytaikaisesta adoptoinnista.

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