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Brood size of four titmice (Paridae) during 1962–2001

Kullstorlek för fyra arter mesar (Paridae) 1962–2001

HANS RYTTMAN & K. SUSANNA S. HALL-KARLSSON

Abstract

Breeding success of four titmice breeding in forests was investigated during 1962–2001. Three of them, Coal Tit *Parus ater*, Willow Tit *Parus montanus* and Marsh Tit *Parus palustris* have shown declining population trends in the annual monitoring of bird species in Sweden. The fourth species, the Crested Tit *Parus cristatus*, has shown a stable population size. Two of the declining species, Marsh Tit and Coal Tit, had the largest broods during the most recent decade and significantly positive trends in brood sizes during the investigated period, whereas the Willow Tit and Crested Tit had stable brood sizes. Our study indicates that the declines of the Coal Tit, Willow Tit and Marsh Tit populations in Sweden cannot be explained by changes in brood size, number of dead nestlings or number of un-hatched eggs. The stable population size of Crested Tit might be explained by its habit of breeding early in the season, which has become more pronounced during the most recent decades, probably in order to match breeding to the earlier spring arrival nowadays.

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Introduction

The bird populations of Sweden have been monitored annually since 1975 (Lindström & Svensson 2002). In the annual report for 2006, Lindström & Svensson (2007) stated that the Willow Tit *Parus montanus* and the Marsh Tit *Parus palustris* had declined for the last 25 years, whereas the Coal Tit *Parus ater* started to decrease in the 1990s and the Crested Tit *Parus cristatus* showed a stable population.

There are two mutually non-exclusive causes for a decline of a population – lower production of offspring or decreased survival of nestlings or older birds. The optimal brood size of a species depends on several factors such as survival probability of young, life expectancy of adults, habitat favourability and predation pressure. In a stable population, the number of offspring surviving to reproductive age should equal the number of adults dying or dispersing from the population each year.

In this study, we investigate the average brood size and number of ringed broods from 1962 to 2001 for the four titmice species. The aim was to investigate if changes in brood size and the proportion of unhatched eggs and dead nestlings per brood could play a role in the declining populations of the titmice.

Materials and methods

This study is based on bird ringing data from 1962 to 2001 reported to the Swedish Bird Ringing Centre (Swedish Museum of Natural History). The four species included, Coal Tit, Crested Tit, Willow Tit and Marsh Tit, depend on forest habitats, and their breeding population changes have been estimated in the Annual report of the Swedish bird monitoring for 2006 (Lindström & Svensson 2007). Altogether, 6447 broods were included in the present study. The total number of broods ringed, the average brood size and the range of brood sizes of each species is presented in Table 1. The term ‘brood size’ used in this study denotes the number of nestlings alive at the ringing occasion even if not all of them were ringed. Unhatched eggs and dead nestlings were not included in the average brood size, if nothing else is stated. The numbers of unhatched eggs and dead nestlings were analysed separately for 1982–2001 since this data was not regularly reported until 1982. It is not possible from this data to tell how many of the nestlings that were predated or died for other reasons.

The number of nestlings of each species included in this study is not equal to the total number of nestlings of the same species ringed in Sweden. In some broods, not all nestlings were ringed, but they

Table 1. Species names, total number of broods ringed 1962–2001 (n), average brood size 1962–2001 with standard error (s.e.) in parentheses, and brood size range.
Artnamn, totalt antal kullar ringmärkta 1962–2001 (n), medelantal ungar per kull 1962–2001 med standardfelet (s.e.) inom parentes samt spridning i kullstorlek.

	n	Average (s.e) *Medel (s.e)*	Range *Spridning*
Coal Tit *Parus ater Svartmes*	3279	7.74 (0.032)	1–13
Crested Tit *Parus cristatus Tofsmes*	425	4.32 (0.055)	1–7 (9*)
Willow Tit *Parus montanus Talltita*	570	6.68 (0.078)	1–11
Marsh Tit *Parus palustris Entita*	2173	7.05 (0.041)	1–12
Sum *Summa*	6447		

*Only one brood of this size. *Endast en kull med denna storlek.*

Table 2. Number of ringed broods per decade 1962–2001.
Antal ringmärkta kullar per årtionde under 1962–2001.

	1962–1971	1972–1981	1982–1991	1992–2001
Coal Tit *Svartmes*	440	796	1184	859
Crested Tit *Tofsmes*	121	216	54	34
Willow Tit *Talltita*	98	257	72	143
Marsh Tit *Entita*	409	560	679	525

Table 3. Mean number of ringed nestlings per brood in different decades. Bold indicates average brood size statistically significantly different from the other brood sizes. s.e. = standard error.
Medeltalet ringmärkta ungar per kull under olika årtionden. Fetstil indikerar kullstorlekar som statistiskt skiljer sig från övriga kullstorlekar. s.e. = standardfel.

	Brood size (s.e.) *Kullstorlek (s.e.)*				
	1962–1971	1972–1981	1982–1991	1992–2001	P
Coal Tit *Svartmes*	7.52 (0.087)	7.58 (0.065)	**7.80** (0.053)	**7.89** (0.062)	<0.001
Crested Tit *Tofsmes*	4.26 (0.103)	4.38 (0.077)	4.24 (0.154)	4.32 (0.194)	0.764
Willow Tit *Talltita*	6.86 (0.189)	6.50 (0.116)	6.58 (0.220)	6.92 (0.156)	0.116
Marsh Tit *Entita*	6.80 (0.094)	6.86 (0.080)	7.04 (0.073)	**7.42** (0.083)	<0.001

Table 4. Regression analysis of mean brood size in different years.
Regressionsanalys för medelkullstorlek under olika år.

	Regression coefficient *Regressionskoefficient*	t	P
Coal Tit *Svartmes*	0.0118*	2.70	0.010
Crested Tit *Tofsmes*	–0.004	–0.63	0.532
Willow Tit *Talltita*	0.0059	0.5	0.620
Marsh Tit *Entita*	0.017*	2.75	0.009

*significant values *signifikanta värden*

are still included in this study as a member of the brood. Nestlings that were ringed outside the nest, without any information regarding their original brood, were excluded from the present study.

A linear regression analysis was performed on the average brood size over time. For additional analyses the ringing data was divided into time periods, i.e. the four decades: 1962–1971, 1972–1981, 1982–1991 and 1992–2001. In order to investigate if there were any differences in brood sizes in different parts of the country, Sweden was divided into three regions: south (south of 59°N), middle (59°N–62°N) and north (north of 62°N). Since all birds included in the study were ringed as nestlings, ringing date was used to test if the breeding start changed over the studied years.

All statistical analyses were performed with JMP (version 2, SAS Institute Inc.). Mean group differences were tested with ANOVAs and Tukey-Kramer HSD. Changes in mean brood size between years were tested with linear regressions.

Results

Number of broods ringed

The number of broods ringed varied between species from 425 broods of Crested Tits to 3279 broods of Coal Tits (Table 1). The number of ringed broods also varied over time, but with only the Crested Tit showing a significant decrease over the last two decades (b = –0.43, t = –3.95, P = 0.0003; Table 2).

Changes in brood sizes over time

The average brood size for the whole time period varied from 4.32 (s.e. = 0.055, Crested Tit) to 7.74 (s.e. = 0.032, Coal Tit, Table 1). The average brood size increased over the studied time period in the Coal Tit and the Marsh Tit (Table 3), whereas no significant change could be detected for the Willow Tit and the Crested Tit. The Marsh Tit had largest brood sizes during the last decade and a regression analysis confirms a statistically significant increase over time (b = +0.017, P = 0.009; Table 4). This increase in brood size was paralleled by the Coal Tit which showed a statistically significant increase in brood size during the last two decades (1982–1991 and 1992–2001; Table 3). Regression analysis confirmed this increase (b = +0.0118, P = 0.010; Table 4). The Crested Tit, which had a stable population over the monitored period (Lindström & Svensson 2007), did not show any tendency towards changes in brood size, neither did the Willow Tit (Table 4).

Differences in brood size between regions in Sweden

Regional differences in brood size were recorded only for the Marsh Tit (Table 5). In the south region the Marsh Tit had larger brood sizes (on average 7.21, s.e. = 0.048, nestlings per brood) compared to the middle region (average 6.60, s.e. = 0.079, nestlings per brood, P < 0.001). Given the southern distribution of Marsh Tits, the number of ringed broods in the northern region was too small for this region to be included in the comparison.

Unhatched eggs and dead nestlings

The number of unhatched eggs was regularly reported only for the last two decades (1982–1991 and 1992–2001). A comparison between these

Table 5. Mean number of ringed nestlings per brood with standard error (s.e.) and number of ringed broods (N) in different regions of Sweden: South (south of 59°N), Middle (59°N–62°N) and North (north of 62°N). The only significant difference is between South and Middle in Marsh Tit (ANOVA and Tukey-Kramer HSD*).
Medeltalet ringmärkta ungar per kull (Mean), standardfel (s.e.) och antalet märkta kullar(N) i olika regioner i Sverige: Södra (söder om 59°N), Mellan (59°N–62°N) och Norra (norr om 62°N). Enda signifikanta skillnaden var mellan Södra och Mellan för entita (ANOVA och Tukey-Kramer HSD).*

	South *Södra*			Middle *Mellan*			North *Norra*			P	N
	Mean	s.e.	N	Mean	s.e.	N	Mean	s.e.	N		total
Coal Tit *Svartmes*	7.76	0.045	1651	7.70	0.049	1418	7.72	0.127	210	0.653	3279
Crested Tit *Tofsmes*	4.25	0.080	201	4.39	0.078	212	4.25	0.327	12	0.734	425
Willow Tit *Talltita*	6.53	0.106	309	6.83	0.140	178	6.88	0.206	82	0.136	569
Marsh Tit *Entita*	7.21	0.048	1503	6.60	0.079	578	6.67	0.548	12	<0.001	2093

Table 6. The mean number of unhatched eggs and dead nestlings during 1982–1991 and 1992–2001. Sample size in parentheses.
Medelantalet rötägg och döda ungar under årtiondena 1982–1991 och 1992–2001. Antal kullar inom parentes.

	Unhatched eggs *Rötägg*			Dead young *Döda ungar*		
	1982–1991	1992–2001	P	1982–1991	1992–2001	P
Coal Tit *Svartmes*	0.29 (1124)	0.24 (833)	n.s	0.05 (1126)	0.05 (836)	n.s.
Crested Tit *Tofsmes*	0.38 (53)	0.18 (33)	n.s	0	0	
Willow Tit *Talltita*	0.63 (62)	0.17 (62)	0.014	0.24 (143)	0.17 (143)	n.s
Marsh Tit *Entita*	0.27 (626)	0.08 (626)	n.s.	0.27 (495)	0.07 (495)	n.s

two decades reveal that the Willow Tit showed significantly fewer unhatched eggs during the last decade (0.63 during 1982–1991 and 0.24 during 1992–2001, P = 0.014). For the other species, no such differences were found (Table 6). The average number of unhatched eggs varied from 0.18 (Crested Tit 1992–2001) to 0.63 (Willow Tit 1982–1991).

The number of dead nestlings varied from on average 0 for the Crested Tit to 0.17 for the Willow Tit and showed no tendencies to change during the studied time period for either of the studied species.

Timing of breeding

The timing of breeding, as measured by ringing date, seemed to differ between the species with most broods of Crested Tits being ringed in May, whereas the majority of broods of the other three species were ringed in June (Table 7). The proportion of broods ringed in different months changed over the studied time period for the Crested Tit from 61% of the broods examined in May during 1962–1971 to 97% during 1992–2001 (Table 8). Marsh Tits showed the same pattern of earlier breeding over time, with the peak of breeding changing from June to May. Coal Tits showed a weak tendency to breed earlier, whereas the Willow Tits did not change timing of their breeding over the studied time period (Table 8).

Discussion

Three of the studied species of titmice have decreasing populations in Sweden, whereas the fourth, the Crested Tit, has a stable population. Interestingly, neither changes in brood size nor in number of dead nestlings or unhatched eggs, seem to co-vary with these patterns, and hence, the explanation to the declining populations has to be sought elsewhere. One possible explanation might be changes in adult or juvenile survival but this does unfortunately go beyond the scope of the present study.

Table 7. The proportion (%) of broods ringed in different months.
Andelen (%) ringmärkta kullar per månad.

	May	Jun	Jul	Aug
Coal Tit *Svartmes*	28	61	11	<1
Crested Tit *Tofsmes*	74	25	1	0
Willow Tit *Talltita*	5	90	4	<1
Marsh Tit *Entita*	35	64	1	0

Table 8. The proportion (%) of broods ringed per decade and month.
Andelen (%) ringmärkta kullar per årtionde och månad.

	May	Jun	Jul	Aug
Coal Tit *Svartmes*				
1962–1971	13	72	15	0
1972–1981	23	63	14	0
1982–1991	33	58	9	<1
1992–2001	32	57	10	<1
Crested Tit *Tofsmes*				
1962–1971	61	39	0	0
1972–1981	79	20	1	0
1982–1991	72	26	2	0
1992–2001	97	3	0	0
Willow Tit *Talltita*				
1962–1971	5	92	3	0
1972–1981	4	89	7	<1
1982–1991	10	89	1	0
1992–2001	4	93	2	1
Marsh Tit *Entita*				
1962–1971	11	87	2	0
1972–1981	26	73	1	0
1982–1991	39	61	<1	0
1992–2001	59	41	<1	0

This study showed increasing brood sizes for decreasing populations of two titmice species and stable brood size for the third decreasing species. This pattern could possibly be explained by decreased competition, if the remaining individuals in the declining populations face relaxed competition with conspecifics and therefore might breed in territories of higher quality. Similar phenomenon have also been found in a few cases for species breeding in agricultural areas (Wheatear, Linnet, Starling; Ryttman & Hall-Karlsson 2009) as well as for Wrynecks (Ryttman 2003).

The four titmice species investigated all have similar habits, prefer similar habitats and are of a similar size (Cramp 1989, Svensson m.fl. 1999). They are also all more or less sedentary (Fransson & Hall-Karlsson 2008). They do however differ slightly in their breeding ecology and especially in their use on rotten tree trunks for breeding. Rotten tree trunks in forests have declined rapidly in Sweden and this has been linked to declining populations of forest birds (Carlsson & Stenberg 1995). The Willow Tit is dependent of rotten trunks for digging out the nest holes. The Coal Tit and the Marsh Tit, on the other hand, use secondary holes from woodpeckers or nest boxes when provided. The decreasing numbers of rotten tree trunks in forests can therefore not explain the declining population of Coal Tits and Marsh Tits. One habit does however single out the Crested Tit from the other three species, and this is the high proportion of broods ringed in May compared to later months (Table 7). The majority of the broods of Marsh, Coal and Willow Tits were ringed in June, whereas as many as 74% of the Crested Tit broods were ringed in May. The proportion of Crested Tit broods ringed in May increased during the studied time period (Table 8) to the extent that almost no broods at all were ringed from June onwards during the last investigated decade. Marsh Tits and Coal Tits showed similar tendencies, but not to the same extent. Even though ringing of nestlings is performed on similar sized (aged) nestlings, one should bear in mind that the nestlings can be ringed during a time period of approximately 10 days, potentially inducing some variation in the estimation of the breeding start data. This is however not likely to be a problem since this variation is similar for all species.

Considering the recent climate change and the earlier onset of spring, breeding earlier might be crucial to ensure a successful breeding. Thessing (2000) showed that Willow Tits synchronise breeding to optimal food abundance for the chicks. Furthermore, warmer springs have been shown to lead to mistimed reproduction in Great Tits (Visser et al. 1998). If spring arrives earlier every year, as is nowadays well recorded (c.f. Hüppop & Hüppop 2003), it is possible that this synchronisation does not work as well as before. This mismatched breeding could then potentially affect both adults and juveniles negatively. The Crested Tits, with the increasing habit of early breeding, might have adapted to the earlier availability of larvae and consequently hatch their eggs at a time period with high food abundance. Crested Tits might therefore be more successful and have more offspring surviving to breeding age compared to Willow Tits, Marsh Tits and Coal Tits.

In this study we have shown that decreasing populations of titmice show increasing brood sizes. Furthermore we show that the decrease in population size cannot be explained by any changes in the number of dead nestlings, or the number of unhatched eggs. We have also shown that the species with a stable population size (Crested Tit) is the species with the most pronounced habit of early breeding. We suggest that the decreasing populations may be a result of decreasing survival of juvenile birds to breeding age or a decreasing survival of adult birds.

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Sammanfattning

Vi har undersökt fyra mesars, svartmes *Parus ater*, talltita *Parus montanus*, entita *Parus palustris* och tofsmes *Parus cristatus*, häckningsframgång

under åren 1962 till 2001 (Tabell 1 och 2). Som mått på häckningsframgången använde vi de ungkullstorlekar som rapporterats till ringmärkningscentralen i samband med ringmärkningen under perioden 1962–2001. Tre av arterna, talltita, entita och svartmes, visar minskande populationstrender i Sverige under denna period. För svartmesen tycks nedgången ha börjat på 1990-talet (Lindström & Svensson 2007). Tofsmesen tycks däremot ha en stabil population.

Vi fann att två av de tre minskande mespopulationerna (entita och svartmes) hade sina största kullstorlekar mellan 1992 och 2001 (Tabell 3) och dessa båda arter visar också en statistiskt signifikant tendens för ökande kullstorlek under de undersökta åren (Tabell 4). Talltitan och tofsmesen visade ingen förändring i kullstorlek under de studerade åren. De nedåtgående populationstrenderna i Sverige tycks alltså inte bero på minskande kullstorlekar. Vi hittade bara små skillnader mellan olika delar av landet och enda signifikanta skillnaden var att entitan hade större kullar i södra än i mellersta Sverige (Tabell 5).

De större kullstorlekarna som svartmes och entita visar kan bero på minskad konkurrens mellan de kvarvarande individerna om de bästa reviren. Fler goda revir finns att tillgå då färre individer finns kvar i populationen och i ett bättre revir kan fler ungar födas upp.

Talltitan hade signifikant lägre antal rötägg under 1992–2001 jämfört med 1982–1991 medan det för övriga tre arter inte fanns någon tendens till vare sig ökning eller minskning i antalet rötägg. Antal döda ungar per kull varierade mellan 0 för tofsmes och 0,17 för talltita, men ingen av arterna visade någon tendens till förändring av denna andel över tiden. Kort sagt indikerar vår studie att varken förändringar i kullstorlek, antalet döda ungar eller antalet rötägg kan förklara de minskande populationerna hos tre av skogsmesarna (Tabell 6).

De fyra undersökta arterna har mycket lika vanor, föredrar mycket lika habitat, är ungefär lika stora samt är mer eller mindre lika stationära. Tofsmesen skiljer ut sig från de övriga arterna genom att lägga majoriteten av sina kullar i maj, medan övriga arter lägger majoriteten av kullarna i juni (Tabell 7). Under den tidsperiod som har undersökts har tofsmesen förändrat sina häckningsvanor så att en allt större andel av kullarna läggs tidigt på säsongen (Tabell 8). Entitan och svartmesen visar liknande tendenser men inte lika extremt som tofsmesen. Thessing (2000) visade att talltitan synkroniserar sin häckning med den optimala tiden för mat till ungarna. I och med klimatförändringarna har nu våren börjat infalla allt tidigare på året och det är då möjligt att denna synkronisering fungerar allt sämre. Att lägga allt tidigare kullar skulle kunna leda till en högre överlevnad för tofsmesens ungar eftersom de kläcks under en period när födotillgången fortfarande är tillräckligt god. Det är möjligt att detta är förklaringen till att tofsmesen är den av de fyra undersökta arterna som inte minskar i antal.

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Clutch and egg size variation in the Marsh Harrier *Circus aeruginosus* in eastern Poland

Variation i kull- och äggstorlek hos brun kärrhök Circus aeruginosus *i östra Polen*

MARCIN POLAK

Abstract

The main aim of this study was to examine how clutch size and season influenced egg size in a population of Marsh Harriers *Circus aeruginosus* in eastern Poland. The Marsh Harriers nested in small, isolated patches of reed belts surrounding fish ponds. A total of 328 eggs from 70 clutches were measured during four nesting seasons (2005–2008). Average clutch size was 4.69 ± 0.71 eggs and did not vary between years; the modal clutch size was 5 eggs. Mean values of the egg dimensions were: egg length = 48.60 ± 1.78 mm; egg breadth = 38.36 ± 1.13 mm; egg volume = 36.53 ± 2.99 cm^3. There was a strong correlation between egg length and egg breadth. The number of eggs in a clutch had no effect on the egg size.

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Introduction

In birds, egg size is of major importance for individual reproductive success (Blackburn 1991, Nager & Zandt 1994). In many studies special attention has been given the adaptive significance of intra-clutch egg size variability, since egg size may influence the condition of the chick at hatching time and hence its survival (Custer & Frederick 1990; Swennen & van der Meer 1992). The Marsh Harrier *Circus aeruginosus* is a medium-sized raptor species, almost exclusively breeding on the ground, mostly in flooded emergent vegetation, but also in arable fields (Glutz et al. 1979, Stanevičius 2004). This short paper describes the variation in size of Marsh Harrier eggs and examines the effect of clutch size and season on egg size variation.

Material and methods

Fieldwork was carried out at eleven fishpond complexes in eastern Poland in 2005–2008: Antopol, Chodel, Czesławice, Garbów, Kraśnik, Niedrzwica, Opole Lubelskie, Orlicz, Piaski, Samoklęski, Zalesie (Lublin region, N 50°55'–51º29'; E 21°58'–23º10'). The fishponds varied in size from 15 to 203 ha and were partially covered by vegetation, mainly dominated by common reed *Phragmites australis*, narrow-leafed cattail *Typha angustifolia* and sedges *Carex sp*. The ponds were situated in an agricultural landscape dominated by arable fields, meadows and woodlots of different ages. The Marsh Harriers nested in small, isolated patches of reed in the reed belt surrounding the ponds. Emergent vegetation in the fishponds was checked regularly (at least once a week) from the end of April to early July each year, and nests were located by systematic walking within the vegetation. A total of 70 nests with complete clutches were found. The length and width of each egg (n = 328) was measured with a calliper to the nearest 0.1 mm. Egg volume was estimated by the equation of Hoyt (1979): volume = $0.00051 \times \text{length} \times (\text{width})^2$. Only eggs from complete clutches and no replacement clutches were chosen for analysis. Statistical data processing was performed using STATISTICA 6.0 package (Statsoft Inc. 2001).

Results and discussion

The Marsh Harriers' clutches contained 3 to 7 eggs (Figure 1), with a mean clutch size of 4.69 ± 0.71 eggs, and a modal clutch size of 5 eggs (n = 70). There were no differences in clutch size between years (Kruskal-Wallis test, $H_{3, 70} = 4.45$, P = 0.22), although such effects have been found in other

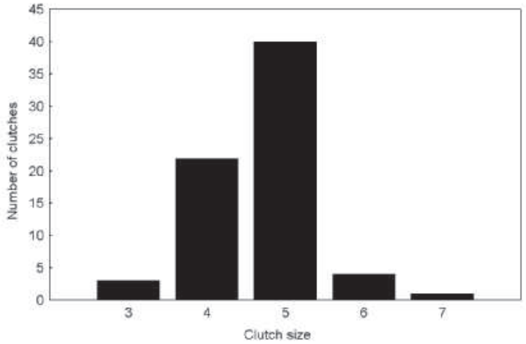

Figure 1. Frequency distribution of clutch sizes in Marsh Harrier nests ($n = 70$).
Frekvensfördelning för kullstorlek hos brun kärrhök.

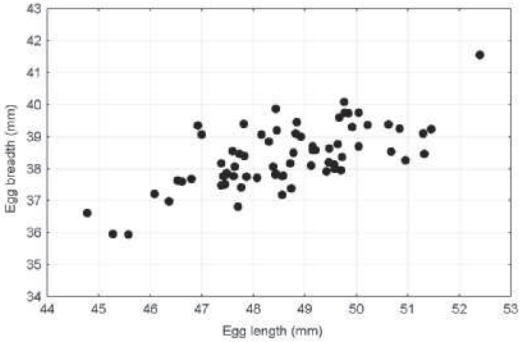

Figure 2. Correlation between within-clutch mean values of egg length and egg breadth in the Marsh Harrier ($n = 70$).
Korrelationen mellan kullmedelvärdena för äggens längd och bredd hos brun kärrhök.

populations (Witkowski 1989, Dijkstra & Zijlstra 1997). In the Netherlands, clutch size decreased significantly in 1975–1995 and was negatively associated with laying date (Dijkstra & Zijlstra 1997). The average clutch size was similar to or in the upper range of what has been described in other European studies. For instance, average clutch size in our study was smaller than recorded in the Barycz valley in SW Poland (5.0; Witkowski 1989), similar to that reported in Finland (4.66; Cramp 1980) and in the Netherlands (4.59–4.68; Dijkstra & Zijlstra 1997), and larger than the average clutch size recorded in Czech Republic (4.06–4.24; Němečková et al. 2008). In general, clutch size is related to food conditions (Lack 1966), and one could argue that the food resource in our study population was stable during study period. Clutch size could also potentially be influenced by the polygynous breeding system of the species. For instance, in a population of Marsh Harriers in Kristianstad, southern Sweden, some large clutches have been recorded which included eggs from more than one female

Table 1. Mean values and ranges of egg measurements in Marsh Harrier recorded at fishponds in eastern Poland in 2005–2008.
Medelvärden och variationsbredd för äggmått hos brun kärrhök vid fiskdammar i östra Polen 2005–2008.

	Mean ± SD	Range *Variationsbredd* (min–max)	
	Medel	Clutch means *Kullmedel* (N)	Eggs *Ägg* (N)
Length *Längd* (mm)			
2005	48.99 ± 1.37	46.62–52.40 (25)	44.8–54.2 (121)
2006	48.16 ± 1.68	44.78–51.30 (24)	39.8–52.2 (108)
2007	48.82 ± 1.45	46.36–51.45 (14)	45.6–52.5 (64)
2008	48.45 ± 1.41	46.08–49.72 (7)	45.8–51.4 (35)
Breadth *Bredd* (mm)			
2005	38.81 ± 0.97	37.37–41.55 (25)	36.3–42.2 (121)
2006	37.91 ± 0.95	35.94–39.36 (24)	32.5–40.3 (108)
2007	38.48 ± 0.89	36.98–39.86 (14)	36.3–40.6 (64)
2008	38.09 ± 0.48	37.20–38.58 (7)	36.5–39.2 (35)
Volume *Volym* (cm^3)			
2005	37.70 ± 2.72	33.57–46.14 (25)	32.5–47.2 (121)
2006	35.39 ± 2.75	30.02–40.00 (24)	21.4–41.3 (108)
2007	36.93 ± 2.49	32.33–40.38 (14)	31.6–42.1 (64)
2008	35.88 ± 1.74	32.53–37.32 (7)	31.3–38.7 (35)

(Roine Strandberg, personal communication). Similarly, at Samoklęski fishponds a probable case of polygyny was recorded by Nieoczym (2006). In our study, we did not detect any suspected cases with eggs from more than one female.

The egg dimensions were as follows: mean egg length = 48.60 ± 1.78 mm (n = 328), mean egg breadth = 38.36 ± 1.13 mm (n = 328) and mean egg volume = 36.53 ± 2.99 cm^3 (n = 328). Mean egg size values were similar to those reported in other studies (Glutz et al. 1979, Cramp 1980, Fefelov 2001). The studied eggs were smaller than noted in The Netherlands (Glutz et al. 1979) and in northwestern Russia (Fefelov 2001). They were very similar to those originating from the Barycz valley in southeastern Poland (Witkowski 1989) and Belgium (Glutz et al. 1979). Egg breadth (ANOVA; $F_{3,\,66} = 4.28$, $P < 0.01$) and egg volume (ANOVA; $F_{3,\,66} = 3.45$, $P < 0.01$) varied between years, but there was no difference between years in egg length (ANOVA; $F_{3,\,66} = 1.36$, $P = 0.27$, Table 1). Post-hoc tests indicated significant differences between eggs measured in 2005 and 2006 (Tukey test, $P < 0.01$ for egg breadth and $P < 0.05$ for egg volume). These results were surprising, because parameters that contribute to egg volume and egg length are generally more variable than egg breadth, which is thought to be limited by the diameter of the oviduct (Surmacki et al. 2003). Generally, the breadth of an egg is determined by the anatomy of the female, the egg volume by her physiology, and the egg length represents the proportion between these two traits (van Noordwijk et al. 1981). In birds, the differences in egg size are related to differences between females, which are in turn are linked to individual or environmental conditions (Swennen & van der Meer 1992, Nager & Zandt 1994). The correlation between egg length and egg breadth was highly significant (Pearson's correlation; r = 0.68, $P < 0.0001$, n = 70; Figure 2). This finding seems to be a more general rule and has been reported for many avian species (Mitrus & Rogala 2001, Zduniak & Antczak 2003, Profus et al. 2004). The largest eggs were found in clutches with four eggs (Figure 3), but egg dimensions (length, breadth and volume) did not vary significantly with clutch size (ANOVA; $F_{6,\,97} = 1.12$, $F_{6,\,97} = 0.24$, $F_{6,\,97} = 0.30$, ns). Witkowski (1989) found that the number of eggs in a clutch had no effect on their weight. Life history theory predicts a trade-off between the number and the size of propagules produced (Blackburn 1991). However, in our study we did not find a correlation between egg dimensions and clutch size, and also other recent studies show that clutch and egg size can be independent of each other in birds (Mitrus & Rogala 2001, Zduniak & Antczak 2003, Surmacki et al. 2003, Profus et al. 2004). Thus, our findings do not support predictions based on the hypothesis of optimal egg dimensions dependent on a negative relationship between clutch and egg size (Blackburn 1991).

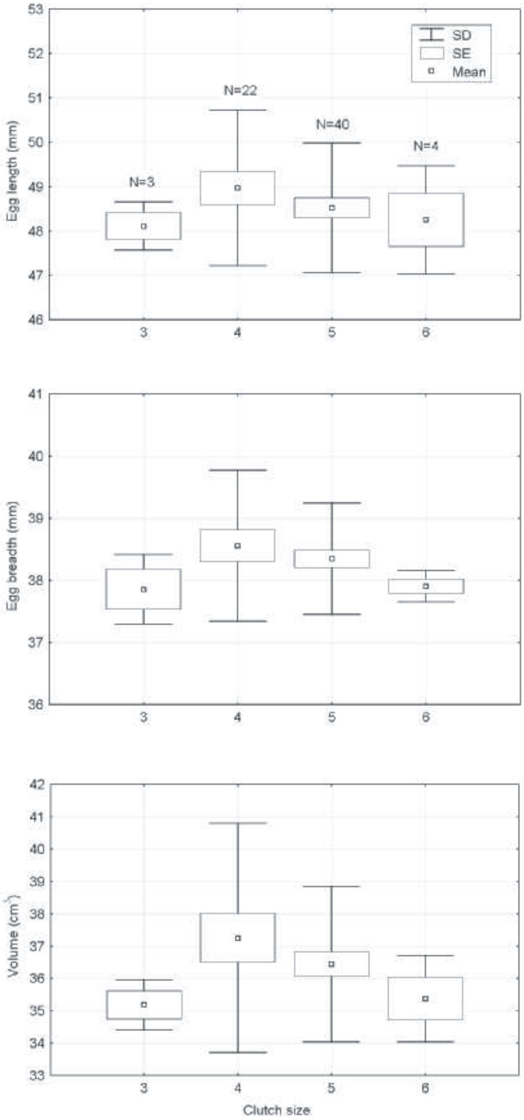

Figure 3. Variation in egg dimensions with clutch size in Marsh Harrier.

Variationen hos äggstorlek i förhållande till kullstorlek hos brun kärrhök.

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Sammanfattning

Hos fåglar är äggens storlek av betydelse för häckningsframgången eftersom storleken kan påverka ungarnas kondition och överlevnad efter kläckningen. Det finns dock en konflikt mellan äggstorlek och kullstorlek eftersom honans kondition bl.a. via födotillgången kan påverka hennes läggförmåga. En hypotes om optimal kullstorlek förutsäger därför att det skall finnas ett negativt samband mellan äggstorlek och kullstorlek.

I denna studie redovisar jag kullstorleken samt äggens längd, bredd och volym för 70 kullar med inalles 328 ägg hos bruna kärrhökar som häckade i vassar vid fiskdammar i Lublin-regionen i östra Polen åren 2005–2008. Medelvärden och spridning för äggmåtten visas i Tabell 1 och fördelningen av kullstorlekarna i Figur 1.

De vanligaste kullstorlekarna var fyra och fem ägg, medelvärdet 4,7 ägg. Det fanns ingen signifikant variation i kullstorlek mellan åren, vilket man dock funnit i andra populationer. Detta kan ha berott på att födotillgången var lika god alla fyra åren. Kullstorleken var med mindre variationer ungefär densamma som man funnit i andra bestånd i Europa.

Äggmåtten var också med bara mindre variationer likartade de som rapporterats från andra delar av Europa. Äggens bredd och volym men inte längden varierade signifikant mellan åren. Största effekten kom från en skillnad mellan åren 2005 och 2006. Resultatet var överraskande. Det brukar nämligen normalt vara längden som varierar mest eftersom bredden begränsas av honans äggledare. Allmänt anser man att äggets bredd bestäms av honans anatomi och volymen av hennes kondition, varefter längden blir ett automatiskt resultat av dessa två storheter. Det fanns en stark korrelation mellan äggens bredd och längd (Figur 2), något som är regel hos fåglar. Visserligen fanns de största äggen i kullar av den vanligaste kullstorleken (Figur 3), men en ANOVA-analys visade att det inte fanns något signifikant samband mellan kullstorlek och vare sig längd, bredd eller volym. I denna studie fann jag således inget stöd för hypotesen om att större kullstorlek ger mindre ägg och vice versa.

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Coloured tail-coverts in *Anser* × *Branta* goose hybrids despite all-white coverts in both parent species

Färgade stjärttäckare hos Anser × Branta *gåshybrider trots helvita täckare hos båda föräldraarterna*

C. G. GUSTAVSSON

Abstract

I tested the hypothesis that barred or dusky tail-coverts are common in *Anser*×*Branta* goose hybrids despite all-white coverts in both parent species. Thirty-two photographically documented *Anser*×*Branta* goose hybrids in the author's archive were assessed. Undertail-coverts were barred or more diffusely dusky in 23 out of the 30 individuals which could be fully evaluated. As to uppertail-coverts, there was some degree of barring or diffuse duskiness in 26 out of the 32 individuals. All-white upper- and undertail-coverts were seen in 1 out of 18 Greylag Goose × Greater Canada Goose hybrids and in 4 out of 5 Snow Goose hybrids; in one Snow Goose × Barnacle Goose hybrid and the only Greylag Goose × Lesser Canada Goose hybrid, barring was restricted to very few uppertail-coverts. In a domestic Swan Goose × Barnacle Goose, under-tail but not upper-tail coverts were coloured. The hypothesis that barred or dusky tail-coverts are common in *Anser* × *Branta* goose hybrids despite all-white coverts in both parent species is thus confirmed.

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Introduction

Unexpected features may occur in bird hybrids. One example is the white area next to the bill which in my experience is commonly found in Greylag Goose *Anser anser* × Greater Canada Goose *Branta canadensis* hybrids, but less commonly in the pure parent species.

In web-discussions and at his own web site, Dave Appleton suggested that barred or dusky undertail coverts might be another such unexpected feature which often is seen in crosses between *Anser* and *Branta* goose species, despite purely white coverts in both parent species (Appleton (www)). The aim of this study was to evaluate that hypothesis in a set of photo-documented *Anser* × *Branta* goose hybrids. In addition, also uppertail coverts were studied.

Material and methods

All *Anser* × *Branta* goose hybrids in the author's photo archive were evaluated, except one which has a parent species with dark coverts (Emperor Goose *Anser canagica*). The number of studied individuals from different species combinations in relation to estimated total numbers in Sweden is shown in Table 1. In several species combinations, the numbers of studied individuals were thus in the magnitude of the whole Swedish populations. Individuals no. 20–24, 26, and 30–32 in Table 2 were presented in a previous article (Gustavsson 2009) and the five Greylag Goose Anser anser × Barnacle Goose *Branta leucopsis* hybrids no. 20–24 in Table 2 are individuals A–E in that article.

There were 18 Greylag Goose × Greater Canada Goose hybrids, which on the one hand constituted a majority of the totally 32 subjects in this study, but on the other hand was only a fraction of the estimated totally 226 Greylag Goose × Greater Canada Goose hybrids in Sweden (Table 1). Eighteen individuals were however considered representative enough to get an idea about the prevalence of coloured tail coverts in that type of hybrid.

The study hypothesis was formulated in the spring 2008. The earlier collected part of the material was thus only reviewed retrospectively whereas later images were made also with this study in mind. Based on the impression that there would be both qualitative and quantitative differences between individuals, I categorised undertail covert colouration as barring or diffuse duskiness and when present I also quantified this on a scale from 0 (absent) to +++ (rich; Table 2). In some cases, it was not possible to achieve conclusive images. Such cases were classified as "?". For uppertail coverts, no differentiation between barring and diffuse duskiness was attempted.

Results

With respect to undertail coverts, the result was inconclusive for case 18 and partly inconclusive for case 16 (Table 2). Barred or more diffusely dusky undertail coverts were found in 23 out of the remaining 30 individuals and in all *Anser* × *Branta* goose hybrid combinations except the one bird where the *Branta* goose was a Lesser Canada Goose *Branta hutchinsii* and the five birds where the *Anser* parent was a Snow Goose *Anser caerulescens*. The only additional hybrid with all-white coverts was a Greylag Goose × Greater Canada Goose.

The degree and pattern of colouration differed both between and within different species combinations (Figures 1–5). The two most common hybrids were Greylag Goose × Greater Canada Goose and Greylag Goose × Barnacle Goose. In these, even the palest Barnacle Goose hybrid (Figure 3) had more extensive undertail covert colouration than the darkest Greater Canada Goose hybrid (Figure 1). Barring was the predominant colouration type when the *Branta* parent was a Greater Canada Goose, whereas a more diffuse dusky colouration was more common when the Branta parent was a Barnacle Goose.

The material included three presumed 1st Calendar year (1st Cy) Greylag Goose × Greater Canada Goose hybrids (individuals 4–6) which were studied repeatedly from 17 August until 14 October 2009. Some minimal barring of undertail and uppertail coverts was seen already at the first observation and at least in one of them there was also conspicuous barring of tail feathers (Figure 6). Tail covert barring then progressively increased and at the last observation 14 October, all three had undisputable barring of both undertail and uppertail coverts (Table 2, Figures 7–8). Dusky uppertail coverts during the first summer were also seen in the five Greylag Goose × Barnacle Goose hybrids whereas image quality did not allow evaluation of undertail coverts. In the other species combinations, only adult birds were documented.

In some Greylag Goose × Greater Canada Goose hybrids, barring and spotting of tail-coverts seemed to be transiently lost in late summer. In individuals 1 and 2, barring had thus been evident 15 October 2008 (Figure 1) and 19 September 2008 respectively. On the next observations 17 August 2009, only minimal barring (i.e. +) according to the classification scale) could be seen and only when thoroughly searched for at close range (Figure 9). In the beginning of September, there was again a low degree barring (i.e. +) which then increased to

Table 1. Number of hybrids in my study material (#H) compared to reported numbers (#05) of different Anser × Branta Goose hybrids in Sweden 2005 according to Kampe-Persson & Lerner (2007).
Antal hybrider i mitt studiematerial (#H) jämfört med rapporterat antal individer (#05) av olika Anser × Branta gåshybrider i Sverige 2005, enligt Kampe-Persson & Lerner (2007).

Branta	*Anser*	#H	#05
Greater Canada Goose *Kanadagås*	White-fronted Goose *Bläsgås*	0 *	6
	Greylag Goose *Grågås*	18	226
	Snow Goose *Snögås*	1	2
	Bar-headed Goose *Stripgås*	0	1
Lesser Canada Goose *Dvärgkanadagås*	Greylag Goose *Grågås*	1	0
Barnacle Goose *Vitkindad gås*	White-fronted Goose *Bläsgås*	0 *	1
	Greylag Goose *Grågås*	5	4
	Snow Goose *Snögås*	2 **	1–2
	Domesticated Swan Goose *Knölgås*	1	0
	Lesser White-fronted Goose *Fjällgås*	0 *	15
	Bar-headed Goose *Stripgås*	2	0

* = Not in the author's own material but pictures of individuals with coloured tail-coverts were found on Internet, see Discussion. *Inte i författarens material men bilder av individer med färgade stjärttäckare funna på Internet, se diskussion.*

** = Plus two in captivity. *Plus två i fångenskap*

Table 2. The occurrence tail covert colouration in relation to parent species and date of observation. Abbreviations: +++ = rich, ++ = moderate, + = poor, (+) = barely detectable, 0 = absent, ? = images not conclusive, [1] = 1st Cy, [2] = possible backcross with Branta canadensis, [3] = captive bird

Fynd i relation till föräldraarter och observationsdatum. Förkortningar: +++ = riklig, ++ = måttlig, + = svag, (+) = knappt noterbar, 0 = saknas, ? = bilder ej bedömbara, [1] = 1k, [2] = möjlig återkorsning med Branta canadensis, [3] = fågel i fångenskap

Ind. no.	*Anser*	*Branta*	Parentage *Föräldraskap*	Date *Datum*	Under tail coverts barring *Strimmiga undre stjärttäckare*	Dusky under tail coverts *Diffust mörka undre stjärttäckare*	Upper tail coverts colouration *Färgade övre stjärttäckare*
1	*anser*	*canadensis*	Presumed	15 Oct 2008	++	+	++
2	*anser*	*canadensis*	Presumed	18 Sep 2009	+	++	+
3	*anser*	*canadensis*	Presumed	18 Sep 2009	(+)	0	(+)
4[1]	*anser*	*canadensis*	Presumed	14 Oct 2009	++	0	+
5[1]	*anser*	*canadensis*	Presumed	14 Oct 2009	+	0	++
6[1]	*anser*	*canadensis*	Presumed	14 Oct 2009	+	0	++
7	*anser*	*canadensis*	Presumed	25 Jul 2009	++	(+)	++
8	*anser*	*canadensis*	Presumed	25 Jul 2009	++	++	+
9	*anser*	*canadensis*	Presumed	22 Aug 2009	+	(+)	+
10	*anser*	*canadensis*	Presumed	25 Jul 2009	0	0	0
11	*anser*	*canadensis*	Presumed	12 Sep 2009	++	+	++
12	*anser*	*canadensis*	Presumed	12 Sep 2009	+	+	+
13	*anser*	*canadensis*	Presumed	12 Sep 2009	+	0	+
14	*anser*	*canadensis*	Presumed	12 Sep 2009	+	?	+
15	*anser*	*canadensis*	Presumed	12 Sep 2009	+	+	+
16	*anser*	*canadensis*	Presumed[2]	12 Sep 2009	?	0	+
17	*anser*	*canadensis*	Presumed	12 Sep 2009	+	?	+
18	*anser*	*canadensis*	Presumed	12 Sep 2009	?	?	+
19	*anser*	*hutchinsii*	Presumed	12 Sep 2009	0	0	(+)
20	*anser*	*leucopsis*	Proven	5 Jun 2007	++	++	++
21	*anser*	*leucopsis*	Proven	10 Jun 2009	++	++	+
22	*anser*	*leucopsis*	Proven	28 Jun 2008	++	+	++
23	*anser*	*leucopsis*	Proven	28 Jun 2008	?	+++	0 / ++
24	*anser*	*leucopsis*	Proven	2 Oct 2009	++	+++	+ / ++
25	*caerulescens*	*canadensis*	Presumed	10 Oct 2006	0	0	0
26	*caerulescens*	*leucopsis*	Proven	11 Jul 2006	0	0	+
27	*caerulescens*	*leucopsis*	Presumed	26 Apr 2003	0	0	0
28[3]	*caerulescens*	*leucopsis*	Presumed	5 Mar 2010	0	0	0
29[3]	*caerulescens*	*leucopsis*	Presumed	5 Mar 2010	0	0	0
30	*cygnoides*	*leucopsis*	Presumed	8 Jul 2006	0	++	0
31	*indicus*	*leucopsis*	Presumed	Feb 2004	++	?	++
32	*indicus*	*leucopsis*	Presumed	12 Jul 2008	0	++	+

be fully developed again when both birds were last seen 14 October 2009. In individual 8 (Table 2), barring had been obvious 25 July 2009 but was reduced though still well visible on the next observation 22 August 2009. In yet another bird, individual 3, no barring was seen until the last observation 18 September 2009 when there was a very faint and thin barring which was visible only at extremely close range (Figure 2).

As to uppertail coverts, these were found to be coloured in 26 out of the 32 hybrids. This number is slightly higher than for undertail coverts. The difference was due to the absence of inconclusive results and to minimal barring in two cases with all-white undertail coverts; one of the four Snow Goose × Barnacle Goose hybrids and the only Greylag Goose × Lesser Canada Goose. On the other hand, only white uppertail coverts could be

Figure 1. Individual 1. This is one of the Greylag Goose x Canada Goose hybrids with the richest barring of both undertail- and uppertail-coverts, classified as ++. 15 October 2008.
Individ 1. Detta är en av grågås x kanadagås hybriderna med den mest uttalade tvärstimmigheten på både de undre och övre stjärttäckarna, klassificerade som ++. 15 oktober 2008.

Figure 2. Individual 3. This was the only occasion when some faint barring of the tail coverts could be ascertained in this bird. 18 September 2009.
Individ 3. Detta var det enda tillfälle då en svag strimmighet på stjärttäckarna kunde säkerställas på denna fågel. 18 september 2009.

Figure 3. Individual 22. This is the palest of the five Greylag Goose x Barnacle Goose hybrids but it is still darker than the darkest Greylag Goose x Canada Goose hybrids. 28 June 2008.
Individ 22. Detta är den blekaste av de fem grågås x vitkindad gås hybriderna men den är ändå mörkare än den mörkaste av grågås x kanadagås hybriderna. 28 juni 2008.

Figure 4. Individual 23. This is the darkest of the Greylag Goose x Barnacle Goose hybrids, with diffuse greyish-brown colouration of undertail- and uppertail-coverts. 28 June 2008.
Individ 23. Detta är den mörkaste av grågås x vitkindad gås hybriderna, med diffus gråbrun mörkfärgning av undre och övre stjärttäckare. 28 juni 2008.

Figure 5. Individual 24. This Greylag Goose x Barnacle Goose hybrid has a number of colouration varieties with diffuse duskiness of undertail-coverts but also greyish black barring, pale barring and brownish areas. 2 October 2009.
Individid 24. Denna grågås x vitkindad gås hybrid har flera färgvarianter, med diffust mörka undre stjärttäckare men också gråsvart strimmighet, ljus strimmighet och brunaktiga områden. 2 oktober 2009.

Figure 6. Presumably individual 4. On the first observation 17 August 2009, there was very faint barring of a few undertail-coverts in this 1st Cy Greylag Goose x Canada Goose hybrid but several tail feathers were conspicuously barred.
Antagligen individ 4. Vid första observationstillfället 17 augusti 2009 fanns det mycket svag strimmighet på några undre stjärttäckare på denna 1k grågås x kanadagås hybrid men flera stjärtfjädrar var iögonenfallande tvärstrimmiga.

Figure 7. Individual 4. On the latest observation 14 October 2009, this was the 1st Cy Greylag Goose x Canada Goose hybrid with the richest barring of undertail-coverts.
Individ 4. Vid den senaste observationen 14 oktober 2009 var detta den 1k grågås x kanadagås hybrid som hade mest tvärstrimmighet.

Figure 8. Individual 6. On the latest observation 14 October 2009, this was the 1st Cy Greylag Goose x Canada Goose hybrid with the poorest barring.
Individ 6. Vid den senaste observationen 14 oktober 2009 var detta den 1k grågås x kanadagås hybrid som hade minst tvärstrimmighet.

Figure 9. Please compare to Figure 1 – this is also individual 1. At the earliest observation date 17 August 2009, only minimal barring just below the flight feathers could be seen.
Jämför med Figur 1 – detta är också individ 1. Vid tidigaste observationsdatum 17 augusti 2009 sågs bara minimal tvärstrimmighet just nedom vingpennorna.

Figure 10. Individual 26. Only three out of several hundred pictures from various angles showed a few barred feathers in this Snow Goose x Barnacle Goose hybrid. 5 September 2007.
Individ 26. Bara tre av flera hundra bilder från olika vinklar visade ett fåtal strimmiga fjädrar på denna snögås x vitkindad gås hybrid. 5 september 2007.

Figure 11. Individual 16. This bird was classified as Greylag Goose x Canada Goose but differs from the other hybrids of that species combination. Backcross with Canada Goose? 12 September 2009.
Individ 16. Denna fågel klassificerades som grågås x kanadagås men skiljer sig från övriga individer av den artkombinationen. Återkorsning med kanadagås? 12 september 2009.

Figure 12. Greyish brown barring of undertail- and uppertail-coverts was also seen in several birds which were considered to be 1st Cy pure Canada Geese but not in any adult bird. 22 August 2009.
Gråbrun tvärstrimmighet på undre och övre stjärttäckare såg också på flera fåglar som uppfattades vara 1k artrena kanadagäss men inte hos någon adult fågel. 22 augusti 2009.

Figure 13. Partly dusky uppertail-coverts in a 1st Cy Greylag Goose. 17 July 2010.
Delvis gråa övre stjärttäckare på en 1k grågås. 17 juli 2010.

seen in the domesticated Swan Goose × Barnacle Goose hybrid which had dusky undertail coverts.

Discussion

This study confirms the hypothesis that barred and spotted undertail coverts are common in *Anser* × *Branta* goose hybrids despite all-white coverts in both parent species. This applies to hybrids of two out of the three studied *Branta* species, Barnacle Goose and Greater Canada Goose, and to all *Anser* species except Snow Goose. The Greylag Goose × Lesser Canada Goose hybrid and the five Snow Goose hybrids had all-white undertail coverts. In addition, not only undertail but also uppertail coverts were barred or spotted in several individuals of several species combinations, also including one of the four Snow Goose × Barnacle Goose hybrids (Figure 10) and the Greylag Goose × Lesser Canada Goose hybrid.

Reasons for negative and inconclusive results

In 3 out of totally 18 presumed Greylag Goose × Greater Canada Goose hybrids, no barring of undertail coverts could be detected (individuals 10, 16, and 18). This may have several causes:

1. The bird is indeed a F1 hybrid with all-white tail coverts.

2. The observation was made at a disadvantageous time in a bird in which repeat observation at another time might have provided a different result. In individuals 1 and 2, barring was thus evidently reduced to be barely detectable for a short period during moulting in late summer. In individual 3, it was not until the last of several observations that a very faint and thin barring of undertail coverts could be registered. Individual 10 was observed only once, 25 July 2009. It is thus uncertain whether its all-white coverts could be due to such a temporal phenomenon, or if the bird constantly carried all-white coverts.

3. Methodological problems may lead to falsely negative or inconclusive results. Barring may be present but so faint and thin that it can be seen only at short range and under optimal conditions (e.g. individual 3). Evaluations were made from photographs of wild birds using focal lengths of 400–1600 mm and detail enlargements. Even so, it was in some cases difficult to come close enough to achieve sufficient image quality. Thin barring similar to that in individual 3 could thus probably not have been visible in individual 16. More marked colouration should however not have gone unnoticed. That particular case was thus regarded as partly inconclusive. Among other circumstances which may have interfered with registration quality are reflexes from the water or otherwise disadvantageous light conditions, unsuitable body positions of the bird, and disturbing vegetation. In individual 18, only a small part of the undertail coverts were visible and no conclusion could be drawn.

4. The bird may not be a F1 hybrid but a backcross. This possibility cannot be excluded in individual 16 (Figure 11), which may be a (Greylag Goose × Greater Canada Goose) × Greater Canada Goose. Such a backcross should be expected to be more similar to pure Greater Canada Geese, and could maybe for that reason have all-white tail coverts.

Different colour pattern in Barnacle Goose and Greater Canada Goose hybrids

Greylag Goose hybrids had a more diffuse dusky type of tail covert colouration in crosses with Barnacle Goose and a more barred type in crosses with Greater Canada Goose. All five Barnacle Goose hybrids were siblings and it can thus not be ruled out that their colouration pattern is a heritage from a single genetically extreme parent individual rather than representative for the species combination as such. However, the more diffuse type of duskiness was seen also in other Barnacle Goose crosses such as Swan Goose × Barnacle Goose and Bar-headed Goose × Barnacle Goose. This favours the alternative that the different colour patterns are indeed correlated to the parent species.

Missing species combinations

One important limitation of the study was that some of the species combinations, which according to Kampe-Persson & Lerner (2007) were reported to occur in Sweden 2005 (Table 1), were missing in the study material, most notably the not too uncommon Lesser White-fronted Goose *Anser erythropus* × Barnacle Goose *Branta leucopsis* hybrid. The other missing hybrids were White-fronted Goose *Anser albifrons* × Greater Canada Goose, Bar-headed Goose *Anser indicus* × Greater Canada Goose, and White-fronted Goose × Barnacle Goose. However, a web search found coloured tail coverts also in Lesser White-fronted Goose × Barnacle Goose (Lehto (www)), White-fronted Goose × Greater Canada Goose (Schmoker (www)) and White-fronted Goose × Barnacle Goose hybrids (Smith (www)). These crosses are marked * in Table 1. Out of the species which were reported to occur in Sweden 2005, it was thus only Bar-headed Goose × Greater Canada Goose which I could not locate any picture of. In addition to the species combinations reported by Kampe-Persson & Lerner (2007), coloured tail coverts were also found in pictures of domesticated Swan Goose *Anser cygnoides* × Greater Canada Goose *Branta canadensis* (Randler 2001, Sweet (www)). Accordingly it seems as if coloured tail coverts are common also in the *Anser* × *Branta* species combinations which were not included in the study material.

Are coloured tail-coverts a preserved juvenile feature?

In late summer, several individuals which were all thought to be 1st Cy pure Canada Geese had barred undertail and uppertail coverts (Figure 12). This was not seen in adult birds. Partly grey colour of uppertail-coverts but with a more even distribution was also seen in all five closely examined 1st Cy Greylag Geese (Figure 13) and like in the Greylag Goose × Barnacle Goose hybrids (e.g. in Figure 4) it was the median half of the feathers that were darkest. My speculative explanation for coloured tail coverts in the hybrids is thus that they are modified juvenile features which are not only preserved in adulthood but often also enhanced in the hybrids.

Acknowledgements

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Sammanfattning

Strimmiga och mörkfläckiga undre och övre stjärttäckare verkar vara vanliga hos hybrider mellan *Anser* och *Branta* gäss, även i de fall då båda föräldraarterna har helvita täckare. Fenomenet undersöktes på 32 dokumenterade *Anser* × *Branta* hybrider i författarens bildarkiv. Tabell 1 visar antalet studerade individer i de olika artkombinationerna i relation till det av Kampe-Persson och Lerner (2007) uppskattade totala antalet exemplar i Sverige. I flera av artkombinationerna är alltså antalet studerade fåglar jämförbart med hela den svenska populationen. Vad gäller grågås × kanadagås utgör 18 studerade fåglar bara en liten del av det uppskattade totalantalet 226, men bedömdes ändå vara

ett tillräckligt representativt antal. Utöver de av Kampe-Persson och Lerner (2007) rapporterade artkombinationerna ingick ytterligare tre kombinationer i materialet: grågås × dvärgkanadagås, knölgås × vitkindad gås och stripgås × vitkindad gås. Bland de artkombinationer som saknas i materialet märks framför allt fjällgås × vitkindad gås.

Tabell 2 visar de studerade individerna. I ett fall kunde de undre stjärttäckarna inte bedömas, och i ett annat fall kunde bara mera uttalad mörkfärgning uteslutas (individerna 18 och 16). Av de resterande 30 individerna hade 23 strimmiga eller mera diffust mörkfärgade undre stjärttäckare. Helvita undre stjärttäckare såg hos alla 5 snögåshybriderna, den enda hybriden grågås × dvärgkanadagås, samt 1 av 18 hybrider grågås × kanadagås. Vid jämförelse mellan grågås × kanadagås och grågås × vitkindad gås hade de förstnämnda mindre av diffus mörkfärgning men lika mycket eller mer av tvärstrimmighet på de undre stjärttäckarna. Även de övre stjärttäckarna bedömdes och där var bildkvalitet och projektioner tillräckliga hos samtliga. Någon grad av mörkfärgning av övre stjärttäckare såg hos 26 av 32 individer. Vita övre stjärttäckare såg hos 4 av 5 snögåshybrider, hos den hybrid grågås × kanadagås som också hade vita undre täckare, samt hos den enda hybriden knölgås × vitkindad gås. Den femte snögåshybriden och hybriden grågås × dvärgkanadagås hade endast enstaka strimmiga övre täckare.

Studien bekräftade således hypotesen att strimmiga eller diffust mörka undre stjärttäckare är vanligt förekommande hos *Anser* × *Branta* gåshybrider, även om båda föräldraarterna har helvita täckare. Även de övre stjärttäckarna är ofta mörkfärgade. De fem hybriderna med snögås utgjorde ett undantag, med vita undre täckare hos alla fem och vita övre täckare hos fyra. Bedömning av fotografier från internet tyder på att färgade stjärttäckare förekommer även vid flera artkombinationer som inte ingick i materialet; dessa har i Tabell 1 markerats med *. Strimmiga täckare sågs också hos en del 1k kanadagäss (Figur 12) men inte hos adulta kanadagäss. Samtliga fem noga undersökta 1k grågäss hade delvis gråfärgade täckare (Figur 13). Kanske är de mörkfärgade täckarna hos hybriderna någon form av juvenil karaktär som behålls av adulter?

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Effect of urbanization and feeding intensity on the distribution of wintering Mallards *Anas platyrhynchos* in NE Poland

Effekt av urbanisering och matning på förekomsten av övervintrande gräsänder Anas platyrhynchos *i nordöstra Polen*

MICHAŁ POLAKOWSKI, MICHAŁ SKIERCZYŃSKI & MONIKA BRONISZEWSKA

Abstract

Urban areas are alternative wintering sites for species with ability to exploit the new conditions that cities offer, such as food, shelter and reduced predation. During four winters (November–February), we recorded the number of Mallards along 108 km of rivers within an urbanization gradient from city centre to rural in north-east Poland. In the urban area, but not in the suburban and rural areas, there was an increase of numbers through winter with highest numbers in February, the coldest month. However, we found no correlation between numbers and ice cover. The only correlation was with feeding intensity by humans, and we suggest that intensity of feeding and the location of the feeding sites is the main factor determining number of wintering Mallards. This was supported by recoveries of ringed birds. Mallards ringed at good feeding sites in the city centre were recovered at the same sites whereas birds ringed in the periphery of the city tended to move to the centre in subsequent winters.

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Introduction

Adaptation to urban ecological niches requires changes in the behaviour and ecology of species primarily occupying non-urban (rural and wild) areas. For example, urban populations of Blackbird *Turdus merula*, Mallard *Anas platyrhynchos*, Coot *Fulica atra*, Mute Swan *Cygnus olor*, and Rook *Corvus frugilegus* in Central Europe usually spend winters in their urban breeding areas, while rural populations of these species migrate over long distances to their wintering sites (review in Luniak 2004). Reduction of seasonal migrations is a consequence of better wintering conditions within cities, particularly related to the milder urban microclimate, providing snow-free spaces and ice-free waters (Avilova 2008, Brauze & Kurkowski 2008).

The urban populations of these species are usually characterized by a year-round high population density, mainly due to lower predation pressure and rich anthropogenic food resources (leftovers, feeding by people). Such opportunities are attractive to many bird and mammal species, leading to changes in their feeding behaviour (Guillemain et al. 2002, Charalambidou et al. 2005, Jones & Reynolds 2008). In the Mallard, anthropogenic food resources contribute to a substantial (sometimes the main) diet component, particularly during winters (Polańska & Meissner 2008). The distribution of feeding sites as well as the feeding intensity are important factors affecting abundance and density of Mallards during winter periods (Jones & Reynolds 2008). In the breeding season it is the availability of suitable nesting sites, dispersed within the matrix of built-up areas, that determines the density of urban populations (Huhtalo & Järvinen 1977).

The Mallard seems to be a species that has adapted particularly well to urban conditions across Europe (Cramp & Simmons 1977, Engel et al. 1988, Luniak 2006). In Poland it is reported as the most numerous over-wintering species (e.g. Brewka 1993, Mazurek & Polakowski 2002, Piotrowska 2003, Tomiałojć & Stawarczyk 2003, Zieleniak 2007, Ławicki et al. 2008), which can be observed in urban areas (Hebda 2001, Biaduń 2005, Luniak 2006). However, we are not aware of any study of

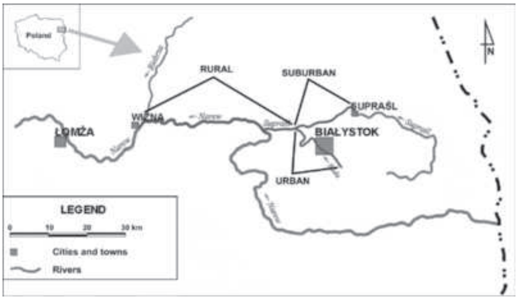

Figure 1. Study area. *Undersökningsområde.*

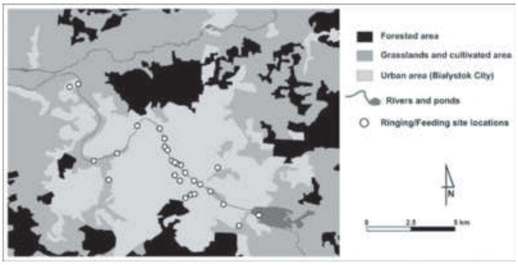

Figure 2. Locations of ringing and feeding sites in the Białystok City.
Lokalisering av platser för ringmärkning och matning i Białystok (små cirklar). Svart är skog, mörkgrått jordbruksmark och ljusgrått tätort.

its distribution in urban and suburban areas under varied winter conditions, including the aspect of feeding intensity. In this paper we investigate the influence of different weather conditions, presence of ice cover and varying food supply on the distribution of wintering Mallards in urban, suburban and rural environments.

Material and methods

This study was carried out in North Podlasie (NE Poland), which is the coldest region in Poland outside the mountains, and therefore provides a good opportunity to study over-wintering bird communities. The data was collected during four winter seasons (2005/2006–2008/2009), in the frame of the regional Wintering Birds Survey headed by The Polish Society for Birds Protection and the Biology Students Scientific Circle at the Institute of Biology, University of Bialystok. Observations were collected along rivers, along 108 km altogether (Figure 1). Each part of the rivers was assigned to one of three categories regarding the urbanization gradient of the surrounding area: (1) urban – Białystok City with the Biała River, (2) suburban – the Supraśl River from Supraśl Town to Fasty Village, and (3) rural – the Supraśl River from Fasty Village to the Narew River and the Narew River from Złotoria Village to Wizna Town. Surveys lasting 2–4 days were done in the middle of each month (from November through February).

Simultaneously, we captured and marked Mallards at 27 ringing sites within the urban area in order to investigate the level of attachment of individual birds to feeding sites between two subsequent winter seasons (Figure 2). At each ringing site, the area of ice cover on the river was recorded, as well as the feeding intensity, expressed as the number of people feeding birds per one hour. A total of 225 Mallards was ringed. They were trapped using a loop-trap made of a fishing line of 0.33 mm diameter, placed on the ground across the ducks' usual route to the water and with bait in the loop. The observer then pulled the line that tightened on the bird's leg. This method is successfully applied in Poland for capturing ducks (*Anas* sp.), geese (*Anser* sp. and *Branta* sp.), gulls (*Larus* sp.) and other birds (M. Polakowski – own unpublished data), and performed by an experienced person this method is equally safe for birds as other capturing techniques.

Statistical tests were performed using Kruskal-Wallis non-parametric analysis of variance and Friedman test in SPSS 12.0 PL for Windows.

Results and discussion

The number of wintering Mallards differed between the habitat categories (Figure 3). Most Mallards wintered in the urban area (Białystok City). The smallest numbers were found in the suburban area, whereas rather high numbers were recorded in the rural area (Narew River).

Mallard abundance did not differ significantly between winters in any of the three considered areas when data from all months were pooled (Figure 3). However, we observed significant increase in the number of individuals in the urban area from November to February ($\rho = 0.679$, $p < 0.01$), whereas numbers remained similar throughout the winter in suburban and rural areas. The increase of the number of individuals during the winter in the urban area was probably caused by relatively little ice on rivers within the city, compared to suburbs

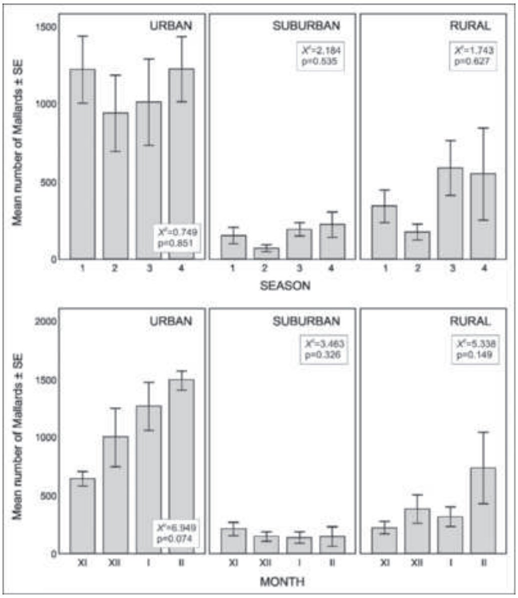

Figure 3. Comparison of mean numbers of wintering Mallards between different winter seasons (upper) and months (lower) under various urbanisation gradients.
Medeltal övervintrande gräsänder olika vintrar (överst) och månader (nederst) i biotoper med olika grad av urbanisering.

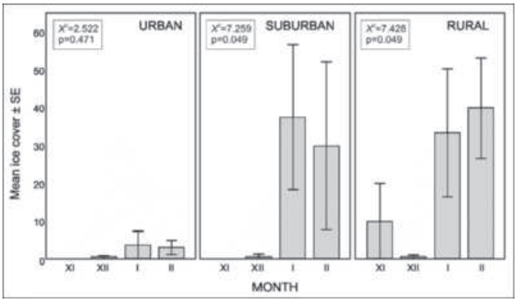

Figure 4. Mean ice cover (percent) in different months in the three habitats with different level of urbanisation.
Istäckning (procent) olika månader inom de tre områdena med olika urbanisering.

and rural area (Figure 4). However, no significant effect of ice cover could be found when this was tested.

There were no significant differences in the mean feeding intensity between months ($\chi^2 = 0.018$, df = 3, p = 0.895). We found that Mallard abundance was positively correlated with feeding intensity ($\rho = 0.534$, $p < 0.01$). Sites with highest feeding intensity (from 4.0 to 5.0 persons per hour), were mostly found in the city centre, while low feeding intensity sites (from 0.5 to 1.5 persons per hour) were located in the peripheral area of the city. We assumed that no feeding occurred in the suburban and rural areas, since we did not observe such activities during field surveys.

Twenty-four ringed Mallards were recaptured in a subsequent winter. Fourteen of them were both ringed and recovered in the city centre. Eight birds that had been ringed in the periphery of the city were recovered at feeding sites in the centre. The remaining two recoveries were made in the city periphery. Individuals ringed at low feeding intensity sites (regardless whether it was the city centre or the periphery) were recovered at sites where feeding intensity was higher than at the ringing site (Figure 5).

The facts that we could find no significant effect of ice cover, the tendency of recovered birds to move from poorer to better feeding sites, and the strong increase of birds in the urban area (they gathered in the city centre where the feeding intensity was highest as the winter became colder) suggest that the main factor affecting wintering Mallard abundance was the location of feeding sites and feeding intensity.

We also observed that during the coldest months (bigger ice cover in sub-urban and rural areas than in the city centre) a high number of Mallards moved into the urban area, reaching the maximum number ever recorded during this study. This suggests that birds from outside the study area were also winter-

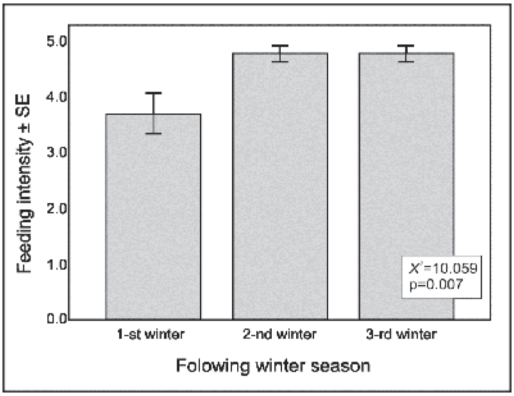

Figure 5. Mallard feeding site choice in following winter seasons.
Val av födosöksområde vinter efter märkning.

ing in the city. This observation can be explained by the migration of birds that usually winter in artificial lakes and ponds around the city. When these lakes had frozen, birds moved into the city which was the closest alternative wintering site.

Our results suggest that both the density and the distribution of wintering Mallards in urban areas are determined mainly by the intensity of feeding and the location of feeding sites. We found that Mallards ringed at good feeding sites in the city centre were recovered at the same sites in subsequent seasons, while birds ringed in the peripheral area tended to move to the centre during the following winters. Moreover, our results show an interesting foraging behaviour of Mallards, where individuals were able to localise good feeding sites from one winter season to another.

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Sammanfattning

De fåglar som anpassat sig till tätorternas annorlunda ekologiska nischer har ofta andra vanor än sina artfränder på landsbygden eller ute i den vilda naturen. Exempelvis övervintrar fåglar som häckar i tätorter i högre grad än de som lever på landsbygden, vilka kan flytta långa sträckor. Arter som i hög grad anpassat sig till urbana miljöer är bl.a. koltrast, sothöna, knölsvan och råka. De har funnit gynnsamma betingelser för övervintring och har ofta tätare bestånd året runt i städerna än uti i naturen. Beroende på art kan orsaken vara gynnsammare mikroklimat, lägre predation eller ett rikare utbud av föda. Gräsanden är en annan art som särskilt väl anpassat sig till urbana förhållanden vintertid på många håll i Europa. Exakt vad som bestämmer antalet övervintrande gräsänder är dock mindre väl känt, och särskilt vilken betydelse som människans utfodring har.

Vi studerade de övervintrande gräsänderna i nor-

ra Podlasie i nordöstra Polen, den kallaste delen av landet nedom bergen. Data insamlades under 2–4 dagar i mitten av varje månad från november till februari under fyra vintrar (2005/2006–2008/2009). Räkningarna utfördes längs 108 kilometer flodsträckor, som delades upp i tre grader av urbanisering utifrån omgivningarna: urban (city), suburban och rural (landsbygd). Antalet gräsänder räknades i alla tre miljöerna. I den urbana delen registrerade vi också matningen i form av antal personer som matade per timme på olika ställen. Vi fångade och märkte gräsänder på olika platser i den urbana delen, både i centrum och i periferin. Vi registrerade också isläget vid varje tillfälle och på varje plats. Totalt märktes 225 gräsänder.

Antalet övervintrande gräsänder skilde sig mellan de tre biotoperna (Figur 3). De högsta antalen fanns i Białostok centrum och de lägsta på platser i de suburban miljöerna. Däremot fanns ganska många där floder rann genom landsbygd. Det var ingen skillnad i antal mellan vintrarna när man slog ihop alla månader. Däremot noterade vi en signifikant ökning under vinterns lopp i stadsmiljön med högst antal i februari, den kallaste månaden. Möjligen kunde detta bero på mindre is på floden i centrum, men vi fann dock ingen statistiskt signifikant effekt av isläget.

Vi registrerade inga skillnader i matningsintensitet mellan olika månader. Men gräsändernas antal var signifikant korrelerat till människornas matningsintensitet, och denna var högst just i centrum men lägre mot periferi i den urbana miljön. Vi tror att det inte förekom någon matning i den suburbana och rurala miljön, något som vi dock inte studerade.

Märkningarna resulterade i 24 återfångster ett senare år. Fjorton fåglar både märktes och återfångades på samma platser i centrum. Åtta fåglar som märkts i periferin återfångades i centrum. De återstående två fåglarna återfångades i periferin. Oberoende av var de märkts återfångades fåglarna på platser där det var högre matningsintensitet än där de märkts (Figur 5).

Det faktum att vi inte fann något signifikant samband med istäckningen, tendensen att fåglarna flytta från sämre till bättre matplatser och den kraftiga ökninen av gräsänder i centrum under den kallaste månaden tolkar vi som att huvudfaktorn som bestämmer antal och plats för övervintring var människornas matning.

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Immature Long-tailed Skuas *Stercorarius longicaudus* in Swedish Lapland in 2009

Förekomst av unga fjällabbar Stercorarius longicaudus *i Lappland under 2009*

ROB VAN BEMMELEN

Abstract

Between 12 and 27 June 2009, 10 immature Long-tailed Skuas *Stercorarius longicaudus* were recorded in breeding areas in Swedish Lapland. Based on plumage characters, these were aged as 3rd calendar year birds. The fraction of immatures in the total number of aged birds was 4–10%, which seems to be in accordance with maximum abundances of immatures reported in earlier studies. The first immature birds were sighted about two weeks after the arrival of adults. There was no breeding this year, and adults and immatures both departed at the end of June. Prospecting before being recruited into the breeding population may enhance early arrival in later years, which in turn may increase the probability to recruit.

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Introduction

In long-lived, long-distance migrants, immatures may visit future breeding grounds in one or more years before breeding for the first time. Generally, these prospecting visits and breeding commence at a higher age in larger species and species with a higher expected life-span (Becker & Bradley 2007, Weimerskirch 2002). For example, Common Terns *Sterna hirundo*, with an average adult survival of around 85–90%, usually start prospecting in their 3rd calendar year (hereafter abbreviated to “cy”) and do their first breeding attempt a year later (Becker et al. 2001), whereas Wandering Albatross *Diomedea exulans*, with an adult survival rate of around 95%, start prospecting in their 7th cy and breed for the first time mostly in their 11th cy (Weimerskirch 1992).

For the Long-tailed Skua *Stercorarius longicaudus*, a transequatorial migrant seabird breeding on (inland) Arctic tundras, it has been suggested that breeding commences in the 4th cy (de Korte 1985). Immatures in their 2nd and 3rd cy have been recorded prospecting the breeding grounds. This has been relatively well-documented at breeding grounds in Greenland (de Korte 1984, de Korte 1985, Meltofte 2007, Meltofte & Hoye 2007), and has been mentioned shortly for Swedish Lapland (Andersson 1976) and Alaska (Howell 1999). Here, I report observations of 3rd cy Long-tailed Skuas in Swedish Lapland in 2009.

Methods

Sightings of Long-tailed Skuas were recorded during breeding bird surveys in tundra areas north-west (Raurejaure) and south-west (Äjvesåjvvie) of the village of Ammarnäs (N 65°57', E 16°12'). Rodent densities were low and all Long-tailed Skuas refrained from breeding and roamed over the tundra alone or in flocks. Flocks were counted and scanned for immatures. Immatures were documented by field sketches and, if possible, photos. These dedicated observations were carried out on 14–27 June 2009. Additional observations from 27 May to 19 July, including areas north (Gelmetje) and north-east (Björkfjället) of Ammarnäs, were received from other observers.

Results

After the first immature was observed on 12 June in the Raurejaure area (Johannes Hungar in litt), there were 10 sightings of immature Long-tailed Skuas. Differences in plumage, most notably the length of the central tail-feathers, the absence or presence of a breast-band and the amount of grey and dark brown feathers among the scapulars and wing-coverts, showed that these sightings concerned 10 individuals. The last immatures were seen on 27 June – which was the last day any skuas were seen in the area (Johannes Hungar in litt). Immatures were only seen in the Raurejaure area and at mount Äjvesåjvvie. Adult Long-tailed Skuas were also seen in two nearby areas (Gelmetje and Björkfjället). The immatures were encountered in five of the six flocks of five or more Long-tailed Skuas. The highest day-counts were 19 adults and two immatures on 16 June in the Raurejaure area and 98 adults with four immatures on 27 June at Äjvesåjvvie. Based on these figures, immatures comprised 4–10% of the total number of Long-tailed Skuas. For comparison of this value with other studies, I corrected absolute numbers of immature birds reported in two previous studies by an estimation of the number of aged individuals. The latter was derived from the size of the breeding population. Meltofte & Hoye (2007) report immatures and the number of breeding pairs for 1996–2006 from NE Greenland. The two years with the highest numbers of immatures were 2003 and 2004, when respectively 6 and 5 individuals were seen. With 29 and 21 breeding pairs, corresponding to 58 and 42 aged adults, the percentage of immatures in these years was 9 and 11%, respectively. In Northern Sweden, the number of immatures reported by Andersson (1976) in 1968, a very poor breeding year, was at least 5 and at most 10 birds. In that year, 70 km2 were surveyed. The maximum breeding density found by Andersson (1976) was 0.6 pairs per km2. This translates into a potential of 42 pairs or 84 individuals for the area. Thus, immatures would make up about 6–11% of maximum population size. For the other years, in which only one or two immatures were seen, the percentage of immatures was 2–6%.

Plumage characters of the observed immatures are summarized in Table 1. Variation between individuals was extensive, but some parallels are apparent. All immatures had an adult-like head pattern and with a single exception (see below), all had a white central belly. If present, central tail-feathers were elongated in four out of six individuals to about half the length of those of adults. All individuals that could be studied while perched showed a mix of grey adult-type and dark brown immature-type scapulars and wing-coverts (the latter sometimes with a pale fringe) – but the proportions of each feather type varied widely. Underwing-patterns showed similar variation. Bars on the underwing and axillaries could be broad or thin. One of two individuals that could be photographed is depicted in Figure 1. One individual (seen on 27 June) differed markedly from the others, being much darker and showing elongated central tail-feathers as long as in adults (Figure 2). The slightly barred axillaries and the blotched upper breast indicate its immaturity.

Discussion

These sightings confirm the occurrence of 3rd cy Long-tailed Skua at the Swedish breeding grounds. Plumage characteristics of immatures recorded in 2009 in Ammarnäs are consistent with what has been described for 3rd cy Long-tailed Skua (Howell 2007). Separation of 3rd cy from 2nd cy birds is based on the adult-type head pattern (which in 2nd cy is similar to that of juveniles), the presence of grey adult-type scapulars and coverts (dark immature-type in 2nd cy) and the projection of the central tail feathers (shorter in 2nd cy) (Olsen & Larsson 1997, Howell 2007, van Duivendijk 2009). The large variation between individuals in the proportions of adult and immature type feathers, which belong apparently to the same moult cycle, and the length of the central tail feathers, may be the result of individual variation in hormone levels and the timing of moult (Howell 2007). It is unlikely that the immatures seen in Ammarnäs in 2009 were in their 4th cy as no Long-tailed Skuas bred in the area in 2006 and hence no young were produced. Moreover, there were no birds observed that fitted the ageing criteria proposed by Olsen & Larsson (1997). All currently used ageing criteria have not been backed up by specimens of known age (de Korte 1984, Howell 2007) and should therefore be treated with some caution. This especially holds for 4th cy, as these birds can probably not be separated from adults whith retained winter feathers.

One individual superficially resembled a dark morph, but showed barred axillaries (Figure 2). According to Roselaar & Prins (2000), who documented the sole record of an immature (probably 3cy) dark morph Long-tailed Skua, genuine dark morph Long-tailed Skuas show plain dark feathers with pale tips, as opposed to dark examples of the barred morph showing barred feathers. Therefore, this individual is probably better treated as a dark example of the barred morph. Whether it also had a dark barred morph juvenile plumage, remains unknown – as individual immature skuas are virtually impossible to follow over several years, it is unknown how plumage morphs may change across years and seasons.

Table 1. Plumage characters of immature Long-tailed Skuas seen in Ammarnäs in 2009.
Dräktkaraktärer hos unga fjällabbar observerade i Ammarnäs under 2009.

June date	Area	Tail feathers	Underwing	Upperparts	Rump	Breastband	Underparts	Undertail coverts	Other characters
12	R		2			2			*
16	R	1		3	1	1	1	1	Neck white; cap with brown mottling; bill base dark brownish; pale fringes on mantle
16	R	2	1	2	2	2	2	1	Neck yellowish; cap with brown mottling; bill base dark brownish with greyish moult scales; legs blue-grey, no spots.
17	R	5	2	4	2	1	1	2	Neck white, cap with brown mottling; some tiny dark spots just below cap; upper mandible brownish above nose; inner left-side terti als renewed, outer old, legs blue-grey, no spots. (Figure 1)
20	R	5	3	4	2	3	1	1	Neck slightly yellowish; crown with brown mottling; some dark spots just beneath cap and on upper throat; bill dark; about half of the scapulars grey, most wing-coverts dark brown, but some grey; legs blue-grey, no spots.
21	A	5	2			1	1	1	
21	A	2	4	1	2	2	1		Underwing plain dark grey from a distance, but some white markings at least on axilleries
27	A	5	3	1		3	1	1	Mantle with pale fringes; scapulars plain grey, but one dark brown; upperwing-coverts plain grey.
27	A	5	2	3		3	1		Mantle with pale fringes; scapulars plain grey, but a few dark brown; upperwingcoverts plain grey; underwingcoverts apparently plain grey; rather extensive breast-band.
27	A	6	4	1	3	3	3	3	Necksides pale, underparts very dark due to extensive, broad grey bands, virtually 'filling' whole of belly and flanks. On upper breast, grey bands slightly separated by white bands. (Figure 2)
27	A	4	1	1	3	2	1		

Area R=Raurejaure; A=Äjvesåjvvie; *Central tailfeathers* 1=missing; 2='not elongated' (could be missing or broken); 3=broken; 4=appr ¼ adult length; 5=appr ½ adult length; 6=appr adult length; *Underwing* 1=thin bars; 2=heavily barred with thick bars; 3='barred' (no details seen/noted); 4=grey and barred feathers mixed; 5=grey; *Upperparts* 1=grey; 2=mixed; 3=more grey; 4=more dark; *Rump* 1=barred; 2=mixed; 3=grey; *Breastband* 1=absent; 2=incomplete; 3=complete; *Underparts* 1=white belly and flanks barred; 2=flanks barred and belly with grey bands; 3=very dark; *Undertailcoverts* 1=barred; 2=mixed; 3=grey
* reported by Johannes Hungar

In Ammarnäs, immatures made up about 4–10% of the number of aged birds. Despite being very rough estimates, they are similar to maxima of 9–11% and 6–11% reported from by Meltofte & Hoye (2007) and Andersson (1976), respectively. In Greenland, most immatures were 3rd cy birds (de Korte 1984, Meltofte & Hoye 2007), with 2nd cy being rare (cf. Meltofte 2007). The presence of 3rd cy and absence of 2nd cy in the study area is in accordance with this. It is however likely that also 2nd cy birds occur in Northern Sweden, but although having been reported (Andersson 1976), they have not yet been fully documented. Also in other skua species, 2nd cy birds are rare at the breeding grounds and immatures start prospecting in their 3rd cy (Furness 1987, Ainley et al. 1990, Kjellén 1997, Klomp & Furness 1992). In absence of a population of individually marked birds and due to the difficulties in ageing 4th cy and older Long-tailed Skuas, it is yet impossible to determine age composition of the remaining prospectors population. It may be similar to the closely related Arctic Skua *Stercorarius parasiticus*, in which most individuals at club sites are 2–4 years old and most individuals start breeding at an age of 4 or 5 years (RW Furness pers comm).

Figure 1. Long-tailed Skua *Stercorarius longicaudus*, 2^{nd} summer (3^{rd} calendar year), Raurejaure, Ammarnäs, Swedish Lapland, 17 June 2009 (Rob van Bemmelen). Note the well defined head pattern and the pale cheeks and upper breast. Furthermore, there is a mix of juvenile-type and adult-type scapulars, tertials and coverts. The projection of the elongated central tailfeathers is about as long as the tail.
Fjällabb Stercorarius longicaudus*, andra sommardräkt (3k), Raurejaure, Ammarnäs, Lappland, 17 juni 2009 (Rob van Bemmelen). Lägg märke till väl definierad täckning på huvud samt blek kind och övre bröst. Man kan också se en blandning av juvenila och adulta skulderfjädrar, tertialer och täckare. De förlängda mellersta stjärtfjädrarna sticker ut ungefär lika långt som stjärten.*

The occurrence and abundance of immatures at the breeding grounds may be dependent on many variables, including number of successfully fledged young and their survival, and natal philopatry (Becker & Bradley 2007). These are unknown for the Long-tailed Skua population of Ammarnäs. If immature Long-tailed Skuas show natal philopatry (see Meltofte (2007) for a possible observation of natal philopatry), then the number of immatures should reflect reproductive output from the preceding years, assuming survival rate is constant across years. In 2005, 2007 and 2008, breeding numbers were good, and it is very likely that at least some young fledged in these years. However, no immatures were seen in June–July 2007 and 2008, despite extensive fieldwork (pers obs).

In line with earlier studies in Swedish Lapland and Greenland, the first immatures were seen about two weeks after the arrival of adults (Andersson 1976, de Korte 1984, Meltofte & Hoye 2007). Also the apparent departure of both adults and immatures at 27 June corroborates earlier work, which showed that birds leave by late June or early July in non-breeding years (Andersson 1976, de Korte 1984). In breeding years, immatures may stay longer at the breeding grounds (de Korte 1984).

In Long-tailed Skuas, recruitment into the breeding population probably takes place in the 4th cy, i.e. at the age of 3 years (de Korte 1985). Then why do younger immatures prospect the breeding areas? In another long-distant migrant, the Common Tern *Sterna hirundo*, individuals with more years spent prospecting arrive earlier at the colony and have a higher probability to recruit (Ludwigs & Becker 2002). This may work similarly in Long-tailed Skuas, which may face declining rodent abundances when arriving too late.

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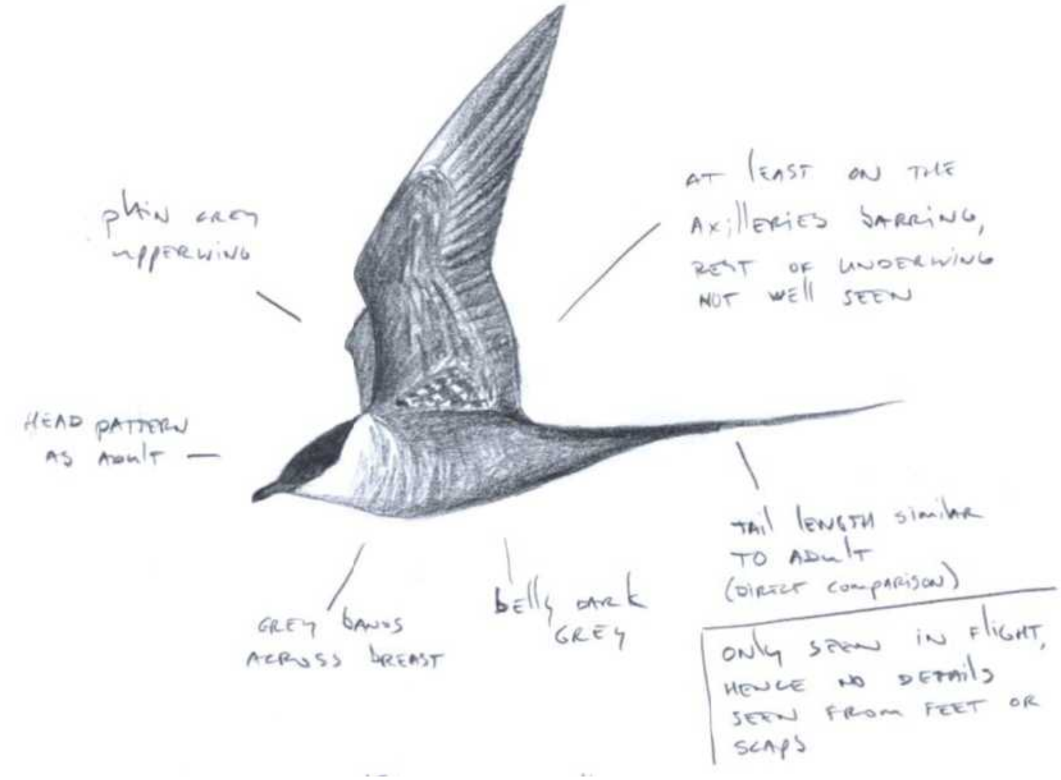

Figure 2. Long-tailed Skua *Stercorarius longicaudus*, 2nd summer (3rd calendar year), Äjvesåjvvie, Ammarnäs, Swedish Lapland, 27 June 2009 (Rob van Bemmelen). Sketch of a dark and long-tailed immature Long-tailed Skua.
Fjällabb Stercorarius longicaudus*, andra sommardräkt (3k), Äjvesåjvvie, Ammarnäs, Lappland, 27 juni 2009 (Rob van Bemmelen). Teckning av en ovanligt mörk och långstjärtad ung fjällabb.*

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Sammanfattning

Unga fåglar kan besöka häckningsområden ett eller flera år innan häckning hos långlivade tropikflyttare. Ju längre genomsnittlig livslängd en art har desto senare besöker arten häckningsområdet och startar häckning för första gången. Fjällabben *Stercorarius longicaudus*, en flyttande havsfågel med övervintringsområden på södra halvklotet och häckningsområden på arktisk fjälltundra, börjar enligt litteraturuppgifter att häcka under det fjärde kalenderåret. Unga fåglar i andra (2k) och tredje (3k) kalenderåret, dvs. året när de blir två respektive tre år gamla, har också rapporterats prospektera i häckningsområdet. Detta fenomen är relativt väldokumenterat från grönländska häckningsplatser, men har bara omnämnts kortfattat för Alaska och svenska Lappland. Här rapporterar jag observationer av unga (3k) fjällabbar från tundraområden nordväst (Raurejaure) och sydväst (Äjvesåjvvie) om Ammarnäs (N 65°57', E 16°12') under sommaren 2009.

Denna sommar var gnagartillgången dålig, samtliga fjällabbar avstod därför från häckning och strövade därför omkring i tundraområdet ensamma eller i flock. Unga individer sågs mellan 12 och 27 juni. Efter denna period sågs inga fjällabbar alls i området. Dessa observationer bekräftar tidigare studier från Lappland och Grönland där de första ungfåglarna sågs ungefär två veckor efter de vuxna fåglarnas ankomst, och både vuxna och unga fåglar flyttade söderut i slutet av juni och början av juli under år utan häckning.

Minst 10 olika unga fjällabbar sågs under sommaren 2009. De högsta dagsiffrorna var 19 vuxna och två unga den 16 juni i Raurejaureområdet och 98 vuxna och fyra unga den 27 juni i Äjvesåjvvie. Baserat på dessa siffror utgjorde ungfåglarna mellan 4 och 10% av den totala fjällabbspopulationen. Liknande andelar ungfåglar (9–11% och 6–11%) har tidigare rapporterats från både Grönland och de svenska fjällen. Tabell 1 sammanfattar dräktkaraktärer för dessa tio ungfåglar. Dessa stämmer väl överens med tidigare beskrivningar av 3k fjällabb. Det fanns stor dräktvariation mellan olika individer, men vissa konsekventa mönster kunde noteras, bland annat adultliknande huvudteckning, mellersta stjärtpennornas längd ungefär hälften av de vuxna fåglarnas och vita bukar (Figur 2). En individ (sedd den 27 juni) skiljde sig distinkt från övriga genom att ha mörkare undersida och centrala förlängda stjärtfjädrar av adult längd (Figur 2). Något bandade axillarer (armhålsfjädrar) och fläckigt övre bröstparti indikerar att detta rör sig om en ungfågel och att den bör betraktas som ett ovanligt mörkt exemplar av den bandade formen snarare än en fågel av rent mörk morf.

Att det fanns 3k fåglar men inte 2k individer i studieområdet stämmer väl överens med uppgifter från Grönland där majoriteten av ungfåglar som besökte häckningsområden var 3k, medan 2k fåglar var ovanliga. Det är sannolikt att också enstaka 2k fåglar besöker häckningsområden i norra Sverige, något som har rapporterats tidigare men inte dokumenterats noggrant. Även hos andra labbarter är det ovanligt att 2k fåglar besöker häckplatserna. De unga fjällabbar som observerades under 2009 kläcktes under 2007, ett år med stort antal häckningar där sannolikt ett antal ungar blev flygga.

Hos fisktärnan *Sterna hirundo* som också är en långflyttande art, har individer som tillbringar fler år åt prospektering större sannolikhet att rekryteras till den häckande populationen. Sådana individer anländer också tidigare till häckplatserna. Om det fungerar på ett liknande sätt hos fjällabben finns risk att individer som anländer sent till häckningsområdena uppleva en vikande gnagartillgång.

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Nesting biology of the Hooded Crow *Corvus corone cornix* in a mixed residential-agricultural area in southern Sweden

Gråkråkans Corvus corone cornix *häckningsbiologi i en blandmiljö av bebyggelse och jordbruk i södra Sverige*

REBECCA HESSEL & JOHAN ELMBERG

Abstract

We studied 11 active and 29 old nests of Hooded Crows *Corvus corone cornix* in a mixed residential-farmland landscape (3.6 km^2) in southern Sweden in 2009. The density of active nests was 3.06/km^2 land area and 7.33/km^2 forest area. Thirty-eight nests were in pine-dominated forest and two in private gardens. All nests (active and old) were in pine trees *Pinus sylvestris*, and sample plots around nest trees had the following characteristics (means): 350 tree stems/hectare, 1487 bushes/hectare, and canopy cover 8%. Distance to the nearest active Crow nest averaged 234 m, but variation was large. Mean distance from nests to nearest forest edge was 19 m and to the nearest inhabited building 68 m. Nests were placed near the tree top (mean height 11 m) in all cardinal directions but with a significant bias towards the south. Seven out of 11 (64%) active nests produced fledglings (mean 1.2 nestling/successful nest). Breeding success was higher in nests that were close to another crow nest. Compared with previous studies, hatching success was high but final fledgling production was low.

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Introduction

The Hooded Crow *Corvus corone cornix* is a common and conspicuous breeding bird over large parts of Europe, inhabiting a range of habitats from the Mediterranean to the Arctic Ocean (Hagemeijer & Blair 1997). Although there is a lot of older and faunistic information about the species (e.g. Cramp & Simmons 1977, Glutz von Blotzheim 1990), surprisingly little recent information is found in the indexed scientific literature. Out of 105 hits in the Biological Sciences data base (18 May 2010, search string "(Hooded crow) OR *Corvus* AND *cornix*", years 1982–2010), only a handful concerns its breeding biology, and only two such papers have appeared in the last 15 years (Smedshaug et al. 2002, Zduniak & Antczak 2003). The paucity of recent data about breeding biology may be of concern, as the Hooded Crow has experienced significant and hitherto unexplained population declines in recent decades in some countries (for example Sweden and Finland; Ottvall et al. 2009, Finnish Museum of Natural History 2010).

Although the Hooded Crow breeds throughout Northern Europe and in almost all habitats, landscapes with a mix of forest, farmland and residential areas can be termed as typical breeding habitat generally holding strong populations (e.g. Møller 1983, Hagemeijer & Blair 1997). We here report on a study on breeding Hooded Crows in a landscape of this type, addressing the following questions: (1) What is the density of nesting territories? (2) What is the preferred nesting habitat? (3) What do nesting territories look like? (4) Which is the preferred species of nesting tree? (5) What are the characteristics of the nearest surroundings of nest trees? (6) When do eggs hatch? (7) When do chicks leave the nest?

Methods

Study area

This study was carried out in 2009 in the north-western part of Åhus municipality (Scania, Sweden). The study area is 3.6 km^2, squarish in shape and bordered by Flötövägen in the south, road #118 in the east, Pallers väg in the north and Hornavägen in the west (corner coordinates: NW: 55°57.039'N, 14°15.620'E; NE: 55°56.644'N, 14°17.088'E; SE: 55°55.784'N, 14°17.397'E; SW: 55°56.159'N, 14°14.631'E). There are three distinct habitats: (1) residential areas (1 km^2), (2) open steppe-type sandy grasslands (1 km^2), and (3) planted pine forest (1.5 km^2). Residential areas comprise low family homes and their gardens. Grasslands are either grazed by horses or fallow fields too dry to cultivate. Pine *Pinus silvestris* forests are fairly mature and planted monocultures, but do in places support clusters of spruce *Picea abies*, silver birch *Betula pendula*, mountain ash *Sorbus aucuparia*, oak *Quercus robur*, beech *Fagus sylvatica*, and poplar *Populus spp*. Parts of the forest have an understorey mainly comprising raspberry *Rubus idaeus*, blackberry *Rubus spp*., elderberry *Sambucus nigra*, red elderberry *Sambucus racemosa*, and hawthorn *Crataegus* spp.. The study area is flat, 5–10 m above sea level, and enjoys a temperate climate with oceanic influence (growing season April–November, mean annual snow cover <1 month).

Mapping of nests and their surroundings

The study area was visited five times in February–March and weekly (in some weeks daily) during the brooding, hatching and fledging periods in April through the first week of June. Active territories, active nests and old nests were mapped in all areas supporting trees (residential areas and forests). All roads and paths in the residential areas were visited, and all forest habitat was covered by foot using parallel line transects 50 m apart. Seventy-five old nests were found during the early visits (February–March), and 29 of them were subsequently selected for further analyses (questions 2, 3, 4 and 5 above). The exact age of the of old nests is unknown, since they can remain fairly intact for at least ten years. Active territories were delineated by mapping resident crows in March and early April, and the nest itself was usually found by listening for incubating females begging for food. Data from active nests of the year were used to address questions 1, 6, and 7 above.

Nest site characteristics were studied in June, when all chicks had left the nests. Nest trees were identified to species and the following measurements were taken: (1) nest height, (2) canopy cover in a 10 m radius from the nest tree's trunk (estimated in %), (3) all trees (defined as woody plants more than 5 m tall) within a 10 m radius from the nest tree were counted and identified, (4) all bushes (defined as woody plants less than 5 m tall) within a radius of 10 m from the nest tree were counted, and (5) the cardinal direction of each nest in relation to the trunk. Further nest data were obtained from maps: (6) distance to the nearest inhabited building, (7) distance to nearest forest edge, and (8) distance to nearest active Hooded Crow nest.

Breeding success

Active nests were visited daily from 28 April to 7 May to record hatching date, which was noted as the first day on which the parent birds were seen feeding chicks or flying to and from the nest very often. Chicks were expected to leave the nest four to five weeks after hatching. Hence, active nests were observed for about an hour each day 26 May–9 June, and the number of chicks were counted both before and after they had left the nest.

Results

Breeding habitat and density

Thirty-eight of 40 nests (29 old and 11 nests of the year) were located in forest habitat, and the remaining two were in garden trees. Eleven active nests were found in 2009, in other words 3.06 territories/km^2 land area, and 7.33 territories/km^2 forest. Distance to the nearest active Hooded Crow nest averaged 234.5 m (SD=170 m, range 110–564 m, N=11 nests of the year).

Nest site characteristics

Mean tree density in the core of the nesting territories was 350 stems/hectare (mean per plot = 11, SD=6.1, range: 1–23, N=40 (old nests and nests of the year pooled)). Mean density of bushes was 1487/hectare (mean per plot=46, SD=34, range 1–128, N=40). Canopy cover averaged 8% (SD=5.6, range=1–25, N=40). To the human eye the typical breeding territory is thus a fairly open forest (Figure 1), but the variation in understorey cover is large.

Most nests were within 10 m of a forest edge, but variation was large (mean=19 m, SD=22, range=0–100, N=40 (old nests and nests of the year pooled), Figure 2). For natural reasons in this study area, most nests were situated within 100 m of a building, but many were within only 40 m, and a few were instead quite distant (mean=68.4 m, SD=114, range=5–472, N=40, Figure 3).

All 40 nests were in a pine tree, and they were often placed near the top (mean height=10.6 m, SD=1.9, range=7--16, N=40 (old nests and nests of the year pooled)). Nests were in all cardinal direc-

Figure 1. Typical nesting habitat of Hooded Crow *Corvus corone cornix* in Åhus, Scania. Photo: Rebecca Hessel.
Typisk häckningsbiotop för gråkråka Corvus corone cornix *i Åhus, Skåne. Foto: Rebecca Hessel.*

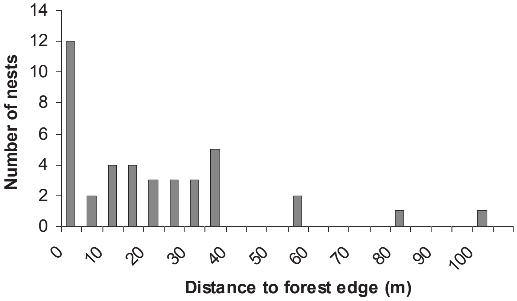

Figure 2. Distance from nests of Hooded Crows to nearest forest edge (N=40).
Avstånd från bon av gråkråka till närmaste skogskant (N=40).

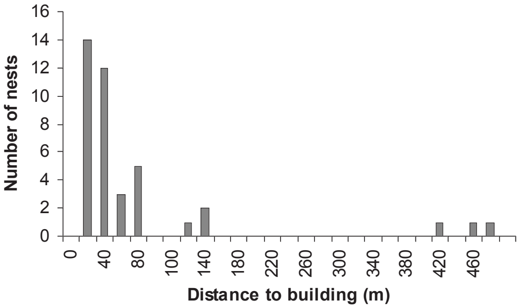

Figure 3. Distance from nests of Hooded Crows to the nearest building (N=40).
Avstånd från bon av gråkråka till närmaste byggnad (N=40).

tions, but significantly biased towards south-facing placement (N=1, E=7, S=18, W=5; 9 nests were centred in the tree; $Chi^2 = 20.49$, df=3, P<0.001).

Breeding success

Ten out of eleven pairs hatched their brood successfully. The reason why one brood failed could not be determined. Most broods hatched between 28 April and 7 May, and there was no clear hatching peak (mean=6 May, N=10 broods). Two broods were a bit late, hatching approximately 14 May. Chicks left the nests between 26 May and 9 June, with a clear peak in the end of this period (mean=5 June, N=7 broods).

Thirty-six per cent of the pairs did not produce any fledglings in 2009 (one brood of eleven did not hatch, three more did not fledge any chicks). No pair fledged more than two chicks. The number of fledglings per pair hatching their eggs averaged 1.2 (SD=0.98, N=7). The number of fledglings per nest correlated negatively with distance to the nearest active crow nest, that is, breeding success was higher when the nearest next pair was close (r_s=—0.68, P=0.02, N=11). However, fledgling number per nest did not correlate with nest height, understorey cover (density of bushes), distance to nearest building, or distance to forest edge (Spearman's rank correlations: P=0.43, P=0.23, P=0.19, and P=0.14, respectively). The variation in stem density (trees) and canopy cover at the nest trees was not large enough to make a correlation analysis meaningful.

Discussion

Breeding habitat and density

The density of breeding Hooded Crows in the study area was very high compared with national averages, and high also compared with typical values for agricultural landscapes in southern Sweden (e.g. national means of 0.1–0.3 pairs/km^2 and regional means of up to 1.1–1.4 pairs/km^2; Ottosson et al., in prep). Our interpretation is that the study area offers exceptionally good conditions for breeding Hooded Crows. We think this is due to a combination of many available nest sites and plentiful food on the one side, and possibly to low densities of predators on the other (cf. Andrén 1992). The latter two factors can be related to anthropogenic influence. Although fragmentation is not straightforward to quantify, we argue that the study area may have a farmland-forest edge-to-area ratio that is favorable for breeding Hooded Crows (cf. Smedshaug et al. 2002). Although some studies from other countries report densities approaching ours (e.g. ca. 2.0–2.6 pairs/km^2; Hewson & Leitch 1982, Myrberget 1982, Parker 1985), even higher values have been reported from Italy (6.7 pairs/km^2; Baglioni, Pieri & Bogliani 1994) and Norway (6.8 pairs/km^2; Munkejord et al. 1985). Nearest-nest distance in our study was very similar to that found in southern Norway by Munkejord et al. (1985; 290–312 m), but noticeably shorter than in a nearby study area in southern Sweden (360–427 m; Loman 1975).

Nest site characteristics

Pine was the preferred nest tree in our study, although mature trees of several other species were available. This result compares well to some previous compilations (e.g. Tenovuo1963, Wittenberg 1968, Kulczycki 1973 in Cramp & Simmons 1977), possibly reflecting that conifers provide better shelter than deciduous trees. However, spruce was not utilized in our study area although it does occur (cf. Munkejord et al. 1985), and neither was oak although it is a much used nest tree in other areas (e.g. Cramp & Simmons 1977, Jollet 1985). Interestingly, Loman (1975) found that Hooded Crows in a study area not very far from ours utilized a variety of nest tree species; *Alnus, Pinus, Betula* and *Picea* were the most common species and they were utilized in fairly equal proportion.

Most nests in our study were very close to a forest edge (cf. Parker 1985). We interpret this as a strategy to have the chicks close to good foraging habitats, which are open ground rather than closed forest. Such placement must be an obvious advantage considering how frequently the chicks need to be fed. Indeed, during the chick-feeding period adults were most often seen foraging in fields and gardens.

Breeding success

Hatching success in the present study (>90%) compares well to previous studies (e.g. 86% in Parker 1985), but the proportion of nests producing fledglings (64%) was low (cf. Parker 1985). So was the number of fledglings per pair, regardless of whether this is calculated per laid clutch or per successful nest (e.g. 3.2 chicks per active nest in Parker 1985 and 1.5 in Munkejord et al. 1985). Interestingly, Loman (1980) found a difference in fledgling production between experienced pairs and first-time breeders (1.6/pair versus 0.7/pair).

In other words, the low overall reproductive output noted by us may reflect a general long-term decline in breeding success and/or result from our study population comprising many unexperienced first-time breeders (i.e. a more demographic causality).

We found that the number of fledglings per nest increased with decreasing distance to the nearest conspecific nest. Though our sample is limited, it should be noted that Munkejord et al. (1985) obtained results pointing in the same direction in a study area with even higher densities than that in our. One of the authors (RH) observed that Hooded Crows in close-nesting pairs were reciprocally very tolerant, and they were not aggressive towards each other. On a few occasions they even seemingly "cooperated" to chase away Hooded Crows emanating from more distant territories. This lends further support to the idea that Hooded Crows inhabiting neighbouring territories increase each other's breeding success. This could be achieved intentionally by common defense against predators and by increasing each other's foraging success (Sonerud, Smedshaug & Bråthen 2001), but also more indirectly by increasing each other's vigilance (cf. Canestrari, Marcos & Baglione 2007).

Conclusion

Although hatching success was high and although we found a positive effect of nest density, mean fledgling production per nest was low compared to historical data. We argue that such low reproductive output in a high-density population raises some concerns, not the least because of the general population decline of the Hooded Crow in some countries. Further studies of the nesting biology of the species are thus called for, and they should ideally include data on clutch size and also address negative density-dependent effects.

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Sammanfattning

Gråkråkan är en vanlig häckfågel över stora delar av Europa, men trots att den tidigare studerats flitigt finns ytterst lite publicerat om dess häckningsbiologi i den vetenskapliga litteraturen från de senaste årtiondena. Mot bakgrund av detta och det faktum att arten minskat i bland annat Sverige på senare tid valde vi ut ett 3,6 km^2 stort område i jordbruksbygd i nordöstra Skåne för en häckningsbiologisk studie. Det undersökta området i utkanten av Åhus tätort utgörs till 1 km^2 av bebyggelse och trädgårdar, 1 km^2 trädlös sandstäpp och 1,6 km^2 planterad tallskog. Trädgårdarnas växtlighet är synnerligen varierad medan den planterade tallskogen har inslag av gran, björk, rönn, ek, bok och poppel. Denna artikel bygger på data från 40 bon av gråkråka, funna under upprepade linjetaxeringar med 50 meters intervall av all trädbevuxen mark i området. Tjugonio av bona var äldre (från 2008 eller tidigare), medan 11 var under 2009 aktiva bon som studerades mer intensivt (3,06 aktiva bon (revir) per km^2 landyta och 7,33 bon (revir) per km^2 skogsklädd yta).

Allmänna karaktäristika baserade på gamla och aktiva bon (N=40) var följande. Alla bon låg i träd, varav 38 i skog och två i villaträdgårdar. Stamtätheten av träd i provytor (314 m^2) med boträden som centrum var i medeltal 350/ha, det vill säga 11 (1–23) stammar per provyta. Motsvarande täthet av buskar var 1487 stammar/ha, det vill säga 46 (1–128) per provyta. Krontäckningen var i genomsnitt 8% (1–25%) och de flesta bon låg inom 10 m (medeltal 19 m (0–100); Figur 2) från en skogskant. Av naturliga skäl i detta studieområde låg de flesta bon ganska nära byggnader, men variationen var stor (medeltal 68 m (5–472); Figur 3). Alla bon låg i tallar, trots att mogna träd av andra arter fanns att tillgå i området. I förhållande till boträdens stam var bona placerade i alla väderstreck, men med en signifikant koncentration till söder (N=1, O=7, S=18, V=5, 9 centerade bon)

De elva aktiva bona låg i medeltal 234,5 m (110–564) från närmsta andra bo av gråkråka. Tio av elva par som skred till häckning kläckte sin kull, vilket inföll mellan 28 april och 14 maj (medeltal 6 maj, ingen tydlig topp). Sju av tio kläckta kullar producerade flygga ungar. De senare lämnade boet mellan 26 maj och 9 juni, med en tydlig topp i slutet av denna period (medeltal 5 juni). De sju flygga kullarna bestod alla av en eller två ungar (medeltal 1,2). Antalet flygga ungar per bo visade ett signifikant samband med avståndet till närmsta kråkbo, så att framgången var högre när närmsta kråkbo låg nära.

Revirtätheten i det undersökta området är mycket hög efter generella svenska förhållanden, och hög även för jordbruksbygd i Sydsverige. Vi tror att detta kan bero på god tillgång på föda i kombination med låga tätheter av predatorer på vuxna kråkor. Kläckningsfrekvensen (96%, 10 av 11 kullar) är i nivå med tidigare studier, men antalet bon som producerade flygga ungar (64%) var lägre än i många andra studier. Detta gäller också antalet flygga ungar per par. Orsaken till den funna låga ungproduktionen är inte känd, men kan tjäna som ett observandum med tanke på artens generella minskning i Sverige.

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What do population viability analyses tell about the future for Baltic Dunlin *Calidris alpina schinzii* and Montagu's Harrier *Circus pygargus* on Öland?

Vad berättar sårbarhetsanalyser om framtiden för sydlig kärrsnäppa och ängshök på Öland?

PER-ERIC BETZHOLTZ, TOBIAS BERGER, JAN PETERSSON & JOHAN STEDT

Abstract

Population viability analysis (PVA) has become an important tool in conservation biology. Even though detailed outcomes of PVA:s are constrained by data quality, it is a useful approach when the objective is exploratory, aiming to identify important parameters for viability or to guide future field work on endangered species. In this study we perform PVA:s based on scarce data to explore viability of two endangered bird species, Baltic Dunlin and Montagu's Harrier, on Öland. Our simulation results underline that both species are under severe threats, with a median time to extinction of 24 years in Baltic Dunlin and 63 years in Montagu's Harrier. Sensitivity analyses show that population growth rate is the most important factor for the model outcome in both species. Since there are no apparent threats for adult birds on Öland, this suggests that conservation measures should focus on improving conditions for successful breeding on the island. In additional simulations we explore some threats in more detail. In the case of Baltic Dunlin nest predation of eggs and chicks increase the extinction risk. In Montagu's Harrier viability increases if breeding attempts within agricultural areas are detected and safeguarded. In order to enhance the PVA model, and build a stage-structured model, we suggest that detailed data on fecundity and survival should be collected.

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Introduction

Population viability analysis (PVA) is a quantitative method that has become an increasingly important tool in the conservation and management of species (Beissinger & McCullough 2002, Akçakaya 2004). The reason for this is that the results of a PVA may be used for several objectives: to assess the vulnerability of species to go extinct, to identify which parameters have most effect on viability (i.e. sensitivity analyses) and to evaluate the outcome of a model under different environmental scenarios (Hanski & Simberloff 1997, Kindvall 1998, Akçakaya & Sjögren-Gulve 2000, Morris et al. 2002).

PVA:s have received some criticism for producing unreliable estimates when absolute extinction risks on longer terms are simulated (Ludwig 1998, Fieberg & Ellner 2000), because demographic data from a PVA commonly are uncertain (Caughley 1994). The outcomes of PVA:s have been validated by Brook et al. (2000), who showed that predictions of abundance and risk of decline closely matched observed outcomes. Data uncertainties can also be handled by performing sensitivity analyses to identify important assumptions and parameters of a PVA (Akçakaya & Sjögren-Gulve 2000). Furthermore, when data are scarce and only based on surveys of population numbers from short-time series, it is still often a useful approach to perform a PVA. This is especially true when the objective of a PVA is exploratory, to identify important parameters of viability or to guide further field work (Dunham et al. 2006).

In this study we use PVA to explore viability under different scenarios in two endangered Swedish bird species on Öland, the Baltic Dunlin *Calidris alpina schinzii* and the Montagu's Harrier *Circus pygargus*. Both species have their main Swedish distribution on Öland. We use scalar models based on short time series of surveys in population numbers, and incorporate data uncertainties in our simulations by performing different sets of sensitivity analyses. We discuss conservation implications of our simulation outcomes, and how our results may guide future field work of the two species on Öland.

Materials and methods

Study area

The island of Öland is situated in the Baltic Sea, close to the Swedish mainland. It is 130 km long and between 10 and 20 km wide, built up on a limestone plateau. Öland is dominated by an agricultural landscape, but there are also other habitats such as coastal meadows, wetland areas, alvar land, large and continuous areas of deciduous forest and in the northern parts also pine forest. At least 150 bird species breed here regularly (Länsstyrelsen Kalmar 1999), and several of these species are included in the Swedish red-list (Gärdenfors 2010).

Study species

The Baltic Dunlin has its main breeding grounds on Iceland and in Great Britain, but there are also small populations in southern Scandinavia and on Greenland (Thorup 2006). The Baltic Dunlin has specific habitat requirements and prefers coastal wetlands (preferably grazed by cattle) with vegetation not more than 10–20 cm high. It also prefers a mosaic structure of varying vegetation heights and access to nearby muddy beaches for foraging (Blomqvist 1994, Jönsson 2006). The Swedish population, estimated at 120 pairs, has shown a long-lasting decrease with a decline of 70% during the last twenty years (Gärdenfors 2010). Öland hosts the most important breeding grounds for the Baltic Dunlin in Sweden and currently 60–70 pairs breed here (Flodin et al. 2010). The species has declined severely also on Öland, during the 1980s and 1990s more than 100 pairs were breeding here.

The reasons for the Swedish population decline are not fully known, but several explanations have been put forward. One important factor is habitat loss because of ceased grazing followed by a closure of suitable habitats. Other causes that have been suggested are habitat deterioration from drainage of the coastal meadows, and nest predation of eggs and chicks (Ottvall 2005, Jönsson 2006, Flodin et al. 2010). A high nest predation has been observed, as much as 70% of the nests have been predated on Öland during some years (Ottvall 2005, Ottvall & Larsson 2005). A low genetic variation has also affected viability in fragmented Baltic Dunlin populations in western Sweden (Ottvall & Larsson 2005, Blomqvist & Pauliny 2007). Since the Baltic Dunlin shows a high level of site fidelity (Jönsson 1991), Flodin et al. (2010) suggest that low genetic variation may also be a severe factor behind the decline.

The Baltic Dunlin is red-listed as critically endangered (CR) in Sweden (Gärdenfors 2010), and an action plan for the conservation of the species has been established. Primary goals are to stop the decline of the population and explore the genetic status of all Swedish subpopulations (Flodin et al. 2010), and they suggest that the first goal can be achieved if each breeding pair produces at least two hatched chicks per year.

The Montagu's Harrier has a fragmented distribution in Eurasia, with the vast majority of breeding pairs in France, Spain, Portugal, Ukraine, Belarus and the Baltic States (Birdlife International 2004). It occurs in a wide range of open habitats such as grasslands, arable land and wetlands (Arroyo et al. 2002). In Sweden the species has a relatively short history as a permanent breeder. During the 1930s and 1940s a few pairs were breeding in Scania, but this population subsequently became extinct due to persecution and collecting of eggs (Rodebrand 2009). During the 1940s the species colonized Öland, and in the following decades a stable population was built up on the island, reaching 40–45 pairs during the 1970s and 1980s (Rodebrand 2009). Öland is the Swedish stronghold of the species and currently holds 30–35 of the estimated Swedish population of 55 pairs (Gärdenfors 2010). On Öland the species utilizes three different kinds of habitats, *Cladium mariscus* marshes, *Dasiphora fruticosa* areas on alvar land and agricultural fields.

The Swedish population of Montagu's Harrier has decreased by 20% during the last twenty years (Gärdenfors 2010). Important reasons behind the decline are deterioration of breeding habitats, competition with Marsh Harriers *Circus aeruginosus* and predation from Goshawks *Accipiter gentilis* (Rodebrand 2009, Gärdenfors 2010). Furthermore, Rodebrand (2009) suggests that another factor behind the decline is that several pairs are breeding in suboptimal habitats, i.e. in agricultural fields, where the breeding success is lower. This is because the fields are often harvested before the young have fledged, and heavy rains bend down the straw of the crop to the ground, exposing the nest to predators (Rodebrand 2009).

The Montagu's Harrier is red-listed as endangered (EN) in Sweden (Gärdenfors 2010), and an action plan for the conservation of the species has been established (Rodebrand 2009). The aims of the action plan are to stop the decreasing trend of the Swedish population, and to establish a viable population on Öland. This goal should be fulfilled if each breeding pair produces at least two fledglings per year.

Model overview and parameterization

We used the generic software RAMAS GIS 3.0 (Akçakaya 1998) to parameterize our models. We built scalar models from time-series data of population numbers, without age or stage structure. The scalar model used by RAMAS is created from the equation $N_{t+1} = \lambda_t N_t$, where λ_t is a deviate taken from the lognormal distribution with a mean and standard deviation estimated for the time series in question. The standard deviation includes all environmental variability, and will be referred to as environmental stochasticity. We calculated the realized rate of population change between successive surveys in a continuous series as $\lambda_i = (N_i/N_{i-1})$, where N_i is the population size at year i, ($i = 0, 1, 2 \ldots q$). All survey data had annual time steps. These population growth rates were then used to calculate the mean and standard deviation of λ for the model created in the software module RAMAS metapop. As the initial population size, we used the population number of the last year in the time-series. We incorporated density dependence as a ceiling-type density, i.e. the population growth is exponential until it reaches the ceiling-value used as carrying capacity. Differences in individual survival and fecundity may have a significant effect on population growth, especially in small populations (Soulé 1986, Lande 1988). Therefore we also included demographic stochasticity in our simulations, which in RAMAS is incorporated by sampling the number of individuals from binomial distributions. We ran the model for a time frame of 100 years, with 10,000 replicates. As a measure of viability, we used the extinction risk for the time frame of 100 years, and the median time to extinction. In species with overlapping generations, as in this case, generations could be used instead of years as the time frame. Since there is no data on survival for the studied species on Öland, and the aim was exploratory, we used years as the time frame. To indicate this population growth rate is denoted by λ, instead of the generally used R. To explore the degree to which each parameter affects the model outcome, we performed sensitivity analyses of model parameters and compared them to a status quo scenario (no change scenario). We included the parameters population growth rate (λ_t), environmental stochasticity ($std_{\lambda t}$), initial abundance and carrying capacity (i.e. the ceiling value used). We ran the sensitivity analyses with an increase and a decrease of 10% and 20% on the value of each parameter.

Table 1. Number of pairs of Baltic Dunlin on Öland based on full scale surveys performed in 1988, 1998 and 2008, and from surveys 2003–2008 where 20% of the suitable breeding habitat was sampled each year.
Antal par av sydlig kärrsnäppa på Öland baserat på heltäckande inventeringar 1988, 1998 och 2008, samt inventeringar 2003–2008 där 20% av lämplig häckningsmiljö inventerades (stickprovsinventering).

	Sample survey *Stickprovsinv.*	Full scale survey *Heltäckande inv.*
1988	-	132
1998	-	105
2003	27	-
2004	30	-
2005	19	-
2006	20	-
2007	13	-
2008	15	62

Table 2. Number of pairs of Montagu's Harrier on Öland 2004–2008, including number of pairs in the three main habitats; *Cladium mariscus* marsh (denoted *Cm*), *Dasiphora fruticosa* area on alvar land (denoted *Df*) and agricultural fields (denoted Af).
Antal par av ängshök på Öland 2004–2008, fördelat på de tre häckningsmiljöerna; våtmarker med ag (förkortat Cm), alvarmark med ölandstok (förkortat Df) och odlingsmark (förkortat Af).

	Total	*Cm*	*Df*	Af
2004	31	13	14	4
2005	23	9	11	3
2006	29	11	14	4
2007	36	15	8	13
2008	33	12	16	5

Full scale surveys of breeding Baltic Dunlin have been performed on Öland 1988 (Pettersson et al. 1995), 1998 (Pettersson 2001) and 2008 (Svensk Naturförvaltning 2009). There have also been annual surveys carried out on 20 % of the area of coastal wetlands on Öland, running between 2003 and 2008 (Table 1). The full scale survey of 2008 resulted in 62 breeding pairs. We parameterized the model from the time-series 2003–2008 (λ= 0.920, std_{λ}= 0.257), but used the value from the full scale survey in 2008 as the initial population size in our simulations. Since there is no lack of suitable breeding habitats carrying capacity was set to 250 pairs, twice the maximum number of breeding pairs in recent decades. Montagu's harrier has been surveyed in detail on Öland under two different time periods, 1975–1981 and 2004–2008 (Länsstyrelsen i Kalmar in letter). We used the latter time-series (Table 2) for the parameterization of the model (λ= 1.040, std$_{\lambda}$= 0.254). Carrying capacity was set to 55 pairs, slightly higher than the maximum number of breeding pairs in recent decades.

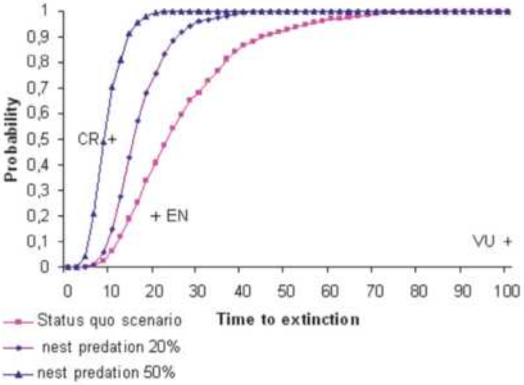

Figure 1. Cumulative extinction risk the next 100 years in Baltic Dunlin on Öland. Three different scenarios are indicated; a status quo scenario (no change), a scenario with 20% nest predation and a scenario with 50% nest predation (details in text). The red-list categories Critically endangered (CR), Endangered (EN) and Vulnerable (VU) are denoted in the figure.

Kumulativ utdöenderisk de närmaste 100 åren hos sydlig kärrsnäppa på Öland. Tre olika scenarior visas; ett scenario med oförändrade parametervärden och två scenarior där bopredation inkluderas och uppgår till 20 respektive 50% årligen (detaljer i texten). Gränserna för rödlistekategorierna akut hotad (CR), hotad (EN) och sårbar (VU) anges i figuren.

Besides performing the status quo scenario simulations described above, data allowed us to explore some of the threats indicated in the action plans (Rodebrand 2009, Flodin et al. 2010). In the case of Baltic Dunlin we performed additional simulations on nest predation, since this factor is suggested as a threat for population decline on Öland, and also varies highly between years (Ottvall 2005, Ottvall & Larsson 2005). Since our status quo simulation is based on a short time-series survey, covering 20% of suitable breeding habitats, there is a risk that we did not catch the effects of nest predation fully in our simulation model. In RAMAS, nest predation is incorporated in the model as a catastrophic event. The model is parameterized with a probability for nest predation to occur, and how severe the effect is when it happens. We explored two different levels of nest predation in our simulations, 20% and 50%. In addition, we included that 50% of the eggs/chicks from a breeding pair were predated when a nest was attacked. This is because mammals regularly predate all four eggs in the nest, while birds such as *Corvidae* often destroy only one or two of the eggs (G. Norevik, pers. comm.). In Montagu's Harrier we performed additional simulations to explore if different population growths among the three main habitats on Öland

Table 3. Viability estimates from sensitivity analysis in Baltic Dunlin on Öland, based on survey data from 2003–2008. A status quo scenario (denoted in bold) and scenarios where the model parameters are changed by ±10% and ±20% respectively, are presented as extinction probabilities in the next 100 years (Ext. prob.) and median time to extinction in years (Md ext.). Model parameters are denoted as follows; Population growth rate (Pop. growth), Environmental stochasticity (Env. stoch.), Initial abundance (Init. abun.) and Ceiling value of population size (Ceil. val.).

Utdöenderisker från känslighetsanalyser av sydlig kärrsnäppa på Öland, baserade på inventeringsdata 2003–2008. Ett scenario med oförändrade parametervärden (i fetstil) jämförs med scenarior där modellparametrarna ändras med ±10% och ±20%, och presenteras som utdöenderisker inom de närmaste 100 åren (Ext. prob.) och mediantid till utdöende i antal år (Md ext.). Modellparametrarna förkortas enligt följande; populationstillväxt (pop. growth), omgivningsstokasticitet (env. stoch.), initial populationsstorklek (init. abun.) och högsta populationsstorlek (ceil. val.).

%	Pop. growth		Env. stoch.		Init. abun.		Ceil. val.	
change	Ext. prob	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.
-20	1.00	11	1.00	22	1.00	23	1.00	23
-10	1.00	14	1.00	23	1.00	23	1.00	24
0	**1.00**	**24**	**1.00**	**24**	**1.00**	**24**	**1.00**	**24**
+10	0.65	67	1.00	25	1.00	24	1.00	25
+20	0.02	>100	1.00	26	1.00	24	1.00	25

affected viability, compared to the status quo scenario described above. Since the survey of 2004–2008 also included categorization of habitats, we used this dataset also in these simulations (Table 2; *Cladium mariscus* marshes: $\lambda = 1.086$, $std_{\lambda} = 0.289$; *Dasiphora fruticosa* areas on alvar land: $\lambda = 1.032$, $std_{\lambda} = 0.428$; agricultural fields: $\lambda = 1.429$, $std_{\lambda} = 1.275$). We were also able to correlate the number of breeding pairs among habitats, and include these correlations in the simulations. Since Rodebrand (2009) suggested that a possible threat is due to more pairs breeding in suboptimal habitats, i.e. in agricultural fields, we also explored how dispersal to agricultural fields from the two other habitats affected the model outcome. In RAMAS dispersal is handled as proportions of the population. We used 10% and 30% of the populations in the two other habitats dispersing to agricultural fields each year.

Results

Baltic Dunlin

The extinction risk in the next 100 years was estimated at 100%, with a median time to extinction of 24 years (Figure 1, Table 3). Sensitivity analyses showed that population growth rate was the single most important parameter for the model outcome, while the parameters environmental stochasticity, initial population size and carrying capacity did not change the model outcome (Table 3). According to the quantitative E-criteria of the red-list, the simulation outcome for the status quo scenario of Baltic Dunlin on Öland corresponds to the threat category endangered (EN) (c.f. Figure 1), indicating that the extinction risk is higher than 20% in the next 20 years.

When nest predation was included as a separate factor in the simulations, viability of the Baltic Dunlin decreased. When probability of nest predation to occur was set to 20% and 50 %, median time to extinction decreased from 24 years in the status quo scenario to 15 and 8 years, respectively.

Montagu's Harrier

The extinction risk in the next 100 years was estimated at 70%, with a median time to extinction of 63 years (Figure 2, Table 4). Sensitivity analyses showed that population growth rate was the single most important parameter for the model outcome. The environmental stochasticity also affected the outcome to a certain degree, while initial abundance and carrying capacity only affected the outcome of the model marginally (Table 4). According to the quantitative E-criteria of the red-list the simulation outcome for the status quo scenario of Montagu's Harrier on Öland corresponds to the threat category vulnerable (VU) (c.f. Figure 2), indicating that the extinction risk is higher than 10% in the next 100 years.

The simulations where the population on Öland were treated as three subpopulations in the main habitats increased the viability. The extinction risk in the next 100 years was 30% and the median time to extinction >100 years (Figure 2, Table 5). The sensitivity analyses revealed the same pattern as in the simulations with the status quo scenario (Table 5). When we included dispersal to the suboptimal habitat agricultural fields, the extinction risk was 35% and 43% in the next 100 years for a 10% and 30% proportion of dispersal, respectively. The me-

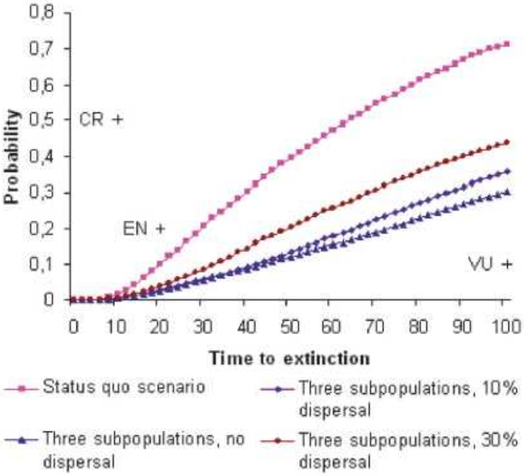

Figure 2. Cumulative extinction risk the next 100 years in Montagu's Harrier on Öland. Four different scenarios are indicated: a status quo scenario (no change), a scenario with populations in the three main breeding habitats and two scenarios with dispersal to the suboptimal breeding habitat agricultural fields from the two other habitats by a proportion of 10% and 30% dispersal each year (details in text). The red-list categories Critically endangered (CR), Endangered (EN) and Vulnerable (VU) are denoted in the figure.

Kumulativ utdöenderisk de närmaste 100 åren hos ängshök på Öland. Fyra olika scenarior visas; ett scenario med oförändrade parametervärden och tre scenarior där bestånden i de tre häckningsmiljöerna betraktas separat, dels utan spridning mellan häckningsmiljöerna och dels med spridning till odlingsmark från de andra två häckningsmiljöerna med en omfattning av 20 respektive 50 % årligen. Gränserna för rödlistekategorierna akut hotad (CR), hotad (EN) och sårbar (VU) anges i figuren.

Table 4. Viability estimates from sensitivity analysis in Montagu's Harrier on Öland, based on survey data from 2004–2008. A status quo scenario (denoted in bold) and scenarios where the model parameters are changed by ±10 and ±20% respectively, are presented as extinction probabilities in the next 100 years (Ext. prob.) and median time to extinction in years (Md ext.). Model parameters are denoted as follows; Population growth rate (Pop. growth), Environmental stochasticity (Env. stoch.), Initial abundance (Init. abun.) and Ceiling value of population size (Ceil. val.).
Utdöenderisker från känslighetsanalyser av ängshök på Öland, baserade på inventeringsdata 2004–2008. Ett scenario med oförändrade parametervärden (i fetstil) jämförs med scenarior där modellparametrarna ändras med ±10 och ±20%, och presenteras som utdöenderisker inom de närmaste 100 åren (Ext. prob.) och mediantid till utdöende i antal år (Md ext.). Modellparametrarna förkortas enligt följande; populationstillväxt (Pop. growth), omgivningsstokasticitet (Env. stoch.), initial populationsstorklek (Init. abun.) och högsta populationsstorlek (Ceil. val.).

%	Pop. growth		Env. stoch.		Init. abun.		Ceil. val.	
change	Ext. prob	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.
-20	1.00	12	0.55	88	0.73	57	0.76	56
-10	0.99	21	0.63	74	0.70	62	0.74	59
0	**0.71**	**63**	**0.71**	**62**	**0.71**	**62**	**0.71**	**63**
+10	0.05	>100	0.76	54	0.70	64	0.68	66
+20	0.01	>100	0.83	47	0.70	65	0.66	69

Table 5. Viability estimates from sensitivity analysis in Montagu's Harrier on Öland with populations in the three main habitats on Öland (c.f. Table 2). No dispersal among populations is included. A status quo scenario (denoted in bold) and scenarios where the model parameters are changed by ±10 and ±20% respectively, are presented as extinction probabilities in the next 100 years (Ext. prob.) and median time to extinction in years (Md ext.). Model parameters are denoted as follows; Population growth rate (Pop. growth), Environmental stochasticity (Env. stoch.), Initial abundance (Init. abun.) and Ceiling value of population size (Ceil. val.).
Utdöenderisker från känslighetsanalyser av ängshök på Öland med antalet par i de tre huvudsakliga biotoperna betraktade som delpopulationer (jmf. Tabell 2). Ingen spridning mellan delpopulationerna är inkluderad. Ett scenario med oförändrade parametervärden (i fetstil) jämförs med scenarior där modellparametrarna ändras med ±10 och ±20%, och presenteras som utdöenderisker inom de närmaste 100 åren (Ext. prob.) och mediantid till utdöende i antal år (Md ext.). Modellparametrarna förkortas enligt följande; populationstillväxt (Pop. growth), omgivningsstokasticitet (Env. stoch.), initial populationsstorklek (Init. abun.) och högsta populationsstorlek (Ceil. val.).

%	Pop. growth		Env. stoch.		Init. abun.		Ceil. val.	
change	Ext. prob	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.	Ext. prob.	Md ext.
-20	1.00	12	0.15	>100	0.35	>100	0.40	>100
-10	0.98	31	0.20	>100	0.33	>100	0.35	>100
0	**0.31**	**>100**	**0.31**	**>100**	**0.31**	**>100**	**0.31**	**>100**
+10	0	>100	0.41	>100	0.28	>100	0.26	>100
+20	0	>100	0.52	97	0.27	>100	0.25	>100

dian time to extinction was >100 years in both scenarios (Figure 2, Table 5).

Discussion

Our simulation results underline that the two species suffer a high risk of extinction in the close future. Sensitivity analyses indicated population growth rate as the most important single factor for viability in both species. This finding agrees with the general aims of the action plan for Montagu's Harrier (Rodebrand 2009) and Baltic Dunlin (Flodin et al. 2010); the decline of both species will be stopped if the fecundity is high enough. However, in our simulation model the factor population growth rate includes fecundity, juvenile and adult survival. We had no opportunity to indicate which of those measures that is most important for viability on Öland, since there is no data available. Several studies in waders closely related to the Baltic Dunlin, i.e. other *Calidris* species, have indicated adult survival as most important for the population growth rate (e.g. Hitchcock & Gratto-Trevor 1997, Koivula et al. 2008). There are no apparent threats for adult birds on Öland. Therefore, what can be done locally on Öland is to enhance possibilities for successful breeding. Several conservation measures are discussed in the two action plans for achieving this goal.

In the case of Baltic Dunlin habitat deterioration has been suggested as one important factor behind the population decline, i.e. from ceased grazing followed by a closure of suitable coastal meadows. However, on Öland the area of coastal meadows suitable for breeding has not declined during the last twenty years. Therefore factors associated with habitat quality are probably involved. Our simulations showed that nest predation increases the extinction risk (Figure 1). Observe that the extinction risk is high even without nest predation, but that nest predation further increases the threats. Nest predation on waders mainly occurs during night, indicating that mammals are involved (Ottvall 2009, Ottvall & Johansson 2009).

In the case of Montagu's Harrier our simulation results showed that populations in three different main habitats on Öland are more viable in the long run than a single population using only one habitat type (Figure 2). This is because the overall extinction risk will be reduced since all habitat types are not affected to the same degree from extreme weather events or predation pressure (c.f. Gilpin & Hanski 1991). Further our simulations showed that dispersal to agricultural fields, from the other two habitats, increased viability even though the breeding success is lower in this habitat. This opens up a new perspective. Since there is a marked dispersal to agricultural fields during certain years, e.g. in 2007 (Table 2), specific measures of detecting and safeguarding the nests during these years could substantially enhance the number of successful broods on Öland. We argue that in order to fulfil the goal in the action plan, 45 breeding pairs of Montagu's Harrier on Öland, a specific management of breeding in agricultural fields will be a key factor. Two possibilities that have been tested in Sweden are to protect large enough areas, at least 25×25 m, around the nest when crops in agricultural fields are harvested, and to plan the timing of harvest activities in relation to status of breeding (Rodebrand 2009). In Western Europe conservation measures in agricultural areas, together with dispersal between populations, are key factors for the survival of the species (Arroyo et al. 2002). There is no evidence of a population decline of Montagu's Harrier in neighbouring countries (Rodebrand 2009). This suggests that immigration from those areas is a factor that may also enhance viability for the population on Öland.

The viability outcomes in our models predicted different threat categories for the studied species compared to the Swedish red-list (Gärdenfors 2010). However, the quantitative E-criteria (i.e. performing a PVA) is just one of five sets of criteria used for classification of threat categories. The other criteria (A-D) are built on measures such as distribution area, population size, number of reproducing individuals, rate of decline etc. If the threat categories differ among criteria, species are red-listed according to the most severe threat category. Both Baltic Dunlin and Montagu's Harrier are classified according to an ongoing decline and a low number of reproducing individuals, not according to a PVA. Therefore our simulations may indicate another threat category than the current red-list classification. A complete overview of the red-list criteria is found on the webpage of the Swedish Species Information Centre (www.artdata.slu.se/rodlista/).

Improving the PVA model

The outcome of a PVA has a higher accuracy if demographic data as fecundity and survival, or surveys on population numbers, are collected over many years. One reason is that the chance of including years with extreme weather situations increases. When there are data on fecundity and survival also more realistic models may be built, i.e. stage-structured models. Scalar models sometimes overestimate extinction risks, compared to structured models including demographic data on fecundity and survival (Dunham et al. 2006). Therefore we suggest that studies on fecundity and survival of Baltic Dunlin and Montagu's Harrier populations on Öland should be performed. Data from such studies would definitely enhance the PVA models and the reliability of the model outcomes. Additional support for this view also comes from the sensitivity analyses, indicating population growth rate as the single most important factor for viability in both species.

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Sammanfattning

Sårbarhetsanalys är ett viktigt verktyg för att förutsäga livskraften hos populationer. Metoden bygger på matematiska modeller där man utifrån befintliga uppgifter om arten, t.ex. populationsstorlek och antal häckningar, simulerar populationens framtida dynamik. Resultaten av en sårbarhetsanalys uttrycks ofta som en sannolikhet för utdöende inom en given tidsperiod. Metodens träffsäkerhet begränsas av kvaliteten på demografiska data, t.ex. häckningsframgång och överlevnad. I de fall simuleringarna främst syftar till att jämföra olika situationer eller bevarandeåtgärder, och inte till att göra mer exakta förutsägelser, ger metoden en god vägledning även om man har en begränsad mängd data.

I denna studie använder vi sårbarhetsanalys för att undersöka livskraften hos de öländska populationerna av sydlig kärrsnäppa och ängshök, två arter som är hotade och har minskat betydande i populationsstorlek under de senaste decennierna.

Sydlig kärrsnäppa och ängshök

Den sydliga kärrsnäppan har specifika krav på sin häckningsmiljö och föredrar strandängar med varierande vegetationshöjd som inte överstiger 10–20 cm, och som gärna betas. Det svenska beståndet är uppskattat till 120 par, varav 60 par finns på Öland. Beståndet i Sverige har minskat med 70% under de två senaste decennierna. En orsak till tillbakagången som framförts är habitatförlust genom upphörande bete, varvid lämplig häckningsmiljö växer igen. Andra orsaker kan vara att strandängarna generellt blivit torrare och att bopredation på ägg och ungar från fåglar och däggdjur ökat. I västra Sverige har även beståndet påverkats negativt av låg genetisk variation. Den sydliga kärrsnäppan är i Sverige rödlistad som akut hotad (CR), vilket innebär att den löper extremt stor risk att dö ut, och ett åtgärdsprogram har därför upprättats.

Ängshöken har en relativt kort historia som häckfågel i Sverige. Under 1930- och 1940-talen fanns några få par i Skåne, men de försvann p.g.a. förföljelse och äggsamlande. Under 1940-talet koloniserades Öland, och beståndet ökade långsamt till 40–45 par under 1970- och 1980-talen. Det svenska beståndet har minskat med 20% de senaste 20 åren, och för närvarande uppskattas beståndet till ca 55 par varav 30–35 par finns på Öland. På Öland nyttjar arten tre huvudsakliga häckningsmiljöer; våtmarker med ag, alvarmark med ölandstok samt odlingsmark. Flera orsaker till beståndets tillbakagång har framförts såsom försämring av häckningsmiljöernas kvalitet, ökad konkurrens från brun kärrhök och predation på yngre kärrhökar av duvhök. Möjligen påverkas beståndet också negativt av ett ökat antal häckningar i odlingsmarker, där häckningsframgången är sämre. Arten är i Sverige rödlistad som hotad (EN), vilket innebär att arten löper mycket stor risk att dö ut, och ett åtgärdsprogram har upprättats.

Modell och underlagsdata

Vi använde programmet RAMAS GIS för sårbarhetsanalyserna. Vi utgick från beståndsdata baserade på inventeringar under ett antal år hos de bägge arterna på Öland. Den sydliga kärrsnäppan inventerades heltäckande 1988, 1998 och 2008, och stickprovsinventeringar på 20% av den lämpliga häckningsarealen genomfördes 2003–2008 (Tabell 1). Ängshöken inventerades heltäckande under 2004–2008 (Tabell 2). Från tidsserierna beräknades populationstillväxten mellan intilliggande år. Från dessa värden beräknades i sin tur medelvärde och standardavvikelse, vilka i simuleringsmodellen motsvaras av populationernas tillväxttakt och omgivningens slumpmässiga variation (t.ex. i klimatiska faktorer eller predationstryck mellan olika år). Som startvärde för simuleringarna använde vi populationsstorleken för det senaste året i arternas respektive inventeringsserier. I dagsläget saknar vi kännedom om hur en eventuell inomartskonkurrens påverkar populationstillväxten. Därför använde vi en modell med exponentiell populationstillväxt och ett s.k. takvärde, d.v.s. en högsta tillåten populationsstorlek. Eftersom små populationer även påverkas av slumpmässiga faktorer i häckningsframgång och överlevnad tog vi med detta i modellen. Vi genomförde s.k. känslighetsanalyser för att se vilka av modellens delar som har störst påverkan på resultatet. I dessa ökade respektive minskade vi modellens ingående delar (populationstillväxt, omgivningens slumpmässiga variation, populationernas start- respektive takvärde) med 10 och 20%.

Förutom dessa grundsimuleringar var det också möjligt att ta med ett par av de hotfaktorer som omnämns i åtgärdsprogrammen. För den sydliga kärrsnäppan gäller detta hur bopredation påverkar den framtida överlevnaden. För ängshökens del gäller det hur den framtida överlevnaden påverkas om de tre häckningsmiljöerna betraktas som en enda sammanhållen population eller som separata delpopulationer, samt hur en spridning till odlingsmarker där häckningsresultatet är sämre, påverkar populationstillväxten.

Resultat

Utdöenderisken inom de närmaste 100 åren är för sydlig kärrsnäppa 100%, med en mediantid till utdöende på 24 år (Figur 1, Tabell 3). I Figur 1 finns möjlighet att avläsa utdöenderisken även för kortare tidsperioder än 100 år, t.ex. är utdöenderisken under de närmaste 30 åren cirka 70%. Känslighetsanalysen visade att populationstillväxten är viktigast för modellens utfall, medan övriga delar inte påverkar resultatet nämnvärt (Tabell 3). Enligt den svenska rödlistan motsvarar simuleringsresultatet för det öländska beståndet en placering i kategorin hotad (EN), vilket innebär att beståndet löper mer än 20% risk att dö ut inom de närmaste 20 åren. Då bopredation tas med i modellen sjunker överlevnaden ytterligare (Figur 1).

I ängshökens fall är utdöenderisken inom de närmaste 100 åren 70%, med en mediantid till utdöende på 63 år (Figur 2, Tabell 4). Känslighetsanalysen visade att populationstillväxten, och delvis omgivningens slumpmässiga variation, påverkar modellens utfall (Tabell 4). Enligt rödlistan motsvarar simuleringsresultatet för det öländska beståndet en placering i kategorin sårbar (VU), vilket innebär att arten löper mer än 10% risk att dö ut inom de närmaste 100 åren. Då vi tog med ängshökens tre häckningsmiljöer som separata delpopulationer i modellen, ökade överlevnaden. Överlevnaden ökade mest då vi inte tog med spridning till odlingsmark från de andra två miljöerna (Figur 2, Tabell 5).

Diskussion

Simuleringsresultaten understryker den allvarliga situationen för de öländska bestånden av sydlig kärrsnäppa och ängshök. Populationstillväxten är den viktigaste faktorn för modellernas utfall hos båda arterna. Denna faktor beror av den årliga häckningsframgången samt unga och äldre fåglarnas överlevnad. Det finns tyvärr inte uppgifter för dessa delars inbördes betydelse för populationstillväxten på Öland, men för den sydliga kärrsnäppan har studier av andra arter inom släktet *Calidris* visat att det är de äldre fåglarnas överlevnad som är nyckelfaktorn. Den del av populationstillväxten som är möjlig att påverka lokalt på Öland, hos båda arterna, är att skapa goda möjligheter att genomföra lyckade häckningar. I respektive arters åtgärdsprogram diskuteras dessa åtgärder utförligt.

Förutom grundsimuleringarna genomförde vi också simuleringar med några av de faktorer som omnämnts som hot i åtgärdsprogrammen. Hos den sydliga kärrsnäppan gällde detta betydelsen av bopredation för beståndets tillväxt. Simuleringsresultaten visade på en ökning av utdöenderisken då denna togs med i modellen (Figur 1). För närvarande pågår en kartläggning av bopredationens påverkan på häckningsframgången hos vadare på Öland. Resultaten från dessa studier visar på att bopredation främst sker nattetid, av däggdjur. Att försöka minska bopredationen hos den sydliga kärrsnäppan blir därför en av åtgärderna i bevarandearbetet på Öland.

I ängshökens fall undersökte vi betydelsen av att det finns tre olika häckningsmiljöer, och att en spridning vissa år sker till odlingsmarker där häckningsframgången är lägre. Utdöenderisken minskade tydligt då detta scenario simulerades, även då en spridning förkom till odlingsmarker från de två andra häckningsmiljöerna (Figur 2). En förklaring till detta resultat är att delpopulationer i olika häckningsmiljöer kan påverkas olika av klimatfaktorer och predation, både under och mellan skilda år. Om man istället tänker sig ett bestånd som bara förekommer i en häckningsmiljö kommer vissa år att vara mycket goda för häckningsframgången, medan andra är sämre. När ett bestånd består av ett mindre antal par finns risken att extremt dåliga år påverkar populationernas tillväxt mycket negativt, och hos mycket små populationer kan då ett utdöende ske. I modellen fångas dessa olika förutsättningar upp i den faktor som beskriver omgivningens slumpmässiga variation. Våra känslighetsanalyser visade också att denna faktor hade en viss inverkan på resultaten i ängshökens fall. Vidare visar våra simuleringar att det inte är så negativt med en spridning till odlingsmarker, där häckningsframgången är lägre. Om man istället skyddar ett tillräckligt stort område runt boplatserna i odlingsmarker, eller skjuter på skörden tills häckningen är klar, kan häckningsframgången ökas. Försök som genomförts har visat att ett område på 25×25 meter runt en boplats kan vara tillräckligt för att häckningen inte ska avbrytas. Detta innebär att en riktad skötsel av häckningar i odlingsmarker, tillsammans med en viss spridning mellan häckningsmiljöerna, ökar möjligheterna för artens överlevnad på Öland. Eftersom bestånden av ängshök i länderna söder om Östersjön inte minskat, kan även en invandring av fåglar från dessa områden öka överlevnaden för det svenska beståndet.

Sårbarhetsanalysen kan förbättras genom att samla in data på häckningsframgång och överlevnad. Modeller där olika åldersklasser ingår kan då utvecklas, och förutsägelserna för arternas framtidsutsikter på Öland kan därmed göras säkrare.

Korta rapporter – *Short communications*

First proven record of within-year nest reuse by a pair of Bramblings *Fringilla montifringilla*

Första bevisade fallet av återanvändning av ett bo samma år hos bergfink Fringilla montifringilla

VLADIMIR YU. ARKHIPOV

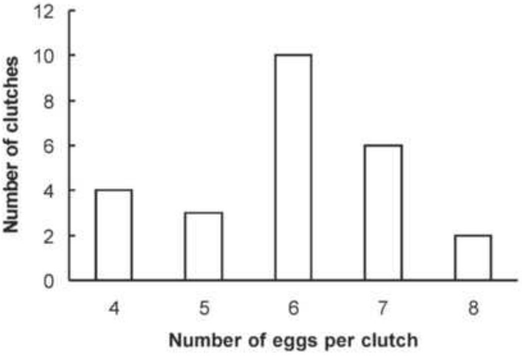
It is known that those solitarily breeding passerines that build open nests rarely reuse old nests within a single breeding season (Hafstad et al. 2005). Indeed, there are many reports specifically of Bramblings building a new nest before a replacement clutch is laid (Cramp & Perrins 1994). Nevertheless, in the severe conditions at high latitudes, the strategy of reusing an old nest within the same season might be adaptive. I present here the first proven record of within-year nest reuse by a colour-ringed Brambling pair during a study in Central Siberia.

Methods, study area and data collection

A breeding population of the Brambling was studied over four consecutive breeding seasons between 1994 and 1997. The study area is situated in the middle taiga subzone of Central Siberia (Russia) at the Yenisei River (Ecological field station “Mirnoye,” 62°20'N, 89°E) in pristine floodplain forest. These floodplain habitats hold an extremely dense and diverse breeding community in comparison with taiga zone habitats. A detailed description of the floodplain habitats of the area and their bird communities is given by Bourski (1995). The study was restricted to the 50 ha floodplain plot on the west bank of the Yenisei. The plot includes both willow-thicket (*Salix sp.*) and upper coniferous-deciduous forest habitats. To obtain detailed survey data, territorial birds on the plot were mist-netted and fitted with a unique combination of plastic colour rings. In the study area, the Brambling occurred at a high mean density of 68 breeding pairs per km^2 (range: 53–78 over four years). In total 42 nests were found and 55 adults from these nest were colour-ringed (Arkhipov 2005).

Results and discussion

The incident of nest reuse after depredation was observed in June and July 1995. The fresh, newly built Brambling nest was found on 12 June, with its owners, a pair of colour-ringed birds sounding alarm calls nearby. Both birds were caught approximately 100–150 m from the nest site; the male was caught on 4 July, the female one day later. The nest was situated in the crotch of a young willow-tree trunk about 3 m above the ground. After a clutch of two eggs had been laid on 14 June, the nest was depredated on a day between 14 and 17 June. When I checked on 17 June, I found it empty but intact. The parent birds were not observed. Just in case, the nest was visited on 23 June. Now an incubating female was noted on it. On June 29, I counted five warm eggs, on 4 July two eggs and three hatchlings, and on 5 July four hatchlings and one egg in the nest. The original pair of colour-ringed birds, which I had registered with the first clutch, fed the nestlings. Clearly, the same pair that had laid the first clutch successfully raised three nestlings from the replacement clutch in the same nest. The nestlings left the nest on 13 July. During our study, the incubation period for the Brambling from the last egg was 10–12 days, which means that in this case, the female may have begun to lay eggs on 18–20 June, some 1 to 5 days after the first nest had been predated. Thus, the total number of eggs laid by



Figur 1. Distribution of size of clutches of Central Siberian Bramblings (our data).
Fördelningen av kullstorlekar hos bergfinkar i centrala Sibirien (egna data).

that female was from 7 to 10, the maximum applying if the predation happened on about 17 July.

It is unlikely that the female would continue to lay to complete one clutch if the gap after depredation of the first part of the clutch was 4 to 5 days or greater. It is known that the Brambling can accommodate a gap in laying sequence of a single clutch of up to 5 days during periods of harsh weather (Hogstad 2000). However, the weather conditions during the period the nest was observed were extremely favorable. The total number of eggs laid in this case was 7, which is within the known limits of a single clutch (Figure 1). Consequently, we observed a true occurrence of within-year nest reuse where a replacement clutch was laid. The gap between laying the two lots of eggs was 5 days if the total number of eggs laid was 7, but only one day if the total was 10 (which would be greater than the known maximum size of a single clutch).

A similar case of Brambling nest reuse was reported from Tana (70°16'N, 28°19'E), Norway Hafstad et al. (2005) for June 2003, where the gap between clutches was greater than a week. As there was no ringing of birds, this record lacks confirmation of the same bird laying both clutches. The authors report four other cases of potential nest reuse after it had been depredated in 2003, all four nests being depredated when they each contained 2 or 3 eggs, the birds were not colour-ringed as well. The gap between the depredation and the initiation of the second clutch in each case was only 1–3 days, the total number of eggs laid per female being between 5 and 7. The authors suggested that these incidents did not comprise clear cases of nest reuse, the evidence not ruling out that the observations were just gaps in the laying sequence of a single clutch. However, all the incidents in this paper demonstrate in behavioural terms the ability of Bramblings to respond to clutch or part of clutch depredation and point to a possible capability of reusing a previously-built nest that had been predated, which response would demand separate egg-laying and incubation periods.

The fact of within-year nest reuse by Brambling is even more interesting to compare with behaviour of the closest relative, the Chaffinch *Fringilla coelebs* that lives further to the west and south. The Chaffinch is much more investigated, but no attempt to use old nests except for using them as material for new nest has ever been observed (Cramp & Perrins 1994).

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Sammanfattning

Det är sällan som frihäckande fåglar lägger en ny kull i samma bo om boet plundras. Även hos bergfink finns många rapporter om att de bygger ett nytt bo för en omläggning, och detta är säkerligen det normala. Men under en flerårig studie av bergfink i centrala Sibirien observerades ett säkert fall där ett färgringmärkt par först fick en delvis lagd äggkull plundrad och senare registrerades mata ungar i samma bo. Detta är det första bevisade fallet, men en del tidigare indikationer på sådan återanvändning finns. Dessa är visserligen inte säkerställda, men kan indikera att vanan kan förekomma i viss frekvens hos just bergfinken. Hos bofinken, som är betydligt bättre studerad än bergfinken, har fenomenet aldrig rapporterats och torde därför inte förekomma. En tänkbar förklaring till att bergfinken skulle återanvända samma bo efter plundring är att häckningssäsongen är kort på artens kärva latituder. Antalet dagar mellan förlust och omläggning kan förkortas om ett nytt bo inte behöver byggas, och därmed ökar chansen för den nya kullen.

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Nya böcker – *New books*

Jeff Watson, 2010: **The Golden Eagle**. Andra upplagan. 448.sid. T & A D Poyser, London.

Jeff Watson dog bara 54 år gammal i September 2007. Han hade då sedan länge samlat material till en ny upplaga av sin kungsörnmonografi, som hade hunnit bli tio år gammal. Jeff Watson hann inte själv föra projektet hela vägen till en ny bok. I stället samlades flera av hans vänner inom kungsörnforskningen och tog vid under ledning av Des Thompson. Resultatet av det gemensamma arbetet föreligger nu.

Det allmänna upplägget av boken är det som Poysers artmonografier brukar ha. Efter en allmän presentation av kungsörnen följer kapitel om jaktbeteende, föda, boplatsernas egenskaper och fördelning, beståndsuppskattningar och trender, häckningscykelns olika faser, ruggning, flyttning, hot mot och skydd av arten samt några historiska och folkloristiska utblickar. Här framgår hur karismatisk och mytologisk örnen varit för många folk. Fjädrar har använts i ceremoniella dräkter och för jakt och prydnad. En praktfull kungsörn med utbredda vingar och med klorna i en hare eller räv var något som förr borde pryda ett välboret hem.

Boken avslutas med ett kort kapitel om ”Ytterligare forskning”, dvs. vad behöver man ta reda på om kungsörnen utöver vad som står i denna bok? Här framhåller Jeff Watson att kungsörnen tillhör de relativt vanliga och lättstuderade rovfåglar som kan tjäna som modell för mera utmanande arter; lättstuderade för att de lever i öppet landskap där man visuellt kan följa deras förehavanden. Detta speglar dock främst att en stor del av Watsons studier skett i öppna skotska bergstrakter. I Sverige är det inte lika lätt att studera kungsörnarna. De flesta av våra kungsörnar bor i skogarna, placerar boet svårsynligt nedanför toppen inne i en trädkrona och är synnerliga varska när de flyger till och från boet. Ett område som är dåligt utforskat är örnarnas rörelser och sysselsättning utanför häckningstiden, både vad gäller bestånd som är stannfåglar och sådana som flyttar. Här bör sändarförsedda örnar snabbt kunna ge intressant information, vilket det i dag finns flera goda konkreta exempel på. Ett annat dåligt utforskat område är vad som händer ungarna tiden efter det att de lämnat boet, dvs. under de flera år som går tills de kan börja häcka själva. Detta kräver dock att man förser ett stort antal ungar med sändare och följer dem hela tiden, ett projekt som är både resurs- och tidskrävande. Men på det sättet skulle man få veta mycket om både ungfåglarnas vanor och dödsorsaker. Ett annat lovande forskningsområde vore att samköra detaljerad information om olika individers rörelser och vistelseplatser med lika detaljerad information om landskaps- och biotopdata. Konkurrens med havsörn framhålls också som något som behöver studeras. I Sverige finns misstanke om att havsörnen kan tränga undan fiskgjusen. Men skulle ett ökande havsörnbestånd kunna hindra kungsörnens spridning i Sydsverige? Och hur stort skulle det svenska kungsörnsbeståndet kunna bli om det fick utvecklas ohämmat i dagens landskap? Enligt svenska studier i både fjäll och skog ligger avståndet mellan grannrevir i storleksordningen 15 kilometer, vilket motsvarar en täthet på 20 revir per 1000 kvadratkilometer (vilket för övrigt är tätheten på Gotland där beståndet nog är så tätt det kan bli). Multiplicerar vi detta med 400 för ungefärlig potentiell häckningsareal i landet får vi 8000 revir. Och det finns inte fler än 800 revir, alltså bara en tiondedel av vad som kunde (borde?) finnas. Anledningen är naturligtvis att det är lång väg kvar tills arten återerövrat de delar av södra Sverige där den blivit totalt utrotad. En märklig skillnad finns mellan svenska och finska kungsörnar enligt en karta som redovisas i boken. De svenska flyttar kortare sträckor inom Skandinavien medan de finska flyttar söderut en god bit ner på kontinenten med fynd ända till Svarta havet. Det märkliga är att det inte är många mil mellan de platser där flyttvanorna är så olika. I Svensk ringmärkningsatlas redovisas dock ett återfynd från kontinenten, av totalt över hundra, och det är en örn från Norrbottens landskap, vilket visar att enstaka svenska fåglar kan följa det finska exemplet. Bara ett par axplock ur all den information som finns i boken, som därför är en helt nödvändig källa till basfakta för den som vill fortsätta att forska om kungsörnen eller bara vill yttra sig om kungsörnen i skrift eller tal.

Mike Archer, Mark Grantham, Peter Howlett & Stegen Stansfield, 2010: **Bird observatories of Britain and Ireland**. T & A D Poyser, London. 592 sid.

Denna bok om brittiska och irländska fågelstationer förstärker den traditionella bilden av vad en fågelstation är. I inledningen får vi faktiskt också en definition: ”a bird migration and population monitorting station”, och närmare förklarat ”en fältstation som upprättats i syfte att genomföra och vidmakthålla långsiktiga observationer av både flyttfåglar och lokalt häckande fåglar, och för att fånga, studera och ringmärka dem”.

I Sverige har man ingen formell ackreditering av fågelstationer och jag tror inte att det finns några formella krav för att komma med i SOFs förteckning över fågelstationer på hemsidan eller i *Fågelåret*. Den ”ackreditering” som finns är den som Ringmärkningscentralen svarar för, dvs. kontrollen över att ringmärkningen sköts enligt RC:s kriterier och av licensierad personal. Men på de brittiska öarna är det annorlunda. Där finns ett särskilt ”Bird Observatories Council” som har uppställt regler för ackreditering. Arton stationer är för närvarande ackrediterade. Men det finns också fågelstationer som antingen själva valt att inte söka ackreditering eller som inte når upp till kraven för ackreditering.

Fair Isle mitt emellan Shetland och Orkney får tjäna som exempel på beskrivningarna. Fair Isle beskrivs på 30 sidor, vilket är genomsnittligt antal för var och en av de arton stationerna (de kursiverade orden är de rubriker som normalt finns för varje station). *Beskrivning*. Ön är fem kilometer lång och tre kilometer bred, med en högsta topp på 217 m, täckt av betad gräsvegetation och med en fast befolkning på 70 personer. Högre vegetation finns bara i anslutning till gårdarna och där man inhägnat till skydd mot betesdjuren. *Historia*. Som fågellokal var Fair Isle känt redan i början av 1900-talet och från och till studerades fågellivet. Fågelstationen startade 1948 då George Waterston köpte ön från den tidigare ägaren och inrättade ”Fair Isle Bird Observatory” som en ”public trust”. Men det var Ken Williamson som kom att identifieras med denna fågelstation, och han var dess chef 1948–1956. Han omvandlade marinens gamla lokaler till ringmärkningslabb och bostäder och byggde en helgolandfälla. Det var hans förtjänst att verksamheten på Fair Isle redan tidigt fick en prägel av vetenskaplig forskning, inte minst genom sina egna studier av vindregimernas betydelse för stora nedfall av flyttare. En ny och mera ändamålsenligt byggnad kom 1969 och 2010 stod den nuvarande stationen färdig. Den kostade fyra miljoner pund och där finns rum av olika slag inklusive familjerum, gemensamhetsutrymmen, utställning, konferensmöjligheter, shop och laboratorier. Personalen består av två heltidsanställda, en vetenskaplig och en administrativ chef, samt säsongsmässigt en biträdande stationschef, en sjöfågelövervakare, en reservatsvakt, en kock, en kockassistent samt tre personer för övriga husliga sysslor. En hel liten hotellrörelse alltså! *Fåglarna*. Redovisningens tyngdpunkt är på särskilt stora dagar och rariteter, men man redovisar också förändringen i sjöfågelbestånden. Ringmärkningen gäller till stor del dessa sjöfåglar medan flyttfåglarna främst fångas i nio helgolandfällor. Nät kan man använda i bara begränsad utsträckning eftersom det mestadels blåser för mycket. *Övrig fauna och flora*. Beskrivs relativt utförligt. *Framtiden*. Det man koncentrerar sig på nu är att stärka det vetenskapliga arbetet genom att öka antalet forskare vid stationen, bl.a. genom stipendier. Man ämnar också datalägga allt gammalt material för att göra det tillgängligt för analys. Man avser också att stärka det publika arbetet. *Förbindelser och boende*. Man tar sig till Fair Isle med båt eller flyg från flera olika platser och bo kan man göra på fågelstationen med helpension. Sist kommer litet statistik, t.ex. att man sett 374 arter, ringmärkt 350.000 fåglar med rekordet 12.000 på ett år.

Med smärre variationer är det ungefär denna information man får om var och en av stationerna. Vill man veta mera kan man gå till respektive stations hemsida. Även om en del resultat redovisas för vissa stationer, är det resultaten från de mångåriga arbetena med fångst och observationer som man får veta minst om. Det hade inte skadat med, exempelvis, referenser till de tio viktigaste vetenskapliga publikationerna från varje station. Men inom ramen för bokens ambitioner är den en alldeles utmärkt introduktion till fågelstationerna på de brittiska öarna. Vill man besöka en station så får man veta vad man behöver för att planera besöket till rätt tid på året och råd för resa och boende.

James A. Jobling, 2010: **Helm Dictionary of Scientific Bird Names**. Christopher Helm, London. 432 pp.

Har man denna bok på hyllan så tror man kanske att man inte längre behöver undra över vad *quiscula* betyder. Men så är det inte. Men en intressant utläggning av möjliga ursprung får man. Nu är det dock inte så med flertalet namn eftersom de har enkelt och välkänt ursprung i klassiska eller andra språk. En del anger helt enkelt färg, form eller någon annan karaktär. Andra anger vanor eller tillhåll. Egennamn, platser eller personer, är också vanliga. Fast ibland förstår man inte riktigt förklaringen trots den rent språkliga enkelheten: ”*Ficedula* en liten fikonätande fågel som förvandlas till svarthätta på vintern”. Den första delen av förklaringen är ju uppenbar, men varifrån har Jobling fått den andra delen? De flesta förklaringar är korta och rakt på sak utan utvikningar. Men några är långa och en av de allra längsta avser *svecica* och lyder så här: ”Blåhaken upptäcktes av Olof Rudbeck i Lappland 1695. Han imponerades av dess skönhet och inspirerad av att hanen var färgad som svenska flaggan (det gula i svenska flaggan hade en mera orange ton på 1600- och 1700-talen) kallade han den *Avis Carolina* efter den svenske kungen Carl XI. Men 1758 hade kungen förlorat sin absoluta makt och Linné, som normalt nära följde sin mentor Rudbeck men hade starka band till hattarnas parti i riksdagen, tyckte säkerligen att *Svecica* nu var politiskt mer korrekt än *Carolina*.” Litet svensk historia på köpet såldes. På detta sätt kan man sitta och bläddra i boken, vilket gör den högst njutbar till och med som läsebok och inte bara som uppslagsbok i hylla.

Alan Davies & Ruth Miller, 2010: **The biggest twitch**. Christopher Helm, London.

Reklamrubriken på omslaget säger allt: “Around the world in 4,000 birds”. Det gällde att slå världsrekord i antal arter under ett år. Och det lyckades man med. Det blev nämligen 4341 arter, 679 fler än det nitton år gamla rekordet på 3662 arter. Boken är i princip en dagbok med successivt nya arter uppräknade blandat med litet sedvanliga resestrapatser, kommentarer om de guider man hade bokat, litet anekdoter och personliga kommentarer i övrigt. Så här gick resan: Arizona, Mexiko, Houston, Ekvador, Wales, Etiopien, Kenya, Gana, Wales, Cypern, Spanien, Texas, Panama, Texas, Kalifornien, Kanada, Kap May, Wales, Cypern, Turkiet, Finland, Estland, Norge, Brasilien, Argentina, Brasilien, Peru, England, Sydafrika, Zambia, Malawi, Sydafrika, Namibia, Australien, Malajsia, Indien och Ekvador. I lugn takt och utspritt över några år vore en sådan resa angenäm. Men för att göra ett nytt rekordförsök skall man nog vara rätt speciellt skapad, åtminstone i huvudet. Boken är ytlig, enkelspårig och torftig, men återigen, har man rätt läggningen så blir läsupplevelsen säkert nog så engagerande.

Julian Fitter, 2010. **Field guide to the wildlife of New Zealand**. A & C Black, London.

Inte alla som besöker Nya Zealand behöver en traditionell komplett fågelguide, som t.ex. *Birds of New Zealand* av Robertson & Heather. Det har observerats drygt 300 fågelarter i landet men många är så tillfälliga eller svåra att hitta att en korttidsbesökare utan specialarrangemang inte har någon rimlig möjlighet att få kontakt med dem. Är man dessutom intresserad av mer än fåglar är denna bok ett fynd. Över hälften av alla fågelarter på Nya Zealands lista finns med i denna bok, och antalet bilder än ännu större. Dessutom finns ett betydande antal arter nämnda parentetiskt i anslutning till liknande, mera vanliga arter, som beskrivs med både text och bild. Styrkan med boken är dess behändighet och att, förutom en inledning med en allmän översikt över öarna, den beskriver de flesta arter man har god möjlighet att se även bland däggdjur, grod- och kräldjur, inhemska träd, buskar, epifyter, parasiter, örter, gräs, ormbunkar och svampar. En del mossor och lavar beskrivs också. Det finns också kortfattad information om bra mål att besöka samt skyddade områden. Även om andelen beskrivna arter inom andra grupper än fåglar och däggdjur är måttligt torde det vara svårt för en besökare att behöva mer än denna bok för att få en fullständigt njutbar biologisk resa på Nya Zealand. Introducerade arter är legio på dessa öar. Och dessutom är de bland de talrikaste. De finns naturligtvis med i boken, exempelvis koltrast, gulsparv, sånglärka, bofink, grönfink, steglist och gråsparv. Men viktigast är att de endemiska arterna är med i mycket välvald omfattning.

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Allmänt gäller att bidrag skall vara avfattade enligt den modell som finns i tidigare häften av tidskriften. Titeln skall vara kort, beskrivande och innehålla ord som kan användas vid indexering och informationssökning. Uppsatser, men ej andra bidrag, skall inledas med en Abstract på engelska om högst 175 ord. Texten bör uppdelas med underrubriker på högst två nivåer. Huvudindelningen bör lämpligen vara inledning, metoder/studieområde, resultat, diskussion, tack och litteratur. Texten får vara på svenska eller engelska och uppsatsen skall avslutas med en fyllig sammanfattning på det andra språket. Tabell- och figurtexter skall förses med översättning till det andra språket. Manuskriptet bör sändas som epostbilaga till soren.svensson@zooekol.lu.se. Texten bör vara i format MS-Word. Figurer och tabeller skall inte inarbetas i den löpande texten utan sändas som separata filer. En papperskopia skall också sändas, och den skall innehålla eventuella orginalfigurer som inte kan sändas elektroniskt. Om nödvändigt tar vi också emot kortare manuskript på enbart papper.

Andra bidrag än uppsatser bör ej överstiga 2 000 ord (eller motsvarande om det ingår tabeller och figurer). De skall inte ha någon inledande Abstract men däremot en kort sammanfattning på det andra språket.

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Referenser *References*
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