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Distribution, reproductive success, and population trend in the Dunlin *Calidris alpina schinzii* on the Swedish west coast

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Abstract

In 1989, the breeding population of the Dunlin in the provinces of Bohuslän and Halland on the Swedish west coast was surveyed. The total population size was estimated at a maximum of 44 pairs. The number of breeding pairs has declined during the 1980s and the population has been restricted to about 10 localities; 55% of the total population occurred at two sites. At two of the surveyed localities, hatching success varied considerably among years, reflecting variation in nest predation rate. An experiment with dummy nests suggested that vegetation height, and thus protective cover, does not influence the probability of predation. On average, 0.8 and 1.0 fledglings per pair were produced at the two localites. Estimates of maintenance of population size in one study area indicated that this subpopulation was not self-supporting, apparently due to low hatching success. No clear relationship was found between moderately decreased grazing intensity and the decline of the population during the last decade. In addition to habitat alterations, other factors seem to affect the population trend of the Dunlin on the Swedish west coast. The small population is vulnerable to unpredictable events, such as temporarily increased nest predation.

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Introduction

The populations of breeding waders in south Swedish wetlands have continously decreased since the middle of the 19th century. Drainage and lowering of lake levels, together with ceasing cattle grazing and haymaking, have completely altered the former breeding habitats (e.g. Larsson 1969, Soikkeli & Salo 1979, Alexandersson & Eriksson 1988). One example is the Dunlin *Calidris alpina schinzii* which has drastically decreased in Sweden during the 20th century. Tjernberg (1985) estimated the breeding population at 250 pairs at the beginning of the 1980s, with the major part in the province of Scania and on the islands of Öland and Gotland. The decline has been especially obvious at inland localities (Eriksson 1980, Emanuelsson & Kjellén 1985).

In some areas the decline has been more rapid than expected from the decrease of suitable breeding habitats alone (Eriksson 1980). Jönsson (1985, 1988) found that the population at Foteviken Bay in the province of Scania is no longer self-supporting although the area was intensively grazed during his study. These results suggest that other factors than habitat loss may have contributed to the observed decline of the Swedish Dunlin population.

It is unknown whether the number of breeding Dunlins on the Swedish west coast has continued to decline or whether a stable level has been reached during the last decade. In order to establish present status and make comparisons with earlier censuses (Eriksson 1980, Åhlund et al. 1987) the breeding population of the Dunlin on the west coast of Sweden was surveyed in 1989.

At two localities we also studied breeding performance. For one of them we used literature data (Soikkeli 1970a, b, Jönsson 1988) and own observations to calculate the average number of first-breeders that each individual produced for a period of six years. By comparing the obtained reproductive output with the estimated mean annual adult mortality we examined whether this subpopulation was self-supporting. We also examined hatching success and fledging success in order to determine whether either of these factors could be responsible for a negative population trend.

Waders have various adaptations for avoiding nest predation. Nevertheless, several studies have reported high frequencies of nests destroyed by pre-

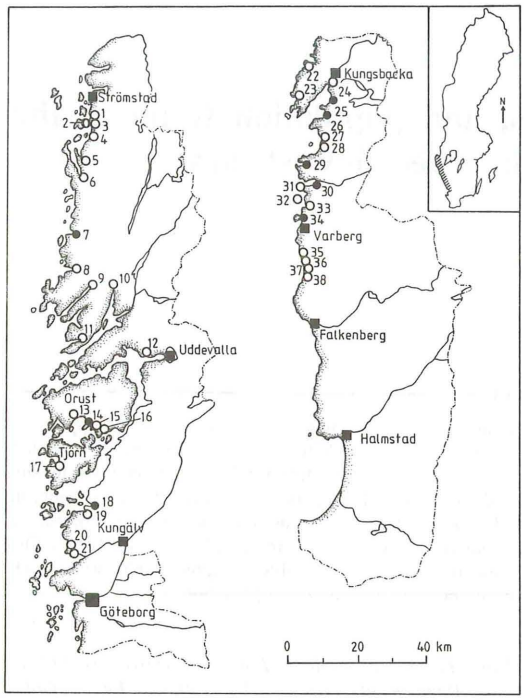

Fig. 1. Coastal pastures in the provinces of Bohuslän (left) and Halland (right) surveyed in 1989. Open circle = locality with no breeding Dunlins, filled circle = locality with breeding Dunlins.

Inventerade strandängar i Bohuslän (vänster) och Halland (höger) under 1989. Öppen cirkel = lokal utan häckande kärrsnäppa, fylld cirkel = lokal med häckande kärrsnäppa.

dation (e.g. Soikkeli 1970a, Jönsson 1988). The Dunlin has no active nest defence against predators, a behaviour typical of large or medium-sized waders such as the Lapwing *Vanellus vanellus* (e.g. Dyrcz et al. 1981, Elliot 1985). The nest is more or less well concealed in vegetation of moderate height (Jönsson 1985, Blomqvist & Thorssell 1988). The risk of nest predation may be related to the degree of concealing vegetation (e.g. Sugden & Beyersbergen 1986) which in turn depends on grazing intensity. We tested this hypothesis experimentally by comparing predation rate on dummy nests placed in two categories of vegetation.

Study area and methods

Survey

From 19 April to 25 May 1989, 38 coastal pastures in the provinces of Bohuslän and Halland (Fig. 1) were surveyed twice. We selected these localities on the basis of knowledge of former distribution of breeding Dunlins or other waders (Eriksson 1980, Åhlund et al. 1987). If Dunlins were observed at any of the first two visits the locality was visited again at least twice until the beginning of July (exceptions see Table 1 and 2). We used the following criteria in order to establish the number of breeding pairs: 1) finding of nests or young, 2) stationary displaying males, or 3) stationary pairs.

At all localities we classified the grazing intensity on the lower part of the pasture, an important habitat for breeding Dunlins (Jönsson 1985, Blomqvist & Thorssell 1988). We used three levels of grazing intensity: continuous areas with vegetation height (1) shorter than 10 cm, (2) about 10 cm, and (3) taller than 10 cm. The census was carried out with the help of 15 ornithologists, each visiting the same area every time.

Breeding performance

Two of the surveyed localities, Ödsmåls kile and Torkelstorp (no. 18 and 25, Fig. 1), were visited regularly from the end of March to the beginning of July in 1987-1990 and 1988-1990, respectively. For Ödsmåls kile we also used data from 1985 and 1986 (Blomqvist &Thorssell 1988, unpubl.). The two areas are quite similar, consisting of shallow marine bays surrounded by coastal pastures and arable land.

In addition to recording displaying males and stationary pairs we searched for nests. Incubating birds were trapped on the nests and individually colour-ringed. The nests were revisited at the estimated hatching date (van Paassen et al. 1984). If no recently hatched chicks were found in the vicinity of the nest they were classified as hatched or robbed according to Green et al. (1987). Possible causes of nest losses other than by predation were also noted.

When possible, chicks were marked with colour rings and the movements of all hatched clutches were recorded. Each brood could thus be identified by colour-ringed parents or/and chicks. Because both sites held few breeding pairs it was possible to establish the fledging rate with a fairly good accuracy by counting newly fledged young when they were feeding on the marine mudflats.

Nest predation experiment

To test whether the vegetation height influences the risk of nest predation we performed an experiment with artificial Dunlin nests. It was carried out at Torkelstorp in the beginning of May 1989, and repeated one month later at Vallda Sandö (locality nr 22, Fig. 1), a former breeding area for Dunlins (Eriksson 1980).

Table 1. Number of breeding pairs of Dunlin on coastal pastures in Bohuslän in 1983 and 1989.

Antal häckande par av kärrsnäppa på havsstrandängar i Bohuslän 1983 och 1989.

Locality (numbers in Fig. 1) *Lokal (nummer i Fig. 1)*	Number of pairs *Antal par* 1983[a]	1989
1 Nöddökilen	0	0
2 Backeleran	0	0
3 Orrevikskilen	1	0
4 Galtö lera	0	0
5 Tanums kile	0	0
6 Sannäsfjorden	0	0
7 Jorefjorden/Sävhedskilarna	0	1
8 Skärholme lera	0	0
9 Åbyfjorden	0	0
10 Färlevfjorden	0	0
11 Trälebergs kile	2	0
12 Bogen	0	0
13 Ängholmen	0	0[b]
14 Råssö/Hjälmvik	4	2
15 Svanviks kile	0	0
16 Borgen	0	0[b]
17 Breviks kile	0	0
18 Ödsmåls kile	9	3
19 Lökebergs kile	0	0
20 Pompa	0	0
21 Överön	0	0
Total *Summa*	16	6
Change *Förändring*		-63%
Number of localities *Antal lokaler*	4	3

[a] From Åhlund et al. (1987). *Efter Åhlund et al. (1987).*

[b] One visit. *Ett besök.*

Table 2. Number of breeding pairs of Dunlin on coastal pastures in Halland in 1978/79 and 1989.

Antal häckande par av kärrsnäppa på havsstrandängar i Halland 1978/79 och 1989.

Locality (numbers in Fig. 1) *Lokal (nummer i Fig. 1)*	Number of pairs *Antal par* 1978/79[a]	1989
22 Vallda Sandö	0	0
23 Råö-Lunnö	0	0
24 Hammargård	-	0
25 Torkelstorp[b]	7	6
26 Näsbofjorden (Tjolöholm-Ölmevalla)	7	3
27 Landabukten	0	0
28 Löftaåns mynning	1	0
29 Båtafjorden	3	9-11
30 Klosterfjorden	3	2[c]
31 Årsnäshalvön	0	0
32 Balgö	-	0
33 Fyrstrandsfjorden	0	0
34 Getterön	11	14
35 Gamla Köpstad	-	0
36 Galtabäck	-	0
37 Utteros	-	0
38 Sik	-	0
Total *Summa*	32	34-36
Change *Förändring*		+9%
Number of localities *Antal lokaler*	6	5

[a] Data from Getterön are from 1978 (Flodin et al. 1979), the others from 1979 (Eriksson 1980). *Uppgiften för Getterön avser 1978 (Flodin et al. 1979), övriga uppgifter från 1979 (Eriksson 1980).*

[b] Corresponds to Äskatorps strandängar in Eriksson (1980). *Motsvarar Äskatorps strandängar i Eriksson (1980).*

[c] Two visits. *Två besök.*

The dummy nests were constructed by making a small depression in the ground and lining it with dry grass. They were exposed during the period when most Dunlin nests were found. In each experiment, 20 dummy nests containing four Quail *Coturnix coturnix* eggs were placed in the lower part of the coastal pasture, which is the usual nest site habitat for the Dunlin in South Sweden (Jönsson 1985, Blomqvist & Thorssell 1988). Quail eggs, like Dunlin eggs, are cryptically coloured. The mean size of eight Quail eggs, was 29.9 x 24.6 mm which is about 10% smaller than Dunlin eggs (Nethersole-Thompson 1986 and references therein). The distances between the dummy nests were approximately 50 m, which is within the range of the nearest neighbour distance found in the study areas. We avoided areas with breeding Lapwings since this species defends an area around the nest (e.g. Elliot 1985). Half of the nests were placed in short vegetation (mean height of cover 3.5 -7.0 cm) and the remaining ones were concealed in taller vegetation (13.5 - 20.5 cm). Nests were checked after four and nine days.

Results

Survey

In 1989 six breeding pairs of Dunlin were found in Bohuslän, which corresponds to a decline of approximately 60% since 1983 (Table 1). The species has disappeared from two former breeding sites, Orrevikskilen and Trälebergs kile, but has appeared at one new site, Jorefjorden. The number of breeding pairs has decreased or the species has disappeared at four localities, of which two exhibit diminishing and two unaltered grazing intensity. The major part of the

Table 3. Breeding success of Dunlins at Ödsmåls kile, Bohuslän 1985-1990.
Häckningsframgång för kärrsnäppa vid Ödsmåls kile, Bohuslän 1985-1990.

Year *År*	Proportion of clutches *Andel bon* Hatched *Kläckta* % (n)	Preyed upon *Rövade* % (n)	Flooded *Dränkta* % (n)	Total *Summa* (n)	No. of pairs *Antal par*	No. of hatched young/pair *Antal kläckta ungar/par*	No. of fledged young/pair *Antal flygga ungar/par*
1985[a]	50 (4)	50 (4)	0 (0)	8	7	2.0	0.9
1986[b]	- -	- -	- -	-	4	-	1.0
1987	0 (0)	75 (2)	25 (1)	3	4	0	0
1988	33 (1)	67 (2)	0 (0)	3	3	1.0	0.3
1989	25 (1)	75 (3)	0 (0)	4	3	1.0-1.3	1.0
1990	100 (3)	0 (0)	0 (0)	3	3	4.0	1.3
Mean *Medel*	42 -	53 -	5 -	-	-	1.6-1.7	0.8

[a] From Blomqvist & Thorssell (1988). *Efter Blomqvist & Thorssell (1988)*

[b] From Blomqvist & Thorssell (unpubl.). Data considering hatching success in 1986 are incomplete and therefore excluded.
Efter Blomqvist & Thorssell (opubl.). Data avseende kläckningsframgång för 1986 är ofullständiga och har därför utelämnats.

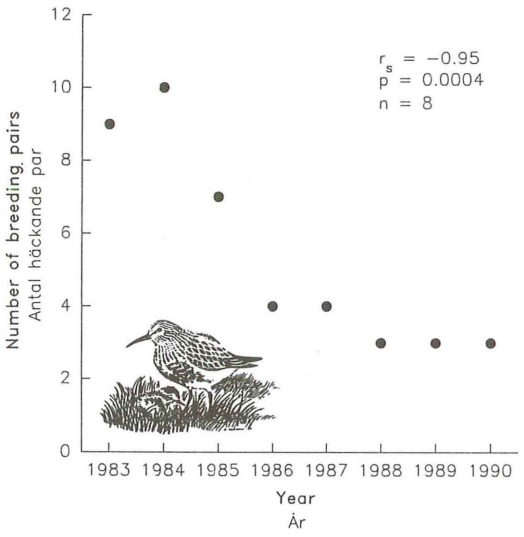

Fig. 2. Number of breeding pairs of Dunlin at Ödsmåls kile 1983-1990 (test: Spearman rank correlation test). Data from 1983 and 1984 from Åhlund et al. (1987), 1985 and 1986 from Blomqvist & Thorssell (1988, unpubl.) Drawing by Billy Hellsten.

Antal häckande par av kärrsnäppa vid Ödsmåls kile under perioden 1983-1990 (test: Spearman rank correlation test). Uppgifter från 1983 och 1984 efter Åhlund m.fl. (1987), 1985 och 1986 efter Blomqvist & Thorssell (1988, opubl.). Teckning: Billy Hellsten.

decline occurred at one locality, Ödsmåls kile. At this locality the number or pairs decreased by two thirds since 1983 (p=0.0004, Fig. 2), though grazing intensity remained fairly constant. Although the sample is small these results suggest that presently there may not exist a clear relationship between the decline of the Dunlin in Bohuslän and a moderately decreased grazing intensity.

On coastal pastures in Halland 34-36 breeding pairs were found, a slight increase since 1979 (Table 2). At five localities, however, the number of breeding pairs has decreased, while in two areas, Getterön and Båtafjorden, the breeding population has increased. No Dunlins occurred on the coastal pastures south of Varberg in 1989. Earlier during the 1980s, however, breeding or displaying birds were reported from this area (Asteling et al. 1985, Hanje et al. 1986, 1987).

Breeding performance

All nests were located in the lower part of the coastal pasture, where the vegetation is dominated by *Juncus gerardii* and various grass species.

On average, the proportion of hatched clutches was 42% at Ödsmåls kile (Table 3), and 55% at Torkelstorp (Table 4). At both localities the hatching success varied considerably among years, mainly because of variation in nest predation rate. This was most obvious at Ödsmåls kile, where the proportion of nests preyed upon ranged from 0 to 75% (Table 3). Other nest losses

Table 4. Breeding success of Dunlins at Torkelstorp, Halland 1988-1990.
Häckningsframgång för kärrsnäppa vid Torkelstorp, Halland 1988-1990.

Year *År*	Proportion of Clutches *Andel bon* Hatched *Kläckta* % (n)	Preyed upon *Rövade* % (n)	Other losses[a] *Övriga förluster* % (n)	Total *Summa* (n)	No. of pairs *Antal par*	No. of hatched young/pair *Antal kläckta ungar/par*	No. of fledged young/pair *Antal flygga ungar/par*
1988	50 (4)	38 (3)	12 (1)	8	4	3.0-3.8	1.8-2.3
1989	14 (1)	57 (3)	29 (2)	7	6	0.7	0.3
1990	100 (3)	0 (0)	0 (0)	3	3	2.3-3.3	0.3-1.0
Mean *Medel*	55 -	32 -	13 -	-	-	2.0-2.6	0.8-1.2

[a] Mainly nests trampled by sheep. *Främst bon söndertrampade av får.*

were few and mainly caused by flooding when sea level was high, and trampling by grazing sheep.

The estimates of fledging success are based on observations of fledglings on the shores before migration. Chicks were sometimes hard to observe at Torkelstorp and therefore, for two years, we could not determine the exact number of fledged young. In total, 18 fledged young were observed at Ödsmåls kile and 10-14 at Torkelstorp, corresponding to a mean fledging success of 0.8 and 0.8-1.2 fledglings per pair, respectively (Table 3 and 4). The proportion of hatched chicks surviving until fledging was 46% at Ödsmåls kile and 31-60% at Torkelstorp.

Nest predation experiment

The experiment with dummy nests was performed at two different localities in order to reduce any influence of local differences in predation pressure. There was no significant difference in predation rate between dummy nests placed in tall and short vegetation (Table 5), suggesting that vegetation height does not influence the probability of nest predation. After 9 days of exposure 90% of the dummy nests were preyed upon, supporting the observed high nest predation rate on natural nests.

Discussion

Distribution and population trend

The number of breeding Dunlins has decreased considerably in the province of Bohuslän during the last seven years. Strandvik (1985) suggested that the population size in Bohuslän was fairly constant during 1967-1984. If so, the decline started in the middle of the 1980s, which also coincides with the decrease of

Table 5. Number of artificial Dunlin nests destroyed by predation in relation to vegetation height and exposure time.

Antalet rövade konstgjorda kärrsnäppebon i relation till vegetationshöjd och exponeringstid.

	After 4 Days *Efter 4 dygn*		After 9 Days *Efter 9 dygn*	
	Predation *Rövade*	Intact *Intakta*	Predation *Rövade*	Intact *Intakta*
Experiment 1 *Försök 1*				
Short[a] vegetation *Låg vegetation*	4	6	10	0
Tall[a] vegetation *Hög vegetation*	5	5	8	2
Experiment 2 *Försök 2*				
Short[a] vegetation *Låg vegetation*	3	7	9	1
Tall[a] vegetation *Hög vegetation*	3	7	8	2

[a] See text for explanation. *Se text för förklaring.*
Note: No significant differences in predation rate between nests in short and tall vegetation (Fisher exact probability test).
Inga skillnader i rövningsfrekvens mellan bon placerade i låg vegetation och bon i hög vegetation (Fisher exact probability test).

the population at Ödsmåls kile. Data concerning grazing intensity in Bohuslän suggest that the decline of the Dunlin population was not caused only by changes in grazing intensity. It seems likely that additional factors have affected the population trend (see below for further discussion).

Compared with the survey in 1979 the breeding population in the province of Halland seems to have been fairly stable. The coast south of Varberg was not surveyed in 1979, but until the middle of the 1980s Dunlins were observed in the breeding season at three localities south of Varberg. Thus, it is possible that the population in Halland has also declined during the 1980s, and that more localities are abandoned than what a comparison with the survey of 1979 indicates. The major part of the population on the Swedish west coast is now restricted to two localities, Getterön and Båtafjorden. At Getterön the number of breeding pairs has been more or less constant, slightly more than 10 pairs, during the 1980s (Flodin 1990). Thus, the population in this area may either be self-supporting or there may have been immigration of birds into the breeding population.

Reproductive success and nest predation experiment

At both studied localities predation was responsible for the majority of nest losses. As the nests were found at different stages of incubation, the observed proportion of nests preyed upon may be an underestimate of the true predation rate (e.g. Mayfield 1975). At Ödsmåls kile the observed nest predation rate was high (53%) in comparison with Torkelstorp (32%), but it was slightly lower than that reported by Jönsson (1985, 1988) and by Soikkeli (1970a). In some other studies nest losses varied between 0% and 30% (Holmes 1966, Soikkeli 1967, Etheridge 1982, Król 1985). It is thus likely that nest predation limited the reproductive success at Ödsmåls kile. In both study areas Hooded Crows *Corvus corone cornix* and gulls (Laridae) were regularly observed searching the pastures. Possibly these species were predators on Dunlin nests. At Torkelstorp in 1989, egg-shells with marks of teeth were found several times, indicating that the substantial nest losses at least partly was caused by mammalian predators. The experiment with dummy nests implied that vegetation cover is of minor importance for the risk of predation. Given that birds are the major predators, this type of experiments tests the probability that a nest will be discovered by visual cues. The result can, however, reflect the possibility that dummy nests were found by mammalian predators. Futhermore, the outcome may also depend on searching behaviour of predators. In experiments with artificial duck nests, Sugden and Beyersbergen (1986) found that concealment provided little or no protection from walking American Crows *Corvus brachyrhynchos*.

At both the studied localities the average number of fledged young per pair as well as the rate of prefledging survival exceeded values (0.28 and 36%, respectively) reported by Jönsson (1988) from SW Scania. The causes of prefledging mortality in the study areas are unknown, but probable ones are predation and starvation due to food shortage or periods of severe weather conditions (e.g. Redmond & Jenni 1986, Jönsson 1988).

Maintenance of a stable population size

What are the survival prospect for the Dunlin population on the Swedish west coast? For one locality, Ödsmåls kile, we have enough information to calculate if this subpopulation is self-supporting. In order to maintain a stable population size the production of recruits need to compensate for the adult mortality. We estimated adult mortality by return rates of individually ringed birds, and by regarding the proportion of unmarked birds that disappeared from one year to another as dead. This assumption may over-estimate adult mortality, but Dunlins, particularly males, show high site tenacity (Soikkeli 1970b, Jönsson 1988). Additionally, by assuming a subadult survival rate of 56% (Jönsson 1988) and a natal philopatry of 33% (Soikkeli 1970b), we could calculate the maximum number of fledged birds that was expected to return to the breeding stock after two years. This expected number minus the observed number of returning birds was also considered to represent dead birds. The estimated average annual mortality rate for the population at Ödsmåls kile was 21%, which is in between the 17% reported by Jönsson (1988) and the 25% given by Soikkeli (1970a). When calculating the number of recruits produced, information on fledging success, post-fledging survival, and age of first breeders are also needed (Soikkeli 1970a, Jönsson 1988). The fledging success at Ödsmåls kile was 0.38 fledglings per adult. By assuming that post-fledging survival was 56% (Jönsson 1988) and the proportions of birds breeding at the age of one and two years equalled those values found by Soikkeli (1970a) (20% and 80%) and Jönsson (1988) (35% and 65%), respectively, 0.17-0.18 first-breeders were produced per adult. This reproductive output did not balance the adult mortality rate, implying that the population was not self-supporting.

The survival of hatched young to fledging was somewhat higher than reported by Jönsson (1988). The major cause of the low reproductive output at Ödsmåls kile was thus probably the low proportion of hatched clutches. Provided that post-hatching survival remain unaltered, hatching success must increase to

1.0 hatched chicks per adult, or about 20%, in order to compensate for the adult mortality.

To sum up, the population of Dunlin on the Swedish west coast has continued to decline during the last decade. If we add birds from two sites in Halland (south of the surveyed area) that held displaying males in 1988 (Hellman & Wikman 1989), the total size of the population on the Swedish west coast is no more than 44 pairs. The population also seems to be increasingly fragmented, and Dunlins now only breed at about 10 localities. Continued cattle grazing in suitable breeding areas is a prerequisite for the survival of the species. However, the declining population suffers a risk of extinction due to other causes than merely habitat alterations. Small populations are vulnerable to stochastic processes and unpredictable events, such as altered sex ratio or age distribution, loss of genetic variation, temporarily increased predation rate and severe weather conditions during breeding(e.g. Soulé 1986, Järvinen & Miettinen 1988). Small populations with poor reproduction, such as the one at Ödsmåls kile, may, however, persist if immigration from other subpopulations is substantial. These subpopulations must have a high reproductive output and recruits which spread must also have good survival chances. Thus, the prospects of the local populations of Dunlins on the Swedish west coast may be interconnected (see Redmond & Jenni 1986).

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Sammanfattning

Förekomst, häckningsframgång och populationsutveckling hos sydlig kärrsnäppa Calidris alpina schinzii på svenska västkusten

Den sydliga kärrsnäppan *Calidris alpina schinzii* har drastiskt minskat i antal inom stora delar av sitt svenska utbredningsområde (ca 250 par i början av 1980-talet, Tjernberg 1985). Tillbakagången förknippas i första hand med förändrad markanvändning av fukt- och strandängar (t.ex. Larsson 1969, Soikkeli & Salo 1979, Emanuelsson & Kjellén 1985, Alexandersson & Eriksson 1988). I vissa områden har nedgången emellertid varit kraftigare än för-väntat om den endast var orsakad av brist på lämpliga bio-toper (Eriksson 1980, se även Jönsson 1988). Detta antyder att andra faktorer än enbart minskande hävd också är av betydelse för kärrsnäppans populationsutveckling.

Under perioden 19 april-25 maj 1989 inventerades 38 betade havsstrandängar i Bohuslän och Halland (Fig. 1) för att dokumentera kärrsnäppans nuvarande status på västkusten samt för att göra jämförelser med tidigare inventeringar (Eriksson 1980, Åhlund m.fl. 1987). Vid två av de inventerade lokalerna, Ödsmåls kile och Torkelstorp (nr 18 och 25, Fig. 1), har vi också utfört häckningsbiologiska undersökningar. Med stöd av litteraturuppgifter (Soikkeli 1970a, b, Jönsson 1988) och egna observationer har vi för en av dessa lokaler undersökt om populationen var självbärande. Vi försökte också avgöra vilken av faktorerna kläckningsframgången eller ungarnas överlevnad till flygg ålder, som kan vara den mest betydelsefulla orsaken till en vikande populationsutveckling. Flera studier har redovisat en hög andel rövade bon hos kärrsnäppa (t.ex. Soikkeli 1970a, Jönsson 1988), och det är möjligt att predationsrisken är relaterad till graden av skyddande vegetation (t.ex. Sugden & Beyersbergen 1986). Vi testade denna hypotes ge-nom att jämföra predationen på konstgjorda kärrsnäppebon som placerades ut i "låg" (medelhöjd 3.5-7.0 cm) respektive "hög" (medelhöjd 13.5-20.5 cm) vegetation.

1989 påträffades sex kärrsnäppepar i Bohuslän (Tabell 1) vilket motsvarar en tillbakagång med drygt 60% sedan 1983. Antalet häckande par hade minskat på fyra lokaler varav två uppvisade minskat betestryck och två oförändrad hävd, vilket antyder att det för närvarande inte finns något entydigt samband mellan kärrsnäppans tillbakagång och måttliga förändringar av betestrycket. Större delen av till-bakagången har skett på en lokal, Ödsmåls kile, där antalet häckande par har minskat med två tredjedelar sedan 1983 ($p=0.0004$, Fig. 2), trots relativt oförändrat betestryck.

Vid de halländska strandängarna påträffades 34-36 par (Tabell 2) vilket är en svag ökning jämfört med 1979. Tidigare under 1980-talet förekom emellertid häckande kärrsnäppor söder om Varberg (Asteling m.fl. 1985, Hanje m.fl. 1986, 1987). Det är därför troligt att även den halländska populationen har minskat något och att antalet övergivna lokaler är fler än vad Tabell 2 visar.

I genomsnitt var andelen kläckta bon 42% vid Ödsmåls kile och 55 % vid Torkelstorp (Tabell 3 och 4). Vid båda lokalerna orsakades majoriteten av boförlusterna av predation. Vid Ödsmåls kile var frekvensen rövade bon högre jämfört med Torkelstorp samt med flera andra undersökningar (Holmes 1966, Soikkeli 1967, Etheridge 1982, Król 1985), men något lägre än vad som rapporterats av Jönsson (1988) och Soikkeli (1970a). Resultatet av experimentet med konstgjorda bon antyder att vegetationshöjden inte är av betydelse för predationsrisken (Tabell 5).

Vid Ödsmåls kile blev i genomsnitt 0.8 ungar flygga per par (Tabell 3) och vid Torkelstorp var motsvarande siffra 0.8-1.2 (Tabell 4). Överlevnaden till flygg ålder var vid respektive lokal 46% och 31-60%.

Vid Ödsmåls kile uppskattades den genomsnittliga årliga adultmortaliteten till 21%. I genomsnitt producerades 0.17-0.18 förstagångshäckare per individ, vilket inte är tillräckligt för att kompensera den årliga adultdödligheten. De kläckta ungarnas överlevnad till flygg ålder var något högre än vad Jönsson (1988) rapporterat. Det är därför troligt att den låga andelen kläckta bon var den främsta orsaken till det otillräckliga reproduktionsresultatet.

Sammanfattningsvis har beståndet av sydlig kärrsnäppa på västkusten fortsatt att minska under 1980-talet. 1988 rapporterades spelande kärrsnäppor från två områden i Halland (Hellman & Wikman 1989) som inte inventerades 1989. Om dessa fåglar fanns kvar 1989 skulle den totala populationen på svenska västkusten uppgå till maximalt 44 par. Populationen tycks också bli allt mer fragmenterad och förekommer nu endast på ett tiotal lokaler. Fortsatt betesdrift i lämpliga områden är en förutsättning för att arten ska kunna fortleva på västkusten. Små populationer riskerar emellertid att dö ut till följd av slumpmässiga processer och oförutsägbara händelser som t.ex. förändrad könskvot eller åldersfördelning, minskad genetisk variation och tillfälligt förhöjd predation (t.ex. Soulé 1986, Järvinen & Miettinen 1988). Små populationer med låg reproduktion, som den vid Ödsmåls kile, är sannolikt beroende av immigration för att överleva på lång sikt (se Redmond & Jenni 1986).