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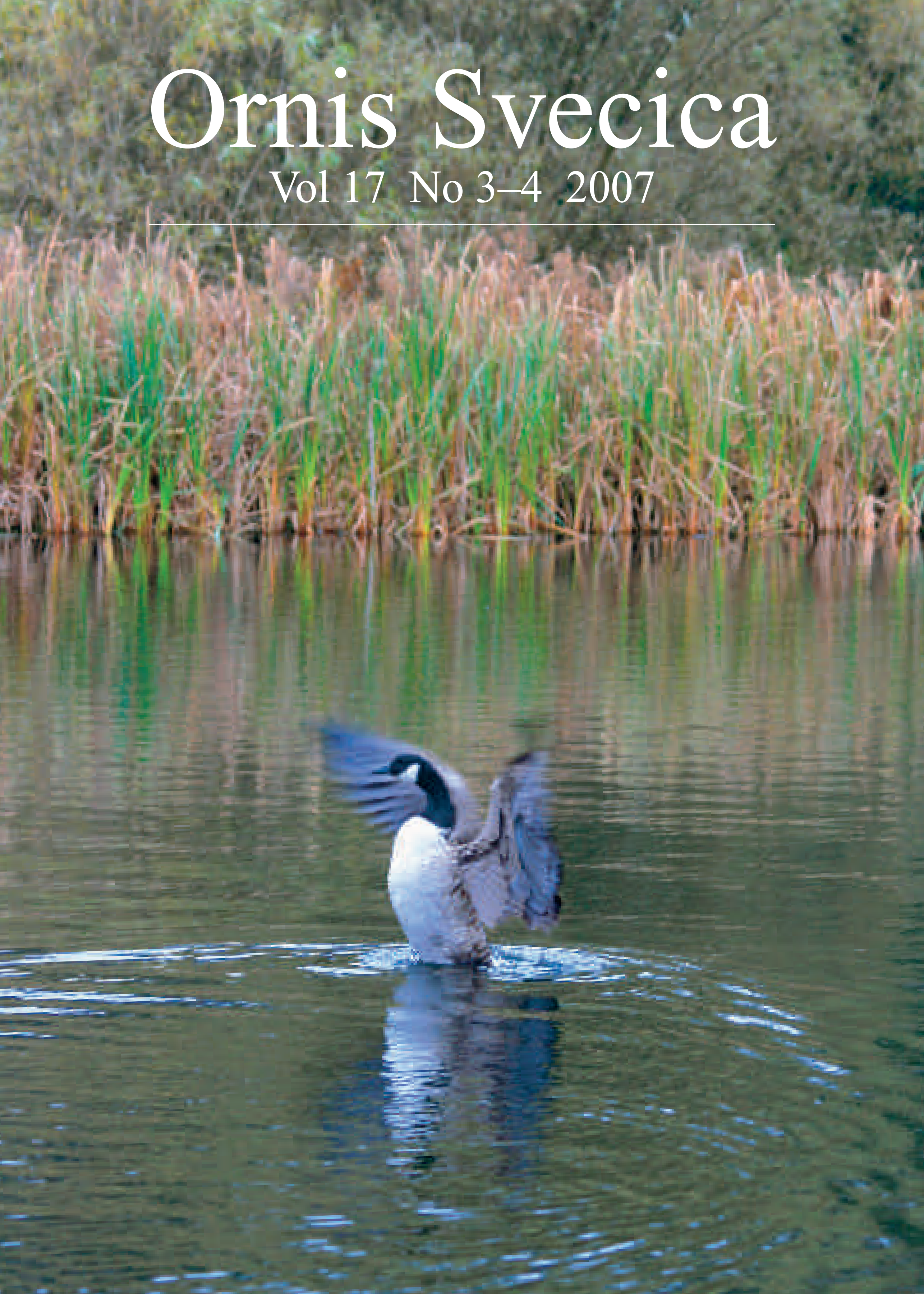

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Könsfördelningen hos bläsand *Anas penelope* under vårsträcket vid Angarnsjöängen, Uppland, 1995–2005

Sex ratio of the Eurasian Wigeon Anas penelope *during spring migration at Angarnsjöängen, Uppland, 1995–2005*

SVANTE SÖDERHOLM

Abstract

The sex ratio of the Eurasian Wigeon *Anas penelope* and its seasonal variation was studied during eleven spring migrations at Angarnsjöängen, Sweden (59° 33´ N, 18° 10´ E). The main passage of birds occurred in the second half of April, and the migration had almost ceased after 15 May. Eurasian Wigeons recorded after this date were mainly males and probably mostly non-breeders, moult migrants or stragglers. The fraction of males was 0.53 (SD=0.028), and there was no difference between years. Neither was there a correlation between the fraction of males and the flock size. About 95% of the females and 85% of the males were paired during the stopover.

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Introduktion

Redan i slutet av 1800-talet publicerades de första uppgifterna om skeva könskvoter hos dykänder (Payne-Gallwey 1882) och ganska snart därefter publicerades ett par arbeten till som beskrev att hanarna var fler än honorna (t.ex. Robinson 1913). Under 1930- och 1940-talen blev könskvoter hos änder föremål för ett större intresse och ett flertal studier publicerades, exempelvis Furniss (1935), McIlhenny (1937, 1940a, 1940b), Erickson (1943), Petrides (1944), Beer (1945) och Yocom (1949). Resultaten av studierna skiljde sig åt och varierade mellan lokaler och årstider samt ifall metodiken baserades på räkningar, ringmärkningsdata eller byte vid jakt (Petrides 1944). Det stod dock klart att andelen hanar överväger för de flesta arter och att skilda flyttningstider i stor utsträckning påverkar könskvoten för arterna (Petrides 1944).

I och med att Lebret (1950) påvisade att hanar och honor av en del andarter övervintrar på olika breddgrader och flyttar vid olika tidpunkter (främst från häckningsområdena) tycks konsensus ha växt fram att könskvoten varierar med undersökningsområdets geografiska position och tidpunkten på året (se även Bellrose et al. 1961, Salomonsen 1968).

Även om man beaktar faktorerna i ovanstående studier, står det klart att hanar överväger för de flesta andarter (speciellt för dykänder) (Bellrose et al. 1961, Aldrich 1973, Bellrose 1980). Detta motiverade mig att sammanställa uppgifter rörande bläsandens *Anas penelope* könskvot under vårsträcket vid Angarnsjöängen i Uppland, eftersom jag noterat att könsfördelningen hos arten där varit mycket jämnare än hos andra vanligt rastande simandsarter (kricka, gräsand och skedand) under våren. Andfåglar (familjen Anatidae) är unika bland flyttfåglar i den bemärkelsen att de bildar par i övervintringsområdet eller under flyttningen (Rohwer & Anderson 1988, Anderson et al. 1992). I regel är det hanen som följer med honan till det område där honan föddes, vilket även gäller bläsand (Amat 1990, Jonsson & Gardarsson 2001). Således borde observationerna vid Angarnsjöängen spegla den häckande populationens könskvot. I detta arbete diskuteras och jämförs uppgifter från Angarnsjöängen med uppgifter från ett häckningsområde på Island (Gardarsson & Einarsson 1997) och från övervintringsområden i Tyskland (Bezzel 1959) och Spanien (Amat 1990).

Lokal och metoder

Angarnsjöängen är belägen 25 km NO om Stockholm (59° 33´ N, 18° 10´ O). Den grunda eutrofa slättsjön har varit föremål för flera sjösänkningar och har en areal av ca 110 ha. Vintern 1992/1993 genomfördes en omfattande restaurering vars mål var att återskapa ett tidigt successionsstadium samt att skapa förutsättningar för att sedan behålla detta stadium. Vattenståndet i sjöängen regleras med hjälp av en damm så att översvämningar, med tillhörande blå bård, skapas vår och höst. Den maximala vattenståndsvariationen är 1,4 m och den ideala 1,2 m. En mängd biotoper återfinns idag runt sjöängen: betade strandängar, beteshagar, åkrar, några lövskogsdungar och brukad barrskog med varierande inslag av lövträd. Utförliga uppgifter om restaureringen och sjöängen finns bl.a. i Söderholm & Eriksson (1999) och Larsson & Welander (2003).

Våtmarksfågelfaunan vid Angarnsjöängen har inventerats årligen sedan 1978 och inventeringen har skett enligt samma riktlinjer under alla år. Målet har varit att inventera hela sjöängen under en dag, minst en gång per vecka. Inventeringarna har företrädesvis skett under veckosluten. Sedan mitten av 1990-talet har inventeringarna inletts i mitten av april och avslutats i första veckan i juni. Tidigare inleddes inventeringarna något senare, men en del arter har uppvisat en tendens under inventeringsserien att påbörja häckningen och/eller anlända tidigare, vilket gjort att inventeringsperioden påbörjats tidigare för att få så goda uppgifter som möjligt. Inventeringarna har genomförts på ett standardiserat sätt där inventeraren gått runt hela sjöängen längs en fastlagd rutt. Startpunkten förändrades i början av serien. Vanligtvis har inventeringen påbörjats vid sjutiden på morgonen och avslutats fem till åtta timmar senare. Variationerna i tidsåtgång beror på vattenstånd, tidpunkt på säsongen och hur mycket växtlighet som funnit i olika delar av sjöängen. Målsättningen har varit att undvika regn eller hård vind under inventeringarna och endast ca 10% av inventeringsrundorna (knappt ett tillfälle per säsong) har genomförts under sådana förhållanden. Vid inventeringstillfällena har sjöängen varit indelad i delområden och antalet par samt antalet hanar och honor ej ingående i par har noterats för varje område. Fåglar i flockar där det inte varit uppenbart om de tillhörde ett par eller ej har förts till de senare kategorierna. Dessutom har iakttagelser som tytt på häckning (dvs. bobygge, spel, ruvande fåglar) noterats. I detta arbete presenteras endast uppgifter från den tid jag själv inventerat sjöfåglar vid Angarnsjöängen, dvs. från 1995 och framåt. Valet av tidsperiod säkerställer dessutom att sjöängen under undersökningsperioden befunnit sig i ett jämförbart tillstånd. Från omkring mitten av 1980-talet och fram till restaureringen var sjöängen rejält igenväxt och föga lämpad som rast- och häckningslokal för änder (Söderholm & Eriksson 1999).

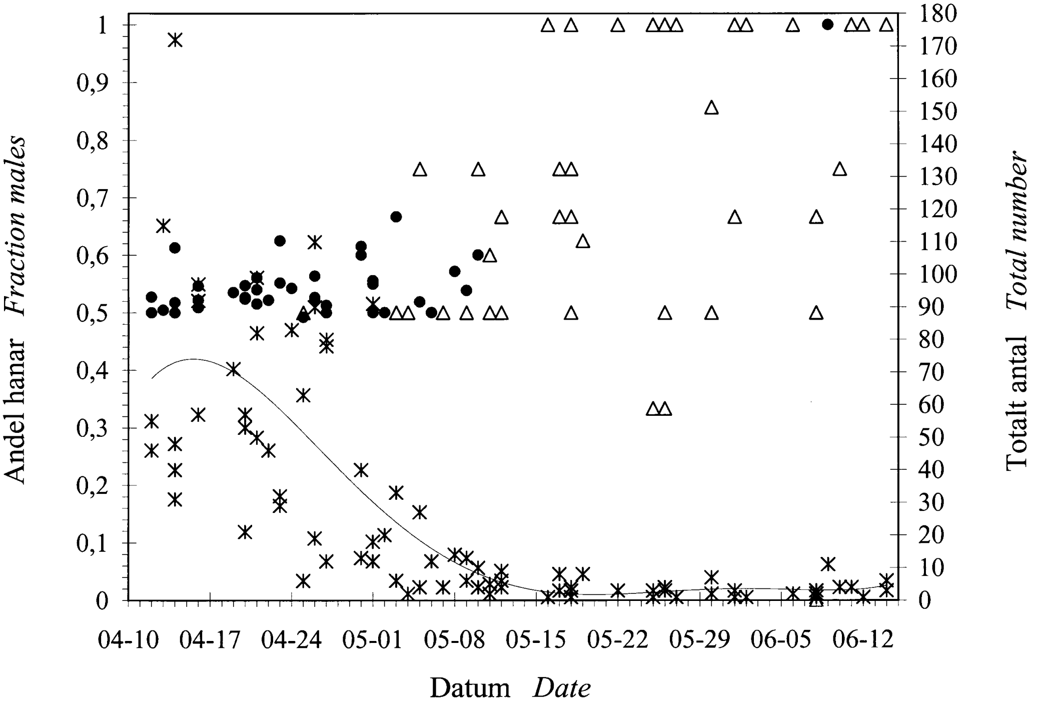
De insamlade uppgifterna kan inte betraktas som oberoende observationer; fåglar kan och har troligen rastat längre än en vecka, vilket gör att en del individer observerats vid två eller flera tillfällen samma säsong. Vidare är det också troligt att individer har observerats under två eller flera säsonger. Då bläsand är en sparsam till sällsynt häckfågel vid lokalen torde resultatet påverkas i mycket ringa omfattning av att häckande fåglar eventuellt dyker upp flera gånger i materialet. Under de elva år som undersökningen omfattar häckade bläsand vid sjöängen under åtta av åren (sex av åren häckade ett par och två år två par). Även om observationer inte är oberoende har statistiska analyser genomförts för att belysa olika förhållanden.

Resultat

Uppgifterna om bläsandens könskvot och vårsträckets tidsmässiga förlopp har insamlats under elva år och under denna period har sjöängen inventerats sammanlagt 100 gånger. Vid 85 av tillfällena har bläsand noterats. Totalt har 2298 individer noterats varav 1256 var hanar. Drygt 80% av bläsänderna noterades i april ($N_{april} = 1887$; $N_{maj} = 365$; $N_{juni} = 46$).

Bläsandens säsongsvisa uppträdande i Angarnsjöängen under inventeringsperioden redovisas i Figur 1. Toppen under vårsträcket infaller i mitten av april, sedan avtar antalet individer snabbt och från mitten av maj noteras arten oregelbundet och endast i ringa antal (mestadels 0–4 individer). Medelvärdet från och med 16 maj är 2,4 bläsänder per inventeringsrunda och arten har inte noterats vid en fjärdedel av dessa besök, dvs. vid 12 av 45 besök.

Andelen hanar som noterats fram till mitten av maj ligger med något undantag mellan 50% och 60% (Figur 1). Efter denna tidpunkt varierar andelen hanar avsevärt och har varit 100% vid nästan hälften av inventeringstillfällena. Förklaringen är att dessa fåglar har utgjorts av en blandning av eftersläntrare, fåglar som häckat eller har gjort häckningsförsök i sjöängen, hanar på ruggningsträck, och översomrande individer. Fram till och med den 15 maj finns det ingen korrelation mellan datum och andelen hanar (Spearman rank korrelation, $r_s = 0{,}16$, $n = 52$, $p = 0{,}27$). Givetvis existerar det en korrelation sett över hela inventeringssäsongen i och med att hanar tenderar att dominera under den sista månaden av säsongen ($r_s = 0{,}48$, $n = 85$, $p < 0{,}001$).



Figur 1. Vänster ordinata: Förhållandet mellan andelen hanar och datum. Totalt antal individer ≥ 10 (●) eller ≤ 9 (Δ). Höger ordinata: Förhållandet mellan totalt antal bläsänder och datum(✻). Kurvan är en hjälp för ögat, anpassning med femte grads polynom.

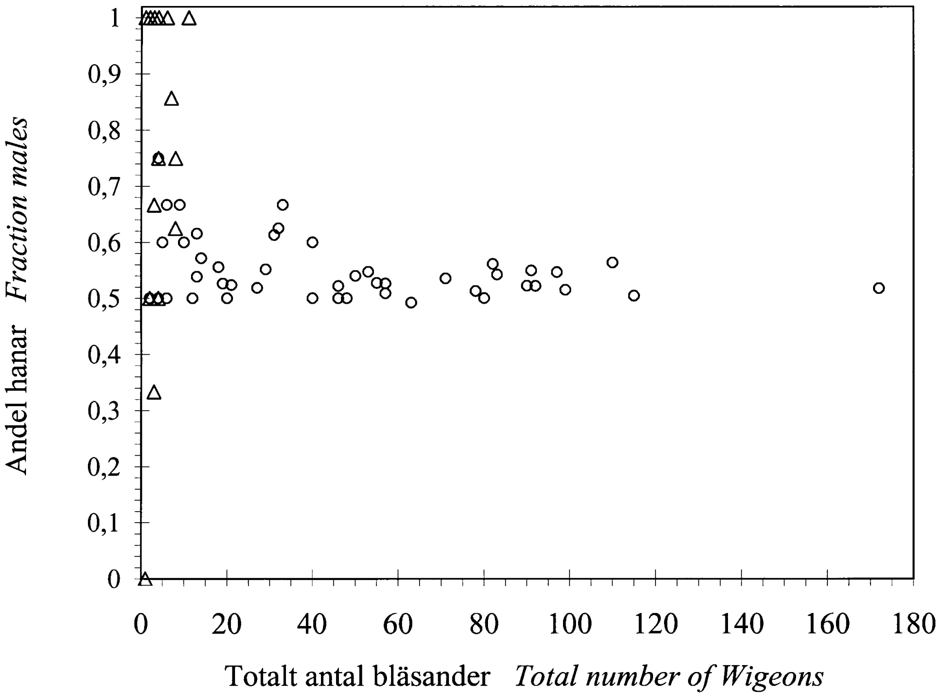
Left ordinate: Relationship between the fraction of males and date. Total number of Wigeons ≥ 10 (●), or ≤ 9 (Δ). Right ordinate: Relationship between total number of Wigeons and date(✻). The curve is a guide to the eye, best fit with 5th order polynomial.

I Figur 2 redovisas hur andelen hanar varierar med det totala antalet observerade bläsänder, vilket kan tas för ett mått på flockstorlek i och med att de observerade bläsänderna i de flesta fall höll ihop. Om samtliga inventeringstillfällen då arten noterats beaktas finns en signifikant korrelation mellan andelen hanar och det totala antalet bläsänder (r_s = –0,36, n = 85, p <0,001). Av figuren framgår dock att sambandet orsakas av att andelen hanar i många fall är närmare 100%. Om man bortser från slutet av säsongen när antalen är ringa och endast använder uppgifter till och med 15 maj saknas denna korrelation (r_s = 0,005, n = 52, p = 0,97).

Inte heller finns det någon korrelation mellan datum och andelen hanar om antalet rastande bläsänder var minst 10 individer (r_s = 0,27, n = 41, p = 0,09), vilket är ett rimligt kriterium för att avgöra när vårsträcket i stort sätt är över (se Figur 1). Denna på gränsen till signifikanta korrelationen orsakas i stor utsträckning av en observation på elva hanar på ruggningssträck den 9 juni 2004. När denna observation utesluts finns det ingen tendens till korrelation (r_s = 0,21, n = 40, p = 0,19).

Att könsfördelningen ändras väsentligt i mitten av maj framgår även av uppgifterna i Tabell 1, i vilken samtliga observationer är uppdelade i olika tidsperioder. Antalet fåglar ingående i par är behäftat med ett visst fel då änderna vid några inventeringar blivit eller varit störda vilket gjort att de legat tätt ihop och/eller uppträtt på sådant sätt att det för majoriteten av änderna inte gått att avgöra om de varit parade eller inte.

Det föreligger ingen signifikant skillnad i könsfördelningen mellan april och perioden 1–15 maj (χ^2 = 1,01 med Yates korrektion, df = 1, p = 0,32). Däremot skiljer sig könsfördelningen mellan april och hela maj, samt könsfördelningen mellan april och 16–31 maj (χ^2=4,07 med Yates korrektion, df = 1, p = 0,04 respektive χ^2 = 7,61 med Yates korrektion, df = 1, p < 0,01). Även skillnaden mellan första och andra halvan av maj är signifikant (χ^2 = 4,33 med Yates korrektion, df = 1, p = 0,04).



Figur 2. Förhållandet mellan andelen hanar och totala antalet observerade bläsänder: (o) observationer 12 april till 15 maj, (Δ) observationer 16 maj till 14 juni. Ett flertal av de senare datapunkterna överlappar vilket gör att antalet punkter är skenbart lägre än i Figur 1.

Relationship between the fraction of males and total number of Wigeons: (o) April 12 to May 15, (Δ) May 16 to June 14. Several of the latter data points overlap which cause the number of points to appear to be lower than in Figure 1.

Tabell 1. Samtliga observationer av bläsand fördelat på par, hanar och honor under olika tidsperioder. För de olika tidsperioderna anges andel hanar i procent och könskvoten (hanar/hona).

All observations of Wigeons distributed on groups, i.e. pairs, males and females, during different periods. The fraction of males in percent and the sex ratio is given for each period.

Tidsperiod *Period*	Par *Pairs*	Hanar *Males*	Honor *Females*	Totalt *Total*	Procent hanar *Percent males*	Könskvot *Sex ratio*
Hela säsongen *Entire season*	930	326	112	2298	54,7	1,21
April, 12–30	820	180	67	1887	53,0	1,13
Maj, 1–31	108	107	42	365	58,9	1,43
Maj, 1–15	93	77	39	302	56,3	1,29
Maj, 16–31	15	30	3	63	71,4	2,50
Juni, 1–16	2	39	3	46	89,1	8,20

Utgående från alla observationer i april och första halvan av maj blir andelen hanar 53,4% och könskvoten 1,15 hanar/hona. Skillnaden gentemot det värde som erhålls om samtliga observationer som ingår i materialet beaktas är ringa, då inalles endast 109 bläsänder noterats efter 15 maj. Av änderna noterade i april och första halvan av maj har minst 83% varit parade. Om hänsyn tas till att det vid några tillfällen inte gått att avgöra i vilken utsträckning änderna varit parade stiger andelen till minst 90%. Andelen av honorna som ingått i par är hög, minst 90% respektive 96%. För hanarna var motsvarande andelar 78% och 84%.

Det föreligger ingen skillnad i fråga om andelen hanar mellan de olika åren, oavsett om enbart april månad eller perioden april t.o.m. 15 maj jämförs (χ^2 =4,95, df = 10, p = 0,90, respektive χ^2 =4,47, df = 10, p = 0,92). Det årsvisa medelvärdet för andelen hanar från april t.o.m. 15 maj är 53,3% (SD = 2,76 procentenheter). För nio av åren är andelen hanar mellan 51% och 56%. Två år avviker något mer från medelvärdet: 1995 med 60% och 1997 med 49% hanar.

Diskussion

Uppgifterna från Angarnsjöängen visar att könsfördelningen hos bläsand är någorlunda jämn, med tanke på den inom underfamiljen *Anatinae* genomgående skeva fördelningen. Andelen hanar är 53% och varierar inte mellan åren, och är oberoende av antalet rastande fåglar under vårsträcket, fram till dess att sträckrörelserna i stort sett upphört. Tidsmässigt föreligger ingen skillnad i könskvot mellan april och 1–15 maj. Könskvoten under perioden 16–31 maj avviker från den tidigare under vårsträcket. Orsaken är att bläsänderna under andra halvan av maj inte kan betraktas som representativa för den häckande populationen, då de till stor utsträckning utgörs eftersläntrare, hanar på ruggningssträck och översomrande individer. Att skillnaden i könskvot mellan april och maj är nätt och jämt signifikant beror i viss utsträckning på att antalet observerade fåglar under andra halva av maj är betydligt lägre än under första halvan av maj.

Även om den skeva könskvoten hos änder varit känd länge existerar, mig veterligen, ingen förklaring till fenomenet i den bemärkelsen att man förstår varför det skulle vara evolutionärt fördelaktigt med ett överskott av hanar. En kort sammanställning över olika hypoteser återfinns i Aldrich (1973). Det bör noteras i sammanhanget att könskvoten inte är skev i äggstadiet och inte heller vid kläckning (se exempelvis Blums & Mednis 1996 och referenser däri), så den skeva könskvoten kan inte vara ett resultat av att honorna via adaptiv kontroll påverkar könskvoten. Vidare är det inte heller klarlagt varför mortaliteten bland honorna är högre än bland hanarna (Aldrich 1973).

Den skeva könsfördelningen hos bläsand som observerats vid Angarnsjöängen kan inte tillskrivas att honorna i större utsträckning undgått upptäckt vid inventeringstillfällen även om de är mer "kamouflagetecknade" än de färggranna hanarna i praktdräkt. Skälet till detta är artens uppträdande vid lokalen. Tidigt på morgnarna betar de ofta på låggräsmarkerna i anslutning till den blå bården och är då väl synliga för observatören. När de senare på dagen betat färdigt, eller skrämts av personer som rör sig i området, tenderar de till att ligga öppet på klarvattenytor i sjön. Vid de tillfällen de befinner sig i vegetationen återfinns de mestadels i områden med gles fjolårsvegetation vilket gör att bläsänderna även när så är fallet är relativt väl synliga. Dessutom, med tanke på att majoriteten av fåglarna som ingår i materialet observerats när ett stort antal fåglar uppehållit sig i sjöängen, så torde ett bortfall av enstaka eller några fåglar inte nämnvärt påverka resultatet.

Könsfördelningen hos bläsand vid Angarnsjöängen under vårsträcket är i överensstämmelse med en omfattande studie av simänder i USA (Bellrose et al. 1961), dvs. det finns ett överskott av hanar och andelen växer snabbt när den egentliga sträckperioden är över. Från Europa finns det åtminstone fyra i sammanhanget relevanta studier som behandlar könsfördelningen hos bläsand på övervintringslokaler eller under vårsträcket, varav två från Island, en från sydvästra Spanien och en från Tyskland. I Spanien var andelen hanar 53,2% (könskvot 1,14) på en övervintringslokal i slutet av vintern (Amat 1990). I Tyskland varierade andelen mellan 55% och 58% (Bezzel 1959). Vid en häckningslokal på Island innan häckningen hade inletts varierade andelen mellan 50% och 54% under en tjugoettårsperiod, tjugo av åren låg dock andelen mellan 50% och 52% (Gardarsson & Einarsson 1997). Det årsvisa medelvärdet var 51% (SD=1 procentenheter, könskvot 1,04) och det fanns ingen signifikant skillnad mellan åren i materialet (Gardarsson & Einarsson 1997). Det finns alltså små skillnader i könsfördelningen mellan de tidigare studierna och mellan dem och den aktuella från Angarnsjöängen, men från det existerande materialet är det inte möjligt att bedöma om dessa skillnader är signifikanta eller inte.

Utifrån vad som är känt om änders övervintringsvanor är det möjligt att skillnaden i könsfördelning i första hand mellan Tyskland och Spanien kan bero på att hanar generellt tenderar att övervintra på nordligare breddgrader än honor. Om så är fallet återspeglar arbetena från Island och Angarnsjöängen, vars uppgifter är inhämtade i nära anslutning till att häckningen ska inledas, bättre könsfördelningen i de häckande populationerna av bläsand och visar att det finns en viss skevhet i könsfördelningen hos arten.

Att uppgifterna från Island och Angarnsjöängen är inhämtade i nära anslutning till häckningen framgår av andelen parade fåglar. I Spanien var 53% av hanarna parade i slutet av februari (Amat 1990). Uppgifter från Island (Jonsson & Gardarsson 2001) visar att andelen parade honor ökar från hösten över vintern till våren eller når ett mättnadsvärde under vintern-våren. Av bläsandshonorna befanns 80–90 % vara parade i april (Jonsson & Gardarsson 2001). Med tanke på svårigheterna att bestämma andelen parade honor måste överensstämmelsen mellan uppgifterna från Island och Angarnsjöängen betraktas som god, 80–90% respektive ca 95%. Skillnaden i andel parade hanar mellan Spanien och Angarnsjöängen som föreligger svarar väl mot att andelen parade fåglar ökar ju närmare häckningsperioden man kommer.

Ovanstående uppgifter om könsfördelningen hos bläsand tyder på att det inte finns någon skillnad i könsfördelningen mellan olika populationer. Fåglarna som passerar Angarnsjöängen häckar N-NO om lokalen och deras övervintringsområde i stor utsträckning är skilt från den isländska populationens vinterkvarter (Cramp & Simmons 1977).

Uppgifterna från Angarnsjöängen visar att bläsandens könskvot är skev och att andelen hanar är större än andelen honor. Skevheten är dock inte särdeles stor. En jämförelse med uppgifterna från USA (Bellrose et al. 1961) visar att bläsand liksom dess släkting amerikansk bläsand *Anas americana* är bland de andarter som har den jämnaste könsfördelningen.

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Summary

The first report on skewed sex ratio in diving duck species was published already in the end of the 19th century (Payne-Gallawey 1882), and was followed by a number of similar publications in the 1930s and 1940s (Furniss 1935, McIlhenney 1937, 1940a & 1940b, Erickson 1943, Petrides 1944, Beer 1945, Yocom 1949). The results differed between studies, but it became clear that there seemed to be a surplus of drakes for many duck species. From the 1950–1960s there is a consensus that drakes are more numerous among ducks, especially among diving ducks, but that the fraction of males can differ at a locality due to season, geography and other factors, as several duck species have gender-specific timing of migration, moult migration and/or winter distributions (e.g. Lebret 1950, Bellrose et al. 1961, Salomonsen 1968).

I have compiled and analysed data on the sex ratio of the Eurasian Wigeon *Anas penelope* collected during the spring migration at a stopover site in south central Sweden. At lake Angarnsjöängen, I have noticed that the sex ratio of Eurasian Wigeons appeared to be less skewed than those of other numerous dabbling duck species, i.e. the Eurasian Teal *Anas crecca*, the Mallard *Anas platyrhynchos* and the Northern Shoveler *Anas clypeata*. Further motivation for conducting this study was the fact that wildfowl (Anatidae) are unique among migrating birds in that they form pairs already at the wintering grounds or during the migration itself. Thus, the sex ratio at Angarnsjöängen should be similar to the sex ratio in the breeding population, since this lake lies at the northern part of the species' spring migration.

Area and methods

Angarnsjöängen is a shallow euthropic, formerly drained lake situated 25 km NE Stockholm (59° 33´N, 18° 10´E). Its area is about 1.1 km^2. During the winter 1992/1993 an extensive restoration was made to improve the site as breeding ground and stopover site for wildfowl. The water level is regulated with the aid of a dam, to ensure that the site is flooded in spring and autumn. The lake is surrounded by a varied landscape with arable fields, grazed wet and dry meadows, a few deciduous groves and coniferous forest.

The wetland bird fauna has been surveyed each year since 1978. The surveys have been carried out in a similar manner since the beginning. The lake was surveyed once a week from around mid-April through early June. In this study, data is only used from the period when I have carried out the census work, i.e. from 1995 and onwards.

Even if the observations of Eurasian Wigeons in the lake cannot be considered as independent (birds may rest for more than a week, or being scored in more than one year) the data has been analysed by statistical methods in order to get an understanding of different conditions.

Results

The lake has been surveyed 100 times during the eleven year long study period, and Eurasian Wigeons were observed on 85 of these occasions. In total 2298 Eurasian Wigeons were observed, of these 1256 were drakes. (N_{April} = 1887; N_{May} = 365; N_{June} = 46). The migration phenology is shown in Figure 1. After a peak at around mid-April, the number of staging birds rapidly decreases. From mid-May and onwards the species appears irregularly and in low numbers in the lake. In the second half of May (May 16 and onwards), Wigeons have only been recorded in 12 out of 45 surveys and the number of staging birds have been low when present (average 2.4 Wigeons per survey).

The fraction of males recorded until the middle of May is with a few exceptions in the range of 50–60% (Figure 1). After this date, the fraction of drakes varies considerably and has been 100% at nearly half of the occasions. In the early phase of migration (April to mid-May) there is no correlation between the fraction of males and date (Spearman rank correlation $r_s = 0.16$, $n = 52$, $p = 0.27$).

Figure 2 shows the relationship between the fraction of males and the total number of birds in the lake, i.e. the flock size since in almost all cases the Eurasian Wigeons were found in the same part of the lake. Using the whole time series, there is a correlation between the fraction of males and the number of staging birds ($r_s = 0.36$, $n = 85$, $p < 0.001$). However, this correlation is spurious, since it is strongly influenced by the late data points in May, where the number of birds is low. Excluding data from the second half of May, there is no correlation between the fraction of males and the number of birds ($r_s < 0.01$, $n = 52$, $p = 0.97$). Neither was there any correlation between the fraction of males and date when the number of Eurasian Wigeons was at least 10 individuals per survey observation ($r_s = 0.27$, $n = 41$, $p = 0.09$), which is a reasonable criterion to determine when the spring migration is more or less over (compare with data in Figure 1). The nearly significant correlation is due to one

observation of eleven males, most likely on moult migration on June 9th, 2004. If this observation is excluded from the analysis there is no tendency to any correlation ($r_s = 0.21$, $n = 41$, $p = 0.19$).

The data compiled in Table 1 shows that the sex ratio changes in the middle of May. The number of pairs given in the table is to some extent uncertain due to that the Eurasian Wigeons at some survey had been disturbed which made it impossible to determine if the birds had paired or not.

In accordance with the data presented in Figure 1 and 2 there is no significant difference in the sex ratio between April and the first half of May ($\chi^2 = 1.01$ with Yates correction; df = 1, p = 0.32). There were significant differences between April and the whole of May, as well between April and the second half of May ($\chi^2 = 4.06$ with Yates correction; df = 1, p = 0.04 and $\chi^2 = 7.61$ with Yates correction; df = 1, p <0.001). Also the difference between the first and second half of May was significant ($\chi^2 = 4.33$ with Yates correction; df = 1, p = 0.04).

Observations made in April and the first half of May comprised of 53.4% of male Eurasian Wigeons, corresponding to a sex ratio of 1.15 males per female. At least 83% of the birds were paired during this period of time. Excluding survey occasions when disturbance had affected the behaviour of the birds, the number of paired Wigeons reached 90%. The females were paired to a larger extent than the drakes, 96% and 84% respectively.

The fraction of males did not differ between years in neither April nor April to mid-May (April: $\chi^2 = 4.95$, df = 10, p = 0.90; April – mid-May: $\chi^2 = 4.47$, df = 10, p = 0.92). The average male fraction for the period April to mid-May was 53.3% (SD=2.76 percent units). Nine of the years the fraction of males was 51–56% and only two years stood out: 1995 with 60% and 1997 with 49% males.

Discussion

The study shows that the sex ratio in the Eurasian Wigeon is fairly even in comparison with the sex ratio in other Anatinae species. The fraction of males was 53.3% and was relatively stable over the years at Angarnsjöängen. Furthermore, the sex ratio was independent of the number of resting birds in the lake during the main migration period. During the last half of May, only occasional birds were seen and most of these were males. I believe that these lone males mainly were late non-breeders and/or drakes on moult migration and that they are not representative of the general population. This is clearly seen when analyzing the data.

A possible criticism, would be that males are more conspicuous and easier to observe than females, or that the sexes differs in behaviour which translates into different detection rates. However, these are not very likely confounding factors given the large proportion of paired birds together with my extensive knowledge on the behaviour of birds at the site. The slightly skewed sex ratio cannot be ascribed to that females have not been detected to the same extent as males.

The seasonal variation in the sex ratio in the Eurasian Wigeon at Angarnsjöängen is in agreement with results from an extensive study of dabbling ducks in the USA (Bellrose et al. 1961), where there is a surplus of drakes and increasing fraction when the main period of migration is over.

In the literature, there are small differences between earlier studies and the present one. In Spain the fraction of males was 53% in February (Amat 1990), in Germany it varied between 55% and 58% (Bezzel 1959), and just before the breeding on Iceland the average was 51% (SD=1 percent unit, one year 54%, twenty years 50–52%) (Gardarsson & Einarsson 1997).

Thus, the fraction of paired birds in the data from Angarnsjöängen is in good agreement with the fraction found on Iceland, considering the difficulties associated with determining if a bird is paired or not. Therefore I believe that the sex ratio measured in Angarnsjöängen is a reliable predictor of the ratio in the larger population passing south central Sweden during spring. The figure could be used to contrast values from other dabbling ducks and be a starting point for assessing the ecological and evolutionary role of male-biased adult sex ratio in ducks.

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The spring migration of Grey Plover *Pluvialis squatarola* in Sweden

Vårflyttningen hos kustpipare *Pluvialis squatarola* över Sverige

SVEN BLOMQVIST, MARTIN GREEN & ÅKE LINDSTRÖM

Abstract

In 1976–1995, 74,650 Grey Plovers *Pluvialis squatarola* were recorded on spring passage, 87% in the southern third of Sweden, and 59% while in migratory flight. Few were observed before May. The passage peaked 24 May–2 June (83%). About one fourth of all birds were observed on a few occasions, when grounded by inclement weather, showing that only a tiny fraction stops over regularly. In northern Sweden, passage peaked earlier (18 May) than in the south (29 May), and these early birds were presumably destined for breeding or staging in the White Sea region. The peak dates in southern Sweden correlate well with arrival time in Siberia, indicating a non-stop flight to these breeding areas. Flocks counted up to several hundred birds in the south but at most 34 birds in the north. Migration patterns along the East Atlantic Flyway were similar with those of the East African/West Asian and Mediterranian/Black Sea flyways. The spring passage of the Grey Plover conforms to the migration system of other tundra waders passing up through the western Palaearctic.

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Introduction

In spring, large numbers of Palaearctic waders migrating along the Eurasian route of the East Atlantic Flyway gather in the Wadden Sea area, before departing for their breeding grounds in northern Europe and Russia (Piersma et al. 1987, Prokosch 1988, Smit & Piersma 1989, Meltofte et al. 1994). When leaving this stopover area, the birds fan out along different flight routes, heading north to east. By its size and geographic position on the Scandinavian Peninsula, latitudinally extending from 55° N to 69° N, Sweden offers favourable opportunities for migration studies of this contingent of birds in Northwest Europe (Blomqvist & Lindström 1992, 1995, Green et al. 2003). There are no major staging areas for spring migrating arctic waders within Sweden, but vast numbers are known to pass. A well developed national system of organised bird reporting, based on local and regional ornithological societies, in combination with a network of bird observatories where regular observations are recorded, further facilitates such migration studies (Blomqvist & Lindström 1996).

So far, the spring occurrence in Sweden of five Arctic-breeding wader species has been analyzed: Red Knot *Calidris canutus* (Blomqvist & Lindström 1992), Sanderling *C. alba*, Little Stint *C. minuta*, Curlew Sandpiper *C. ferruginea* (Blomqvist & Lindström 1995) and Bar-tailed Godwit *Limosa lapponica* (Green et al. 2003). In the present paper, we describe the spring migration of another Arctic-breeding wader, the Grey Plover *Pluvialis squatarola*, for which much is still unknown concerning the composition of the migrating population, migration routes, regional movements and wintering areas (Pienkowski & Evans 1984, Smit & Piersma 1989, Byrkjedal & Thompson 1998, Exo & Stepanova 2001, Branson 2002).

We describe the geographical pattern and timing of the Grey Plover spring passage over Sweden, based on an extensive data set of Grey Plover observations from almost the whole country (Figure 1), including a long-term series of records from a

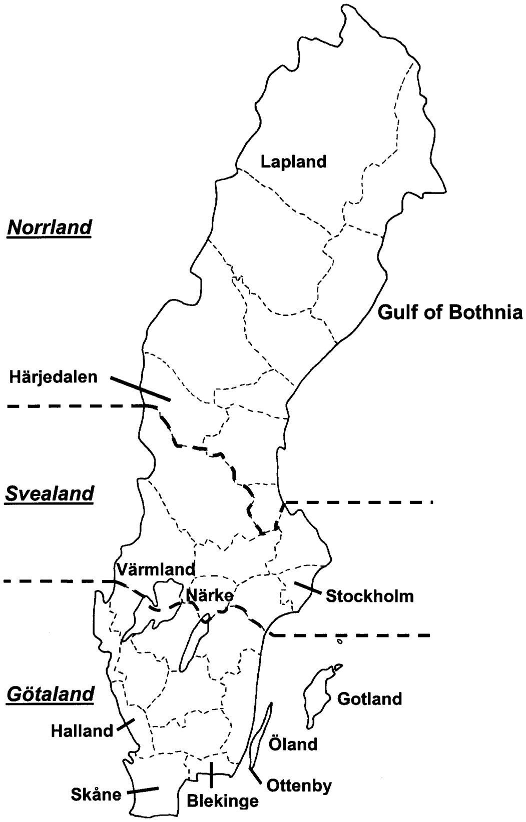

Figure 1. Map of Sweden with regional report areas, and the different provinces/counties mentioned in the text. The three large regions of Götaland, Svealand and Norrland, respectively, are separated by thick broken lines.
Karta över Sverige med de olika rapportområdena. Områden och regioner som omnämns i texten anges med namn.

single site (Ottenby), starting in the 1940s (Svärdsson 1947). We then compare the spring migration pattern of the Grey Plover with that of the previously analysed arctic wader species (Blomqvist & Lindström 1992, 1995, Green et al. 2003).

Breeding, distribution and migration

Breeding range

Grey Plovers observed in West Europe follow the Eurasian route of the East Atlantic Flyway. These birds are considered monotypic (Byrkjedal & Thompson 1998, but see Engelmoer & Roselaar 1998), and breed in the tundra zone from the western White Sea, and eastward over the Yamal, Gydan and Taimyr peninsulas (Beloposkii et al. 1970, Mineyev & Impe 1997, Byrkjedal & Thompson 1998). Birds ringed and recovered along the flyway support this view (Branson & Minton 1976, Prokosch 1988, Meltofte 1993, Exo & Wahls 1996, Byrkjedal & Thompson 1998, Exo & Stepanova 2000, Tomkovich et al. 2000, Branson 2002). However, the breeding range of the species extends farther east throughout arctic Siberia, via the Far East and Alaska, all the way to Baffin Island in northern Canada (Paulson 1995, Byrkjedal & Thompson 1998). The nesting habitat is mainly arctic heath tundra of dry hills, intersected by moister sections (Flint & Kondratjew 1977, Rogacheva 1992, Paulson 1995, Byrkjedal & Thompson 1998, Exo & Stepanova 2000).

Breeding regulation

The annual variation in breeding productivity of Grey Plover observed in the Wadden Sea (Prokosch 1988), in South Africa (Underhill 1987, Martin & Baird 1988) and in southeastern India (Balachandran et al. 2000) has been attributed to a cyclic interaction between lemmings and their predators on the tundra. These predators switch to eggs and young of ground-nesting birds in years following lemming peaks, and thereby affect the nesting success and the avian population dynamics (Summers et al. 1998, Blomqvist et al. 2002, and references therein). It is worth noticing that Grey Plovers following the East Atlantic Flyway do not breed until they are two or three years old, and therefore remain in the wintering habitat throughout the first summer (Prokosch 1988), and perhaps also the following summer (Dijk et al. 1990).

Wintering areas

In Sweden, a few observations of Grey Plovers have been reported in winter from the southwestern provinces of Scania (Skåne) and Halland (Roos 1962, Ekberg 1994, SOF 2002). Scattered winter observations are likewise reported from the southern coast of the Baltic Sea proper (Berndt 1984, Nehls & Struwe-Juhl 1998, Brenning 2001), but most Grey Plovers winter in areas of more benign climate. In winter during the 1980s, about 61,000 Grey Plovers were found along the European Atlantic coast, 23,000 in the western part of the Mediterranean Sea, and 81,000 birds in West Africa (Smit & Piersma 1989).

Population increase

Since the early 1950s, the breeding area of the Grey Plover has expanded westward in the European part of Russia, and the population has increased (Mineyev & Impe 1997). The species showed a spectacular increase in wintering numbers in British estuaries from the 1930s to the 1990s (Moser 1988, Tubbs 1991, Cayford & Waters 1996, Rehfisch et al. 2003). The Grey Plover population along the Continental Atlantic seaboard of West Europe has been reported to have increased strongly (Rösner 1994, Smit & Zegers 1994, Stroud et al. 2004, Blew et al. 2005a). Compared with the 1980s (Smit & Piersma 1989), the number of Grey Plover wintering along the Atlantic coast of Europe in 1997–1999 had increased to 90,000–100,000, while in the western part of the Mediterranean fewer birds (9,000–13,000) were found (Gilissen et al. 2002). The recorded increase may be due, at least partly, to a northward shift in the distribution of wintering birds, but most data indicate a true population growth to 247,000 birds in the East Atlantic Flyway (Stroud et al. 2004). However, it should also be noted that some decreases in spring staging numbers have lately been registered in the German part of the Wadden Sea (Günther & Rösner 2000, Blew et al. 2005a, b).

Northward migration

In West Africa, the Grey Plover is mainly found on the Banc d'Arguin in Mauritania (Trotignon et al. 1980, Gowthorpe et al. 1996, Smit 2004), and in the Arquipélago dos Bijagós in Guinea-Bissau (Zwarts 1988, Salvig et al. 1994, Frikke et al. 2002), but also as far east as Ghana (Ntiamoa-Baidu & Grieve 1987, Ntiamoa-Baidu 1991). Starting end of April, the Grey Plover departs from West Africa (Piersma et al. 1990), and passes successively up along the North Atlantic coast. Some birds are also reported from inland sites of Continental West Europe, but in fairly low numbers, i.a., in France (Le Mao 1980), and different cantons of Switzerland (Glutz von Blotzheim 1963, Baula & Sermet 1975, Schmid et al. 1992) and federal states of Germany (Dathe 1949, Harengerd & Mester 1966, Wüst 1966, Müller 1967, Harengerd et al. 1973). The largest spring gathering of Grey Plover (140,000 birds) occurs in the Wadden Sea in May (Meltofe et al. 1994). A recent study of the body mass of the birds departing from the North Sea area at the end of May (Serra et al. 2006), concludes that sufficient fuel is stored to allow Grey Plovers to fly non-stop to the Siberian breeding grounds in western Taimyr.

Material

Data collection

Our data cover the whole of Sweden, and originate from three main sources: (1) the regional report committees of the Swedish Ornithological Society, (2) direct communication with certain observers and observatories, and (3) literature searches, chiefly in local and regional ornithological bulletins. Observations from the time period of 1 March to 20 June were included in the analysis. As in the earlier analyses of the spring migration of arctic waders in Sweden (Blomqvist & Lindström 1992, 1995, Green et al. 2003), the bulk of the material is from the time period of 1975–1995, but some records from the period before 1975 are also included.

Replies were received from all 30 regional report committees in Sweden (Figure 1). These committees compile records reported voluntarily by ornithologists. Spring observations of the Grey Plover were reported to most of the regional committees, except that at times it was considered too common in north Halland, Öland and Gotland. From Halland observations were available from two bird observatories (Getterön and Nidingen), and from Gotland large flocks and migration count data have been reported. Hence, for most of the period studied (1975−1995), we believe that the data set fairly well reflects the spring occurrence of the Grey Plover in Sweden. Furthermore, a single observation series of 48 years (1947−1994) from the Ottenby Bird Observatory on the island of Öland, allowed an analysis of long-term trends.

To avoid double counts of birds within localities, all records were carefully assessed. Birds staying for longer periods at a stopover site were entered with the first date of observation. Hence, reported figures represent the minimum number of birds observed. All figures refer to the total number of Grey Plovers observed during an approximate 20-year period, unless otherwise stated. In the diagrams, the observations have been lumped into three-day periods. For details of the statistical tests used, see Sokal & Rohlf (1995).

Results

Spring observations of the Grey Plover were reported from all regional committees, except Härjedalen (Figure 2). In all, 74,650 Grey Plovers were

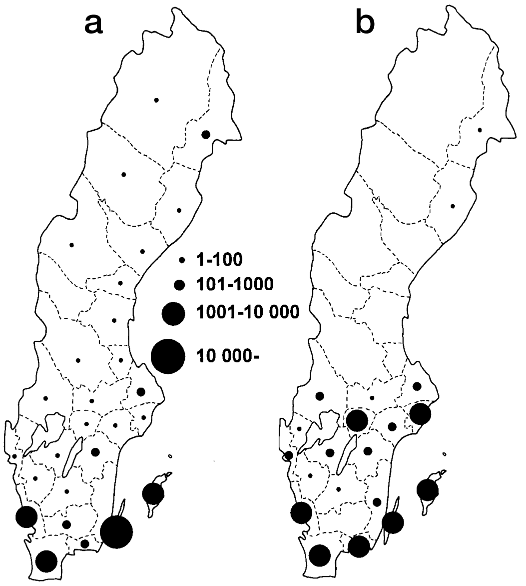

Figure 2. Geographic distribution of the total number of the Grey Plover *Pluvialis squatarola* observed in Sweden in spring (n = 74,650), separated into birds at stopovers (a) and on migration (b).
Den geografiska fördelningen av det totala antalet rapporterade kustpipare under våren i Sverige (n = 74.650), fördelat på rastande fåglar (a) och sträckande fåglar (b).

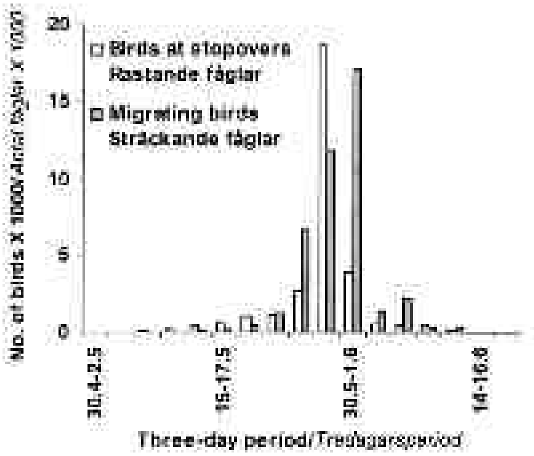

Figure 3. Number of the Grey Plover *Pluvialis squatarola* recorded during spring in Sweden. Median date for the grand total is 29 and 30 May, respectively (n = 74,650).
Tidsmönster för rapporterade kustpipare under våren i Sverige. Mediandatum för hela materialet är 29 respektive 30 maj (n = 74.650).

reported in Sweden during spring, mainly from the end of May to early June (Figure 3). Most (59%) were seen while in active flight, the rest on the ground (Figure 2). Yearly totals varied greatly, from 550 to 16,000 birds (Figure 4a).

Regional differences in bird numbers

The distribution of Grey Plovers observed in Sweden varied much between the three regions of Götaland (87%), Svealand (12%) and Norrland (<1%), respectively (Figure 5). The overwhelming majority of the Grey Plovers were reported from coastal marine areas of the southern third of the country. Small numbers were reported from inland areas of south Sweden in most years, in certain years reaching over one hundred birds. About 3% of the national grand total, in one year (1991) over 900 birds, were reported from the area of large lakes in south central Sweden, mainly in the provinces of Värmland and Närke.

In the east coast county of Stockholm, migration of Grey Plover was observed almost yearly, usually of less than a hundred individuals, but in 1992 ca. 1000 birds were reported. In all, 7% of the national grand total was recorded in the county of Stockholm. Most of the birds reported from Norrland were observed along the coast of Gulf of Bothnia.

Differences in geographical distribution were found between Grey Plovers recorded at stopovers and birds seen in flight (Figure 2 and 5). Large numbers of birds (>50) on the ground were recorded only in the five southernmost coastal provinces. Among these, Halland, Skåne and Öland were the only provinces regularly holding Grey Plovers at stopovers (Cederlund 1985, Wirdheim 1985, Ekberg 1994, Green 2003). On a few occasions, large numbers of birds were reported to halt temporarily in the southeastern parts of Sweden, when encountering headwind of gale force in combination with rain. Such situations occurred in 1976, with about 4500 birds at Öland 27–30 May (Breife 1976) and 800 birds at Gotland 27–29 May, and in 1987, with about 7050 birds at Öland 29–30 May, 1200 birds at Gotland 28–29 May and 300 birds in Blekinge 29–30 May (Waldenström 1987, Hedgren 1988). Also, on the last mentioned dates large numbers of low-altitude migrating birds (4500) were observed in Blekinge. These observations (25% of all birds recorded) show that only a tiny fraction of the passing Grey Plovers regularly use Sweden for stopover.

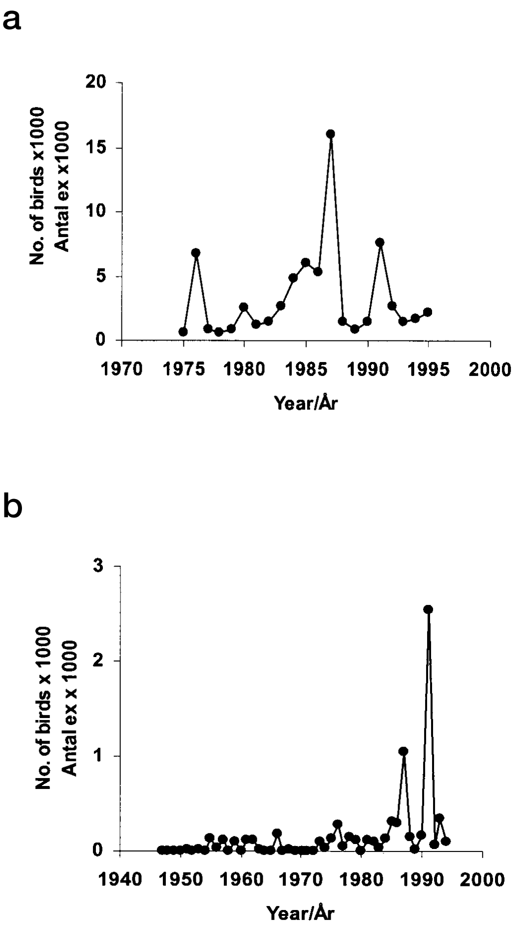

Figure 4. Annual spring number of the Grey Plover *Pluvialis squatarola* recorded (a) in Sweden 1975–1995 and (b) at Ottenby 1947–1994.

Årliga antal kustpipare som rapporterats från (a) Sverige under tidsperioden 1975–1995 och (b) Ottenby 1947–1994.

General time pattern

Grey Plovers turned up along the coasts of southernmost Sweden from the first week of May (Figure 5). In total, 6192 birds (8% of the national grand total) were observed before 24 May (Figure 3), mostly in the provinces of Halland, Skåne and Öland. The migration of Grey Plover in Götaland (Figure 5) peaked sharply in the last days of May and first days of June, with a concentration of 62,000 birds (83% of the national grand total) observed within the 10 day period of 24 May–2 June. Only a few birds were seen thereafter. A distinct peak applied to resting birds (median date 29 May), as well as those observed migrating (30 May). These dates are close to the median date (28 May) recorded for Grey Plovers resting and migrating in Svealand, although the birds observed in Svealand were somewhat less concentrated in time (Figure 5). However, in the region of Norrland the passage of Grey Plovers took place earlier than in the south; median date in Norrland was as early as 18 May, and here most (79%) passed before 24 May (Figure 5).

The number of birds passing before 20 May increased significantly at Ottenby during the 48-year period of 1947–1994 (Spearman's rank correlation r_s=0.51, n=48, p=0.002), but no significant trend in early numbers observed was recorded for the shorter 20-year period 1975–1994 (r_s=0.22, n=20, p=0.35). However, for the period of 1975–1995, there was a tendency towards increase over time in lumped numbers of recorded Grey Plovers (before 20 May) in the provinces of Skåne and Halland (r_s=0.41, n=21 years, p=0.07).

Flock size

Grey Plovers recorded in the first week of May appeared singly, or in groups of a few individuals. Later, the flock sizes and the number of large flocks increased in south Sweden, culminating in the 10-day peak period starting on May 24. In Norrland, Grey Plovers appeared singly, or in groups of up to maximally 34 individuals.

The data did not allow a thorough analysis of flock sizes since such information was only rarely provided. Nevertheless, considering 120 detailed records from Götaland, 16 from Svealand and 13 from Norrland, flock sizes ranged from single birds up to 925 individuals. The latter flock was seen at Klåvudden, Lake Vättern in Närke, on 28 May, 1991. In Götaland, the median number of birds per observation (flock size) was 47 birds, in Svealand 78 individuals, and in Norrland the median number was one bird. Flocks of >50 birds were observed only in Götaland and Svealand, during the end-of-May to early June peak.

Population trends

In the period of 1975–1995, the number of Grey Plover observed in Sweden varied between 550 birds in 1975 to 16,000 birds in 1987 (Figure 4a), but with no statistically significant overall trend (Spearman's rank correlation r_s = 0.34, n=21 years, p=0.13). However, if the three highest annual

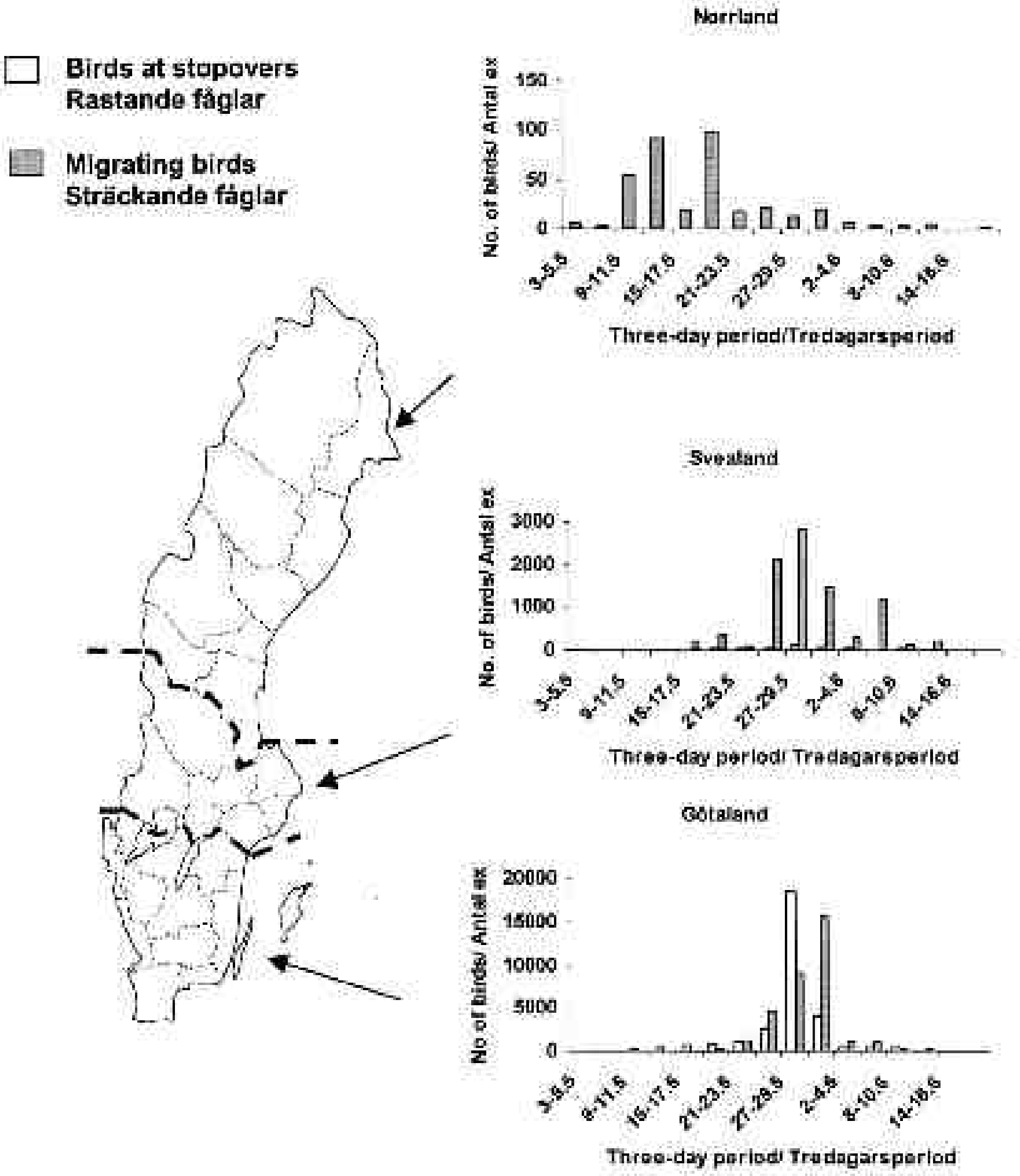

Figure 5. Time patterns in spring occurrence of the Grey Plover *Pluvialis squatarola* in three regions of Sweden (for regional median dates, see text).
Tidsmönster i vårupppträdandet av kustpipare i tre olika regioner i Sverige (för mediandatum för de olika regionerna, se texten).

spring values (1976, 1987 and 1991—all related to extraordinary heavy grounding by inclement weather conditions) were excluded, a statistically significant increase appeared ($r_s = 0.50$, $n = 18$ years, $p= 0.03$).

In the longest time series (Ottenby 1947–1994), the annual spring numbers varied from a handful up to 2500 birds in 1991 (Figure 4b). A correlation analysis of this time series revealed a highly significant overall increase in the number of birds observed ($r_s = 0.62$, $n = 48$ years, $p < 0.001$). However, for the period of 1975–1994, corresponding to the period analysed for the whole country, no significant change in numbers with time were recorded at Ottenby ($r_s = 0.22$, $n = 20$ years, $p = 0.34$).

Finally, we tested whether the variation in annual number of Grey Plovers passing Sweden in spring, as represented by the long-term series from Ottenby (Figure 4b), was related to variation in predation pressure driven by the lemming cycle (Blomqvist et al. 2002), in the preceding breeding season in Taimyr. We assumed that either first summer birds (one-year old) or both first and second summer birds (one–two years old) remain in the winter quarters. However, neither with one nor two years delay did we find a significant correlation between the number of birds in the focal year versus the predation pressure (Appendix 2 in Blomqvist et al. 2002) in any of these previous years (r_s= -0.02, $n = 38$ years, $p = 0.90$ with first summer birds staying in the winter quarters, and $r_s = -0.28$, $n = 38$ years, $p = 0.09$ if also second summer birds stay in the wintering area).

Discussion

In spring, the Grey Plover is a conspicuous species, easy to identify in flight, and by its typical loud call. Therefore, we feel confident that the spatial and temporal migration pattern compiled for the 74,650 birds observed during more than 20 years (Figure 2–5) fairly well reflects the general, overall spring passage of the Grey Plover over Sweden (Figure 6). If anything, the number of birds recorded in Norrland is comparatively low (Figure 5), in part due to relatively low density of observers (cf., Olsson & Wiklund 1999). Such a bias should, however, not influence the temporal pattern found.

Numerical occurrence

The total number of Grey Plover ($n = 74,650$) reported over ca. 20 years in Sweden, is about 30% of the estimated population size ($n = 247,000$ birds) following the East Atlantic Flyway (Stroud et al. 2004). During roughly the same period of years, proportionally fewer birds, 19%, were reported in the Bar-tailed Godwit: 160,300 individuals reported in Sweden (Green et al. 2003) out of two passing populations together amounting to 825,000 birds (Smit & Piersma 1989). In the Siberian Red Knot (*C. c. canutus*), with 55,000 birds recorded (Blomqvist & Lindström 1992) out of 570,000–750,000 spring migrants passing each year (Gudmundsson 1994), the observed fraction is 7% to 10%. In the Sanderling, with only 1939 birds reported during 20 years (Blomqvist & Lindström 1995), out of an estimate of some 50,000 Sanderlings passing (Meltofte et al. 1994), the fraction is merely 4%. Finally, for the smallest species analysed the proportions are even lower: about 1% in the Little Stint (n=1851; Blomqvist & Lindström 1995) out of 174,000 wintering birds along the East Atlantic Flyway (Smit & Piersma 1989), and only 0.2% in the Curlew Sandpiper (n=675; Blomqvist & Lindström 1995) out of 416,000 birds in the same flyway (Smit & Piersma 1989).

Several factors, often in combination, might affect the fraction of birds observed, such as conspicuousness and use of different migration routes. The

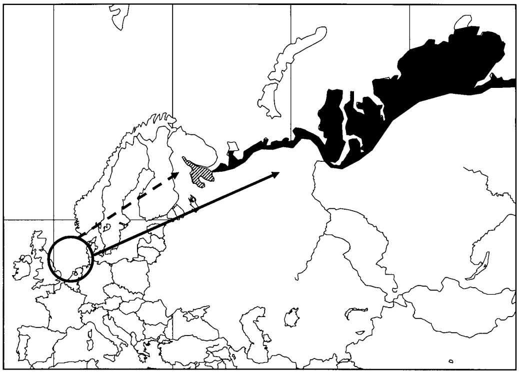

Figure 6. Spring routes of the Grey Plover *Pluvialis squatarola* migration from the Wadden Sea to staging posts/breeding grounds in the White Sea (grey; Belopolskii et al. 1970), or directly to the main breeding areas (black), i.e., east of the White Sea to the Yamal, Gydan and Taimyr peninsulas (Mineyev & Impe 1997, Byrkjedal & Thompson 1998). Most (79%) of the former birds (dashed arrow) passed Norrland 10–23 May, whereas in the latter group (solid arrow) 83% passed southern Sweden principally 24 May–2 June. Map projection: Mercator.

Vårflyttningsrutter för kustpipare från Vadehavet till rast- och häckningsområdena vid Vita havet (streckad pil), respektive häckningsområdena österut till Taimyr (heldragen pil).

proportion of Grey Plover recorded in flight (59%) versus seen on the ground at stopover sites (41%; Figure 3) is fairly similar to the likewise large and visually conspicuous Bar-tailed Godwit, where two thirds of all reported birds in Sweden were seen on the ground (Green et al. 2003), but contrasts to the Red Knot, where stopover is only accidental (Blomqvist & Lindström 1992). Also, the loud, whistling call of the Grey Plover may make them easier to recognize than the more silent Bar-tailed Godwit and Red Knot. Many Little Stints and Curlew Sandpipers, and similarly some Sanderlings, wintering in West Africa follow a more continental eastern (trans-African) route of homeward migration (referred in Blomqvist & Lindström 1995). Thereby, the number of birds passing Sweden is reduced, and fewer small waders are observed. Large birds are easy to detect in flight, while small waders have mostly been seen on the ground in Sweden (Blomqvist & Lindström 1995), which certainly indicates an under-representation of the latter group.

Flock size

Some large and even very large flocks of Grey Plovers pass Sweden in spring. The largest flock size in the present data was 925 individuals. Previously, large flocks have been reported from the Baltic proper, for instance 500–600 birds on 27 May 1962 at the islands of Öja (Landsort) (Blomberg 1963), ca. 150 birds on 29 May 1955 (Norbeck & Melin 1955), and 100 birds on 27 May 1965 (Höjer 1967) at the island of Gotska Sandön. Inland a flock of about 300 Grey Plovers were seen near Kristinehamn (in Värmland) on 29 May 1937 (Samuelsson 1954). From the province of Skåne, a median flock size of 150 birds (range 17–250) has been reported (Green 2004). All in all, based on data of the present study and several previous reports from Götaland (Roos 1961, Höjer 1967, Hedin et al. 1969, Jönsson et al. 1990, Green 2003, 2004) and Svealand (Blomberg 1963, Betzholtz & Swenzén 1992, Tjernberg 1996), it is evident that flocks of up to 100 Grey Plovers (at times even several hundred birds) regularly pass southern Sweden, whereas in Norrland groups of some twenty or thirty individuals are found, with single birds the most frequent observation.

Population trends

The long-term increase in total number of spring migrating Grey Plover observed at Ottenby in the period of 1947–1994 (Figure 4b) agrees with a general long-term increase in the number of birds found wintering in the United Kingdom from the 1930s to the 1990s (Moser 1988, Tubbs 1991). The steady increase in number of birds recorded in our data set from 1977 to the peak year of 1987 (Figure 4a) coincides with a prominent annual increase in wintering numbers of birds reported from the United Kingdom (Prŷs-Jones et al. 1994), and accords with a reported increase from the Dutch Wadden Sea in the time period 1977 to the beginning of the 1990s (Smit & Zegers 1994). Likewise, autumn migration data of the Grey Plover in Denmark (Blåvandshuk) seem to reflect a population increase in 1965–2003 (Meltofte et al. 2006).

A considerable increase (almost 50%) in the number of Grey Plovers wintering in coastal areas of the European East Atlantic Flyway is reported from the mid-1980s to the early 1990s (Davidson 1998, Stroud et al. 2004). These population growths coincide with a period of mild winter climate in Northwest Europe (Hurrell 1995, Watkinson et al. 2004, Austin & Rehfisch 2005). Therefore, Stroud et al. (2004) suspected that the higher winter number of Grey Plover in Northwest Europe, at least partly, reflected a shift in wintering grounds rather than a true population increase. However, the large number of birds passing Ottenby during this time period (Figure 4b), seems likely to reflect a real increase in the total number of Grey Plovers following the East Atlantic Flyway, since only a redistribution of wintering areas would not result in a higher number of birds transiting the migration route upward the Wadden Sea, while the field activity at the Observatory has been roughly constant. Moreover, the long-term tendency of an increase in number of early passing Grey Plover agree with similar reports for the Bar-tailed Godwit in southern provinces of Sweden (Green et al. 2003), suggesting that arctic waders adjust the timing of their spring passage to climate change (cf., Vähätalo et al. 2004). These tendencies give high scientific priority to further studies of the timing of spring migration in Arctic-breeding waders in relation to climate change, as indicators of large-scale climate change effects (cf., Lindström & Agrell 1999, Rehfisch & Crick 2003, Piersma & Lindström 2004).

We found no correlation between the spring numbers of Grey Plover in Sweden versus the lemming-driven three year cyclicity of the predation pressure in Siberia when considering the time-lags of two to three years spent in wintering quarter and migration areas, before they for the first time transit Sweden upon returning to the Russian breeding areas (Prokosch 1988, Dijk et al. 1990). This lack of correlation with lemming cyclicity contrasts to those reported on spring staging birds in the Wadden Sea (Prokosch 1988), in wintering birds in South Africa (Underhill 1987, Martin & Baird 1988), and likewise in southeastern India (Balachandran et al. 2000). Also worth noticing, is that years of late spring and slow thaw in Taimyr, such as in 1989 and 1992 (Syroechkovski & Lappo 1994, Stock & Bruns 1995, Kokorev & Kuksov 2002), plausibly resulting in very poor breeding success, seem not to result in a consistent change in the number of birds observed in Sweden (Figure 4).

Comparison with other tundra breeding waders

The two-peak temporal distribution pattern of spring migrating Grey Plover in Sweden (Figure 5) is found also in two other wader species passing Sweden in this season, namely the Red Knot and the Bar-tailed Godwit. All three species show a peak in mid-May in Norrland, and a much more prominent peak at the end-of-May to early June in southernmost Sweden (Blomqvist & Lindström 1992, Green et al. 2003, this study).

The mid-May peak of the Grey Plover now recognized in Norrland (median 18 May; Figure 5) is close in time to that reported for Nearctic-breeding Red Knot (*C. c. islandica*) passing the same area (median 16 May; Blomqvist & Lindström 1992), as well as the European population (*L. l. lapponica*) of the Bar-tailed Godwit (13–14 May; Green et al. 2003). These three similar-sized wader species, migrate through northern Sweden at about the same time, but with different final destination. The Red Knots head for transit staging areas in North Norway (Strann 1990, 1992, Blomqvist 1991, Wilson et al. 2006), before entering a non-stop, trans-oceanic flight to the New World (Davidson et al. 1986, Uttley et al. 1987, Wilson & Strann 2005). The Bar-tailed Godwits are mainly bound for breeding areas in the tundra of northern Fennoscandia (Green et al. 2003). Grey Plovers passing northern Sweden in mid-May are presumably en route for staging posts in the White Sea area, where they are reported to arrive around 22 May (average of 19 years; Belopolskii et al. 1970). This arrival matches nicely the recorded mean passage of 18 May in Norrland (Figure 5).

The end-of-May peak of Grey Plover in southern Sweden (median 28–30 May; Figure 5) coincides with the time of departure of the species from the Wadden Sea (Prokosch 1988, Meltofte et al. 1994), and with the peak of birds recorded staging at the south-west coast of the Baltic Sea proper in 1976–1999 (Brenning 2001). The passage schedule matches fairly well with a reported arrival date of 6 June from breeding areas in western Taimyr (Hötker 1995). The end-of-May passage of the Grey Plover in southern Sweden also coincides with the migration peak of other wader populations destined for breeding grounds on the Taimyr Peninsula, or perhaps even farther eastward, such as the Afro-Siberian Bar-tailed Godwit (*L. l. taymyrensis*) (28–30 May; Green et al. 2003), the Sanderling (29 May) and the Curlew Sandpiper (29 May–3 June) (Blomqvist & Lindström 1995). The Siberian Red Knot peaks about 10 days later (median 8 June; Blomqvist & Lindström 1992). In the Little Stint, the spring migration culminates already 24 May (Blomqvist & Lindström 1995), possibly reflecting a somewhat earlier spring arrival in breeding areas southwest of Taimyr.

Parallelism of flyways

The Grey Plover also winters and migrates up along the East African/West Asian–Mediterranean/Black Sea flyways (*sensu* Stroud et al. 2004), although winter counting from East Africa (Summers et al. 1987, also Bregneballe et al. 1989), the Persian Gulf (Zwarts et al. 1991, Have et al. 2002), and the Mediterranean region (Smit 1986) give a lower total number than for the East Atlantic Flyway (Stroud et al. 2004). The East African/West Asian–Mediterranean/Black Sea flyways merge near the Black–Azov seas (Summers et al. 1987, Smit & Piersma 1989, Kube et al. 1998, Stroud et al. 2004), a conclusion supported by ringing recoveries of the Grey Plover (Korzukov 1991, Serra et al. 2001).

Interestingly, the timing of spring migration is very similar in Grey Plovers following the East Atlantic Flyway and the East African/West Asian–Mediterranean/Black Sea flyways. From the end of April, the Grey Plover starts leaving West Africa (Piersma et al. 1990), and passes successively up along the European Atlantic coast, via Portugal (Rufino & Araujo 1987), Spain (Galarza 1984, Becerra & Pajuelo 1985, Dominguez & Rabuñal 1991), France (Bredin 1985, Girard 1989) and Holland (Dijk & Wassink 1980). Analogously, Grey Plovers in East Africa (Pearson & Britton 1980, Pearson & Serra 2002), at the Persian Gulf (Hirschfeld 1994) and in the southern and eastern Mediterranean region – in Tunisia (Berk & Have 1990, Ruiters 1993), Egypt (Berk & Have 1990), southern Turkey (Have et al. 1988, Berk & Have 1990, Berrevoets et al. 1994) and in northeast Greece (Nobel et al.

1990) – starts migrating north mainly in the end of April and first or second week of May.

Farther north, in the area of the Black and Azov seas, such as the Kizilirmak Delta in Turkey (Hustings et al. 1994), the Dobrodgea-Danube area in Romania (Brehme et al. 1992, Schmitz et al. 2001) and the Sivash lagoon system in Ukraine (Berk & Have 1990, Winden et al. 1993), the occurrence of Grey Plovers appears to culminate in the third week of May to first five days of June. This timing is in parallel with the end-of-May to early June peak in the southern Baltic Sea area (Figure 5). Finally, as further parallels, the remaining flight distance to the breeding grounds from the Wadden/Baltic seas and Black/Azov seas when following the East Atlantic and the Mediterranean/Black Sea flyways is quite similar (2500–4500 km and 3000–4500 km, respectively), and no major stopover sites are known farther up along any of the two migration routes.

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Sammanfattning

Sverige ligger geografiskt väl till för att studera det vårsträck av arktiska vadare som går från Vadehavet (Nederländerna, Tyskland, Danmark) upp mot den nordvästeuropeiska och sibiriska tundran. Denna artikel följer på tidigare redovisade arbeten om våruppträdandet av arktiska vadararter i Sverige, d.v.s. kustsnäppa *Calidris canutus*, sandlöpare *C. alba*, småsnäppa *C. minuta*, spovsnäppa *C. ferruginea* och myrspov *Limosa lapponica* (Blomqvist & Lindström 1992, 1995, Green et al. 2003).

Kustpiparens utbredning, flyttning och antal

Endast en population kustpipare förekommer regelbundet i Europa (Byrkjedal & Thompson 1998). De häckar på tundran från Vita havet till Taimyrhalvön. Arten förekommer även vidare österut i Sibirien, ända bort till arktiska Kanada, men dessa fåglar berör inte Västeuropa.

Häckningsframgången hos tundralevande fågelarter varierar starkt mellan åren, ofta relaterat till lämlarnas cykliska förekomst i häckningsområdena. När det finns få lämlar ger sig lämmelätande predatorer på fåglars ägg och ungar med svag reproduktion som följd. Goda lämmelår lyckas vadarna bättre (Summers et al. 1998, Blomqvist et al. 2002). Kustpiparna häckar inte förrän de uppnått två eller tre års ålder och stannar fram tills dess i sina vinterkvarter.

Senaste uppskattningen av antalet kustpipare som flyttar via Västeuropa uppgår till 247.000 fåglar (Stroud et al. 2004). Dessa övervintrar från Västafrika i söder till Vadehavet och Storbritannien i norr. I Sverige ses arten endast i enstaka exemplar om vintern (SOF 2002). I slutet av april börjar kustpiparna lämna Afrika och passerar sedan successivt upp längs Europas västkust (Piersma et al. 1990). Den största koncentrationen av kustpipare påträffas i Vadehavet under maj månad (140.000 fåglar; Meltofe et al. 1994). Vikterna hos dessa fåglar indikerar att de sedan flyger non-stop till sina häckningsområden (Serra et al. 2006).

I denna uppsats beskriver och analyserar vi kustpiparens vårflyttning över Sverige, baserat på observationer från ett förnämligt system av lokala rapportkommittéer, fågelstationer och enskilda observatörer (Blomqvist & Lindström 1996).

Material och metoder

Insamling av data

Våra data härstammar framför allt från svar på förfrågningar hos landets 30 regionala rapportkommittéer (rrk, Figur 1), men också från direkta kontakter med vissa observatörer och fågelstationer, samt litteratursökning i nationella och regionala tidskrifter. Observationer från 1 mars till 20 juni under i huvudsak perioden 1975–1995 har analyserats. Alla vårobservationer har tidigare genomgående begärts in av rapportkommittéerna, förutom i Halland, på Öland och Gotland. För dessa landskap finns dock observationer från fågelstationer, av större flockar och från enstaka observatörer. Från Ottenby har vi analyserat observationsdata från perioden 1947−1994.

Resultat

Uppgifter om observerade kustpipare fanns från alla rapportområden utom Härjedalen (Figur 2). Så mycket som 59% av fåglarna sågs förbiflygande, medan resten iakttogs rastande. Flest kustpipare observerades i slutet av maj och början på juni (Figur 3, 5). Sammanlagt rapporterades 74.650 kustpipare, inom intervallet 550 till 16.000 individer per år (Figur 4a).

Regionala skillnader i uppträdande

Fynden fördelade sig med 87% i Götaland, 12% i Svealand och mindre än 1% i Norrland (Figur 2). Övervägande mängden fåglar sågs längs kusterna. Omkring 3% av samtliga observerade fåglar (som mest drygt 900 individer år 1991) rapporterades nära de stora sjöarna i Mellansverige (Värmland och Närke). I Stockholmstrakten sågs arten årligen (7% av samtliga observationer), med som mest 1000 fåglar år 1992. Större antal rastande fåglar sågs endast i de sydligaste landskapen, framför allt då fåglarna tvingats ner av mycket dåligt sträckväder. Så mycket som 25% av alla observerade kustpipare i Sverige sågs vid några sådana väderbakslag, vilket tyder på att kustpiparna normalt undviker att rasta i Sverige.

Tidsmönster och flockstorlekar

De första enstaka fåglarna dök upp i Sydsverige första veckan av maj (Figur 3, 5). Flyttningen i Götaland kulminerade i slutet av maj, med 83% av hela Sveriges totalsumma observerad under tiodagarsperioden 24 maj till 2 juni, med mediandatum 28 maj för rastare och 29 maj för förbiflygare. Sträcket i Norrland kulminerade tidigare än i Sydsverige, med mediandatum 18 maj (Figur 5).

Tidsserien 1947–1994 från Ottenby visar att antalet kustpipare som passerat före den 20 maj ökat. En tendens till tidigare passage finns även för perioden 1975–1995 från Skåne–Halland.

De tidigaste kustpiparna uppträdde ensamma eller i små grupper. Flockarna var som störst när sträcket kulminerade i slutet av maj, som mest sågs 925 fåglar i en flock (Klåvudden vid Vättern, 1991). I Norrland sågs ingen flock med mer än 34 individer.

Populationstrender

Ingen statistiskt säkerställd förändring kunde påvisas i antal observerade kustpipare i Sverige under perioden 1975–1995, med mindre än att tre extremår (1976, 1987, 1991) uteslöts ur observationsserien (Figur 4a). Vid Ottenby ökade antalet observerade fåglar under perioden 1947–1994 (Figur 4b), dock påträffades inte heller här någon statistiskt säkerställd trend för perioden 1975–1994, d.v.s. då observationsdata även finns från övriga Sverige.

Antalet kustpipare förväntades variera i antal mellan åren gentemot lämmeltillgången. Inget samband kunde dock påvisas mellan antalet fåglar sedda vid Ottenby om våren och lämmelförekomsten på den ryska tundran åren före.

Diskussion

Troligen motsvarar de rapporterade fåglarna förekomsten i Sverige i stort, även om Norrland på grund av sin lägre täthet av ornitologer säkert är underrepresenterat i observationsmaterialet. Dock bör detta inte påverka artens tidsmässiga uppträdande.

Antal och geografiskt mönster

Om man delar antalet observerade kustpipare (74.650) med den förmodade populationsstorleken (247.000) erhålls ett relativt andelsmått på artens förekomst om 30%. För de andra arterna som vi redovisat tidigare (Blomqvist & Lindström 1992, 1995, Green et al. 2003) skulle motsvarande andel vara 19% för myrspov, 7–10 % för kustsnäppa, 4% för sandlöpare, 1% för småsnäppa och 0,2% för spovsnäppa. Större vadararter upptäcks således proportionellt oftare än mindre former. Här spelar naturligtvis både storlek och ljudlighet in. I fallen med små- och spovsnäppor påverkas den fåtaliga vårförekomsten av att dessa arter väsentligen passerar söder och öster om Sverige.

Tendensen med ökande antal kustpipare som observerades tidigt om våren i södra Sverige under senare år är ett fenomen i linje med vad som rapporterats hos myrspov (Green et al. 2003), och indikerar att artiska vadare under tidsperiod med mildare klimat kan tidigarelägga vårflyttningen.

Populationstrender

Tendensen mot ökat antalet observerade kustpipare i Sverige under åren 1975–1995 (om de tre extremåren uteslutits) är intressant (Figur 4a). Och en långsiktig ökning av antalet fåglar sedda vid Ottenby under perioden 1947–1994 (Figur 4b) stämmer väl överens med artens generella ökning på vinterlokaler på Brittiska öarna och i Nederländerna. Denna sentida ökning beror till del på mildare vintrar. Vi fann inte ett förväntat samband mellan predationstryck på tundran och antalet kustpipare räknade vid Ottenby. Troligen går det inte att dra några slutsatser av artens uppträdande vid Ottenby för enskilda år, medan däremot den funna långtidstrenden med ökande antal observerade fåglar bör vara relativt tillförlitlig (Figur 4b).

Jämförelse med andra tundrahäckande vadare

Kustpiparens tvåtoppiga förekomst i Sverige (tidig topp i Norrland, sen topp i Sydsverige, Figur 5) återfinns även hos två andra nordliga vadare, nämligen myrspov och kustsnäppa. Märkligt nog betyder detta mönster olika saker i de tre fallen. Toppen i mitten av maj för kustsnäppa gäller de fåglar (*C. c. islandica*) som via rastplatser i Nordnorge skall vidare till grönländska och eventuellt kanadensiska häckningsplatser (Blomqvist & Lindström 1992). För myrspov gäller det fåglar (*L. l. lapponica*) som är på väg till sina Nordskandinaviska häckningsområden (Green et al. 2003). I kustpiparens fall är det fåglar på väg till häckplatser vid Vita havet (Figur 6), alternativt rastning inför vidare flygning österut.

Sträcktoppen i södra Sverige (mediandatum 28–29 maj) sammanfaller med avflyttningsdatum från Vadehavet (Prokosch 1988, Meltofte et al. 1994), men också med ankomstdatum till häckningsområden (Hötker 1995). Sträcket sammanfaller också väl med det av andra vadare på väg mot den ryska tundran. Motsvarande mediandatum för myrspov (*L. l. taymyrensis*) är 28–30 maj (Green et al. 2003), sandlöpare 29 maj och spovsnäppa 29 maj –3 juni (Blomqvist & Lindström 1995). De sibiriska kustsnäpporna (*C. c. canutus*) är dock betydligt senare (8 juni; Blomqvist & Lindström 1992) och småsnäpporna något tidigare (24 maj; Blomqvist & Lindström 1995).

Parallella flyttningsvägar

De kustpipare som häckar längre österut i Asien flyttar från vinterkvarter i södra, östra och nordöstra Afrika, upp via Persiska viken och Svarta havet. Detta sträck pågår i stort sett parallellt med, och på ett snarlikt vis som, flyttningen från Västafrika via Nordeuropa (över Sverige) till västra Rysslands tundra (Figur 6). I slutet av april bryter nämligen kustpiparna upp från Västafrika och Östafrika och söker sig successivt upp mot rastplatserna i Vadehavet respektive Svarta havet. Dessa rastområden lämnas i månadsskiftet maj–juni för non-stop-flygningar om 250 till 450 mil till häckningplatserna på tundran.

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Distribution and population changes of two subspecies of Chiffchaff *Phylloscopus collybita* in Sweden

Utbredning och populationsutveckling hos två raser av gransångare Phylloscopus collybita *i Sverige*

ÅKE LINDSTRÖM, SÖREN SVENSSON, MARTIN GREEN & RICHARD OTTVALL

Abstract

We describe the breeding distribution and population trends of the two subspecies of Chiffchaff *Phylloscopus collybita* that occur in Sweden. Our data come from the Swedish Bird Survey: free choice point counts (1975–2006) and fixed (and habitat-representative) line transects (1996–2006). *Ph. c. abietinus* occurs north of about 60ºN with a stronghold in central Sweden and along the coast of the Bothnian Bay. This population declined with about 75% between 1983 and 1997, but has increased again during the last decade, matching closely the changes in Finland. *Ph. c. collybita*, a recent immigrant, breeds mainly in southwesternmost Sweden. The population in 2006 was estimated to be 15 times larger than in 1975 but with little range expansion. The breeding distribution of the two subspecies does not yet overlap. The distribution of the northern subspecies seems to be determined by the occurrence of spruce forest, and the northern range border may be set by early autumn frost. The recent positive trend in the north may possibly be due to an increase in area of old spruce forest.

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Introduction

The Chiffchaff *Phylloscopus collybita* occurs as a breeding bird in Sweden with two subspecies (Svensson et al. 1999).

In northern Sweden Chiffchaffs belong to the subspecies *Ph. c. abietinus* (Nilsson 1819, SOF 2002). This subspecies is distributed from Norway to the Pechora River and the Ural mountains. It prefers old and rich spruce forests with interspersed deciduous trees (Svensson et al. 1999, Lapshin 2000). *Ph. c. abietinus* grades into the western and southern subspecies *Ph. c. collybita* through Poland and Ukraine (Tiainen & Wesolowski 1997). Berggren (1999) and Olsson & Wiklund (1999) reported strong declines between 1975 and 1998 in Västerbotten and Norrbotten (the northeasternmost provinces of Sweden) based on census work, ringing statistics and general observations. A similar decline took place over the same period in Finland (also *abietinus*), but there numbers started to increase again from 1998 onwards (Väisänen 2006). There is ambiguous evidence about the population trends further east, but there seems to be a common pattern of a rather strong decline between the early 1980s and the late 1990s (Lapshin 2000, Sokolov et al. 2000).

In southern Sweden the species is represented by the nominate subspecies *Ph. c. collybita* (SOF 2002), whose range includes western and southern Europe apart from the range of the Iberian Chiffchaff. The latter is now considered a separate species *Phylloscopus ibericus* (Svensson 2001). *Ph. c. collybita* occurs in a broader variety of habitats than *abietinus* and is often found in pure deciduous forests (Svensson et al. 1999). Although Ekman (1922, p. 133, 167) talks about “the Skåne population” and “a southern range in Skåne”, and although breeding records exist from that southernmost province in 1898–1899 (Hedeby 1918), the Chiffchaff is a late newcomer. The first recent breeding was reported as late as the early 1970s from southernmost Sweden (Dahlman 1974, Svenaeus 1978, Ellegren & Pettersson 1985). During the Swedish atlas work in 1974–1984 (Svensson et al. 1999) there were many records of Chiffchaffs in various parts south of 60°N. However, records belonging to the category “confirmed breeding” were restricted to the very south and very west of southern Sweden. The atlas work was carried out from early spring, so many of the records in central south Sweden may have referred to *abietinus* males that were singing during migration. According to the latest national evaluation, the area between the two subspecies is still not colonised to any substantial degree (SOF 2002). However, the number of southern Chiffchaffs in southern Sweden has increased substantially as expressed in ringing figures at bird observatories in southern Sweden like Ottenby (Håkansson & Rhönnstad 1993, Lindström et al. 2006) and Falsterbo (Karlsson et al. 2002).

The aim of this paper is to describe in detail the recent population trends of the two subspecies in Sweden and for the first time provide a quantitative distribution map based on one geographically representative census method. To do this we use Swedish breeding bird monitoring data from 1975–2006. We also discuss some potential causes of the population changes found.

Methods

The data presented here are based on two programmes included in the Swedish Bird Survey (Lindström & Svensson 2007), a monitoring scheme within the Environmental Monitoring Programme of the Swedish Environmental Protection Agency. Chiffchaffs are not determined to subspecies in the field and it is not known exactly where the present border between the two subspecies' breeding distributions is. However, based on the geographical distribution of breeding Chiffchaffs in the Breeding Bird Atlas (data from 1974–1984; Svensson et al. 1999) and from SOF (2002), we considered all birds recorded south of 60ºN as *collybita* and all records north of 60ºN as *abietinus* (see also Hansson et al. 2000). The exact choice of border will have no or very little effect on the overall conclusions.

Free choice routes

This programme started in 1975 and consists of several hundred routes, each with 20 point counts (Svensson 1975, Naturvårdsverket 1978). At each point all birds heard or seen were counted during five minutes. We used the sum of all birds observed at each route for our analyses. The geographical location of the routes and the exact position of the points were chosen by the observer. Observer-chosen routes are likely to be biased, on a regional scale to populated areas and on a local scale to areas close to roads and paths. How and if this sampling bias affects trends we do not know. A given route was censused once a year by the same observer at a route-specific date (± 5 days) and starting hour (±30 minutes). Routes abandoned by one observer were not taken over by a new observer and therefore the number of years a route was counted varied between 1 and 32. Point count data were used for trend analyses only.

Fixed routes

A new monitoring programme was started in 1996 (Svensson 2000, Svensson & Lindström 2002). A total of 716 routes are systematically distributed over the whole of Sweden, with 25 km between the centres of near-by routes in both north–south and east–west directions. Each route is 8 km long and shaped like a square with 2 km sides so that the census person returns to the starting point at the end of the census. All birds seen or heard along the 8 km transect were counted and we used the sum of all birds per route for our analysis. Many routes have been shorter than 8 km because some parts are over water bodies. Five minute point counts were also made each one km, but these data are not used in this analysis. The aim is to census each route once a year at a date adapted to its latitude and elevation. The southernmost routes were carried out from mid May to early June with average dates gradually changing towards the north. The northernmost routes were counted between mid June and early July.

In contrast to the free choice routes the observer of a fixed route may change between years. Data from the fixed routes were used for analyses of both trends and breeding distribution. Since the number of routes censused in 1996–1997 was comparatively low, we only used data from 1998 onwards for the trend analyses. For the breeding distribution analysis we used the data from all eleven years.

Trend analyses

Population trends were calculated using TRIM (TRends and Indices for Monitoring data; Pannekoek & van Strien 2001), a statistical package developed especially for monitoring data of the kind we have. TRIM analyses time series of counts with missing observations using Poisson regression taking serial correlation and overdispersion into account. We used the ”time-effect model” to estimate overall trends as well as yearly indices. For more information, see Pannekoek & van Strien (2001).

We did not look for observer or site effects. For the fixed routes the sampling scheme as such will take site effects into account. To allow for direct comparison between the two monitoring programmes we used 1998 as baseline year (index set to 1) for the nine years with parallel data.

Breeding distribution and densities

As an index of breeding density we used the yearly average number of Chiffchaffs observed on a given route. This means that for each route the density estimate is based on censuses from between one and eleven years. Since the fixed routes are systematically distributed over Sweden, the number of birds reported is proportional to the breeding densities in different regions and habitat types. The number of birds observed will vary not only due to variations in bird numbers, but also depend on weather and observer differences. Therefore routes censused many years, and averages from many nearby routes, will give more precise estimates of abundance than values based on single routes and years. How accurate these estimates are (in relation to true breeding density) we do not know, but we assume that the accuracy level does not vary systematically over Sweden.

Route coverage

In 1975–2006 the number of free choice routes censused in the two regions varied between 13 and 71 in the north and between 61 and 241 in the south. The overwhelming majority of counts were made in early mornings between 10 May and 20 June, but the total span of dates ranges from early April to early August.

The yearly number of fixed routes that were censused increased steadily over the period, from 48 in 1996, via 86 in 1997, 166 in 1998 to 411 in 2006. A total of 2855 censuses were carried out. With few exceptions the censuses south of 60°N were carried out between 15 May and 15 June, and those north of that latitude between 25 May and 25 June. Some routes in the Scandinavian mountain ridge were censused later in summer, but no Chiffchaffs breed in those areas. From about 2002 and onwards the southern half of Sweden was almost completely covered each year with proportionally fewer routes being censused in the north (Lindström & Svensson 2007). In 1996–2006 the fixed routes in northern and southern Sweden were censused on average 3.1 and 5.8 times, respectively. All routes within the regular breeding distribution of Chiffchaffs were censused at least once. The variation in number of routes censused in different years in a given scheme is taken into account in the TRIM analyses.

Results

The following data form the basis for our analyses. A total of 2656 northern and 1536 southern Chiffchaffs were recorded along the free choice routes. For the fixed routes, a total of 1459 northern and 393 southern Chiffchaffs were counted in 1996–2006, forming the basis for the distribution data. The trend estimates for the fixed routes in 1998–2006 were based on 1404 northern and 387 southern birds.

Breeding distribution

The data from the fixed routes show two distinct breeding areas for Chiffchaffs in Sweden, one in the very south and one in central Sweden (Figure 1).

North of 60°N, the yearly averages per route varied between 0 and 15 birds. The main distribution is in east central Sweden, that is, the provinces of Hälsingland, Medelpad, Jämtland and Ångermanland, with a marked presence of Chiffchaffs also in adjacent parts of Dalarna, Västerbotten and Norrbotten.

South of 60°N, the average number of Chiffchaffs per route varied between 0 and 6.2. The stronghold is in Skåne (the southernmost province), but there is also a continuous distribution along the western and southern coasts. The rest of the area south of 60°N had a more scattered and irregular occurrence of Chiffchaffs.

The design of the fixed route scheme assures that at a national level habitats and region are censused in proportion to their size. Assuming that birds of different subspecies, and birds in different habitats, are detected in equal proportion to their actual abundance, we have estimated the proportion of the two subspecies in Sweden. Should all 716 routes have been censused in a year and we found the same average abundance of Chiffchaffs per route as recorded in 1996–2006, we would have found 423 (standard deviation 27.4) birds in northern Sweden and 56 birds (s.d. 9.9) in southern Sweden. This means that in the period 1996–2006 about 88% of the Swedish Chiffchaffs were *abietinus* and 12% were *collybita*.

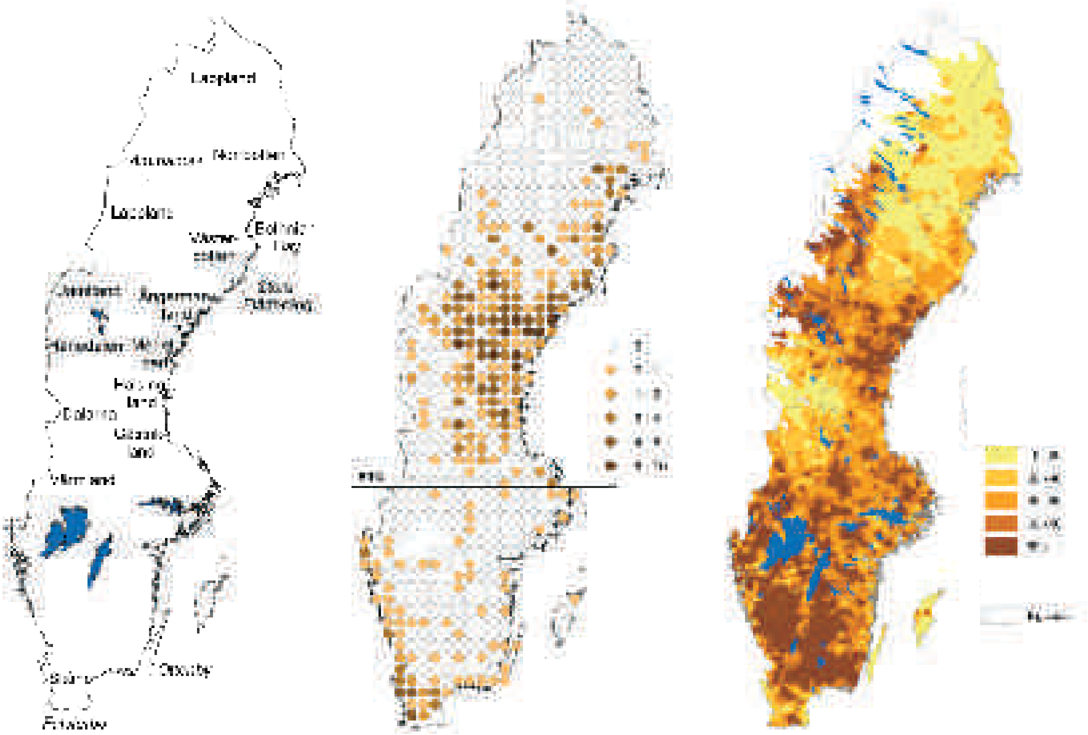

Figure 1. Left. Map of Sweden with regions and sites (circles, name in italics) mentioned in the text. Middle. The average number of Chiffchaffs recorded per fixed route in Sweden 1996–2006. Each route censused at least once is marked with a circle. The number of censuses per route varied between 1 and 11 and the number given is the yearly average number of Chiffchaffs recorded. The interval classes are set so that an average of 1.00 birds per route belongs to the class ”0–1”. An average of 1.01 belongs to ”1–2”, etc. Right. The volume (m^3/ha) of spruce in Sweden 1999–2003. Source: Swedish National Forest Inventory.

Vänster. Karta över Sverige med platser och områden nämnda i texten. Mitten. Antalet gransångare noterade på de svenska standardrutterna 1996–2006. Varje rutt som inventerats minst en gång är markerad med en cirkel. Antalet gånger en rutt inventerats varierar mellan 1 och 11. Det är medelantalet gransångare noterade för dessa inventeringar som anges. Intervallen är lagda så att medelvärdet 1,00 faller inom intervallet ”0–1” och medelvärdet 1,01 faller inom ”1–2”, osv. Höger. Volymen levande gran (*m^3/ha*) *i Sverige 1999–2003. Källa: Riksskogstaxeringen.*

Trends

The northern Chiffchaff declined with on average 3.6% per year between 1975 and 2006 (TRIM, $p<0.001$, Figure 2), although there was a clear shift towards a positive trend from 1997 onwards. In the period 1975–1997 the decline was about 75%, with the most dramatic loss occurring between 1983 and 1997 (75% also for this period). The increase in 1997–2006 amounted to about 85%, but the numbers are still way below the values from around 1980. A similar recent increase was seen in the fixed routes 1998–2006, amounting to an average of 6.8% per year (TRIM, $p<0.001$, Figure 2) and a total increase of about 50%.

For the southern Chiffchaff the trends were overall positive in both programmes (Figure 2). Over the 32 years with point counts there was an average yearly increase of 9.7% (TRIM, $p<0.001$), amounting to a total increase of about 1400% (the indices increased from about 0.1 to about 1.3). It is noteworthy that the increase started first in 1985. For the shorter period 1998–2006 the fixed routes showed an increase of 11.9% per year (TRIM, $p<0.001$), leading to a total increase of 150% (indices increased from about 0.8 to 2). The corresponding increase based on point counts in the same period was 6.3 % per year (TRIM, $p<0.001$) and a total increase of about 60%.

Discussion

Distribution

Our data on the breeding distribution of Chiffchaffs in Sweden builds on a coarse net of routes (25 km between routes). Therefore, conclusions about local abundance from individual routes cannot be drawn with any certainty. However, at a larger scale the data are likely to be more representative. Generally, the distribution found accords well with earlier distribution maps, although these were basically presence/absence maps (e.g. Svensson et al. 1999, SOF 2002). However, this is the first time that relative densities are shown, emphasizing the drastic differences between different parts of the country and providing a new and better picture of the species' occurrence in Sweden.

Ph. c. abietinus. The distribution of the northern subspecies in the last decade is more restricted than earlier reported (SOF 2002), now forming an almost triangular (∇) shaped area in central Sweden. The densities in Värmland, westernmost Härjedalen, Jämtland and southern Lappland were much lower than indicated in SOF (2002). Furthermore, the particularly high density described for southern Dalarna (SOF 2002) finds only weak support in our data. Rather, the highest densities in Sweden, according to our study, are found in Ångermanland. This partly new picture of the subspecies' distribution may be due to recent changes, but is more likely a result of more and better data being available due to our representative census methods.

The subspecies' distribution in northern Sweden closely coincides with the areas with the largest volumes of spruce (Figure 1). In much of the main breeding area of northern Chiffchaffs, spruce make up 50% of total tree volume (Source: Swedish National Forest Inventory). This gives further strong support to the general notion that the northern Chiffchaff is tightly connected to spruce (when translated, the Swedish name for the Chiffchaff is "Spruce Warbler"). It is not clear whether it is the spruce as such that is important for Chiffchaffs or the generally denser structure of spruce forest as compared to the more open pine *Pinus* forests (Lars Edenius, *pers. comm.*). It is noteworthy that in the spruce-dominated area northwest of the triangular Chiffchaff distribution area (northernmost Jämtland and southernmost Lappland), there are comparatively few Chiffchaffs. We do not know if this area differs in habitat quality for Chiffchaffs (the forest may be less dense), but there are climatic differences between the areas.

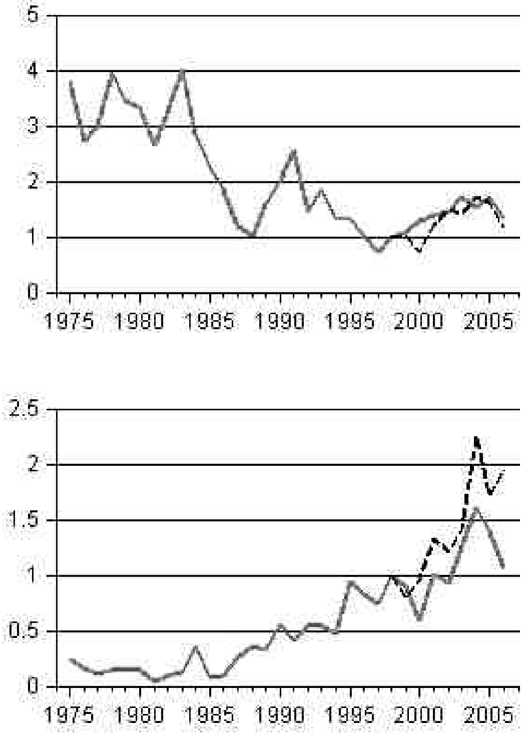

Figure 2. Population trends of Chiffchaffs in Sweden according to the free choice routes 1975–2006 (solid line) and the fixed routes 1998–2006 (stippled line). The graphs refer to Chiffchaffs north (upper) and south (lower) of 60°N, respectively. The population index is set to 1 for 1998.
Populationsutvecklingen hos gransångare i Sverige enligt punktrutterna 1975–2006 (heldragen linje) och standardrutterna 1998–2006 (streckad linje). De två figurerna visar gransångare norr (övre) respektive söder (undre) om 60°N. Populationsindex 1998 har satts till 1.

The main distribution area of northern Chiffchaffs coincides with a relatively mild belt across central Sweden and coastal northern Sweden, where the first autumn frost comes on average between 1 and 15 September (Source: Swedish Meteorological and Hydrological Institute). But only a short distance north and inland of this belt, where there is plenty of spruce but no Chiffchaffs (Figure 1), the first night frost comes already 14 days earlier. Possibly this early frost is the explanation of the *abietinus* range limitation towards the north and west. For comparison, young Bluethroats *Luscinia s. svecica* (a small insectivorous bird) near Ammarnäs, a climatically harsher area north of the *abietinus* range (Figure 1), start leaving their breeding grounds already in early August. This coincides with the first frost in that area (1–15 August) and the birds leave with only small amounts of fuel (Lindström & Lind 2001). The same patterns hold for all the small insectivorous birds in the Ammarnäs area (Åke Lindström, pers. obs). When experimentally fed the Bluethroats are able to accumulate fat, suggesting that food shortage is a key factor surprisingly early in the season (Lindström et al. 1985, 1990, Hansson 1997). Whether northern Chiffchaffs, being smaller than Bluethroats, are so sensitive to a harsh climate that it explains their northern range limit remains to be investigated. The larger Bluethroat is a ground living bird feeding on invertebrates in the forest floor litter whereas the Chiffchaff is a leaf gleaner. Possibly, the effect of frost is stronger on insects and spiders in the trees than on invertebrates in the litter.

The most enigmatic question is rather why the northern subspecies has not expanded southwards. There is clearly plenty of spruce forest in south Sweden that at least superficially seems suitable for northern Chiffchaffs. Several Swedish species consists of a southern and a northern subspecies, for example Yellow Wagtail *Motacilla flava*, Sedge Warbler *Acrocephalus schoenobaenus*, Willow Warbler and Common Redpoll *Carduelis flammea*, where the two subspecies are assumed to have colonized Sweden from two different directions following the last glaciation (SOF 2002). The Yellow Wagtail and the Willow Warbler have closed the gap between the two subspecies creating hybrid zones, and the Sedge Warbler is probably about to do it (cf. the maps in Ekman 1922, p. 92, and Svensson et al. 1999, p. 391). As far as northern Chiffchaffs are concerned, Ekman (1922) wrote that it was impossible to understand why a bird that thrived in Poland and southern Russia would not do so in southern Sweden unless the southern limit of the range in Sweden was a result of its immigration history. Today we know that the *collybita* subspecies was well adapted to the conditions of southern Sweden as soon as it got a foothold, albeit not in the southern spruce forests.

Ph. c. collybita. The southern subspecies has its stronghold in Skåne and to some degree the coastal areas of southern and western Sweden. In contrast to the habitat selection of its northern conspecifics it seems to avoid the dense spruce forests of southern Sweden (Figure 2). This fits well with the notion that the southern Chiffchaffs strongly prefer deciduous forests (Svensson et al. 1999).

There is some other information about how the distribution of southern Chiffchaffs has changed since the first occurrence in southernmost Sweden in the 1970s. An ongoing repeat of the breeding bird atlas in Skåne (the southernmost province of Sweden) has revealed that the subspecies now occurs in high numbers over much of the province, while 20–30 years ago it was found mainly along the very coast and in much lower numbers (Martin Green, unpublished data). Over the same period in nearby Denmark, the subspecies went from covering half of the country to occupying almost every corner (Grell 1998). The expansion is a part of a process that has been going on south of Scandinavia for a long period of time (invasion of Schleswig-Holstein c. 1850 and southern Denmark at the end of the 19th century; review in Bauer et al. 2005). From this respect the colonization was expected. It is quite possible that the invasion of southern Sweden could have come long ago if only the first immigrants had happened to form a viable population. Ekman's (1922) "Skåne population" may have been an attempt that failed not because it did not find suitable habitats but simply due to stochastic mortality.

It is difficult to judge what the few and scattered observations in central south Sweden, outside the main distribution areas, represent (Figure 1). Most likely the migration of northern birds has passed when the censuses are carried out in late May and early June. The median passage date of northern Chiffchaffs at Ottenby Bird Observatory in southeasternmost Sweden is already around 1 May (Håkansson & Rhönnstad 1993). Therefore the birds observed during the censuses are most likely southern birds. However, given that none of the routes had Chiffchaffs in all the years the route was censused (all yearly averages were below one), the population in general must be small and not very stable. In line with this view SOF (2002) describes central south Sweden as almost devoid of breeding Chiffchaffs. Thus, although we have possibly had a slow spread northward and eastward in Sweden the last decades and a strong population increase (Figure 2), it is clear that the two populations have not yet met to any substantial degree. It is possible that the large coniferous forests of southern Sweden to this date have formed an expansion barrier.

Hansson et al. (2000) compared birds from Skåne and Central Sweden and found them not only to be morphologically different but also that males (in playback experiments) reacted differently to population-specific song. This implies that if and when they meet they may behave as two separate species.

Population trends

Both populations of Chiffchaffs in Sweden clearly have undergone pronounced changes in population size the last decades (Figure 2).

Ph. c. abietinus. The strong long-term decline of the Chiffchaff population in northern Sweden, Finland and further east, amounting to the very same 75% in both Sweden and Finland (Väisänen 2006), has yet to be explained. Equally unexplained are the remarkable trend shifts that occurred almost simultaneously in Sweden and Finland (1997–1998), when the declines turned into strong increases. Further support for such a trend shift comes from ringing figures at Stora Fjäderägg ringing station, a coastal site just east of the main breeding areas, where the trend in trapping figures in autumn closely match the breeding bird survey data (Lars Edenius, pers. comm.).

Olsson & Wiklund (1999) suggested that the decline in the 1980s and 1990s may at least in part have been due to the loss of older spruce forests in their area (Västerbotten), but also recognized that seemingly optimal and untouched habitats had lost their Chiffchaffs in this period. We compiled information about the temporal trend in the amount of thicker (older) spruce trees within the main breeding areas of the northern Chiffchaff (Figure 3, Source: Swedish National Forest Inventory). When looking at the total volume of larger spruce trees, being either 20, 25 or 30 cm or more in diameter, there is no overall loss of large trees coinciding with the population decline of the Chiffchaff in the period 1983–1997. However, this is only one of many factors influencing the breeding habitat quality of the Chiffchaff and therefore cannot be taken as evidence that the availability of large spruce trees is not important. There was indeed an increase in the volume of larger trees between the last two periods, coinciding with the Chiffchaff population recovery, but if there is a biological connection remains to be investigated. Another data set gives the total area of old forest (all tree species, but mainly spruce and pine) in the boreal parts of Sweden, that is, the northern two thirds of Sweden (Figure 4, Source: Swedish National Forest Inventory). Although this data set is less specifically applicable to Chiffchaffs (it includes a larger geographical area and all forest types), it is nevertheless interesting to see that a decade's decline in the total area of old forest from mid 1985 onwards turns into a significant increase from about 1993. This is just a few years before the shift in population trend of the northern Chiffchaff.

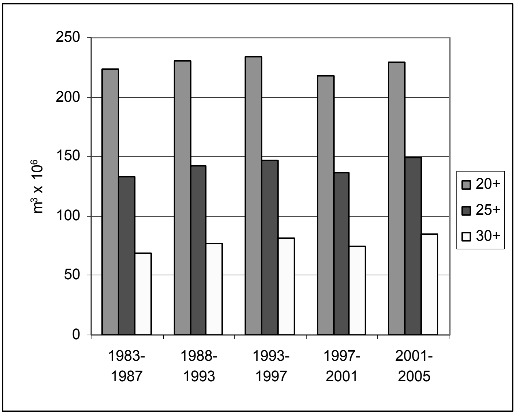

Figure 3. The volume of spruce trees (millions of m^3) in the area of Sweden where the northern Chiffchaff breeds (see Figure 1). The area includes Norrbotten and Västerbotten, Jämtland, Härjedalen, Ångermanland, Medelpad and Hälsingland. Values are five-year averages, for trees with 20, 25 and 30 cm diameter or more, respectively, starting at the time of the main population decline of Chiffchaffs (see Figure 1). Source: Swedish National Forest Inventory.
Volymen levande gran inom det område som är den nordliga gransångarens huvudområde, nämligen de kustnära delarna av Norrbotten och Västerbottens län, hela Jämtlands och Västernorrlands län, samt landskapet Hälsingland (Figur 1). Värdena är fem års medelvärden, för granar med 20, 25 respektive 30 cm diameter eller mer, från och med den tidpunkt när gransångarens minskning började. Källa: Riksskogstaxeringen.

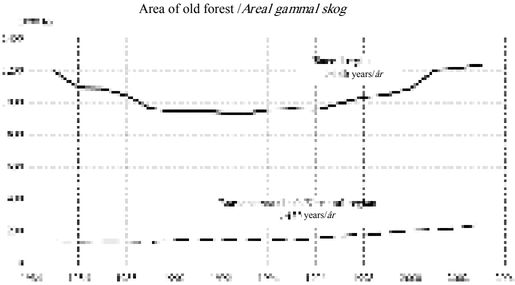

Figure 4. The area of old forest (more than 140 years, all tree species, millions of m^3) in boreal Sweden (approximately the northern half). Values are sliding five-year averages. It is noteworthy that there is a trend shift from decline to increase around 1993, a few years before the shift in population trend of the northern Chiffchaff. Source: Swedish National Forest Inventory.
Arealen gammal skog (>140 år, alla trädslag) i de boreala delarna av Sverige (Norrland, samt Dalarnas, Värmlands och Örebro län). Värdena är löpande fem års medelvärden. Notera att mängden gammal skog börjar öka i norra Sverige runt 1993, några år innan gransångarkurvan vänder uppåt. Källa:Riksskogstaxeringen.

Local habitat change, as expressed in the forest data above, cannot easily explain the population dynamics of *abietinus* Chiffchaffs and it is likely that also other factors are at play. The parallel trends in northern Sweden and Finland (cf. Väisänen 2006), and possibly in a still larger part of northeastern Europe (Lapshin 2000, Sokolov et al. 2000), hints at large scale factors being important. This could be a change in climate or of habitat quality along the migration routes or in the wintering grounds.

We know very little about the ecology of northern Chiffchaffs outside the breeding period. Actually, even the migration route and wintering grounds of northern Chiffchaffs have yet to be established. The ringing recovery maps of *abietinus* for Sweden (Fransson & Hall-Karlsson in press), Norway (Bakken et al. 2006), and Finland (Zink 1973) are suggestive but inconclusive. There are several recoveries hinting at an easterly component during autumn migration for *abietinus* in contrast to the more westerly component of migration in the southern *collybita* Chiffchaffs. Thus, there may be a migratory divide between the subspecies similar to the one found in the two Scandinavian subspecies of Willow Warblers *Phylloscopus trochilus* (Bensch et al. 1999). How far the birds migrate is also not really known. There are a few recoveries within and just south of the Sahara of birds that probably were *abietinus*. Since so little of the migration ecology is known we refrain from speculating in migration-related causes of population change in *abietinus* Chiffchaffs.

Ph. c. collybita. The numerical increase in *collybita* Chiffchaffs in southern Sweden has amounted to several hundred percent in just two to three decades. A recent local breeding bird census at Kullaberg in northwestern Skåne, the area where the first Chiffchaffs were found to breed (Dahlman 1974), showed that the numbers of Chiffchaffs had increased from 10 to 107 between 1974 and 2004 (Peterz & Rellmar 2007). In Denmark, also inhabited by *collybita* Chiffchaffs, the population increased with 6% per year from 1976 to 2004, a total increase of about 500% (Heldbjerg 2005). We know that this follows a long-term expansion from the southwest (Bauer et al. 2005), but the reasons behind this dramatic range expansion and increase in numbers of *collybita* Chiffchaffs are not known.

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Sammanfattning

Gransångaren *Phylloscopus collybita* företräds i Sverige som häckfågel av två raser. I norra Sverige finns *Ph. c. abietinus* som föredrar gammal och rik granskog med visst lövinslag. För denna ras rapporterades kraftiga minskningar mellan 1975 och 1998 i Västerbotten, Norrbotten och Finland. Möjligen var trenden liknande i Ryssland. I Finland ökade dock antalet igen efter 1998. I södra Sverige finns nominatrasen *Ph. c. collybita*, som främst förekommer i ren lövskog. Den sydliga gransångaren är en sentida invandrare i Sverige, med de första häckningarna rapporterade i början av 1970-talet. Rasen har ökat kraftigt i antal de senaste decennierna, enligt fångststatistik från våra sydligaste fågelstationer. Enligt den senaste nationella kartläggningen är det dock fortfarande en stor utbredningslucka mellan raserna (Sveriges Fåglar, 3:e uppl.).

Vi använder i denna uppsats data från det nationella miljöövervakningsprogrammet Svensk Fågeltaxering för att presentera de båda rasernas nuvarande utbredning i Sverige samt deras populationsutveckling 1975–2006. Vi har i analyserna ansett fåglar påträffade söder om 60°N vara *collybita* och de norr om 60°N vara *abietinus*. Data kommer från de ”fria punktrutterna” som pågått sedan 1975 samt från ”standardrutterna” som startade 1996.

En fri punktrutt består av 20 punkter som inventeraren valt själv. Vid varje punkt räknas alla fåglar som ses eller hörs under fem minuter. Rutten upprepas sedan en gång per år vid ungefär samma datum (i huvudsak mellan 10 maj och 20 juni) och tid på dygnet. Vid analysen användes för varje rutt summan av fåglarna observerade på de 20 punkterna. Antalet rutter utförda per år varierade mellan 13 och 71 i norr och mellan 61 och 241 i söder. Antalet år en rutt räknats varierade mellan 1 och 32. Totalt räknades 2656 nordliga och 1536 sydliga gransångare på punktrutterna. Dessa data användes enbart för att analysera trender.

Totalt finns 716 standardrutter i Sverige, utlagda systematiskt med 25 km lucka över landet (Figur 1). Varje rutt är 8 km lång, formad som en kvadrat. Alla fåglar som ses och hörs längs dessa 8 km räknas. För en del rutter utgår en del av sträckan på grund av vattenhinder mm. Målet är att en rutt skall inventeras en gång per år, från mitten av maj i södra Sverige till början av juli längst upp i nordligaste Sverige, men alla rutter har dock inte kunnat räknas varje år. Vem som inventerar en given rutt kan variera mellan åren. Standardruttsdata har använts både för trendanalys (data för åren 1998–2006) och

för att beskriva rasernas utbredning i Sverige (data för åren 1996–2006). Antalet utförda standardrutter ökade från 48 under 1996 till 411 under 2006.

Populationstrender analyserades med statistikprogrammet TRIM, där antalet fåglar år 1998 gavs index 1 både för punkt- och standardrutterna. Eftersom standardrutterna är systematiskt utlagda över Sverige och därmed kan anses vara representativa för de olika habitatens utbredning i landet använde vi det genomsnittliga antalet gransångare registrerade på en rutt som ett mått på tätheten i detta område (medelvärdet baserat på 1–11 år, beroende på hur ofta rutten gjorts). Värdet för enskilda rutter har i många fall ganska stor osäkerhet, men för större områden bör värdena vara representativa. På standardrutterna räknades totalt 1459 nordliga och 393 sydliga gransångare perioden 1996–2006, på vilka utbredningsdata beräknats. Trendanalysen grundades på 1404 nordliga och 387 sydliga fåglar för den något kortare perioden 1998–2006.

Gransångarens häckningsutbredning i Sverige är tydligt tvådelad (Figur 1). Norr om 60°N finns en tydlig koncentration av gransångare i Hälsingland, Medelpad, Jämtland och Ångermanland, med god förekomst även i närliggande delar av Dalarna, Västerbotten och Norrbotten. Upp till 15 gransångare registrerades i genomsnitt på rutter i området. Söder om 60°N sågs upp till 6 fåglar per rutt, med en markant tyngdpunkt på utbredningen i Skåne och till viss del Västkusten och i Blekinge. Resten av området söder om 60°N kännetecknas av ströfynd och genomsnittliga värden på färre än 1 fågel per rutt. Om vi antar att gransångare upptäcks i samma utsträckning på olika rutter runt om i landet bör under perioden 1996–2006 ungefär 88% av Sveriges gransångare ha varit nordliga *abietinus* och 12% sydliga *collybita*.

Den nordliga gransångaren minskade med i genomsnitt 3,6% per år perioden 1983–1997, med en total minskning på 75% (Figur 2). Den därpå följande ökningen 1997–2006 uppgick till 85%, men antalen 2006 är fortfarande långt under värdena runt 1980. En liknande sentida ökning noterades även på standardrutterna, med i genomsnitt 6,8% per år och sammanlagt 50% (Figur 2).

Den sydliga gransångaren ökade med ungefär 1400% över punktrutternas 32 år, en genomsnittlig årlig ökning med 9,7% (Figur 2). Ökningen startade dock inte markant förrän 1985, så ökningen har egentligen skett på bara drygt 20 år. De senaste 9 åren var ökningen ungefär 60%, fördelat på 6,3% per år. Över motsvarande period var ökningen ungefär 150% på standardrutterna, med i genomsnitt 11,9% per år.

Eftersom standardrutterna bildar ett ganska grovmaskigt nät över landet kan man från dessa inte dra slutsatser om lokala detaljer i rasernas förekomst, men över större områden bör de ge en rättvisande bild. I det stora hela bekräftas den utbredning som presenteras i Svensk Fågelatlas och Sveriges Fåglar. Dock kan spännande detaljskillnader urskiljas, främst kanske beroende på att det för första gången är möjligt att beskriva variationen i täthet över Sverige med en enhetlig metod.

Den nordliga gransångarens tätheter är i Värmland, södra Dalarna, västra Härjedalen, västra Jämtland, samt södra Lappland, lägre än vad som anges i Sveriges Fåglar. Huruvida denna nya bild är en effekt av ett krympande utbredningsområde eller på att mer jämförbara data finns tillgängliga är okänt. Rasens utbredning i främst Norrland sammanfaller till stor del med områden där granen är dominerande trädslag (Figur 1). Kanske är det något med granen som sådan som är viktigt. Det kan också vara att granen bildar tätare skogar än tallen och att det är denna skogsstruktur, oavsett trädslag, som gransångaren föredrar. Vidare återstår att förklara varför de grandominerande skogarna i norra Jämtland och västligaste Västerbotten håller så få gransångare. En möjlig förklaring är klimatet. I detta område kommer frosten på hösten 14 dagar tidigare än i rasens klimatmässigt mildare huvudutbredningsområde något längre söderut. Tättingar studerade i Ammarnäs, lite längre norrut i Lappland, har visat sig vara väderkänsliga och de har svårt att finna mat redan i början av augusti. Kanske missgynnas gransångaren speciellt mycket i områden där sensommaren blir kall tidigt. Varför den nordliga gransångaren inte koloniserat de stora granområdena längre söderut i Sverige är än mer svårbegripligt!

Den sydliga gransångaren har sitt huvudfäste i Skåne och sydligaste Sveriges kusttrakter. Det pågående atlasarbetet i Skåne visar att rasen nu förekommer i höga antal över hela landskapet, till skillnad från artens fåtaliga och kustnära fördelning för 30 år sedan. Under samma period i Danmark har arten expanderat på ett motsvarande sätt. De fåtaliga och till synes tillfälliga observationerna i övriga Sydsverige (Figur 1) rör visserligen med stor sannolikhet den sydliga rasen (de nordliga har då flyttat förbi), men arten verkar inte ha fått något riktigt fotfäste där ännu. För denna lövälskande fågel har möjligen Smålands granskogsområden varit en rejäl spridningsbarriär. De två raserna har med andra ord ännu inte överlappande utbredning i Sverige. Studier av morfologi och sångigenkänning hos de två raserna indikerar att de kan komma att bete sig som två skilda arter om de en gång möts.

Både de nordliga och sydliga gransångarnas populationssvängningar återstår att förklara. Enligt skogsstatistiken verkar ingen dramatisk förändring i volymen kraftigare (äldre) gran ha inträffat inom den nordliga rasens utbredningsområde i Sverige de senaste decennierna (Figur 3), men skogens kvalitet som häckningsbiotop speglas inte nödvändigtvis så väl av denna variabel. Däremot sammanfaller förändringen av ytan gammal skog (alla trädslag, skog äldre än 140 år) i norra Sverige relativt väl med gransångarens populationsutveckling, med först en minskning och sedan en ökning från mitten av 1990-talet (Figur 4). Om detta samband bara är en tillfällighet återstår att undersöka. De parallella populationssvängningarna i norra Sverige och Finland indikerar att även mer storskaliga faktorer kan ha betydelse, såsom förändring i klimat eller förändringar i habitatkvalitet längs flyttningsvägar och i övervintringsområden. Ringåterfynd indikerar att de nordliga gransångarna flyttar mer östligt och längre (strax söder om Sahara?) än de sydliga. Dock är flyttningsvägar, övervintringsområden och vinterekologi överlag så dåligt kända att en noggrannare analys inte låter sig göras. Någon bra förklaring till den sydliga gransångarens enorma framgång finns inte heller, men ökningen har föregåtts av en långvarig och kraftig spridning norrut i Europa över de senaste 150 åren.

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Behaviour of Mute Swans *Cygnus olor* wintering at a municipal beach in Gdynia, Poland

Knölsvanars Cygnus olor *beteende under övervintring på en kommunal strand i Gdynia, Polen*

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Abstract

Mute Swan time-activity budget was studied on a municipal beach in two consecutive winter seasons, 2005 and 2006. The major difference between years in activity pattern was that adult swans decreased minimum feeding time, rested less and moved more in 2006. This year air temperatures were lower at the same time as humans provided less bread due to avian influenza fear. Despite higher energy expenditure in 2006, Mute Swans did not increase the total feeding time, probably because they still met metabolic demands. In 2006 the amount of aggressive attacks (mostly by adults on juveniles) increased.

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Introduction

Mass feeding by people is one of the key factors regulating the number of Mute Swan *Cygnus olor* and other waterfowl wintering in cities (Nilsson 1975, Avilova & Eremkin 2001). The main food given to waterfowl in parks and on municipal beaches is bread, which is preferred to natural plant material by swans because it is easier to digest and assimilate (Sears 1989). Wintering in densely populated areas leads to habituation to the frequent proximity of people (Józkowicz & Górska-Kłęk 1996, Luniak 2004). The feeding behaviour of birds in urban areas is adjusted to human customs and is aimed at finding or receiving human food (Luniak 2004). When feeding by humans decreases, Mute Swans are known to adjust their behaviour by increasing their aggressiveness and intensity in begging for bread (Sears 1989). The availability of bread provided by humans strongly influences their daily time budget because due to high energetic value of this kind of food, they spent less time foraging (Sears 1989, Józkowicz & Górska-Kłęk 1996). Quantitative data on behaviour and time budgets of waterbirds staying within urban areas are still sparse and are related mainly to breeding season (Jędraszko-Dąbrowska 1990, Luniak 2004, Kelcey and Rheinwald 2005).

In this paper the behaviour of Mute Swans wintering at a municipal beach was described with particular focus on feeding and intraspecific aggression.

Study area

The study was conducted in Gdynia city (54°30' N, 18°32' E) on a small municipal sandy beach near the yacht harbour. The seawalls of the harbour were overgrown by water plants, mainly algae. This place is visited regularly by people who often feed wintering birds, throwing small pieces of bread towards birds. The significance of municipal beaches for Mute Swans increases in harsh winters when many shallow water areas freeze and hundreds of birds move to urban areas in search for food (Meissner 1993).

Materials and methods

Each year we observed swans on nine different days that were as evenly distributed between the beginning of January and the end of February as possible. Observations were conducted between 8:00 and 16:00 on days free from precipitation and strong winds from a distance of 30–50m. To our knowledge the presence of observers did not influence the birds' behaviour. We used the focal sampling method (Altman 1974). Each observation session started with the choice of a focal individual by selecting a random number from random number series generated by computer and counting the number of individuals alternatively from the left and right sides of the flock. The focal individual was then observed continuously for 3 minutes and its behaviour was recorded on the tape recorder. The age of the bird was noted. However, juveniles were omitted in all analyses, except in those of intraspecific aggression, due to their small number. In 2005 we collected data on behaviour of adult birds for a total of 810 minutes and in 2006 for 822 minutes. At night Mute Swans showed no activity and all birds stayed inactive in the study area, which was checked six times during the study.

We assigned behaviour into one out of four categories: feeding, locomotion (walking and swimming), comfort activities (preening, bathing and resting) and aggression. During feeding we noted the type of food: as either natural (mainly water plants taken from bottom or concrete seawall of the yacht harbour) or provided by humans (mainly bread). Begging for food from humans was included in feeding activities. Two categories of aggression were recognised: threatening (when one bird approached another with neck arched) and pecking (when one swan peck or caught the other with bill).

During observations we also noted the number of strollers, dogs and people feeding birds, because they may have influenced the behaviour of the birds. Temperature was measured daily within the whole studied period (beginning of January – end of February) at 7 am at a place situated 25 km from the study area. All statistical procedures followed Zar (1996).

Results

The mean number of adult Mute Swans in 2005 was 29.7 birds, whereas in 2006 it was significantly higher reaching 45.6 birds (t-test, t=9.16, df=214, p<0.0001). Juveniles were less numerous and in the first and in the second season their mean number was 5.3 and 6.9 birds respectively (t-test, t=3.11, df=178, p<0.002).

Differences between seasons in wintering conditions for Mute Swans

The mean air temperature within the studied period in 2005 was +0.3° C (N=59, SD=4.7) whereas it was significantly lower in 2006, –4.3° C (N=59, SD=6.1) (t-test, t=4.61, df=116, p<0.001). The period of the harshest weather conditions took place between 17 and 25 January 2006, when the temperatures dropped below –12° C.

In January 2006 avian influenza was noted in several sites in Europe and the Mute Swan was the most common victim of this outbreak (Sabirovic et al. 2006). On 12 February 2006 it was announced that in the one of Polish cities two Mute Swans died due to HPAI H5N1 infection. As a consequence of this the other birds from this flock were captured and kept in an aviary. Avian influenza was widely discussed in media and many people stopped feeding waterfowl, because of fear of the transmission of this disease. Despite this, the daily mean number of people visiting the municipal beach was significantly higher in the second season (t-test, t=3.76, df=214, p=0.0002). In 2005 43% of the visitors provided bread to the swans whereas only 17% did this in 2006 (χ^2-test, χ^2=42.92, df=1, p<0.0001). There was no significant difference between years in the number of dogs recorded in the study area (t-test, t=1.14, df=214, p=0.22).

Activity patterns of birds

More people visited the beach in Sundays than during other days, but we found no difference in Mute Swans behaviour between weekdays and Sundays (χ^2-test, p>0.05 in all cases) and we pooled data from all days of the week in both seasons.

Mean percentage of time spending on different activities by adult birds differed significantly between years (G-test, G=28.43, df=3, p<0.0001). In 2005 Mute Swans spent 23.0% of their time feeding and 48.8% resting whereas in 2006 they spent 16.7% and 43.3% feeding and resting, respectively. In 2006 they spent more time on locomotion (39.2%) than in 2005 (27.3%) (Figure 1). The percentage of time spent on activities connected with foraging was also different between years (G-test, G=15.93, df=2, p=0.0004). In 2005 birds fed more on bread (79.7% in 2005 and 59.4% in 2006) (G-test, G=359.0, df=1, p<0.001) and less on water plants than in 2006 (10.7% in 2005 and 19.1% in 2006) (G-test, G=17.0, df=1, p <0.001). In 2006 mute swans spent much more time begging than in the 2005 (9.6% and 21.5% respectively) (G-test, G=101.8, df=1, p<0.001) (Figure 2).

Aggression

Aggression by pecking was more common in 2006 than in 2005 (χ^2-test, χ^2=17.17, df=1, p<0.0001)

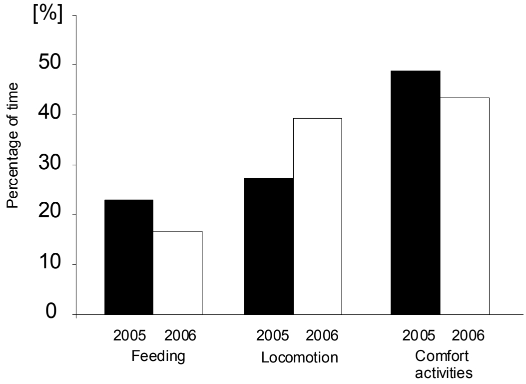

Figure 1. Percent of time spent on main types of activities by adult Mute Swans wintering on a municipal beach, Gdynia in Poland, in two seasons.
Procent tid med olika huvudaktiviteter (från vänster till höger: födosök, förflyttningar och vila) hos knölsvanar som övervintrade två olika år på en kommunal strand vid Gdynia, Polen.

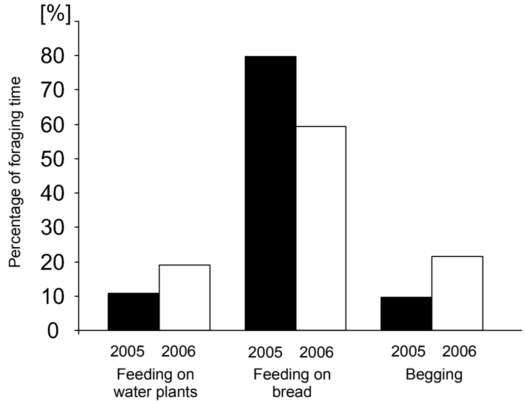

Figure 2. Percent of time spent on different foraging activities by adult Mute Swans wintering on a municipal beach in two seasons.
Procent tid med olika födosök (från vänster till höger: vattenväxter, bröd, tiggande) hos adulta knölsvanar på en kommunal strand två säsonger.

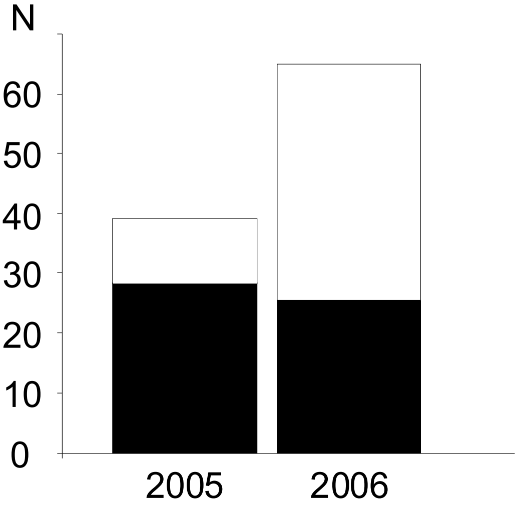

Figure 3. The total number of aggressive interactions among Mute Swans in two winter seasons. Black bar: adult bird attacked. White bar: juvenile bird attacked.
Totala antalet aggressiva möten mellan knölsvanar två vintersäsonger. Svart del av stapel: adult fågel attackerade. Vit del: juvenil fågel attackerade.

(Figure 3). Furthermore in the second year juveniles were more frequently victims of aggression (28.2% in 2005 and 57.8% in 2006) (χ^2-test, χ^2=8.54, df=1, p=0.0035). 64% of the juveniles were attacked by adults.

Discussion

Mute Swans prefer bread instead of their traditional food even in places where natural food is abundant (Sears 1989, Keane & O'Halloran 1992), probably because algae and vascular water plants are comparatively poor quality food for waterfowls. The caloric value in aquatic plants is lower than in terrestrial plants and considerably lower than bread (mean from commercial data on bread caloric value: 246 kcal/100g; terrestrial plants: 40–46 kcal/100g of fresh mass, water plants 38–42 kcal/100g of fresh mass, assuming 90% of water content in plants; Verduin 1972, Dourado et al. 2004). Moreover, in large herbivore waterfowls like swans and geese food is retained for a long period in the intestines, which may lower their digestive capacities (Bruinzeel et al. 1997). Thus, bread provided by people is a high energy food source that increase foraging efficiency and minimize feeding time. However, bread made of wheat grains is deficient in several amino-acids that are required by waterfowl (Joyner et al. 1987). Hence, inclusion of water plants in the diet provides important nutrients that do not occur in bread. Thus Mute Swans included aquatic plants in the diet also during 2005, when bread provision was high.

Among many other factors weather conditions may influence the behaviour of Mute Swans wintering in urban areas. Wintering waterfowl generally have higher energy expenditure during periods of cold stress (Prince 1979, Bech 1980). To survive low temperatures birds can increase foraging effort and minimize energy expenditure to save energetic reserves (Smith and Prince 1973, Guillemain et al 2002). In 2006 air temperatures were lower than in 2005 at the same time as provisioning of bread decreased. The major difference in activity pattern of Mute Swans between two winters was the lower feeding and resting and higher locomotors time in the colder winter of 2006. Because of the higher energy demands birds increased feeding on water plants and spent more time moving (searching of food and walking toward people) and begging. Even though the birds experienced higher energy expenditure in 2006 they did not increase the total feeding time compared to 2005. Probably in that period the swans relied on fat reserves accumulated earlier and more intensive begging from humans. The rate of heat loss (thermal conductance) decreases with body mass (Smith & Prince 1973) and the relatively low surface-to-volume ratio enable mute swans to withstand periods of low temperatures better than much smaller waterbirds. Thus, it seems that temperature and human feeding behaviour are probably two main factors that affected Mute Swan activities at a municipal beach, but the number and sex ratio of birds in the flock and availability of natural food could be also important to bird behaviour.

Results of comparable studies of Mute Swan activity patterns in urban and rural areas in southern Poland and in England showed that they spent less time on foraging and much more on loafing and aggression in the cities in comparison to those wintering in the countryside (Sears 1989, Józkowicz & Górska-Kłęk 1996). In the cities Mute Swans form dense flocks and aggressively beg for food. When the competition for food increased Mute Swans showed more agonistic behaviour towards their flock mates. Usually juvenile birds are subordinate to adults (Monaghan 1980, Milinski et al. 1995) and thus juvenile swans were victims in most aggressive interactions. The increase of aggressive acts towards juveniles in 2006 was not an effect of an increase in the number of this age category. On average, there was only 1.6% more juveniles in 2006 than in 2005, but the percent of attacks on juveniles increased twice. Conover et al. (2000) claimed that grey plumage of juveniles act as a signal of subordinate status and reduce aggression from older birds, but this mechanism may not work in urban areas where Mute Swans form dense flocks and try to put themselves in better position next to people feeding them bread.

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Sammanfattning

Introduktion

Antalet övervintrande knölsvanar *Cygnus olor* i våra städer är intimt förknippat med intensiteten av fågelmatning från privatpersoner och det är till och med så att svanarna föredrar bröd framför naturliga vegetabilier om valet ges. Som en konsekvens av detta är ofta övervintrande svanar vana vid mänsklig aktivitet och har i en del fall utvecklat tiggbeteenden. Dessutom har man visat att knölsvanarna anpassar graden av aggressivitet och tiggeri beroende på födotillgången. I vår uppsats beskriver vi hur beteende och aggressivitet bland övervintrande knölsvanar i Gdynia, Polen, påverkades av en drastisk nedgång i mattillgången till följd av folks rädsla för fågelinfluensa.

Studieområde

Studien genomfördes vid en mindre sandstrand nära turisthamnen i Gdynia (54°30' N, 18°32' E), norra Polen. De omkringliggande pirarnas stenfundament är bevuxna med vattenväxter, främst alger, som övervintrande svanar äter av. Naturliga vegetabilier är dock endast en del av födan. Särskilt under kalla vintrar, när andra områden fryst, är bröd från människor en viktig födokälla.

Material och metoder

Under vintrarna 2005 och 2006 studerades knölsvanarnas beteende under vardera nio fältdagar utan nederbörd eller starka vindar, jämnt spridda från januari till slutet av februari. Varje besök varade mellan kl 08.00 och 16.00.

För våra studier använde vi oss av individcentrerade beteendestudier (så kallad focal sampling metod, Altman 1974), där varje session började med att vi slumpmässigt valde ut en knölsvan som vi sedan följde kontinuerligt i tre minuter. Fågelns beteende antecknades, liksom dess ålder. Under vintern 2005 insamlades sammanlagt 810 minuters beteendestudier, att jämföras med 822 minuter under vintern 2006.

Vi delade in fåglarnas beteende i fyra kategorier: födosök, rörelser (gång och simning), vila (fjäderputsning, bad eller sömn) och aggression. Vid födosök antecknade vi om maten bestod av naturlig föda (alger och andra vattenväxter) eller bröd från matande människor. Fåglarnas tiggeribeteende räknades in i kategorin födosök. Vad gällde aggression, noterades två olika beteenden: hot (när en svan närmade sig en annan med halsen rest i en båge) eller hugg (när en svan högg efter en annan med näbben).

Vi noterade också antalet besökande människor, antalet hundar och antalet människor som matade fåglarna. Temperatur mättes dagligen vid en väderstation ca 25 km från studielokalen. Statistik räknades ut enligt Zar (1996).

Resultat

Under 2005 sågs i medeltal 30,7 adulta knölsvanar per besök, medan motsvarande siffra för 2006 var signifikant högre, hela 45,6 fåglar per besök. Antalet ungfåglar var lågt och varierade från i medel 5,3 individer per besök under 2005 till 6,9 under 2006. 2006 års vintersäsong var signifikant kallare än året innan (lufttemperatur i snitt −4,3°C jämfört med +0,3°C. Allra kallast var det i perioden 17–25 januari 2006, när temperaturen låg under −12°C.

Januari 2006 påträffades högpatogen fågelinfluensa av typen H5N1 i ett flertal europeiska länder och knölsvan var den vilda art som oftast påträffades död. Den 12 februari påträffades den första sjuka fågeln i Polen. Utbrotten fick stort utrymme i medierna och folks rädsla för sjukdomen gjorde att matningsfrekvensen gick ner. Vid vår studiestrand ökade antalet besökare samtidigt som andelen personer som matade fåglarna minskade (17% 2006 jämfört med 43% 2005) och båda förändringarna var signifikanta.

Flest personer besökte stranden under söndagarna, men vi fann ingen skillnad i knölsvanarnas beteende beroende på veckodag vilket gjorde att vi valde att slå ihop data från alla veckodagar i alla analyser. Tiden svanar ägnade åt olika aktiviteter skiljde sig signifikant åt mellan åren. Under 2005 spenderade de adulta knölsvanarna 23% av tiden till födosök och 49% till vila, att jämföras med 17% respektive 43% för vintern 2006. Under 2006 var fåglarna mer aktiva och ägnade 39% av den uppmätta tiden till att röra på sig (jämfört med 27% 2005; Figur 1).

Även dieten varierade mellan åren. Under 2005 var ca 80% av noterat födointag från bröd jämfört med 60% under vintern 2006. Samtidigt som andelen bröd minskade ökade tiggbeteendet mellan åren (10% 2005 mot 22% 2006; signifikant skillnad; Figur 2).

Aggressiviteten, mätt som antalet hugg, var signifikant högre 2006 än 2005 (Figur 3) och ungfåglarna fick i signifikant större utsträckning stryk det andra året (28% 2005 mot 58% 2006). Den attackerade fågeln var i 64% av fallen en adult fågel.

Diskussion

Knölsvanar föredrar bröd framför naturlig vegetabilisk föda även där den senare förekommer rikligt. Detta torde bero på att bröd har mycket högre energivärde än växter. Emellertid saknar vetebröd flera aminosyror som svanarna behöver. Därför konsumerade svanarna växter även 2005, då brödransonerna var stora.

Vädret och särskilt temperaturen påverkar svanars beteende i urbana områden. Är det kallt går det åt mer energi, och för att överleva kan fåglarna öka energiintaget eller spara energianvändningen. Temperaturen var lägre 2006 än 2005 samtidigt som matningen med bröd minskade. De borde alltså rimligen ha rört sig mindre och ägnat mer tid åt att äta växter. Men främsta skillnaden i svanarnas aktivitet var att ägna mindre tid åt att äta och vila och mera tid till förflyttningar (söka föda, följa folk och tigga) den kallare vintern. Det de åt var dock växter i stället för bröd. Trots att svanarna således spenderad mer energi 2006 ökade de alltså inte den totala tiden för att äta jämfört med 2005. Detta tyder på att svanarna hade tillräckliga fettreserver lagrade för att kompensera bortfallet av bröd och den ökade energiåtgången på grund av mer förflyttningar under den kalla perioden 2006. Knölsvanar är så stora att de har ett fördelaktigt förhållande mellan kroppens massa och yta, och de klarar sig uppenbarligen utan större problem på naturliga vattenväxter när så krävs.

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Occurrence of hybrid geese in Sweden – a conservation problem?

Förekomst av gåshybrider i Sverige – ett naturskyddsproblem?

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Abstract

This report provides basic data about hybrid geese and mixed pairs in Sweden; combinations of species, numbers, trends and origins, which can serve as a framework for future studies. Data published in national, regional and local magazines and reports as well as unpublished observations through August 2007 have been analysed. Sightings in this report were based on the observers' suggestion of parent species. No less than 17 species were involved in the hybrid geese sighted in Sweden. Some of the combinations of species involved the red-listed species Lesser White-fronted Goose, the nominate race of Taiga Bean Goose and Red-breasted Goose. The first combinations of species appeared in Sweden already 1918-1930s, but since the last half a century, the number of hybrid geese in Sweden shows a positive trend. Several explanations to this increasing trend is proposed but not further analysed. Among all the several theories proposed for hybridisation in geese, field data from Swedish goose haunts support at least two; the "Best-Option-Hypothesis" and "Inter-specific mate choice following false imprinting".

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Introduction

Inter-specific hybridisation is exceptionally common in wildfowl, and even inter-generic hybridisation is not unknown (Johnsgard 1960, Scherer & Hilsberg 1982, McCarthy 2006). Among true geese, almost every combination of hybrid is possible, both within and between the two genera, *Anser* and *Branta* (Ogilvie 1978). Hybrids are often produced in captivity but are comparatively rare in the wild (Rutschke 1997). Fertile hybrids are usual within goose genera but not always between them (Owen 1980; but see Kear 1990). All the grey geese are similar genetically (Ruokonen et al. 2000), and many fertile crosses have been produced. Crosses between the Greylag Goose *Anser anser* and Swan Goose *Anser cygnoides*, for instance, are completely fertile (Darwin 1859, 1880), but a slight chromosome difference can cause reduced hatchability at back-crossing (Lärn-Nilsson 1996). The several fertile inter-generic crosses between *Anser* and *Branta* indicate the very close relationship existing between these two morphologically fairly distinct groups (Johnsgard 1960). Still, few studies have tried to measure the importance of hybridisation in terms of actual number of individuals (but see Delany 1993, Randler 2000, Rowell et al. 2004). For Sweden, no such study has previously been done, even if trends for hybrids have been discussed shortly in two papers (Lerner 2005a, Lerner & Kampe-Persson 2006).

That closely related species interbreed and produce fertile hybrids is relatively rare in nature, where interbreeding is usually avoided by the action of geographical, ecological, behavioural or morphological barriers (May 1970). When separated by geographical barriers, species may be less likely to evolve ecological, behavioural or morphological mechanisms to avoid interbreeding. In such case, hybridisation may be facilitated when a species is introduced in a region that contains a close relative. Hybridisation caused by fauna manipulation is of that reason a conservation issue, because it may alter the genetic structure and reduce the fitness of native populations. A number of cases corroborate the importance of this phenomenon in birds.

Through fauna manipulation, hybridisation can become a severe conservation problem, sometimes threatening native populations by extinction. The introduction of the Ruddy Duck *Oxyura jamaicenses* to England in the 1940s is an illustrative example of this (Green & Hughes 1996, Hughes 1996, Persson & Urdiales 1997, Muñoz-Pomer 2006, Hughes et al. 2006). After establishing a naturalised population on the British Isles, the Ruddy Duck started to spread to other countries, where it came in contact with its native relative, the White-headed Duck *Oxyura leucocephala*. The two species started to hybridise, and the hybrids turned out to be fertile. The situation was aggravated by the fact that both Ruddy Duck males and hybrid males were dominant over White-headed Duck males, at the same time as the White-headed Duck was recovering from a very low population level (Torres 2001).

Also the Fennoscandian Lesser White-fronted Goose *Anser erythropus* conservation project has been affected by hybridisation (Aarvak & Timonen 2004). When genetic studies revealed that approximately 25% of the studied captive Lesser Whitefronts, used in the Swedish re-establishing project (Andersson 2004) and the Finnish restocking project (Markkola et al. 1999), carried the mitochondrial DNA of Siberian White-fronted Goose *Anser albifrons albifrons* (Ruokonen 2000, 2001, Tegelström et al. 2001), further releases were stopped in both countries.

Delaying conservation measures within this field can prove very expensive. Reducing the British Ruddy Duck population to the level it had when the problem of hybridisation with White-headed Duck became known will take several years and be very costly (Smith et al. 2005). To that must be added the cost of eradicating all Ruddy Ducks and hybrids in those countries in Europe, North Africa and the Middle East where the species has spread to since 1980. These are the extra costs, coming on top of the cost to eradicate the British population in 1980 of about 300 individuals. Accordingly, when actions must be taken to prevent hybridisation, it is of utmost importance that these can be decided on a sound basis and implemented without unnecessary delay.

This study aims at providing basic data about hybrid geese and mixed pairs in Sweden, combinations of species, numbers, trends and origins, which can serve as a framework for future studies, especially when conservation measures, such as control programmes or eradication, are actualised. Special attention was paid to species included on the Swedish Red List. Included on this list are the Lesser White-fronted Goose as *critically endangered* and the Taiga Bean Goose *Anser fabalis* as *near threatened*, while the nominate race of the latter species is included as *vulnerable* (Gärdenfors 2005). Also, attention was paid to the Red-breasted Goose *Branta ruficollis*, on the IUCN Red List regarded as *vulnerable* (IUCN 2006).

Material and methods

Hybrid geese often present problems of identification. In some hybrids, morphological characters from both parents are obvious, as for example in crosses between Greylag and Greater Canada Goose *Branta canadensis*. Hybrids between closer relations than these might be harder to distinguish, as for example crosses between Lesser and Siberian White-fronted Goose (see, for example, Lerner 2005a). Identification is further complicated by individual differences within crosses (Randler 2001), differences depending of which species the parent male was, and the existence of second-generation hybrids (Lack 1974). For crosses between Ruddy and White-headed Duck, the characters of the hybrid depend on which species the parent male was (Urdiales & Pereira 1993). The same seems to apply to hybrid geese (cf. Olsson 1954). In some crosses, large differences exist even among individuals from the same brood (see e.g. Lebret 1983, Rodríguez & Palacios 1993, Palacios & Rodríguez 1999).

These problems of identification, combined with inexperience in observing odd geese, have resulted in a number of misidentifications in Sweden (Amcoff et al. 1989, Carlsson et al. 2006). The first crosses between Greylag and Greater Canada Goose seen in a winter flock, for instance, were recorded as Barnacle Geese *Branta leucopsis* (Bolund 1964). Several crosses between Barnacle and Bar-headed Goose *Anser indicus* were reported as hybrids between Bar-headed Goose and either Greylag or Greater Canada Goose, while crosses between Barnacle and Snow Goose *Anser caerulescens* often were reported as Blue Goose; the Blue Goose is a colour morph of Snow Goose. Crosses between Greater Canada and Siberian White-fronted Goose have been reported as hybrids between Barnacle and Lesser White-fronted Goose. In Blekinge, crosses between Lesser White-fronted Goose and Cackling Goose *Branta hutchinsii minima* were initially reported as Lesser White-fronted Geese (Nilsson 1983), while in Skåne, a male Cape Shelduck *Tadorna cana* was reported as a hybrid between Ruddy Shelduck *Tadorna ferruginea* and Greylag Goose. Albinistic Greater Canada Geese have been reported as hybrids between Greater Canada and either Snow or Bar-headed Goose, while some juvenile Bar-headed were reported as hybrids. Most of the sighted second-generation hybrids have, of obvious reasons, most likely been reported as first-generation ones.

This report is based on data published in national, regional and local magazines and reports, observations made by the authors (HKP and HL), and unpublished sightings made by others, reported either to the authors or on Svalan (www.artportalen.se), up to August 2007. Also, several regional rarities committees have provided information and two preliminary papers (Lerner 2005a, Lerner & Kampe-Persson 2006) enhanced reports of hybrids. All existing data were not available for this report however, partly because many bird-watchers pay little attention to these birds and partly because all regional and local publications were not accessible.

In general, sightings in this report were based on the observers' suggestion of parent species. In Sweden, hybrids are rarely considered by local, regional or national rarities committees. In some cases, for instance when the same bird was given more than one combination of species by different observers, or as in the cases given above, misidentifications were corrected. Omitted were all hybrids where only one of the parent species was identified. Combinations of species for which all available sightings were denoted either probable or possible were excluded. In all but a few instances when sightings are included in this report, the word probable is deleted, a word that some observers have used for nearly every single hybrid reported by them. Also, mixed pairs, where a male of one species was paired to a female of another species, were included. These are more seldom reported.

The nomenclature follows recommendations of Commissie Systematiek Nederlandse Avifauna (Sangster et al. 1999, 2003), which means that Bean Goose is represented by Taiga Bean Goose *Anser fabalis* and Tundra Bean Goose *Anser serrirostris*, Canada Goose by Greater Canada Goose *Branta canadensis* and Lesser Canada Goose *Branta hutchinsii*, and Brent Goose by Dark-bellied Brent Goose *Branta bernicla*, Pale-bellied Brent Goose *Branta hrota* and Black Brant *Branta nigricans*.

Combinations of species in the headings in the Appendix are given in alphabetical order, without indicating which of the parents being male or female. For second and third generation hybrids scientific names within brackets refer to one of the parents.

Abbreviations of geographical provinces, given in brackets after each site name, are in accordance with those used for national reports (SOF 2002, 2006). For observations published in bird reports or on Svalan (www.artportalen.se), as well as earlier unpublished ones, name(s) of observer(s) is/are given in brackets if there was/were only one or two, while only the first name is given in case of more than two. This applies also to sightings where the identification was changed or modified by the authors.

For most combinations of species, all available data were included, in the text or in an Appendix, to facilitate future updates.

Results

No less than 17 species were involved in the hybrid geese sighted in Sweden through August 2007 (Tabell 1, Appendix). Involved in most first-generation combinations of species were the Barnacle Goose (ten), followed by the Greylag Goose (nine), the Greater Canada Goose (eight), and the Siberian White-fronted Goose and the Snow Goose (seven each). Represented by only one type each were the Ross's Goose *Anser rossi*, the Pale-bellied Brent Goose and the Red-breasted Goose. One species, the Greylag Goose, was also represented by a cross with a swan species, and mixed pairs with a duck species and Crane *Grus grus* as well.

Some combinations of species have been known for a long time, the first ones (Siberian White-fronted Goose x Snow Goose, Siberian White-fronted Goose x Taiga Bean Goose, Siberian White-fronted Goose x Bar-headed Goose and Greylag Goose x Greater Canada Goose) appeared already in 1918–1930s (Tabell 2). Most of the other combinations of species were only reported during the last 30 years; second-generation ones mainly since the mid-1980s (Tabell 2, 3).

Ever since the Greater Canada Goose was introduced in Sweden three quarters of a century ago, crosses between this species and the Greylag Goose have been by far the most common combination of species. During the non-breeding season, some of the hybrids were seen in Greylag Goose flocks but the vast majority among Canada geese. In flocks of Greylag and Greater Canada Geese staging and wintering in South Sweden, there were no clear trends in the frequencies of hybrids during the last 36 years (Tabell 4). In Greylag flocks, the average frequency was higher during the years 1991–

Table 1. Different first-generation combinations of species observed in Sweden through August 2007.
Förstagenerationshybrider som observerats i Sverige till och med augusti 2007.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	*A. albifrons*	-	X		X			X	X	X				X			X	
2	*A. anser*	X	-	X	X	X	X		X	X				X			X	
3	*A. brachyrhynchus*		X	-					X			X						
4	*A. caerulescens*	X	X		-				X	X	X			X			X	
5	*A. canagica*		X			-											X	
6	*A. cygnoides*		X				-							X				
7	*A. erythropus*	X						-						X		X	X	
8	*A. fabalis*	X	X	X	X				-			X		X				
9	*A. indicus*	X	X		X					-				X			X	
10	*A. rossi*				X						-							
11	*A. serrirostris*			X					X			-						
12	*B. bernicla*												-		X		X	
13	*B. canadensis*	X	X		X		X	X	X	X				-			X	
14	*B. hrota*												X		-			
15	*B. hutchinsii*							X								-	X	
16	*B. leucopsis*	X	X		X	X		X		X			X	X		X	-	X
17	*B. ruficollis*																X	-

2001 than earlier or later, 0.27‰ (N=191,148) vs. 0.05‰ (N=39,974) and 0.06‰ (N=130,556). Average frequencies for the entire period were 0.17‰ (N=361,678) in Greylag flocks and 0.92‰ (N=157,489) in Canada flocks, while the corresponding values for the 2005 autumn, the year with the largest sample sizes, were 0.06‰ (N=49,719) and 2.13‰ (N=18,764) respectively. Among Canada geese wintering in Kristianstad, high frequencies were noted already four decades ago, with, for instance, 8.57‰ (N=350) in 1964/1965 and 4.00‰ (N=500) in 1965/1966 (Axelsson 1967). The second most commonly reported combination of species is Greater Canada and Barnacle Goose, and the third Lesser White-fronted and Barnacle Goose.

An estimate of the total number of hybrids in Sweden was made for 2005, the latest year with good data (Table 5). For crosses between Greylag and Greater Canada Goose, an estimate of the total number of individuals in Sweden was obtained by multiplying observed frequencies (Table 4) with population sizes of the two species. Estimated sizes of the post-breeding populations in 2005 were 210,000 Greylag Geese and 100,000 Greater Canada Geese (Nilsson 2006, Svenska Jägareförbundet 2006). In that way, a total of 226 hybrids was obtained, 13 among the Greylags and 213 among the Greater Canadas. A similar calculation was made for crosses between Pink-footed and Taiga Bean Goose, as 20% of all staging bean geese in Sweden in the late 2005 autumn were carefully checked by HKP. However, as it was uncertain whether there were any hybrids in the unchecked flocks, the result is presented as an interval, ranging from the number of hybrids actually seen to the calculated figure. For other combinations of species, estimates were based on available sightings.

Discussion

The problems of identification

A chain of factors, running from occurrence to inclusion, such as observer availability, knowledge and devotion of the field observers, detectability, reporting frequency, publishing frequency, and the ability of the reviewers to find the sources, creates the necessary conditions for how well a review article can describe the true picture.

Staging and wintering geese in Sweden started to be checked more in detail from the late 1950s (e.g. Lennerstedt 1962, Markgren 1963). Since then, the number of persons checking the geese have doubled many times over. Better binoculars and telescopes, as well as better roads and access to watch towers, have facilitated field observations. At the same time, however, most goose populations regularly occurring in Sweden have increased markedly in size (Nilsson 2006). These larger numbers, in combination with more and more multi-species flocks, make it in several places harder to spot hybrids today than earlier. During the period covered by this report, hybrids went unnoticed in two ways,

Table 2. Year of first observation for different combinations of species in Sweden. Also the year of first observation of a mixed pair is given for crosses where a mixed pair was reported earlier than a hybrid.
Årtal för förstafynd av olika hybridtyper i Sverige. Också förstaår för blandpar har angetts när blandpar rapporterats tidigare än en hybrid.

	Hybrid	Pair
Anser albifrons x *Anser anser*	1988	1962
Anser albifrons x *Anser caerulescens*	Early 1930s	
Anser albifrons x *Anser erythropus*	1992	1991
Anser albifrons x *Anser fabalis*	1918	
Anser albifrons x *Anser indicus*	Early 1930s	
Anser albifrons x *Branta canadensis*	1985	1970
Anser albifrons x *Branta leucopsis*	Before 1959	
Anser anser x *Anas platyrhynchus*		2006
Anser anser x *Anser brachyrhynchus*	1994	
Anser anser x *Anser caerulescens*	1979	
Anser anser x *Anser canagica*	2004	
Anser anser x *Anser cygnoides*	1985	
(*Anser anser* x *Anser cygnoides*) x *Anser anser*	1987	
((*Anser anser* x *Anser cygnoides*) x *Anser anser*) x *Anser anser*	1992	
Anser anser x *Anser fabalis*	2001	1992
Anser anser x *Anser indicus*	1984	
(*Anser anser* x *Anser indicus*) x *Branta canadensis*		2006
Anser anser x *Branta canadensis*	Late 1920s	
(*Anser anser* x *Branta canadensis*) x *Anser anser*		Before 1984
(*Anser anser* x *Branta canadensis*) x *Branta canadensis*	1985	1982
(*Anser anser* x *Branta canadensis*) x (*Anser anser* x *Branta canadensis*)	1993	
Anser anser x *Branta leucopsis*	1984	
Anser anser x *Cygnus olor*	1972	
Anser anser x *Grus grus*		2007
Anser brachyrhynchus x *Anser fabalis*	1984	
Anser brachyrhynchus x *Anser serrirostris*	2006	
(*Anser brachyrhynchus* x *Anser serrirostris*) x *Anser brachyrhynchus*		2006
Anser brachyrhynchus x *Branta leucopsis*		2007
Anser caerulescens x *Anser fabalis*	1988	
Anser caerulescens x *Anser indicus*	1999	
Anser caerulescens x *Anser rossii*	2003	
Anser caerulescens x *Branta canadensis*	1978	
Anser caerulescens x *Branta leucopsis*	1987	1979
Anser canagica x *Branta leucopsis*	1993	
Anser cygnoides x *Branta canadensis*	1986	
Anser erythropus x *Branta canadensis*	1990	1989
Anser erythropus x *Branta hutchinsii*	1979	
(*Anser erythropus* x *Branta hutchinsii*) x Branta leucopsis		1983
Anser erythropus x *Branta leucopsis*	1985	
(*Anser erythropus* x *Branta leucopsis*) x *Branta canadensis*		1989
Anser fabalis x *Anser serrirostris*	2004	
Anser fabalis x *Branta canadensis*	1983/84	
(*Anser fabalis* x *Branta canadensis*) x *Branta canadensis*		2007
Anser indicus x *Branta canadensis*	1965	
Anser indicus x *Branta leucopsis*	1985	
(*Anser indicus* x *Branta leucopsis*) x *Anser anser*	1997	
(*Anser indicus* x *Branta leucopsis*) x (*Anser indicus* x *Branta leucopsis*)		1985
Branta bernicla x *Branta hrota*	2002	
Branta bernicla x *Branta leucopsis*	2004	
Branta canadensis x *Branta leucopsis*	1969	
(*Branta canadensis* x *Branta leucopsis*) x *Branta canadensis*	1997	
(*Branta canadensis* x *Branta leucopsis*) x *Branta leucopsis*	2006	2000
Branta hutchinsii x *Branta leucopsis*	1998	
(*Branta hutchinsii* x *Branta leucopsis*) x *Branta leucopsis*	2005	
Branta leucopsis x *Branta ruficollis*	1978	

Table 3. Number of new combinations of species in Sweden during different decades.
Antalet nya hybridtyper i Sverige fördelat på årtionden.

Decennium *Decade*	Antal *Number*
1910–1919	1
1920–1929	1
1930–1939	2
1940–1949	0
1950–1959	1[1]
1960–1969	2
1970–1979	5
1980–1989	14
1990–1999	10
2000–2007	9

[1] = before 1959.

partly by flocks and families remaining unchecked, especially during the breeding season, and partly by bird-watchers paying little attention to hybrids. As a result of the latter, at least up to the late 1990s, the bulk of all sightings in most geographical areas was reported by only 1–3 persons. But even if many hybrids passed unnoticed for long periods, there were good chances that they, due to the longevity and mobility of geese in general (Owen 1980), were seen at least occasionally.

Identification of hybrid geese is not covered by field guides, and is rarely the theme of identification articles. By that, knowledge gained by the most devoted field observers is not passed on to others. Of that reason, the ability among bird-watchers in general to correctly identify encountered hybrids has improved slowly over time, mainly reflecting a

Table 4. Frequency (number of hybrids per 1000 geese) of Greylag Goose x Greater Canada Goose hybrids, including second-generation ones, in flocks of Greylag Goose and Greater Canada Goose, respectively, in South Sweden in the seasons 1970/71–2005/06. For the Greylag, only mid-September counts were used, while for the Greater Canada, the mid-monthly count with the largest number of checked individuals during the period September–February was used. Only censuses made by HKP were used. N = number of checked geese.
Frekvens (uttryckt som antal hybrider per 1000 gäss) av grågås x kanadagås-hybrider i flockar av grågås respektive kanadagås i Sydsverige säsongerna 1970/71–2005/06. För grågås utnyttjades endast mittmånadsinveneringar gjorda i september, medan för kanadagås utnyttjades den mittmånadsinventering med flest kontrollerade individer under perioden september–november. Endast inventeringar gjorda av HKP utnyttjades. N = antalet kontrollerade gäss.

	In Greylag Goose flocks *I flockar av grågås*		In Canada Goose flocks *I flockar av kanadagås*	
	‰	N	‰	N
1970/71			0.00	243
71/72			0.00	204
72/73			0.00	37
73/74			0.00	300
74/75			0.00	105
75/76			0.00	400
76/77			0.00	297
77/78			0.92	2169
78/79	3.81	525	0.00	5805
79/80			0.00	5092
1980/81			0.25	3981
81/82			0.00	3864
82/83			0.58	8600
83/84	0.00	2468	1.32	12886
84/85	0.00	5031	0.39	5113
85/86			0.23	13000
86/87			0.40	5000
87/88	0.00	6900	0.87	1150
1988/89	0.00	6700	0.00	233
89/90	0.00	9050	0.00	750
1990/91	0.00	9300	2.67	1500
91/92	0.82	13469	0.00	650
92/93	0.78	23225	1.25	3210
93/94				
94/95				
95/96	0.09	10636		
96/97	0.04	24162	1.50	2672
97/98	0.13	15707		
98/99	0.09	23100	0.75	13386
99/00	0.18	22813	1.70	18193
2000/01	0.26	31039		
01/02	0.19	26997	0.63	12635
02/03	0.04	28334		
03/04	0.08	24999	2.11	3317
04/05	0.07	27504	0.29	13933
05/06	0.06	49719	2.13	18764

Table 5. Estimate of the total number of individuals of different combinations of species present in Sweden in 2005 (based on Table 4, studies by HKP in the 2005 autumn and reported observations; see text for details), compared with similar estimates for Great Britain in 2000 (Rowell et al. 2004) and in 1991 (Delany 1993) and Germany in 1998 (Randler 2000). Excluded were second-generation hybrids, and hybrids where none or only one of the parent species was identified.

Beräkning av totalantalet individer av olika hybridtyper som förekom i Sverige 2005 (bygger på Tabell 2, studier av HKP hösten 2005 samt rapporterade observationer 2005; se text för detaljer), jämfört med motsvarande beräkningar för Storbritannien 2000 (Rowell mfl 2004) och 1991 (Delany 1993) och Tyskland 1998 (Randler 2000). Andragenerationshybrider samt hybrider där ingen eller endast en av föräldraarterna identifierats exkluderades.

	Sweden 2005	Great Britain 2000	Germany 1998	Great Britain 1991
Anser albifrons x *Anser anser*	1	12		13
Anser albifrons x *Anser erythropus*	2			2
Anser albifrons x *Branta canadensis*	6			7
Anser albifrons x *Branta leucopsis*	1		3	
Anser anser x *Anser caerulescens*	1	20		5
Anser anser x *Anser cygnoides*	1	57	38	2
Anser anser x *Anser fabalis*	2			
Anser anser x *Anser indicus*	2	6	6	3
Anser anser x *Branta canadensis*	226	88	140	262
Anser anser x *Branta leucopsis*	4			2
Anser brachyrhynchus x *Anser fabalis*	4–20			
Anser brachyrhynchus x *Anser serrirostris*	1			
Anser caerulescens x *Anser indicus*	1	1		
Anser caerulescens x *Branta canadensis*	2	2	1	4
Anser caerulescens x *Branta leucopsis*	1–2	2		2
Anser canagica x *Anser caerulescens*		1		
Anser canagica x *Anser indicus*		1		
Anser canagica x *Branta canadensis*		1		
Anser canagica x *Branta leucopsis*	1	5		
Anser cygnoides x *Anser indicus*			12	
Anser cygnoides x *Branta canadensis*		4	3	1
Anser erythropus x *Branta leucopsis*	15		1	
Anser fabalis x *Anser serrirostris*	1			
Anser indicus x *Branta canadensis*	1	1	12	2
Anser indicus x *Branta leucopsis*		1	5	
Anser rossii x *Branta leucopsis*			1	
Branta bernicla x *Branta leucopsis*	3			
Branta canadensis x *Branta leucopis*	30	8	6	13
Branta hutchinsii x *Branta leucopsis*	3			
Branta leucopsis x *Branta ruficollis*	1		1	
Total:	310–327	210	229	318

general improvement in identification skill. Above all, individual variation within each combination of species have and will give rise to misidentifications. Individual variation is supposedly partly caused by which species the male is. Encountering hybrids where the male parent was of the opposite species compared to the normal can cause the observer to believe that these birds were of another combination. Improvements in identification skill over time might explain some of the new combinations of species reported in Tables 2 and 3, but far from all.

As the aim of the study was to describe the occurrence of hybrid geese in Sweden, it was impossible to restrict the material to only those hybrids that for certain were correctly identified. The more so as hybrids have to be studied genetically to be sure of their ancestry. It is not enough to see the hybrid together with its parents, as extra-pair fertilisation occurs also in mixed pairs (Berg 1937). Obvious misidentifications were corrected before inclusion in this report, but all of them were most likely not found. As the majority of all observations, also of the least reported combinations of species, were made by devoted field observers, the overall frequency of misidentifications was probably low. The largest remaining uncertainty regards crosses between Emperor *Anser canagica* and Barnacle Goose. Available sightings, some of them reported as unidentified Emperor Goose hybrids, were not included until one of them had been reported as a cross between these two species. Another kind of misidentifications was when second- and third-generation hybrids were reported as first-generation ones. This was probably of minor importance as such hybrids apparently occurred in very low numbers. After three generations of back-crossing it is probably no longer possible to identify the individual as a hybrid in the field.

The chance of being overlooked in the field is, of obvious reasons, higher for crosses between closely related species, with high morphological resemblance, than for inter-generic crosses, and higher for second- and third-generation hybrids than for first-generation ones. The most likely candidates of having passed unnoticed during the period covered by this study were the following combinations of species: Siberian White-fronted Goose x Lesser White-fronted Goose, Greylag Goose x Pink-footed Goose, Greylag Goose x Swan Goose, Greylag Goose x Taiga Bean Goose, Greylag Goose x Bar-headed Goose, Dark-bellied Brent Goose x Light-bellied Brent Goose, Snow Goose x Barnacle Goose, Greater Canada Goose x Barnacle Goose, Bar-headed Goose x Barnacle Goose and Lesser Canada Goose x Barnacle Goose. There are no data indicating to which extent hybrids were overlooked.

The interest of reporting and publishing observations of hybrid geese in Sweden has varied markedly during the past decades, among areas as well as years, which becomes evident when examining regional and national bird reports. The introduction of Svalan (Report system for Birds, www.artportalen.se) changed this by stimulating a higher reporting frequency and enhancing data availability. However, in the only study of reporting frequency so far it was found to be extremely low. Of hybrids found during four mid-monthly counts of geese in South Skåne during the period September 2006–January 2007, only 5% (N=61) were reported on Svalan (Kampe-Persson 2007). This low figure was obtained even though data were extracted for a 16-day period each counting month.

The picture given in this study might be somewhat skewed, partly due to the omission of all hybrids where only one of the parents was identified and partly to an unknown number of misidentifications. If it had been possible to include also these sightings correctly identified, the total number of combinations of species might have been higher than now, especially second- and third-generation ones, and the relative frequencies of the different combinations of species had very likely been slightly different. For instance, as Swedish birders rarely differentiate between Lesser and Greater Canada Goose as hybrid parent, generally reporting all of them as the latter, the total number of sightings of crosses between Lesser Canada and Barnacle Goose had very likely been higher than now. As few geese of captive or semi-captive origin are reported correctly to the rarities committees, some sightings of small Canadas might have been hybrids. A better understanding in this issue might be reached with more written descriptions and photos of these birds.

In spite of the shortcomings discussed above, there are good reasons to accept the picture given in this study as a good representation of the true one.

Trends

During the latter half a century, the number of hybrid geese in Sweden shows a positive trend similar to that of the breeding populations of Greylag, Greater Canada and Barnacle Goose (Madsen et al. 1999), but also to the summer occurrence of northern breeders and exotic geese (Kampe-Persson & Lerner, in prep.). To which degree this trend is due to increasing breeding populations, to differences in number of birds of captive and semi-captive origin, to the summer occurrence of species normally breeding farther north, or to a higher reporting frequency is and will remain unknown.

The trend of an increasing number of first-sightings of new hybrid types from the 1980s is applicable to also other goose areas in Europe. In goose flocks in North and West Europe, it is nowadays normal to find a great variety of hybrids, especially crosses involving introduced species (Delany 1993, Lensink 1996, Randler 2000, van Horssen & Lensink 2000, Rowell et al. 2004, this study). When originating from birds used in re-stocking and re-establishment projects, also parts of native populations can be regarded as alien (Randler 2000). In Sweden, that applies to Taiga Bean, Greylag, Lesser White-fronted and Barnacle Goose (Svensson et al. 1999).

There were large similarities among Sweden, Germany and Great Britain, in total number of hybrids, that the majority (61–82%, though lower in Great Britain in 2000) was made up of crosses between Greylag and Greater Canada Goose, and that the minority was made up of at least 12 different combinations of species (Delany 1993, Randler 2000, Rowell et al. 2004, this study). Between-country differences for combinations of species with low numbers (less than 20 individuals) may be due to stochastic reasons, but notably crosses between Greylag Goose and Swan Goose were rarer in Sweden in 2005 than in Great Britain 2000 and Germany 1998. As geese are long-lived (for the Greylag Goose, see Kampe-Persson 2002), a single mixed pair can produce a large number of hybrids during their reproductive life, hybrids that can be alive long after their parents have died. In Skåne, one hybrid was more than 17 years old when last seen (this study). Hence, one reason that so many combinations of species were represented by less than 15 individuals might be that each combination was produced by a single pair.

Origins

Of hybrid geese seen free-flying in Sweden, some were born in captivity, semi-captivity or close to sites with captive breeding, others in the wild abroad, but the vast majority in the wild in Sweden. Also among those born in the wild most had at least one parent or ancestor of captive origin. The captive origin is obvious when it comes to the introduced Greater Canada Goose and aliens, but rarely for birds emanating from re-stocking or re-establishment programmes, or for escaped individuals of native species. Geese that have been bred in captivity for a number of generations are more prone to hybridise than their wild con-specifics (Randler 2000). In the Greylag Goose, for instance, the frequency of hybrids was markedly higher in naturalised than in natural populations (Bruns 1982, 1985, Sibley 1994, Kreutzkamp 1996, Randler 2000). Hence, effects of captive origin must be taken into consideration for a long time after that geese have been released for re-stocking or re-establishment.

As most hybrid geese have an obvious captive origin, it might be more fruitful to ask: Which of the reported combinations of species were of natural origin? If, besides crosses involving introduced species, also those involving released and escaped parent birds are excluded, only seven combinations of species remain: Siberian White-fronted Goose x Lesser White-fronted Goose, Siberian White-fronted Goose x Barnacle Goose, Dark-bellied Brent Goose x Light-bellied Brent Goose, Dark-bellied Brent Goose x Barnacle Goose, Pink-footed Goose x Taiga Bean Goose, Pink-footed Goose x Tundra Bean Goose and Barnacle Goose x Red-breasted Goose. Most likely, Taiga Bean Goose x Tundra Bean Goose does not belong to this group.

Very high frequencies of hybrids between Taiga and Tundra Bean Goose were formerly reported from Central Europe (Johansen 1962, Bauer & Glutz von Blotzheim 1968, Litzbarski 1974, Cramp 1977, Ogilvie 1978, Owen 1980, Rutschke 1983a, 1983b, 1997, Klafs & Stübs 1987, Liebherr & Rutschke 1993, Rutschke & Liebherr 1996), with no less than 54%, 73% and 97% of all bean geese in Mecklenburg, Brandenburg and Hungary, respectively, reported as hybrids. These false conclusions were due to a typological approach, which did not account for the individual variation that occurs in the subspecies *fabalis* and *rossicus*, especially in the shape and coloration of the bill (Persson 1995b, 1997b). A careful check of mixed flocks, where one of the species occurred in low numbers, were recently carried out in Germany. The outcome of this study was the sighting of one mixed pair (Thomas Heinicke, pers. comm. to HKP).

During more than 40 years of careful checks of the European bean goose haunts neither Georges Huyskens nor Leo van den Bergh found any crosses between Taiga and Tundra Bean Goose (Huyskens 1986, 1999, Leo van den Bergh, in litt.), or any crosses or mixed pairs between Pink-footed and Taiga Bean Goose (Leo van den Bergh, in litt.). The lack of sightings south of the Baltic highlights the origin of the bean goose hybrids seen in Sweden, especially as it cannot be ruled out that one, or even both, of the parent birds in each pair was of captive origin. Five Pink-footed Geese of presumed captive origin were, for instance, sighted in Skåne in the autumns of 1995 and 1996 (Elleström et al. 1996, Green et al. 1997). The fact that two of the four sightings of hybrids between Taiga and Tundra Bean Goose in Skåne were done in early autumn, before the parent species started to arrive in this part of Sweden, gives support to a captive or semi-captive origin.

The first Pink-footed Goose reported breeding in northern Fennoscandia bred paired to a Greater Canada Goose at Hammervatnet in Nord-Trøndelag in 1994 (Husby 1994). This was followed by a female that bred paired to a male Siberian White-fronted Goose at Lofoten in 2002 and 2003 (Birina 2005). Before the first breeding pair was found at Tromsø in 2003 (Irgens 2004), one Pink-footed Goose was caught together with moulting Taiga Bean Geese at Tana in 1971 (Tveit 1984), breeding was reported but never confirmed from Karasjok (Gjershaug et al. 1994) and a family group of two adults and three young was found at Øysand in Sør-Trøndelag 6 September 1992 (Gustad 1993), the early date indicating that breeding might have taken place on the mainland. An increasing Pinkfoot population in northern Fennoscandia, at the same time as the Taiga Bean Goose population decreases there, could result in hybridisation between these two species.

Hybridisation between Lesser and Siberian White-fronted Goose is believed to be occasional in the natural populations (Nagy 1950, Shackleton 1956, Voous & Wattel 1967, Rogers 1979, Panov 1989, Müller 2001, Lerner 2005a, this study, but see Van Impe 1982), although difficult to detect reliably due to the great morphological similarity of the two species. According to Peter Scott (*British Birds* 49(1956): 229): “It is my theory that hybrids between Lesser and European [Siberian] White-fronts occur from time to time among the geese visiting Britain. This idea is based (1) on the occurrence, in the winter flocks, of Lesser White-fronts which are paired to European [Siberian] White-fronts; (2) on observations of “Lesser White-fronts” which are unusually large; and (3) on the bill-measurements of a specimen from the Severn Estuary now in the British Museum (Natural History).” A male Lesser White-fronted Goose mated to a Siberian White-fronted Goose with two young, the young not distinguishable from those of Siberian Whitefronts, were seen at Slimbridge, Gloucestershire 6–7 March 1956 (Scott & Boyd 1956). Another mixed pair was seen at the same site 28 February–5 March 1969 (Smith 1970). An indication of the possible magnitude of hybridisation between these closely related species can be obtained by comparing with a similar pair of goose species in the Nearctic. Among 5471 Ross’ and 8155 Snow Geese caught for ringing in USA during 1961–1968, there were 32 hybrids, corresponding to a frequency of hybrids of 2.34‰ (Trauger et al. 1971). Overall among birds, however, about one in 50,000 individuals (0.02‰) is a hybrid (Mayr 1970).

Injuries can force migrating geese to remain in or close to their wintering quarters during the following breeding season. Sometimes such birds breed far south of their normal breeding range, paired to either a con-specific or a bird of another species. Examples of the former are the successful breeding of a Greylag Goose pair in northern Spain in 1993 (Moreno 1993) and of Tundra Bean Goose pairs in the Netherlands in 1993 and 1994 (Lensink 1996b) and of the latter, the unsuccessful breeding of a mixed pair of Taiga Bean and Greylag Goose in South Sweden in 1992 (this study). So, hybridisation outside the breeding range of one of the species making up a mixed pair is not always unnatural.

To understand the causes of hybridisation between waterfowl species, several theories have been proposed (for a summary, see Randler 2000, 2006). Field data from Swedish goose haunts support at least two of these: the ”Best-Option-Hypothesis” and ”Inter-specific mate choice following false imprinting”.

In most cases, when breeding and breeding attempts of mixed goose pairs were recorded in Sweden, one of the parent species was represented by only one individual at that very site (this study). That applies not only to the rare species, but also to such numerous and wide-spread ones as the Greylag Goose and the Greater Canada Goose (Fabricius & Norgren 1987). These observations support the ”Best-Option-Hypothesis”. Instead of giving up breeding altogether, the singly bird mate with an individual of another species (Hubbs 1955).

Some of the Lesser White-fronted Goose males from the Swedish re-establishment project, which were released with Barnacle Geese as foster parents, later paired to Barnacle females (Lerner 2005a, this study). Such inter-specific mate choice after false imprinting has been demonstrated in the Greylag Goose (Fabricius 1991). Of 19 males and 16 females that had been cross-fostered by Canada geese in semi-captivity, five males paired to Canada females, while the other males and all females paired to Greylags. When widowed, these five males re-paired to a new partner which was always a Canada female. Two of the males paired as many as nine and five times. In the same study, all of 78 Greylag males that had been reared by conspecifics paired with females of their own species and never even courted Canada Geese. A detailed discussion on the factors involved in sex differences in sexual imprinting was given by ten Cate (1985).

Cross-fostering during natural conditions can occur either by a pair taking over a nest where a female already has started to lay (Fabricius 1983) or by brood amalgamation (Eadie et al. 1988, Beauchamp 1998, Randler 2005). Evidences of these behaviours are few from Sweden. A Greater Canada Goose pair took over a Whooper Swan *Cygnus cygnus* nest at Öfjärden (Ång) in 2001 (Thomas Birkö). Inter-specific nest parasitism was recorded in Fjällfotasjön (Sk) in 1986, when a Barnacle Goose nest contained four Barnacle eggs and six Greylag eggs (Persson 1997a) of which the former hatched, and in Malmö (Sk) in 2007, when a Mute Swan *Cygnus olor* nest contained five swan eggs and one Greylag egg of which all hatched (Conny Hagman). Mixed broods of Greylag and Greater Canada Goose have been reported from Angarnsjöängen (Upl), where eight adult Canadas were followed by nine Canada goslings and ten Greylag goslings in 2004 (Söderholm 2005a), ten adult Canadas were followed by 11 Canada goslings and 11 Greylag goslings in 2005 (Söderholm 2005b) and eight adult Canadas were followed by 20 Canada goslings and four Greylag goslings in 2007 (Svante Söderholm), from Ivösjön (Sk), where a Greater Canada Goose pair was followed by two Canada goslings and one Greylag gosling in 2006 (HKP) and from Tidaholm (Vg), where a Greater Canada Goose pair was followed by two Canada goslings and two Greylag goslings in 2007 (Magnus Hallgren). In 2006, one Greylag gosling was seen together with a Canada family at Hörby (Sk) 4 July (Mattias Persson) and two Greylag goslings together with a Canada family at Lokasjön (Sm) 19 July (Max Lundberg, David Gustafsson). Two Greylag goslings with Canadas as foster parents were seen at Lillskärsudden (Vb) 16 July 2005 (Stefan Delin), while one Greylag gosling was adopted by a pair of Mute Swan at Dröstorpsmossen (Öl) in 2002 (Waldenström 2003). To obtain information about brood amalgamation in Sweden either pure luck or great devotion of the field observer is needed. Data presented here constitute of that reason very likely only a fraction of what really have occurred.

In Germany, there are records of eggs of both Mallard *Anas platyrhynchos* and Mute Swan in Greylag nests, of Greylag eggs in nests of Mute Swan, and of a Mute Swan pair successfully raising a Greylag Goose as well (Dittberner & Dittberner 1976, Hauff 1982, Plath 1985).

A strong pattern of natal female philopatry and male dispersal is the usual pattern in Anatidae (Greenwood 1980). In the Greylag Goose, the female rarely disperse more than 10 km, while the male can start to breed more than 1000 km from the site of birth (Nilsson & Persson 2001). A similar pattern was found in a naturalised Greater Canada Goose population (Lessells 1985). One consequence of this sex-difference is that males can get problems in finding a female of their own species during a period of breeding range expansion. The Swedish Greylag Goose population is in such a phase since half a century (Svensson et al. 1999), during which time it has increased hundredfold in numbers. The fact that about 95% of all crosses between Greylag and Greater Canada Goose were found in flocks of the latter species should probably be viewed as most successful mixed pairs were made up of a male Greylag and female Canada. Field evidences are lacking however, as very few parent birds were ever sexed.

As the Greylag and the Greater Canada Goose get breeding ranges that are more or less overlapping, one can expect fewer crosses according to the ”Best-Option-Hypothesis”. At the same time, the chances of pre- and post-hatch brood amalgamation increase, for instance, by Greylag females laying eggs in Canada nests (Fabricius & Norgren 1987). So far, however, mixed broods of these two species have only been reported from three breeding sites in Sweden (see above).

Owing to problems of identification, second-generation hybrids are hardly ever reported except when seen together with both parents. In Sweden, there were reports of nine broods of seven different combinations of species, with a total of 28 young, and one possible young of an eighth combination as well (this study). These eight combinations represented, however, three different crossing possibilities, as six were back-crosses, one a cross between hybrids and one involved a third species. Most combinations of species proving to be fertile in this study were known to be so already half a century ago (Johnsgard 1960), the combination of Greylag Goose and Greater Canada Goose already by Bengt Berg (see Jansson 1984). In the latter combination of species, besides back-crosses with both parent species, also successful breeding of two hybrids was reported (Persson 1997). Moreover, one such hybrid was seen paired first to one of the parent species and later to the other one (*Snatter* 18(1993): 4). The only observation of a third-generation hybrid was, not surprisingly, recorded between Greylag and Swan Goose (cf. Lärn-Nilsson 1996).

Hybrids differ from individuals of the parental species not only in morphology but usually also in fertility and viability (Mayr 1970, Lack 1974). In general, the hybrids recorded in Sweden seemed to produce very few offspring. Several breeding attempts did not result in any hatchlings, and in those producing fledglings, two thirds of all broods numbered only 1–2 young. Larger broods were only produced by pairs where one of the parents was a hybrid between a Greater Canada Goose and a Barnacle or Greylag Goose. When three species were involved, a total of three breeding attempts of three different species combinations resulted in only one hatchling, a bird that never fledged. A fourth three-species combination, a Siberian White-fronted Goose x Greylag Goose hybrid paired to a Lesser White-fronted Goose, was reported by Kolbe (1972).

Conservation implications

An increased incidence of hybridisation, similar to that at range expansion, often occurs during population declines (Randler 2006). This has implications for Red List species, in Sweden especially due to an increased occurrence of individuals of captive origin.

The only native species in Sweden that seemingly has been affected by hybridisation is the Greylag Goose, in which introgression of genetic material from the Swan Goose has taken place in Skåne. This process passed almost unnoticed however. Instead, it was the revelation that about 25% of the captive stock of Lesser White-fronted Geese, used in the Swedish re-establishing project, carried mitochondrial DNA of Siberian White-fronts that caught attention. Some geneticists are of the opinion that these haplotypes might be a relict from a distant shared ancestor (Kholodova & Severtsov 2002), but the general assumption is that this introgression took place by hybridisation in captivity (Ruokonen et al. 2004). However, it can very well be that it originates from a wild-caught individual, as such hybridisation occurs in the wild (see references above). One reason for genetecists not having found Siberian Whitefront genes in wild Lesser Whitefronts (Ruokonen et al. 2004, 2007) might be that such hybrids mainly associates with Siberian White-fronted Geese. The scientificly founded reasons to eradicate birds that have been released are of that reason quite weak. In either case, to obtain a more natural, though unknown, frequency of Siberian Whitefront DNA in the re-established Lesser Whitefront population, future releases in Sweden should be of pure-bred birds, and in large scale, by means of which the existing frequency can be diluted (cf. Andersson 2006, Andersson & Holmqvist 2007).

As hybrids produced by released Lesser Whitefront males paired to Barnacle Geese seem to associate with Barnacles, they ought to have no negative impact on the re-established Lesser Whitefront population, even if there are indications that second-generation hybrids might have been produced (www.artportalen.se). A re-evaluation might be necessary, however, after the successful breeding of a Lesser Whitefront pair at Hörningsholm (Mpd) in 2006 (Allberg & Marklund 2006). Hybridisation with Siberian White-fronted Geese of captive origin, on the other hand, constitutes a real threat to both the re-established and the native population. Especially to the native one as it has declined to about 20 breeding pairs (Øien et al. 2007). An increasing number of Siberian Whitefronts has been recorded in Sweden in summer during the last few decades (Kampe-Persson & Lerner, in prep.), and hybridisation with different species has occurred in northern Fennoscandia (Birina 2005, this study). There is also one record of an individual paired to a Lesser White-fronted Goose staging in Lule lappmark in May 1991 (this study). A possible source of Siberian Whitefronts turning up in Fennoscandia during breeding time is the increasing naturalised population in the Netherlands, which numbered 400 pairs in 2005 (van der Jeugd et al. 2006). The first Dutch breeding was recorded in 1980, but it was a national ban on the use of live-decoys for hunting in 1998 that enhanced the establishment of a larger population. In 2005, there were also three pairs of Lesser White-fronted Goose in the Netherlands (van der Jeugd et al. 2006). There is also a report of one breeding mixed pair of Lesser White-fronted and Greylag Goose (Koffijberg et al. 2005).

The fact that the Lesser White-fronted Goose is *critically endangered* according to the Swedish Red List (Gärdenfors 2005), urges for action to prevent all kinds of devastating hybridisation. Also the EU Life Nature project ”Conservation of the Lesser White-fronted Goose on European migration route” identifies hybridisation as a threat, however, in quite a different way: ”An additional threat for the Fennoscandian LWfG is the possible hybridisation with the reintroduced and/or escaped captive LWfG (cf. IUCN guidelines for reintroduction and restocking). As shown by the recent genetic studies of the Finnish and Swedish stocks used or planned to be used in the reintroduction programmes, hybridisation with the White-fronted Goose (*Anser albifrons*) and Greylag Goose (*Anser anser*) has occurred several times during the captive history. The reintroduced birds of these captive stocks form also threat in the sense that the small unpedigreed and ill managed captive populations might have accumulated deleterious mutations with untested effects in the wild. When introduced into small wild population, these alleles might become quickly fixed by genetic drift and accelerate the extinction of the wild Fennoscandian population. The present project will not, however, directly target the genetic threat." (WWF Finland). The genetic studies referred to in the cited statement were made by Ruokonen et al. (2007). But, at the same time as the released birds are depicted as a threat, re-stocking is very likely the only measure by which the native population can be prevented from extinction within a near future. It is in the light of this, that projects other than the Life project shall be viewed (for a summary, see Hansson 2005).

Also for the Taiga Bean Goose, all factors negatively affecting the Swedish population (for a summary, see Kampe-Persson et al. 2005) ought to be limited to a minimum, due to the status of this taxon as *vulnerable* (Gärdenfors 2005). Evidently, hybridisation did not become one of these factors until quite recently (this study). But due to its small population size of only 800-1,250 breeding pairs (Leif Nilsson, pers. comm. to HKP), measures to prevent introgression of genetic material from closely related taxa, especially from birds of captive origin, should be considered for inclusion in a future conservation plan. Fauna falsification of that kind has occurred in the Swedish Greylag Goose population, by introgression of genes from the eastern subspecies *rubrirostris* (Kampe-Persson 2002), resulting in the occurrence of individuals with pink bills (Kampe-Persson 2003).

Regarding the third Red List species, the Red-breasted Goose, hybrids recorded in Sweden so far seem to have originated from the species' natural breeding grounds. Several summer sightings of free-flying Redbreasts with a suspected captive origin were done during the last years however (see, for example, Lerner 2004a). These birds might be a source for future hybridisation.

Both introduced and naturalised species have been found to hybridise with native geese, which calls for increased vigilance in regard to invasive species. After establishing itself in Great Britain (Sutherland & Allport 1991, Delany 1993, Brown & Grice 2005, Baker *et al.* 2006) and the Netherlands (Lensink 1996, 2002, van der Jeugd et al. 2006), the Egyptian Goose *Alopochen aegyptiacus* is now invading Sweden (Bengtsson 2007). Except for Common Shelduck, no reports of hybridisation with native species exist so far, only with introduced ones, such as Greater Canada Goose and Ruddy Shelduck *Tadorna ferruginea* (Lensink 1996). In captivity, however, interbreeding has occurred between Egyptian and Greylag Goose (Gray 1958).

Some culling of hybrid geese is taking place on a regular basis, for instance in Skånes Djurpark (Staffan Åkeby; in litt.), and attempts are made to cull the hybridising Lesser White-fronted Geese of the Swedish re-establishment project (Lerner 2005a). One such bird, paired to a Barnacle Goose, was, for instance, shot at Hjälstaviken (Upl) 20 April 2007 (Karl-Gustav Sjölund et al.). That male, released in Swedish Lapland in 1997, had produced hybrids during the last 2–3 years, and should most likely have continued to do so (Bo Fagerström, in litt.). Another male, which never had shown any indication of hybridisation, was caught in 2005 (Åke Andersson, in litt.). Culling is also used locally to prevent naturalised populations from growing too large. It seems worth considering if culling should be used on a larger scale, as naturalised populations can serve as sources for both hybridisation and the spread of alien genes and behaviours. The more if situations similar to those in Great Britain (Delany 1993, Baker et al. 2006) and the Netherlands (Lensink 1996a, 1998, van Horssen & Lensink 2000, Ouweneel 2001, Sovon Vogelonderzoek Nederland 2002, van Roomen et al. 2003, van der Jeugd et al. 2006) are undesirable.

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Sammanfattning

Hybridisering mellan arter inom samma släkte är vanligt hos andfåglar, men även hybridisering mellan arter från olika släkten förekommer. Bland gässen kan i princip varje artkombination förekomma mellan släktena *Anser* och *Branta*. Få skattningar av antalet hybrider i det vilda har gjorts och den här artikeln är den första heltäckande för Sverige. Studien ger grundläggande data kring alla de fynd av blandpar och hybridgäss som har noterats i Sverige fram till och med augusti 2007. Typer av hybrider, antal, trender och ursprung diskuteras. Extra stor vikt har fästs vid de rödlistade arterna fjällgås, sädgås och rödhalsad gås.

Rapporten bygger på observationer publicerade i nationella, regionala och lokala tidskrifter och rapporter, inlagda i Svalan, gjorda av författarna (HKP och HL) eller av andra som sänt sina observationer till författarna. Ett problem med observationer av hybrider är att alla fågelskådare inte noterar och rapporterar dessa. Ett annat att ett flertal lokala publikationer är svårfunna. Majoriteten av observationerna i denna rapport är inte granskade och korrigerade utan bygger på observatörens angivande av föräldrafåglar. Nomenklaturen i rapporten följer rekommendationer gjorda av Commissie Systematiek Nederlandse Avifauna (Sangster et al. 1999, 2003), vilket innebär att sädgåskomplexet delats upp i taigasädgås *Anser fabalis* och tundrasädgås *Anser serrirostris*, kanadagåskomplexet i kanadagås *Branta canadensis* och dvärgkanadagås *Branta hutchinsii* samt prutgås i mörkbukig *Branta bernicla*, ljusbukig *Branta hrota* och svartbukig prutgås *Branta nigricans*.

Av samtliga i Sverige förekommande gäss har 17 arter varit involverade som föräldrar till hybrider (Tabell 1, Appendix). Bland hybridtyperna var vitkindad gås den mest representerade (tio typer), följt av grågås (nio), kanadagås (åtta) samt bläsgås och snögås (sju vardera). Vissa hybridtyper noterades redan under perioden 1918–1930-talet (bläsgås x snögås, bläsgås x taigasädgås, bläsgås x stripgås och grågås x kanadagås; Tabell 2). De flesta av de andra typerna noterades först under de sista 30 åren (Tabell 3). Andragenerationshybrider har rapporterats sen mitten på 1980-talet. Antalet hybrider verkar ha ökat i Sverige under det senaste halvseklet (Tabell 4). Den i antal vanligaste hybridtypen är grågås x kanadagås och den näst vanligaste kanadagås x vitkindad gås (Tabell 5).

Hybridgässen har det senaste halvseklet ökat i antal i Sverige. Huruvida detta beror på ökande populationer, förändringar i förekomsten av antalet tama och halvvilda fåglar, en ökande förekomst på sydliga breddgrader av nordliga arter eller en högre rapporteringsfrekvens behöver utredas närmare.

Resultaten från den här studien stöder åtminstone två av de teorier som framlagts för att förklara hybridisering inom andfåglarna, nämligen ”Best-Option-Hypothesis” och ”Inter-specific mate choice following false imprinting”.

I populationer som minskar ökar risken för hybridisering. Bland de rödlistade gässen, fjällgås, taigasädgås och rödhalsad gås, har hybrider med andra arter observerats, vilket är oroande. Det är av yttersta vikt att hänsyn tas till risken för hybridisering när åtgärdsprogram för hotade arter upprättas eller revideras. Avlivande av hybrider och individer som uppträder i blandpar bör också i vissa fall övervägas.

Appendix

Anser albifrons x *Anser anser*
Pairs were seen at Getterön (Hl) 19 April 1962 (Uno Unger), Gustavsvik (Vrm) 5 May 2001 (Torbjörn Mossberg), Hornborgasjön (Vg) 21 April 2003 and 2–8 April 2004 (Albin Thorsson, Clas Hermansson), Ölmeviken (Vrm) 11 May 2003 (Per Gustafsson, Roger Johansson), Juviken (Ång) 3 April 2005 (Leif Johansson), Åsunden (Vg) 9 May 2005 (Jan Larsson), Torslandaviken (Boh) 28 June–18 July 2006 (Göran Gustafson et al.) and Lomma (Sk) 28 August 2006 (Jörgen Larsson, Vaileth Krantz), while one possible pair was seen at Gävle (Gstr) 17 April 2006 (Anders Johansson et al.). Hybrids were seen with two at Sövdesjön (Sk) 15 September 1988 (HKP), two at Västerfärnebo (Vstm) 28 February and 4 April 1998 (Markus Rehnberg), one at Yddingen (Sk) 25 July 2001 (HKP), two at Sövdesjön (Sk) 8 October 2003 (HKP) and one at Hornborgasjön (Vg) 21–29 May 2004 (Jörgen Fritzson).

Anser albifrons x *Anser caerulescens*
Free-flying hybrids were produced at Kalmarsund (Sm) in the early 1930s (Berg 1937), while one was seen at Ilstorp (Sk) 18 October 1992 (Anders Jönsson).

Anser albifrons x *Anser erythropus*
One pair staged at Luspertjärn (Lu lpm) 20 May 1991 (Åke Aronsson). Maybe the same White-fronted Goose staged at Porjus (Lu lpm) 21 May 1989. In Skåne, one hybrid was seen at Ringsjön 15 November 1992 (HKP), one 2nd cy bird at Vomb 29 March–8 April 2004 (Nils Kjellén et al.) and very likely, the same individual at Tomelilla 15 December 2005 (HKP), Vombsjön 16 October 2006 (HKP) and Tomelilla 13 November 2006 (HKP), while a third individual was seen at Näsbyholmssjön 15 October 2006 (HKP). Outside Skåne, one hybrid was seen at Östen (Vg) 18 March 2001 (Andreas Gustafsson et al.) and one 2nd cy bird at Alviksgården (Nb) 29 April–3 May 2004 (Ulf Eriksson, Marie Björklund). These hybrids have no relation to the released Lesser White-fronted Geese but originate probably from hybridisation in the wild (Lerner 2005a). Two possible hybrids were seen at Roslagsbro (Upl) 7 October 2006 (Joakim Ekman, Gabriel Ekman).

Anser albifrons x *Anser fabalis*
One pair, the male a Siberian White-fronted Goose, produced three free-flying hybrids at Uppsala (Upl) in 1918 (*Svenska Jägareförbundets Tidskrift* 56(1918): 192, 318). One pair was seen at Tärnsjö (Upl) 28 March 2004 (Ulrik Lötberg, Lars Gustavsson), while one probable pair migrated at Vänersborgsviken (Vg) 11 September 2003 (Göran Darefelt) and one probable hybrid was seen at Kilsviken (Vrm) 3–4 June 1995 (Thomas Landgren, Torbjörn Mossberg).

Anser albifrons x *Anser indicus*
Free-flying hybrids were produced at Kalmarsund (Sm) in the early 1930s (Berg 1937).

Anser albifrons x *Branta canadensis*
Pairs were seen at Listersjön (Bl) 1970, 1972 and 1973 (Nilsson & Lundgren 1993) and Brunnesjön (Ång) 13 May 2006 (Leif Johansson). Available sightings of hybrids, done north to Jämtland (Table A1), indicate that breeding took place more than once during the period 1985–2006. A Norwegian origin for at least some of the observed hybrids seems likely. Greater White-fronts have regularly been seen together with Canadas in Trøndelag for a number of years, and one hybrid, in appearance very alike the bird found in Jämtland in 2005, was seen in Tydal during spring migration in 2002, 2003 and 2004 (Sørhuus 2005).

Anser albifrons x *Branta leucopsis*
Successful breeding has been recorded on several occasions in Malmö (Sk) and at Skansen (Srm) (Curry-Lindahl 1959). One pair was seen at Getterön (Hl) 12–19 April 2002 (Johan Frölinghaus), and singly hybrids at Foteviken (Sk) 13 December 1983 (HKP), Ilstorp (Sk) 21 November 1987 (Nils Kjellén), Vombs ängar (Sk) 30 October 1993 (Lars Nilsson), Tosteberga (Sk) 3 March 2002 (Patric Österblad) and Hjälstaviken (Upl) 14–24 May 2005 (Martin Tjernberg et al.). Some of these hybrids might have originated from the Malozemelskaya and Bolshezemelskaya tundras, Yugorskij peninsula of Nenets Autonomous District of Arkhangelskaya region, where both mixed broods and hybrids have been recorded (Oleg Mineev pers. comm. to HKP).

Anser anser x *Anas platyrhynchos*
One pair, the male a Greylag, was seen in Halmstad (Hl) 2 February 2006, 29 January 2007, 7 February 2007 and 28 February 2007 (Christer K. Andersson).

Anser anser x *Anser brachyrhynchus*
One pair was seen at Getterön (Hl) 12 February 2007 (Roland Asteling), one possible pair at Rönnen (Sk) 1 April 2001 (Mats Rellmar) and one hybrid at Lena (Upl) 9 April 1994 (Håkan Andersson, Mathias Andersson).

Anser anser x *Anser caerulescens*
One pair was seen at Rinkaby ängar (Sk) 25 April 1997 (Greger Flyckt), three 2nd cy hybrids at Foteviken (Sk) 6 February 1979 (HKP), and singly hybrids at Ellestadsjön (Sk) 27 August–11 September 1985

(HKP), Barsebäck (Sk) 14 December 1985 (Stefan Cherrug) and Sörfjärden (Srm) 26–30 March 2005 (Lars Broberg). A male Snow Goose was intensively courting a Greylag Goose at Asköviken (Vstm) 3–4 April 2007 (Janne Virking, Markus Rehnberg).

Anser anser x *Anser canagica*
One 1st cy hybrid was seen at Lilla Hammars näs (Sk) 24 October 2004 (Nils Kjellén).

Anser anser x *Anser cygnoides*
One pair produced four fledglings at Fjällfotasjön (Sk) in 1985, (HKP). Singly hybrids were seen at Barsebäck (Sk) 8 December 1986–2 January 1987 (HKP et al.), Ellestadsjön (Sk) 24 June–30 July 1987 (HKP), Vombsjön (Sk) 24 December 1993 (Lars G R Nilsson), Ellestadsjön (Sk) 14 September 1996 (HKP), Foteviken (Sk) 18 October 1996 (HKP) and Hornborgasjön (Vg) 22 May 2005 (Jörgen Fritzson), while two probable hybrids were seen at Hult (Vrm) 21–28 April 2004 (Anders Olsson, Magnus Köpman).

(*Anser anser* x *Anser cygnoides*) x *Anser anser*
Two 1st cy hybrids were seen together with their parents at Ellestadsjön (Sk) 24 June–20 July 1987 (HKP).

((*Anser anser* x *Anser cygnoides*) x *Anser anser*) x *Anser anser*
One bird was seen at Ellestadsjön (Sk) 3 August 1992 (HKP).

Anser anser x *Anser fabalis*
One pair, the male a Taiga Bean Goose, bred unsuccessfully at Yddingen (Sk) in 1992 (HKP), while a pair of captive origin, the male a Greylag Goose, made a breeding attempt at Årsta (Srm) in 2003 (Mats Gothnier). A third pair, the male a Greylag Goose, wintering at the Kampanische Heide in the Netherlands since the early 1980s, was seen at Hagby (Ög) 25 October 1994 and Stepnica in Poland 4 November 1995 (van den Bergh 2004). Sightings of a pair in Stockholm (Srm/Upl) between 28 March 2002 and 10 May 2006 (Gunilla Hjorth et al.), and at Norrtälje (Upl) 7 December 2002–13 February 2003 (Bo Granberg, Karl-Olov Johansson) very likely refer to the aforementioned pair of captive origin. Pairs were seen also at Strängnäs (Srm) 2 May 2004 (Yngve Meijer), Vendelsjö (Upl) 20 August 2005 (Anders Arnell), Tranvik (Upl) 17 April 2006 (Carl Bredberg), Charlottenlund (Sk) 13 October 2006 (HKP), Näsbyholmssjön (Sk) 27 December 2006 (Anders Sennmalm) and Råda (Vg) 12 March 2007 (Johannes Löfqvist). In Skåne, one hybrid was seen at Vombsjön 6 September 2001, two at Vombsjön 12 October 2006 and one, together with its parents, at Charlottenlund 13 October 2006 (HKP).

Anser anser x *Anser indicus*
One pair was seen at Hornborgasjön (Vg) 16 May 2007 (Stig Karlsson et al.), while 20 sightings were reported during the period 1984–2006, but more than one individual was seen only twice (Table A2). A Norwegian origin for some of the observed individuals is possible, as breeding was recorded at Namsos in Nord-Trøndelag in July 1991 (Gustad 1992).

(*Anser anser* x *Anser indicus*) x *Branta canadensis*
One pair, where the hybrid was not fully identified, staged at Eggby (Vg) 14 May 2006 (Patrick Åström, Sofia Åström).

Anser anser x *Branta canadensis*
Free-flying hybrids were produced at Kalmarsund (Sm) as early as in the late 1920s (Berg 1930, 1937). Reports of hybrids among staging and wintering Canada geese started to appear in the 1960s (Borg 1962, Bolund 1964, Nord 1964, Jonasson 1966, Axelsson 1967, Johansson 1968), but observations were made in Norrköping already in the winter 1956–57. By now, this hybrid type has been reported from most parts of the country, but in some regions not until recently, as for instance, Gotland (1997) and Norrbotten (2003). In 2007, a mixed pair was seen in both Lule and Pite lappmark (Stefan Holmberg).

The earliest reported breeding occurred in Boulongerskogen (Hls) in the 1960s (Johan Södercrantz). Since then, breeding has been reported from large parts of the country. At the typical breeding site, there were no pairs of one of the species, while the other was represented by quite a number of pairs (see e.g. Elmfors 1980, Eriksson 1982, Cronert & Svensson 1991).

Some pairs were very productive, illustrated by observations of pairs with 11 juveniles at Vesan (Bl) 17 October 1989, 10 juveniles at Trolle-Ljungby (Sk) 8 September 1985, 9 juveniles at N Håslövs By (Sk) 19 November 1999 (HKP) and 8 juveniles at Jultorp Larv (Vg) 25 July 2007 (Ingemar Nilsson & Maj-Britt Nilsson). The largest observed family was a pair with 17 young at Krageholmssjön (Sk) 27 August 1992 (HKP), but in that case it must have been young born in both 1992 and 1991, maybe also in 1990. A flock of 15 hybrids was seen at Östen (Vg) 18 November 2006 (Patrick Åström) and another of 11 at Hökafältet (Hl) 10 February 2007 (Mikael Haraldsson).

(*Anser anser* x *Branta canadensis*) x *Anser anser*
Pairs were seen in Uppland before 1984 (Amcoff et al. 1984), at Lidingö (Upl) in the autumn of 1992 (Stefan Risberg et al.) and at Hästefjorden (Dsl) 16 November 2005 (Lars Eric Rahm). The hybrid at Lidingö had in the spring of 1992 been paired to a Canada goose (*Snatter* 18(1993): 4). Probable second-generation

hybrids were seen at Hjälstaviken (Upl) 23 May 2004 (Micke Nederman, Svenne Schultzberg), Kolboda (Sm) 16 September 2006 (HKP) and Stavholmsskäret (Vstm) 22 April 2007 (Thomas Pettersson).

(*Anser anser* x *Branta canadensis*) x *Branta canadensis*

Pairs with one young were seen at Södersjön (Upl) 10 July 1985 (Edholm 1987) and Järvafältet (Upl) 27 May–3 June 2001 (Michel Goiny, Svante Söderström), and a pair with two young at Hornborgasjön (Vg) 30 May 2006 (Patrick Åström). Breeding attempts were recorded at Limmaren (Upl) in 1982 (Bo Granberg), Nydala (Sm) in 1987 (Stefan Isaksson), Kristinehamn (Vrm) in 1991 (Thomas Landgren), Järvafältet (Upl) in 1998 (Järvafältets Ornitologiska Klubb) and Rinkabysjön (Sm) in 1999–2002 (Joakim Hagström). The hybrid at Järvafältet was a male, one year old in 1998. Breeding probably took place on several occasions during the period 1984–2006, bearing the large number of pairs reported during that period in mind (Table A3).

(*Anser anser* x *Branta canadensis*) x (*Anser anser* x *Branta canadensis*)

Eleven 1st cy birds were seen together with hybrid parents at Ellestadsjön (Sk) 29 July–1 August 1993 (Persson 1995a). A similar group, numbering 11 hybrids, was seen in the very same lake 12–14 September 1991, but at that time it was not possible to check if they made up a family (HKP).

Anser anser x *Branta leucopsis*

One pair bred successfully in Malmö (Sk) in 2005 (Tommy Holmgren), pairs were seen at Västra Ringsjön (Sk) 2 May 2002 (Lars Lundquist), Hyby (Sk) 2 April 2005 (Christer Sjögren), Isbladskärret (Upl) 30 April 2005 (Magnus Hägg), Marstrandsön (Boh) 5 May 2005 (Peter Strandmark) and Gillsby mossar (Öl) 15 April 2007 (Staffan Rodebrand), while one possible pair was seen at Vänersborgsviken 18 April 2007 (Göran Darefelt & Ingemar Johansson). Of 32 sightings of hybrids during the period 1984–May 2007, all but nine were made in Skåne (Table A4).

Anser anser x *Cygnus olor*

One pair, the male a Greylag Goose, produced at Staffanstorp (Sk) one fledgling in both 1972 and 1975 (Anders Björkman). The Greylag had been raised up by a Mute Swan pair.

Anser anser x *Grus grus*

One pair was seen at Sandsjön (Sm) 27–29 August 2007 (Sven Boberg).

Anser brachyrhynchus x *Anser fabalis*

Pairs were seen at Tåkern (Ög) in the autumn of 1985 (Ingemar Johansson), Hederviken (Upl) 12 April 2001 (Tommy Eriksson), Närtunaby (Upl) 16 April 2001 (Bo Granberg), Roxen (Ög) 29–30 March 2004 (Berndth Gustafsson, Magnus Lindberg) and Östen (Vg) 12–14 March 2007 (Lena Kempe), while probable pairs were seen at Kristinehamn (Vrm) 17 May 2003 (Per Gustafsson, Nisse Carlsson), Fjugesta (Nrk) 10 April 2006 (Fredrik Litsgård), Långhalsen (Srm) 22 April 2006 (Andreas Grabs) and Svensksundsviken (Ög) 17 October 2006 (Robert Petersen). Four juveniles were seen together with their parents, the male a Pink-footed Goose, at Tåkern (Ög) in the autumn of 1985 (Ingemar Johansson), while one hybrid was seen at Biskops-Kulla (Upl) 12 April 1984 (Tjernberg 1987), one at Mossheddinge (Sk) 19 October 1984 (HKP), one at Hjälstaviken (Upl) 18 September–2 November 1986 (Martin Tjernberg, Pekka Westin), one in (Vg) in 1997 (Lerner & Kampe-Persson 2006), two at Ilstorp (Sk) 24 November 2005 (HKP) and another two at Trolle-Ljungby (Sk) 7 December 2005 (HKP).

Anser brachyrhynchus x *Anser serrirostris*

One migrating possible pair was seen at Svältholmen (Gtl) 27 September 2006 (Olof Armini), while singly hybrids were seen at Tomelilla (Sk) 13 November 2006 (HKP) and Vanneberga (Sk) 8 December 2006 (HKP), the latter paired to a Pink-footed Goose (see below).

(*Anser brachyrhynchus* x *Anser serrirostris*) x *Anser brachyrhynchus*

One pair was seen at Vanneberga (Sk) 8 December 2006 (HKP), and maybe the same pair at Umeälvens delta och slätter (Vb) 31 March 2007 (Niklas Lindberg).

Anser brachyrhynchus x *Branta leucopsis*

One pair was seen at Rödön (Jmt) 28 May 2007 (Yngve Larsson).

Anser caerulescens x *Anser fabalis*

One hybrid was seen at Tåkern (Ög) 25 September–10 October 1988 (Anders Elf).

Anser caerulescens x *Anser indicus*

Three different individuals were probably involved in the sightings made during the years 1999–2006 (Table A5).

Anser caerulescens x *Anser rossii*

One adult was seen at Risinge (Öl) 4 September 2003 (Björn Liedén).

Anser caerulescens x *Branta canadensis*

Pairs bred at Ingsbergasjön (Sm) in 1978 (Thorin 1981), Viaredssjön (Vg) in 1983–84 (Magnus Neuendorf) and Kvarnsjön (Vg) in 1989, while a breeding pair was seen at Romanäs (Sm) in 2004 (Anders Ring). In Viaredssjön, Borås a pair occurred in 1982, made the first breeding attempt with three hatched eggs in 1983, while two hybrids were seen and six eggs resulted in at least four fledglings in 1984. During the following years (1985–86 and 1988) hybrids were observed in the same lake (for all observations at Viaredssjön, Magnus Neuendorf). The pair at Kvarnsjön was seen with five young 27 April (Hans-Erik Olausson). Hybrids from Ingsbergasjön were seen in the area around Anebygård, usually from the middle of August to the middle of October, the first four autumns three birds, then two birds up to 1986, and finally, one bird up to 1991. These hybrids were also seen elsewhere in Småland, for instance at Nävelsjö (Westring 1984). These hybrids might have had their winter quarters in western Skåne, where two birds wintered in 1981–1986 (Table A6). Other sightings made up to 1994 might have been of hybrids from either Ingsbergasjön, Viaredssjön or Kvarnsjön (Table A6).

Anser caerulescens x *Branta leucopsis*

One pair staged at Vombsjön (Sk) 1 April 1979 and two hybrids were seen at Barsebäck (Sk) 24 Februay–17 March 1987 (HKP). One pair produced hybrids at Hargs bruk (Upl) in 1994 (Fredriksson & Tjernberg 1996), and most likely also in 1995. Hybrids from Hargs bruk were maybe involved in all sightings made in Sweden during the period 1995–May 2007 (Table A7).

Anser canagica x *Branta leucopsis*

A total of 15 sightings exists, but few were identified with certainty (Table A8).

Anser cygnoides x *Branta canadensis*

One pair was seen at Säve (Boh) 23 March 2006 (Uno Unger) and Ytterby (Boh) 30 December 2006 (Lars Gustafsson), and singly hybrids at Tosteberga (Sk) 18–26 October 1986 (HKP), Barsebäckshamn (Sk) 17 January 1993 (Anders Jönsson), Fäholmen (Bl) 5 September 1995 (Patrik Österblad) and Eskilstorps ängar (Sk) 14 August 1999 (HKP).

Anser erythropus x *Branta canadensis*

One pair was seen at Falun (Dlr) 4 June 1989 (Fredrik Friberg et al.), one hybrid at Lilla Hammars näs (Sk) 22 February 1990 (Nils Kjellén) and probable singly hybrids at Lomma (Sk) 21 December 1999 (Anders Jönsson), Tranås (Sm) 4–8 April 2004 (Anders Ring) and Leksand (Dlr) 5 August 2006 (Bogdan Persson).

Anser erythropus x *Branta hutchinsii*

At least two different individuals (for descriptions, see Nilsson 1983, Österblad 1987) were recorded in West Blekinge and North-east Skåne on a number of occasions during 1979–1993 (Nilsson 2000, Table A9). In all probability, these hybrids originated from the breeding of geese at Eriksberg (Bl) (Nilsson 1983). In 1983, one of these hybrids made a breeding attempt paired to a Barnacle Goose (see below).

(*Anser erythropus* x *Branta hutchinsii*) x *Branta leucopsis*

One pair, the male a hybrid, made a breeding attempt at Karlshamn (Bl) in 1983, but none of the four eggs hatched (Nilsson 1984).

Anser erythropus x *Branta leucopsis*

Breeding has since 2002 become annual in Jämtland and Hälsingland. A male Lesser White-fronted Goose, cross-fostered by Barnacle Geese, and paired to a Barnacle, bred in at least three successive years (Fabricius 1991). One hybrid was born in Stockholm (Upl) in 1985 (Kyrk 1987), and seen at Isbladskärret (Upl) 26 August–4 September 1985 (Thomas Strid). The four hybrids in Skåne in autumn 1994 (Table A10) indicate that another successful breeding took place that year. Up to 2002, possible pairs were reported from Flöjelberget (Ång) 22 August 1998 (rrk Ång), Ledskärsområdet (Upl) 6 August 1999 (Johan Södercrantz, Kjell Pålsson), Rödön (Jmt) 31 May 2001 (Sölve Westlund), Söderbärke (Dlr) 26 August–12 September 2001 (Yngve Johansson et al.) and Kronholmens fyr (Gtl) 4 May 2002 (Olof Armini). In 2002, one hybrid was produced in the Archipelago of Söderhamn (Hls) (Bo Fagerström), while one hybrid was seen with its parents at Araviken (Jmt) 23 August (Sölve Westlund). In 2003, one possible pair was seen at Tunasjön (Hls) 4 June 2003 (Bo Johnsson). In 2004, at least four male Lesser White-fronted Geese paired to Barnacle Geese bred in Sweden (Bo Fagerström). In the Archipelago of Söderhamn (Hls) at least two pairs bred, producing 1+3 hybrids. In Jämtland, two pairs produced a total of 4–5 hybrids (Bo Fagerström). In 2005, breeding at Ålsjön (Hls) resulted in two fledglings (Stefan Persson et al.). In 2006, one gosling was seen together with its parents at Stålnäshararna (Hls) 5 July (Esbjörn Nordlund), while another three 1st cy birds were seen at Hjälstaviken (Upl) 26 August (Martin Tjernberg). In 2007, five 1st cy birds were seen together with their parents at Gävletravet (Gstr) 1–4 August (Yngve Meijer et al.), and probably the same family at Hjälstaviken (Upl) 26 August (Martin Tjernberg).

Two sites frequently used by staging hybrids during the years 2004–2006, at least by those born in Hälsingland, were Gävletravet (Gstr) in August and Hjälstaviken (Upl) from mid-August to mid-October.

Some birds staged at Hjälstaviken also in May and early June. Hybrids were occasionally seen also at other sites in Jämtland, Hälsingland, Gästrikland and Uppland. Sightings further south were mainly done in Gotland and Skåne (Table A10).

Winter quarters of these hybrids were situated in the Netherlands (Bo Fagerström, Koffijberg et al. 2005) and the Doñana area, South-west Spain (Kampe-Persson 2004).

(*Anser erythropus* x *Branta leucopsis*) x *Branta canadensis*
One pair, the male a hybrid, bred unsuccessfully at Gussjön (Ång) in 1989 (Sjöberg 1990); none of the six eggs hatched. The pair was seen at the breeding site 11 May–20 July, and at Härnösand 20 September (Leif Johansson).

Anser fabalis x *Anser serrirostris*
Possible pairs were seen at Vadsjön (Srm) 21 February 2004 (Göran Andersson), Tofta kile (Boh) 7 April 2004 (Peter Strandvik), Foteviken (Sk) 12 January 2005 (Claes Larsson et al.), Östansjösjön (Ång) 16 April 2005 (Bo Nensén), Svartsjöviken (Upl) 1 April 2006 (Linus Brobacke, Signe Hagerman), Mellsta by (Öl) 14 October 2006 (Peter Bryngelstam, Per Nyberg), Gräsgårds hamn (Öl) 22 October 2006 (Olle Wahlentin) and Hullsjön (Vg) 12 March 2007 (Kent Kristenson & Saga Boberg). Three adult hybrids were seen at Vombs ängar (Sk) 3–8 October 2004, one adult at Trolle-Ljungby (Sk) 2 November 2005, and at Karsholm (Sk) 8 December 2006 as well, and one individual at Vellinge ängar (Sk) 10 September 2006 (HKP). Birds reported as morphologically intermediary to Taiga and Tundra Bean Goose might have been hybrids; four at Skatelövsfjorden (Sm) 19 February 2001 (Joakim Hagström), 2–3 at Tydjesjön (Dls) 8 March 2002 (Håkan Krave) and two at Umeälvens delta och slätter (Vb) 28 October 2002 (Emmanuel Naudot).

Anser fabalis x *Branta canadensis*
One pair was seen at Hålsjö (Hls) 29 April–9 May 2001 (Arnold Larsson, Mats Åberg), Delsbo (Hls) 14 April 2002 (Arnold Larsson) and Bjuråker (Hls) 28 April 2002 (Arnold Larsson), and maybe the same at Torslanda (Boh) 20 February 2004 (Johan Svedholm). At least two hybrids were seen at Kristianstad (Sk) in the winter 1983/84 (Benny Lorentzon in litt. to HKP), another two at Rönningsberg (Jmt) 30 September 1994 (Berth Bergman) and one adult probable hybrid at Krageholmssjön (Sk) 29 December 2001 (Roger Jonsson). These hybrids were thought to be an unexpected outcome of a re-establishment project run by the Swedish Association for Hunting and Wildlife Management (cf. Holmberg 1986). During the years 1974–1991, a total of 376 Taiga Bean goslings, with Greater Canadas as foster parents, were released in the provinces Dalarna, Härjedalen and Hälsingland (von Essen 1982, Svensson et al. 1999). Several of these families wintered at Höllviken, South-west Skåne (HKP). One male from this project, paired to a Greater Canada Goose, bred at Öster-Malma (Srm) for five years, before he was removed, whereupon the female re-paired with a Greylag Goose and finally with a Canada Goose (Fabricius 1991).

(*Anser fabalis* x *Branta canadensis*) x *Branta canadensis*
One pair, the male a hybrid, was seen at Hög kyrka (Hls) 16 March 2007 (Kenneth Karelius).

Anser indicus x *Branta canadensis*
This hybrid type was mainly reported from Skåne, usually singly, but there were also observations of a family at Tåkern (Ög) in 1987 and 1988 (Table A11).

Anser indicus x *Branta leucopsis*
One pair made up of two hybrids was recorded in South-west Skåne during the years 1985–1994 (see below). After that one of the mates had died, the surviving bird continued to use the same sites, and bred paired to a Greylag Goose in 1997 (see below). This individual was last seen 15 September 2001, when more than 17 years old (HKP). Sightings of other individuals than the two afore-mentioned ones were also they mainly done in South-west Skåne (Table A12).

(*Anser indicus* x *Branta leucopsis*) x *Anser anser*
In Skåne in 1997, one young was seen together with its parents at Fjällfotasjön 29 May–24 June, while the pair, without young, was seen at Börringesjön and Foteviken 11 July–21 October (HKP).

(*Anser indicus* x *Branta leucopsis*) x (*Anser indicus* x *Branta leucopsis*)
In Skåne, one pair, first recorded at Yddingen 7 May 1985, bred unsuccessfully at Fjällfotasjön annually during the period 1986–1994 (HKP). After leaving the breeding site, the pair spent the rest of the summer and autumn at Börringe and Foteviken (HKP).

Branta bernicla x *Branta hrota*
One bird was seen at Torhamns udde (Bl) 26 September 2002 (Fredrik Lennartsson).

Branta bernicla x *Branta leucopsis*
Ten sightings, all of them from the last three-year period, involved probably at least three different individuals (Table A13).

Branta canadensis x *Branta leucopsis*
Since the first sighting in 1969 (Table A14), the increase in both total number of observations and the number of winter sightings (Table A15) parallel the development of the Swedish Barnacle Goose population (Ganter et al. 1999).

One pair, the male a Barnacle Goose, produced three hybrids at Västra Harg (Ög) in 1985 (Gunnar Björkman). Another pair, the Barnacle Goose born at Skansen (Srm), bred at Skanssjön (Vstm) in the years 1992–1994, producing 4 young in 1992 (Pontus Lindberg, Markus Rehnberg) and five in 1994 (Per Eriksson, Stefan Johansson). In 1992, a third pair was seen in Lagårdssjön (Vstm), with five juveniles in September (Nils Erik Zetterström). At Skanssjön, breeding was recorded also in 2000, while two pairs were reported in 2001 (Per Eriksson). A pair with five newly-fledged young was seen at Tjolöholm (Hl) 26 July 2002 (Göran Säwén). Pairs were seen at Vimmerby (Sm) 21 April 2007 (Sam Hallingfors) and Styrnäs (Ång) 6 May 2007 (Lasse Bengtsson). Breeding has most likely also occurred in Dalarna, at least during the last few years.

In Västmanland, this hybrid type was recorded from February to November annually from 1992, with as many as ten birds at Färdskär 29 September 2004 (Ralf Lundmark) and eight at Västerås 26 October 2003 (Markus Rehnberg). In Dalarna, this form was recorded from March to November, one bird 11 May 1997 (Lars Hansson et al.), annually from 2002, with as many as eight birds at Gustafs 4 October 2003 (Nils-Erik Björkbacka, Erik Björkbacka) and five at Tyllsnäs 7 November 2004 (Nils-Erik Björkbacka).

In March and April, this hybrid type was frequently seen in Småland, with as many as seven birds at Vidöstern 13 March 2001 (Roger Ahlman et al.), but also in Halland (2006), Gotland (2001), Västergötland (2001, 2002, 2003, 2004, 2007), Östergötland (2005, 2007), Bohuslän (2002), Dalsland (2002, 2007), Närke (2005, 2006), Sörmland (2001, 2004, 2005, 2006), Uppland (2002, 2003, 2006, 2007) and Gästrikland (2007). Summer and early autumn sightings were done in the same regions, and in Öland and Skåne as well. The largest autumn flock was 15 birds at Landsjön (Sm) 7–11 October 2006 (Stefan Löfgren, Toni Hermansson). Late autumn sightings include two at Hederviken (Upl) 6 November 2005 (Ulf Linnell, Åke Österberg), one at Brissund (Gtl) three days later (Lars Ericson), one at Östen (Vg) 18 November 2006 (Patrick Åström), one at Dettern (Vg) 26 November 2006 (Göran Darefelt) and one at Tösse (Dsl) 28 November 2006 (Tage Kyrk).

(*Branta canadensis* x *Branta leucopsis*) x *Branta canadensis*
Four juveniles were seen together with their parents, the male a Greater Canada Goose, at Eriksberg (Vstm) 10 October 1997 (Per Eriksson), while pairs were seen at Vrångö (Vg) 25 April 1997 (Gösta Olofsson), Steneby (Dsl) 2 April 2002 (Inge Haraldsson), Västerås (Vstm) 20 April 2002 (Markus Rehnberg) and Lisjö ängar (Vstm) 18 May 2006 (Ralf Lundmark).

(*Branta canadensis* x *Branta leucopsis*) x *Branta leucopsis*
Breeding was recorded at Skanssjön (Vstm) in 2000 (Per Eriksson). Pairs were seen at Friberg (Upl) 10 June 2002 (Pekka Westin), Hjälstaviken 31 March–3 April 2003 (Gabriel Ekman et al.) and Västsura (Vstm) 9 April 2006 (Maj Karsten). Five second-generation hybrids were seen together with one first-generation hybrid at Skrea (Hl) 19 January 2005 (Joakim Hagström), while one second-generation hybrid staged together with one first-generation hybrid at Kolbäck (Vstm) 31 March 2005 (Per Eriksson).

Branta canadensis x *Cygnus cygnus*
One Greater Canada Goose was seen courting a Whooper Swan *Cygnus cygnus* at Idbyfjärden (Ång) 27 April 2007 (Sven Edfors, Anders Lindström). Two days later, the swan was seen alone at that site (Bo Nensén).

Branta hutchinsii x *Branta leucopsis*
The most probable origin of the hybrids observed ever since 1998 (Table A16) is Malmö (Sk), where one pair produced two young in 2004 (Jim Sundberg, Jonas Sundberg).

(*Branta hutchinsii* x *Branta leucopsis*) x *Branta leucopsis*
One 1st cy bird was seen together with its parents at Foteviken (Sk) 13 September–12 October 2005, and probably the same second-generation hybrid around Foteviken (Sk) 20 October 2006–22 January 2007 (HKP). Two birds seen at Årike Fyris (Upl) 11 October 2005 might have been of this hybrid type (Johan Södercrantz et al.). One probable pair was seen at Roxen (Ög) 7–8 April 2007 (Filip Larsson & Anders Ring).

Branta leucopsis x *Branta ruficollis*
All sightings of this form, eleven in total, were made along the migration route of the Russian Barnacle Goose population (Ganter et al. 1999), and regarded singly birds (Table A17). The first sighting was of a bird that wintered at Haringvliet in the Netherlands (van der Lee & Ouweneel 1976, Högström 1980).

In the following Appendix tables (A1–A17), the four columns refer to, from left to right: date, number of individual hybrids (pairs in Table A3), site, and observer or reference. Date is given as day, month, year. When nothing else is stated, the observations refer to numbers observed through August 2007.

I följande Appendix-tabeller (A1–A17) avseer de fyra kolumnerna, från vänster till höger: datum, antal hybridindivider (par i Tabell A3), lokal och observatör eller referens. Datum ges i form av dag, månad och år. När inget annat anges gäller observationerna fåglar som setts till och med augusti 2007.

Table A1. Siberian White-fronted Goose x Greater Canada Goose. *Bläsgås* x *kanadagås*.

7.10.1985	1[1]	Rådasjön (Upl)	Michael Averland
23.11.1985	1[1]	Finsta (Upl)	Lars Olsson, Michael Averland
27.6.1989	1	Mölle (Sk)	Anders Jönsson
30.9.1989	2	Foteviken (Sk)	Ola Elleström, Hans Larsson
8.4.1990	1	Vattenmöllan (Sk)	Anders Jönsson, Kerstin Svalin
24.2.1991	1	Värpinge (Sk)	Nils Kjellén
11–18.7.1992	1	Höganäs (Sk)	Christer Lundin
15.11.1993	1	Vanneberga (Sk)	Niklas Holmkvist
10.2.1994	1	Vombsjön (Sk)	Anders Jönsson
29.3.1997	2	Fläcksjön (Vstm)	Ralf Lundmark
30.10–5.11.1997	1–3	Kolbäck (Vstm)	Ralf Lundmark
11.4.1998	2	Karbenning (Vstm)	Ralf Lundmark
14.10.2000	2	Sjötorpasjön (Vg)	Ulla Carlsson, Ingemar Carlsson
25.12.2000–24.2.2001	2	Alnarp/Lomma (Sk)	Lars Nilsson et al.
15.4.2001	2	Sonnboviken (Dlr)	Berndt Söderlund
2.9.2001	1	Knösen (Sk)	Tommy Holmgren
17.10.2001	1	Landskrona (Sk)	HKP
16.10.2003	2	Barsebäckshamn (Sk)	HKP
8.10.2004	1	Medstuguån (Dlr)	Sørhuus (2005)
1.4.2005	1	Mockfjärd (Dlr)	Vesa Juujärvi
8.5.2005	1	Njurunda (Mpd)	Staffan Bergman, Ingvar Wedberg
14.8.2005	1	Bodsjöbränna (Jmt)	Sørhuus (2005)
9.9.2005	1	Trönninge ängar (Hl)	Joakim Lindblom
30.10.2005	1	Roxen (Ög)	Anders Elf
2.11.2005	1	Göteborg (Vg)	Uno Unger
20.12.2005	1	Säve (Boh)	Johan Svedholm
2.4.2006	1	Ekoparken (Upl)	Andreas Zetterberg
9.10.2006	1	Järvafältet (Upl)	Charles Wiklund
11–12.3.2007	1	Järvafältet (Upl)	Stefan Kyrklund et al.

[1] = probably the same individual. *Troligen samma individ.*

Table A2. Greylag Goose x Bar-headed Goose. *Grågås* x *stripgås*.

16.9–19.10.1984	1	Börringe (Sk)	HKP
4.11.1985	1	Bromölla (Sk)	HKP
15.8–15.9.1988	1	Sövdesjön (Sk)	HKP
5.3.1989	1	Sövdesjön (Sk)	Anders Jönsson
6.10.1990	2	Foteviken (Sk)	Joakim Hagström
21.10.1995	1	Foteviken (Sk)	HKP
1.11.1998	1	Barsebäckshamn (Sk)	Kent Andersson
25.2–10.3.1999	1	Veselången (Vg)	Mikael & Joakim Karlsson
6.3 and 11.4.1999	1	Östen (Vg)	Kent-Ove Hvass
2000	1	(Ög)	Lerner & Kampe-Persson (2006)
31.7–2.8.2001	1	Bara (Sk)	HKP
3.9.2002	5	Frövi (Vstm)	Jan-Erik Malmstigen
23.7–7.9.2003	1[1]	N Hyn (Vrm)	Magnus Köpman et al.
5.6–31.10.2004	1[1]	Klarälvsdeltat/N Hyn (Vrm)	Per Gustafsson et al.

27.3.2005	1	Roxen (Ög)	Lasse Linde
April–October 2005	1	Svartåmynningen (Ög)	Carlsson et al. (2006)
8.5–8.9.2005	1[1]	N Hyn (Vrm)	Dan Mangsbo et al.
2.4.2006	1	Bergs mader (Boh)	Per Karlsson
1–2.5 and 25.7.06	1[1]	N Hyn/Södra Hyn (Vrm)	Dan Mangsbo et al.
1.10.2006	1[1]	N Hyn (Vrm)	Dan Magnsbo

[1] = probably the same individual. *Troligen samma individ.*

Table A3. Greylag Goose x Greater Canada Goose hybrid and Greater Canada Goose, non-breeding pairs. *Grågås* x *kanadagås-hybrid och kanadagås, icke häckande par.*

7–17.4.1984	1	Väsbysjön (Upl)	Bill Douhan
23.4–20.5.1984	1	Hosjön (Upl)	Bill Douhan, Gabriel Ekman
7.4.1985	2	Kundbysjön (Upl)	Bill Douhan, Bo Granberg
12.5.1985	1	Lövstabruk (Upl)	Mats Edholm
29.3.1987	1	Kundbysjön (Upl)	Bo Granberg, Bill Douhan
Spring 1992	1[1]	Lidingö (Upl)	Stefan Risberg et al.
29.10.1994	1	Skärholmen (Srm)	Mats Gothnier
30.11.1994	1	Albysjön (Srm)	Bengt Jansson
3.4.2001	1	Forsa (Hls)	Mats Axbrink
9.4.2002	1	Ekebysjön (Upl)	Henrik Bergendal
10–31.7.2002	1	Edsbergs slott (Upl)	Michel Goiny
25.3.2003	1	Sjötorpasjön (Vg)	Albin Thorsson, Ulla Carlsson
3.4.2004	1	Tidaholm (Vg)	Magnus Hallgren
22.4–14.5.2004	1	Tidaholm (Vg)	Magnus Hallgren
26.4.2004	1	Bälteberga (Vg)	Magnus Hallgren
29.4.2004	1	Klarälvsdeltat (Vrm)	Per Gustafsson
17.9.2004	1	Kvicksund (Srm/Vstm)	Markus Rehnberg
23.3.2005	1	Ramnäs (Vstm)	Ralf Lundmark
2.4.2005	1	Skövde (Vg)	Christopher Magnusson
8.4.2005	1	Lovön (Upl)	Svenne Schultzberg
21.4–6.5.2005	1	Eskilstorps ängar (Sk)	Nils Kjellén
3–10.5.2005	1	Ekoparken (Upl)	Erik Peurell
2–3.4.2005	1	Asköviken (Vstm)	Markus Rehnberg
15.6.2005	1[2]	Asköviken (Vstm)	Markus Rehnberg
22.3.2006	1	Stenungssund (Boh)	Owe Hougström
24.3.2006	1[3]	Västerstadsviken (Öl)	Tommy Knutsson
30.3–1.4.2006	1	Gnien (Vstm)	Ralf Lundmark
11.4.2006	1	Baggensstäket (Upl)	Nils Magnus Fredriksson
6–9.5.2006	1	Järvafältet (Upl)	Blanca Larkeson, Martina Kadin
9.5.2006	1	Hornsjön (Vg)	Lars-Göran Lindgren
18.5.2006	1	Ullersättersviken (Vstm)	Jan-Erik Malmstigen
8.6.2006	1	Hässelby (Upl)	Niklas Westermark et al.
23.7.2006	1	Ekoparken (Upl)	Nils Magnus Fredriksson
12.5.2007	1[2]	Järvafältet (Upl)	Björn Wester

[1] = paired to a Greylag Goose in autumn 1992. *I par med grågås under hösten 1992.*

[2] = the hybrid was a female. *Hybriden var en hona.* [3] = the hybrid was a male. *Hybriden var en hane.*

Table A4. Greylag Goose x Barnacle Goose. *Grågås* x *vitkindad gås.*

16–28.9.1984	1	Klosterviken (Sk)	HKP
19–20.10.1984	1	Saritslöv (Sk)	HKP
5.4.1985	1	Kapelludden (Öl)	Wallin (1995)
12.1–2.2.1990	1	Foteviken (Sk)	Jan Åke Hillarp
29.8–20.9.1992	1	Svensksundsviken (Ög)	Fredrik Johansson

5.9.1996	1	Björkesåkrasjön (Sk)	HKP
9.9.1996	1	Vombsjön (Sk)	HKP
11–14.9.1996	3	Ellestadsjön (Sk)	HKP
15.10–10.11.1996	1–2	Vombsjön (Sk)	HKP
2.12.1996	1	Glostorp (Sk)	HKP
24.9.1998	2[1]	Malmö (Sk)	HKP
25.9.1998	2[1]	Havgårdssjön (Sk)	HKP
20–31.10.1998	2	Foteviken (Sk)	HKP
11.11.1998	1	Malmö (Sk)	HKP
4–14.4.1999	1	Kilsviken (Vrm)	Thomas Landgren et al.
21.10.1999	1	Foteviken (Sk)	HKP
21.11.1999	1	Salviken (Sk)	Nils Kjellén
13.5.2000	1	Hornborgasjön (Vg)	Magnus Hallgren
14.4.2003	1	Hornborgasjön (Vg)	Andreas Zetterberg et al.
4.8.2004	1	Beijershamn (Öl)	Göran Dahlman
20.9.2004	1	Edsbergs slott (Upl)	Michel Goiny
2.6.2005	1	Tannamskilen (Boh)	Pär Lydmark
7–11.10.2005	1	Spillepeng (Sk)	HKP
12.10.2005	1	Lilla Hammars näs (Sk)	HKP
15.10.2005	1	Ellestadsjön (Sk)	HKP
30.8.2006	3	Lomma (Sk)	Max Lundberg
9.9.2006	1	Ellestadsjön (Sk)	HKP
17.10.2006–2.1.2007	4[2]	Lomma/Lundåkrabukten (Sk)	HKP
20.10.06–25.1.2007	1	Foteviken (Sk)	HKP, Peter Öhrström
16.11.2006	1	Spillepeng (Sk)	HKP
13.1.2007	2	Flyingeby (Sk)	HKP
22.4.2007	1	Petgärde träsk (Öl)	Uno Unger, Mats Wallin

[1] = different individuals. *Olika individer.* [2] = together with parents. *Tillsammans med föräldrar.*

Table A5. Snow Goose x Bar-headed Goose. *Snögås* x *stripgås.*

1.1–13.3.1999	1	Rinkaby/Yngsjö (Sk)	Greger Flyckt
21.4.1999	1	Spillepeng (Sk)	Anders Jönsson
30.10–5.12.1999	1	Tosteberga (Sk)	Greger Flyckt
14.5.2000	1	Håslövs ängar (Sk)	Erik Schönbeck
28.10.2005	1[1]	Torslandaviken (Vg)	Uno Unger
16.5.2006	1[1]	Lövsund (Srm)	Arne Hellström
8.8–3.12.2006	1[1]	Stockholm (Upl)	Glenn Cornland et al.
18.11.2006	1[1]	Östen (Vg)	Patrick Åström

[1] = ad. *Adult.*

Table A6. Snow Goose x Greater Canada Goose, except Småland and Västergötland 1978–1991. *Snögås* x *kanadagås utom i Småland och Västergötland 1978–1991.*

9–10.2.1981	2	Habo Lung (Sk)	Paul-Eric Jönsson, Göran Karlsson
9.1–23.2.1982	2	Barsebäck (Sk)	Anders Jönsson, HKP
25.12.1982	2	Klagshamn (Sk)	Jesper Segergren
13–18.2.1983	2	Barsebäck (Sk)	Anders Jönsson et al.
7.1–25.2.84	2	Kullabygden (Sk)	Kullabygdens ornitologiska förening
17.4.1984	1	Borrie (Sk)	HKP
2.2.1985	2	Barsebäck (Sk)	Ulf Gärdenfors
12.12.85–16.3.86	2	Barsebäck (Sk)	Anders Jönsson et al.
24.2–17.3.1987	1	Foteviken (Sk)	HKP
15–25.9.1989	1	Foteviken (Sk)	Anders Jönsson et al.
5.1.1992	1	Skanör (Sk)	Joakim Hagström

20.9.1992	1	Visingsö (Sm)	Åke Ankarberg
6–17.11.1992	1	Lundåkrabukten (Sk)	Anders Jönsson
27.10.1993	1	Jönköping (Sm)	Jan-Erik Henriksson
10.3.1993	1	Knösen (Sk)	Anders Jönsson
26.11.1994	1	Barsebäck (Sk)	Ola Elleström, Johan Lorentzon
16.9.2001	1	Tjolöholm (Boh)	Andreas Wållberg
17.10.2006	1[1]	Värpinge (Sk)	HKP
17.10–16.11.2006	1[1]	Barsebäck (Sk)	HKP

[1] = different individuals. *Olika individer.*

Table A7. Snow Goose x Barnacle Goose 1995–August 2007. *Snögås* x *vitkindad gås 1995–augusti 2007.*

2.1–11.3.1995	2–5	Segesholm/Rinkaby (Sk)	Christer Neideman, Johan Svedholm
26.3–9.4.1995	3–5	Angarnsjöängen (Upl)	Erik Koppe et al. (Angarngruppen)
September 1995	6	Enköping (Upl)	Sven Pettersson
6–11.11.1995	7	Vanneberga (Sk)	Leif Klinteroth et al.
10.3–26.5.1996	4	Hammarsjön (Sk)	Mårten Björnsson et al.
3.9–21.10.1996	1+1	Stockholm (Srm/Upl)	Engström (1996), L Samuelsson et al.
7.10.1997	1	Vaxholm (Upl)	Lennart Werner
6–15.10.1998	2	Vellinge ängar (Sk)	HKP
23.8–3.9.2001	1	Ottenby (Öl)	Kent Andersson
16.9.2001	2	Salviken (Sk)	HKP
17.9.2001	1	Nabben (Sk)	Nils Kjellén
25.5–18.7.2002	1	Hornborgasjön (Vg)	Kent-Ove Hvass et al.
1–10.6.2002	1	Vannebergaholmen (Sk)	Olof Jönsson, Kaj Svahn
10.8–1.12.2002	1	Lommabukten (Sk)	Lars Nilsson et al.
25.9.2003	1	Nabben (Sk)	Nils Kjellén
30.11.2003	2	Barsebäck (Sk)	Nils Kjellén
9–16.4.2004	1	Nyen (Gtl)	Sten Wikström et al.
20.10.2004	2	Höjeå (Sk)	HKP
13.11.2004	1	Morup (Hl)	Uno Unger
16.4.2005	1	Hammaren (Gtl)	Marie Jacobsson et al.
13.9–12.10.2005	1	Foteviken (Sk)	HKP
18.7.2006	1	Sandarviken (Gtl)	Carl Tholin, Michael Tholin
18.7.2006	1	Sallmandsudd (Gtl)	Carl Tholin, Michael Tholin
23.8.2006	1	Rivet (Gtl)	Carl Tholin
9.2.2007	1	Tolångaån (Sk)	HKP

Table A8. Emperor Goose x Barnacle Goose. *Kejsargås* x *vitkindad gås*.

25.4.1993	1	Närsholmen (Gtl)	Jesper Danielsson
23–29.4.1994	1	Närsholmen (Gtl)	Per Smitterberg et al.
13.5.1994	1	Lausvik (Gtl)	Per Smitterberg
8–9.10.1994	1	Faludden (Gtl)	Jörgen Petersson
15.10.1994	1	Hoburgen (Gtl)	Jörgen Petersson et al.
24.4–13.5.1995	1	Närsholmen (Gtl)	Per Smitterberg et al.
26.4–7.5.1996	1	Närsholmen (Gtl)	Per Smitterberg et al.
27.4–10.5.1997	1	Närsholmen (Gtl)	Olof Armini et al.
9.6.1997	1	Laus holmar (Gtl)	Henk van der Jeugd, Kjell Larsson
15.4.1998	1	Närsholmen (Gtl)	Anders Elf
25.4–7.5.1999	1	Austerviken (Gtl)	Jörgen Petersson
26.4–3.5.1999	1	Stockviken (Gtl)	Bimbi Ollberg, Tina Ollberg
9.4.2000	1	Djaupdy (Gtl)	Sylve Häglund
31.8–13.9.2005	1	Lilla Hammars näs (Sk)	Johan Södercrantz et al.
8.4.2007	1[1]	Lillvik (Gtl)	Per Smitterberg

[1] = ad. *Adult.*

Table A9. Lesser White-fronted Goose x Lesser Canada Goose. *Fjällgås* x *dvärgkanadagås.*

5.8.1979	2	Tosteberga (Sk)	HKP
30.11–1.12.1980	1	Ådala, Mjällby (Bl)	VBOF[2]
14–16.3.1981	1	Matvik, Karlshamn (Bl)	Karlshamns Fältbiologer
13.3.1982	1	Mjällby (Bl)	Mårten Hammar
12.5.1982	1	Eriksberg, Karlshamn (Bl)	Ingemar Jönsson et al.
23.7.1982	1	Tocken, Mjällby (Bl)	Mats-Åke Persson
29.10.1982	1	Trolle-Ljungby (Sk)	HKP
20.5–30.6.1983	1	Eneskäret, Karlshamn (Bl)	Hans Linderson et al.
20.11.1983	1	Sölvedal (Bl)	Mats-Åke Persson
4–7.12.1983	1	Ådala, Mjällby (Bl)	VBOF[2]
30.9.1984	1[1]	Trolle-Ljungby (Sk)	HKP
1–11.11.1984	1[1]	Trolle-Ljungby (Sk)	HKP
22–23.11.1984	1	Lörby (Bl)	Thomas Nilsson
26.11.1984	1	Ådala, Mjällby (Bl)	Thomas Nilsson
8.8.1985	1	Fäholmen (Bl)	Mårten Hammar, M-Å Persson
16–26.10.1986	1	Tosteberga (Sk)	HKP et al.
10.11.1986	1	Sölvedal (Bl)	Patrik Österblad
1–3.12.1986	1	Ådala, Mjällby (Bl)	Patrik Österblad
5.12.1986	1	Ysane (Bl)	Mats-Åke Persson
27.3.1987	1	Ådala, Mjällby (Bl)	Patrik Österblad
15.8.1987	1	Vannebergaholmen (Sk)	Magnus Persson, Leif Klinteroth
15.4.1989	1	Matvik, Karlshamn (Bl)	Kjell Essebo
1.1.1993	1	Vesan (Bl)	Johan Wolgast
23.1–14.2.1993	1	Ådala, Mjällby (Bl)	Patrik Österblad et al.
4.9.1993	1	Fäholmen (Bl)	Mats-Åke Persson
12.9.1993	2	Fäholmen (Bl)	Mats-Åke Persson

[1] = different individuals. *Olika individer.* [2] = Västblekinges ornitologiska förening *Orn. Soc. W. Blekinge*

Table A10. Lesser White-fronted Goose x Barnacle Goose, except individuals seen together with their parents or involved in breeding attempts through May 2004, and all observations outside Jämtland, Hälsingland, Gästrikland and Uppland in June 2004–August 2007.

Fjällgås x *vitkindad gås, utom individer som setts tillsammans med sina föräldrar eller involverade i häckningsförsök till och med maj 2004, samt alla observationer utanför Jämtland, Hälsingland, Gästrikland och Uppland under juni 2004–augusti 2007.*

1–15.5.1987	1	Västergarn (Gtl)	Olof Armini et al.
25.3.1990	1[1]	Stigsjö (Ång)	Leif Johansson
1–2.5.1991	1	Hoburgen (Gtl)	Björn Andersson et al.
19–20.9.1991	1[1]	Stigsjö (Ång)	Leif Johansson, Oskar Norrgren
12.4.1993	1	Hudiksvall (Hls)	Bo Fagerström
31.8–1.10.1994	1	Djurgården (Upl)	Fredrik Taube
19.11–30.12.1994	4	Vanneberga/Rinkaby (Sk)	Leif Klinteroth
6–8.9.1999	1	Ottenby (Öl)	Ivar Kleman
25.10.2000	1	Järvafältet (Upl)	Johan Nilsson
27.9–25.10.2001	1	Järvafältet (Upl)	Johan Nilsson
6.9.2003	1	Helenelund (Upl)	Johan Nilsson
5.10.2003	1	Edsbergs slott (Upl)	Johan Nilsson, Björn Wester
28.2.2004	1	Flyingeby (Sk)	Olof Jönsson et al.
21.4.2004	1	Södviken (Öl)	Staffan Rodebrand
6.10.2004	1[2]	Björkesåkrasjön (Sk)	HKP
20.10.2004	1[2]	Höjeå (Sk)	HKP
29.3.2005	1	Hornborgasjön (Vg)	Matthis Persson
4.4.2005	6	Fröbbestad (Vstm)	Gunnar Nicklasson
5.10–10.11.2005	1	Norrköping (Ög)	Messer (2005), Johan Brenander et al.

21.11.2005	2	Stora Uppåkra (Sk)	HKP
9–27.4.2006	1	Svanviken (Srm)	Jan Hägg et al.
11.5.2006	1	Lausviken (Gtl)	Göran Knutas
11.5.2006	1	Kåseberga (Sk)	Sven Splittorff et al.
13.5.2006	1	Kåseberga (Sk)	Olof Jönsson et al.
6.8.2006	5	Lomma (Sk)	Anders Jönsson
7–9.9.2006	1	Svanviken (Srm)	Kalle Brinell, Jan Hägg
21.9.2006	1	Ringstad mosse (Ög)	Stig Löwenhamn
11–17.10.2006	1	Norrköping (Ög)	Robert Petersen et al.
17.10.2006	1	Barsebäck (Sk)	HKP
20.10.2006	1	Vellinge ängar (Sk)	HKP
21.10.2006	1	Fredshög (Sk)	Ola Elleström, Nils Kjellé
27–31.10.2006	2	Dettern (Vg)	Ulf Lindell et al.
26.12.2006	2	Ulricehamn (Vg)	Claes-Göran Ahlgren
15.3.2007	1	Faludden (Gtl)	Per Smitterberg
22–25.3.2007	1	Yttre Stockviken (Gtl)	Michael Tholin, Carl Tholin
28.3.2007	1	Nabben (Gtl)	Josef Andersson
15.4.2007	2	Horns båtvarv (Srm)	Nisse Nilsson
22.4.2007	2[2,3]	Kyrkbingegrunn (Gtl)	Michael Tholin, Carl Tholin
24.4.2007	2[2]	Lausviken (Gtl)	Carl Tholin
27.4.2007	1	Lausviken (Gtl)	Bimbi Ollberg
5.5.2007	1	Klase (Gtl)	Mikael Wänskä

[1] = Bred, paired to a Greater Canada Goose, at Gussjön (Ång) in 1989. *Häckade i par med kanadagås vid Gussjön (Ång) 1989.* [2] = Different individuals. *Olika individer.* [3] = Possibly Greater White-fronted Goose x Barnacle Goose hybrids. *Eventuellt bläsgås* x *vitkindad gås-hybrider.*

Table A11. Bar-headed Goose x Greater Canada Goose. *Stripgås* x *kanadagås*.

1965	1	Kristianstad (Sk)	Axelsson (1967)
1966	1	Kristianstad (Sk)	Nordöstra Skånes rk (1968)
12.4.1980	1	Finnåkerssjön (Vstm)	Malmstigen (1980)
21.2.1984	2[1]	Sjöbobaden (Sk)	Anders Jönsson et al.
30.9–28.10.1984	1[2]	Näsbyholm (Sk)	Anders Jönsson et al.
3.11.1984	1[2]	Skönabäck (Sk)	Anders Jönsson et al.
15.12.1984	1[2]	Fredshög (Sk)	Anders Jönsson et al.
20.2.1987	1	Kämpinge (Sk)	Anders Jönsson
3–14.6.1987	5[3]	Tåkern (Ög)	Anders Elf et al.
5.9.1988	4	Kyleberg, Tåkern (Ög)	Benny Ekberg
9.10.1992	1	Tosteberga (Sk)	Stig-Arne Svensson
24.3.1995	1	Händelöp (Sm)	Thomas Ewerlid
2–3.11.1996	1	Sjötorpasjön/Mönarpsområdet (Vg)	Jonas Grahn
1.11.1998	1	Barsebäckshamn (Sk)	Kent Andersson
11–25.7.2000	2	Torhamns udde (Bl)	Fredrik Lennartsson et al.
11.1.2001	1	Klagshamnsudden (Sk)	Mattias Ullman
28.3.2004	1	Vimmerby (Sm)	Gunnar Ölvingson
16.1.2005	1[4]	Örtofta (Sk)	Per Lagerås

[1] = Together with a Bar-headed Goose. *Tillsammans med en stripgås.* [2] = Probably the same individual. *Troligen samma individ.* [3] = Juveniles (probably 2nd cy birds) together with their parents. *Juveniler (troligen 2K) tillsammans med föräldrarna.* [4] = Possible. *Möjlig.*

Table A12. Bar-headed Goose x Barnacle Goose, except the pair seen in Skåne 1985–1994 and of the surviving mate that was last seen 15 September 2001. *Stripgås* x *vitkindad gås, utom paret som sågs i Skåne 1985–1994 samt den överlevande individ av det paret som senast sågs den 15 september 2001.*

15.12.1986	1	Karups ängar (Sk)	HKP
26.3–31.12.1990	1[1]	Lillfjärden (Hls)	Bengt Sättlin
9.8.1990	1	Foteviken (Sk)	HKP
19.8.1997	1[2]	Marbystrand (Ög)	Messer (1999)
Oct–Nov.1997	1[2]	Himmelstalund (Ög)	Messer (1999)
24.6–12.8.1998	1	Börringe (Sk)	HKP
11–19.9.1998	1	Foteviken (Sk)	HKP
19.9.1998	1	Foteviken (Sk)	HKP
25.8.1999	1	Vellinge ängar (Sk)	HKP
15.9.1999	1	Ellestadsjön (Sk)	HKP
21.10.1999	1	Foteviken (Sk)	HKP
23.8.2000	2	Vellinge ängar (Sk)	HKP
7–11.10.2005	1	Spillepeng (Sk)	HKP

[1] = The bird had been there some years when first reported. *Fågeln hade funnits på lokalen några år då den först rapporterades*. [2] = The same invidual. *Samma individ*.

Table A13. Dark-bellied Brent Goose x Barnacle Goose. *Mörkbukig prutgås* x *vitkindad gås*.

6.10.2004	1[1]	Vellinge ängar (Sk)	Nils Kjellén, Mattias Ullman
22.10.2005	1[1]	Knösen (Sk)	Tommy Holmgren
25.10.2005	2	Kungstorp (Sk)	Tommy Holmgren
19.5.2006	1	Faludden (Gtl)	Johan Södercrantz, Tommy Magnusson
4.10.2006	1	Hagbyhamn (Sm)	Stig Ljungdahl
7.10.2006	1	Risinge hamn (Öl)	Mats Wallin
13.10.2006	1	Vellinge ängar (Sk)	HKP, Peter Greenstreet
14–21.10.2006	1	Knösen, Skanör (Sk)	Max Lundberg et al.
17–21.10.2006	1	Barsebäck (Sk)	HKP, Anders Jönsson
20.10.2006	1	Kämpinge (Sk)	HKP

[1] = 1st cy. *1K*.

Table A14. Greater Canada Goose x Barnacle Goose, through 1994, except breeding and winter observations. *Kanadagås* x *vitkindad gås till och med 1994, utom häcknings- och vinterobservationer*.

29.10.1969	1	Ottenby (Öl)	Lars Brolund
24.9.1977	2	Vendelsjön (Upl)	Kenneth Pless, Thomas Pless
3–16.11.1983	1	Norje/Vesan (Bl)	Thomas Nilsson
1–2.5.1984	1	Säby, Tåkern (Ög)	Kent Elwer
20.10.1985	1	Farhult (Sk)	Peter Svensson
9.5.1987	1	Överenhörna (Srm)	Stefan Classon, Johan Ehrlén
13.3.1988	1	Starby (Sk)	Henrik Johansson, Mats Rellmar
10.9.1988	1	Rönnen (Sk)	Johan Hammar
17.8–22.9.1989	1	Erstavik (Srm)	Johan Larsson
24.9–19.11.1989	3	Norra Aspen (Srm)	Mats Gothnier
1.10.1989	1	Björsätersviken (Vg)	Torbjörn Gustafsson et al.
13.10.1989	1	Ymsen (Vg)	Torbjörn Gustafsson et al.
26.4.1990	1	Löddesnäs (Sk)	Anders Jönsson
10.10.1990	1	Botkyrka (Srm)	Anders Löfgren
Summer–1.9.1991	1	Lillfjärden (Hls)	Bengt Sättlin, Sebastian Sundberg
28.7.1991	1	Östen (Vg)	T. Gustafsson, G. Johansson
Late autumn 1991	3	Stensjön (Srm)	Rundström (1992)
31.3.1993	1	Fåsjön (Vstm)	Roland Thuvander et al.

16.5.1993	4	Ryningenäsfälten (Sm)	Lars Johan Johansson
6.9.1993	1	Segerstad (Vrm)	Torbjörn Gustafson
12.11.1993	1	Salviken (Sk)	Anders Jönsson
2.10.1994	6[1]	Skanssjön (Vstm)	Per Eriksson

1 = Four 1st cy + two 2nd cy hybrids. *4 1K + 2 2K.*

Table A15. Greater Canada Goose x Barnacle Goose, observations in December–February through Februay 2007. *Kanadagås* x *vitkindad gås. Observationer under december–februari till och med februari 2007.*

29.1.1986	2	Fjelie (Sk)	Anders Jönsson
25.12.1987	1	Sandön (Sk)	Mats Rellmar, Henrik Johansson
25.2.1989	1	Starby (Sk)	Anders Jönsson
17.2.1991	1	Hittarp (Sk)	Ingemar Andell, Lars-Erik Jönsson
17.2.1991	1	Kungstorp (Sk)	Ingemar Andell, Lars-Erik Jönsson
17.1.1993	4	Barsebäckshamn (Sk)	Anders Jönsson
18.12.93–10.2.94	1	Elleholm/Fäholmen (Bl)	Thomas Nilsson, Patrik Österblad
27.2.1997	1	Västsura (Vstm)	Ralf Lundmark
21–26.2.1998	1–2	Lagårdssjön (Vstm)	Markus Rehnberg
26.2.2000	5	Östen (Vg)	Torbjörn Gustafson, Lena Kempe
17.12.2000	1	Ulricehamn (Vg)	Jan Andersson
5.12.2002	1	Ramdalaslätten (Bl)	Fredrik Lennartsson
9.1.2005	1	Roxen (Ög)	Oscar Haraldsson
16.1.2005	2	Örtofta (Sk)	Per Lagerås
19.1.2005	6	Gödastorp (Hl)	Joakim Hagström
22.1.2005	1	Skottorps våtmark (Hl)	Sonja & Klas Henningsson
11.12.2005	1	Petersborg (Sk)	HKP
27.12.2005	2	Stockholms ström (Upl)	Filippa Ek
4.1.2006	1	Stockholms ström (Upl)	Niklas Henriksson et al.
9.2.2006	2	Stockholms ström (Upl)	Ingvar Skoog
1.12.2006	1	Roxen (Ög)	Fredrik Broms
27.12.2006	6	Lagårdssjön (Vstm)	Ralf Lundmark
1.1.2007	8	Kvismaren (Nrk)	Anders Jacobsson
13.1.2007	1	Östra Odarslöv (Sk)	HKP
17.1.2007	1	Torsjön (Sk)	HKP
21.2.2007	1	Kirseberg (Sk)	Kaj Svahn

Table A16. Lesser Canada Goose x Barnacle Goose. *Dvärgkanadagås* x *vitkindad gås.*

17.11.1998	1	Foteviken (Sk)	HKP
15.9.2000	6	Foteviken (Sk)	HKP
23.9.2000	2	Foteviken (Sk)	HKP
13.10.2001	3	Vombs ängar (Sk)	HKP
17.10.2001	2	Barsebäck (Sk)	HKP
13.11.2001	1	Trolleberg (Sk)	HKP
1–20.5.2002	1[1]	Hjälstaviken (Upl)	Ulf Larsson, Tom Sandström
20.10–14.11.2004	1	Värpinge/Kronotorp (Sk)	HKP
13.9–12.10.2005	1[2]	Foteviken (Sk)	HKP
15.9.2005	2[3]	Fulltofta (Sk)	HKP
11–18.10.2005	1[1]	Årike Fyris (Upl)	Johan Södercrantz et al.
17.4.2006	1[1]	Bergs mader (Dsl)	Per Karlsson Linderum
10.9.2006	1	Vellinge ängar (Sk)	HKP
7–12.10.2006	2[3]	Vombsjön (Sk)	HKP, Peter Greenstreet
8.10.2006	1[1]	Ottenby (Öl)	Pav Johnsson
17.10.2006	1	Barsebäck (Sk)	HKP
20.10.2006	2[3]	Kämpinge (Sk)	HKP

20.11.2006	2[3]	Bodarp (Sk)	HKP
23.12.2006	1[1]	Södra Sallerup (Sk)	Stefan Cherrug
22.1.2007	1	Annexdal (Sk)	HKP

[1] = Probably this cross. *Förmodligen denna korsning*. [2] = Together with partner and one young. *Tillsammans med partner och en unge*. [3] = The same individuals. *Samma individer*.

Table A17. Barnacle Goose x Red-breasted Goose. *Vitkindad gås* x *rödhalsad gås*.

19.4–20.5.1978	1[1]	Faludden (Gtl)	Jonsson (1979)
18.10.1979	1[1]	Ottenby (Öl)	Wallin (1995)
22.4.1983	1	Närsholmen (Gtl)	Per Smitterberg
27.4.1984	1	Grötlingboudd (Gtl)	Pierre Unge
21–23.4.1995	1[2]	Närsholmen (Gtl)	Jörgen Petersson, Per Smitterberg
25.4.1995	1[2]	Hablingbo (Gtl)	Björn Andersson, Tord Lantz
19.4–1.5.1997	1	Faludden (Gtl)	Per Smitterberg et al.
11–12.10.1997	1	Enetri (Öl)	Kalle Brinell
25.4.1998	1	Valjeviken (Bl)	Mats-Åke Persson, Christian Persson
14.10.2004	1[3]	Faludden (Gtl)	Per Smitterberg
14.10.2005	1[4]	Bottorpsslätten (Sm)	Peter Sieurin
22.10.2005	1[4,5]	Knösen (Sk)	Tommy Holmgren
22.10.2005	1[4,5]	Eskilstorps ängar (Sk)	Mattias Ullman
28.3–4.4.2007	1[3]	Nabben (Gtl)	Bimbi Ollberg

[1] = Probably the same individual. *Troligen samma individ*. [2] = Probably the same individual. *Troligen samma individ*. [3] = Adult. *Adult*. [4] = Probably the same individual. *Troligen samma individ*. [5] = 1st cy bird. *1K*.

Korta rapporter – *Short communications*

Häckning i träd – en ny trend bland svenska grågäss?

Tree-nesting – a new trend among Swedish Greylag Geese?

HAKON KAMPE-PERSSON

I Hornborgasjön togs fiskgjusebon över av grågås såväl 2005 som 2006 (Anonym 2006), och även 2007 sågs arten besöka ett fiskgjusebo (Clas Hermansson på Svalan). En lyckad häckning genomfördes 2003 av ett grågåspar i ett cirka 10 meter ovanför vattnet beläget fiskgjusebo i Glöttret, Torsång i Dalarna (Yngve Johansson & Eddine Hodi på Svalan). I april 2007 sågs ett grågåspar landa i ett fiskgjusebo i en trädtopp vid Timmernabben i Småland (Björn Liedén på Svalan). Samma månad sågs i västgötska Uddasjön även en kanadagås ruvande i ett fiskgjusebo (Manne Johnsson på Svalan). Dessutom häckade 2006 ett grågåspar i ett konstgjort havsörnsbo i skånska Ellestadssjön (Ivarsson 2006).

Sporadiskt har häckning av grågäss i träd rapporterats från Sverige även tidigare. På 1970-talet häckade ett par i ett 9 meter högt beläget fiskgjusebo i Södermanland (Bylin 1979) och på ön Lübeck i skånska Krageholmssjön häckade ett par i ett havsörnsbo år 1995 (Ivarsson 2006). På denna ö befanns dock en tredjedel av samtliga grågåspar vara trädhäckande redan under 1980-talet (egna observationer). Sannolikt har häckning i träd skett även vid skånska Yddingen, ty grågäss har utom häckningsid setts landa i en stor bok vid denna sjö (egen observation).

Trädhäckande grågäss är dock inget nytt fenomen (Hudec & Rooth 1970, Kampe-Persson 2002). Första gången beteendet rapporterades var från Volgas nedre lopp (Pallas 1827). I norra Tyskland har det konstaterats vid ett flertal tillfällen, bland annat i bon av häger, ormvråk och korp (Heinroth 1926, Hauff m.fl. 1983, Knief & Struwe 1991, Neubauer 1996, Rutschke 1997, Hauff & Illman 1999, Berndt m.fl. 2001). Utanför Oslo häckade ett par 1993 och 1994 ovanpå ett skatbo i toppen av en 15–20 meter hög tall (Barth 1994). Från Nederländerna finns två fall rapporterade, i bon av ormvråk respektive duvhök, båda belägna 9 meter ovan markytan (Bles & Kleefstra 2000). Även från England föreligger två rapporter, dels i en ihålig ekgren 10 meter ovan markytan (Redfern 2002) och dels i toppen av en 20 meter hög tall (Coath 2006).

På en del lokaler, framförallt i översvämningsområden, har häckning i träd blivit vanligt, till exempel i Polen (Mrugasiewicz & Witkowski 1962, Osiejuk & Kuczyński 2007), Mähren (Kux 1963) och Kasachstan (Dolguschin 1960). Vanligtvis har bona där byggts i poppel eller olika *Salix*-arter (vide och pil), ofta i hamlade träd, mellan 1,5 och 4,5 meter ovan vattenytan. På dessa lokaler har häckning i träd förekommit i årtionden och praktiserats av en stor del av populationen, till exempel 35% av paren i Mähren (Hudec & Rooth 1970). Det är dock inte endast i översvämningsområden som grågåsen flyttat upp i träden, ty i Norge har alltfler par börjat häcka i gamla kråkbon (Nilsson m.fl. 1999).

Bon av grågås har konstaterats i ett flertal trädslag, till exempel poppel, tall, ek, bok, körsbär, björk och olika *Salix*-arter, och i en lång rad av fågelbon, såväl i träd som på plattformar, till exempel av häger, ormvråk, fiskgjuse, duvhök, havsörn, korp, kråka och skata. Sannolikt ockuperar gässen vanligtvis övergivna bon. Att de även kan ta över aktiva bon bekräftas dock från Hornborgasjön 2005. Boplattformen intogs först av ett gräsandspar, vilka dock blev bortkörda av ett grågåspar i början av april (Anonym 2006). När fiskgjuseparet sedan anlände utbröt en våldsam flera dagar lång strid, ur vilken grågässen gick segrande.

Orsaken till att vissa honor hos normalt mark-häckande arter väljer boplats ovan mark, en utveckling som redan konstaterats hos purpurhäger i Nederländerna (Kooij 1995), är en strävan att undkomma marklevande predatorer (Owen 1980). Vanligtvis undviks dessa av grågåsen genom att boet byggs i tät vass eller på någon mindre ö (Kampe-Persson 2002). För att inte enbart hinna upptäcka en hotande predator i tid, utan även ges en chans att fly, bits all vegetation av på ett ganska stort område runtom boet när detta byggs i vass. Därmed kan honan omedelbart ta till vingarna när fara hotar. På öar måste det likaledes vara möjligt för honan att lyfta från boet eller dess omedelbara närhet. Anledningen till att så många honor på ön Lübeck flyttade upp i träden var säkerligen att de kände sig otrygga på marken på grund av öns risighet. Det var då avsevärt lättare att snabbt undkomma en hotande fara genom att lyfta från ett bo i ett träd 10-talet meter ovan markytan än att en längre sträcka ta sig igenom den täta undervegetation springande.

När brist på säkra boplatser i markplanet uppstår, verkar det ge upphov till olika lokala lösningar. På en lokal i Nederländerna, där grågässen häckar kolonivis på en liten ö, löstes det hela genom att en del av bona återanvändes. En del honor skrider helt enkelt till häckning först sedan de tidigast lagda kullarna kläckts (Berend Voslamber muntligen). På andra lokaler avstår en del par, och då framförallt de yngre, från att häcka, till exempel i skånska Hammarsjön. Ett tredje alternativ är att söka boplats ovan mark. Men även boplatser i träd kan det uppenbarligen bli brist på. När ett av de holländska bona övergavs av grågåsparet togs det omedebart över av ett par nilgäss (Kleefstra & Bles 2000).

Kanadagåsen har i Sverige endast rapporterats häcka i träd vid ett tillfälle (se ovan). I Nordamerika accepterar de däremot varje del av ett träd som är tillräckligt brett och stabilt för att bära deras bo (Ogilvie 1978). Detta val av boplats har även utsträckts till att omfatta gamla fågelbon, speciellt av häger och fiskgjuse, belägna upp till 30 meter ovan mark. På lokal nivå har denna preferens för häckning i träd utnyttjats för att öka på antalet häckande kanadagåspar, genom att boplattformar eller avsågade trätunnor satts upp, antingen i träd eller på pålar på land eller i vatten. I en del områden häckar faktiskt mer än 50% av kanadagässen på sådana plattformar.

Gässlingar skadas vanligtvis inte av att studsa ner en lång distans mellan bo och markyta, samtidigt som det allmänt antas att honor söker sig till liknande boplatser som där de själva föddes (Kear 1990). Därmed kan det, speciellt mot bakgrund av att vi idag har en betydligt större grågåspopulation än någonsin tidigare i historisk tid (Nilsson 2006), vara befogat att fråga sig om en trend mot en ökande frekvens av häckning i träd är under utveckling även i Sverige.

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Summary

One Greater Canada and some Greylag Goose pairs were reported breeding in Osprey nests in Sweden during the years 2003–2007, and one Greylag Goose pair bred in an artificial White-tailed Eagle nest as well. Three of the Osprey nests were situated in trees, while the others were built on nesting platforms in Lake Hornborga. One of these platforms was first occupied by a Mallard pair, but the nest was taken over by a Greylag Goose pair in early April. When the Osprey pair returned, a violent, several day long fight followed, won by the geese. From earlier years, there are reports of one Greylag Goose pair breeding in an Osprey nest in the 1970s, and of another pair breeding in a White-tailed Eagle nest in 1995. At the latter site, one third of all Greylag Goose pairs were, however, found nesting in trees already in the 1980s. One reason for geese to breed in trees is to avoid flooding, and another to avoid ground-living predators. Among Greylag Geese, the former has been reported from Poland, Moravia and Kazakstan, and the latter from Norway.

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Nya böcker – *New books*

Robert Kenward, 2006: **The Goshawk**. T & A D Poyser, London.

Robert Kenward disputerade 1976 i Oxford med en avhandling som handlade om duvökens predation på ringduvor. Bland annat gällde det att studera om duvhöken kunde användas som biologiskt bekämpningsmedel mot ringduvor som orsakade skador på grödor. Duvhöksstudierna förde Kenward till de nordiska länderna. I Sverige fick han kontakt med Vidar Marcström och 1979 började han sina postdoc-studier på Gotland. Nu var problematiken något annorlunda. I Sverige debatterade man om duvhökens predation hade negativ inverkan på fasanbeståndet och omvänt om den jakt på duvhökar som pågick för att skydda fasanerna påverkade duvhöksbeståndet negativt. Det blev en sjuårig studie av duvhökens ekologi på Gotland. Det är följaktligen lätt att förstå att stora delar av denna duvhöksmonografi baserar sig på resultaten från Gotland. Och många andra resultat kommer också från Sverige och Norden, varför denna bok i allra högsta grad präglas av det som gäller för den svenska duvhöken. Följaktligen kan den som vill debattera duvhöksfrågor sakligt knappast göra det med hedern i behåll utan att ha läst denna bok.

Boken följer Poysers traditionella mall med olika kapitel om systematik, morfologi, häckning, rörelser, födoval, predation, populationsdynamik och demografi. Den avslutas med kapitel om uppfödning och träning för falkenering samt metoder att värna om duvhöken. Uppfödning är numera ingen udda aktivitet när det gäller rovfåglar; allehanda rovfåglar odlas ju för utplantering. Och metoden att på detta sätt artificiellt stödja vilda bestånd eller introducera arter i nya områden har spritt sig till de flesta fågelgrupper, fast med olika mottagande bland andra ornitologer och fågelskyddare. Detta gäller inte minst att föda upp och träna rovfåglar för uppvisning och falkenering. Att Kenward rätt utförligt behandlar detta ämne beror naturligtvis på hans intresse för falkenering, som var en viktig del av hans tidiga arbeten med bekämpning av ringduvor. Han argumenterar en hel del för att uppfödning av rovfåglar för falkenering rent generellt bör ses som ett positivt inslag i fågelskyddsarbetet. Här finner säkert en del läsare saker att argumentera emot.

Eftersom jag själv är intresserad av duvhöken har jag läst boken rätt detaljerat. Den ger ett mycket positivt intryck och Kenward har fått med så gott som allt väsentligt om duvhökens biologi. I överensstämmelse med Poysers övriga artmonografier är språket och faktaredovisningen enkel att ta till sig. Komplicerade och avskräckande teoretiska och matematiska inslag saknas så gott som helt. Man förstår att Kenward tycker om sin art och han återkommer ofta till hur den skall bevaras. Således avslutas varje kapitel med en underrubrik om ”Implications for conservation and management”, d.v.s. en sammanfattning om hur duvhöksbeståndet skall bevaras och skötas. För svenska ornitologer är detta en av de mest läsvärda böckerna på länge.

SÖREN SVENSSON

Martin Tjernberg & Mikael Svensson (red.), 2007: **Artfakta. Rödlistade ryggradsdjur i Sverige**. ArtDatabanken, SLU, Uppsala. 550 sidor. 285 kr. Beställs från SLU Publikationsservice, Box 7075, 750 07 Uppsala, publikationstjanst@slu.se eller 018-671100 (tel.), 018-673500 (fax).

För kort tid sedan kom denna efterlängtade och viktiga publikation. I den presenteras nämligen de fakta om ryggradsdjuren som ligger bakom deras inkludering i Rödlistade arter i Sverige 2005. Varje art presenteras fylligt under rubrikerna Utredning och status, Ekologi, Hot och Åtgärder. Viktig litteratur anges. Boken utgör det bästa och mest auktoritativa som finns i ämnet. Eftersom fåglarna upptar hela 63% av artfaktasidorna är det lätt att inse att denna bok bör pluggas in ordentligt av varje fågelskådare som är intresserad av bevarandefrågorna.

SÖREN SVENSSON

Innehåll i årgång 17, 2007 *Contents of volume 17, 2007*

Instruktioner till författarna

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Allmänt gäller att bidrag skall vara avfattade enligt den modell som finns i tidigare häften av tidskriften. Titeln skall vara kort, beskrivande och innehålla ord som kan användas vid indexering och informationssökning. Uppsatser, men ej andra bidrag, skall inledas med en Abstract på engelska om högst 175 ord. Texten bör uppdelas med underrubriker på högst två nivåer. Huvudindelningen bör lämpligen vara inledning, metoder/studieområde, resultat, diskussion, tack och litteratur. Texten får vara på svenska eller engelska och uppsatsen skall avslutas med en fyllig sammanfattning på det andra språket. Tabell- och figurtexter skall förses med översättning till det andra språket. Tabeller, figurer och figurtexter skall finnas på separata blad. Det skall finnas minst 4 cm marginal och texten skall vara utskriven med dubbelt radavstånd. Manus skall insändas i tre kopior inklusive tabeller och figurer. *Såväl text som figurer skall om möjligt levereras på diskett* eller *som bilaga till epost.*

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Contributions should be written in accordance with previous issues of the journal. The title should be short, informative and contain words useful in indexing and information retrieval. Full length papers, but not other contributions, should start with an Abstract in English not exceeding 170 words. The text should be divided by no more than two levels of subheadings. The following primary subheadings are recommended: Introduction, Methods/Study areas, Results, Discussion, Acknowledgements, and References. The text may be in English or Swedish and the paper should end with a comprehensive summary in the other language. Table and Figure legends should be in both languages. Tables and Figures must be on separate sheets of paper. Manuscripts should be submitted in three copies with 4 cm margin, printed with double line spacing. Text and figures should preferably be provided on a floppy disk.

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Referenser *References*

I texten *In the text*: Andersson (1985), Bond (1913a, 1913b), Carlsson & Dennis (1956), Eriksson et al. (1989), (Andersson 1985), etc.

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