The influence of nest controls, catching and ringing on the breeding success of Baltic Dunlin *Calidris alpina*

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A six year study of the breeding biology of Baltic Dunlin on Tipperne, Denmark indicates that frequent nest controls, catching of adults on nests, and colour-marking of newly hatched chicks have had no influence on the breeding success. A reduction in breeding success was only observed in areas where Common Gulls *Larus canus* searched for food continually. Here nest predation was much higher immediately after catching than in the other periods; the data are limited though, and the difference is not statistically significant. However, it is recommended that precautionary measures should be considered when catching Dunlin and other "timid" waders in similar situations.

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INTRODUCTION

The influence of disturbance made by scientists undertaking breeding biology studies is often an unrecorded factor that may have adverse effects on breeding success. In general, any impact on breeding success caused by the research might seriously bias the results, making conclusions unclear or even meaningless. Studies that influence the breeding success of threatened or vulnerable species might even contribute to population decreases, and thus cause serious conservation problems.

A study of the breeding biology of the Baltic Dunlin was initiated in 1990 on Tipperne. The study was not designed to highlight human impact. However, data from the first six years of this study allows the estimation of the possible impact of various study methods on the breeding success.

Since the influence of different kinds of research on breeding success is generally little recorded, these results are presented to help minimisation of the impact of scientists on breeding success. A review of recorded effects of investigator disturbance on nesting birds is presented by Götmark (1992). This analysis of 100 breeding biology papers concerning investigator disturbance effects does only include four wader studies, however.

A review of nest desertion in waders following the catching of adults is presented by Kania (1992).

METHODS

Tipperne is a nature reserve in western Jylland, Denmark (55°53' N, 8°14' E), consisting of 650 ha of brackish meadows (see Thorup 1991 for further description). In the study area the meadows are managed with relatively intensive cattle grazing starting fairly late in the breeding cycle of the Dunlin, and regular mowing.

Tipperne holds a breeding population of 125-150 pairs of Baltic Dunlin, locally breeding at densities of 50-80 pairs/km².

Within the area, three intensive study plots were established (64 ha, 40 ha and 55 ha, respectively). Additionally a reference area (50 ha), where no catching at the nest took place, and where nest visits were kept to a minimum (one visit every 6 to 10 days) was established.

Nest controls: A nest control is defined as a visit during which the number of eggs and possible presence of pipping eggs or young was registered. On some visits an egg was water-tested to determine the approximate stage of incubation (see van Paassen *et al.* 1984). At the visit following a catching attempt a nest control usually included a check to determine a possible desertion of the nest. If the incubating bird was not seen leaving the nest it was controlled whether the eggs were warm and thus still incubated.

To determine any possible influence of visiting nests, a comparison was made between the survival of nests frequently visited (nests controlled more than every third day), regularly visited (nests controlled on average between every third and sixth day) and rarely visited (nests checked with on average more than six days intervals). In general neighbouring nests were controlled at the same visits, and the nest control frequency is corresponding to the actual level of disturbance.

Catching adults on the nest

To establish a study population of individually recognisable birds, as many adult birds as possible were caught on the nest and ringed (and measured). A walk-in-trap (see Bub 1974) was used. The trap was placed on the nest, then the ringer left for 25-35 minutes, and in about two out of three attempts the incubating bird was caught at the return (Table 1). An interval of at least 24 hours was chosen between two

catching attempts at the same nest.

Table 1. The number of catching attempts and successful catches of Baltic Dunlin on Tipperne in the seasons 1990-94, and in different parts of the nest period.

	Catching attempts	Catches
1990	68	50
1991	87	57
1992	58	42
1993	57	33
1994	82	55
1995	47	28
TOTAL	**399**	**265**
During laying	0	0
First week of incubation	128	76
Second week of incubation	132	92
Third week of incubation	130	94

To estimate whether the catching reduced hatching success, nest survival in the study plots and in the reference area was compared. Similarly, nest survival in the three days following a catch or catching attempt was compared with the nest survival in the remaining days of incubation.

Ringing of chicks

During the study as many chicks as possible were ringed. In 1990 to 1992 all chicks found were given an individual colour code (five rings) and a metal ring; in 1993 to 1995 the chicks were only given a year code (two rings) and a metal ring. In 1990-92, 143 chicks in 51 broods and in 1993-95, 152 chicks in 59 broods, were ringed. As chicks were rarely found after leaving their nest, the only chance to ring them was when they were newly hatched and still in the nest.

About 40% of all broods left the nest before I found and ringed them and it was thus possible to compare brood survival in ringed and unringed broods. The first few days after hatching both parents share attending the chicks, but from about a week after hatching most females leave the family. Based on data on chicks later found as fledged, a chick is always attended by at least the male parent until it reaches an age of 12 days; after this age they might be left alone. The proportion of hatched broods with at least one chick still alive in the brood being attended by an individually recognisable male parent at 11 days after hatching was used as a measure of brood survival.

This study only concerns nests in fields without cattle present. Five nests flooded and two nests deserted (very late in the season) are excluded, and the only cause of nest-loss in this material is predation.

Accordingly, nest "survival rate" and "predation rate" are used indiscriminately; the survival rate always being 1 minus the predation rate and *vice versa*.

RESULTS AND DISCUSSION

Nest controls

The procedure is harmless to the birds in itself, but especially the handling of eggs may attract the attention of an airborne predator; walking to the nests makes a scent track, which may help a mammal predator to detect the nests and, especially if made regularly, a track in the vegetation ending at nests may help an airborne predator to find them.

Nest controls had no negative influence on the survival of Baltic Dunlin nests (Table 2). The frequently visited nests even had a lower predation rate than the two other categories, but the differences are not statistically significant (z-test, Hensler & Nichols 1981).

Table 2. Predation rate on Baltic Dunlin nests at Tipperne, separated into three visit frequency categories: "frequently visited": nests controlled more than every third day; "regularly visited": nests controlled averagely between every third and sixth day; and "rarely visited": nests controlled with on average more than six days intervals. Method according to Mayfield (1961, 1975) and Johnson (1979).

Visit rate	No. nest days	Daily pred-ated	Predation rate	SE	No. nests (n)
Frequently	2040.5	53	0.0260	± 0.0069	187
Regularly	652.5	20	0.0307	± 0.0333	50
Rarely	151.5	6	0.0396	± 0.0311	16

As the nests in the different categories had a similar distribution between habitats and inside and outside Common Gull hunting areas, the slightly better nest survival in frequently visited nests may indicate that mammalian predators to a certain degree avoid to enter areas with a strong human scent, as suggested by Götmark (1992).

Catching of adults on the nest

Desertion

Catching on nests and catching attempts sometimes result in the birds deserting the nest (*e.g.* Kania 1992). As a result of 399 catching attempts and 265 catches of Baltic Dunlin on Tipperne, not one nest was found deserted at the next visit, always taking place one to five days (on average two days) after the catch. No catching was performed during laying, the catching attempts being quite equally dispersed over the three weeks of incubation (Table 1). Some nests could have been predated after desertion, before the next nest control, thus having escaped detection as a deserted nest. In 24 deserted nests (hatched nests with one or two eggs left unhatched), a daily

Table 3. Nest survival of Baltic Dunlin on Tipperne, in an area with no catching of adults on nests, and in areas where catching was performed. The nest survival has been calculated using 26 days as the egg period (from laying of first egg to hatching) (Soikkeli 1967; Jönsson 1988, own observations). Method according to Mayfield (1961, 1975) and Johnson (1979).

	Nest days	Nests predated	Predation rate	Daily survival rate	SE	Nest success	Nests (n)
Catching area	2672.5	74	0.0277	0.9723	±0.0032	48%	236
Non-catching area	172	5	0.0291	0.9709	±0.0128	46%	18

Table 4. Nest survival in the three days following a catch or a catching attempt, and nest survival in other periods. Calculations, see caption for Table 3.

	Nest days	Nests predated	Predation rate	Daily survival rate	SE	Nest success	Nests (n)
Three days following catching	627	18.5	0.0295	0.9705	±0.0068	46%	(252 caputers)
Three days following catching attempt	866.5	24	0.0277	0.9723	±0.0056	48%	(364 catching attempts)
No catching period	1749	45	0.0257	0.9743	±0.0038	51%	

Table 5. Nest survival on Tipperne in areas a): where Common Gulls hunted when Dunlins incubated and b): where agressive waders prevented such hunting. Nest survival is calculated and sub-divided as in Table 4.

	Nest days	Nests predated	Predation rate	Daily survival rate	SE	Nest success	Nests (n)
a) Common Gull area							
Three days following catching	77	8	0.1039	0.8961	±0.0348	6%	(31 captures)
Three days following catching attempt	97	11	0.1134	0.8866	±0.0322	4%	(40 catching attempts)
No catching period	261	12	0.0460	0.9540	±0.0130	29%	
b) Area without Common Gulls							
Three days following catching	323.5	2	0.0062	0.9938	±0.0043	85%	(127 captures)
Three days following catching attempt	456.5	3	0.0066	0.9934	±0.0038	84%	(193 catching attempts)
No catching period	695	9	0.0129	0.9871	±0.0043	71%	

predation rate of 0.011 was found, a very low rate compared to incubated nests. Accordingly the desertion rate can be assessed as negligible.

Overpredation

Catching and catching attempts may create unnatural predation rates due to various factors:

- the placing of a trap and catching a bird could attract the attention of an airborne predator to the nest, and repeated catching could cause the development of a new search-image by predators like Common Gulls and Crows *Corvus corone;*
- the catching and handling of a bird could create a certain 'insecurity', that could make the bird act 'nervously' for some time, for instance, on the appearance of a predator it might leave the nest at

the wrong moment, or it might leave the nest too often, *etc.*);

- the placement of a trap and the activities of a catcher could make signs in the vegetation around the nest, attracting the attention of a predator and thus making the nest easier to detect.

Almost no difference was found on Tipperne between the nest survival in the "non catching area" and in the areas where catching was performed (Table 3), indicating that catching of adult Dunlins on the nest has no influence on the nest survival. Hatching success (the chance that an initiated nest will hatch) was just below 50%, independent of area.

Overpredation caused by catching is likely only to take place in the days immediately following a catching attempt. Only a minor and not statistically significant difference (z-test, Hensler & Nichols 1981) is found between the daily nest survival in the days following a catch or a catching attempt, and in the remaining days within the incubation period (Table 4), again indicating that, overall, catching has no influence on nest survival.

The most important predator on wader eggs on Tipperne in the study period was the Common Gull. Mapping of predator activity showed that, during the breeding seasons 1991 to 1994 the meadows were sub-divided into areas where Common Gulls hunted and areas where this hunting was prevented by agressive waders especially Black-tailed Godwits *Limosa limosa*. The nest success of 'timid' waders such as Redshank *Tringa totanus*, Ruff *Philomachus pugnax* and Dunlin was three to ten fold higher, in areas without Common Gulls, than in areas where the gulls hunted continually (Thorup manuscript).

In these Common Gull hunting areas, the relatively limited data indicate that the catching of Dunlin results in a marked and almost statistically significant overpredation (z-test Hensler & Nichols 1981: $z=1.94$, $p \approx 0.05$; Table 5a). This overpredation meant that almost no breeding Dunlin succeeded in these areas when catching was attempted; the chance of an initiated nest succeeding being only around 5%. Even under undisturbed conditions the predation pressure was relatively high here, the chance of a nest hatching being around 30%. The main reason for the limited extent of data on catching in the Common Gull hunting areas was, that overpredation was suspected at an early stage of the project and catching therefore was suspended.

In areas without hunting Common Gulls, no increased predation rate was found in the days following a catch or catching attempt (Table 5b). Here the chance that an initiated nest will hatch was between 70-85%, a relatively high hatching success (Jönsson 1988; Stiefel & Scheufler 1989).

Ringing of chicks

The weight of the rings is about 0.6 g (five colour, one metal) or 0.4 g (two colour, one metal) and the mean weight of a newly hatched chick is 7.0 g (Soikkeli 1967). As the weight of the rings is proportionately fairly high, it was thought that they may hinder the mobility of the ringed chick. Furthermore a Dunlin chick is extremely well camouflaged in vegetation, and the application of colourful plastic rings might increase the detectability of a hiding chick.

Table 6. Brood survival of Baltic Dunlin on Tipperne. The proportion of hatched broods where at least one chick was alive 11 days after hatching (determined by a warning adult male) in colour-marked and in un-ringed broods.

	Colour-marked and ringed broods	Broods not ringed	χ^2-test
1990-1995	55 % (n=47)	52% (n = 42)	$\chi^2 = 0.03$, $p > 0.1$ (df=1, Yates' corr.)
1990-1992 (individually marked chicks)	72 % (n=18)	44% (n = 16)	$\chi^2 = 1.76$, $p > 0.1$ (df=1, Yates' corr.)
1993-1995 (year-code marked chicks)	45 % (n=29)	56% (n = 25)	$\chi^2 = 0.49$, $p > 0.1$ (df=1, Yates' corr.)

From Table 6 it seems obvious that the brood survival was at the same level, whether the chicks were ringed or not. Even in the seasons 1990 to 1992, where chicks were individually ringed, the survival was not lower in the ringed than in the un-ringed broods. Obviously the colour ringing of even very young chicks did not increase their mortality.

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