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Age of Great Grey Owls *Stirix nebulosa* observed in Scandinavia in 2012 as revealed by digital photos in the national species report archives

Ålderssammansättning hos lappugglor Strix nebulosa *observerade i Skandinavien 2012 bestämd med hjälp av digitala fotografier inskickade till Artdatabankens artportal*

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Abstract

Record breaking numbers of breeding Great Grey Owls *Strix nebulosa* were reported in Sweden and Norway in 2010 and 2011, followed by 4105 observations in 2012 as revealed by the national Species archives. Based on locality id numbers, at least 144 individuals were reported with photos which could be used to age the individuals. The majority (76%) of these birds were young birds hatched in 2011 (83% including birds aged probably 2CY). Among dead owls brought to the Natural History Museum in Stockholm, the percentages of owls hatched in 2011 were similar (78% and 88%). The high percentage of young owls could be caused by young birds hunting closer to human settlement than older birds, but more likely it was caused by a higher total production of young in south-central Scandinavia in 2011 than in 2010. This study shows that photos in the national species archives reveal the age structure of the Great Grey Owl population, fundamental data to understand the current distributional expansion of this species. This method may also be applied to other species.

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Introduction

The Great Grey Owl *Strix nebulosa* has expanded its range in NW Europe the last decades (Lawicki et al. 2013). In Sweden, there was a marked increase in population size from 1960 to the late 1980s (Stefansson 1997). According to Stefansson (1997), the autumn population in Sweden was probably at least 3000 individuals in 1987, which was a very good breeding year. Since 1989 the Great Grey Owl has become a regular breeder in SE Norway (Solheim 2009a), and in 2011 a total of 22 nests or breeding attempts were recorded in the county of Hedmark (Berg et al. 2011). Also in Sweden 2011 was a record-breaking breeding year for Great Grey Owls, with an estimated late summer population of 4000–4500 individuals (Stefansson 2013). Several individuals found dead or photographed in SW Norway and Sweden in the autumn of 2009 were adult birds as judged by their moult patterns (Solheim 2009). This sparked a study of the moult sequences and patterns of Great Grey Owls, based on skinned birds ringed as nestlings (Solheim 2011). As juvenile and adult flight feathers are usually markedly different and easily recognizable, it is possible to age a Great Grey Owl at least up to the spring after its second flight feather moult. The moult patterns can also be detected on live birds in the field, and documented on digital photographs (Solheim 2009a, 2010, 2011, 2013).

Methods

The Swedish and Norwegian species report archives collect data on animals and plants (Artdatabanken.se and Artsdatabanken.no). Both countries use the same digital database based on the Swedish Species Project started in 2002, where informers can make daily entries of their observations. The bird pages are extensively used by ornithologists, both amateurs and professionals, and represent an easily accessible up-to-date register of a species´ observed distribution and recent presence in the two Scandinavian countries. When reporters document their observations with digital photos, extra information can be gained. The number of reports of Great Grey Owl observations peaked in 2012, with more than 4000 single reports filed.

I first downloaded all Swedish entries of Great Grey Owl observations up to 16 November 2012, and the remaining reports on 7 January 2013, and manually counted the number of entries by month. On 21 August 2013 I downloaded all reports on Great Grey Owl observations from Norway and on 22 August from Sweden. In the last check of the data from Sweden I sorted observations by landscape before downloading the reports. While the freely accessible number of reports from Norway for the whole 2012 was only 58, there were a total of 3998 reports from Sweden. After I gained access to the total material from Norway and Sweden, including reports with restrictions on publication, the total number of reports from Norway amounted to 107, compared to 4263 from Sweden (265 restricted reports). The Norwegian reports thus made up a mere 2.4% of all Great Grey Owl reports from Scandinavia in 2012 (Table 1). All entries with photos of the owl(s) reported were inspected on a high quality PC screen, and all images which

Table 1. Reports of Great Grey Owl observations from Sweden and Norway in 2012. For Sweden only openly accessible reports are included, which could be separated to landscape. Number of localities based on number of separable dots on the species maps as shown on the Species Archives websites. +images: images which can be used for age determination of bird. Minimum number of individuals as shown on +images. Parentheses: restricted localities included.
Rapporter om observerade lappugglor i Norge och Sverige 2012. Från Sverige är skyddade observationer ej medtagna. Antal lokaliteter är antal prickar som framkommer i varje landskapskarta från Artdatabankens register. +images: foton som kan användas för att åldersbestämma fågeln. Minimum antal fåglar på +foton. Parentes: antal med skyddade lokaler inräknade.

Landscape/ land		Min. no. of localities	Number of reports	Reports with images	Reports with +images	Min. no. of individuals
Lappland						
	T	1	1	0	0	0
	Lu	3	4	0	0	0
	Pi	10	11	0	0	0
	Ly	7	7	0	0	0
	Ås	1	1	0	0	0
Jmtl		8	12	3	2	2
Hjd		1	1	0	0	0
Nb		24	38	4	0	0
Vb		52 (53)	100	7	3	3
Ång		58	230	51	20	13
Mpd		72	299	90	55	23
Hsl		79 (81)	189	9	2	2
Dlr		37 (43)	118	27	15	5
Gstr		32	186	33	15	5
Upl		77 (81)	1059	170	40	12
Srm		70	780	166	73	31
Vstm		26 (38)	54	14	5	3
Nrk		15	106	9	5	3
Vrm		37 (39)	163	40	20	8
Ög		15	132	16	6	3
Vg		39	181	32	10	5
Dls		7	8	2	2	2
Boh		6	30	11	8	1
SM		18 (21)	130	42	18	7
HL		3	5	1	0	0
Bl		6	47	11	2	1
Sk		6	106	29	9	2
Sums						
Sweden		710 (740)	3998	767	310	131
Norway		33	107	46	13	13
Total		743 (773)	4105	813	323	144

Figure 1. Tail of young Great Grey Owl in age category 1CY–2CYs (left), showing typical juvenile feathers, compared to a tail of a bird that has moulted once (2CYa; right). The juvenile feathers are sharply pointed with a diffuse, dark crossbar close to the whitish edge. The adult tailfeathers are broader with rounded tips, and no diffuse crossbars between the outer distinctive dark crossbar and the tip of the tailfeathers. See also Figure 2 and 3. Specimens photographed in the Natural History Museum, Stockholm.
Stjärt av ung lappuggla (vänster) med juvenila fjädrar, sammanliknat med stjärt från en uggla som har ruggat första gången. Juvenila fjädrar är spetsiga med en ljus yttre kant. Adulta stjärtpennor är bredare, avrundade och utan diffusa mörka band utanför det markanta yttre tvärbandet. Se även Figur 2 och 3.

might reveal the age of the owl were downloaded for closer inspection.

Birds are aged according to the calendar year approach. A juvenile is thus 1CY until 31 December, when it becomes a 2CY bird. Because wing feather moult takes place during summer, I specified if an owl was from spring (s) or autumn (a). A 2CYs owl has not moulted any wing or tail feathers yet, while a 2CYa owl has an adult tail and some typical adult feathers in the wing. For further explanation; see Solheim (2010).

The age of most of the owls was judged by the character of their tail feathers (Figure 1). On the images where an outspread wing was in focus and visible, the moult sequence was used to age the owl after the 2Y stage. It turned out to be next to impossible to sort out localities of photos accompanying the selection of restricted reports from Sweden, so these photos were excluded in the Swedish material in Table 3.

When searching for reports in the species archives, one can choose different ways of selections and presentations. Species observations can be searched for specific periods, regions, and combinations. When presenting the reports, one can choose distribution maps, lists, histograms and others. The different ways of searching and presenting result in different numbers of reports displayed. I do not know the reason for these discrepancies, and have also been unable to find an explanation for them. However, as the listed observations are the main source for this work, I have used the numbers from these listings as the number of reports from each country and landscape (Sweden).

The downloading of Great Grey Owl reports from Sweden in January and August 2013 gave different numbers of entries. The report strings from January were manually counted for each day and month (Table 2), resulting in 3103 reports, of which 547 were supported by photos. The count from August, sorted by landscapes, gave a total of 3998 entries (Table 1), while a count of all pin-

Table 2. Great Grey Owl reports by month from Sweden 2012, as revealed by downloads from the national Species Archive on 16 November 2012 and 7 January 2013. Based on openly accessible reports only. * days with reports/days in month.
*Antal rapporter om lappuggleobservationer i Sverige 2012 när rapporterna laddades ner från Artportalen den 16 november 2012 och 7 januari 2013. Inga skyddade lokaler inräknade. *: dagar med observationer/ dagar per månad.*

Month	Days with reports*	Number of reports	Reports with images	Mean to reports per report day
January	26/31	191	46	7.3
February	29/29	188	53	6.5
March	31/31	810	142	26.1
April	30/30	616	92	20.5
May	31/31	504	67	16.3
June	30/30	207	50	6.9
July	28/31	101	17	3.6
August	27/31	69	7	2.6
September	28/30	114	26	4.1
Oktober	29/31	110	15	3.8
November	27/30	134	21	5.0
December	24/31	59	9	2.5
Sum		3103	547	9.1

pointed localities from Sweden when sorting observations onto maps, gave a total of 4465 reports. The numbers of report strings from August 2013 have been used, as I at this time gained access to the total material from both countries.

Fiure 2. Young, female Great Grey Owl with typical juvenile tail feathers (2CYs). This female was banded as a chick on an artificial breeding platform close to lake Siljan in central Sweden in 2010 and controlled as a breeding bird in Hedmark county, eastern Norway, in 2011.
Ung lappugglehona med karaktäristiska juvenila stjärtpennor (2K vår). Denna hona blev ringmärkt som unge på en boplattform vid Siljan 2010 och kontrollerades som häckfågel i Hedmark, östra Norge 2011.

Results

Of a total sample of 4105 report strings of observed great grey owls, 813 (19.8%) reports included one or more photographs of the observed owl(s). In 323 (39.7%) of these reports at least one of the images (termed +images) could be used for aging the owl. Based on the locality names these photos were judged to portray a minimum of 144 individuals (Table 1).

Of 144 birds, 102 observed in spring had juvenile tail feathers (Figure 2) and these were all 2CY birds from 2011. Another 9 birds were classified as probably belonging to the same age category (Table 3). Only 3 individuals could be aged as 3CY birds, hatched in 2010, while 16 birds were 3CY or older (Figure 3). Two individuals were classified as probably at least 3CY birds. From autumn 2012 there were 10 individuals which were classified as 2CY+, based on their adult tail feathers. Only two of the birds observed in autumn had typically juvenile tail feathers, revealing that they must have been hatched in 2012.

The Swedish species report archives secretariat provided a list of 38 photos accompanying 19 of the restricted reports. While 18 of the photos could not be used for aging, rendering 7 individuals as un-aged, 12 individuals could be aged based on the other 20 images. Of these 9 individuals were 2CY birds, 1 was probably a 2CY bird, while 2 individuals were classified as 3CY+ and 5CY+ birds respectively.

When the report strings from Sweden, downloaded in November 2012 and January 2013 were sorted to monthly reports (tab. 2), March had highest number of reports (810), followed by April (616) and May (504). Uppland and Södermanland topped the list as the landscapes with highest num-

Table 3. Age distribution of Great Grey Owls in Sweden (to landscapes) and Norway in 2012, identified from photos. Photos from restricted reports from Sweden not included.
Ålderfördelning av observerade lappugglor I Sverige (efter landskap) och Norge 2012, identifierade från foton. Foton från skyddade lokaler I Sverige inte medtagna.

Landscape	1CY	2CY	Prob 2CY	2CY+a	3CY	3CY+s	Prob 3CY+s	
Jmtl	0	1	0	1	0	0	0	
Vb	0	1	0	0	0	2	0	
Ång	0	12	0	0	0	1	0	
Mpd	0	19	0	1	1	2	0	
Hsl	0	2	0	0	0	0	0	
Dlr	0	3	1	0	0	1	0	
Gstr	0	5	0	0	0	0	0	
Upl	0	8	0	3	0	1	0	
Srm	1	23	1	0	1	4	1	
Vstm	0	2	1	0	0	0	0	
Nrk	0	3	0	0	0	0	0	
Vrm	0	5	0	1	0	2	0	
Ög	0	1	1	0	0	0	1	
Vg	0	3	1	1	0	0	0	
Dls	0	1	1	0	0	0	0	
Boh	0	1	0	0	0	0	0	
SM	1	2	1	1	0	2	0	
HL	0	0	0	0	0	0	0	
Bl	0	0	1	0	0	0	0	
Sk	0	1	0	1	0	0	0	
Sum	2	93	8	9	2	15	2	
Norway	0	9	1	1	1	1	0	
Sum all	2	102	9	10	3	16	2	144

ber of reports (1059 and 780 respectively; Table 1). A majority of the Great Grey Owls reported from Norway were sighted in the coastal areas from Vest-Agder county to Østfold county, and also in Sweden more observations were reported close to coastal areas (Figure 4).

Discussion

Because the 2CY+ birds from autumn 2012 are non-conclusive as to whether they were hatched in 2011 or earlier, they were excluded from the age distribution comparisons. This means that at least 102 of 134 (76.1%) Great Grey Owls on +images from 2012 were hatched in 2011. When including the individuals classified as probably 2Y birds, there were as many as 111 of 134 birds (82.8%) from 2012 that were hatched in 2011. Stefanssons table 3 (2013) lists 69 Great Grey Owls found dead in 2012 and registered by the Swedish Natural History Museum. In his table 3, 41 of these birds are aged, with 32 as 2CY birds, and 4 as probably 2CY birds. The birds from 2011 thus make up 78.0% of the aged dead birds, and 87.8% when including the four individuals classified as probably 2CY. Thus, the age distribution in my sample of live birds was very similar to that in the sample of dead birds reported by Stefansson (2013).

The high number of young 2CY birds is an obvious result of 2011 being the best breeding year ever for Great Grey Owls in Sweden (Stefansson 2013), and Norway (Berg et al. 2011). Both 2010 and 2011 were however vole peak years on the Scandinavian peninsula, with 2011 as an exceptionally good breeding year for several owl species (Berg et al. 2011, Nyhus & Solheim 2011, Jacobsen et al. 2012). While 2011 was the exceptional Great Grey Owl year in eastern Norway with 22 nests or breeding attempts, both 2010 and 2011 brought high numbers of breeding records in Sweden (77 and 81 nests or breeding attempts; Stefansson 2013). In spite of 2010 being a good breeding year, only 3 of 134 individuals could be classified as 3CY birds in the 2012 reports. Even if we assume that all of the other 3CY+ birds could be 2010-birds, they would maximally make up only 15.7% of the observed

Figure 3. Adult, 3CY+ bird photographed on Tromøya, Aust-Agder county in southern Norway on 14 January 2012. Note the rounded, broad tail feathers with long distance from the outermost dark band to the tip of the feathers.
Adult 3K+ fågel fotograferad på Tromøya, Aust-Agder fylke i Södra Norge 14 januari 2012. Märk de breda, avrundade stjärtpennorna med stort avstånd från det yttre, mörka tvärbandet till fjädrarnas ytterkant.

owls, compared to at least 76.1% 2011-birds. A hypothetical explanation could be that the 2010 birds had lower survival than the 2011 birds. This does not seem very likely, considering the high abundance of voles through autumn 2010 into the breeding season of 2011, which to the contrary ought to give high survival rates of the young hatched in 2010. Another interpretation could thus be that the number of young great grey owls produced in 2011 outnumbered the 2010 generation at least five times. This could very well be the case in the western part of the Great Grey Owl´s distribution range in Scandinavia, as the number of recorded nests or breeding attempts in eastern Norway rose from 3 in 2010 to 22 in 2011 (Berg 2010, Berg et al. 2011). As stated by Stefansson (2013), Great Grey Owls are studied in detail only at a few sites in Sweden, leaving vast forest areas subjected to little or no knowledge of their whereabouts.

It is also possible that young Great Grey Owls behave differently than older birds during food shortage. The congregation of reports from March and April, and close to coastal areas, points to birds hunting voles on snow-free fields close to human settlements. This behavior could indicate that the birds observed had trouble finding enough voles in the forest areas. If older birds are more experienced hunters than young ones, one might expect an overrepresentation of young birds among the observed Great Grey Owls. There is however no reason to assume that older owls are less prone to be killed by traffic than younger birds. The high percentage of 2CY birds among the dead owls from the Natural History Museum in Stockholm (Stefansson 2013) thus supports the interpretation that the population really held a very high proportion of young birds in 2012, since traffic hits make up the majority of mortality amongst these birds. This is in accordance with results found during a winter famine that killed hundreds of tawny owls in southern Norway (Solheim 2006, 2009b), where the proportions of young and older birds were exactly similar in starved and road-killed specimens. Photos of Great Grey Owls from the southern part of Norway during the winter and spring 2011–2012 points to adult birds being as likely as young ones to be observed; of 8 birds, 4 were 2CY, and 4 were older individuals (Solheim unpublished).

The high number of reports from Uppland and Södermanland in Sweden may be caused by high numbers of owls along the eastern coast of central Sweden. However, it may also be explained by the high density of birders in the Stockholm area, with many observers reporting separately on the same individuals. Through the local rarity committees such observations have been lumped together, which made sorting by locality easier in August 2013 than in January 2013.

In Norway a minimum of 63 young fledged from 17 successful great grey owl nests in 2011 (Berg et al. 2011). During winter 2011–2012 no Great Grey Owls were reported seen in the breeding areas of Hedmark county, and remarkably few birds were observed at all in Norway during 2012. Two breeding females controlled in Hedmark county in 2010 and 2011 were hatched on artificial breeding platforms southwest of lake Siljan in central Sweden in 1999 and 2010 respectively (Berg et al. 2011). Because Great Grey Owls have been controlled more than 200 km away from their birth place, it is not unlikely that both old and juvenile birds may have migrated eastwards from Hedmark into Sweden in late 2011, contributing to the high proportion of young 2CY birds reported in Sweden in 2012.

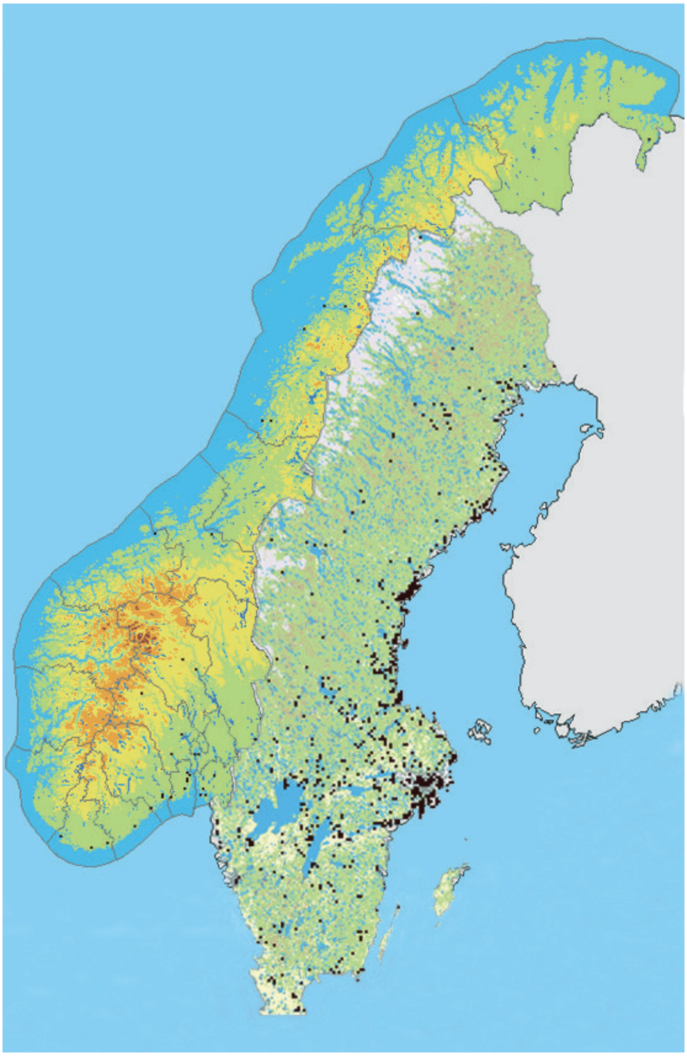

Figure 4. Reports of Great Grey Owls from Norway and Sweden in 2012, as revealed through the mapping command of the national species archives. Maps were presented for each country separately, and had to been stitched together after downloading the images.
Rapporter om observerade lappugglor i Norge och Sverige 2012. Kartor från Artdatabanken i Norge och Sverige. Kartorna kan endast laddas ner från varje land, och är sammankoplade i efterhand.

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Sammanfattning

Lappugglan har under de senaste årtiondena expanderat åt sydväst i hela Nordvästeuropa (Lawicki et al. 2013). I östra Norge är arten en regelbunden häckfågel sedan slutet av 1980-talet (Solheim 2009a), och 2011 var ett rekordår med 22 häckfynd eller häckningsförsök i Hedmark fylke (Berg et al. 2011). Också i Sverige var 2011 ett mycket bra år, med ett beräknat höstbestånd på 4000-4500 individer (Stefansson 2013). Följande år inkom rekordmånga rapporter till Artdatabanken i både Sverige och Norge om observerade lappugglor. De flesta rapporterna kom från Sverige.

Metodik

Hos lappugglor är det tydliga gränser mellan juvenila och adulta ving- och stjärtfjädrar, och ruggningsmönstret kan användas för att ålderbestämma fåglarna, åtminstone efter deras andra vingfjäderruggning (Figur 1, 2 och 3, Solheim 2011). Dessa ruggningsmönster kan också ses på fåglar i fält, och har dokumenterats genom digitalfotografering (Solheim 2009a, 2010, 2011, 2013).

Artdatabanken i Norge och Sverige använder samma databas, utvecklad av det svenska artprojektet som startades 2002. Sökmetodiken är likartad i de två länderna. När rapportörerna dokumenterar sina observationer med digitala foton, kan man hämta ut extra information. Denna studie är ett försök att använda sådan information för att analysera lappugglepopulationens ålderssammansättning under 2012.

Jag laddade ner alla observationer av lappugglor från Sverige och Norge första gången i november 2012 och januari 2013. Denna process upprepades i augusti 2013 eftersom jag efterhand hade fått tillgång till alla observationer i båda länderna. Medan materialet från Norge omfattar 107 enskilda rapporter (varav 49 dolda), var det inte mindre än 4263 enskilda rapporter (varav 265 dolda) från Sverige. I det norska materialet kunde alla dolda rapporter med tillhörande foton hänföras till fyndlokal. I det svenska materialet visade detta sig svårare. I det svenska materialet uteslöts därför de dolda rapporterna. Ålderssammansättningen bland fåglarna i denna lilla del av materialet avviker dock inte från det övriga. Alla rapporter som ledsagades av foton granskades noggrant på en datorskärm med hög upplösning. Alla foton som visade fågelns ålder blev nerladdade för närmare granskning.

Av okänd anledning var antalet rapporterade observationer olika i januari och august 2013. I januari fanns 3103 rapporter som räknades manuellt för att se fördelningen över året (Tabell 2). Rapporterna som laddades ner i augusti 2013 användes slutligen eftersom material från båda länderna var tillgängligt vid denna tidpunkt.

Resultat

Av de 4105 rapporterna ledsagades 813 (19,8%) av ett eller flera foton (Tabell 1). Åtminstone ett fotografi kunde i 323 fall användas för att ålderbestämma lappugglan i fråga. Utifrån lokalitets-id-numren gällde dessa rapporter minst 144 individer, varav åtminstone 102 var 2k-fåglar kläckta 2011. Ytterligare nio fåglar klassificerades som troliga 2k-fåglar, medan tio från hösten 2012 var 2k+ med adulta stjärtpennor. Eftersom dessa fåglar teoretisk kan vara antingen från 2011 eller äldre fåglar, blev de uteslutna vid åldersjämförelsen. Om man inkluderar de möjliga 2k-fåglarna från våren med 2011-fåglarna, utgör denna ålderskategori inte mindre än 82,8% av alla lappugglor som kunde åldersbestämmas 2012.

Störst antal rapporter kom från landskapen Uppland (1059) och Södermanland (780) (Tabell 1). I Norge kom flest rapporter från kuststräckan mellan "fylkene" Vest-Agder och Østfold. Även i Sverige kom flera rapporter från kustnära områden (Figur 4).

Diskussion

Den höga andelen unga fåglar är uppenbarligen ett resultat av att 2011 blev det bästa häckningsåret för lappugglor hittills i såväl Sverige (Stefansson 2013) som Norge (Berg et al. 2011). Medan 2011 var ett framgångsrikt häckningsår i östra Norge med 22 häckningsförsök, var både 2010 och 2011 goda år I Sverige (77 resp. 81 häckningar eller häckningsförsök; Stefansson 2013). Trots detta kunde bara tre av 134 lappugglor med säkerhet bestämmas till 3k-fåglar. Även om man antar att de 16 fåglarna i kategorin 3k+ var från 2010, så utgör denna ålderskategori endast 15,7% av de lappugglor som gick att åldersbestämma. En hypotetisk förklaring på denna låga andel kan tänkas vara att fåglarna kläckta 2010 haft högre mortalitet än fåglarna från 2011. Denna hypotes kan tyckas mindre sannolik då gnagaråret 2010 sträckte sig åtminstone över sommaren och hösten 2011. Ungfåglarna kläckta 2010 borde alltså ha haft mycket goda förhållanden att överleva sitt första levnadsår.

Det är möjligt att ungfåglar har ett annat jaktbeteende än äldre fåglar och oftare samlas på öppna marker nära tätorter när det blir ont om gnagare i skogstrakterna. Det är dock inte troligt att yngre fåglar löper större risk att trafikdödas än äldre fåglar. Av 69 döda lappugglor från 2012 inlämnade till Riksmuseet, kunde 41 åldersbestämmas enligt tabell i Stefansson (2013). Av dessa var 32 ex. säkra 2k-fåglar, och fyra var troliga 2k-fåglar. Bland de döda lappugglorna utgör alltså ungfåglarna minst 78,0%, och möjligen 87,8%. En annan tolkning kan vara att ungproduktionen av lappugglor 2011 var fem gånger högre än föregående år. Detta kan mycket väl vara förhållandet, åtminstone i den västra delen av lappugglans utbredningsområde i södra Skandinavien, då antal kända häckande lappugglor i östra Norge steg från tre 2010 till 22 under 2011 (Berg 2010, Berg et al. 2011). Enligt Stefansson (2013) studeras lappugglans häckning i Sverige endast på några få platser, och det finns mycket stora områden i landet där kunskap saknas om lappugglans förekomst och reproduktion.

Även om minst 63 lappuggleungar blev flygga i 17 framgångsrika revir i Norge 2011, rapporterades förvånansvärt få lappugglor från Norge 2012. Två lappugglehonor som kontrollerats häckande i Hedmark i Norge 2010 och 2011, kläcktes på två olika boplattformar 440 meter från varandra, väster om Siljan 1999 och 2010. Lappugglornas förmåga att på detta vis förflytta sig 200 km eller längre kan mycket väl ha fått alla dessa ungfåglar från 2011 att flyga österut och in i Sverige, och således bidragit till den höga andelen av unga fåglar rapporterade därifrån 2012.

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European Storm Petrels *Hydrobates pelagicus* visiting the Swedish west coast; results from a ringing study 1988–2012

Stormsvalor Hydrobates pelagicus *som besöker den svenska Västkusten; resultat från en ringmärkningsstudie 1988–2012*

KÅRE STRÖM & AIMON NIKLASSON

Abstract

The results of a 25 year study of the Storm Petrel *Hydrobates pelagicus* on the Swedish west coast are described. The first bird was captured on 29 August 1988 (Orust in Bohuslän). A total of 72 Storm Petrels were captured between 1988 and 2012 (64 in Bohuslän and 8 in Halland). Sixty-eight of these were ringed by us and 4 were ringed abroad. Thirteen Storm Petrels (~18 %) were captured twice or thrice: 4 re-traps by us (ringed abroad, 3 in Norway, 1 in Britain), 2 own re-traps and 6 recaptured abroad (2 in Britain and 4 in Norway; one own ringed bird recaptured twice). Three additional birds were spontaneously captured in other studies in southern Sweden during the same period. Mean body mass (SD) was 25.5 (1.9) g, and wing length was 123.1 (2.6) mm. A concentration of birds during the turn of the millennium may be related to periods of upwelling. Still no birds have been found breeding in Sweden. Comments are made regarding the first description by Linnaeus.

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Introduction

The European Storm Petrel *Hydrobates pelagicus* (hereafter Storm Petrel), is a monogamous colonial seabird usually divided into two different subspecies. The Atlantic population of *H. p. pelagicus* (nominate ssp.) represents 97% of the world population, mainly breeding in Iceland, Faeroe Islands, the British Isles and Norway. The total population of *H. p. pelagicus* has been estimated at 300,000–680,000 pairs (Mitchell et al. 2004). The other subspecies *H. p. melitensis* counts only about 10,000 pairs and breeds in the Mediterranean area (Mitchell et al. 2004, Gutierrez et al. 2006). Since the Storm Petrel is nocturnal when arriving or leaving the breeding site (due to predation of gulls or other predators) breeding time and migration has a latitudinal variation. Breeding starts in May in the British Isles but not until August in northern Norway when it is dark enough (Anker-Nilssen & Anker-Nilssen 1993).

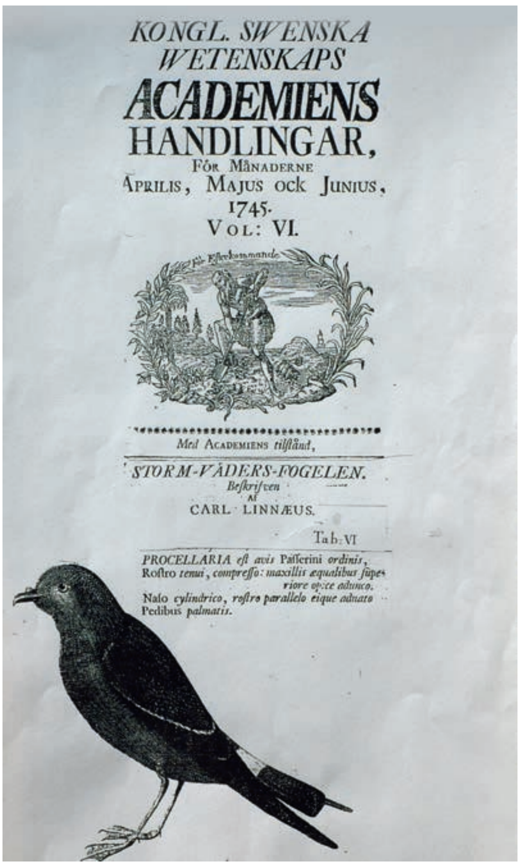
Beside the breeding population there are also a large number of non-breeders moving around in the Atlantic Ocean, because Storm Petrels do not start breeding until 4–5 years old, some breed at other sites and some stop breeding or abandon the egg due to poor conditions. The Storm Petrel can fly more than 350 km per day and wintering areas are considered to be situated outside West Africa, but wintering is known as south and east as Mozambique, as demonstrated by the recoveries of two birds from Norway (Anker-Nilssen 2000, Bakken 2003). The Storm Petrel is a long-lived bird with ages above 30 years or more (Byrkjeland 1997, Bakken et al. 2003).

Only a few breeding localities are known in Norway and none in Sweden or Denmark. The species is difficult to find and the Norwegian breeding sites have only been known since the 1960s: Röst at Lofoten Islands in the 1960s, Bleiksöya at Vesterålen in 1986, and Erkna close to Ålesund in 1996 (Helling 1962, Barret & Strann 1987, Olsen 1996, Byrkjeland 1997, Anker-Nilssen 2000).

Before 1988 the Storm Petrel was only observed during stormy weather (wind from the west), mostly during autumn and early winter. Single birds, carried by the wind, have also been found exhausted or dead in areas far from the sea. The Storm Petrel has been found at least 160 times in Sweden since the first finding in 1744–1745 (SOF 1978, 1990, SOF 1993–2012, SOF 2003, and Artportalen 2013).

This first Swedish record is both remarkable and interesting. The bird was caught alive far from the sea at Hedemora (province of Dalarna) in the middle of Sweden by a hunter, but died soon thereafter. The bird was sent to Carl von Linnaeus who described it as the ”Storm-väders-foglen” (”The stormy weather bird”), *Procellaria pelagica*, in his dissertation *Migratiore avium* 1745 (Linnaeus 1745) (Figure 1). In 1758 the species got its scientific name, *Hydrobates pelagicus* (L.), (Brolén & Lönnberg 1935).

Nearly 100 years passed until the next finding which was made in 1825 in the south of Sweden (province of Skåne). Altogether seven different records were made before 1900, and there were less than 30 accepted records before 1970 (SOF 1990). Nearly all records before 1995 were birds observed during daytime in connection with strong westerly winds. The trapping of a Storm Petrel at Akeröya, Östfold county, Norway, on 30 August 1987 (Viker 1988), near the border in south-east Norway by the late Norwegian ringer Erik Aspegren (Appendix 1), inspired us to try to capture Storm Petrels with mist nets and tape-lures on the Swedish west coast (the Kattegat and the Skagerrak). Some reports from fishermen who had seen Storm Petrels at sea close to the fishing boat and people who believed they had noticed Storm Petrels at lighthouses also awoke our interest. Already at the second trial with tape-luring, a Storm Petrel was caught in a mist net at Hermanö, an island outside Orust in the middle of the province of Bohuslän on 29 August 1988 (Ström & Börjesson 1988).


KONGL. SWENSKA
WETENSKAPS
ACADEMIENS
HANDLINGAR,
FÖR MÅNADERNE
APRILIS, MAJUS ock JUNIUS,
1745.
VOL: VI.

Med ACADEMIENS tilstånd,

STORM-VÄDERS-FOGELEN.
Beskrifven
af
CARL LINNÆUS.

Tab: VI

PROCELLARIA est avis Passerini ordinis,
Rostro tenui, compresso: maxillis æqualibus superiore apice adunco.
Naso cylindrico, rostro parallelo eique adnato
Pedibus palmatis.

Figure 1. The first description of the Storm Petrel *Hydrobates pelagicus (Procellaria)* by Carl von Linné (Linnaeus 1745).
Den första beskrivningen av stormsvala Hydrobates pelagicus (Procellaria) *av Carl von Linné 1745.*

The ”Storm-petrel Project” was initiated by one of us (KS) and Roland Börjesson (Appendix 2) in order to determine the presence, breeding status and movements of Storm Petrels. Later, other questions were included, such as to find out if the presence of Storm Petrels is linked to periods of upwelling and to determine what are their main areas of origin (Ström & Niklasson 2005).

Upwelling of water from deeper water layers is a well-known mechanism that has a large influence on hydrographic conditions and marine life along many coasts around the world. The water exchange with the open sea is important for hydrographic conditions and marine life in the coastal zone by bringing in water with different characteristics like salinity, temperature, nutrient content, and plankton fauna and flora. Upwelling areas can attract and aggregate seabirds foraging in these waters (Haney 1985, Adams & Takekawa 2008 and Wynn & Kastrel 2012).

The purpose of this study is to show that Storm Petrels not only occur at the Swedish west coast in stormy weather but that they also regularly visit this area during the presumptive breeding time at these latitudes, in July to September (Ström & Börjesson 1996, Ström 1997, Ström & Niklasson 2000 and 2005).

Methods

Localities

The field work was performed annually since 1988 between the middle of July and the end of September on different islands and peninsulas (Figure 2). Most of the work was performed in two groups of islands in Bohuslän in the Skagerrak part of the coast: near the lighthouse at Måseskär (58°05’N;

Figure 2. Ringing localities of the Storm Petrel Project on the Swedish west coast (filled red circles). Other localities where Storm Petrels have been netted unintentionally are shown by black-dotted white circles. The big black dot indicates the approximate finding place of the first Storm Petrel described by Carl von Linné (Linnaeus 1745).The Jutland coastal stream is indicated by a black arrow.
Ringmärkningslokaler i Stormsvaleprojektet på svenska Västkusten (fyllda röda cirklar). Andra lokaler med tillfällig fångst av stormsvala (vita cirklar med svart mitt). Första fyndplatsen för den av Carl von Linné beskrivna stormsvalan anges med stor svart fylld cirkel. Jutska strömmen är markerad med svart pil.

11°20'E) and at the "Head" of Hermanö (58°8'N; 11°21'E), Soteskär (58°25'N; 11°11'E), Pater Noster (57°53'N; 11°28'E) and the group of islands named Väderöarna (58°35'N; 11°04'E). In the Kattegat section of the coast the study took place at two peninsulas, Ringhals (57°15'N; 12°05'E), and Getterön, ("Gubbanäsan"; 57°07'N; 12°12'E). The Bohuslän islands are mostly treeless with gorges, diabase formations and cracks finally formed by the last glacial period. Some small islands in the archipelago of Väderöarna and Soteskär have earlier been the home for small populations of auks like Guillemots *Uria aalge* and Puffins *Fratercula arctica*. However, these populations became extinct during the 1960s, probably due to mink predation and/or the decline of the Atlanto-Scandian herring population. The peninsulas Getterön and Ringhals in the Kattegat are good observation sites for passing seabirds during periods of strong westerly winds (Ström & Niklasson 2005).

Bird ringing and measurements

Intentional attempts of mist-netting of Storm Petrels were made each year, usually between 15 July and 30 September and always assisted by tape-lures. In most cases this was done during calm nights with no rainfall close to the sea at sites where rocks and clefts provided a dark background for the nets. In addition to tape-luring we occasionally also spilled fish liver oils close to the nets in order to help attract birds as described by Grubb (1972) and Hutchinson & Wenzel (1980). Unmarked birds were ringed with rings of stainless steel (Riksmuseum, Stockholm). Most birds were weighed to nearest 0.1 g, and the length of their right wing ("W max", Svensson 2005), tarsus, and, in a few cases, also the tail were measured to the nearest 1.0 mm. In many cases the bill (culmen) and head+bill lengths were measured (to the nearest 0.1 mm). Moulting and wearing of the feathers was also studied in order to assess the age of the birds (Scott 1970, Cramp 1977, Ginn & Melville 1983, Baker 1993 and Bolton & Thomas 2001). We also recorded if the birds were "playing", that is responded with "purr-call" (song) or "terr-chick call" (flight call) during tape-luring or in net or when ringing the bird (cf. Scott 1970). We also noted if the birds regurgitated oily fluids during the netting and handling. The status of the brood patch was also scored in order to recognize different stages in the brood patch cycle and to help assess if the bird was in an active breeding stage or not. We used three categories for classifying the brood patch: (1) unknown status, (2) immature (occurrence of down, down still left or bare, no down), together with somewhat more developed ("bare, grey and pinkish brood patch"), and (3) mature (well developed red veiny skin or both red veiny and vascularized brood patch) (cf. Scott1970 and Table 2).

Statistics

Basic statistics were calculated using SAS 6.3. Summary statistics are given as mean, standard deviation, median, range and 95% confidence limits of the mean (clm95) in some cases together with a t-test. A p-value of <0.05 is considered significant. Multiple regression was used to evaluate relationships between body mass and other variables. "True time" (local mean solar time) is calculated as GMT+45 min since Swedish official clock time including summertime is GMT+2 hour and 15 min for Måseskär (15 minutes corresponds to the longitudinal difference between actual position and time given by the time zone). Time is given when bird is taken from net being checked at least every hour.

Other technics and investigations

In some years we glued small radio transmitters (Holohill, 0.69 gram, www.holohill.com) to the central tail feathers of altogether five Storm Petrels suspected to be breeding birds. The radio signals could be received within 1 km distance.

We have also been looking for signs of breeding evidence on different islands and coastal sections on the West Coast of Sweden using playback of tape-recordings, playback of Storm Petrel calls next to entrances to potential nest sites during daytime. From 2005, we have basically used the same technology as for the seabird 2000 census 1998–2002 in the British Isles (Mitchell et al. 2004). The "purr-call" was played for about ten seconds within two meters of potential nest cavities in order to provoke answers from possible breeding birds (Mitchell et al. 2004). We repeated this procedure at least two or three times and were waiting a couple of minutes for possible answer. We also played the nestling's "begging" sound in the same way at potential breeding grounds for possible responses from crevices, boulders, and other structures. We have also used advanced listening devices with sensitive microphones at such sites. From around 2005 the Storm-petrel Project was concentrated to Måseskär and a few other islands in Bohuslän.

Fish-oil was been used on some occasions to attract Storm Petrels, since they are known to have a good developed sense of smell (Grubb 1972, Hutchinsson & Wenzel 1980). It has even been described as a way fishermen caught Storm Petrels for use as bait.

Meteorological data like temperature, wind, moon cycle and upwelling for the period 1997-2012 were provided by SMHI, the Swedish Meteorological and Hydrological Institute. SMHI has long time series on the Swedish west coast of wind data, coastal stratification and upwelling on day to day basis (Björk & Nordberg 2003, SMHI 2012).

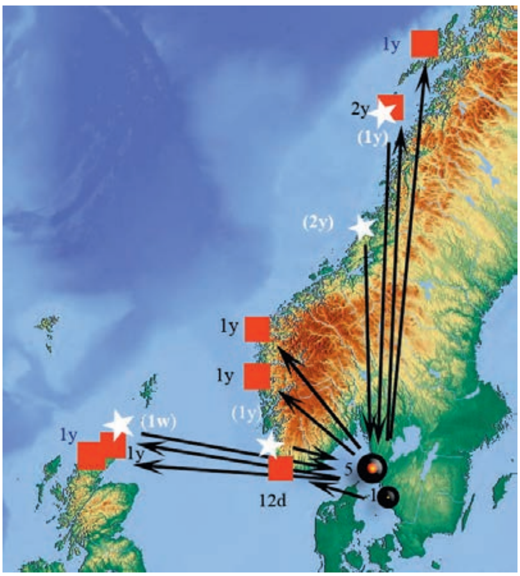


Figure 3. Controls in Sweden of Storm Petrels ringed abroad (white stars). All four birds were controlled at Måseskär (black filled circle). Birds ringed in Sweden and controlled abroad (6 birds, 7 localities, red filled squares). Time between ringing and control is indicated in days (d), weeks (w) or years (y).

Kontroller av stormsvalor ringmärkta utanför Sverige (vita stjärnor). Alla fyra fåglarna kontrollerade vid Måseskär (svart fylld cirkel). Lokaler för fåglar märkta i Sverige och återfångade utomlands (6 fåglar, 7 lokaler, röda fyllda fyrkanter). Tidsavstånd i dagar (d), veckor (w) eller år (y).

Results

Numbers captured

A total of 72 Storm Petrels were captured on the Swedish west coast during the project period, 1988–2012. Out of these, 68 birds were ringed

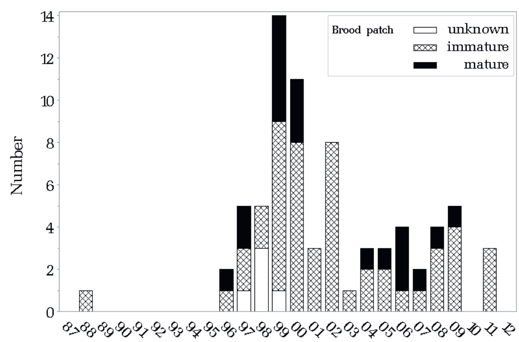


Figure 4. Number of Storm Petrels netted on the Swedish west coast by year and maturity of the brood patch. The pattern in the histogram reflects the maturity of the brood patch (black indicate "potential breeders" or individuals who have reached breeding age and are in an active breeding period). Two own re-traps are included, one in 1999 (n=74).

Antal stormsvalor som nätfångats på svenska Västkusten under olika år och i förhållande till ruvfläckens utvecklingsstadium (mognad). Mönstret i staplarna indikerar graden av denna (svart färg indikerar "potentiella häckande fåglar" eller fåglar som uppnått häckningsåldern och befinner sig i aktiv häckningsfas). Två återfångade egna märkta fåglar ingår, varav en 1999 (n=74).

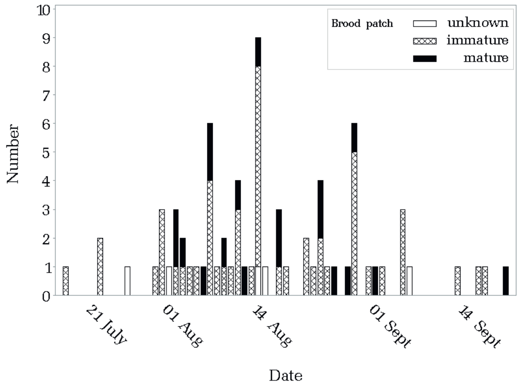


Figure 5. Number of Storm Petrels netted on the Swedish west coast in relation to time of the year and maturity of the brood patch. Two own re-traps are included (n=74). Symbols as in Figure 4.
Antal nätfångade stormsvalor på svenska Västkusten i förhållande till tid på året och ruvfläckens mognad. Två återfångade egna märkta fåglar ingår (n=74). Symboler som i Figur 4.

by the Storm Petrel Project, 60 in Bohuslän and 8 in Halland. The remaining four individuals were already ringed, three in Norway and one in Scotland (Figure 3). We recaptured two of the birds we ringed on the same or close to the same location. Notably, three other Storm Petrels were unintentionally caught in the Baltic Sea in southern Sweden, one in 1990 at Utklippan Bird Observatory (55°57'N, 15°42'E) in Blekinge 1990, and two, in 2008 and 2010, during ringing of Common Terns

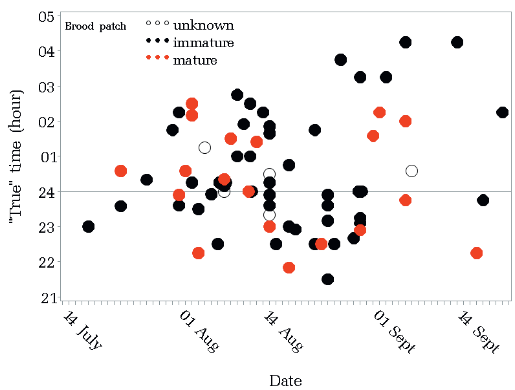


Figure 6. "True" time (local mean solar time, see methods) for netted Storm Petrels on the Swedish west coast in relation to maturity of the brood patch and time of the year .Two own re-traps are included (n=74).
"Sann" tid (lokal medelsoltid, se metoder) för nätfångade stormsvalor på svenska Västkusten i förhållande till ruvfläckens mognad och tid på året. Två återfångade egna märkta fåglar ingår (n=74).

Sterna hirundo at Sandön (56°13'E, 12°46'E) in Kattegat in southwest of Sweden. We caught only one Storm Petrel between 1988 and 1995, which we consider was due to poor trapping techniques and equipment during the first years of our project. Since 1996, the tape-luring was significantly improved with better nets, more sophisticated recording and playback equipment, and better sound recordings. There was a peak in capture rate of Storm Petrels in 1998–2002 (Figure 4), which at least for 1998–1999 might have been linked with periods of up-welling in the Kattegat and the Skagerrak. The mean capture success over the 25-year study period was 0,374 birds per night or about three per year (74 catches during 198 nights).

Timing of the captures

The earliest capture was made on 18 July (1999) and the latest on 17 September (2000), but too few attempts were made outside the main capture period (15 July – 30 September) to exclude the presence of Storm Petrels earlier or later in the season (Figure 5). Most captures were made within two hours of true midnight (Figure 6).

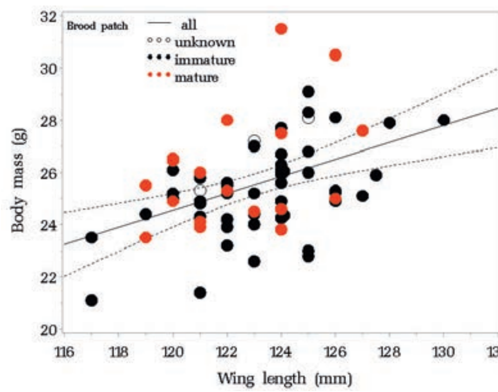


Figure 7. Relationship between body mass (BM) and wing length (WL) of 67 different Storm Petrels netted on the Swedish west coast (BM=-14.65+0.327*WL, r^2=0.19, p<0.0002, each individual measured once). Broken lines indicate 95% confidence limits of the mean regression line for all birds regardless of maturity (red filled circle indicate potential breeders or individuals who have reached breeding age and are in an active breeding period).
Förhållande mellan vikt och längd hos 67 stormsvalor nätfångade på den svenska Västkusten.
*(Vikt=-14,65+0,327*Vinglängd, r^2=0,19 p<0,0002, en mätning per individ). Streckad linje visar 95 % konfidensintervall för regressionslinjens medelvärde (röd färg indikerar potentiella häckande fåglar eller fåglar som uppnått häckningsåldern och befinner sig i aktiv häckningsfas).*

Table 1a. Biometric data for 72 Storm Petrels captured on the Swedish west coast 1988–2012.
Biometriska data för 72 stormsvalor fångade på svenska Västkusten 1988–2012.

Variable	N	Mean	Median	SD	Min	Max
Wing length mm *Vinglängd*	71	123.1	123.0	2.6	117.0	130.0
Bill length mm *Näbblängd*	43	11.5	11.5	0.7	10.1	13.6
Head+Bill length mm *Huvud+Näbb längd*	55	31.8	32.0	0.7	28.5	33.3
Tarsus length mm *Tarslängd*	60	22.9	22.9	0.8	20.8	24.9
Tail length mm *Stjärtlängd*	14	58.4	58.5	2.8	54.0	62.0
Body mass g *Kroppsmassa*	67	25.5	25.3	1.9	21.1	31.5

Table 1b. Biometric data, in two age groups, for 72 Storm Petrels captured on the Swedish west coast in 1988–2012.
Biometriska data, i två åldersgruper, hos 72 stormsvalor fångade på svenska Västkusten 1988–2012. För variablerna på svenska, se Tabell 1a.

Age group and variable *Åldersgrupp och variabel*	N	Mean	SD	Confidence interval (95%)	Min	Max
Age *Ålder* 2K+						
Wing length mm	32	122.8	2.6	121.8–123.7	117.0	127.5
Tarsus length mm	21	23.0	0.9	22.6–23.4	21.0	24.9
Body mass g	30	25.5	2.0	24.8–26.3	21.1	30.5
Age *Ålder* 3K+						
Wing length mm	39	123.4	2.5	122.6–124.2	117.0	130.0
Tarsus length mm	39	22.8	0.7	22.6–23.0	20.8	24.0
Body mass g	37	25.5	1.8	24.9–26.1	22.6	31.5

The weather was a major limiting factor during some years, when long periods of low pressure and unstable weather resulted in fewer capture opportunities than planned. One example is the 2010 season when catch efforts could only be made at three different occasions.

Size measurements

The mean wing length of all individuals measured was 123.1 mm (n=71, SD=2.6; Table 1a). There was no significant difference in wing length between individuals classified as 2+ and 3+ calendar year birds (t-test, t=0.98, df=69, p=0.33; Table 1b).

The body mass ranged between 21.1 and 31.5 g (mean 25.5 g, SD 1.9, n=68; Table 1a) with no statistical significant difference between the age groups (t-test, t=0.09, df=65, p=0.93; Table 1b). The high body mass in some birds could not be explained by body size expressed by wing length, which only explained 19 % of the variation in body mass (regression test F=16.1, r2=0.19, df=66, p=0.0002; Figure 7). We found no significant differences in tarsus measurements between age categories (t-test, t=1.06, df=58, p=0.29), or other measurements (Table 1a and 1b).

Other variables of birds captured

Some additional observations are given in Table 2. Nineteen (27.5 %) of 69 individuals examined had a “mature” and “well-developed” reddish bare and veiny brood patch (a few brood patches even “vascularized”) without down. Fifty-two (75 %) of 69 tape-lured individuals produced a sound when trapped in the net or during subsequent handling. Twenty-seven (39 %) of 69 individuals regurgitated food at capture or during later handling. In all cases this was an oily orange-colored liquid smelling like fish-oil.

Table 2. Distribution of the 74 Storm Petrels (including 2 own retraps) captured on the Swedish west coast in 1988–2012 in relation to some criteria that might suggest breeding (see text for details).
Fördelning av 74 stormsvalor (inklusive 2 egna återfångade individer) fångade på svenska Västkusten 1988-2012 i relation till några kriterier som skulle kunna indikera häckning (se text för detaljer).

Criterium	Age group *Åldersgrupp*			
	?	2K+	3K+	Total
N (all birds included *alla fåglar medräknade*)	0	45	29	74
N (excluding 2 own controls *exclusive 2 egna kontroller*)	0	45	27	72
Calls *Läten*	5	25	27	52
Regurgitation *Uppstötning*	5	12	15	27
Fully developed brood patch *Fullt utvecklad ruvfläck*	5	10	9	19
Body mass >27 g *Kroppsmassa >27 g*	6	7	7	14

Radio transmitters mm.

The radio transmission technology was not successful and was given up 2004. When releasing the birds after ringing we could only follow one or two birds and the flight direction up to half a minute and found no indication of birds breeding or occupying a burrow in the investigation area. It put great demands on the detection operations at night and the transmission signals has clear limitations in space and time. One of the radio-tagged Storm Petrels on Måseskär was checked nearly a year later on the west coast of Norway, at Fedje in Hordaland, and appeared to be in good condition. The antenna equipped radio transmitter was still in place on the un-moulted central tail feathers.

Listening and playback at potential nesting habitats

Playback using "Purr- or churr- sound" at potential nest sites or nesting habitats on different islands in the archipelago in Bohuslän was tested from 2005 but gave no positive results. Similarly, the playback of "begging" sound of nestlings did not provoke any audible responses from rock crevices or cavities in the ground. Nor did the use of sensitive microphones at potential nest sites on some islands detect any signs of birds.

Use of fish oil

We found no increase in capture rates of Storm Petrels since we started to use fish oil spilled on the ground close to the nets, but have no control group for comparison.

Recoveries

We have captured four Storm Petrels ringed abroad, three in Norway and one in UK (Figure 3). As we have two recoveries of birds that we have ringed ourselves, 8 % of the birds captured on the Swedish west coast have been ringed (6 of 72). This is in accordance with some Norwegian ratings (8.1 to 12 %; Byrkjeland 1997, Bakken et al. 2003) in spite of our small material. When including also 6 birds ringed by us, but recaptured abroad, the recovery rate was about 18 % (13 of 72, when including one bird recaptured twice) (cf. Byrkjeland 1997, Bakken et al. 2003, Naturhistoriska riksmuseet 1988–2012).

One of the birds from Norway was ringed at Klepp, in Rogaland (58°45'N; 05°30'E) in southern Norway, one in central Norway, in Namsos in Nordtröndelag (64°37'N 11°02'E) and one at Hernyken in Röst the outermost part of the Lofoten Islands (67°26'N 11°52'E). All these birds were caught at Måseskär (Sweden) and the distance to Röst is 1038 km. The last bird was checked a month later, farther north in Norway, at Hovden in Vesterålen in Nordland (68°47'N 14°32'E).

The Storm Petrel from Britain was ringed on 27 July 2006 on Sanday, Orkney (59°13'N 02°30'E) and was controlled at Måseskär nine days later.

Officially six Storm Petrels ringed at the Swedish west coast, all at Måseskär, were recaptured abroad, four in Norway (one bird recaptured twice) and two in the British Isles (Figure 3). Two of the birds were captured in northern Norway, at Fuglenyken in Nordland (67°47'N; 14°26'E), 1200 km north of Måseskär, and one at Hernyken (see above). Two birds were recaptured in southern Norway, at Fedje in Hordaland (60°46'N 04°42'E) and at Eigersund in Sor-Rogaland (58°22'N 06°03'E).

The Storm Petrel recaptured at Hernyken had two years earlier (one month after time of ringing) been recaptured at Kråkenes in central Norway, but the ring number was wrongly read (figure 6 read as 9, a ring at that time not yet used). It is therefore not registered as an official record. The last two birds were recaptured in Scotland, at Faraid Head (58.36N 04.47E) in the Highland Region, and on Sanday in Orkney (see above) (Figure 3). One of the Storm Petrels, ringed at Måseskär in 1999, was recaptured almost a year later on the little island Torsö in the Väderöarna archipelago, whereas one ringed on the west side of Måseskär in 2009 was recaptured only a few hours later in a mist-net on the north side of the island. Three birds have been caught three times, including the misread record in Norway (Figure 8).

Discussion

During the 25 years of the Storm Petrel Project we demonstrated that Storm Petrels regularly visit the Swedish west coast at night during the presumptive breeding time at this latitudes, in contrast to wind-driven birds occasionally found inland like the one first described by Linnaeus (1745). The species' avoidance of moving in coastal areas at day-time is considered to be an adaption to predation by gulls,

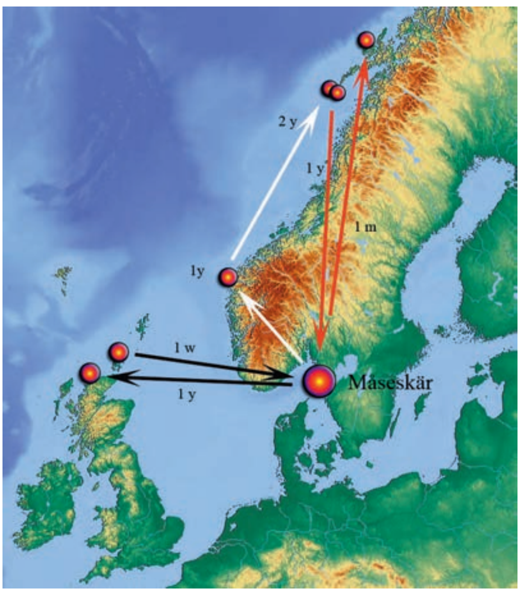


Figure 8. Three Storm Petrels netted on Måseskär by the Swedish Storm Petrel Project and ringed or re-trapped on two other different localities. The plots for each bird are connected with arrows of the same colour.

Tre stormsvalor nätfångade på Måseskär i "Stormsvaleprojektet" och som märkts eller återfångats på två andra lokaler. Varje fågel sammanbinds med pilar av samma färg.

and to prey moving to the surface at night. They are also known to travel long distances in a short time, even within the breeding season (Scott 1970, Anker-Nilssen 2000, Bakken et al. 2003).

The high body mass and well-developed brood patch exhibited by some of the netted birds might suggest that some birds were active breeders, but high body mass could also well be explained by good food supply in the area. This type of brood patch could resemble the stages named highly vascularized with systems of dilated blood vessels (vi) and greatly distended blood vessels with knotted appearance (type vii) by Scott (1970) in his thesis, indicating that these individuals have reached breeding age and that they have just left the nest cavities and are in an active breeding period.

Nevertheless, it is difficult to determine whether tape-lured, mist-netted Storm Petrels with red, veiny featherless brood patches are sexually mature birds or if they are non-breeding wandering birds. According to Scott, no bird with these criteria can be classified as a nesting bird, but it is an indication of a bird possessing a cavity at a breeding site (Scott 1970). Non-breeding wandering individuals may also occur at breeding sites in the breeding season and non-breeding birds can also display a red veiny nude brood patch. Storm Petrels also move rapidly over great distances at their foraging (Scott 1970). Immature birds are also reported to be easier to catch (Harris et al. 1993). Most British Storm Petrels are ringed as sound-lured, wandering, immature birds when between two and five years old when studying the recapture rate of birds ringed as chicks (Okill & Bolton 2005). The decline in recapture rate reflects losses from the wandering population due to both mortality and recruitment as breeding adults.

The mean weight was in accordance with that of a breeding population in England, 25.4 g (Cramp 1977, n=62). On the other hand, in Scott`s studies in 1970 at Skokholm (n=6856, July–September), the average weight was 27.3 g (sd=2.6) for all birds (27.6 g for adult breeders and at least 2/3 of all birds) and 25.3 g for non-breeders. For adult birds there was a continuous reduction of weight from May (30 to 26.7 g) until late September, which could not be found in our own material.

Måseskär is strategically placed where the eastbound Jutland current (Jutska strömmen) approaches the coast and meets the northbound Baltic current, running close to the coast. The island lies in a nutrient- and fish-rich coastal area, which at times is likely to attract foraging Storm Petrels. In Skagerak significantly more Fulmars

Watercolours and ink. *Vattenfärger och bläck.* Kåre Ström 1996.

Storm Petrel ringed at Nidingen 23 July 2011. Photo Kåre Ström.

Fulmarus glacialis and Little Auks *Alle alle* were found in upwelling areas under certain hydrological conditions and different times of the year (Skov & Durinck 2000). It is well-known that seabirds like petrels, are attracted to upwelling areas where cooler subsurface and nutrient rich water is drawn toward the surface and concentrate zooplankton and small prey fish in the upwelling zone (Hanley 1985, Adams & Takekawa 2008, Wynn & Kastrel 2012). Between 1988 and 2012 maximum number of captured Storm Petrels was reached in 1999 (13 birds). Increased periods of upwelling were also registered this year in Skagerak and Kattegat (SMHI 2012).

It is well known that Storm Petrels can move rapidly long distances between different coastal localities for foraging, (in Norway >10 km/h up to 360 km in 24 hours; Byrkjeland 1997, Bakken et al. 2003, Anker-Nilssen 2000).

Our study, like others, shows that Storm Petrels are attracted by playback of their calls and also react with different answering calls. Enhanced playback of "churring song" attracts Storm Petrels to the netting area and subsequently into the net as shown in a number of different studies (Scott 1970, Mitchell et al. 2004). In order to take advantage of the Storm Petrels' sense of smell of natural oil substances (Grubb 1972, Hutchinson & Wenzel 1980) we briefly tested this method with no obvious success. Although we tried many different technics used in other studies (cf. Mitchell et al. 2004), we found no evidence of breeding birds.

The average wing length (123.1 mm), in our study (W "max", Svensson 2005), was significantly longer than in several other studies. It can be compared with the mean length 120.0 mm (sd=2.2 n=1302) for breeding adults and 119.2 mm (sd=2.6 n=1010) for first-season non-breeders in Skokholm (Scott 1970), 120 mm in the British Isles (Cramp 1977) and 123.5 mm (sd=3.1; n=22) in August and 121.81 (sd=1.9, n=27) mm in October at Hernyken in Lofoten (Aarvak & Öien 2005). The differences indicated above may well be significantly biased by different methods, although they can suggest a latitudinal increase in size, which appears to be valid for most bird species (Meiri & Dayan 2003). We found no significant difference between age groups in our material, although the samples were rather small in comparison and certainly not mutually exclusive. Referring to Scott (1970) the longest wing-lengths would appear in category 3+. He stated in his study that two or three year old birds have not yet attained full growth and even not reached the adult wing length (on average 0.82 mm shorter).

Conclusion

We found no evidence of nesting on the west coast of Sweden, although Storm Petrels appear at night during the presumptive breeding season in July–September. We cannot, however, exclude that breeding could occur in some years with extremely favourable conditions during long periods of upwelling and occurrence of nutrient-rich cold water from the ocean currents. Notably, Storm Petrels are seen in day-time during stormy weather, especially in autumn (a total of 160 sightings in Sweden). However, our results show that there is a regular occurrence of Storm Petrels on the Swedish west coast from the middle of July to late September.

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Sammanfattning

Bakgrund

Under sommaren 1988 påbörjades studier av stormsvala på Västkusten, ett nattligt fångst- och ringmärkningsprojekt i skärgården. Det kom att kallas Stormsvaleprojektet och var inspirerat av fynd av stormsvalor som skett några år tidigare utanför Norges sydkust nära gränsen till Sverige. Redan den 29 augusti 1988 fångades en stormsvala på Hermanö, en ö på västsidan av Orust i mellersta Bohuslän. Syftet med studien var att undersöka om stormsvalor förekom under presumtiv häckningstid på Västkusten och inte bara vid enstaka tillfällen höst- och vintertid längs kusten vid stormigt väder. Ringmärkning förväntades ge möjligheter att studera flytt- och rörelsemönster utmed kusten samt kartlägga rekryteringsområden och eventuella häckplatser för arten.

Stormsvalan har påträffats åtminstone vid 160 tillfällen i Sverige sedan det första fyndet 1744–1745, som är både remarkabelt och intressant. Detta vinddrivna första exemplar hittades av en jägare utanför Hedemora i Dalarna och dog en kort tid senare. Fågeln skickades till Linné, som gav den namnet ”Stormvädersfogeln, *Procellaria pelagica*” i sin avhandling *Migratiore avium* 1745. Några år senare, 1758, fick den sitt ännu gällande vetenskapliga namn, *Hydrobates pelagicus* (Brolén & Lönnberg 1935, Figur 1).

Studieområde och metodik

Verksamheten har i huvudsak ägt rum under perioden 15 juli–30 september på kala öar och vissa utskjutande uddar i skärgården på Västkusten. I Bohuslän har det främst varit i kustområdet vid Hermanö huvud och Måseskär på Orust, och i Halland vid ”Gubbanäsan” på Getterön och Ringhals udde (Figur 2 och Figur 4–6).

Fångstförsöken av stormsvalor har skett under lugna nätter med hjälp av slöjnät och bandspelare med inspelade stormsvaleläten. Vid vissa tillfällen har utspilld fiskolja använts som lockmedel. Fångstnäten har som regel placerats nära vattnet i bergsklyftor eller vid klippbranter för att få en mörk bakgrund och undvika att fåglarna ser näten.

Stormsvalorna har vägts till närmaste 0,1 g. Vinglängden har mätts (sträckt vinge enligt W ”max”, Svensson 2005) liksom tarsens längd samt i vissa fall stjärtlängd, näbb och näbb-nacke. Ruggning och slitage har studerats för att om möjligt kunna åldersbestämma fåglarna. Vi har också noterat om fåglarna spytt upp föda och spelat i nätet. Under den efterföljande undersökningen har vi studerat ruvfläckens utseende med ledning av den klassificering som Scott beskrivit i sin avhandling (1970). Med hjälp av ruvfläckens utseende har vi försökt klarlägga dess utvecklingsstadium för att undersöka om en fågel befinner sig i en aktiv häckningsfas eller inte.

Några stormsvalor även försetts med små radiosändare på 0,69 g för att kunna pejla rörelsemönster vid fångstlokalerna. För att leta efter häckande stormsvalor har vi tillämpat samma teknik (uppspelning av ”purrlätet” i ca 10 sekunder upprepade gånger vid tänkbara bohålor) som använts vid sjöfågelinventeringarna på Brittiska öarna 1998–2002 (Mitchell et al. 2004). Vi har också använt oss av känslig avlyssningsutrustning i bergskrevor och vid jordhålor och spelat upp ungarnas tiggläte för att eventuellt få svar från stormsvalor i bohålor.

Meteorologiska data som salthalt, temperatur, vind- och månförhållanden och eventuell förekomst av uppvällning av bottenvatten har samlats in under perioden 1997–2012 och tillhandahållits av SMHI. SMHI har sedan lång tid dagligen registrerat vind- och vattenförhållanden och uppvällning längs svenska västkusten (Björk & Nordberg 2003 och SMHI 2012). Det är välkänt att sjöfåglar som stormsvalor attraheras till kustområden med uppvällning, där kallare och näringsrikt havsvatten flödar upp till ytvattnet och koncentrerar zooplankton och mindre bytesdjur och småfiskar i uppvällningszonen.

Resultat

Sammanlagt har 72 stormsvalor fångats 1988–2012 inom Stormsvaleprojektet. Av dessa har 68 individer ringmärkts av oss, 60 i Bohuslän och 8 i Halland. De övriga fyra stormsvalorna var redan ringmärkta, tre i Norge och en i Skottland. Efter det första fyndet 1988 kom det att dröja åtta år innan nästa stormsvala fångades och ringmärktes. I slutet av 1990-talet fångades en större andel, som mest 13 ex. under toppåret 1999, ett år då det förekom perioder med uppvällning i Kattegatt och Skagerack (Figur 4). Den genomsnittliga fångstfrekvensen under 25-årsperioden (74 fångster under 198 nätter) blev 0,374 fåglar per natt eller omkring tre fåglar per år.

Den tidigaste fångsten har skett den 18 juli (1999) och den senaste den 17 september (2000), men alltför få fångsttillfällen har skett före den 18 juli och efter den 17 september för att kunna utesluta att stormsvalor uppträder längs kusten tidigare eller senare på säsongen (Figur 5). Det har varit en viss koncentration av fångster till augusti månad och en dygnstopp vid midnatt (Figur 5–6). Vädret har varit en begränsande faktor under vissa år med långa perioder av lågtryck och ostadigt väder, vilket resulterat i färre fångsttillfällen än planerat.

Den genomsnittliga vinglängden för samtliga individer var 123,1 mm (SD 2,57 och variationsbredd 117–130 mm, n=71). Vi fann ingen signifikant skillnad mellan de båda åldersgrupperna; Tabell 1a och 1b). Jämfört med flertalet andra studier var vinglängden förhållandevis lång vilket kan bero på att mätningen skett med sträckt vinge i vår undersökning.

Vikten varierade mellan 21,1 och 31,5 g (medelv. 25,5 g, SD 1,86, n=68) oavsett ålder; Tabell 1a och 1b). Noterbart är att 21 % (14 ex.) av fåglarna vägde över 27 g och att några enstaka individer vägde över 30 g, vilket kan tyda på att dessa antingen var adulta individer som intagit rikligt med föda eller att de möjligen hade ägg i kroppen (jmf. Scott 1970) (Tabell 1a, 1b och 2). Av Figur 7 framgår att de tyngsta fåglarnas vikt inte kan förklaras av proportionellt stor längd då endast 19 % av variationen i vikt förklaras av variationen i längd

Tars- och stjärtmått har i vissa avseenden ansetts kunna visa på en skillnad mellan kön och olika åldersgrupper (Cramp 1977). Det fanns inget i vårt material som tydde på någon signifikant skillnad hos dessa eller annan mätt variabel (Tabell 1)

Nitton (27,5 %) av 69 undersökta stormsvalor uppvisade en rödaktig bar och ådrig ruvfläck utan dun i, vilket skulle kunna tyda på att det är fåglar som uppnått häckningsåldern och sannolikt nyss lämnat en bohåla, dvs. fågeln befinner sig i ett aktivt häckningsstadium (jmf Scott 1970, Tabell 2).

Femtiotvå (75 %) av 69 fångade stormsvalor ”spelade” eller lät i nätet eller i handen i samband med urplockning ur näten och ibland även vid efterföljande ringmärkning (Tabell 2). Vår studie visade i likhet med andra studier att stormsvalor attraheras av stormsvaleläten som spelas upp med hjälp av förstärkt ljudupptagning och högtalare och att fåglarna även reagerar med olika svarsläten. Vi fick inga svar från klippskrevor och andra tänkbara ”bohålor” vid uppspelning av ”purr- eller churringlätet” vid tänkbara boplatser, som varit en framgångsrik metod vid brittiska inventeringar för att kartlägga häckplatser (Mitchell m.fl. 2004)

Tjugosju (39 %) av 69 examinerade stormsvalor spydde upp föda, en trandoftande orangefärgad vätska, vilket skulle kunna tyda på att de är individer som uppnått häckningsåldern enligt Scott (1970) (se Tabell 2).

Radiosändare testades några säsonger, men tekniken ställde för stora krav på pejlingsinsatser nattetid och sändarna hade för kort varaktighet och räckvidd. Känsliga mikrofoner testades också, men gav heller inga positiva resultat. Fiskolja testades men om det medförde ökad fångst kunde inte avgöras eftersom vi saknade kontrollgrupp.

Vi har fångat fyra stormsvalor som ringmärkts utomlands, tre i Norge och en i Skottland (Figur 3). Inklusive två egna kontroller är andelen redan märkta fåglar på Västkusten omkring 8 % (6 av 72), vilket är i nivå med vissa norska data (8.1–12%). Återfyndsfrekvensen av samtliga fångade och ringmärkta stormsvalor i Stormsvaleprojektet (medräknade även 6 egna ringmärkta stormsvalor som kontrollerats på andra platser) är något högre, ca 18 % (13 av 72 inklusive en fågel kontrollerad två ggr i Norge).

Av de norskmärkta fåglarna som kontrollerades på västkusten var en ringmärkt vid Klepp i Rogaland (58.45N 05.30E) i södra Norge och en vid Namsos i Nordtröndelag (64.37N 11.30E) i mellersta Norge och en på Hernyken vid Röst på Lofoten (67.26N 11.52E). Samtliga fåglar fångades på Måseskär i mellersta Bohuslän, och avståndet till Röst är 1038 km. Den brittiska stormsvalan var märkt den 27 juli 2006 på Sanday, Tres Ness på Orkney (59.13N 02.30E) och kontrollerades även den på Måseskär den 5 augusti samma år (Figur 3).

Sex stormsvalor har ringmärkts på svenska västkusten, samtliga på Måseskär, och sedan fångats och kontrollerats utomlands, fem i Norge (varav en två gånger) och två på de Brittiska öarna. En av fåglarna fångades på Fuglenyken i Nordland (68.47N 11.26.E), ett avstånd på 1200 km till Måseskär. Ytterligare en fågel kontrollerades i Nordnorge, på Hernyken i Lofoten (se ovan). Två fåglar återfångades i södra Norge, vid Fejde i Hordaland (60.46N och 04.42E) och vid Eigersund i Sör-Rogaland (58.22N 06.03E). Den stormsvala som fångades och kontrollerades på Hernyken hade två år tidigare (en månad efter ringmärkningstillfället) även blivit kontrollerad vid Kråkenäs i mellersta Norge, men ringnumret blev felaktigt avläst (slutsiffran 6 blev avläst som 9), vilket var ett ringnummer i vår serie som ännu inte blivit använt vid det tillfället, och har därför inte blivit registrerat som ett officiellt återfynd. Två stormsvalor kontrollerades i norra Skottland, den ena vid Faraid Head i Highland region (58.36N 04.47E) och den andra vid Sanday på Orkney (se ovan) (Figur 3). En stormsvala som märktes på Måseskär 1999, dök upp igen nästan ett år senare, men denna gång lite längre norrut på Västkusten, på Torsö i Väderöarkipelagen. Ytterligare en fågel som fångades 2009 på västsidan av Måseskär återfångades flera timmar senare i ett annat nät på nordsidan av ön.

Diskussion

Vid jämförelse med andra studerade populationer av stormsvalor var den genomsnittliga uppmätta vinglängden förhållandevis lång i vår studie (W-”max” enligt Svensson 2005); 123,1 mm (95 % konfidensintervall för medel värdet mellan 122,49–123,69, n=71), vilket kan jämföras med 120,0 mm för häckpopulationen vid Skokholm (sd=2,2 n=1302, Scott 1975) och 120 mm för en häckpopulationen i England (Cramp 1977) samt 123,5 mm (n=22) i augusti och 121,81 mm (n=27) i oktober för populationerna på Hernyken vid Lofoten 1989. De olika mätresultaten kan bero på individuella skillnader i mätmetod och olika fördelning mellan häckande och kringvandrande icke-häckande stormsvalor i respektive populationsstudie.

Scott angav i sin studie att två och tre år gamla fåglar ännu inte uppnått full kroppsstorlek och inte heller helt utvuxen vinglängd. De har en signifikant kortare vinglängd än äldre och könsmogna individer, i genomsnitt 0,82 m.m. kortare. Detta har vi inte kunnat visa i vårt relativt begränsade material. Bolton och Thomas revidering av ruggnings- och ålderskriterierna 2001 har underlättat åldersbestämningen av stormsvalor. Från säsongen 2002 började vi tillämpa dessa kriterier i vår studie, vilket sannolikt har inneburit en något säkrare åldersbestämning av stormsvalor från säsongen 2002 i våra studier.

Den genomsnittliga kroppsvikten hos samtliga ringmärkta stormsvalor på Västkusten var förhållandevis låg, 25,5 g, vilket överensstämmer med medelvikten för icke-häckande fåglar, 25,3 g i Scotts undersökningar på Skokholm (1970). Där var medelvikten klart högre för könsmogna vuxna fåglar, 27,6 g. Enligt Scott lägger icke häckande kringvandrande fåglar inte upp fettreserver på samma sätt som häckande fåglar inför häckningssäsongen. De icke-häckande fåglarna på Skokholm var därför genomgående ca 1,5–2,5 g lättare sett över hela säsongen än häckande individer. Viktfördelningen i vår undersökning kan tyda på att det råder en dominans av icke häckande kringvandrande stormsvalor på Västkusten.

Brittiska studier har visat att kringvandrande icke könsmogna stormsvalor lättare lockas i näten än adulta häckande fåglar (Harris et al. 1993). Det har framkommit vid uppföljande studier av ringmärkta stormsvaleungar att återfångstfrekvensen successivt avtar mellan två och fem års ålder och sedan i princip upphör helt (Okill & Bolton 2005). Nedgången i återfångstfrekvensen visar i dessa studier att stormsvalorna efterhand antingen dör eller lämnar den kringvandrande populationen och rekryteras som häckande fåglar. Det är svårt att avgöra om kategorin fångade stormsvalor på Västkusten med förhållandevis hög kroppsvikt och välutvecklad ruvfläck (19 % eller ungefär var femte fångad fågel) utgör adulta könsmogna fåglar i aktivt häckningsskede eller tillhör kategorin kringvandrande icke häckande fåglar. Ruvfläckens utseende liknar och motsvarar sannolikt de ruvfläcksstadier som Scott i sin avhandling (1970) rubricerade som antingen ”highly vascularized with systems of dilated blood vessels” (typ vi) eller som ”highly vascularized with greatly distended blood vessels with knotted appearance” (typ vii). Enligt Scott kan ingen fågel med dessa kriterier säkert klassas som häckande, men det är en indikation på att det är en fågel som tagit en bohåla i besittning. Kringvandrande icke häckande fåglar kan även förekomma på häckplatser och uppvisa välutvecklade röda, ådriga ruvfläckar med likartat utseende (andelen av denna kategori som tagit en bohåla i besittning är ca 30 % på Skokholm enligt Scott).

Fåglarna rör sig även över stora avstånd vid födosök och Måseskär ligger strategiskt till på Västkusten där den Jutska havsströmmen går in mot Västkusten och möter den baltiska havsströmmen. Ön ligger i ett näringsrikt och fiskrikt kustområde som även tidvis torde kunna attrahera tillfälligt födosökande stormsvalor, som följer dessa strömmar. Studier har visat att signifikant fler havssulor och alkekungar påträffades i uppvällningsbälten i Skagerack under särskilda hydrologiska förhållanden och under olika tider på året (Skov & Durick 2000). Ett ökat antal uppvällningar registrerades i Kattegatt och Skagerack under 1999, det år då även flest stormsvalor fångades mellan 1988 och 2012.

Slutsats

Det är tveksamt om det finns häckande stormsvalor på Västkusten i Sverige på grundval av hittills utförda studier. Möjligen skulle häckning kunna ske vissa år, under extremt gynnsamma förhållanden, t.ex. år med långa perioder av uppvällning av näringsrikt vatten från havsströmmarna. Inventeringar av stormsvala längs Västkusten har visat att det, vid jämförelse med kända häcklokaler utomlands, finns platser som skulle kunna utgöra tänkbara häckningslokaler för stormsvala.

Noterbart är att det förekommer stormsvalor dagtid under stormigt väder, särskilt under hösten (sammanlagt över 160 observationer i Sverige). Det är dock helt klart att det regelbundet förekommer eller passerar stormsvalor på svenska västkusten under presumtiv häckningstid, från mitten av juli till slutet av september.

Appendix 1

Erik Aspegren har studerat och ringmärkt stormsvalor på Hernyken vid Lofoten sedan 1970-talet. Genom sin fångst av en stormsvala 1987 på Akeröya vid norska kusten nära gränsen till Sverige inspirerade han oss att börja undersöka en eventuell förekomst av stormsvalor på svenska Västkusten. Han medverkade även vid några fångstförsök i Sverige, bl.a. på Nordkoster och på Måseskär i Bohuslän samt vid Ringhals udde i Halland. Han bjöd även in oss att besöka och ringmärka stormsvalor och klykstjärtade stormsvalor på Lofoten, där vi också deltog i ett lunnefågelprojekt på Hernyken. Erik Aspegren kom från Nesoddtangen utanför Oslo och gick bort 1999.

Erik Aspegren ringed Storm Petrels at Hernyken in the Lofoten Islands since 1970. His capture of a Storm Petrel 1987 in Akeröya on the Norwegian coast close to the Swedish border inspired us to examine possible occurrence of Storm Petrels along the west-coast of Sweden. He participated in some of our initial efforts at the North Koster Islands, Måseskär, and the Ringhals peninsula. He invited us to visit and ring Storm Petrels and Leach's Petrels in the Lofotens Islands, where we also assisted in the Puffin research. Erik Aspegren lived at Nesoddtangen at the outskirt of Oslo and passed away in 1999.

Appendix 2

Roland Börjesson var en av initiativtagarna till Stormsvaleprojektet på Västkusten och var drivande i projektet och medverkade entusiastiskt varje år från starten 1988 ända fram till sin död 2011. Han var född 1932. Han var särskilt engagerad av nattaktiva fåglar och deltog även aktivt i olika uggleprojekt, bl.a. Berguv sydväst och verkade främst i Bohuslän på Västkusten

Roland Börjesson was one of the initiators of the Storm Petrel project at the Swedish west-coast and one of the driving forces and participated with great enthusiasm from the very beginning 1988 to his death 2011. He was born 1932. He was especially engaged in night active birds and owl projects, among others the Great Horned Owl Southwest. Most of his work was done in Bohuslän at the Swedish west coast.

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Density and fluctuations of a nest-pocket breeding population of the Treecreeper *Certhia familiaris* over a 28-year period

Tätheten och fluktuationerna hos en holkhäckande population trädkrypare Certhia familiaris *under 28 år*

ANDERS ENEMAR & KERSTIN WIKLANDER

Abstract

The number of breeding Treecreeper pairs was estimated from 1982 to 2009 in a 2.7 km^2 study area located in south-western Sweden (57°39´ N; 12°4´ E). Most of the area, which was provided with 205 man-made nest pockets, is covered by broad-leafed forest. The number of first clutches varied between 5 and 21 with an annual average of 14±4.2 (SD) breeding pairs (CV 30%). The density of breeding Treecreepers varied from 1.9 to 7.8 pairs/km^2 with a mean of 5.1±1.86 pairs/km^2. The population did not show any statistically significant density trend over the 28 years. The between-year variation in the return rate of ringed adult females that bred after wintering was significantly negatively related to the temperature and precipitation means of the preceding winter. Thus, fewer females returned after milder winters with higher precipitation. The statistical tests pertaining to the variation in the whole breeding population indicate that the species can cope with moderate fluctuations in winter weather, thus preventing significant changes in the number of breeders in the study area.

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Introduction

The density of a passerine bird population is generally a consequence of the reproductive success during the preceding breeding season and the survival rate prior to the new breeding season (e.g. Newton 1998). It will therefore fluctuate between years. Most studies on fluctuation patterns deal with breeding populations because their numbers are relatively easy to estimate compared to those of the non-breeding or floating populations. Much knowledge in this field emanates from numerous long-term studies on populations breeding in nest boxes that facilitate estimation of both the number of breeding pairs and the reproductive rate. In this type of studies, both resident and long-distance migrant species have been investigated and include the classical long-term studies that started in the early part of the twentieth century (e.g. Kluijver 1951, Perrins 1979). The present work is of a similar nature and concerns a local population of the Treecreeper *Certhia familiaris* breeding in man-made nest pockets.

The Treecreeper is a small resident insectivorous passerine that is double-brooded and fairly site tenacious. In Sweden it inhabits various kinds of woodland from coniferous to deciduous broad-leaved forests. It naturally nests behind loosened bark and in similar crevices in tree trunks. The main aim of this study was to document the long-term fluctuation pattern of a breeding Treecreeper population in a study area equipped with special nesting facilities. The possible influence of a number of environmental factors, mainly the winter temperature and precipitation, on the density of the breeding pairs was investigated.

Long-term bird census work in the breeding season can provide information of general interest about the density and fluctuation pattern of populations. These population parameters will be reported here for a local Treecreeper population (see Figure 1, showing the distribution of the breeding females in the study area in a season with almost maximum density). The results mainly concern the number of breeding pairs and the return rate of individually marked females after wintering. As the variation in other factors not included in this study such as food supply, fledgling production and predation pressure is unknown, it has not been possible to explain

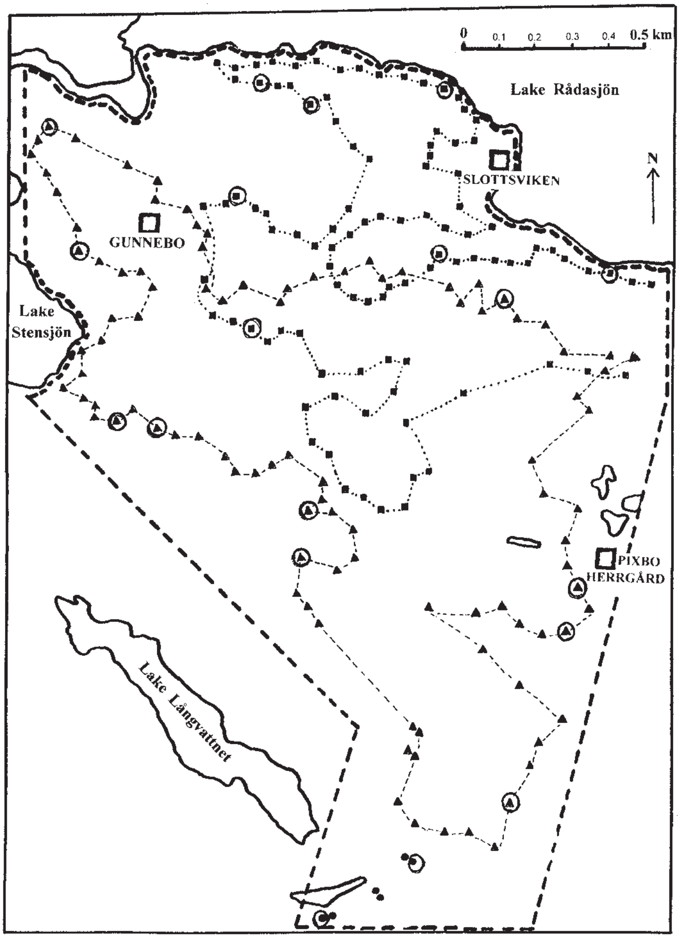

Figure 1. Sketch of the study area showing its position between Rådasjön, Stensjön and Långvattnet lakes. The broken line indicates the boundaries that include the 2.7 km^2 study area. The three open squares represent three landmarks, namely the manor house of Gunnebo and the mansions of Slottsviken and Pixbo Herrgård. The sketch includes the two winding trails alongside which 99 nest pockets (filled squares) and 100 nest pockets (triangles), respectively, were erected. Together with another 6 pockets (filled circles) in the southern part of the area the total number of nest pockets was 205. The distribution pattern of occupied nest pockets (encircled) is exemplified by the 19 breeding pairs in 1999 (see Figure 2, maximum number of breeding pairs was 21).

Skiss som visar provytans läge mellan Rådasjön, Stensjön och Långvattnet. Dess gränser markeras av den streckade linjen, som omsluter en yta om 2,7 km^2. De tre stora och öppna kvadraterna markerar lägena för tre riktpunkter, nämligen Gunnebo slott, samt herresätena Slottsviken och Pixbo Herrgård. Skissen visar två vindlande stigar. Längs den ena är 99 trädkryparfickor (små kvadrater) uppsatta och längs den andra 100 (små trianglar). Tillsammans med ytterligare 6 fickor (fyllda cirklar) i sydligaste delen av provytan blir totalantalet trädkryparfickor 205. Fördelningen av bebyggda fickor (inringade) visas för år 1999 med 19 häckande par (se Figur 2, högsta antal hittills 21 par).

the often very dramatic fluctuations in the number of breeding pairs between adjacent seasons.

Study area and methods

The number of breeding Treecreeper pairs has been estimated annually from 1982 to 2009 in a study area, most of which is located on the Gunnebo recreation grounds (57°39′ N; 12°4′ E) between the small town of Mölndal and the village of Pixbo. Deciduous broad-leaved forest covers most of the area, with between 10 and 15% of open land mostly used for grazing. About 25% of the forest consists of mature coniferous plantations.

The study area has been richly equipped with man-made nesting facilities for the Treecreeper, so-called nest pockets spread all over the 2.7 km^2 (Figure 1). Most likely all breeding female Treecreepers in the study area nest in these pockets (Enemar 2009), which are made of roofing felt and attached to the tree trunks with their entrance openings generally between 1.1 m and 1.4 m above ground. A piece of aluminium sheeting is attached to the occupied nest pockets to prevent Greater Spotted Woodpeckers *Dendrocopos major* from robbing the nests. The nest pockets are cleaned and the aluminium sheeting removed at the end of each breeding season. The number and location of the nest pockets have remained the same throughout the 28-year period. New pockets have replaced lost or damaged ones on the same tree or, when the original tree has been felled or blown over, on the nearest suitable trunk.

The number of clutches started within the 21 days following the laying of the season's first egg is deemed to represent the size of that year's breeding population and henceforth referred to as the "21-day population". This restriction is necessary to avoid counting twice those females that lay a replacement clutch when their first breeding effort has failed. The first clutch is mostly replaced after the 21-day period (Enemar 2009). This time limit is necessary when studying a non-colour-ringed population, as in the years 1982–1994 in our investigation. An analysis of the estimated 21-day populations of colour-ringed females (see below) reveals that only 3% (6 out of 180) of the clutches included in the 21-day period (i.e., broods counted as first broods) were in fact replacement broods. Hence, the risk of erroneously overestimating the size of the unmarked 21-day populations (in the years 1982–1994) is likely to be insignificant.

The nest pockets were inspected at various intervals depending on the demands of the season's research programme. To establish the size of the 21-day population, all pockets were visited at least once during the first 21 days, followed by one or two visits during the subsequent two weeks. From 1995 to 2009 (with the exception of 2004, 2006 and 2007), the inspections were combined with trapping the incubating or brooding females for colour ringing. Each female received a unique combination of three coloured rings as well as in most cases one metal ring.

Daily temperature and precipitation means were obtained from Säve airport (SMHI 1981–2009), which is situated about 15 km to the north of the study area. The temperature data are closely correlated with those of the study area (r = 0.98; Enemar 1997). However, the precipitation data of the two localities have not been compared. The winter temperature and precipitation means were calculated using the daily means of either the four winter months (November–February) or the six months of the winter half-year (October–March). Consequently, each winter period covers the turn of two calendar years. Thus, e.g. the 1995 breeding season is preceded by the winter of 1994/1995.

Since in some cases the identity of a bird was unknown, knowing whether or not there were correlations in the data set was an issue. Therefore, it was necessary to reduce the data to ensure that the requirements and assumptions of the independence of the statistical methods were fulfilled.

The statistical tests were kept to a minimum as the field data were relatively limited. Where applicable, special statistical tests are explained and commented on in the text.

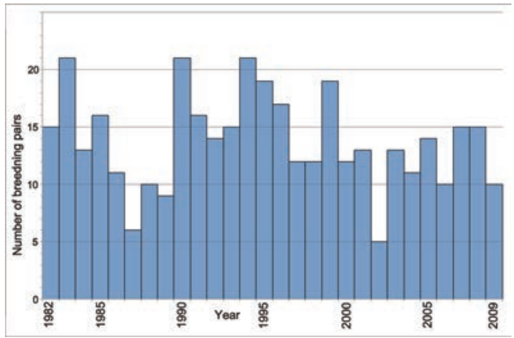

Figure 2. The annual numbers of breeding Treecreeper pairs (the 21-day populations, see text) in the study area from 1982 to 2009.
Staplarna visar antalet häckande trädkryparpar i provytan under perioden 1982 – 2009. Endast de häckningar, där värpningen påbörjats inom 21 dagar efter säsongens första trädkryparägg, är medräknade.

Results and Discussion

The size and fluctuations of the population

The size of the breeding Treecreeper population varied considerably during the course of the 28 seasons (Figure 2) with 5 and 21 pairs being the lowest and highest annual numbers, giving a yearly average of 14±4.2 (SD) pairs. Three resident tit species, i.e., Great Tit *Parus major,* Blue Tit *Cyanistes caeruleus* and Coal Tit *Periparus ater,* have all shown fluctuation amplitudes of the same magnitude in long-term nest-box investigations (e.g. Perrins 1979). The size of the study area population revealed no statistically significant changing trend over the 28 years. The estimated slope in a model is −0.1 and the p-value 0.32.

The nation-wide Swedish Bird Survey (SBS) found a decrease of between 20 and 30% in the Treecreeper population in the period 1976–2006 (Ottvall et al. 2009), mainly concentrated in the last 10 years. A close comparison between the results of the SBS and our investigation would be pointless because they differ markedly in terms of the size of the studied area, the census technique, the units counted and the proportion of habitat types surveyed. The Treecreepers in our study area almost exclusively inhabited deciduous woods. The SBS included coniferous forests where the density of resident co-inhabitants, such as the Willow Tit *Poecile montana*, Coal Tit and Goldcrest *Regulus regulus,* has decreased significantly (Ottvall et al. 2009, Ottosson et al. 2012). The decreasing trend in the Treecreeper population would probably become obvious first and foremost in coniferous forests and may be most pronounced in efficiently managed ones.

The results of the two investigations agree as regards the amplitude of the population fluctuation between years. The CV-value of the SBS results is 25% (calculated from the yearly SBS-indices received from Å. Lindström), a figure of the same magnitude (30%) as that of the present study population. The fluctuation pattern of the Treecreeper is similar to that of most other small-bird populations, which can halve or double in size between years (Figure 2) (Newton 1998).

Population density

The density of the breeding Treecreepers in the study area varied from about 1.9 to around 7.8 pairs/km^2 with a mean density of approximately 5 pairs/km^2 (5.1±1.86 pairs/km^2). Similar density values have been reported elsewhere in southern Sweden (Ahlén & Nilsson 1982, Angelstam in Kuitunen & Helle 1988). The rich supply of breeding facilities and unoccupied space for territories in the study area (see Figure 1) did not lead to an increase in breeding density above its normal level, which according to a review published by Ottosson et al. (2012) is 8–12 pairs/km^2 in southern Sweden. The somewhat lower density in our study area is probably a consequence of the fact that counting was restricted to Treecreeper pairs that started breeding at the beginning of the season (see Study area and methods). According to Glutz von Blotzheim & Bauer (1993), about the same density has been reported in numerous investigations elsewhere in Europe. However, contrary to our results, the introduction of a surplus of artificial breeding facilities increased the breeding density many times over in some German study areas (Schönfeldt 1983, Schwerdtfeger 1987).

Relationship between winter weather and size of the subsequent breeding population

As a resident small passerine bird, winter survival of the Treecreeper is expected to be affected by local weather conditions (winter temperature and precipitation). More breeding pairs usually appear after a winter with favourable weather conditions, while fewer pairs are present after harsh winters. Generally, the species is fairly vulnerable to harsh weather, which also applies during the breeding season, because Treecreepers often postpone or interrupt egg laying during cold periods and desert clutches or young nestlings during days of heavy rain (Enemar 1995).

The seasonal temperature and precipitation means have been calculated for those 24 years (1986–2009) for which data on both these weather parameters are available. The temperature means (ºC) ranged from −2.7 to +3.9 for the November–February period and from −1.5 to +5.3 for the October–March period. The corresponding ranges for the precipitation means were 1.5–4.8 mm and 1.4–4.7 mm, respectively.

The probability of the influence of the midwinter (November–February) temperature and precipitation on the size of the breeding population was tested statistically. For the population size, a Poisson regression was used with temperature and precipitation as so-called regressors. The result for temperature was a p-value of 0.221, for precipitation 0.324 and for the interaction between temperature and precipitation 0.139, which suggests that the species is adapted to cope with moderate fluctuations in the winter weather and this may prevent a significant decrease in population numbers. However, the fairly small sample size and the correlation between temperature and precipitation (colinearity) might reduce the power of this study. The results were also found to be insignificant when the two weather variables were tested in separate models (large p-values, above 0.7).

Return rate of individual females

When the breeding females have been colour ringed it is possible to investigate the extent to which they survive the winter and return to the study area to breed. The return rate can differ between years and might depend on, among other factors, the varying weather conditions during wintering. A considerable drawback in our study is the small number of investigated years. Colour ringing did not start until 1995 and due to circumstances beyond our control it was not possible in 2004, 2006 or 2007, which means that only eleven years can be used in this analysis.

We were able to calculate the yearly mean return rates, as the number of ringed breeding females in the study area at the end of each breeding seasons was known as well as the number that returned to breed in the following spring (Table 1). When an individual female returned and bred for more than one season, only the first occasion was included in the analyses.

The possible relation between the weather conditions during both the short and long winter periods (see Study area and methods) and the return rate

Table 1. Upper table part. Number of trapped and colour ringed breeding Treecreeper females in the study area during 1995 to 2009 and the percentage of returned ringed females of those ringed when breeding in the area in the preceding year. - Lower table parts. Mean temperature (°C) and mean precipitation (mm) of the long winter (October–March) and the short winter (November–February), respectively, during 1995 to 2009.
Övre delen av tabellen. Antal fångade och färgringmärkta honor i provytan under perioden 1995–2009 samt procentandelen återvända honor som ringmärkts året innan som häckare i provytan. - Nedre tabelldelarna. Medeltemperaturen (°C) och medelnederbörden (mm) för den längre vinterperioden (oktober–mars) respektive den kortare (november–februari) för åren 1995 till 2009.

Year *År*	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09
Number ringed *Antal ringmärkta*	19	9	10	12	15	9	7	7	6	0	13	0	0	21	6
Number returned *Antal återvända*	-	8	2	3	2	3	2	1	7	0	-	3	-	-	8
Per cent returned *% återvända*	-	42	22	30	17	20	22	14	100	0	-	23	-	-	38
Mean temperature *Medeltemperatur*															
Oct. – March		0.7	2.0	2.5	1.7	3.1	3.2	3.5	0.2	2.0	2.6	2.4	5.4	4.1	3.3
Nov. – Febr.		−1.7	0.1	2.1	0.1	2.4	2.2	1.7	−1.5	1.4	2.1	0.3	3.9	3.6	1.8
Mean precipitation *Medelnederbörd*															
Oct. – March		1.3	2.7	2.1	3.1	3.1	3.5	3.1	1.7	2.3	2.9	2.7	4.7	3.5	2.3
Nov. – Febr.		1.1	3.1	2.3	2.3	3.3	3.5	2.8	1.7	2.5	2.5	2.2	4.8	3.7	1.9

of females was statistically investigated. A logistic regression was applied to analyse the simultaneous influence of temperature and precipitation on the probability of return. A model with the two explanatory variables, temperature and precipitation as well as their interaction was applied. The p-values were all greater than 0.1, which was also the case when the insignificant interaction was excluded from the model. The short winter period values led to similar results, although the model fit was slightly poorer.

A drawback of these data is that the two explanatory variables, temperature and precipitation, have a high correlation (r=0.714 and significant with p-value 0.014). This fact makes the inference weaker with greater uncertainty in the parameter estimates in the full model that includes both explanatory variables and the interaction term. This could explain why the result failed to reveal any significant effects (see Table 2). However, correlated explanatory variables and a small sample size make the power very low. Therefore, claiming that neither temperature nor precipitation influences the probability of return is incorrect.

However, when the regressors (i.e., the explanatory variables temperature and precipitation) ap-

Table 2. Summary of the results from different models for Return rate.
Sammanfattning av resultat från olika modeller för återkomst.

Model	Estimate of the parameters *Parameterskattning*	Standard error	p-value
With both regressors *Med båda regressorer*			
For temperature:	−0.180	0.2572	0.485
For precipitation:	−0.666	0.4107	0.105
With only temperature *Med bara temperatur*	−0.475	0.1881	0.012
With only precipitation *Med bara nederbörd*	−0.865	0.3001	0.004

peared alone in separate models, colinearity obviously was eliminated. Then, there were significant results in both cases. With the long-winter temperature in the model, the p-value was 0.012 and with the long-winter precipitation, the p-value was 0.004. When applying the short-winter explanatory variables, the p-values were 0.014 and 0.010, respectively. The use of simpler models with only one regressor generally leads to larger error terms. In this case, it turned out that the simplification did not cause as great a problem as the colinearity (a well-known problem resulting in bad precision of the estimates). For both regressors, the estimates of the parameters were negative. This means that an increase in temperature lessens the probability of return. The same applies to precipitation (see Figure 3a and 3b.)

Since there was colinearity, yet another model was applied where only the interaction term was included, i.e., the product of the two regressors formed one explanatory variable. In this case, the p-value was 0.008 and the estimate of the parameter hade a negative value. The interpretation is that the combination of low values of both regressors predicts a higher probability of return than a combination of high values. The latter may be followed by feeding difficulties such as those caused by ice glazing (see below). However, the difference in importance for the two regressors cannot be judged from this result.

Final remarks

It is generally known that the Treecreeper is vulnerable to adverse weather during winter, especially when rain or wet snow is followed by hard frost resulting in ice glazing on tree trunks and branches, which causes major difficulties for a foraging bird (e.g. Marchant et al. 1990, Peach et al. 1995). The Treecreeper seems best adapted to constant and moderately cold winters with or without snow. This assumption is supported by the fact that the winters during which the three midwinter months (December, January and February) had temperature means below zero, varying from −2.0 to −4.7, were followed by exceptionally high return rates (1996 and 2003, Table 1). On the other hand, the infrequent extremely cold winters are known to dramatically increase the winter mortality of the forest resident passerines including the Treecreeper (Marchant et al. 1990).

The occasionally dramatic fluctuations in population numbers (Figure 2) might indicate the impact of a strong winter mortality factor. Perhaps the technique chosen to characterize the winter weather (see Study area and methods) is not refined enough to clearly reveal the connection between winter severity and the disappearance rate of the wintering birds. Unfortunately, the percentage change between years in the size of the breeding population cannot be estimated by means of ringing in the same way as the return rate of the adult females (see above). The reason is that very few of the ringed and surviving fledglings return to breed in the study area. Only four out of about 185 ringed female fledglings (assuming an equal sex ratio) returned to the study area and bred as yearlings, a negligible figure as about 70% of the breeding females every year are new and recruited from elsewhere. Moreover, other factors may also have impact on the breeding population size, such as freezing and thawing episodes, periods of high

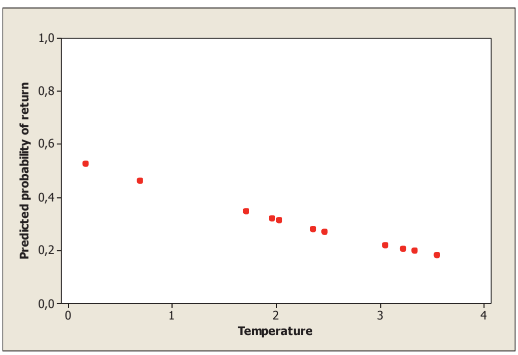

Figure 3a. Estimated probability of return as a function of temperature. Calculations from a logistic regression model. *Skattning av sannolikheten för återkomst. I beräkningarna har inverkan av temperatur tagits med där en logistisk regression har använts.*

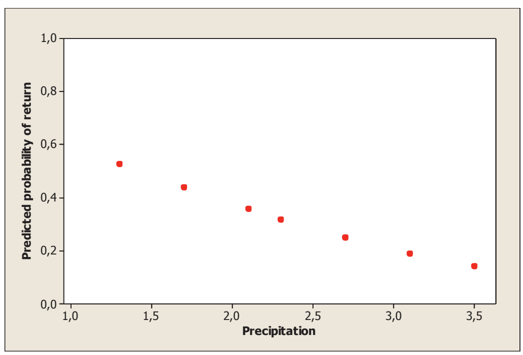

Figure 3b. Estimated probability of return as a function of precipitation. Calculations from a logistic regression model. *Skattning av sannolikheten för återkomst. I beräkningarna har inverkan av nederbörd tagits med där en logistisk regression har använts.*

predation pressure and preceding seasons with poor production of fledglings or food organisms.

Acknowledgements

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Sammanfattning

Studieområde och metoder

Under senare decennier har en rad studier utförts över trädkryparens häckningsbiologi strax söder om Göteborg, närmare bestämt i Gunnebo slottspark med närmaste omgivningar mellan Mölndal och Pixbo (e.g. Enemar 1995, 2009). Terrängen täcks av lövskog som lämnar 10–15 % öppen terräng, mestadels i form av betesmark. Omkring en fjärdedel av skogsmarken består av odlad granskog. För trädkryparstudierna har 300 specialholkar för arten, s.k. häckningsfickor, satts upp i ca brösthöjd på trädstammarna. Av häckningsfickorna är 205 samlade i en 2,7 km^2 stor provyta, där antalet fickor och i möjligaste mån deras placering har hållits konstant under 28 år (1982–2009). Häckningsfickor på avverkade och omkullblåsta träd har flyttats till närmaste lämpliga trädstam. En skiss över denna provyta med häckningsfickornas placering markerade presenteras i Figur 1. Det är antalet häckande trädkrypare i denna provyta som årligen bestämts så som beskrivs nedan.

Häckningsfickan tillverkas av ett rektangulärt stycke underhållsfri takpapp, som nubbas fast på trädstammen sedan den klämts ihop något, varmed ett utrymme lämnas för trädkryparboet mellan stammen och pappen. På vardera sidokanten snittas en öppning för fågeln för passagen till och från boet. Eftersom den större hackspetten gärna hackar upp ett hål mitt på fickan och rövar boet kan förlusterna ibland bli besvärande stora. Detta förhindras effektivt om man täcker fickan med ett stycke perforerad aluminiumplåt, vilket bör göras så snart värpningen börjat. Då är uppenbarligen trädkryparhonan så starkt bunden vid boet att den plötsligt uppträdande plåtrustningen inte orsakar övergivning.

En häckande småfågelpopulation inom en provyta ändrar sin storlek och sammansättning under hela häckningstiden. Frågan är vad som skall räknas som årets beståndsstorlek. Skall dess fluktuationer under årens lopp följas, måste beräkningsmetoden hela tiden vara densamma. I denna undersökning har vi räknat alla kullar vars värpning påbörjades inom 21 dagar efter vårens först värpta ägg i provytan ("21-dygnskullarna"). Därmed undviker man praktiskt taget helt risken att dubbelräkna någon hona, dvs. sådana som förlorat sin första kull och sedan efter några dagars uppehåll häckar på nytt i en annan häckningsficka inom provytan. Denna metod att undvika dubbelräkning har testats de år, då alla honor färgringmärkts. Det visade sig att endast 3 % (6 av 180) av de inräknade häckningarna bland ”21-dygnskullarna” var omläggningar.

Alla häckande honor ringmärktes säsongerna 1995 till 2009 med undantag för 2004, 2006 och 2007. Varje hona försågs med en unik kombination av tre färgringar och en aluminiumring.

Väderdata (temperatur och nederbörd) är hämtade från SMHI:s månadsskrift ”Väder och vatten” (SMHI 1981-2009). Data från väderstationen vid Säve flygplats har använts. Dygnsmedeltemperaturen är vid Säve i stort sett densamma som i provyteområdet (Enemar 1997). Då vintervädrets inverkan på trädkryparnas överlevnad har studerats, har två vinterlängder använts, dels en midvinterperiod (november – februari), dels en helvinterperiod (oktober – mars).

Populationsstorlek och täthet

Av diagrammet i Figur 2 framgår att det häckande beståndets (21-dygnsbeståndets) storlek varierat avsevärt mellan säsongerna med 5 par som minsta och 21 par som största bestånd. Medelantalet för de 28 åren är 14 ± 4,2 par. Trots de emellanåt häftiga antalsändringarna mellan åren har provytans bestånd lyckats hålla sig långsiktigt stabilt. Enligt de landsomfattande häckfågeltaxeringarna (Ottvall et al. 2009) har dock det svenska trädkryparbeståndet minskat under 10-årsperioden fram till 2006.

Vad gäller populationsvariationernas storlek är det landsomfattande beståndet och provytans population samstämmiga. Deras CV-värden är 25% resp. 30%. De ligger alltså nära varandra. (CV uttrycker beståndsvariationens storlek i procent av beståndsstorleken.)

Trädkryparen är ju känd som en förhållandevis glest häckande art. I provytan har tätheten som väntat varierat stort, nämligen från 1,9 till 7,8 par/km^2, vilket betyder en medeltäthet på ca 5 par/km^2 (5,1 ± 1,86 par/km^2). En häckningstäthet på denna nivå har rapporterats från andra lokaler i södra Sverige. Den rika tillgången på häckningsfickor och på lämplig miljö har uppenbarligen inte lockat fler par till häckning än normalt. En häckande beståndstäthet av samma storleksordning har rapporterats från många håll i Europa. Dock har uppsättning av trädkryparholkar i överskott åtföljts av en betydande ökning av häckningstätheten i ett par tyska undersökningar.

Vintervädrets inverkan på den häckande populationens storlek

Som den stannfågel trädkryparen är, har den att härda ut en lång vinter i väntan på nästa häckningssäsong. Eftersom arten visar sig vara väderkänslig även under häckningen, då honorna kan göra en paus i äggläggningen eller överge äggkullar och även små boungar under kyliga och regniga perioder, kan man förvänta sig att den ökade dödligheten under särskilt bistra vintrar åtföljs av minskat antal häckande par påföljande vår. Sambandet mellan medeltemperatur och medelnederbörd under såväl november – februari som oktober – mars och den påföljande beståndsstorleken under häckningssäsongen har undersökts statistiskt. Någon bekräftelse på ett signifikant samband mellan vintervädrets stränghet och det häckande beståndets storlek erhölls icke, kanske främst beroende på att det studerade trädkryparbeståndet är förhållandevis litet samt på att de två väderfaktorerna, temperatur och nederbörd, samvarierar. Dessutom påverkas antalet häckande även av andra faktorer såsom antalet flygga ungar föregående säsong, tillgången på näring och förekomsten av predatorer.

De individuella trädkryparhonornas återkomst

Eftersom de häckande honorna färgringmärktes åren 1996 till 2009 (undantag 2004, 2006 och 2007) kunde vi också studera vinteröverlevnad för enskilda honor. Eftersom antalet ringmärkta honor vid häckningssäsongens slut var känt liksom antalet återvändande häckare nästa säsong kunde återkomstfrekvensen beräknas. Resultatet presenteras i Tabell 1. Sambandet mellan frekvensen återvändande honor och väderförhållandena under vintern undersöktes statistiskt på olika sätt. Testas temperaturen och nederbörden var för sig erhålls ett signifikant samband i båda fallen mellan frekvensen återkomster och de båda väderfaktorerna. Med sjunkande temperatur och minskande nederbörd ökar frekvensen återkomster. Blir det varmare och regnigare drabbas uppenbarligen trädkryparna av större övervintringsförluster. Detta kan till en del bero på att vätan ger upphov till isbark när temperaturen rör sig kring 0-läget, något som försvårar näringsfånget och orsakar förluster.

Det är dock känt att även vintrar med långa perioder med mycket sträng köld kan slå ut en stor del av de övervintrande småfåglarna inklusive trädkryparna. Vissa arter kan försvinna helt från stora områden. Bäst för trädkryparnas överlevnad torde vara en vintertemperatur som konstant håller sig ett måttligt antal grader under noll i kombination med ingen eller ringa nederbörd i form av snö.

ORNIS SVECICA 24:00–00, 2014

A hybrid Common Redstart x Black Redstart (*Phoenicurus phoenicurus x P. ochruros*) breeding in southeastern Sweden

*En hybrid rödstjärt x svart rödstjärt (*Phoenicurus phoenicurus *x* P. ochruros*) häckande i sydöstra Sverige*

ANNCHARLOTTE PETERSSON, ADAM BERGNER & MATS THORIN

Abstract

Breeding Redstart hybrids occur regularly and have been described from central but not from northern Europe. Many of the hybrids exhibit plumages resembling those of eastern subspecies of Black Redstart, making it difficult to assess the identity of certain birds. We present information on a well documented breeding by a hybrid male Common Redstart × Black Redstart (*Phoenicurus phoenicurus* × *P. ochruros*), successfully rearing offspring together with Common Redstart females at an industrial estate in southeastern Sweden (57°49’16’’N; 15°16’52’’E) in the summers of 2009–2012. During its first summer at the location, the bird was captured and ringed, representing the second Redstart hybrid ever to be ringed in Sweden. With vocals like Black Redstart, the bird had a plumage highly similar to that of individuals belonging to the subspecies *phoenicuroides* in central Asia. Examined in hand, the bird exhibited some plumage characters and morphological traits consistent with details previously presented for Redstart hybrids in Europe. We confirm previous assumptions that Redstart hybrids can be separated from similarly looking eastern subspecies of Black Redstarts by means of differences in wing formulae.

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Introduction

Hybridization between the two redstart species Common Redstart *Phoenicurus phoenicurus* and Black Redstart *P. ochruros* occurs regularly (Grosch 2003, Ertan 2006), and successful breedings between hybrids and their non-hybrid partners have been studied and described in urban environments across Central Europe (see Landmann 1987, Blattner & Kestenholz 1993, Lambert 1997, Nowak 1999, Grosch 2004, Zedler 2004, Forschler 2006). Since F1-hybrids are known to be fertile and capable of producing viable and fertile progeny through backcrossing (Berthold 1999), individuals exhibiting a broad variation of intermediate traits might occur. Phenotypically, F1-hybrids and backcrosses sometimes also strongly resemble a few subspecies of *P. ochruros* distributed in Asia and the Middle East, particularly *semirufus* (distributed across the eastern Mediterranean region from Turkish Anatolia southwards to Egypt and eastwards to Syria), *ochruros* (distributed over much of Turkey, Caucasus region and northern Iran), *rufiventris* (distributed from Turkmenistan through Pamir eastwards to Himalaya) and *phoenicuroides* (distributed from Central Asia east to Mongolia) (Cramp 1988, Svensson et al. 2009). In cases of possible records of easterly subspecies of Black Redstarts, hybrids first need to be safely ruled out. During the autumn of 2011, northwestern Europe in general and southern Sweden in particular, was affected by an influx of Black Redstarts exhibiting plumage characters consistent with those of either *P. o. phoenicuroides*/*ochruros*/*semirufus*/*rufiventris*, indicating eastern origin. Mitochondrial DNA from one captured individual in Sweden, and one in Great Britain, respectively, revealed strong resemblance to genetic material from Black Redstarts previously collected near the border between Russia and Mongolia (Lagerqvist 2013). Most other birds occurring in Sweden were thoroughly documented with good photos, and due to their relative resemblance in plumage they were all considered as being pure Black Redstarts of eastern or south-eastern origin, from either of the subspecies *phoenicuroides*/

ochruros/*semirufus*/*rufiventris* (although, probably mistakenly, published as *semirufus*/*rufiventris*/*xerophilus* in Strid & Eriksson (2013)). The findings however raised issues on how to safely distinguish between hybrids and eastern subspecies, pointing out large gaps in knowledge about the abundance, distribution and appearance of Redstart hybrids in northern Europe. Nicolai et al. (1996) claimed that hybrids and eastern subspecies of Black Redstarts are inseparable by means of plumage traits alone. Instead, Steijn (2005) and Pérez-Garcia & Sallent (2011) suggest that differences in the wing formula present stronger reliability.

Here we present information on a confirmed breeding between a hybrid male between Common and Black Redstart and a female Common Redstart, successfully rearing offspring at an industrial estate in southeastern Sweden in the summers of 2009–2012. During its first summer at the location, the Redstart hybrid was also captured and ringed, representing a remarkably rare event in Sweden. We present interesting details on plumage traits and morphological measurements sampled in the hybrid in order to increase the knowledge on individual variation amongst Redstart hybrids in northern Europe.

Record details and biometry methods

On June 16, 2009, A P visited the timber sale Träullit, located at a small industrial estate in the village of Österbymo, southeastern Sweden (57°49'16''N; 15°16'52''E). The location has previously been known as one of few in this part of the county that annually holds a pair of breeding Black Redstarts. A singing male was found at the location after just a few minutes, but A P concluded that the bird had a plumage deviant from that of the western subspecies *P. o. gibraltariensis* and more resembled that of a Black Redstart of eastern origin, particularly subspecies *semirufus* and *phoenicurioides*. A few photos were taken and uploaded on the website forum for bird identification, Swedish Ornithological Society (www.sofnet.org). Some comments were obtained, confirming that the bird was interesting due to its resemblance of eastern subspecies. The comments also pointed out the difficulties in safely distinguish hybrids from eastern subspecies of *P. ochruros*. In order to find out the origin of the bird, AP and local ringer MT visited the location a few times in the end of June, trying to catch the bird. Using two mist-nets and playback of contact calls from both Common Redstart and Black Redstart they eventually managed to capture and ring the bird. Full biometry, including maximum wing length, weight and fat score was taken in the hybrid. Wing formula was assessed using a technique previously described by Svensson (1992).

The male hybrid was breeding together with a female Common Redstart, regularly feeding chicks under the roof ridge of one of the buildings. Three nestlings, estimated to be around two weeks of age, were later ringed. The following springs of 2010, 2011 and 2012, the male hybrid returned and successfully reared offspring together with female Common Redstarts (own observations).

Results

Morphology

The male hybrid strongly resembled a male *P. o. phoenicuroides* owing to dark grey back and wings, some white feathers on central forehead and a black throat extending downwards ending in a bow across the central part of the breast (Figure 1–3). The black color also extended to a small area under the carpal joint. Some other characters were found to be intermediate between the two redstart species. The bird was safely determined a hybrid by means of the five following characters: (1) Remaining white color on emargination of outer web on innermost tertial; (2) Paler red color on lower breast and underparts; (3) Scattered white feathers on lower belly (behind the legs), rump and under tail coverts; (4) Absence of emargination of outer web on the sixth primary; and (5) Wingtip was made up of primaries 3–5. Due to extensive abrasion of tips of flight feathers, the exact distances

Figure 1. The male hybrid at its breeding site in Österbymo, southeastern Sweden.
Hybridhanen på sin häckningsplats i Österbymo, *sydöstra Sverige.* Photo: Magnus Johansson.

Figure 2. The hybrid male in the hand. Notice the white feathers on central forehead, absence of white margins on outer webs of tertials and secondaries and the extent of black on throat and upper belly, details more or less intermediate between the two Redstart species, but resemble those found in some eastern subspecies of Black Redstart.
Hybridhanen i handen. Notera vita fjädrar i pannan, avsaknad av vita ytterkanter på tertialer och armpennor samt utbredningen av det svarta på strupe och bröst, detaljer som uppvisar mer eller mindre intermediära drag för de båda rödstjärtsarterna, men som påminner om dräkten hos vissa ostliga underarter av svart rödstjärt. Photo: Mats Thorin.

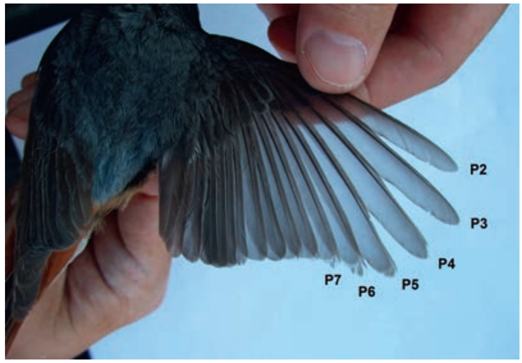

Figure 3. Examination of the hybrid wing. Notice the abraded tips of primaries 4–9. The look of the wing formula resembles that of a Common Redstart with rather low relative distances between the tips of primaries 5–7.
Vingen hos hybridhanen examineras. Notera slitna toppar på handpennorna 4–9. Vingformelns utseende liknar mer den hos rödstjärt med små relativa avstånd mellan topparna hos handpennorna 5–7. Photo: Mats Thorin.

between primary 5/6 and 6/7, respectively, could not be safely determined. The relative distance between the abraded tips was found to be 1:1.

Aging and moulting

Wing- and tail feathers were rather worn, particularly primaries 4–9 (ascendently numbered) with partly or entirely abraded tips. The hybrid exhibited uniformly colored greater coverts and no distinct dark markings on tips of outer tail feathers, equal to that described for adult Black Redstart by Svensson (1992). It was therefore considered an adult bird being two years or older (in its third calendar year or later). During the following three summers (2010–2012), a ringed hybrid male was spotted at the same location. During the first two years, we were unable to tell if it was the original male or just one of the returning juveniles from the summer of 2009. In the summer of 2012, it was eventually confirmed as being the original ringed male owing to photographs where the ring number was successfully read. In the summer of 2012 the age of the male was at least five years, which seems to be a new age record for redstart hybrids in Europe.

Calls

The song was inseparable from that of a Black Redstart, while the contact calls resembled those of a Common Redstart. During the attempts to capture the hybrid, contact calls from both Common Redstart and Black Redstart were played in order to catch the bird's attention and attract it towards the mist nets. The bird was obviously enticed to the calls of both recordings, but seemed even more interested in the ones from Common Redstart.

Discussion

Habitat selection

In their most natural breeding habitats, the likelihood of hybridization between Common Redstart and Black Redstart has to be considered relatively low due to differences in the species' habitat preferences. Common Redstarts prefer forested areas and parklands, while Black Redstarts are found in mainly tree-less stony and rocky terrain, as well as close to human settlements in villages, industrial estates and harbors (Cramp 1988, Svensson et al. 2009). In urban environments, particularly in areas made up of a mixture of buildings and trees, the two species can be found breeding side by side exhibiting regular interspecific aggression (Sedláček et al. 2004). At the breeding site for the hybrid in Österbymo, Common Redstarts and Black Redstarts can be found breeding in the same environment, which is a mixture of industrial buildings in proximity to open pine forests.

Hybrid characters

Recent studies on hybridization between Common Redstart and Black Redstart have shown that plumage characters alone are insufficient for safe determinations of hybrids due to relatively large phenotypical overlap between hybrids and eastern subspecies of *P. ochruros* (Nicolai et al. 1996). According to Steijn (2005) and Pérez-Garcia & Sallent (2011), details in the wing formula, especially the relative distances between primaries 5/6 and 6/7, respectively, can be used as a relatively safe measure to separate hybrids from eastern subspecies of Black Redstart (Table 1). In Common Redstarts of the nominate form *phoenicurus*, the relative distances vary from 1:0.41–1:1.17 and in Black Redstarts of the subspecies *gibraltariensis* from 1:2.0–1:2.5. Individuals of the central-Asian subspecies *phoenicuriodes* vary from 1:1.57–1:3.0, and show some overlap to hybrids previously examined across Europe (1:0.94–1:2.14). Ertan (2002) found, in his study on hybrids from Germany, the average relative distances to be 1:1.22, significantly less than the lower limit of eastern subspecies of Black Redstarts. That would indicate that hybrids exhibit wing formulae more closely related to the ones found in Common Redstart, and the biometrics of the male hybrid captured in Österbymo fall well into this pattern.

Calls

Frauendorf et al. (1997) documented hybrids to sing like Black Redstarts, similar to what we found in Österbymo (Petersson 2010). Other observations from Sweden indicate that hybrids occasionally sing like a mixture between the two species, or sometimes like one of the species interspersed with vocals reminding of the other species. In Österbymo, the hybrid had contact calls resembling those of Common Redstart, but reacted to playback of contact calls from both species.

Redstart hybridization in Sweden

The abundance of hybridization between the two species of Redstarts naturally occurring in Sweden is not yet well-documented and seems to be a relatively rare event. The first confirmed hybridizations between the two species in Sweden were reported from Skövde, south-central Sweden, in 1959–1960 (Andersson 1963) and Dals Ed, southwestern Sweden, in 1985 (Orrhult 1986). The first confirmed hybrid bird, safely determined by wing formula biometrics and plumage traits, was spotted in the Gothenburg harbor in 1987 (Andersson 1988). Since the mid 1990s, at least ten findings of male hybrids have been reported from Sweden, mainly in the southern parts (The Species Gateway; R. Andersson, pers. comm.). Apart from the confirmed breedings in Österbymo in the summers of 2009–2012, two other hybrid males were observed together with partners during the same period: in the Limhamn limestone quarry, Scania in the spring of 2012 and in the copper mine of Falun, Dalarna in the summer of 2012. In Limhamn, the male hybrid was seen together with a pallid female Redstart (S. Cherrug, pers. comm.), most likely a *P. phoenicurus*. In the copper mine of Falun, the hybrid was observed mating with a female Black Redstart (P. Adenäs, pers. comm.).

Of the Swedish hybrids that have been thoroughly documented with photos, there is a relatively large diversity in plumage traits. A male claiming territory in Västra Tunhem, near Vänersborg, reminded strongly of a male Common Redstart with a slightly grayer tinge on back and head with a black throat extended downwards to the central

Table 1. Wing formula (interval of relative distances between primaries 5/6 and 6/7, respectively) and wing lengths in Common Redstarts, Black Redstarts of subspecies gibraltariensis and phoenicuroides, and hybrids Common Redstart x Black Redstart (according to Pérez-Garcia & Sallent (2011)) compared with the bird in this study.
Vingformel (intervall för relativa avstånd mellan handpennorna 5/6 och 6/7, respektive) och vinglängd hos hybriden från Österbymo jämfört med mått hos raser av rödstjärt, svart rödstjärt och hybrider.

Taxon	Wing formula *Vingformel*	Wing-length (mm) *Vinglängd*
P. p. phoenicurus	1:0.41–1:1.17	77–84
P. o. gibraltariensis	1:2.0–1:2.5	85–91
P. o. phoenicuroides	1:1.57–1:3.0	80–85
P. phoenicurus x P. ochruros	1:0.94–1:2.14	80–85
Österbymo bird	1:1	86

breast (P. Åberg, pers. comm.). Another similar bird was spotted near the copper mine of Falun in the summers of 2011 and 2012, with the exception of having a diffuse white wing panel. A second calendar year male (aged by means of remaining brownish-tinged juvenile flight feathers) temporarily observed near Torslandaviken, Gothenburg in April 2008 resembled a male *P. ochruros semirufus*, but exhibited some white feathers on central forehead and a diffuse transition between black throat and red underparts on upper belly. The male in Limhamn strongly resembled a male Black Redstart, typically exhibiting white wing panels. The black throat extended downwards to the upper belly, ending in a diffuse transition to red underparts. A tricky bird observed and photographed in the harbor of Malmö in 1994 was initially reported as a male *P. o. phoenicuroides* (see Olsson 1994). A few years later, following an increased knowledge and experience in the subject, the reported bird was, however, re-examined and eventually assessed a probable hybrid, despite the strong resemblance to central-Asian subspecies.

According to photos available in the Species Gateway database, Redstart hybrids spotted in Sweden exhibit a rather broad variation in plumage traits. The relative differences might, however, not be that pronounced as assumed, and too large conclusions should not be drawn since the photos hold some differences in lighting and contrast. Plumage characters that seem to be most varying are the look and extension of black on throat and upper belly, the amount of white feathers/feather tips on central forehead and the presence/absence of whitish outer margins on tertials and secondaries. Large variation in plumage characters can be expected from hybrids in different stages of generations, and shows the difficulties in safely distinguish hybrids from eastern subspecies of *P. ochruros* by means of plumage characters alone.

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Sammanfattning

I mitten av juni 2009 upptäcktes en avvikande hanfärgad svart rödstjärt (Figur 1–3) på ett industriområde i samhället Österbymo i södra Östergötland. Fågeln sjöng som en sådan och påminde utseendemässigt starkt om en svart rödstjärt av den centralasiatiska underarten *phoenicuroides* med bl.a. mörkt grå rygg och vingovansidor, en del vitt i pannan samt en stor svart strupe som slutade i en vid båge centralt över bröstet. Dock utmärkte den sig genom att uppvisa en diffus övergång mellan svart haklapp/bröst och mer blekt rödfärgad mage och undergump med insprängda vita fjädrar. Det är sedan tidigare känt att hybridisering mellan rödstjärt och svart rödstjärt förekommer sällsynt men regelbundet och att såväl första generationens hybrider som återkorsningar är fertila. Hybrider är fenotypiskt variabla och överlappar till viss del utseendemässigt ostliga svarta rödstjärtar, varför säker bestämning med ledning av dräktkaraktärer många gånger är omöjligt. Enligt nyligen publicerat material från Steijn (2005) och Pérez-Garcia & Sallent (2011) beskrivs istället de relativa avstånden mellan handpennespetsarna 5/6 och 6/7 som en av få utslagsgivande karaktärer. Hybrider har i tyska studier uppvisat en vingformel med ett relativt avstånd om 1:1,22, ett mått intermediärt mellan den europeiska nominatformen av rödstjärt (1:0,41–1:1,17) och svart rödstjärt av den västliga underarten *gibraltariensis* (1:2,0–1:2,29). För att säkert kunna uttala sig om ursprunget beslöts att fånga och ringmärka den östgötska fågeln för att i detalj kunna studera dräktkaraktärer och vingformel. I slutet av juni 2009 lyckades fångstförsöket, och vid samma tillfälle kunde också tre ännu ej flygfärdiga ungar, resultatet av en samhäckning mellan den hanfärgade fågeln och en hona av rödstjärt, märkas. Den hanfärgade individen uppvisade jämnfärgade större täckare och teckningar på yttre stjärtpennor liknande de hos adult svart rödstjärt, varför den kunde bokföras som 3k+. Individen kunde sedermera säkert bestämmas till en hybrid mellan den västliga underarten av svart rödstjärt (*Phoenicurus ochruros gibraltariensis*) och nominatformen av rödstjärt (*Phoenicurus phoenicurus phoenicurus*) med ledning av följande fem karaktärer: 1) kvarsittande vitt på inre tertialens inre ytterfan, 2) blekare röd färg på kroppsundersidan, 3) vitfärgad nedre buk (bakom benen), undergump och undre stjärttäckare, 4) avsaknad av ytterfansinskärning på sjätte handpennan, och 5) vingspetsen bildades av handpennorna 3–5. Slitna handpennespetsar gav inte möjligheter att exakt fastställa avstånden mellan handpennorna 5/6 och 6/7. Det relativa avståndet mellan de avnötta fjäderskaften var cirka 1:1. Särskilt den senare karaktären är ett relativt starkt indicium för att den hanfärgade individen var en hybrid mellan de båda i Sverige förekommande rödstjärtsarterna (Tabell 1). Den aktuella fågeln återkom till industriområdet också nästföljande tre säsonger och genomförde lyckade häckningar med rödstjärtshonor. Den konstaterades under sommaren 2012 vara en fågel av minst fem års ålder (6k+), vilket så vitt känt är ett nytt åldersrekord för rödstjärtshybrider i Europa.

Den första konstaterade hybridiseringen mellan rödstjärt och svart rödstjärt i Sverige konstaterades i de västgötska orterna Skövde 1959–1960 och Dals Ed 1985. Konstaterade eller möjliga häckningar mellan rödstjärtshybrider och sina artrena partners har rapporterats ett tiotal gånger i Sverige det senaste decenniet. Den aktuella fågeln i Österbymo utgjorde emellertid den blott andra ringmärkta hybriden någonsin i Sverige, efter ett förstafynd i Göteborg 1987. Det är dock den enda individ som utvärderats närmare och jämförts med fåglar från den europeiska kontinenten. Bland de misstänkta hybrider som fotograferats i Sverige de senaste femton åren finns en relativt stor variation i fjäderdräkt (med viss reservation för att tillgängliga foton håller olika ljus- och färgmättnad). De tre dräktkaraktärer som tycks vara mest variabla är 1) förekomst/ ickeförekomst av vita tertial- och armpennekanter, 2) mängden vita fjädrar i pannan och 3) utbredningen och utseendet av det svarta på bröstet. Dessa skillnader i utseende kan förväntas bland hybrider av olika generationer, och visar på svårigheterna att säkert kunna särskilja hybrider och ostliga svarta rödstjärtar med ledning av enbart dräktkaraktärer.

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Breeding biology of a Tawny Owl *Strix aluco* population in south-western Sweden – a 15 year survey

Häckningsbiologin hos en population av kattuggla Strix aluco *i sydvästra Sverige – en femtonårig studie*

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Abstract

The breeding biology of the Tawny Owl *Strix aluco* was studied during 15 years in a 1000 km^2 area in south-western Sweden. The owls were breeding in c. 170 nest boxes, one in each of a potential territory. Occupancy rose from less than 20% in the first years to better than 50% in most of the later years. During the first years most nest boxes were relocated to sites within the territories that we considered to be of better quality. Absence of any increase in 48 high quality control territories indicates that the relocations were important for increasing population size. Nesting success was positively correlated with population density. This unexpected result could regrettably not be analyzed in relation to food abundance as we estimated food abundance by the number of prey found in nests. Bank vole, field vole and wood mice were the most predominant prey. All these three taxa had a peak in 2010 when owl density also peaked. The mean brood size was 2.3 young, similar to that in other European populations

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Introduction

There is a considerable interest of how reproductive success varies between years and over longer periods of time. A large number of articles have been written on the subject (for example, Lundberg 1976, Lundberg 1981, Tjernberg 1983). The interest focuses primarily on how to understand the mechanisms that regulate the size of animal populations. In many bird populations a correlation between food availability and reproductive success has been found. In particular, this applies to the impact of prey abundance on the reproductive output in top predators like raptors and owls (Newton 1979, Tjernberg 1983, Lundberg & Westman 1984, Wendland 1984, Hörnfeldt et al. 1990, Village 1990, Brommer et al. 1998, Rosenberg et al. 2003).

Tawny Owls *Strix aluco* feed on different kinds of animal prey but predominantly on small rodents, and the breeding density varies between years depending on prey abundance (Southern 1954, Mikkola 1983, Wendland 1984, Kirk 1992, Zalewski 1994). Hence, during rodent peak years in the breeding area, the owls often breed in large numbers (Southern 1954, 1970, Wallin 1988, Redpath 1995, Coles & Petty 1997, Petty & Fawkes 1997, Sunde 2001, Sunde et al. 2001, Persson 2003, Sunde et al. 2003, Avotins 2004, Kekkonen et al. 2008). In Wytham Wood at Oxford, Great Britain, a long-term study (1947–1959; Southern 1970) showed a mean value of 1.96 produced young per brood (n=76). Studies of Tawny Owls in two other forests in Great Britain showed that 84–96 percent of the population began to breed when food abundance was high, but only 30 percent when food abundance was low (Petty, 1987, Petty & Fawkes 1997).

The predominant prey species varies between different geographical areas. Studies of Tawny Owl diet from the British Isles showed that the most common prey was bank vole *Clethrionomys glareolus* and wood mouse *Apodemus sylvaticus* (Southern 1954, Kirk 1992). Another study in an upland forest showed that the most common prey was field vole *Microtus agrestis* (Petty 1987). When rodent abundance drops, Tawny Owls are able to change to alternative prey such as birds and amphibians but also beetles and earthworms (Mikkola 1983, König & Weick 2008).

The male is responsible for food delivery when the female incubates the eggs and until the young are about six days old (Mikkola 1983, König & Weick 2008, own observations). When food is abundant, the male sometimes loads up a stock of rodents in the nestbox (own observations).

The Tawny Owl is a common bird, perhaps the most common owl species in Europe (König & Weick 2008). It is non-migratory and strongly territorial. Immature birds usually try to establish territories near their birthplace, but can geographically expand their search for a suitable vacant territory (Mikkola 1983). Tawny Owls typically breed in tree cavities, often made by the Black Woodpecker *Dryocopus martius*. Sometimes they breed in twig nests of Crow *Corvus corone*, Magpie *Pica pica*, Sparrowhawk *Accipiter nisus* and Buzzard *Buteo buteo*. They readily accept nest boxes and may breed near human settlings (Mikkola 1983, Svensson et. al 1999, König & Weick 2008, own observations). This makes them well suited for scientific studies and this is probably the main reason why the Tawny Owl is one of the most studied species of birds of prey in Europe.

In this paper, we present results on changes in the breeding population size and breeding results between the years 1996 and 2010 as a contribution to the knowledge of the geographical variation of the breeding biology of Tawny Owls.

Methods

The investigation began in the mid-1980s, when the first breeding attempts were recorded in 1987 (Ericsson et al. 2006). It was a modest project the first couple of years, with a long learning curve. The number of nest boxes was high from the start, but many of the boxes were located incorrectly, with high rejection rate as a result. With increased knowledge, nest boxes were relocated to areas more suitable to the preferences of Tawny Owls. Suitable locations have been identified since 1991, and relocations of nest boxes to maximize occupancy have been carried out, more or less, on a yearly basis since then. However, there are 48 territories where the nest boxes have had the same location throughout the study and these territories serve as controls when we estimate the effect of the relocations. The monitoring of breeding females started in 1994. The methods of collecting data have remained unchanged throughout the study.

The study was carried out west of Lake Vättern in the municipalities of Hjo, Karlsborg, Laxå, Tibro, Töreboda and Skövde. The owls in this study bred in a variety of habitats, like deciduous and mixed coniferous forests, but also in larger parks and semi-open pastures. The total geographical area is about 1000 km^2. Within this area, large parts are not suitable as breeding habitats for Tawny Owls.

All nest boxes and natural nesting sites were inspected every year of the study period 1996–2010. A first inspection was made in April–May. When an owl was found breeding, that nest was visited at least three times (to control or ring the females, to ring the young and to clean the nest), but usually more visits than three were needed to collect reliable data on clutch size, hatching results, determine the age of the young. The majority of the monitored owls were breeding in nest boxes, but occasionally breeding owls were found in natural cavities. The nest boxes were placed in trees at a height of 3 to 5 meters, and approximately 1 to 3 km apart. Inside the nest box a layer of sawdust was placed, facilitating better incubation conditions of the eggs.

Females were caught during breeding. Unringed females were ringed (rings Museum of Natural History, Stockholm) and aged up to their third calendar year (CY). Age of unringed adult Tawny Owls could be determined by examining the moult pattern and condition of their secondary wing feathers (Petty 1992, Baker 1993, Peter Sunde, pers comm.). Females older than 3 CY were classified as 4 cy+. Age and condition (based on weight) of captured females were measured.

Eggs and all hoarded prey were monitored during the early stages of the incubation period (usually during the first inspection of the nest). Nestlings were ringed, generally between 18 and 25 days old. At ringing, we also measured the weight and determined the age of the nestlings. The age was estimated by measuring their 4th primary using a scale adapted for young Tawny Owls (Peter Sunde, pers comm.). When the nestlings had left the nest (at 30 to 35 days of age), the nest box was cleared of old nesting material. The nest box was also searched for rings or dead chicks and new sawdust was placed for the next year's breeding.

A breeding attempt was defined as an attempt when at least one egg was found in the nest. A successful breeding attempt was defined as a case when at least one young was ringed. Nesting success was measured as the proportion of successful breeding attempts out of all breeding attempts. Hatching success was measured as the number of hatched young per egg laid.

Each prey found in a nests was identified to species in the field, except for the genera of *Apodemus* (wood mouse or yellow-necked wood mouse *A.*

flavicollis) and *Sorex* (common shrew *S. araneus* or pygmy shrew *S. minutus*), which were identified to their respective genus.

Regression analyses were conducted with STATISTICA 6.0.

Results

The total number of ringed owls between 1987 and 2010 was 3252, including ringed young and breeding adults. Of these birds, 535 were recovered dead or controlled alive. Of the latter, 303 were controlled as breeding females by ourselves. Other people found 220 of our ringed owls dead, and 20 were controlled alive. These latter had been trapped in barns or summerhouses and were released after rehabilitation. During the period of 1996–2010, 925 breeding females were ringed and monitored. Age is known for 572 of them (Table 1). This number also includes breeding females that have been monitored in subsequent years. Uncontrolled and controlled females, with known and unknown age, varied during the period. Only in 1996 did the number of uncontrolled females exceed the number of controlled females. After 2001, the proportion of controlled females stabilised, and no less than 80 % was controlled each year (Table 1). The proportion of females with known age was low during the early years but since 2001 it has always been 50% or better (Table 1).

Population

The total breeding population, with all nest boxes included, varied with peaks in 2003, 2008 and 2010 (Figure 1). The mean number of young per successful breeding was 2.34. The mean number of breeding attempts per year was 74, the mean number of eggs laid per year was 259, and the mean number of ringed young per year was 174 (Table 2). The number of breeding attempts as well as the number of successful breeding attempts was highest in 2010 (108) and lowest in 1996 (23) (Table 2).

The population of breeding owls showed a significant positive trend in the area over the whole study period (regression analysis, $R= 0.84$, $R^2= 0.70$, Adjusted $R^2=0.68$, $F(1,13)=30.23$, $p<0.01$) (Figure 2). The main increase occurred during the first part of the period. When considering only the 48 territories without any relocation of nest boxes, we found

Table 1. The number of breeding females during 1996–2010. Uncontrolled females are females that could not be controlled during breeding. Females with known age are those that were ringed as nestlings or as breeding adults through their third calendar year. Females with unknown age are those that were ringed as breeding adults older than in their third calendar year.
Antal häckande honor 1996–2010. Okontrollerade honor är honor som inte kunde kontrolleras under häckningen. Honor med känd ålder är honor som märkts som boungar eller som häckande till och med tredje kalenderåret. Honor med okänd ålder är honor som märkts som häckande senare än under tredje kalenderåret.

Year *År*	Breeding attempts *Häcknings-försök*	Uncontrolled females *Ej kontrollerade honor*	Controlled females *Kontrollerade honor*	Females of known age *Honor med känd ålder*	Famales of unknown age *Honor av okänd ålder*
1996	23	16	7	3	4
1997	33	13	20	1	19
1998	48	11	37	10	27
1999	64	27	37	20	17
2000	52	13	39	18	21
2001	76	6	70	40	30
2002	87	11	76	48	28
2003	104	20	84	52	32
2004	63	12	51	35	16
2005	92	12	80	51	29
2006	94	8	86	59	27
2007	87	10	77	58	19
2008	106	18	89	69	20
2009	79	6	68	50	18
2010	108	4	104	58	46
Total	1117	187	925	572	352

Breeding habitat for Tawny Owls.
Kattugglebiotop. Foto: Lars-Ove Nilsson.

Breeding habitat for tawny owls.
Kattugglebiotop. Foto: Lars-Ove Nilsson.

Nesting box for Tawny Owls.
Holk för kattuggla. Foto: Peter Ericsson.

Female Tawny Owl, 3 cy+.
Hona av kattuggla, 3k+. Foto: Peter Ericsson.

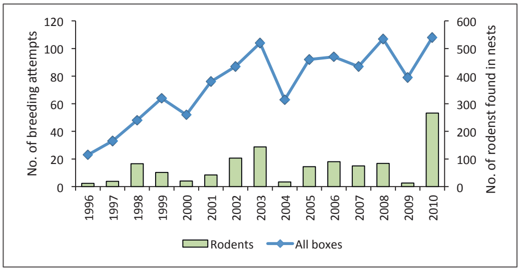

Figure 1. Number of breeding attempts (blue dots) and prey abundance (total number of prey items found in active nests; green bars) between 1996 and 2010.
Antal häckningsförsök (blå prickar) och bytesantalen (totala antalet byten påträffade i aktiva bon; gröna staplar) mellan 1996 och 2010.

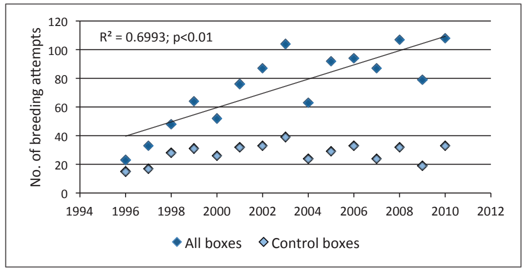

Figure 2. Upper, dark blue squares: Number of breeding attempts in all territories, including those where nest boxes have been relocated from poor sites to areas with habitat more suitable for tawny owls, as well as in 48 territories where the nest boxes were never relocated (control boxes). Lower, light blue squares: Number of breeding attempts in the 48 control territories where no relocation of nest boxes has been made.
Mörkblå kvadrater upptill: Antal häckningsförsök i samtliga revir, såväl i de där holkar flyttats från sämre till bättre kattugglebiotoper som i de 48 revir där ingen holkflyttning skett. Ljusblå kvadrater nertill: Antal häckningsförsök i de 48 kontrollholkar som aldrig flyttats om inom sina revir.

Table 2. Breeding results during 1996–2010. N=number of controlled nest boxes and natural cavities. Territories are the number of potential territories that could have had breeding Tawny Owls. Nesting success is the proportion of successful breeding attempts. Hatching success is the number of hatched young per laid egg.
Häckningsresultat 1996–2010. N=antal kontrollerade holkar och naturliga håligheter. Revir är antalet potentiella revir som kunde ha haft häckande kattugglor. Häckningsframgång är andelen kullar med minst en ringmärkt unge av samtliga häckningsförsök. Kläckframgång är andelen kläckta av alla lagda ägg.

Year *År*	N	Territories *Revir*	Breeding attempts *Häckningsförsök*	Occupancy *Andel bebodda*	Successful *Lyckade*	Nesting Success *Häckningsframgång*	Eggs *Ägg*	Ringed young *Märkta ungar*	Hatching success *Kläckframgång*
1996	176	170	23	14%	15	65%	67	40	60%
1997	172	168	33	20%	18	55%	99	51	52%
1998	171	170	48	28%	36	75%	189	126	67%
1999	171	168	64	38%	58	91%	246	194	79%
2000	174	172	52	30%	34	65%	139	80	58%
2001	174	171	76	44%	57	75%	269	172	64%
2002	179	175	87	50%	74	85%	324	235	73%
2003	181	177	104	59%	82	79%	365	255	70%
2004	184	178	63	35%	43	68%	155	97	63%
2005	183	179	92	51%	80	87%	329	252	77%
2006	187	182	94	52%	72	77%	379	242	64%
2007	188	184	87	47%	70	80%	311	194	62%
2008	192	185	107	58%	83	78%	364	242	66%
2009	195	187	79	42%	63	80%	209	140	67%
2010	201	196	108	55%	86	80%	439	291	66%
Mean	182	177	74	42%	58	76%	259	174	66%
Total	2728	2662	1117		871		3884	2611	

no significant increasing trend in population size (regression analysis, R= 0.32, R^2= 0.10, Adjusted R^2=0.03, F(1,13)=1.49, p=0.24) (Figure 2).

Breeding results

The number of ringed young has varied considerably over the years, with peaks in 2003, 2005 and 2010. The highest number of ringed nestlings (291) was recorded in 2010 and the lowest number (40) in 1996. In two seasons (2000 and 2004), the number of ringed chicks was less than 100 (Table 2). Hatching success was highest in 2005 when 77 percent of the eggs hatched. However, the proportion of successful breeding attempt was highest in 1999, when 91 percent of the breeding attempts were successful (Table 2). There was a significant positive correlation between nesting success and population density (regression analysis, R= 0.66, R^2= 0.44, Adjusted R^2=0.40, F(1,13)=10.27, p<0.01) (Figure 3).

Prey

Nine different species of mammalian prey were found in the nest boxes during the study period (Table 3). The two most common prey species were bank vole and field vole followed by pooled number for the two species of wood mouse. Peak years for bank vole occurred in 1998, 2002 and 2010. Peak years for field vole were recorded in 2003, 2006 and 2010. Peaks of wood mice were recorded in 2008 and 2010. All these three taxa had a peak in 2010. A total of 266 different rodent specimens were recorded in 2010, which is the highest number ever during the study.

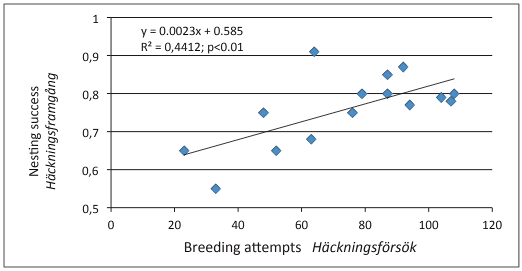

Figure 3. Relationship between nesting success and number of breeding attempts.
Förhållandet mellan häckningsframgången och antalet häckningsförsök.

Discussion

The population increase during the first part of the study period may have had two reasons. First, the population size may have been low before the start of the study and the increase a delayed effect from the presence of a large number of nest boxes already when the study started in 1996. Second, the relocation of nest boxes to more suitable habitats within the territories may have attracted the pairs to use nest boxes instead of natural cavities. Although the majority of nest box relocations were made before 2001, relocations have also been made in later

Table 3. Number of mammalian prey recorded in nest boxes between 1996 and 2010.
Antal däggdjursbyten i holkarna mellan 1996 och 2010.

Year	*Clethrionomys glareolus*	*Microtus agrestis*	*Apodemus sp.*	*Sorex sp.*	*Arvicola terrestris*	*Muscardinus avellanarius*	*Mus musculus*	*Talpa europaea*	*Rattus norvegicus*	Total
1996	10	0	0	0	0	1	1	0	0	12
1997	9	1	0	1	5	1	0	1	1	19
1998	65	0	1	2	9	5	0	0	1	83
1999	26	6	1	10	4	1	2	1	0	51
2000	7	0	0	2	5	2	2	2	0	20
2001	11	0	19	6	6	0	0	0	0	42
2002	60	4	13	8	8	7	1	2	0	103
2003	40	63	18	5	16	0	0	1	1	144
2004	1	2	6	4	4	0	0	0	0	17
2005	18	13	17	6	13	3	1	0	1	72
2006	21	47	4	4	10	2	0	2	0	90
2007	16	8	15	13	14	7	0	0	2	75
2008	23	12	26	13	7	3	0	0	0	84
2009	1	3	2	1	5	0	0	0	1	13
2010	59	129	25	39	4	6	0	2	2	266
Total	367	288	147	114	110	38	7	11	9	1091
Mean	24,5	19,2	9,8	7,6	7,3	2,5	0,5	0,7	0,6	72,7

years but not to the same extent. After about 2001 the breeding population has not responded to the relocations in a similar way as in the early part of the period, and the population increase has leveled off and seems now to be governed mainly by the abundance of rodents. As we found a significant population increase when we included all nest boxes but not when we included only the forty-eight nest boxes that had never been relocated and hence already from the start were located in good habitat, we conclude that the main factor for the population increase was the relocation of the nest boxes. Possibly, there might also have been a combination of low owl numbers and relocation of nest boxes during the early part of the study period. Perhaps the area became saturated with breeding owls so that relocation of nest boxes no longer could have any effect even if they were place in successively better habitats.

Despite the harsh weather conditions during the winter 2009–2010, the Tawny Owls began to breed in large numbers in 2010. A total of 129 field voles, twice as many as in any previous year was found in the nests of breeding owls. This high number of prey appears to be a consequence of the deep snow cover during the winter of 2009–2010. As suggested by Hörnfeldt (2004), we believe that the field voles were able to forage and reproduce under safe conditions from attacking predators from above. The numbers of breeding attempts, eggs laid and ringed young reached record levels in 2010. The most important factor of this high breeding numbers seems to be the high abundance of the most important vole species, bank and field vole and wood mice. For the first time, these species shared a common peak year in 2010.

It is interesting that not only the density of owls but also their nesting success increased when the nest boxes were relocated to better habitats. This is surprising as increasing density is normally assumed to cause food scarcity and increasing competition and then declining breeding success. The explanation of the unexpected effect is probably that the effect of food abundance variation is sufficiently strong to conceal the effect of competition so that in good rodent years both the number of breeding owls and their breeding success increase.

The mean brood size reported in this study showed no big differences from that in other studies in Europe (e.g. Southern 1970, Mikkola 1983, Petty 1987, Persson 2003). We found a mean value of 2.3 young/brood (successful breeding attempt), which can be compared with 1.96 young per brood in England (n=76, Southern 1970) and 2.1 young per brood in Sweden (n=18, Persson 2003). Mikkola (1983) gives the following average brood sizes: 3.05 (n=601) in Finland, 2.61 (n=131) in Central Europe and 2.27 (n=181) in Britain. Southern (1970) states that the optimum brood size of Tawny Owls is two young per brood. His main argument is that growth rate (weight increase per chick and day) decreases with number of chicks in the brood. Our results support his theory, but before it can be fully accepted, other factors must be controlled, such as age and breeding experience of the breeding pair.

Acknowledgements

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Sammanfattning

I många fågelpopulationer har man hittat ett samband mellan häckningsframgång och födotillgång. I synnerhet gäller detta för predatorer som rovfåglar och ugglor. Kattugglor livnär sig på olika typer av djur, men främst på smågnagare, och antalet häckande par varierar mellan åren beroende på hur mycket bytesdjur det finns inom reviren. Under gnagartoppar kan kattugglorna få stora kullar. När gnagartillgången avtar kan kattugglor byta till alternativa byten, till exempel fåglar och groddjur men även skalbaggar och daggmaskar kan ingå i menyn.

I denna studie häckade kattugglorna i holkar. Studien genomfördes väster om Vättern, i kommunerna Hjo, Karlsborg, Laxå, Tibro, Töreboda och Skövde. Till en början var projektet blygsamt med ganska få häckningar de allra första åren. Antalet holkar var högt från början, men många var felplacerade och antalet häckningar var också lågt till en början. Allteftersom kunskapen om kattugglorna ökade flyttades holkar till områden som är mer lämpade för arten. Lämpliga miljöer för kattuggla har identifierats sedan 1991, och omplaceringar av holkar har utförts, mer eller mindre, varje år sedan dess. Det finns 48 områden som är oförändrade, alltså revir där inga omplaceringar har utförts.

Ägg och de bytesdjur som fanns i holken räknades vid det första besöket. Ungar ringmärktes då de var mellan 18 och 25 dagar gamla. När ungarna hoppat ut ur holken och lämnat boet rensades den från gammalt bomaterial och ett lager kutterspån lades i holken. Alla bytesdjur identifierades i fält, förutom släktena inom *Apodemus* (större skogsmus och mindre skogsmus) och *Sorex* (vanlig näbbmus och dvärgnäbbmus), som identifierades till respektive släkte.

Det totala antalet ringmärkta ugglor mellan 1987 och 2010 var 3252. Av dessa har 535 återfunnits döda eller kontrollerats levande. Under perioden har 925 honor ringmärkts och studerats. Åldern är känd hos 572 av dem.

Antalet påbörjade häckningar varierade under perioden, med toppar under 2003, 2008 och 2010. Det genomsnittliga antalet ungar per häckning var 2,34. Antalet påbörjade häckningar var 74 i genomsnitt, antalet ägg 259 och ringmärkta ungar per år var 174. Antalet häckningsförsök liksom antalet lyckade häckningsförsök var högst i 2010 (108) och lägst 1996 (23).

Antalet ringmärkta ungar har varierat mellan åren, där de högsta topparna registrerades under 2003, 2005 och 2010. Sistnämnda år ringmärktes det högsta antalet ungar (291) under perioden medan 1996 hade det lägsta antalet märkta ungar (40). Häckningsframgången var störst 2005 då 77 procent av äggen kläcktes. Andelen lyckade häckningsförsök var störst 1999, då 91 procent av de häckande paren lyckades.

De två vanligaste bytesdjuren som observerades i holkarna var åkersork och skogssork. Toppåren för skogssork inträffade 1998, 2002 och 2010. Toppåren för åkersork registrerades under 2003, 2006 och 2010. Toppar av skogsmöss inföll under 2008 och 2010. Alla dessa tre taxa hade en topp under 2010.

Trots de svåra väderförhållanden under vintern 2009–2010, började kattugglor häcka i stort antal under 2010 då tillgången på sork var mycket god. Den viktigaste faktorn i den höga siffran under 2010 verkar bero på den goda förekomsten av de viktigaste bytesarterna, åker- och skogssork samt skogsmus.

Kattugglepopulationen visade en positiv signifikant trend i området under studieperioden. Om man endast ser till de 48 revir där inga omlokaliseringar av holkar skett, kunde inte samma signifikanta trend ses.

Det är intressant att inte bara tätheten av häckande ugglor, utan också häckningsframgången ökade när holkar flyttades till mer lämpliga miljöer för kattuggla. Detta är särskilt förvånande eftersom en ökande densitet av häckande fåglar normalt antas orsaka födobrist, ökad konkurrens samt sjunkande häckningsframgång. Förklaringen till denna oväntade effekt beror sannolikt på att effekten på god födotillgång är tillräckligt stark för att dölja effekterna av konkurrensen, då antalet häckande ugglor samt häckningsframgången ökade då tillgången på föda var god.

Den genomsnittliga kullstorlek som rapporteras i denna studie visade inga stora skillnader från det som andra studier i Europa tidigare rapporterat. Vi hittade ett medelvärde på 2,3 ungar/kull, vilket kan jämföras med 1,96 ungar/kull i England (n = 76) och 2,1 ungar per kull i Sverige (n = 18). Mikkola (1983) ger följande genomsnittliga avkommor storlekar: 3,05 (n = 601) i Finland, 2,61 (n = 131) i Centraleuropa och 2,27 (n = 181) i Storbritannien. Southern (1970) påstår att den optimala kullstorleken hos kattugglor är två ungar per kull. Hans huvudargument är att tillväxttakten (viktökning per unge och dag) minskar med antalet ungar i kullen. Våra resultat stödjer denna teori men innan den kan accepteras fullt ut, måste andra faktorer kontrolleras, som exempelvis ålder och tidigare häckningserfarenhet av det häckande paret.

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A Second brood in Canada Geese *Branta canadensis*?

Andrahäckning hos kanadagås Branta canadensis?

CHARLOTTE BERG & HENRIK LERNER

Abstract

Canada Geese *Branta canadensis* do normally not produce more than one clutch per year. On the island of Nidingen off the west coast of Sweden a pair of Canada Geese successfully reared one early brood of young in the spring (2 and 8 young respectively in 2011 and 2012). Apparently the same pair in both years, approximately 35–40 days after hatching the first brood, laid a second batch of eggs in the same nest. In this paper, these events are described in detail and alternative explanations are discussed. No indications of adoption of young or change of partner in the couple could be identified; hence the hypothesis of a true second brood remains strong.

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Introduction

Generally amongst geese and other waterfowl, a second breeding attempt might occur when a clutch is lost early in the nesting period within temperate populations (West et al. 1986). In wild arctic populations no re-nesting has been found to occur (Cramp & Simmons 1977, Ogilvie 1978). No second broods are known in geese (Cramp & Simmons 1977), with the exception of one record in wild Canada Geese *Branta canadensis* (Brakhage 1985) and a few cases in semi-captive Barnacle Geese *Branta leucopsis* (West et al. 1986). The reasons for not laying a second brood are likely twofold. First, the female loses substantial body weight (in the form of fat, protein and other nutrient stores) during egg-laying and incubation and, second, regaining weight takes time and may delay the re-initiation of breeding too late in the season (Ogilvie 1978, Alisauskas & Ankney 1992). There are also hormonal changes in the adult birds during rearing of the first goslings that would prohibit renesting (West et al. 1986, Bluhm 1992). Suggested explanations in the case of the wild Canada Geese were a prolonged nesting season, involving resident birds which did not invest energy in migration and a sufficiency of food supplies (Brakhage 1985). Here, we present data from what seems to be a case of a second clutch in Canada Geese, thus questioning the established theory, which claims that the species does not lay a second clutch in temperate climates.

The Canada Goose was introduced to Sweden about 1930 (Madsen et al. 1999, Kampe-Persson 2010, Ottosson et al. 2012). Most individuals seem to belong to one of the larger races, although there is still some uncertainty as to their origin (Sjöberg 1993). The breeding population in Sweden is approximately 17 000 pairs (Ottosson et al. 2012, see also Kampe-Persson 2010) and increasing (Fox et al. 2010). In June 2011, staff at the Nidingen bird ringing station noticed that a pair of Canada Geese, which had hatched two young previously during the same season, was incubating a second brood. The following year, i.e. 2012, the same phenomenon was noticed again, when it was decided to gather information to establish whether this was actually a true case of a second brood in Canada Geese or related to adoption of young or involved exchange of one of the responsible parents of the original pair.

Materials and methods

The Ornithological Society of Gothenburg runs the bird ringing station on the small uninhabited island of Nidingen approximately 8 km off the coast of Halland, Sweden (N 57° 18.166'; E 11° 54.123'). The island is a nature reserve and visitors are allowed only onto restricted areas during the breeding season. Bird ringing staff stationed on the island continuously from March to November catch and ring birds and report daily bird species abundance via the internet reporting system *Artportalen* (http://www.artportalen.se/birds/). Observations include breeding status of the birds involved, ranging from "observed in a suitable breeding environment" to "nest with eggs or young observed", with free text comments and explanatory notes added to the records. There is also an internet-based daily diary publication system included in *Artportalen*, where the station manager publishes short summaries of the activities and events of the day. Records relating to Canada Geese on the island of Nidingen during the breeding season (here limited to mid March – mid July) in 2011 and 2012 were compiled from *Artportalen* and the Nidingen diary, and the results described and discussed below are based on information from these records.

Results

From 13 March until 13 August 2011, Canada Geese were recorded on the island almost every day. During April, what appeared to be 4 pairs using 4 different nesting sites were recorded using distinctively discrete home ranges with specific nest sites identified (the West Point pair, the Hollow pair, the Eastern Groove pair and the Vicar's Grave pair) (Figure 1). On 2 April the West Point pair was noted on the breeding ground and 3 days later, it was reported that the male in the West Point pair was wearing a ring on his left leg. At that time there were 6 eggs in the nest. By 7 April, the Vicar's Grave pair's nest had been predated and was abandoned, whereas the West Point pair had 7 eggs in their nest. On 7 May, the West Point pair had hatched 2 young, which were frequently reported and by 7 June were the only Canada Geese hatched on the island. No details about the other 2 nests were mentioned, but from the absence of brood records it can be assumed that these eggs were not hatched.

On 8 June the West Point pair was reported with a second batch of 3 eggs in the same nest with a fourth laid by 11 June, while the male continued accompanying the young and guarding the incubating female, showing aggression towards approaching humans. Photographs from 19 June show the female standing over the 4 eggs in the nest, with the male standing next to her together with 2 well grown young (Figure 2). The male clearly bears a metal ring on his left leg, although the female is not ringed.

By 27 June, the West Point female was reported as not having been incubating the nest for several

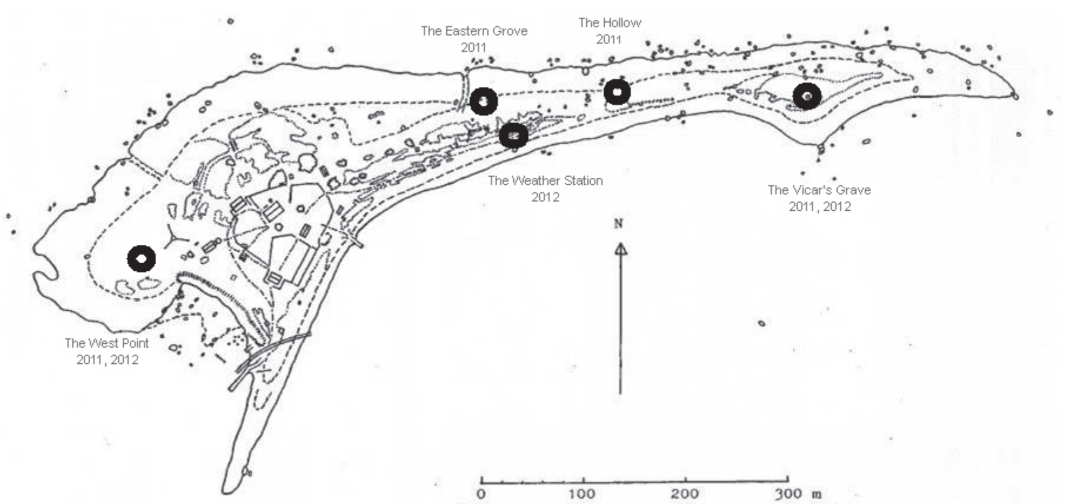

Figure 1. Map of the island of Nidingen, indicating Canada Goose nest locations in 2011 and 2012 respectively. Original map produced by U. Unger.
Karta over ön Nidingen, som visar var kanadagässens bon var belägna år 2011 respektive 2012. Originalkarta framtagen av U. Unger.

Figure 2. Photograph taken on 19 June 2011, showing the pair of Canada Geese described in this paper, the two young and the four eggs. Photo: C. Berg
Fotografi taget den 19 juni 2011, som visar det kanadagåspar som beskrivs i denna artikel, deras två ungar och de fyra äggen. Foto: C. Berg.

days, and when bird station staff approached the nest is was empty, presumably as a result of predation by gulls or crows. The pair and 2 large goslings were seen at sea close to the West Point area on 28 June with no reports of Canada Geese breeding activities after that date.

During 2012, a similar pattern was observed. Canada Geese were recorded present from 11 March until 5 August. During April 6 separate pairs were seen, but only 3 nest sites identified (the West Point pair, the Weather Station pair and The Vicar's Grave pair) (Figure 1). The West Point pair (the male again ringed on his left leg with an unmarked female) was recorded present and incubating 6 eggs on 29 March, rising to 8 on 31 March. On 29 April these eggs hatched eight young which were regularly reported through June in the West Point area and adjacent areas. On 7 May the Weather Station pair was recorded incubating and an unmarked pair was seen on West Point. The Weather Station female was caught and ringed (right leg) on 8 May when the Vicar's Grave pair's nest was found predated. It was not known if there were more active Canada Geese nests on the island, but the Weather Station nest hatched four young on 12 May. From 28 May to 9 July, these 2 families of 3 and 8 goslings were continuously reported.

On 11 June, the unmarked West Point female (assumed by the staff to be the same one throughout the entire season) was incubating 6 eggs in the same nest as the previous clutch, when an unmarked bird was associating, but not in an aggressive manner. The male with a ring on his left leg was seen together with the eight large young from the previous clutch. On 14 June, the female was still incubating the eggs, but by 16 June, it was recorded that she had been absent for two days and was back with the male and the 8 large young on the northern shore of the island.

On 10 July, 1 dead gosling was found at the

Kausan beach, and 1 was reported as diseased on 12 July. However, these 2 young did not belong to the West Point pair, as their litter of 8 large young was still recorded as intact on 12 July.

The interval between the hatching of the first clutch and the first eggs laid in the second clutch was, based on the *Artportalen* records, estimated to 35–40 days for both years.

Discussion

These records strongly suggest this female Canada Goose laid a second clutch, contrary to the established view that geese never lay a second clutch (Cramp & Simmons 1977) if the first clutch is reared successfully. Whilst we cannot prove the identity of the female conclusively, the presence of the same defending male (bearing a ring) and the use of the same nest in the same area in two consecutive years is suggestive this was the case. This implies that despite the substantial body weight loss during egg-laying and incubation (Ogilvie 1978), geese in the temperate areas may be able to recoup stores in time to lay a second clutch in the wild. Canada Geese do not overwinter on Nidingen, but stay on the island during the entire nesting season which indicates sufficient food resources.

The first published record of a second clutch for individually marked Canada Geese (Brakhage 1985) was also from the temperate zone (Missouri, USA). The eggs were laid earlier in the season, probably due to the more southern location. In 1983 the first clutch of 10 eggs resulted in one gosling. When the female laid the first egg in the second clutch 24 days later the gosling was no longer with the pair. The second clutch contained 9 eggs resulting in one gosling. From the semi-captive flock of 200 Barnacle Geese at the Wildfowl Trust in southern England, five different pairs were reported producing second clutches (West et al. 1986). The authors in that case suggested that this was a result of the superabundant of food supply, as the flock was fed grain and a high protein supplement during the breeding season.

The island of Nidingen lies far from the coast and from other islands, with very little exchange of geese during the breeding season, except for geese moulting in the area. For this reason, we are confident that the West Point male was involved in the first, successful hatching of broods in 2011 and 2012 and was also involved in the second brood, as this male bird was the only ringed Canada Goose on the island during the season in question during 2011, and the only bird ringed on the left leg during 2012. Unfortunately, we cannot confirm the identity of the female as being responsible for both broods in both years. The established theory mainly focuses on the constraints imposed by female body condition that limit her ability to invest in a second clutch. The male suffers no such demands and therefore is more able to invest in a second clutch because he is not producing eggs, but still creates conflicts between his investment in mate guarding at the nest and brood rearing which is normally undertaken by both parents. There were no indications that the broods of two and eight goslings could have been hatched by another pair in another nest, and then adopted by the West Point pair. Although not theoretically impossible, this seems highly unlikely as no other pair was seen nesting that early in the season either year. The distance to the nearest of the other Canada Goose nests was estimated to 350 meters (2011) and 420 meters (2012).

In both years, the second clutch failed to hatch. Based on the recorded information, we hypothesize that the eggs were predated after being abandoned by the female. This study shows that second broods may occur very rarely in short distance migratory temperate nesting Canada Geese, in contrast to conventional theories about breeding in northern geese. However, individual marking (preferably neck-banding, which can be read from a distance), close observation and DNA analysis of parents and young are necessary to establish the parent-offspring-sibling relationships involved (see Black et al. 2007 for a presentation on such studies). The study of isolated island populations might facilitate this.

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Sammanfattning

Generellt gäller hos gäss och andra simfåglar i tempererat klimat att en andra kull kan läggas om den första omgången ägg/ungar förloras tidigt under häckningssäsongen (West et al. 1986). Hos vilda arktiska gäss har omläggning däremot inte kunnat påvisas (Cramp & Simmons 1977, Ogilvie 1978). Andrakullar förekommer normalt inte hos gäss (Cramp & Simmons 1977), med undantag av några exempel gällande vitkindade gäss *Branta leucopsis* som hållits i parker (West et al. 1986). Orsaken till detta är tudelad. Dels förlorar honan förhållandevis mycket i vikt under ruvningsperioden, och det tar tid att återfå denna vikt efteråt, och då är det alltför sent på säsongen (Ogilvie 1978, Alisauskas & Ankney 1992). De hormonella förändringar som uppstår hos de vuxna fåglarna skulle också kunna medverka till att förhindra omläggning (West et al. 1986, Bluhm 1992). Dock har ett fall av andrakull hos kanadagås *Branta canadensis* rapporterats tidigare (Brakhage 1985). Föreslagna förklaringar i det fallet var lång häckningssäsong, icke-migrerande fåglar som därför inte förlorar energi i samband med flytt, samt god födotillgång. Den allmänt vedertagna uppfattningen torde dock likväl vara att kanadagäss egentligen inte kan få mer än en kull gässlingar per år.

På ön Nidingen, belägen ungefär 8 km utanför Hallands nordligaste kust (N 57° 18.166'; E 11° 54.123'), tycks dock 1 par kanadagäss framgångsrikt ha fött upp en tidig kull ungar på våren (2 respektive 8 ungar år 2011 respektive 2012). Samma par har sedan, ungefär 35–40 dagar efter det att den första kullen kläckts, lagt en andra omgång ägg i samma bo (Figur 1). På ön ligger Nidingens fågelstation (Göteborgs Ornitologiska Förening), vilken är bemannad från mars till november. Nidingen är naturreservat och besökare får under häckningstid endast beträda en mycket begränsad del av ön. Fågelstationens personal gör dagligen anteckningar och rapporteringar både genom artvisa rapporter på Artportalen och i form av mer allmänt hållna dagboksanteckningar i samma forum. Dessa noteringar och rapporter har utgjort det huvudsakliga underlaget till denna artikel.

Eftersom ön är lättövervakad och endast ett fåtal par häckar på ön (Figur 1) är data relativt säkra. Då inga tecken på adoption av andras ungar eller byte av partner kunnat ses kvarstår en stark hypotes om att det rör sig om äkta andrahäckningar.

De publicerade fallen av andrahäckning hos Branta-gäss har samtliga inträffat i tempererade områden (Brakhage 1985, West et al. 1986, den här studien). Tänkbara förklaringar till att en andrakull är möjlig är att tempererade områden till skillnad från arktiska uppvisar en längre häckningssäsong samt god tillgång till föda. För att i framtiden kunna säkerställa andrakullar hos gäss torde det vara lämpligt att studera dem i tempererade områden, med individuell märkning kombinerat med DNA-analyser.

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Staging and wintering Taiga Bean Geese *Anser fabalis fabalis* in north-east Scania, south Sweden

Rastande och övervintrande taigasädgäss Anser fabalis fabalis *i Nordostskåne*

HAKON KAMPE-PERSSON

Abstract

In the municipalities of Bromölla and Kristianstad, south Sweden, monthly counts of Bean Geese have been carried out during October–March/April since November 1976. The seasonal peak count was up to 1987/1988 recorded in March, during the following six seasons in January, and from 1994/1995 onwards in November or December. April numbers decreased from more than 5000 birds in 1977 to hardly any at all from 1997 onwards. Fewer Bean Geese were counted up to the 1986/1987 season than thereafter. In most of the last 25 seasons, the number of Taiga Bean Geese *Anser fabalis fabalis* in north-east Scania peaked at about 20% of the total Western Palearctic population, with a highest count of 24 000 birds in December 1997. Most or all Bean Geese left north-east Scania during severe winters. Checks of staging bean goose flocks and hunting bags showed that, except for Lake Hammarsjön from 2004/2005 onwards and a few flocks in the other areas, the Tundra Bean Goose *Anser serrirostris rossicus* was quite rare in the region.

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Introduction

The breeding range of the Taiga Bean Goose *Anser fabalis fabalis* stretches from Scandinavia to the lower Ob region, western Siberia (Alphéraky 1905, Nilsson et al. 1999). It breeds in the forest zone, in areas with a mixture of different types of mire, mire forest, ponds and small lakes. High breeding densities have been found in the aapa mire zone (Pirkola & Kalinainen 1984).

The majority of all Taiga Been Geese stages in Sweden in late autumn (Nilsson 2013a), and winters in south Sweden and Denmark (Nilsson et al. 1999), with small numbers in Scotland and Norfolk (Mitchell et al. 2010). Staging areas of birds migrating on a route south of the Baltic Sea are less well known (Kampe-Persson 2010a). That part of the population winters in north-east Germany and north-west Poland (Heinicke 2004, Heinicke et al. 2005), with small numbers in the Netherlands and Belgium (Nilsson et al. 1999, Koffijberg et al. 2011). There are also small numbers of Taiga Bean Geese wintering in central Asia (Heinicke 2009).

Taiga Bean Geese use different migration routes to their winter quarters (Söderberg 1917, Jägerskiöld & Kolthoff 1926). Large efforts to map these migration routes have been undertaken but little is known of where birds from different parts of the breeding range stage and winter. Birds fitted with GPS tags in Scotland revealed a spring migration route through North Jutland and Oslo to breeding grounds in the Swedish province of Dalarna (http://scotlandsbeangeese.wikispaces.com). The vast majority of birds neck-collared at a moulting site in the southern part of Swedish Lapland were re-sighted staging in both autumn and spring in north-west Jutland and wintering in Norfolk (Parslow-Otsu 1991, Parslow-Otsu & Kjeldsen 1992). Birds fitted with satellite transmitters during spring staging in northern Sweden were followed to breeding grounds in northernmost Sweden, Finnmark in Norway and Karelia in Russia, as well as to moulting grounds on Novaja Zemlja (Nilsson et al. 2010). Neck-collared individuals from these spring staging areas were in winter re-sighted at the Swedish west coast, in North Jutland and in Scania (Skyllberg et al. 2009a). Birds ringed at moulting sites in north Norway were recovered, most of them hunted, along the west coast of Finland and at haunts in south Sweden and Denmark (Tveit

1984). Finnish Taiga Bean Geese mainly winter in south Sweden (Nilsson 2011) and to a lesser extent in Denmark, Germany and the Netherlands (Saurola et al. 2013). Recoveries of birds ringed in the Netherlands revealed migration routes to partly northern Fennoscandia and partly the west Siberian lowland (Burgers et al. 1991). Re-sightings of birds neck-collared in Germany indicated that most Taiga Bean Geese wintering in Germany and Poland use a migration route south of the Baltic Sea (Heinicke 2010).

The Taiga Bean Goose is listed as Near Threatened in the Swedish Red List (Tjernberg et al. 2010) and qualifies to be red-listed also internationally. The population wintering in the Western Palearctic declined from 100 000 birds in the 1990s to 63 000 birds in the season 2008/2009 (Nilsson et al. 1999, Fox et al. 2010). The wintering population in central Asia has been estimated at 2000–5000 birds (Heinicke 2009). Whether the population decline is caused by factors acting during the breeding (Mellquist & von Bothmer 1982, Filchagov et al. 1985, Kampe-Persson et al. 2005) or the non-breeding season (Huyskens 1999) is not known. Also unknown is when the decline started and whether all parts of the breeding range have been affected. The Swedish breeding range, for instance, was markedly reduced already between 1922 and 1969 (Mellquist & von Bothmer 1982).

The lack of explanation to the recorded population declines is due to difficulties to study this taxon. Taiga Bean Geese breed in remote areas and are experts of concealment. They can be hard to find also during the non-breeding season (Parslow-Otsu & Kjeldsen 1992, Kampe-Persson 2010a, b). A factor that has caused large problems for more than a century is misidentification. During the non-breeding season, the Taiga Bean Goose regularly occurs together with other bean goose taxa, of which the Tundra Bean Goose *Anser serrirostris rossicus* is the most numerous. In this contribution, Taiga Bean Goose and Tundra Bean Goose were treated as species (Naumann 1842, Van Impe 1980a, b, Sangster & Oreel 1996, Sangster et al. 1999, 2003, Banks et al. 2007, Mitchell & Vinicombe 2012). As the taxonomy differs among countries, the Taiga Bean Goose and the Tundra Bean Goose are as a rule referred to as *fabalis* and *rossicus*, respectively. Also Middendorff's Bean Goose *Anser* (*fabalis*) *middendorffii* and the Thick-billed Bean Goose *Anser serrirostris serrirostris* have been reported from north-west Europe (van den Bergh 2003b, 2004).

Based on material from Mecklenburg and Brandenburg it was stated that the majority of all Bean Geese were made up of hybrids between *fabalis* and *rossicus* (Litzbarski 1974, Cramp 1977, Ogilvie 1978, Klafs & Stübs 1979, Owen 1980, Rutschke 1983, 1987, Liebherr & Rutschke 1993). This conclusion was the result of a typological way of looking at the birds; all individuals that differed from the "type individual" were regarded as belonging to a mixed population. In reality, there is large individual variation, especially in size, shape and colouration of the bill, in both *fabalis* and *rossicus* (see e.g. Liebherr & Rutschke 1993). Despite the fact that *fabalis* and *rossicus* often occur in mixed flocks, mixed pairs of these taxa are rare (Kampe-Persson & Lerner 2007, Leo van den Bergh in litt., Thomas Heinicke pers. comm.) and hybrids of supposedly wild origin are limited to one bird observed in north-east Scania (Kampe-Persson & Lerner 2007, and unpubl.). Due to misidentification there is a lack of data about the number of staging and wintering Taiga Bean Geese in Germany before the early 1990s. In Sweden, counters have usually not separated Taiga and Tundra Bean Geese but reported them all as "sädgäss" ("bean geese"). For that reason, Bean Goose in Swedish reports (Nilsson 2000) has been denoted as "a *fabalis* population mixed with small numbers of *rossicus* and a few occasional *middendorfi* and *serrirostris*." Up to about ten years ago the total number of staging Tundra Bean Geese in Sweden only occasionally exceeded 1000 individuals but the taxon has become more numerous since then (Persson 1990, 1997b, Kampe-Persson 2011, Heinicke & de Jong 2013).

Many changes in the non-breeding distribution of geese have been described in the last decades. One major pattern is referred to as "short-stopping". This term is used when southerly areas are deserted by birds as conditions closer to the breeding grounds become favourable. This phenomenon has been reported for several goose species (Mathiasson 1963, Kear 1965, Reeves et al. 1968, Dzubin et al. 1975, Owen 1980, Persson & Urdiales 1995, Kampe-Persson 2002). The changes in bean goose occurrence in north-east Scania described in this contribution will partly be interpreted as "short-stopping".

Long-term monitoring in a region of importance during the non-breeding season can give valuable information for the conservation of a species. The more if the counts have covered the entire non-breeding season and the actual region is situated at a crucial part of the species' non-breeding range. The aim of this contribution was to document the monthly counts of Bean Geese undertaken in north-east Scania from November 1976 to December 2013 and to put these counts, as well as counts carried out during the years 1947–1976, into a historical, ecological and international context.

Study area

The study area comprises the two municipalities Bromölla and Kristianstad, and a small area in the municipalities Hässleholm and Östra Göinge as well, north-east Scania, south Sweden (Figure 1). The main soil type is sand, the area is situated south of the January −1.0ºC isotherm and the annual precipitation ranges from 500 mm at the coast to 600 mm inland, of which 10–20% comes as snow (Germundsson & Schlyter 1999). One third of the total land area is used for agriculture. The main crops are (percentage of total cultivated area in 2012): cereals (36%), grasses (29%), potatoes (9%), sugar beet (7%), vegetables (6%), oilseed rape (4%) and maize (2%) (http://statistik.sjv.se). All fields are situated within normal flight distances of a night roost (Persson 1989). The shallow coast between Landön and Tosteberga, River Helgeå, and the Lakes Ivösjön, Oppmannasjön, Råbelövsjön, Gummastorpasjön, Araslövsjön, Hammarsjön, Pulken and Yngsjösjön have been used for roosting (Mathiasson 1963, Swegen 1963, Hakon Kampe-Persson pers. obs.). The coastal roost was, at least earlier, also used by Taiga Been Geese feeding at Vesan in the westernmost part of the province of Blekinge (Nilsson & Persson 1984). River Helgeå, the largest river in the study area, flows or flowed through Lakes Gummastorpasjön, Araslövsjön, Hammarsjön, Pulken, Yngsjösjön and Egeside.

Also other geese than the bean geese spend the non-breeding season in north-east Scania (Kampe-Persson et al. 2007, www.spoven.com). Most counts of Canada Geese *Branta canadensis* in the months October–March during the period 1976/1977–2013/– ranged between 1500 and 10 000 birds but numbers were higher from the 1999/2000 season onwards than before. The Greylag Goose *Anser anser* occurred in quite low numbers up to 1990/1991. Numbers increased during the 1990s and from 2001 counts often exceeded 10 000 in September and October, from 2005 also in November. The occurrence during the winter months fluctuated greatly depending on the severity of the winter, with a maximum count of 7000 birds in February 2008. Since 2003, about 6000 birds were often counted in March. In 1993, the number of Barnacle Geese *Branta leucopsis* in October and November started to increase. From 2000 onwards, numbers counted in October and November often exceeded 5000 birds, increasing to more than 26 000 in November 2013. Occasionally, up to 7000 Barnacle Geese were found in September and up to 12 000 in December. The White-fronted Goose *Anser albifrons* has been more numerous from 1995 onwards than previously but numbers have rarely exceeded 1000 birds.

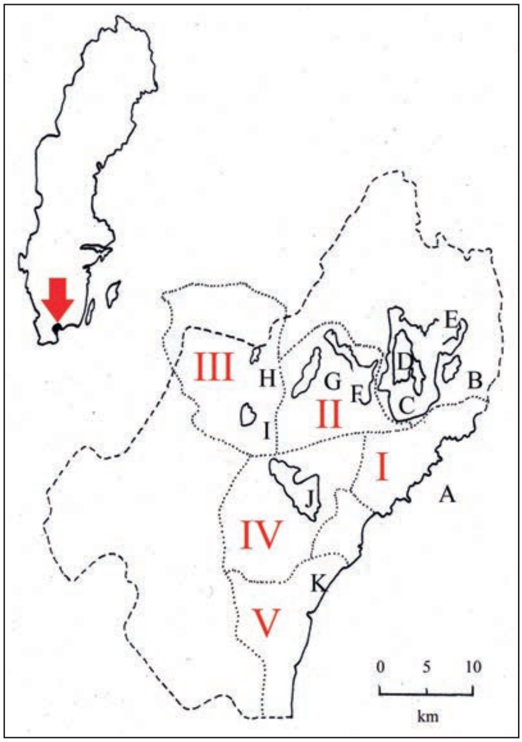

Figure 1. Map of the study area. Depicted are the land border of the municipalities Bromölla and Kristianstad (broken line), shorelines (unbroken line) and borders of the five main census areas (stippled line); I. Trolle-Ljungby, II. Oppmannasjön + Råbelövsjön, III. Araslövsjön + Gummastorpasjön, IV. Hammarsjön and V. Egeside. A = coastal roost between Landön and Tosteberga, B = Lake Levrasjön, C = Lake Ivösjön, D = Ivö, E = Näsum, F = Lake Oppmannasjön, G = Lake Råbelövsjön, H = Lake Gummastorpasjön, I = Lake Araslövsjön, J = Lake Hammarsjön and K = Egeside.

Karta över undersökningsområdet. Markerat är landgränsen för kommunerna Bromölla och Kristianstad (streckad linje), strandlinjer (heldragen linje) samt gränserna för de fem huvudsakliga inventeringssområdena (prickad linje); I. Trolle-Ljungby, II. Oppmannasjön + Råbelövsjön, III. Araslövsjön + Gummastorpasjön, IV. Hammarsjön och V. Egeside. A = nattplats längs kusten mellan Landön och Tosteberga, B = Levrasjön, C = Ivösjön, D = Ivö, E = Näsum, F = Oppmannasjön, G = Råbelövsjön, H = Gummastorpasjön, I = Araslövsjön, J = Hammarsjön och K = Egeside.

Material and methods

Goose counts 1976/1977–2013/-

The part of the study area used by geese during the non-breeding season was divided into five census areas (Neideman & Svensson 1976, Figure 1): Trolle-Ljungby, Oppmannasjön + Råbelövsjön, Araslövsjön + Gummastorpasjön, Hammarsjön and Egeside. Later, two sites at Lake Ivösjön were added: Näsum from October 2003 and Ivö from December 2006. At Lake Levrasjön geese were counted within the framework of mid-monthly waterfowl counts but no Taiga Bean Geese were encountered (Persson & Persson 1992, and unpubl.). The division into census areas was based upon well-defined borders, usually larger roads. By that, doubts were avoided regarding who should count the geese in each flock.

With some exceptions given below, counts were undertaken by members of the local bird-watching society, Nordöstra Skånes Fågelklubb, every month during the period October–April. In addition, September counts were carried out in 1977 and from 1993 onwards. Only three complete counts were carried out in 1976/1977 and 1978/1979, but another three counts were undertaken in some of the census areas during the last-mentioned season. Due to blizzards with snowed-up roads, only some of the census areas could be checked in February 1978 and no area at all in December 2012. Due to advancement of the pre-nuptial migration, and therefore no geese present, there have been no counts in April since 2004.

The counts were undertaken Saturday morning during the week-end closest to the 15th. The majority of all geese were counted more or less simultaneously while seeking food in the fields. All individuals of all goose species were counted. Taiga Bean Geese and Tundra Bean Geese were not differentiated but reported as Bean Geese.

The counted numbers should be regarded as minimum numbers, especially during the first seasons, before the observers learned the counting technique. Problems during the counts were caused by rain, wind (January 2007 and March 2007), mist (February 2005, November 2007 and December 2007) and hunting (October 2003, November 2006 and November 2009). Due to these problems, some geese were not found by the observers, while others were reported as unidentified. Up to 90 unidentified geese were noted on 19 occasions, 17 of these before the 1990/1991 season, while more than 100 unidentified were noted on five occasions; 336 in October 1977, 536 in October 1984, 516 in December 1986, 303 in January 1999 and 1100 in February 2004 (Kampe-Persson 2007).

Proportions of Taiga Bean Goose and Tundra Bean Goose

To obtain estimates of the proportion of Taiga Bean Geese among the staging and wintering bean geese, three sets of data were used: field checks in 1976–2013 by the author, Georges Huyskens, Leo van den Bergh, Thomas Heinicke, Frank Abrahamson, Greger Flyckt and Sven Birkedal, checks of hunting bags at Trolle-Ljungby Manor, and observations of staging flocks of Tundra Bean Geese numbering at least 50 birds. Huyskens, van den Bergh, Heinicke and Abrahamson checked the bean geese in the five main census areas, Flyckt at Egeside, Birkedal at Trolle-Ljungby, and the author mainly at Trolle-Ljungby and Oppmannasjön. No checks were undertaken at Hammarsjön and Egeside during the seasons 2004/2005–2008/2009 and no checks at all at Ivösjön.

Results

Goose counts 1976/1977–2013/-

Both temporal and numerical changes took place in north-east Scania during the period 1976/1977–2013/– (Table 1). Numbers of Bean Geese in April decreased from more than 5000 birds at the first count to hardly any at all from 1997 onwards. A similar change, though on a smaller scale, might have taken place in the autumn, because 389 birds were counted in September 1977 (Svensson 1977), the only September count undertaken before 1993. The seasonal peak count was up to the 1987/1988 season recorded in March, during the following six seasons in January and from the 1994/1995 season onwards in November or December. In general, fewer Bean Geese were counted up to the 1986/1987 season than thereafter. Count figures exceeding 22 000 birds were recorded five times during the period 1991/1992–2004/2005 and the highest count was of 24 064 birds in December 1997. Most or all Bean Geese left north-east Scania during severe winters.

Except for Egeside and Ivösjön the different census areas showed about the same temporal and numerical changes as the entire area (Appedix 1–6). In general, Trolle-Ljungby was the area housing most staging and wintering Bean Geese, the seasonal peak count often exceeding 10 000 birds, reaching 15 802 in November 2003 (Appendix 1). Oppmannasjön + Råbelövsjön showed the largest among-year variation in both occurrence pattern and numbers (Appendix 2). In most seasons during

Table 1. Number of Bean Geese recorded at mid-monthly counts in the municipalities of Bromölla and Kristianstad, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i Bromölla och Kristianstad kommuner säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	3 567	–	609	–	5 807	–
77/78	1 855	5 500	4 981	7 919	–	11 140	5 641
78/79	1 906	–	–	728	–	6 617	–
79/80	825	5 061	3 628	2 036	1	5 244	–
80/81	956	5 300	2 075	3 822	5 047	5 374	3 487
81/82	2 036	4 781	1 925	0	69	17 345	6 448
82/83	1 016	4 943	8 200	6 747	1 648	13 462	3 517
83/84	770	5 434	2 032	9 407	4 901	10 958	4 831
84/85	1 909	3 881	11 849	1 461	887	8 280	5 369
85/86	295	5 118	3 361	269	633	6 761	4 238
86/87	674	3 358	7 975	0	186	1 442	1 761
87/88	247	3 013	12 763	8 288	14 344	17 767	1 314
88/89	31	7 110	12 021	19 960	9 694	1 379	839
89/90	372	1 977	7 804	16 359	13 107	628	480
90/91	342	10 581	17 703	16 913	4 968	1 611	275
91/92	5	10 397	13 644	23 874	16 564	836	507
92/93	762	15 310	12 319	16 099	15 385	4 694	192
93/94	786	10 181	9 456	14 213	8 802	7 115	377
94/95	810	17 518	18 366	17 222	12 727	695	101
95/96	248	9 415	12 636	523	7 630	13 541	224
96/97	201	14 510	18 693	3 106	8 460	515	59
97/98	930	19 933	24 064	16 390	8 627	1 766	7
98/99	8	16 086	13 635	10 171	6 034	2 081	0
99/00	2 300	13 201	16 810	13 918	6 320	389	1
00/01	40	4 186	11 178	15 637	13 657	578	0
01/02	35	18 223	14 512	3 762	11 234	53	0
02/03	711	20 793	22 274	8 387	7 598	333	64
03/04	3	23 752	15 099	10 326	6 813	4 572	–
04/05	243	23 381	14 818	10 256	9 685	8 582	–
05/06	217	3 753	17 633	7 765	8 540	4 127	–
06/07	866	18 329	13 835	8 802	9 867	90	–
07/08	511	16 156	15 862	14 846	8 831	138	–
08/09	0	6 066	12 034	11 715	11 483	286	–
09/10	441	6 829	15 173	7 291	4 162	9 380	–
10/11	2 446	12 636	5 631	533	2 247	8 753	–
11/12	1 372	13 143	12 999	9 980	5 176	153	–
12/13	20	4 593	–	7 387	7 278	17 159	–
13/14	122	3 756	19 402	–	–	–	–

the entire survey period, the seasonal peak count was in the range 2000–2500 birds at Araslövsjön + Gummastorpasjön (Appendix 3) and around 5000 birds at Hammarsjön (Appendix 4). Egeside, on the other hand, was a typical wintering and spring staging area with few Bean Geese in autumn, often no birds at all in October (Appendix 5). A similar timing of the occurrence was reported for the Egeside area in the period 1970–1976 (Månsson 1977). The seasonal peak count usually fell in the range 2500–4000 birds during the period 1987/1988–2005/2006, lower before and after that period. The Bean Geese at Ivösjön were counted too few seasons to discern any patterns (Appendix 6).

Proportions of Taiga Bean Goose and Tundra Bean Goose

Field checks of 1000 or more bean geese were realised in a total of 45 months during the period 1976/1977–2013/– (Table 2). The proportion of Taiga Bean Geese during these checks was 100%

Table 2. Percentage of the staging and wintering bean geese in the municipalities of Bromölla and Kristianstad that was made up of Taiga Bean Geese *Anser fabalis fabalis*, 1976/1977–2013/–. No checks were undertaken in the census areas Hammarsjön and Egeside during the seasons 2004/2005–2008/2009. The census area Hammarsjön was excluded from the 2009/2010 season onwards. Data are given for months when at least 1000 bean geese were checked (sample sizes in brackets). For the remaining months, a bar indicates that no complete mid-monthly count was carried out or that fewer than 1000 bean geese were found. Sources other than the author: October 1983 and November 1984 (Huyskens 1986); December 1986, October 1993, October 1994 and October 2003 (Leo van den Bergh in litt.); February 2012, March 2013 and November 2013 (reports on http://svalan.artdata.slu.se/birds); December 2013 (Evert Valfridsson in litt., reports on http://svalan.artdata.slu.se/birds).
P*rocentandelen av de rastande och övervintrande sädgässen i Bromölla och Kristianstad kommuner som utgjordes av taigasädgäss* Anser fabalis fabalis *säsongerna 1976/1977–2013/–. Inga kontroller företogs inom räkningsområdena Hammarsjön och Egeside under säsongerna 2004/2005–2008/2009. Räkningsområdet Hammarsjön exkluderades från och med säsongen 2009/2010. Resultat ges för de månader då mer än 1000 sädgäss kontrollerades (antalet kontrollerade sädgäss anges inom parentes). För övriga månader anger ett minustecken att ingen komplett mittmånadsinventering genomfördes eller att färre än 1 000 sädgäss hittades. Källor andra än författaren: oktober 1983 och november 1984 (Huyskens 1986); december 1986, oktober 1993, oktober 1994 och oktober 2003 (Leo van den Bergh i brev); februari 2012, mars 2013 och november 2013 (rapporter på http://svalan.artdata.slu.se/birds); december 2013 (Evert Valfridsson i brev, rapporter på http://svalan.artdata.slu.se/birds).*

	October	November	December	January	February	March
76/77	99.5 (1 256)	99.7 (2 010)	–	–	–	
77/78	100 (1 500)	100 (6 500)			–	100 (1 909)
78/79		–	100 (2 618)	–	–	
79/80	–				–	
80/81	–	100 (2 230)	100 (1 090)			
81/82				–	–	
82/83			100 (2 500)	100 (1 750)	100 (1 364)	
83/84	100 (2 176)	100 (4 310)	100 (2 501)	100 (2 550)		100 (3 875)
84/85		100 (3 000)	100 (1 730)	100 (2 750)	100 (1 050)	
85/86	–			–	–	
86/87	100 (1 011)	100 (2 200)	100 (4 417)	–	–	
87/88	–					
88/89	–					
89/90	–					–
90/91	–					
91/92	–					–
92/93	100 (1 050)					
93/94	99.9 (8 007)					
94/95	96.8 (3 077)					–
95/96	–			–		
96/97	99.4 (3 520)	99.9 (12 715)				–
97/98	–					
98/99	–	99.8 (10 519)				
99/00	99.8 (6 410)		99.8 (6 813)			–
00/01	–					–
01/02	–					–
02/03	–					–
03/04	98.1 (2 818)					
04/05	–		100 (3 498)			
05/06	–					
06/07	–		99.9 (7 800)			–
07/08	–		99.9 (7 500)			–
08/09	–					–
09/10	–			99.9 (4 884)		
10/11		98.8 (6 201)				
11/12		98.8 (6 578)		100 (7 970)	99.4 (2 424)	
12/13	–	99.6 (2 489)	–	100 (1 626)		100 (4 196)
13/14	–	99.9 (4 146)	99.1 (6 213)			

Table 3. Staging flocks of Tundra Bean Goose *Anser serrirostris rossicus* numbering at least 50 individuals in the municipalities of Bromölla and Kristianstad, up to 2013.
Rastande flockar av tundrasädgås Anser serrirostris rossicus *i Bromölla och Kristianstad kommuner fram till och med 2013 som uppgått till minst 50 individ.*

	No. *Antal*	Site *Lokal*	Source/observer *Källa/observatör*
14 April 1974	60	Tosteberga	Hakon Kampe-Persson
14 February 1975	>50	Trolle-Ljungby	Hakon Kampe-Persson
18 October 1975	250	Trolle-Ljungby	Persson 1990
2 November 1975	100–300	Trolle-Ljungby	Hakon Kampe-Persson
27 October 1994	85	Trolle-Ljungby	Leo van den Bergh in litt.
11 January 2003	95	Hovby	Flyckt et al. 2004
9 March 2003	580	Vanneberga	Flyckt et al. 2004
29 February 2004	70	Yngsjö	Bernsmo et al. 2005
13 March 2004	120	Trolle-Ljungby	Bernsmo et al. 2005
2–11 February 2006	65	Trolle-Ljungby	Bernsmo et al. 2007
5 November 2006	200	Tosteberga	Bernsmo et al. 2007
3–4 February 2007	50	Yngsjö	Bernsmo et al. 2008
6 December 2009	90	Vanneberga	Karlsson et al. 2010
4 January 2010	55	Tosteberga	Bernsmo et al. 2011
12 November 2010	72	Östra Ljungby	Hakon Kampe-Persson
Mid November 2010	5 042	Hammarsjön	Thomas Heinicke
12 February 2011	85	Hovby	Bernsmo et al. 2012
12 February 2011	50	Hovby	Bernsmo et al. 2012
12 November 2011	54	Hovby	Frank Abrahamson
14 January 2012	350	Hovby	Frank Abrahamson
14 January 2012	1 100	Norra Åsum	Frank Abrahamson
Mid January 2012	4 988	Hammarsjön	Thomas Heinicke
4 February 2012	235	Gärds Köpinge	Frank Abrahamson
2 March 2013	210	Hovby	Frank Abrahamson
2 March 2013	256	Svaneholm	Frank Abrahamson
2 March 2013	450	Mosslunda	Frank Abrahamson
9 March 2013	71	Hovby	Frank Abrahamson
9 March 2013	111	Gärds Köpinge	Frank Abrahamson
16 March 2013	309	Gärds Köpinge	Frank Abrahamson
23 March 2013	420	Horna	Frank Abrahamson
23 March 2013	200	Hovby	Frank Abrahamson
23 March 2013	1900	Hovby	Frank Abrahamson
17 November 2013	300	Hovby ängar	Frank Abrahamson
23 November 2013	90	Gärds Köpinge	Greger Flyckt
30 November 2013	620	Hovby	Frank Abrahamson
8 December 2013	100	Yngsjö	Greger Flyckt
8 December 2013	460	Egeside	Greger Flyckt
15 December 2013	4 489	Vittskövle	Frank Abrahamson
22 December 2013	1 100	Vittskövle	Greger Flyckt

27 times, 99.1–99.9% 14 times and 96.8–98.8% four times. Of bean geese hunted and taxonomically checked at Trolle-Ljungby Manor during the years 1976–2012, 99.9% (N=2043) were Taiga Bean Geese. Flocks numbering 50 or more Tundra Bean Geese were reported 39 times in the study area up to 2013 (Table 3). All but five of these observations were made during the years 2003–2013. Flocks numbering more than 1000 Tundra Bean Geese were only recorded in the census area Hammarsjön during the last four seasons of the survey period. In the fields around Lake Hammarsjön, up to 5000 Tundra Bean Geese but very few Taiga Bean Geese were found in the seasons 2010/2011–2013/– (Table 3, reports on http://svalan.artdata.slu.se/birds). In meadows along the shores of this lake however, especially in Rinkaby ängar and Hovby ängar, flocks of up to 415 Taiga Bean Geese were recorded between mid-January and mid-March in the seasons 2010/2011–2012/2013 (reports on http://svalan.artdata.slu.se/birds).

Discussion

Both Taiga and Tundra Bean Geese occur in north-east Scania but undoubtedly, the vast majority of the birds counted were Taiga Bean Geese. However, to be able to interpret the overall picture, I start by discussing the much rarer Tundra Bean Goose.

Tundra Bean Goose

During the last decade, increasing numbers of Tundra Bean Geese have started to winter in Denmark (Pihl & Vikstrøm 2006, Stefan Pihl unpubl.) and at Lake Hammarsjön (Heinicke & de Jong 2013). As no field checks were carried out at Lake Hammarsjön in the seasons 2004/2005–2008/2009, it is not known when the Tundra Bean Goose started to use that area for staging and wintering. The fact that 4988 birds were counted in January 2012 compared to none a year earlier should not be regarded as the start of wintering however, as it merely reflects the severity of the winter. Few Tundra Bean Geese remain in north-east Scania in severe winters (Heinicke & de Jong 2013). The Tundra Bean Geese found at Lake Hammarsjön very likely originated from the westernmost part of the breeding range (van den Bergh 1999, Aarvak & Øien 2009). Birds neck-collared in northernmost Norway from 2003

Table 4. Number of Bean Geese recorded during counts in the municipalities of Bromölla and Kristianstad before the 1976/1977 season. Besides five complete counts, results are given for one count covering two areas and 23 single area counts. Count data provided by the author and Huyskens (1986) refer to Taiga Bean Geese.
Antalet sädgäss inräknade vid inventeringar i Bromölla och Kristianstad kommuner före säsongen 1976/1977. Utöver fem kompletta inventeringar ges resultat från en inventaring omfattade två områden och 23 inventeringar omfattande vardera ett område. Inventeringssiffror givna av författaren och Huyskens (1986) avser taigasädgäss.

	No. *Antal*	Area(s) *Område(n)*	Source/observer *Källa/observatör*
18 May 1950	300	Araslövsjön	Mathiasson 1963
22 January 1951	210	Hammarsjön	Mathiasson 1963
25 May 1952	300	Araslövsjön	Mathiasson 1963
4 December 1955	1 000	Araslövsjön	Mathiasson 1963
5 May 1956	20–25	Hammarsjön	Mathiasson 1963
9–15 November 1956	2 000	Araslövsjön + Hammarsjön	Mathiasson 1963
2 May 1958	100	Hammarsjön	Mathiasson 1963
17 November 1958	3 000	Araslövsjön	Mathiasson 1963
1 December 1958	1 000	Hammarsjön	Mathiasson 1963
1 March 1959	10 000	North-east Scania	Mathiasson 1963
7–8 March 1959	3 855	North-east Scania	Mathiasson 1963
5 April 1959	945	North-east Scania	Mathiasson 1963
10 October 1959	3 000	Hammarsjön	Mathiasson 1963
30 October 1960	>1920	Araslövsjön	Jensen et al. 1962
30 October 1960	630	Hammarsjön	Jensen et al. 1962
5 March 1961	3 000	Egeside	Swegen 1963
27 October 1973	2 000	Trolle-Ljungby	Hakon Kampe-Persson
17 November 1973	2 000	Trolle-Ljungby	Hakon Kampe-Persson
16 February 1974	1 000	Trolle-Ljungby	Hakon Kampe-Persson
17–19 October 1974	800	North-east Scania	Huyskens 1986
2–3 November 1974	450	Trolle-Ljungby	Hakon Kampe-Persson
29–31 December 1974	1 500	Trolle-Ljungby	Hakon Kampe-Persson
14 February 1975	1 150	Trolle-Ljungby	Hakon Kampe-Persson
12 April 1975	575	Trolle-Ljungby	Hakon Kampe-Persson
26 April 1975	200	Trolle-Ljungby	Hakon Kampe-Persson
9 November 1975	2 488	Trolle-Ljungby	Hakon Kampe-Persson
11–14 November 1975	4 500	North-east Scania	Huyskens 1986
2 January 1976	>2935	Trolle-Ljungby	Hakon Kampe-Persson
8–25 January 1976	1 505	Trolle-Ljungby	Hakon Kampe-Persson
8 February 1976	1 664	Trolle-Ljungby	Hakon Kampe-Persson

onwards have in late autumn and winter mainly been reported from north-east Scania (de Jong et al. 2013). A migration route from northern Fennoscandia through staging areas in north-east Scania to winter quarters in east Germany was indicated in an earlier neck-collaring project (Persson 1997a). Wintering was reported from the Trolle-Ljungby area in the winter 1974/1975 (Persson 1995). The 95 birds observed at Hovby in January 2003 (Table 4) were maybe also wintering.

The establishment of the Tundra Bean Goose as a staging and wintering bird at Lake Hammarsjön shows that areas situated close to each other can develop very differently. Lake Hammarsjön was, in fact, one of a few goose areas in Scania that were not regularly checked for the occurrence of Tundra Bean Geese during the years of establishment (Kampe-Persson 2011, this study). This calls upon awareness of patchy distributions when mapping goose areas (Kampe-Persson 2013b).

Short-stopping

To follow the short-stopping process at a locality is like viewing the entire flyway during a season. From the north to the south you find in the ideal case a sequence of areas used in different ways: not at all, for staging only, for both staging and wintering, only for wintering, for wintering but in declining numbers and only in the past. Data from Lake Hammarsjön shows an almost complete cycle, as that area was not used by Taiga Bean Geese before 1947 (Nordquist 1947a) and only by low numbers during late winter/early spring nowadays (this study).

A northward shift in the distribution during the non-breeding season has been recorded in the Taiga Bean Goose since the mid 20th century (Mathiasson 1963, Nilsson 2013a). The proportion of the total number of Bean Geese counted in October that was found north of Scania increased from 14% in 1960 (Mathiasson 1963) to 100% in 2012 (Nilsson 2013b). During the same period of time, the area holding the largest number of birds in October shifted northwards, first from south-west Scania to Lake Tåkern (50 000 birds in 1988) and then to the province of Närke (35 000 birds in 2001) (Nilsson 2013a). About 1500–3000 birds wintered in south-west Scania and none in the rest of the country during the years 1947–1960 (Mathiasson 1963). Later, the wintering area was extended to include also north-east Scania but the species is only sometimes found north of Scania in January (Nilsson 2013a). Few spring counts are available. The centre of distribution in March was south-west Scania during counts in 1977–1980 (Nilsson & Persson 1984) but the province of Uppland in 2007 (Skyllberg & Tjernberg 2008). At Umeå, the peak count was about 3–4 weeks earlier in the springs 2003–2008 (Skyllberg et al. 2009b) compared to in 1977–1980 (Nilsson & Persson 1984).

The occurrence of Taiga Bean Geese in north-east Scania since the mid 1940s gives an excellent example of short-stopping as it covers also the phase before the birds started to winter. In the 1950s, this region was only used for staging in autumn and spring of birds that wintered in south-west Scania, Denmark, Germany and Netherlands (Nilsson 1984). Large acreages of autumn-sown crops and milder winters gradually made it possible for the geese to winter in north-east Scania. However, the severity of the winter, primarily the thickness of the snow-cover on the feeding grounds, determined how many geese that actually could remain the entire winter. Often, heavy snowfall forced the geese to move southwards/south-westwards for shorter or longer periods of time. At the same time as conditions for wintering improved in north-east Scania conditions for staging, especially in spring, improved further north. To be able to match the phenology of their main food plants along their migratory pathways (Drent 1996, Drent et al. 2006, Nilsson 2006, Tombre et al. 2008) the geese started to initiate their pre-nuptial migration from this region earlier and earlier. The last phase in the on-going process would be for the geese to choose winter quarters closer to their breeding grounds. Lower numbers of Taiga Bean Geese in north-east Scania during the last decade compared to the decade before might be a step to complete disappearance from the region. However, lower numbers might also be related to an overall population decline.

Also the Tundra Bean Goose has gone through a period of short-stopping since the 1940s, during which the Spanish wintering population vanished (Persson & Urdiales 1995). Instead, they started to spend the winter in Germany and the Netherlands (van den Bergh 1999). A new shift started a decade ago (Pihl & Vikstrøm 2006, this study). Up to 9200 Tundra Bean Geese were found staging in South Sweden, especially at the Lakes Kvismaren, Östen and Tåkern, in October in the years 2009–2011 (Heinicke & de Jong 2013). In November, during mild winters also in January, up to 5000 Tundra Bean Geese were recorded at Lake Hammarsjön during the same period of time (Heinicke & de Jong 2013). Regular staging of Tundra Bean

Geese in autumn is a new phenomenon in South Sweden. During field checks of feeding bean geese at all main staging areas for Bean Geese in South Sweden in October 2003, a total of 38 648 Taiga Bean Geese but only 106 Tundra Bean Geese were recorded (Leo van den Bergh in litt.). Of these Tundra Bean Geese, ten were found at the four aforementioned lakes.

Range changes in autumn and winter can be brought about in a short period of time (Owen 1980). The Tundra Bean Goose is not the only recent example of such a change in South Sweden. The total number of Barnacle Geese counted during mid-monthly counts in Sweden had up to 1999 never exceeded 5000 birds (Nilsson 2000). In November 2000, more than 55 000 Barnacles were counted (Nilsson 2001). Since then, the counted numbers have remained on a high level, with peak counts of 201 000 birds in south Sweden in November 2012 (Nilsson 2013a), of 132 000 in south-west Scania in October 2012 (Kampe-Persson 2013a) and of 26 000 in north-east Scania in November 2013 (www.spoven.com).

Milder winters in south Sweden may lead to further re-distributions of the goose populations. The Tundra Bean Goose might replace the Taiga Bean Goose as the most numerous wintering goose species in north-east Scania. Also the Pink-footed Goose may become more numerous, partly as a response to the implementation of the management plan for the Svalbard population (Madsen & Williams 2012). In either case, there are good reasons to continue the monitoring of staging and wintering geese.

Taiga Bean Goose

Except for the census area Hammarsjön during the last decade and a few staging flocks in the other areas, the Tundra Bean Goose has been quite rare in north-east Scania (Persson 1990, 1995, this study). Therefore, with the exception of the census area Hammarsjön during the last decade, there are good reasons to accept the count data for Bean Goose as good representatives of the true numbers of Taiga Bean Geese.

North-east Scania is beyond dispute an area of international importance for staging and wintering Taiga Bean Geese. In most of the last 25 seasons, the number of Taiga Bean Geese in north-east Scania peaked at about 20% of the total Western Palearctic population. Except for Hammarsjön from 2004/2005 onwards, each of the five main census areas regularly housed more than one percent of the world population, Trolle-Ljungby often 10–19 percent, during the same period of time.

While changes in the overall distribution during the non-breeding season were brought about by short-stopping, the local and regional occurrence patterns depended on a set of factors. The main requirements of a goose during the non-breeding season are a safe night roost and suitable feeding grounds situated not too far from the roost (Owen 1980). North-east Scania is well provided with suitable roosts, with many lakes and a shallow coast, partly rich in low uninhabited islands. Food choice of the Taiga Bean Goose has been studied in Scania since the mid-1940s (Nordquist 1947b, Markgren 1963, Mellquist & Nilsson 1968, Persson 1982, 1989, Nilsson & Persson 1984, 1991, 2000, Nilsson & Kampe-Persson 2013). In the light of these studies, it is possible to follow how north-east Scania developed into a region of international importance for the Taiga Bean Goose.

Natural grasslands and fields of clover were the main feeding habitats for Taiga Bean Geese in both autumn and winter before the 1960s (Markgren 1963). In spring, natural grasslands were and still are the preferred feeding habitat (Markgren 1963, Persson 1982, 1989). Large extensions of grasslands along River Helgeå offer a plausible explanation to the importance of the area for staging geese in the 1950s and also to why the numbers were larger in spring than in autumn (Mathiasson 1963, Table 4). In the Trolle-Ljungby area, on the other hand, the acreage of natural grasslands was quite low and very few Taiga Bean Geese staged there up to the early 1960s (Mathiasson 1963). No bean geese at all were recorded in this area in the years 1841–1866 (Wallengren 1849, 1853, 1866, Gadamer 1852, 1853).

Taiga Bean Geese used agricultural fields in Scania for feeding already two centuries ago (Nilsson 1835). However, it was the mechanisation of the agriculture during the post-war period (Myrdal & Morell 2011) that made farmland feeding possible on a larger scale. Mechanical harvesting of potatoes and sugar beet leaves large amounts of spill for the geese to exploit (Persson 1982, 1989, Nilsson & Persson 1984, 1991, 2000, Nilsson & Kampe-Persson 2013). Such spill made it possible for the Taiga Bean Goose to start using the Trolle-Ljungby area for staging in the 1960s or early 1970s (Table 4). With a rich food supply and a safe night roost nearby, the Trolle-Ljungby area developed into a staging and wintering area for large numbers of Taiga Bean Geese.

Hunting has been singled out as the factor during the non-breeding season having the largest negative impact on Taiga Bean Geese from both the western and eastern part of the breeding range (Huyskens 1999). Relevant data about hunting bags and other effects of hunting are scanty however. Besides killing birds hunting can have a negative impact by injuring birds, dissolving pair bonds and other social units, causing birds to desert a haunt completely (Ogilvie 1968), increasing the amount of time spent in flight or in alert positions and making birds keep larger distances to humans, cars and sites where hunters might hide (Karlsson et al. 1978). The latter factor significantly reduces the area available for feeding, sometimes forcing geese to leave an area altogether. Disturbance caused by hunting as well as interruption of pair bonds can significantly reduce the number of fledged young produced during the following breeding season (Persson 1999, Nilsson & Persson 2001). In north-east Scania, the hunting pressure seems to have been quite low but information is only available from Trolle-Ljungby Manor, an entailed estate in the Trolle-Ljungby area, comprising about 12 000 ha.

During the years when the open season was restricted to the first three weeks of November (1960–1991), bean geese were usually hunted during only two days in this large estate. Later, when the length of the open season had been extended to three months (October–December), hunting was reduced to one day a year (New Year's Eve). As only geese landing at pre-dug holes in agricultural fields were shot at, scared birds could search refuge at the night roost. There, they could wait undisturbed until the hunting stopped at 11 a.m. That a majority of the Taiga Bean Geese can leave an area altogether during the first hunting day was observed in other parts of Scania (Nilsson & Persson 1978). Hunters that did not follow the local ethical rules, designed to keep the number of injured birds at a minimum, were not invited to future goose hunting parties at Trolle-Ljungby Manor (Lars Liljenberg pers. comm.). Among Taiga Bean Geese shot with a rifle in south-west Scania, mainly after the closure of the open seasons of 1978 and 1979, 28% of the first calendar-year birds and 62% of the older birds carried 1–12 lead pellets in their tissues (Jönsson et al. 1985). So, in spite of the fact that often quite large numbers of geese were bagged during a hunting day in the Trolle-Ljungby area, the geese remained in the area.

Inter-specific competition may occur among feeding geese. Several spring staging sites in Norway that earlier were used by Pink-footed Geese are nowadays used by Barnacle Geese (Ingunn Tombre pers. comm.). The Pink-footed Geese are excluded from these sites as the Barnacle Geese graze the vegetation too short for the Pink-footed Geese to feed on. Shortly after that a mixed flock has landed in a field, all Pink-footed Geese are found at the edge of the flock. Also in Scania, where often up to six or seven species feed in the same field in autumn and winter, it is normal to find the different species separated from each other. When the species occur in low numbers, such a separation can be due to "sub-flocking", that closely related individuals stay together (Raveling 1969, Rutschke 1982, Nilsson & Persson 1992). Another explanation has to be sought when the species occur in large numbers. One suggestion is that each species avoid species with higher pecking and pacing rates (Madsen 1985). This avoidance may also be related to how dense the feeding flocks are, because fast-feeding species keep a shorter inter-individual distance than slow-feeding species (pers. obs.). The Taiga Bean Geese are, in either case, at a disadvantage as they have lower pecking and pacing rates and keep a longer inter-individual distance than Barnacle Geese, White-fronted Geese, Pink-footed Geese and Tundra Bean Geese (pers. obs).

However, for inter-specific competition to be present, food should be limiting. Food supplies are nowadays usually superabundant during the non-breeding season but there might be two annual bottlenecks. First, when the harvested fields are depleted or ploughed. Later, when all fields with winter cereals have been grazed. Due to population increases among staging and wintering geese in north-east Scania during the last decades, November 2013 and December 2013 were the two months with the largest counted totals so far (www.spoven.com), inter-specific competition may be an important factor in the observed distribution patterns.

Food depletion is the most plausible reason for the progressively earlier seasonal peak counts in north-east Scania, due to the increasing overall food intake from increasing goose numbers. Each switch of the seasonal peak count to an earlier month coincided with a marked increase in the total number of Bean Geese counted in the first months of the season. Also numbers of other goose species staging and wintering in north-east Scania have increased markedly since the mid-1990s (Kampe-Persson et al. 2007, www.spoven.com), all species feeding on the same food sources (Nilsson & Kampe-Persson 2013). Apparently, when the energy-rich food (harvest spill) was depleted, some of the geese moved on southwards/south-westwards, while the others switched to less profitable food sources (fields with winter cereal). As long as Taiga Bean Geese have access to fields with winter cereal and experience little disturbance, the geese are not in want. Frequent exposure to disturbance might, however, force the birds to leave the haunt as they no longer can balance their energy budget (Persson 1989).

Another factor reducing the availability of the felds for feeding geese are actions taken by farmers to keep them away from growing crops. It was after the agricultural revolution in the 18th and 19th centuries, that farmers started to scare the geese away from their fields to alleviate crop damage. In north-central Spain, the villages employed boys, so called *ganseros*, to keep the geese from the autumn-sown crops (Madoz 1849). In 2004, north-east Scania got its own *gansero*. Under the auspices of a regional management plan (Edberg 2004), this person has since the 2004/2005 season helped the farmers to scare the Greylag Geese away from sensitive crops. However, as all goose species use the very same food sources during the non-breeding season, often in mixed flocks (Nilsson & Kampe-Persson 2013), all species are affected even if only one of them is actively scared. So, the disappearance of the Taiga Bean Goose from cultivated fields at Lake Hammarsjön and a decline in the numbers of staging and especially wintering Taiga Bean Geese in north-east Scania since 2004 might be more than a coincidence.

In the 1990s, the number of wintering Greylag Geese increased in the Netherlands at the same time as the number declined in south-west Spain. Birds followed all-year-round showed that these numerical changes were due to birds wintering in the Netherlands had higher survival and higher breeding output, at the same time as they recruited into the breeding population at an earlier age (Nilsson & Persson 1996). Corresponding data are lacking for Taiga Bean Geese wintering in north-east Scania. In fact, even the origin of the birds is poorly known. A number of individuals neck-collared at breeding grounds in Finland have been re-sighted here (Nilsson 2011) and in January, low numbers of large-sized birds with large, mainly black bills, strongly indicating an eastern origin (van den Bergh 2003a) often were observed (Hakon Kampe-Persson unpubl.). Whether or not the majority of the unmarked birds originated from the same areas as the marked ones is unknown. Uncertainty regarding origin of the birds makes it impossible to determine if the Taiga Bean Geese that wintered at Lake Hammarsjön switched to another wintering area or if that part of the population has markedly declined in number.

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Sammanfattning

Här redovisas de månatliga inventeringar av sädgäss som medlemmar av Nordöstra Skånes Fågelklubb genomfört under ickehäckningstid i Nordostskåne (kommunerna Bromölla och Kristianstad, samt ett mindre område i kommunerna Östra Göinge och Hässleholm) sedan november 1976. Målet var att sätta in dessa resultat i ett historiskt, ekologiskt och internationellt sammanhang. Av den anledningen redovisas även samtliga kända inventeringar från åren 1947–1976, dels av området som helhet och dels av enskilda gåsområden (Tabell 4).

Inventeringarna genomfördes månaderna oktober-mars/april på lördag förmiddag under den helg som inföll närmast den 15:e. Före den första inventeringen delades regionen in i fem räkningsområden, vilka förblivit oförändrade. Ett sjätte räkningsområde med två lokaler har tillkommit, Näsum från och med oktober 2003 och Ivö från och med december 2006. Antalet inräknade gäss bör ses som absoluta minimisiffror, ty otjänlig väderlek och jakt medförde emellanåt att gäss blev oräknade eller oidentifierade.

Eftersom inventerarna inte skiljt på taigasädgäss (skogssädgäss) och tundrasädgäss samlades information om andelen taigasädgäss i flockarna in genom separata kontroller av rastande flockar, genomgång av jaktbyten på Trolle-Ljungby Gods samt uppgifter om flockar på minst 50 tundrasädgäss (Tabell 2 och 3). Sammantaget visade dessa uppgifter att bortsett från räkningsområde Hammarsjön från och med säsongen 2004/05 och några rastande flockar i övriga räkningsområden har tundrasädgåsen förekommit sparsamt i Nordostskåne. Med undantag för Hammarsjön från och med 2004/05 kan de inräknade sädgässen på goda grunder antas ha varit taigasädgäss. Uppgift om andelen taigasädgäss vid Hammarsjön saknas för säsongerna 2004/05–2008/09. Under de senaste fyra säsongerna har så gott som samtliga sädgäss som setts på fälten inom detta område varit tundrasädgäss medan flockar på upp till 415 taigasädgäss har setts på Rinkaby ängar och Hovby ängar.

Under åren 1947–1960 rastade sädgässen höst och vår vid Araslövsjön, Hammarsjön och Egeside. Även under de följande 16 åren ankom gässen i slutet av september och flyttade bort i början av maj, men ett ökande antal stannade kvar över vintern. Någon gång under 60-talet eller i början av 70-talet började gässen även uppträda vid Trolle-Ljungby och Oppmannasjön + Råbelövsjön.

Ett flertal förändringar inträffade under de senaste 37 säsongerna. Tidigare bortflyttning om våren gjorde att antalet sädgäss i april minskade från drygt 5000 fåglar vid den första räkningen till knappt några alls från och med 1997. En liknande förändring om än i mindre skala kan ha skett under hösten, ty 389 fåglar inräknades i september 1977, den enda septemberräkning som genomfördes före 1993. Generellt sett räknades förre sädgäss fram till och med säsongen 1986/87 än därefter. Totalsiffror på över 22 000 fåglar noterades vid fem tillfällen under perioden 1991/92–2004/05 och det högsta inräknade antalet var 24 000 fåglar i december 1997. Under hårda vintar lämnade de flesta eller alla sädgäss Nordostskåne.

Bortsett från Egeside och Ivösjön uppvisar de olika räkningsområdena i stort sett samma tids- och antalsmässiga förändringar som området som helhet. Trolle-Ljungby var det område som vanligtvis hyste flest rastande och övervintrande sädgäss och säsongshögsta överskred ofta 10 000 fåglar (15 802 i november 2003). Oppmannasjön + Råbelövsjön uppvisade de största mellanårsvariationerna. Under de flesta säsongerna uppgick säsongshögsta till 2 000–2 500 fåglar vid Araslövsjön + Gummastorpasjön och c:a 5000 fåglar vid Hammarsjön. Egeside har däremot varit en typisk övervintrings- och vårrastlokal med få sädgäss på hösten, ofta inga alls i oktober. Säsongshögsta uppgick under perioden 1987/88–2005/06 vanligtvis till 2500–4000 fåglar.

Under de flesta av de senaste 25 säsongerna har antalet taigasädgäss i Nordostskåne vid åtminstone någon inventering uppgått till drygt 20 % av det totala antalet i Västpalearktis. Under samma period har, med undantag för Hammarsjön från och med säsongen 2004/05, vart och ett av de fem huvudräkningsområdena hyst mer än en procent av världspopulationen, Trolle-Ljungby ofta mer än tio procent. Dessa områden är således av internationell betydelse för rastande och övervintrande taigasädgäss.

Före 1960-talet födosökte sädgässen under höst

och vinter framförallt på gräsmark och klövervallar, medan gräsmarker var det habitat som prefererades under våren, såväl då som senare. Denna preferens för gräsmarker förklarar varför sädgässen fram till och med 1960 rastade i stora flockar längs med Helgeån, samtidigt som arten knappast alls besökte Trolle-Ljungby-området. Visserligen sökte sädgäss föda på åkermark i Skåne redan för 200 år sedan, men det var först med jordbrukets mekanisering under efterkrigstiden som födosök på åkermark blev möjlig i någon större omfattning. Maskinell upptagning av potatis och sockerbetor lämnar mycket spill och det var just detta spill som möjliggjorde för gässen att börja utnyttja fälten i Trolle-Ljungby-området för födosök. Med ett rikt utbud på föda, framförallt skördespill, tillgång till en säker nattplats (skärgård) i närheten samt en utformning av jakten som inte skrämde bort gässen utvecklades Trolle-Ljunby-området till ett rast- och övervintringsområde för ett mycket stort antal taigasädgäss.

Att fåglar överger sina traditionella vinterkvarter till förmån för lokaler som ligger närmare häckningsområdena kallas med ett engelskt ord för ”short-stopping”. Detta fenomen har beskrivits för ett flertal arter gäss. Uppgifterna om taigasädgåsens förekomst i Nordostskåne omfattar dock, till skillnad från de publicerade fallen, även tiden innan denna utveckling inleddes. På 1950-talet utnyttjades Nordostskåne endast som rastlokal höst och vår av gäss som övervintrade i Danmark, Tyskland och Nederländerna. Stora arealer med höstsådda grödor och mildare vintrar tillät så småningom även övervintring, även om kraftigt snöfall ofta tvingade gässen söderut. Samtidigt med att villkoren för övervintring förbättrades i Nordostskåne, förbättrades längre norrut villkoren för rastande gäss, framförallt om våren. Detta ledde till att gässen började lämna området tidigare om våren. Sista fasen i den pågående utvecklingen skulle vara att taigasädgässen börjar söka sig till vinterkvarter som ligger ännu närmare häckningsområdena. Färre inräknade taigasädgäss i Nordostskåne under det senaste decenniet jämfört med närmast föregående decennium skulle kunna vara ett steg mot ett totalt försvinnande från regionen. Men färre gäss kan också bero på en populationsnedgång.

Mildare vintrar i Sydsverige kan leda till ytterligare förändringar i gåspopulationernas utbredning vintertid. Under det senaste decenniet har tundrasädgåsen börjat övervintra i såväl Danmark som vid Hammarsjön. I framtiden kan tundrasädgåsen komma att ersätta taigasädgåsen som den talrikaste gåsarten i Nordostskåne vintertid. Även spetsbergsgåsen kan komma att etablera sig som övervintrare i denna del av Sverige. I vilket fall som helst finns det goda skäl för medlemmarna i Nordöstra Skånes Fågelklubb att fortsätta sin övervakning av rastande och övervintrande gäss.

Appendix 1. Number of Bean Geese recorded at mid-monthly counts in the census area Trolle-Ljungby, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Trolle-Ljungby säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	1 860	–	172	–	1 663	–
77/78	930	3 135	1 500	1 600	0	1 500	1 375
78/79	1 135	1 090	1 500	0	0	3 100	930
79/80	400	3 310	430	360	0	983	996
80/81	731	2 318	1 043	522	950	574	1 363
81/82	1 290	2 240	220	0	0	1 865	1 130
82/83	230	2 400	3 080	2 500	466	900	1 340
83/84	380	3 240	1 532	1 755	810	1 000	1 490
84/85	460	2 042	1 550	771	300	150	1 529
85/86	110	4 334	487	159	320	1 942	1 850
86/87	65	2 330	2 533	0	0	0	480
87/88	230	1 264	1 481	2 340	2 229	2 320	331
88/89	12	2 225	2 000	3 022	3 368	571	0
89/90	82	1 572	3 138	3 262	3 200	46	0
90/91	87	5 803	5 690	4 014	1 500	200	0
91/92	4	7 500	4 610	6 895	4 295	76	0
92/93	534	10 655	3 637	3 770	2 660	509	0
93/94	564	7 570	4 920	3 560	3 610	965	0
94/95	658	12 020	7 140	6 955	3 432	2	0
95/96	0	6 025	5 100	208	4 100	6 674	66
96/97	6	8 850	10 234	1 489	785	8	0
97/98	0	9 417	13 874	5 314	1 578	165	0
98/99	0	12 321	7 895	7 060	1 686	0	0
99/00	1 296	10 092	4 613	4 134	1 030	0	0
00/01	10	2 295	5 792	5 191	4 964	19	0
01/02	10	8 882	1 743	1 543	1 430	0	–
02/03	392	5 499	12 011	4 888	2 908	7	0
03/04	3	15 802	7 990	5 269	2 526	105	–
04/05	61	11 990	3 687	1 787	3 867	4 050	–
05/06	0	1 677	5 317	3 970	4 598	1 636	–
06/07	0	1 380	4 391	752	2 990	0	–
07/08	241	6 730	8 318	1 920	1 510	40	–
08/09	0	2 400	8 100	1 296	3 790	0	–
09/10	110	4 423	6 305	3 942	872	4 825	–
10/11	1 915	5 113	2 581	126	350	1 593	–
11/12	980	6 000	2 908	1 180	450	0	–
12/13	0	1 888	–	875	882	8 509	–
13/14	110	1 485	12 010	–	–	–	–

Appendix 2. Number of Bean Geese recorded at mid-monthly counts in the census area Oppmannasjön + Råbelövsjön, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Oppmannasjön + Råbelövsjön säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	554	–	2	–	840	–
77/78	0	75	15	205	–	1 700	630
78/79	280	–	–	0	0	0	–
79/80	0	80	800	84	0	285	230
80/81	0	3	2	0	0	920	455
81/82	121	510	0	0	0	480	540
82/83	62	645	60	270	0	1 025	515
83/84	0	515	0	190	210	1 600	510
84/85	217	350	925	250	1	11	602
85/86	0	140	0	0	0	300	8
86/87	20	560	840	0	0	0	675
87/88	5	950	600	400	35	1 175	350
88/89	19	3 150	425	893	725	3	274
89/90	195	340	400	312	886	100	100
90/91	75	1 250	1 300	450	0	454	90
91/92	0	950	1 100	402	1 555	130	0
92/93	70	1 400	2 300	1 500	80	80	0
93/94	100	940	650	121	190	370	0
94/95	120	1 133	602	130	60	355	0
95/96	120	685	2 750	5	0	370	0
96/97	195	1 023	725	0	535	45	0
97/98	750	2 231	4 850	2 050	1 200	224	7
98/99	7	1 402	4	238	0	493	0
99/00	422	1 685	2 455	80	1 423	169	0
00/01	0	1 008	800	410	760	24	0
01/02	0	2 650	3 780	500	1 253	7	0
02/03	200	8 807	2 609	350	460	109	52
03/04	0	3 550	1 070	803	760	2 280	–
04/05	70	5 900	2 283	550	1 158	378	–
05/06	13	765	1 945	1	0	0	–
06/07	2	8 150	2 669	1 521	545	5	–
07/08	220	1 990	77	1 830	90	85	–
08/09	0	1 416	777	1 240	1 135	162	–
09/10	60	300	1 630	0	24	20	–
10/11	200	1 395	0	0	0	853	–
11/12	30	75	1 500	560	52	2	–
12/13	0	65	–	2	560	1 190	–
13/14	8	526	186	–	–	–	–

Appendix 3. Number of Bean Geese recorded at mid-monthly counts in the census area Araslövsjön + Gummastorpasjön, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Araslövsjön + Gummastorpasjön säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	540	–	69	–	990	–
77/78	871	2 095	1 366	864	140	1 800	1 144
78/79	490	–	1 040	80	0	1 000	–
79/80	400	1 030	140	110	0	186	597
80/81	225	1 650	7	500	787	1 593	378
81/82	535	1 600	1 450	0	69	4 630	1 808
82/83	577	1 850	2 067	600	8	3 127	982
83/84	370	1 093	0	1 191	11	1 578	810
84/85	500	537	2 817	0	0	361	350
85/86	110	173	1 282	0	0	875	390
86/87	539	394	2 595	0	2	80	5
87/88	12	454	1 960	2 055	2 325	3 204	0
88/89	0	350	907	2 050	501	0	0
89/90	80	11	1 690	2 000	1 945	0	0
90/91	75	398	2 155	2 890	597	75	0
91/92	1	540	1 746	2 435	3 776	120	0
92/93	87	1 204	1 369	2 170	2 170	3 112	2
93/94	22	1 002	1 612	827	900	1 116	2
94/95	32	1 445	1 375	2 250	2 505	1	1
95/96	22	1 747	681	110	3 210	2 833	8
96/97	0	1 021	2 014	600	1 091	1	0
97/98	0	770	1 090	2 351	919	13	0
98/99	0	220	1 456	59	549	133	0
99/00	402	74	1 232	2 044	814	150	0
00/01	30	23	1 643	3 486	2 338	11	0
01/02	0	1 554	1 606	328	686	6	0
02/03	104	3 350	2 223	1 243	2 205	42	12
03/04	0	623	3 500	383	887	1 950	–
04/05	86	1 400	1 335	450	0	600	–
05/06	200	405	1 835	14	417	150	–
06/07	850	1 980	2 575	2 386	2 000	70	–
07/08	38	330	1 830	1 819	620	11	–
08/09	0	50	1 517	1 792	1 533	0	–
09/10	0	363	2 000	1 145	773	220	–
10/11	270	0	820	0	328	1 283	–
11/12	68	2 350	570	922	1 400	150	–
12/13	20	74	–	400	1 095	3 395	–
13/14	0	23	700	–	–	–	–

Appendix 4. Number of Bean Geese recorded at mid-monthly counts in the census area Hammarsjön, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Hammarsjön säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	590	–	189	–	1 740	–
77/78	42	172	1 000	2 150	740	4 450	2 012
78/79	1	–	–	0	0	2 000	–
79/80	7	336	1 805	1 465	1	2 400	2 610
80/81	0	1 300	760	1 100	2 200	1 875	600
81/82	23	327	255	0	0	2 370	970
82/83	131	45	1 750	2 427	128	4 910	670
83/84	6	336	300	3 491	2 260	4 930	771
84/85	380	952	4 148	440	586	5 998	1 303
85/86	75	450	852	110	192	1 014	1 010
86/87	0	8	1 387	0	184	1 352	441
87/88	0	328	7 705	1 143	4 831	4 527	211
88/89	0	1 375	4 445	10 595	4 210	305	0
89/90	15	0	2 576	5 695	3 808	62	0
90/91	105	2 350	4 858	6 139	2 355	184	20
91/92	0	1 407	4 978	8 961	6 228	10	7
92/93	71	2 010	2 275	4 959	8 180	978	10
93/94	100	646	1 044	6 009	1 602	1 664	0
94/95	0	2 564	7 074	4 200	4 901	67	0
95/96	106	879	3 110	100	290	1 004	150
96/97	0	3 232	4 270	1 017	4 750	461	9
97/98	180	7 015	3 550	5 355	4 570	314	0
98/99	0	2 140	4 230	2 514	3 150	55	0
99/00	172	1 350	8 290	5 040	2 034	0	0
00/01	0	860	2 703	4 230	4 435	24	0
01/02	0	3 577	4 579	514	3 565	0	0
02/03	13	2 824	2 591	897	960	144	0
03/04	0	3 716	2 276	3 110	1 317	225	–
04/05	26	3 100	5 375	4 521	3 038	2 761	–
05/06	2	820	3 650	3 450	2 875	2 225	–
06/07	15	6 750	3 570	3 020	2 173	2	–
07/08	12	5 700	2 700	5 510	5 600	2	–
08/09	0	2 200	680	5 550	2 450	108	–
09/10	271	1 710	4 490	1 734	2 307	3 210	–
10/11	31	5 600	2 050	369	990	2 904	–
11/12	265	4 250	4 500	3 901	957	1	–
12/13	0	1 110	–	4 275	3 332	2 980	–
13/14	0	203	5 540	–	–	–	–

Appendix 5. Number of Bean Geese recorded at mid-monthly counts in the census area Egeside, 1976/1977–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Egeside säsongerna 1976/1977–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
76/77	–	23	–	177	–	574	–
77/78	22	23	1 100	3 100	–	1 690	480
78/79	0	–	–	648	0	517	–
79/80	18	305	453	17	0	1 390	–
80/81	0	29	263	1 700	1 100	412	691
81/82	67	104	0	0	0	8 000	2 000
82/83	16	3	1 243	950	1 046	3 500	10
83/84	14	250	200	2 780	1 610	1 850	1 250
84/85	352	0	2 409	0	0	1 760	1 585
85/86	0	21	740	0	121	2 630	980
86/87	50	66	620	0	0	10	160
87/88	0	17	1 017	2 350	4 924	6 541	422
88/89	0	10	4 244	3 400	890	500	565
89/90	0	54	0	5 090	3 268	420	380
90/91	0	780	3 700	3 420	516	698	165
91/92	0	0	1 210	5 181	710	500	500
92/93	0	41	2 738	3 700	2 295	15	180
93/94	0	23	1 230	3 696	2 500	3 000	375
94/95	0	356	2 175	3 687	1 829	270	100
95/96	0	79	995	200	30	2 660	0
96/97	0	384	1 450	0	1 299	0	50
97/98	0	500	700	1 320	360	1 050	0
98/99	0	3	150	300	649	1 400	0
99/00	8	0	220	2 620	1 019	70	1
00/01	0	9	240	2 320	1 160	500	0
01/02	25	1 560	2 800	877	4 300	40	0
02/03	2	313	2 840	1 009	1 065	31	0
03/04	0	15	7 990	732	573	0	–
04/05	0	257	1 680	2 738	1 228	651	–
05/06	2	5	3 686	40	370	116	–
06/07	0	69	630	843	994	1	–
07/08	0	806	937	2 517	800	0	–
08/09	0	0	950	1 112	675	16	–
09/10	0	33	638	210	170	1 070	–
10/11	30	158	180	0	470	1 650	–
11/12	19	168	2 901	2 992	1 951	0	–
12/13	0	1 145	–	1 198	1 406	740	–
13/14	0	959	839	–	–	–	–

Appendix 6. Number of Bean Geese recorded at mid-monthly counts in the census area Ivösjön, 2006/2007–2013/–. A bar (–) indicates that no complete count was carried out that month.
Antalet sädgäss inräknade vid mittmånads-inventeringar i räkningsområdet Ivösjön säsongerna 2006/2007–2013/–. Minustecken (–) anger att ingen komplett inventering genomfördes den månaden.

	October	November	December	January	February	March	April
06/07	–	–	467	–	1 165	12	–
07/08	0	600	2 000	1 250	211	0	–
08/09	0	0	10	725	1 750	0	–
09/10	0	0	110	260	16	35	–
10/11	0	370	0	38	109	470	–
11/12	10	300	620	425	366	0	–
12/13	0	311	–	637	3	345	–
13/14	4	560	127	–	–	–	–

Nya böcker – *New books*

Elena Lappo, Pavel Tomkovich & Evgeny Syroechkovskiy, 2012. **Atlas of breeding waders in the Russian Arctic.** Publishing House OOO, Moscow. 448 sidor, 173 kartor, otaliga tabeller, etc.

Arktiska vadare från Ryssland och Sibirien har länge spelat en stor roll inom svensk ornitologi – väl illustrerat redan av gamla klassiker som finlandssvensken J.A. Palméns "Über die Zugstrassen der Vögel" (1876) och "Bidrag till Sibiriska Ishavskustens Fogelfauna, enligt Vegaexpeditionens iakttagelser och samlingar" (1886). Eller Gustaf Kolthoffs "Zur herbstwanderungen der nordischen Sumpfvögel uber die Insel Öland" (1896), en tidigt tändande gnista vilken så småningom (1946) bidrog till grundandet av Ottenby fågelstation – där vadarfällorna ju på hösten ständigt fylls av arktiska vadare ända bortifrån Taymyrhalvön!

Långt senare, som en följd av den reformerte kommunistpartiledaren Gorbatchovs epokgörande tal i Murmansk om arktiskt samarbete hösten 1987, vilket ledde till öppnandet av ryska arktis för internationellt vetenskapligt samarbete, började bl.a. svenska biologer, geologer och andra forskare strömma dit upp! En höjdpunkt var den Svensk-Ryska Tundraekologi-expeditionen med forskningsfartyget "Akademik Fedorov" sommaren 1994, vilken täckte in större delen av den ryska arktiska kusten och många utanförliggande öar, från Kolahalvön i väster till Tjuktjerhalvön i öst.

Nu har, författad av två deltagare i ovannämnda expedition (Elena Lappo och Evgeny Syroechkovskiy) ihop med en av Rysslands allra mest välkända arktiska ornitologer (Pavel Tomkovich), det utgivits en fantastisk översikt över vadarfåglarna i ryska arktis. Detta dessutom med stort ekonomiskt och databearbetningsmässigt stöd från Holland – ett annat "vadarintresserat" land som tagit till sig möjligheterna att få fältarbeta i dessa nordliga rekryteringsområden för många fåglar som senare passerar dess egna kuster!

Atlasen inleds med välillustrerade kapitel om Arktis, dess yttre gränser och olika zoner, från den allra nordligaste taigan upp till polaröknarna på Severnaja Zemlja och Franz Josephs Land. Därefter redovisas ursprunget för de data som använts (och hur de använts), karteringsprinciperna och hur man s.a.s. sytt ihop massor av data av olika ålder, ursprung, typ, o.s.v. Så följer fåglarna själva, ett 70-tal arter varav 51 detaljerat beskrivna i var sitt kapitel med olika kartor över deras utbredning och varierande talrikhet i olika områden. Dessutom presenteras använda data i tabellform och kapitlen kompletteras med trevliga illustrationer av fåglarna själva och deras miljöer. T.ex. en roskarl sittande på en ur tundran uppstickande fossil mammutbete! Litteraturlistan, slutligen, har både en rent rysk (kyrillisk) avdelning och en med europeisk skrivning – och i den senare listas åtminstone ett 15-tal svenska arbeten, flera med direkt anknytning till "Tundraexpeditionen" 1994.

Förutom hela det grundläggande materialet i Atlasen illustreras på slutet, bl.a. i tabellform, olika förändringar som skett/sker i vissa arters utbredning. Grönbenan, t.ex., expanderar norrut, som resultat av ett varmare klimat får man förmoda. En del utbredningar är kanske lite oväntade för många av oss, som t.ex. att "vår" ljungpipare och den sibiriska tundrapiparen överlappar i ett ganska stort område, från Jamalhalvön till Taymyr – om än med viss nordligare utbredningspreferens för den senare arten. Rödhalsade snäppans område sträcker sig numera västerut ända till sträckdelaren på Taymyrhalvön, mellan Atlant- och Stillahavsområdena. Tuvsnäppan häckar idag både på västra Taymyr och på Jamalhalvön och detta är ju en bättre förklaring till att så många av dem numera ses i Västeuropa än (som man förr trodde) att de flesta kommit vinddrivna över Atlanten från Nordamerika! Den Sibiriska beckasinen har också expanderat västerut och häckar numera ända till hitom Pechoraområdet. Men det är ju dessvärre inte alla arter det går så bra för och sämst av alla går det väl för skedsnäppan. Den häckar bara allra längst i öster, på Tjuktjerhalvön och en bit söderut ner mot Kamchatka, och man uppskattar här den totala världspopulationen till att vara nere på mellan 150–350 par! Bl.a. ett resultat av industriell expansion ut i dess övervintringsmarker nere i de sydligare delarna av Asien.

Ja, författarna är bara att gratulera till det här extremt innehållsrika “praktverket”, som med sin parallella ryska (kyrilliska) och engelsk text är helt tillgänglig för alla!

CHRISTIAN HJORT

Keith Vinicombe, Alan Harris & Lauren Tucker, 2014: **The Helm Guide to Bird Identification**. Bloomsbury Publishing. 396 sidor.

Introduktionen kan göras kort – minns ni den gamla *Macmillan Field Guide to Bird Identification* från 1989? På sin tid lite revolutionerande, dels för att den inte utgjorde en heltäckande fågelbok, utan istället fokuserade på ett antal välkända bestämningsproblem och behandlade dessa i bestämningsuppsatsliknande form, och dels också för att den lärde oss att i högre utsträckning ta hänsyn till form, proportioner och allmän byggnad (s.k. jizz). Den här aktuella *The Helm Guide to Bird Identification* är varken mer eller mindre än en uppdatering av den gamla *Macmillan-guiden*, och som läsare känner man omedelbart igen upplägget. Orsaken till denna ”nyutgåva” hittas i arturvalet som här breddats ordentligt på grund av nya uppträdanden (t.ex. brun törnskata som ju numera är en någorlunda regelbunden gäst i Västeuropa) och ny taxonomi (t.ex. trutar, *Iduna*-sångare, varfåglar) som nu täcks in på ett bättre sätt. Men precis som i *Macmillan-guiden* behandlas också långt mycket mindre exotiska arter, så som t.ex. fisk- och silvertärna liksom gråsparv och pilfink. Texterna är förtjänstfullt uppdaterade av Vinicombe och känns överlag skarpa, aktuella och uttömmande. Nå, håller då detta? Personligen tycker jag inte det. Det är lätt att framföra klagomål på att planscher saknas (var finns t.ex. vårhannar av svarthakade och vitgumpade buskskvättor?) och att många aktuella och intressanta problem inte redovisas alls (t.ex. de olika ”rödstrupiga sångarna”). Men bokens stora akilleshäl hittas i planschernas utförande – många av dem är oförändrade från *Macmillan-guiden*. De nymålade alstren av Harris är klart bättre än Tuckers äldre illustrationer, men svarar trots allt inte upp mot dagens med rätta högt ställda krav. De funkar bra för vide- och dvärgsparv men inte alls för t.ex. ek- och saxaulsångare. Med konstnärer som Dan Zetterström, Ian Lewington, Lars Jonsson och Killian Mullarney aktiva inom den europeiska fågellitteraturen har ribban lagts högt och vi ornitologer har blivit svårimponerade. Vinicombes texter till trots – jag tror att den här boken har relativt lite att ge oss i skuggan av *Fågelguiden*.

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