

Double-brooding and brood overlap by Northern New Zealand Dotterels (*Charadrius obscurus aquilonius*)

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ABSTRACT

Double-brooding has not previously been recorded in the New Zealand Dotterel (*Charadrius obscurus*). Since 1994, we have recorded five definite cases of double-brooding in which both birds of the pair were colour-banded, two cases where banded females had unbanded mates, and several probable cases involving unbanded birds. In the five cases in which pairs were banded, females always re-nested with the same mate (monogamous double-brooding). We recorded one definite and one probable case of brood-overlap; in some other cases there was definitely no overlap. Predation, timing of laying, and individual variation are some of the factors that may determine whether double-brooding occurs in the New Zealand Dotterel.

KEYWORDS: New Zealand Dotterel, *Charadrius obscurus*, plover, breeding system, double-brooding, brood overlap

INTRODUCTION

The New Zealand Dotterel (*Charadrius obscurus*) is an endemic plover classified as endangered (Collar *et al.* 1994). The northern subspecies (*C. o. aquilonius*) numbers about 1500 individuals and breeds around the coastline of the northern North Island (Dowding 1994). Although New Zealand Dotterels have been banded for many years, there has been no detailed study of the breeding biology of the species. The basic features are, however, known; first clutches are normally laid from late August to late October and incubation lasts 28-32 days (Marchant & Higgins 1993). The fledging period is variable (McKenzie *et al.* 1977) but is commonly 36-46 days (JED, unpubl. data). Eggs are rarely laid after mid-January (Marchant & Higgins 1993). Although Northern New Zealand Dotterels commonly re-nest after the loss of eggs or small chicks, there have been no documented cases of double-brooding, i.e. re-nesting within a breeding season after chicks have been raised to fledging (Marchant & Higgins 1993).

Double-brooding can occur either when a female re-nests with the same mate (monogamous double-brooding) or when she leaves the care of the chicks from the first brood to the male and re-nests with a second male, a mating system termed sequential (or serial) polyandry. We report here five definite cases of monogamous double-brooding by pairs of individually colour-banded New Zealand Dotterels.

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STUDY AREAS & METHODS

At a number of sites in the North Island, wardens are employed each spring and summer to protect New Zealand Dotterels and other shorebirds, and to monitor their breeding success (Dowding 1993). Most of our observations were made at three of these managed sites, namely Langs Beach, North Auckland (35°03'S, 174°32'E), Omaha Spit, North Auckland (36°20'S, 174°47'E), and Matakana Island, Bay of Plenty (37°37'S, 176°08'E). Some observations were also made at two unmanaged sites, which were being monitored as part of a study on the impact of predation on breeding (Dowding 1997); these were the mouth of Pakiri River, North Auckland (36°15'S, 174°44'E) and Sulphur Beach, Waitemata Harbour (36°49'S, 174°45'E).

Since the 1994-95 season, we have suspected that some pairs of Northern New Zealand Dotterels were double-brooded. Two birds at Langs Beach (the only New Zealand Dotterels at the site) probably raised two consecutive broods to fledging in both the 1994/95 and 1995/96 seasons, but only the male (BM-YB) was banded and it was therefore not certain that the same female was involved in the two attempts in each season. During 1996, we colour-banded the female to try and determine whether the pair was double-brooding. Most New Zealand Dotterels breeding at the other North Auckland sites have been individually colour-banded for some years as part of a on-going study of the biology of the species (Dowding & Chamberlin 1991).

RESULTS

Evidence for double-brooding

During the 1996/97 season, we recorded two definite cases in which a pair of individually marked birds re-nesting after fledging chicks. At Langs Beach, BM-YB and OW-WM had a 3-egg nest on 19 September 1996. These eggs had hatched by 8 October. One banded chick survived and fledged about 24 November and left Langs Beach on 25 or 26 November. It was seen at Waipu, 7.5 km north-west of its natal site, on 27 November and later at South Kaipara Head, about 55 km south-west of Langs Beach on 28 December. By 10 December, the adults were incubating a new 3-egg nest, which hatched on 27 December (one egg) and 28 December (two eggs). Two chicks disappeared, one at 7-8 days (seen being taken by a Southern Black-backed Gull *Larus dominicanus*) and the other at 13-15 days. The third chick was banded on 30 January 1997 and had fledged by 11 February. At Pakiri River, M-WYW and M-OWY began incubation of a clutch of three eggs on 16 September 1996. Two of the eggs hatched on 16 October and two banded chicks fledged between 30 November and 3 December. They were seen with the adults at Pakiri River on 6 December but had left the site by 9 December. On 17 December the two adults were defending a new nest containing three eggs. This second attempt failed when the nest was trampled by people between 25 and 31 December.

During the 1998/99 season, we recorded three further definite cases of double-brooding. At Langs Beach, BM-YB and OW-WM hatched their first clutch on 10 and 11 October 1998 and had fledged one chick by 20 November. On 9 December, they were incubating at a new nest, and the eggs hatched on 7 January 1999. At Omaha Spit, MR-WG and M-WBY began incubation of their first clutch during the first week of October 1998 and successfully reared two chicks, which were banded on 2 December and fledged between 15 and 19 December. The parents were incubating and defending a new 2-egg nest on 8 January 1999. At Sulphur Beach, male YM-O and female OM-GG (the only pair at this site) had a 3-egg nest that hatched on 29 October 1998 (two eggs) and 30 October (one egg). Two chicks fledged in mid-December and the parents were incubating a new 3-egg nest on 8 January 1999. One of the fledged juveniles was still present on 16 January.

In earlier years, we had suspected that other pairs were double-brooded. During the 1994/95 season on Matakana Island, a banded female (YB-MY) laid a second clutch (which was subsequently lost) after fledging one chick, but we do not know whether the same male was involved in the two attempts. During the 1995/96 season on Matakana Island, three pairs probably raised (or attempted to raise) second broods after fledging chicks. Neither adult was banded in two of these pairs, but in the third case another banded female (YB-WM) definitely reared two broods of two chicks to fledging. Again, we could not tell whether the same male was involved in her two broods.

Brood overlap

We obtained definite evidence of brood overlap in one case and probable brood overlap in another case. At Langs Beach in 1997, the second nest of BM-YB and OW-WM started to hatch on 27 December. Allowing a laying period of 7 days and incubation of 30 days (Marchant & Higgins 1993), this clutch would have been initiated about 20 November, 4 days before the first chick fledged and about 6 days before it left its natal territory. An unbanded pair on Matakana Island hatched their first nest on 7 November 1995. By 7 December, when the surviving chick was a month old, they had a new 3-egg nest. The colour-banded juvenile from the first brood was evicted (seen being chased repeatedly by the male) between 20 and 24 December shortly after it could fly, suggesting brood overlap of about two weeks in this case. Although they were unbanded, we believe that the same adults were involved in these two broods, as this pair was the only one at an isolated site (Opureora Point); the nearest other New Zealand Dotterels were breeding 1.7 km away.

Brood overlap did not occur in all cases. During the 1995/96 season on Matakana Island, one female that definitely double-brooded and one pair that probably double-brooded did not overlap their broods. In the case of the banded female (YB-WM), there was a gap of 1-2 weeks between fledging of the two chicks from the first brood and initiation of the second clutch. In the other case, the colour-banded chicks had been flying for a week by the time the second clutch was initiated.

During the 1998/99 season at Langs Beach, there was a gap of 12-14 days between fledging of BM-YB and OW-WM's first chick and initiation of their second clutch.

DISCUSSION

In all the cases we describe above, in which both birds of the original pair were colour-banded, females re-nested with the same mate (monogamous double-brooding). We have detected no examples of sequential polyandry in New Zealand Dotterels yet, but it could have occurred in some of the cases on Matakana Island where only the female (or neither of the pair) was banded. In most cases, juveniles left their natal territory (or were evicted) just before, or about the time, incubation of the second clutch began, but this departure was not a prerequisite of double-brooding – at Sulphur Beach in 1998/99, for example, one juvenile was still present at least a week after incubation of the new clutch had started.

Other New Zealand plovers vary in the extent to which they double-brood and the type of double-brooding. Double-brooding and sequential polyandry occur in Banded Dotterels (*C. bicinctus*) and the frequency of females engaging in double-brooding varied from 4-40% over four seasons (A. Rebergen, pers. comm.). Double-brooding has not been recorded in the Shore Plover (*Thinornis novaeseelandiae*; Davis 1994). In contrast, Wrybills (*Anarhynchus frontalis*) regularly re-nest following successful rearing of chicks; the number of pairs double-brooding varied from 11-32% during three consecutive seasons on the upper Rakaia River (Hay 1984). Most (if not all) cases of double-brooding by Wrybills were monogamous (J.R. Hay, pers. comm.).

The Northern New Zealand Dotterel has been studied for many years, apparently without detection of double-brooding. This may be partly due to the fact that a high level of egg predation at many sites (Dowding 1997) means that few early nests hatch and few pairs have the opportunity to raise two broods. Consistent with this suggestion is the fact that five of the eight pairs known (or suspected) to have double-brooded, bred at sites where intensive predator control occurred and nest survival was higher than normal. At the increasing number of managed sites where monitoring is more intensive, and effective predator control increases survival of early nests, double-brooding may be recorded more frequently in future.

The laying period of Northern New Zealand Dotterels is protracted (extending from late August to mid-January), so there appears to be sufficient time for many pairs to attempt a second brood with little or no brood overlap. In the cases we describe above, first clutches were laid between early September and early October and second clutches from late November to early January. Many other pairs have also laid their first clutches by early October, but the majority of those that rear chicks successfully do not attempt a second brood (JED & DEW, unpubl. data). This suggests that timing is not the only factor determining whether double-brooding occurs. There appears to be individual variation; many banded pairs, some monitored for up to ten seasons, have never been recorded double-brooding (JED, unpubl. data), but the pair at Langs Beach has probably double-brooded in

four of the past five seasons. It is interesting to note that the male of the Sulphur Beach pair that double-brooded during the 1998/99 season is the offspring of the Langs Beach pair. There may also be geographical, seasonal or age-related variations, and further research is needed before we have a good understanding of the factors underlying double-brooding in the New Zealand Dotterel.

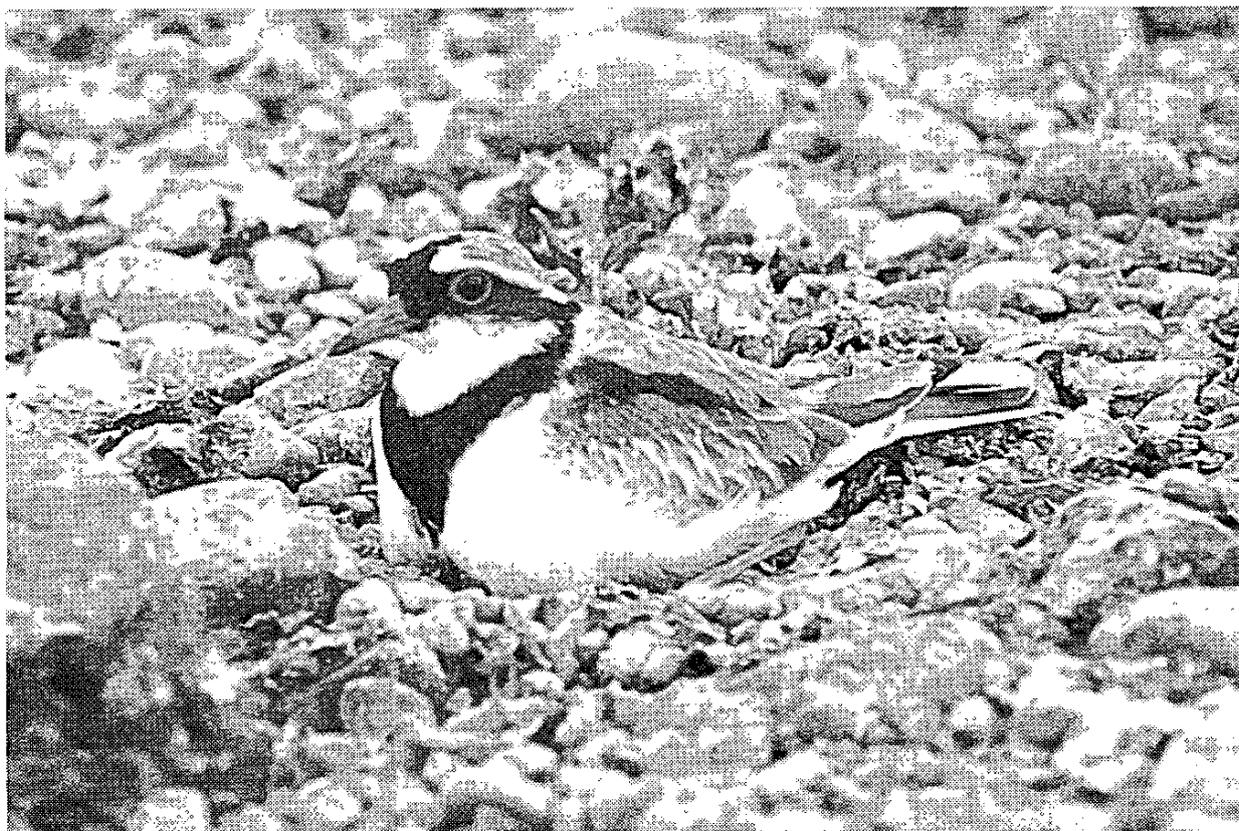
Current management of the Northern New Zealand Dotterel concentrates on protection of early clutches so that chicks are fledged (or close to fledging) by late December, when birds are subjected to especially high levels of disturbance from recreational users of beaches (Dowding 1993). Our observations suggest a second good reason for this strategy – if chicks fledge from early clutches, some pairs may attempt to raise a second brood and so potentially increase productivity.

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Black-fronted Dotterel (*Charadrius melanops*) nesting at Te Ore Ore, Wairarapa.

(Hugh Robertson)