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Ungfågelspridning och höstflyttning hos svart rödstjärt *Phoenicurus ochruros* i södra Sverige

Dispersal of yearlings and autumn migration of Black Redstart Phoenicurus ochruros *in southern Sweden*

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Abstract

The number of ringed Black Redstarts at Ottenby, Falsterbo and Nidingen bird observatories showed two distinct peaks after the breeding season. During the first peak in July–August, with 63, 67 and 89 percent of the total catch, the proportions of yearlings were 92, 100 and 96 percent, respectively, and most of them had not yet begun their postjuvenile moult and showed relatively low weights. During the second peak in October–November, all yearlings had completed this moult and carried more fat. Black Redstarts have a delayed postjuvenile moult, a unique strategy among European thrushes. This allows for wide dispersal during late summer. Several ringed Belgian and German yearlings have moved up to 290 km northward during this time. This paper confirms, using ringing data and observations from a population study in western Sweden, that summer dispersal is well separated from autumn migration. I speculate that some of the birds of the July–August peak could have their origin in southern breeding populations, for example Denmark, where a major population increase has occurred in recent decades.

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Inledning

Svarta rödstjärten uppvisar årligen en kulmination av ringmärkta fåglar i juli–augusti vid fågelstationerna Ottenby, Falsterbo och Nidingen. Det rör sig främst om årsungar i juvenil dräkt, som efter flyggperioden har lämnat sina födelseplatser. Med juvenil avses här den första egentliga fjäderdräkten (Figur 1). Denna ersätts av adulta kroppsfjädrar i en partiell postjuvenil ruggning före höstflyttningen (Svensson 1992, Jenni & Winkler 1994). Från Mellaneuropa hänvisar Biber (1973) till studier i de schweiziska Alperna, där en markant sträcktopp av huvudsakligen juvenila årsungar noterades i skiftet juli–augusti. Zink (1981) och Glutz & Bauer (1988) anger flera fall där unga belgiska och tyskmärkta svarta rödstjärtar vid denna tidpunkt förflyttat sig även i nordlig riktning, som längst en sträcka på 29 mil.

Svarta rödstjärtens årsungar har en unik ruggningsstrategi jämfört med andra europeiska trastfåglar. Arter som rödstjärt och rödhake påbörjar normalt sin postjuvenila ruggning i födelseområdet endast några veckor efter att de blivit flygga (Glutz & Bauer 1988, Landmann 1996, Waldenström & Bengtsson 2001). Svarta rödstjärtens ungfåglar startar däremot sin partiella kroppsruggning först då de uppnått en medelålder av 87 dagar (Berthold 1983, 1985, Glutz & Bauer 1988, Landmann 1996). Detta ger utrymme för en ungfågelspridning under sommaren, vilket leder dem till nya platser där de genomför den partiella ruggningen. Det är

Figur 1. Svart rödstjärt i juvenil dräkt fotograferad på Nidingen 9 juli 2006. Foto: Uno Unger
Black Redstart in typical juvenile plumage 9 july 2006.

också känt att årsungar av blåhake kan påbörja sin flyttning innan de ruggat färdigt (Lindström m. fl. 1985, Lindström & Lind 2001).

Tidiga ungfågelrörelser bland tättingar är dåligt utforskade (Goodbody 1952, Baker 1978, 1993, Greenwood & Harvey 1982, Boddy 1983, Norman 1991, Paradis m.fl. 1998, Raine m.fl. 2006). I Sverige har ämnet endast berörts kortfattat för svart rödstjärt (Knutsson 1981, Andersson 1986, 2001). Denna uppsats avser att utifrån ringmärkningsdata, vikt- och ruggningsuppgifter, ge en utförligare bild av ungfågelspridningens förlopp i förhållande till höstflyttningen. Det är särskilt motiverat då dessa spridningsrörelser ibland har uppfattats som en tidig inledning av höststräcket. Att sommarfynden är väl åtskilda från den egentliga höstflyttningen finns dock tidigare belagt från mellersta Europa (Menzel 1983, Glutz & Bauer 1988). Berthold (1983, 1985) anger att flyttningsoron och det observerade huvudsträcket hos årsungar infaller betydligt senare i oktober–december, i medeltal två veckor efter avslutad ruggning. I samband med den ökade flyttningsoron, noterades dessutom en viktökning hos försöksfåglarna. Även adulta fåglar lämnar normalt sina häckningsplatser i oktober–november, efter en utpräglad sångperiod i september–oktober (Cramp 1988, Glutz & Bauer 1988, Andersson 2001). En viss rörlighet tycks dock även förekomma hos äldre hannar, framför allt om de förblivit oparade. Ungfågelspridning bland tättingar i Sverige har därutöver beskrivits för bl.a. talgoxe, rörsångare, sävsångare och trastsångare (Ehrenroth 1976, Johansson 1980, Bensch & Nielsen 1995, Stervander 1999). Bland icke-tättingar är ungfågelspridning ett mer välkänt begrepp och ofta uppges de tidiga sträckrörelserna ha en nordlig riktning (Otterlind 1954, Nielsen 1977).

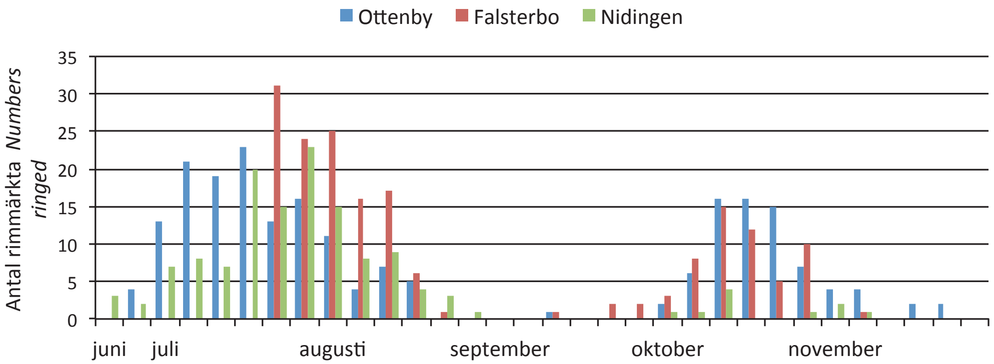
Material och metoder

I materialet ingår ringmärkningsdata, vikt- och ruggningsuppgifter från Ottenby 1980–2011 samt Falsterbo och Nidingen 1980–2012. Den aktuella tidsperioden omfattar 20 juni–30 november. På Nidingen har fångsten varit kontinuerlig över säsongen, däremot inte standardiserad. Vid Ottenby har fångsten skett högst spontant fram till 25 juli, då standardiserad ringmärkning påbörjats. Vid Falsterbo har ringmärkningen, som varit standardiserad, startat först den 21 juli. Viktuppgifter presenteras här för att visa på en skillnad mellan sträcktoppen under sommaren och den egentliga höstflyttningen i oktober–november (resultaten har testats med t-test). Syftet med ruggningsuppgifterna är att bekräfta att ungfågelspridningen huvudsakligen sker i juvenil dräkt före ruggningsperioden och höstflyttningen. Klassningen av den postjuvenila ruggningen har följt den så kallade pullskalan, en poängsättning av olika ruggningsstadier, från helt juvenil dräkt utan inledd ruggning till helt färdigruggad första vinterdräkt (Lindström m.fl. 1985, Bensch & Lindström 1992). Klassningen som redovisas i denna uppsats har dock anpassats efter de olika metoder som använts på fågelstationerna.

Dessutom har data medtagits från en tidigare populationsstudie med färgringmärkta individer i Västsverige, främst Göteborg, Varberg och Falkenberg (Andersson 1987, 1990, 1995, 2001). De berör rörelser efter häckningsperioden hos 19 av 188 ringmärkta boungar, 34 av 105 revirhävdande hannar och 8 av 20 honor ringmärkta samma vår. Detta för att ge en kompletterande bild av årsungarnas spridningsmönster, men också av adulternas eventuella rörelser inför höstflyttningen. Studieområdena som finns beskrivna i refererade uppsatser, besöktes i genomsnitt varannan dag under juli–augusti och var femte dag september–november 1983–1997. Fyra år (1988, 1990, 1993, 1994) gjordes dock färre besök under hösten med kontroller i genomsnitt var tolfte dag. Under dessa besök genomsöktes områdena efter så många fåglar som möjligt för att göra avläsningar av färgringar. Om inga fåglar sågs på tidigare besatta revir, spelades sång upp från bandspelare i högst två minuter, för att effektivisera upptäckten av färgringmärkta individer. På platser där fåglar iakttogs inom fem minuter, undveks däremot banduppspelning för minimera påverkan på deras beteenden.

Resultat

Antalet ringmärkta svarta rödstjärtar vid fågelstationerna hade två tydliga toppar under höstsäsongen (Figur 2). Den totala andelen årsungar uppgick till 86, 98 respektive 96 % (Tabell 1). Under den tidiga sträcktoppen i juli–augusti var andelen något högre (92, 100 respektive 96 %). Vid Ottenby och Falsterbo ringmärks då 63% respektive 67% av den totala höstfångsten, medan motsvarande siffra för Nidingen uppgår till 89%. I september märks sammantaget ytterst få fåglar, eftersom denna månad sammanfaller med årsungarnas ruggningsperiod. Vid Ottenby och Falsterbo fångades flera individer samma dag vid vardera 20 tillfällen, som mest fyra exemplar på respektive station. Vid Nidingen



Figur 2. Antal ringmärkta svarta rödstjärtar per femdagarsperiod vid Ottenby, Falsterbo och Nidingen höstsäsongerna 1980–2012 (Ottenby t.o.m. 2011).
Number of ringed Black Redstarts per five day period at Ottenby, Falsterbo and Nidingen bird observatories during the autumn seasons 1980–2012 (Ottenby through 2011).

fångades som mest tre exemplar samma dag vid nio tillfällen.

Vid Ottenby registrerades påbörjad ruggning hos årsungar under juli–augusti i större utsträckning än vid Falsterbo och Nidingen (Tabell 2). Om man däremot slår samman de två första stadierna (0, 1), som representerar en huvudsakligen juvenil dräkt, uppgår procentandelen till 80, 81 respektive 93 %. De årsungar som fångas senare på hösten har alla slutfört sin ruggning. Svarta rödstjärtar fångade under perioden juni–augusti var generellt lättare än de som fångades i oktober–november. Detta mönster var likadant vid samtliga tre fågelstationer. Medelvikten för Ottenbyfåglarna fångade i juni–augusti uppgick till 15,3 gram (n=106) och oktober–november 16,3 gram (n=62, F=9,47, P<0,01). Vid

Tabell 1. Antal ringmärkta svarta rödstjärtar per månad vid Ottenby, Falsterbo och Nidingen höstsäsongerna 1980–2012 (Ottenby t.o.m. 2011).
Number of ringed Black Redstarts per month at Ottenby, Falsterbo and Nidingen bird observatories during the autumn seasons 1980–2012 (Ottenby through 2011).

	Ottenby		Falsterbo		Nidingen	
	Adulta *Adults*	Årsungar *Yearlings*	Adulta *Adults*	Årsungar *Yearlings*	Adulta *Adults*	Årsungar *Yearlings*
Juni	0	4	0	0	1	4
Juli	10	95	0	55	4	76
Augusti	1	26	0	65	1	39
September	0	1	1	4	0	0
Oktober	17	45	2	51	0	7
November	2	10	0	1	0	3
Total	30	181	3	176	6	129

Tabell 2. Antal ringmärkta årsungar av svart rödstjärt i olika ruggningsstadier* under juli–augusti vid Ottenby, Falsterbo och Nidingen höstsäsongerna 1980–2012 (Ottenby t.o.m. 2011). Ruggningspoängen har anpassats efter olika klassningsmetoder.
Number of ringed yearlings of Black Redstart in different moult stages during July–August at Ottenby, Falsterbo and Nidingen bird observatories during the autumn seasons 1980–2012 (Ottenby through 2011). The moult score was adapted to different classification methods.*

Ruggningspoäng	Ottenby		Falsterbo		Nidingen	
Moult score	n	%	n	%	n	%
0	2	4	60	60	59	86
1	41	76	21	21	5	7
2	5	9	14	14	5	7
3	6	11	5	5	0	0

*Ruggningsstadier *Moult scores*
0 = Ruggningen ej påbörjad. *No moult occuring.*
1 = Ruggar fjädrar på strupe och flanker men strupfjädrarna har ännu inte brutit ut ur spolarna (mindre än 10% växande/nya fjädrar). *Moulting feathers on throat and sides of breast but throat feathers still in pin (<10% growing/new feathers).*
2 = Ruggar fjädrar på strupe och flanker (tre ruggningscentra). Strupfjädrarna har brutit ut ur spolarna (10–50% växande/nya fjädrar). *Moulting feathers on throat and sides of breast (three moulting areas). The throat feathers have now emerged from the sheaths (10–50% growing/new feathers).*
3 = De tre ruggningscentra har vuxit ihop. Det går att följa ett sammanhängande stråk med nya fjädrar från strupen ner längs vardera kroppssidan (50–90% växande/nya fjädrar). *The three moulting areas have merged. There is an uninterrupted band of new feathers from the throat along each side of the breast and flanks (50–90 % growing/new feathers).*

Falsterbo var motsvarande siffror 15,0 (n=106) och 15,5 (n=45, F=12,95, P<0,001). Medelvikten på Nidingen uppgick till 15,0 (n=122) respektive 16,5 (n=10, F=20,83, P<0,001).

Av 188 färgringmärkta boungar i Västsverige påträffades 19 under höstsäsongen. Två var stationära 29 respektive 68 dygn, medan sjutton av dem iakttogs endast ett dygn på samma plats. Dessa ungar rörde sig till nya lokaler och avlästes som längst 7000 meter bort. Av 105 färgringmärkta, revirhävdande hannar i Västsverige iakttogs 34 under hösten. Nitton av dem stannade endast 1–5 dagar på samma plats. Sju av dessa påträffades senare 500–2000 meter bort, medan vidare observationer saknas. Åtta av de 20 honor som färgringmärktes under häckningssäsongen observerades under hösten. Samtliga var dock mycket stationära och rörelser registrerades som längst upp till 800 meter.

Diskussion

Ringmärkningsmaterialet från Ottenby, Falsterbo och Nidingen bekräftar att majoriteten av sommarfynden i juli–augusti utgörs av årsungar som inte har genomfört eller endast påbörjat sin postjuvenila ruggning. Detta indikerar tillsammans med lägre erhållna vikter, att denna sträcktopp inte utgörs av några egentliga flyttningsrörelser. Att årsungarna vid denna tidpunkt uppvisar en stor flexibilitet och rörlighet styrks, utöver individomsättningen på de olika stationerna, även av de färgringmärkta boungarnas uppträdande i Västsverige. I ett flertal fall ringmärktes på fågelstationerna flera individer under en och samma dag. Åtta fall från Västsverige ger belägg för att kullsyskon uppträtt tillsammans under sina rörelser mellan olika lokaler (Andersson 1990, 2001, egna opublicerade data). Detta skulle möjligen kunna innebära att ungfågelspridningen i vissa fall sker kollektivt. Att det i första hand rör sig om ungar från förstakullar kan uttolkas redan av Nesenhöner (1956), som anger att andrakullar vanligtvis stannar kvar längre i födelseområdet. Detsamma har noterats i Västsvenska häckningsområden, där andrakullar ofta varit kvar i sina födelseområden fram till bortflyttningen i oktober (Andersson 1990, 2001). Även en del adulta hannar visade på en förvånansvärt stor rörlighet under hösten, till skillnad från de äldre honorna som föreföll vara stationära på häckningsplatserna.

Varje höst sker ett markant tillskott av okända individer i de västsvenska häckningsområdena, vilket sannolikt härrör från en omfattande ungfågelspridning. En mindre del av påspädningen utgörs även av adulta individer, vilket antyds av vissa hannars dokumenterade rörlighet samt att majoriteten försvann från de västsvenska häckningsområdena redan under sommaren (Andersson 2001). Många av dem genomför antagligen längre förflyttningar och undgår därmed vidare upptäckt under hösten. Ett exempel på detta är en hanne som hävdade revir under tre veckor vid Ljunghusen i Skåne och som sjutton dagar senare kontrollerades vid Sundre på Gotland, cirka 35 mil i nordostlig riktning (Anonym 1981). Det är inte helt givet att fåglar norrifrån har störst inverkan på det okända individtillskottet. Årsungar kan även som tidigare konstaterats röra sig norrut (Zink 1981). Kanske utgörs istället majoriteten av individtillskottet i de västsvenska häckningsområdena, liksom uppträdandet på Nidingen och Falsterbo under sommaren, av svarta rödstjärtar från Sydsverige eller Danmark. Detta skulle delvis kunna förklara varför inga kontroller av kända västsvenska fåglar har gjorts på Nidingen, trots att cirka 20% av Göteborgs årsungar periodvis varit färgringmärkta (egna opublicerade data). Inte heller ungar från häckningsområdena i mellersta Halland, där en ännu högre andel av årsungarna varit färgringmärkta, har resulterat i några kontroller varken på Nidingen eller i Falsterbo. I Danmark har en kraftig populationsökning ägt rum under senare decennier (Svensson m.fl. 1999, Danmarks Fugle, Dansk Ornitologisk Forening: www.dofbasen.dk/ART/). Samtidigt har den västsvenska populationen genomgått en drastisk minskning (Ottosson m.fl. 2012, egna opublicerade data). Man skulle också kunna tänka sig att Ottenbys ringmärkningssiffror kan ha en del av sitt ursprung i sydligare populationer. Hur långt årsungarna kan förflytta sig under denna årstid är ännu oklart. Det har dock framhållits att längre ungfågelrörelser kan spela en viktig roll för framtida revir- och häckningsetableringar (Baker 1993). Flera nordliga återfynd av Västsvenska årsungar föreligger under påföljande vår exempelvis i södra Norge, där en hona konstaterades häcka 25 mil NV födelseplatsen (Steel 1993). Det är inte otänkbart att den rört sig dit redan under sensommaren och genomfört sin första ruggning där.

Denna uppsats speglar främst spridningsförloppet hos årsungar under sommarmånaderna och den senare höstflyttningen hos svarta rödstjärten i södra Sverige. Mycket återstår dock att utforska när det gäller de enskilda individernas uppträdande under dessa spridningsrörelser. Hur deras detaljerade livsmönster ser ut är fortfarande höljt i dunkel, liksom strövtågens omfattning och ursprung. Utökade och riktade ringmärkningsinsatser med fler återfynd och kontroller, skulle möjligen kunna avfärda eller bekräfta några av ovanstående spekulationer.

Tack

Ett stort tack riktas till Ottenby, Falsterbo och Nidingens fågelstationer som välvilligt ställt sina ringmärkningsmaterial till förfogande. Tack också till Magnus Hellström, Uno Unger, Bo Nielsen, Anders Nothagen, Pär Sandberg och Kåre Ström för granskning av uppsatsen eller intressanta diskussioner. Detta är meddelande nr. 272 från Ottenby fågelstation.

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Summary

The Black Redstart *Phoenicurus ochruros* shows an annual culmination of ringed birds in July–August at Ottenby, Falsterbo and Nidingen bird observatories. These birds are primarily yearlings in juvenile plumage, which have left their birthplaces after fledging (Figure 1). Black Redstart yearlings have a unique moult strategy compared to other European thrushes. Species like Redstart and Robin normally begin the postjuvenile moult in the birth area only a few weeks after fledging (Glutz & Bauer 1988, Landmann 1996, Waldenström & Bengtsson 2001). Black Redstarts, however, start the partial body moult when they reach an average age of 87 days (Berthold 1983, 1985, Glutz & Bauer 1988, Landmann 1996). This allows for dispersal of yearlings during the summer, leading them to new locations where they carry out the partial moult. It is also known that yearlings of Bluethroat can begin their migration before the moult is finished (Lindström et al.1985, Lindström & Lind 2001).

Dispersal of yearlings among passerines is poorly researched (Goodbody 1952, Baker 1978, 1993, Greenwood & Harvey 1982, Boddy 1983, Norman 1991, Paradis et al. 1998, Raine et al. 2006). In Sweden, the topic has only been touched upon briefly for Black Redstart (Knutsson 1981, Andersson 1986, 2001). This paper intends to give a more detailed picture of the progress of the yearling dispersal in relation to the autumn migration by utilizing data on ringing, weight and moult. It is especially motivated since these dispersal movements have sometimes been perceived as an early start of autumn migration. However, as has previously been confirmed from Central Europe, the summer records are well separated from those of the autumn migration (Menzel 1983, Glutz & Bauer 1988). Berthold (1983, 1985) shows that migration restlessness and the main observed migration of yearlings occurs much later in October–December, an average of two weeks after the moult is finished. Together with the increased migration restlessness, an increase in weight of experimental birds has also been noted. Adult birds normally also leave their breeding grounds in October–November, after a pronounced singing period in September–October (Cramp 1988, Glutz & Bauer 1988, Andersson 2001). However, some movements before the migration seem to occur also in older males.

The material analyzed here includes ringing, weight and moult data from the bird observatories at Ottenby 1980–2011 and Falsterbo and Nidingen 1980–2012. The period that has been analyzed is 20 June through 30 November. On Nidingen trapping has been continuous over the season, but not standardized. At Ottenby trapping has occurred spontaneously until 25 July, from that date it has been standardized. At Falsterbo ringing has been standardized from 21 July.The classification of the postjuvenile moult has followed the score of different moult stages, from completely juvenile plumage to finished first winter plumage (Table 2, Lindström et al 1985, Bensch & Lindström 1992). The classification presented in this paper was adapted to the different methods used on the bird observatories. In addition, data has been included from a previous population study with color-ringed individuals in western Sweden (Andersson 1987, 1990, 1995, 2001). They concern movements after the breeding period in 19 of 188 ringed nestlings, 34 of 105 territorial males and 8 of 20 females ringed during the spring. This is to provide a complementary picture of yearling distribution patterns, but also of the movements of the adults before the autumn migration.

The number of ringed Black Redstarts at the bird observatories had two distinct peaks in the autumn season (Figure 2). The total percentage of yearlings was 86, 98 and 96 % for the three observatories respectively (Table 1). During the early peak in July–August the proportion of yearlings was slightly higher (92, 100 and 96 %). At Ottenby and Falsterbo 63 and 67 % of the total autumn catch was ringed during July–August, while the corresponding figure for Nidingen was 89 %. In September very few birds were ringed as that month coincides with the main yearling moult period.

More yearlings were observed to have commenced moult during July–August at Ottenby (96%) than at Falsterbo (40%) and Nidingen (14%) (Table 2). However, if also birds in moult stage 1, representing essentially juvenile plumage, are added to those in stage 0 the percentages are more equal, 80, 81 and 93 % respectively. Birds caught in early autumn were lighter than birds caught in late autumn. The average weight for Ottenby birds captured in June–August was 15.3 grams (n=106) and in October–November 16.3 grams (n=62, F=9.47, P<0.01). At Falsterbo, the corresponding figures were 15.0 (n=106) and 15.5 (n=45, F=12.95, P<0.001). The values of Nidin-

gen was 15.0 (n=122) and 16.5 (n=10, F=20.83, P<0.001).

Out of 188 color-ringed nestlings in western Sweden, 19 were found during the autumn season. Two were stationary during 29 and 68 days, while seventeen were observed only one day in the same place. These yearlings moved to new sites and were observed up to 7000 meters away. Out of 105 color-ringed, territorial males in western Sweden 34 were observed in the autumn. Nineteen of them stayed only 1–5 days in the same place. Seven of these were later encountered 500–2000 meters away, while further observations are missing. Eight of the 20 females that were color-ringed during the breeding season were observed during the autumn. All were very stationary and no movements were recorded beyond 800 meters. The ringing data from Ottenby, Falsterbo and Nidingen bird observatories confirms that the majority of the ringed Black Redstarts in July–August, consists of yearlings that have not undergone or only begun their postjuvenile moult. This indicates, together with lower weights, that this peak does not represent any actual migration. The behavior of colour-ringed yearlings in western Sweden also supports the idea that yearlings at this time show a high degree of flexibility and mobility. Even some adult males showed surprisingly large non-migratory movements during the autumn season.

Every autumn, there is a significant influx of unringed individuals in the breeding areas of western Sweden, probably a result of extensive dispersal of yearlings. A small part also consists of adult individuals, as suggested by documented adult male mobility (Andersson 2001). Perhaps the majority of the individuals from this influx in western Sweden as well as the birds that are trapped at Nidingen and Falsterbo in July–August have their origin in southernmost Sweden or Denmark. This could explain why there are no recoveries at Nidingen of yearlings ringed in Gothenburg c. 40 km to the north, where in some years up to about 20% of the yearlings have been ringed (own unpublished data). No yearlings from the breeding areas in central Halland (where an even higher proportion of birds have been ringed), have resulted in any controls at either Nidingen (30 km to the north) or Falsterbo (230 km to the south). A major population increase has occurred during recent decades in Denmark (Svensson et al 1999, www.dofbasen.dk/ART/). In the same period, the population of western Sweden has undergone a drastic decline (Ottosson et al 2012, own unpublished data). It is also possible that some of the birds ringed at Ottenby could have the origin in southern populations. How far yearlings can move during July–August is still unclear. Zink (1981) and Glutz & Bauer (1988) indicate several instances where young Belgian and German ringed Black Redstarts dispersed in a northerly direction up to a distance of 290 kilometers. It has also been argued that long dispersal of yearlings can play an important role for future territorial and breeding establishments (Baker 1993). There are several cases when birds that had been ringed as yearlings in western Sweden were recovered in the following spring north of the ringing site. One example comes from southern Norway, where a female was found to breed 250 kilometers north-west of the birthplace (Steel 1993). It is not inconceivable that it had moved there during late summer and went through its first moult.

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Territory vegetation structure and habitat preferences of the Savi's Warbler *Locustella luscinioides* in lake Tåkern, Sweden

Vegetationsstrukturer i revir och habitatpreferenser hos vassångare Locustella luscinioides *i Tåkern*

ADAM BERGNER & LARS GEZELIUS

Abstract

Savi's Warbler *Locustella luscinioides* has established as a nesting species in a few shallow reed lakes of southern Sweden during the last twenty years. Knowledge of the habitat requirements of a newly established species is important to maintain a viable population and design action plans. We examined the vegetation parameters in occupied territories of Savi's Warblers at Lake Tåkern, the country's stronghold for the species. We found association with the outer edge zones and fragmented areas of vegetation dominated by common reed *Phragmites australis.* Occupied territories differed from randomly chosen unoccupied (control) sites by having a thicker layer of basal litter, and on average more willow bushes (*Salix* spp.). Reed density and height did not differ between occupied territories and control sites. It is likely that the Tåkern population will continue to increase until it is limited by lack of willows or dense basal litter, the traits important for the establishment of territories. It is also likely that the species will continue to increase in Sweden as long as suitable reed habitats are left unaffected.

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Introduction

Passerines associated with reed environments need to establish territories that can provide a suitable habitat and sufficient food supply. In reed-nesting passerines, nest predation rate is generally high (Hansson et al. 2000, Batáry et al. 2004). Especially vulnerable are species that breed in less dense stands of reed and reed in shallow water. Since predation is an important factor influencing habitat selection in birds, studies on the utilization of structures found within occupied territories are important for understanding the breeding biology. On the European continent, several studies have analyzed the habitat requirements and the breeding biology of the Savi's Warbler *Locustella luscinioides* (see Dittberner & Dittberner 1985, Pikulski 1986, Aebischer et al. 1996, Neto & Gosler 2005, Neto 2006), but the knowledge is still limited in the northern parts of its European distribution. As a breeder, the species has a short history in Sweden. The first confirmed breeding was in Lake Hammarsjön, Scania, in 1992 (Svensson et al. 1999). Four years later, the first nest was found in Lake Tåkern (Gezelius 1996), and since the beginning of the 2000s the species has established a small population at this location, apparently breeding annually. During the same period the number of established territories has shown a steady increase (Figure 1), so far peaking at a total of 16 in the spring of 2012 (Gezelius & Nilsson 2013). Presently, Lake Tåkern is probably one of few locations in southern Sweden that holds a small, but well-established and increasing, population of Savi's Warblers (Bergner 2012). No previous studies on the species have been conducted in Sweden. Hence, the importance of various vegetation parameters connected to habitat selection is poorly understood. In order to understand the species' breeding biology, it is also important to shed light on vegetation structure of occupied territories. The Swedish population is small, probably not exceeding 30 pairs (Ottosson et al. 2012), so the risk of local extinction due to random events is substantial (Tjernberg 2010). Restoration and protection of habitats for birds associated with reed environments is important because such habitats have been affected by human activity through fragmentation (Paracuellos 2006) and declined due to drainage of wetlands and eutrophication (Van der Putten 1997). More recently, reed habitats have also been affected as a result of extensive grazing by moulting Greylag Geese *Anser anser* (Nilsson et al. 2001). The purpose of this study was to examine the habitat preferences for the Savi's Warbler and describe vegetation parameters of occupied territories at an important breeding site in southern Sweden, that is, at the species' northwestern distribution range limit.

More specifically, we examined the following issues in our study: is there any difference in reed height, reed density, basal litter thickness and abundance of bushes and trees between territories occupied by Savi's Warblers and unoccupied sites (potentially suitable as territories)?

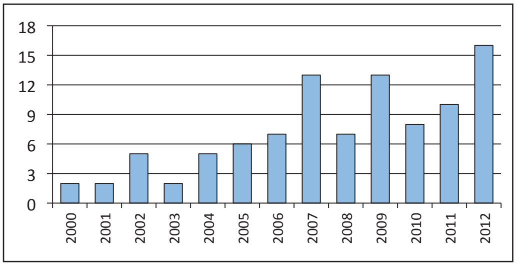


Figure 1. The number of territorial Savi's Warblers in Lake Tåkern during the period 2000–2012, based on data from annual inventories.
Antalet revirhävdande vassångare i Tåkern under perioden 2000–2012, baserat på data från årliga inventeringar).

Methods

General biology

As a reed-specialist, the Savi's Warbler is associated with vegetated lakes, estuaries and bays in large parts of southern and central Europe east to southwestern Siberia (Svensson et al. 1999). The species spends the winter in sub-Saharan Africa (Cramp 1992) and arrives to its South and Central European nesting grounds from the beginning of March, and to the Swedish breeding sites during the second half of April. As in most long-distance migrant warblers, the males arrive in general 1–2 weeks before the females (Pikulski 1986). The nest is built in dense basal vegetation and tussocks at low levels in reed and sedge vegetation, occasionally just 10–20 cm above the water surface (Neto 2006). The males claim and defend their territories with a monotonous, mechanical buzzing song that can be heard in minute-long intervals without

Figure 2. Map of Lake Tåkern with the censusing area.
Karta över sjön Tåkern, Östergötland med experimentområde.

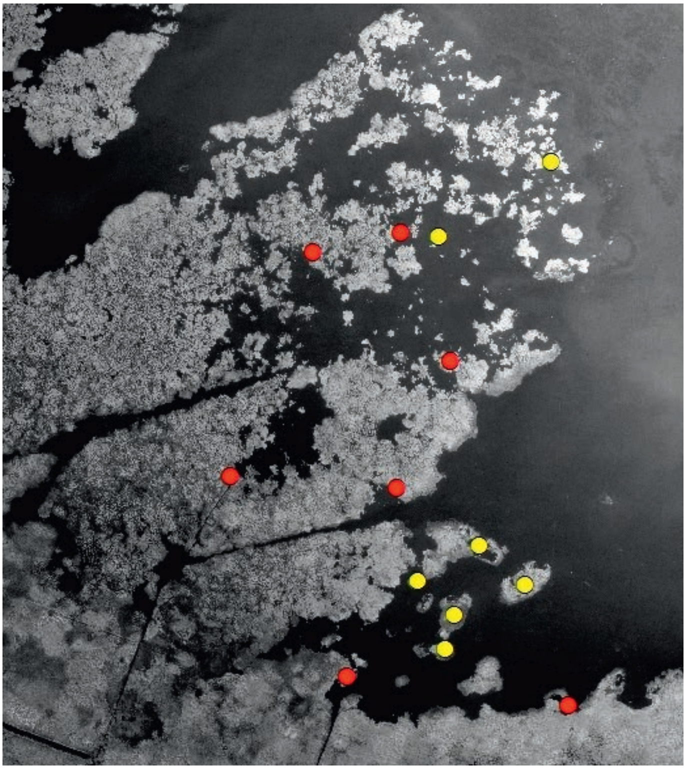


Figure 3. Map of the reed habitats in the censusing area with occupied territories (yellow) and pseudo-territories (red).
Karta över vassområdena inom experimentområdet med besatta revir (gul) och pseudorevir (röd) markerade.

a break. After mating and during the nestling period, the males sing only occasionally (Kloubec & Čapek 2005), but some individuals can start defending a secondary territory (Neto et al. 2010).

Description of the location

The survey of Savi's Warblers was conducted in the shallow, mesotrophic 42 km^2 Lake Tåkern, in southern Central Sweden (58º21′N, 14º47′E). The lake is protected as a nature reserve since 1975 and is included within the Ramsar Convention as a wetland of international importance for biodiversity, especially birds. The area specifically studied, the southwestern part of the lake (Figure 2), contains some of the largest reeds of northern Europe making up an area of 1 200 ha. The reed beds are crisscrossed by numerous man-made canals, and the reed edges are fragmented, consisting of bays, lagoons and reed isles of various sizes. The emergent vegetation is typical of shallow, nutritious lakes in southern Sweden. Dense belts of common reed *Phragmites australis* form stands and other species like common cattail *Typha latifolia*, narrowleaf cattail *Typha angustifolia*, iris *Iris pseudacorus*, common tule *Schoenoplectus lacustris* and sedges *Carex* spp. are found sparsely (Milberg & Ekstam, unpublished material).

Data sampling and methodology

During the period 26 April to 16 May, 2012, the occurrence of Savi's Warblers was assessed mainly by canoeing along the outer reed belts and the canals. Field work was conducted at days with good weather and weak to moderate winds in order to facilitate transportation and the location of territorial males. The survey was limited to the southwestern parts of Lake Tåkern, where the largest number of territories has been found in previous years (Gezelius & Nilsson 2011). Territorial males react strongly to playback of song in the vicinity of their territories and often come up in full view at the reed edge while they warn or sing against the speaker (personal observations). Early in the season, before the territories are fully established, males may, however, even temporarily leave their areas to approach the speaker. Previously not recommended by Aebischer et al. (1996), we therefore did not use this method in censusing established territories, but just occasionally to study if previously located sites were still occupied. For playback, a standard smartphone and an external very powerful mini speaker (RadioShack® Mini Amplifier) were used. Playback sounds included song interspersed with contact calls. At the first visit to the censusing area, the positions of males relative to each other were located and coordinates registered using a GPS (Garmin GPSMAP® 62st). Any realignment among singing males was noted during the following week after arrival in order to investigate if the birds were truly territorial. During this period we took notes of the male movements in order to assess the size and vegetation structures of the territories. A total of 12 occupied territories were located, but since this study was conducted using a limited time frame we only had time to include seven randomly selected territories for further studies (Figure 3).

One to two weeks after each male's arrival, we measured vegetation parameters at 10 randomly selected points (at least 5 meters apart) in the vicinity of the most frequently used song position in each territory. The purpose of these point measurements was to provide representative data of territory vegetation structures. Parameters measured included: (1) The number of reed stalks within squares of 0.25 m^2 at each half meter above the water surface, between 0.5 m and 3.5 m reed height. From this, mean reed height was calculated according to Aebischer et al. (1996) using the formula:

$$ARH = \frac{1}{RD_{0.5}} \sum_{h=0.5}^{3.5} (RD_h - RD_{h+0.5})h$$

ARH = average reed height, h = reed height in meters, RD_h = reed density (the number of reed stalks within 0.25 m^2) at reed height h.

Only last year's reed stalks were counted as sprouts gradually emerged during the study period, and probably did not affect the species' choice of habitat. (2) The thickness of the basal stratum (Figure 4) assessed at the same ten points by measuring the thickness of vegetation debris from last year that was lying just above the water surface, from the upper surface down to the water surface. (3) The presence of willow shrubs was assessed by counting the number of individual bushes within each territory while standing on a two meter high kitchen-ladder placed at reed edges. Identification of occurring shrubs was not made due to difficulties to safely distinguish the species early in the growth season. The presence of trees such as common alder *Alnus glutinosa* and birch *Betula* sp. was noted in a similar manner.

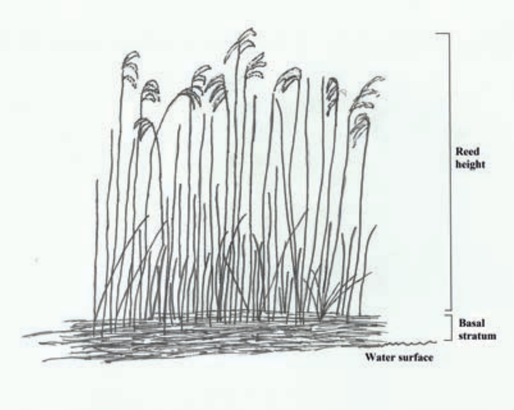


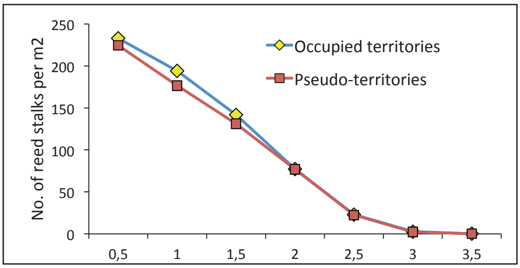
Figure 4. Descriptive illustration of the reed and some parameters mentioned in the text.
Illustration av vass med förklaringar till parametrar omnämnda i uppsatsen.

Pseudo-territories

In order to make comparisons with the vegetation parameters sampled in occupied territories, so-called pseudo-territories were designed (see Aebischer et al. 1996). These were constructed to reflect the average vegetation in areas lacking Savi's Warblers. Because the size of occupied territories in Lake Tåkern has not been previously described, results from other European studies were used for proper evaluation. Aebischer et al. (1996) found that the territory size varied between 500 and 3300 m^2. In a study conducted in Hungary, Báldi (2004) found that the smallest territories in fragmented reed beds (similar to those found in Lake Tåkern) covered an area of only 380 m^2. Based on these data, the size of pseudo-territories in Lake Tåkern was assessed as the average size (1459.24 m^2). Measurements of vegetation parameters within pseudo-territories did not start until all measurements in occupied territories were completed. This was mainly done in order to select for similar areas where pseudo-territories could be randomly chosen. All males found during the study period resided in edge zones, thus limiting the potential areas for pseudo-territories to edge areas. Seven pseudo-territories were created using a quadratic grid ($\sqrt{1459.24\, m^2}$ = sides 38.2 m) on a map of the reed distribution. The pseudo-territories were then chosen by random selection of numbered quadrats using the map of the reed distribution. Once in place in the pseudo-territories, the same vegetation parameters as in occupied territories were measured.

Statistics

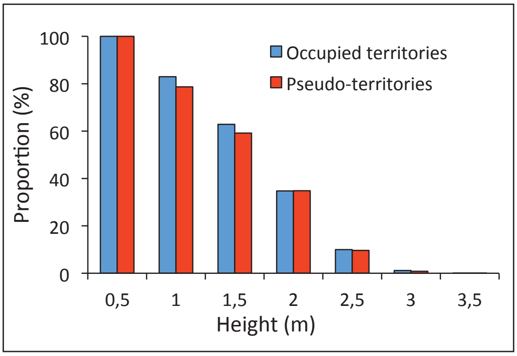
Data on average reed height in occupied territories were tested against corresponding data from pseudo-territories using t-test (significance level of $P<0.05$). The difference in reed density at different reed heights was tested in one-way ANOVAs (significance level of $P<0.05$). Data on basal litter thickness and number of willow bushes did not meet the need for normal distribution, as showed in



Figur 5. Average number of reed stalks per m^2 at different reed heights in occupied territories and pseudo-territories.
Genomsnittligt antal vasstrån per m^2 vid olika vasshöjder för besatta revir och pseudorevir.

Results

The vegetation over large areas in the surveyed parts of the lake was found to be relatively uniform with a tendency for more variation in terms of density, height and species composition at reed edges. However, usually no other species than common reed formed stocks. Other species occurring more sparsely included narrowleaf cattail, iris, valerian *Valeriana officinalis* and tufted loosestrife *Lysimachia thyrsiflora*. Willows were found in six out of seven surveyed territories, showing large variation in the number of shrubs. Of the seven investigated pseudo-territories, willow shrubs were found in two. The number of willows was significantly greater in occupied territories than in pseudo-territories (W=69.5, P<0.014, N=7). Mean number of willows was 11.14 ±0.88 SE in occupied territories and 0.71 ±0.48 SE in pseudo-territories. Presence of common alder and birch were rare, making no statistical analyses possible.



Figur 6. Proportion of reed stalks at different reed heights in occupied territories and pseudo-territories. The number of reed stalks at the lowest level measured, 0.5 m, represents 100%.
Proportionell fördelning i höjd av vasstrån hos besatta revir och pseudorevir. Antalet vasstrån vid den lägsta nivån, 0.5 m, utgör 100%.

Reed heights above 3.5 meters occurred rarely in both the occupied territories and pseudo-territories. The normal maximum height of the reed was within the range from 2.5 to 3.0 meters. The mean reed height was on average 3.6% higher in occupied territories (mean: 1.47 ±6.52 SE m) than in pseudo-territories (mean: 1.41 ±4.56 SE m), but the difference was not significant (t=1.17, P=0.24, N=70). At lower levels, usually <1.0 m, the proportion of short broken stalks was great. Occupied territories had on average 3.6% more reed stalks with height ≥0.5 m (t=0.55, P=0.580, N=70) and 9% more reed stalks with height ≥1.0 m (t=1.38, P=0.170, N=70), but the differences were not statistically significant.

The reed structure exhibited typical properties, increasing in density vertically towards the ground. The density (number of reed stalks/area) in occupied territories differed significantly at all measured levels lower than 2 m ($F_{6,483}$=232.78, P<0.001). A similar result was demonstrated for pseudo-territories as well. At heights >2 m any changes in the number of individual reed stalks were too small (Figure 5), making statistical tests impossible. The maximum number of reed stalks at the level 0.5 m differed greatly between individual sample points, ranging from 76–448 stalks/m^2 in occupied territories and 72–464 stalks/m^2 in pseudo-territories. When comparing at the level of individual sampling points, the increase in reed height was found to be negatively associated with a decrease in reed density (Pearson r=-0.258; P=0.031, N=70). Using the formula described above, no significant difference was found in average reed height between occupied and pseudo-territories. At all levels except the highest (3.5 m), the average reed density was higher in occupied territories than in pseudo-territories (Figure 6). The difference was greatest in the height range from 0.5 to 1.5 m, but at no level the difference was significant (0.5 m: t=0.55, P=0.580, N=70; 1.0 m: t=1.38, P=0.170, N=70; 1.5 m: t=1.05, P=0.296, N=70; 2.0 m: t=0.03, P=0.972, N=70.

The thickness of the basal stratum differed in appearance from a thin layer of broken last year's reed stalks and leaves to very dense mats of laying dry reed. Especially the latter structure was frequently present on at least a few places in most of the occupied territories surveyed. The litter thickness was on average 83.6% higher in occupied territories (occupied territories: mean = 9.39 ±0.93 SE cm, pseudo-territories: mean = 1.54 ±0.47 SE cm; W=6086.5, P<0.001).

Discussion

In Lake Tåkern, homogeneous edge areas predominated by common reed hold most of the Savi's Warbler territories. This is, however, the predominant vegetation type and the only plant species to create substantial stocks in the shallow waters along the shores of the lake. Studies conducted elsewhere in Europe suggest that the species is not primarily linked to common reed only, but also prefers other grassy vegetation with scattered shrubs. In a Spanish study, Martinez-Vilalta et al. (2002) found that the Savi's Warbler avoided homogenous reed and instead preferred vegetation mainly consisting of saw-sedge *Cladium mariscus*. In Portugal, most nests were found in dense vegetation: rushes *Juncus* spp., most often mixed with reed, and some in raspberry plants *Rubus* spp. (Neto 2006). In Lake Neuchâtel, Switzerland, most territorial males were found in vegetation consisting of saw-sedge, cattail or sedges, though in all cases with an element of common reed (Aebischer et al. 1996). These findings of a non-selective preference for different plant species suggest that the Savi's Warbler is not dependent on specific plants, but rather other properties of the vegetation, such as its height and density.

The results of our study suggest that the species prefers some scattered bushes in its territories. Presence of elevated structures, like trees, has been shown to increase nest parasitism in songbirds inhabiting reed (Honza et al. 1998), but Savi's Warblers are very rarely parasitized by Cuckoos. In the few cases where nests have been found depredated in Lake Tåkern, Water Rail *Rallus aquaticus* predation has most likely been the main cause of brood loss (J. Stepniewski, personal comm.). No previous study has found scattered bushes as being important structures in occupied territories of the Savi's Warbler. Báldi & Kisbenedek (1999) stated that the species did not show a preference for edges where bushes were plentiful, most likely because of the apparent transition between two different vegetation types. In Lake Tåkern, bushes were found to be rather low and most of the larger structures were found in interior reedbeds, possibly limiting the negative effects of such structures. The importance of willow shrubs for the quality of a territory has not yet been analyzed, and needs further study. In a few cases, Savi's Warblers were observed singing from the top of willow shrubs, most likely as a way to be heard over a wider area and increase the chance of mating.

Neither reed height nor reed density differed significantly between occupied territories and pseudo-territories in Lake Tåkern. Aebischer et al. (1996) demonstrated both denser and higher reed vegetation in occupied territories in Lake Neuchâtel. Also Neto (2006) showed that most birds were found in vegetation that on average was higher, but this did not seem to be of large importance for nest site selection. In order to find distinct differences in vegetation data, a large number of replicates is usually needed. If any differences truly exist in Lake Tåkern, the reed edges examined in this study were too uniform to reveal such differences. Occupied territories were found to have a slightly higher number of short (≤1.5 m) reed stalks, resulting in denser basal structures in the reed beds. This finding cannot be explained using the data obtained from this study, but indicate that differences in vegetation density might exist. The most important vegetation parameter for the species seems to be an extensive basal stratum of straw litter (broken reed stalks from the previous year). This was confirmed by the study in Lake Tåkern and has previously been discussed by Aebischer et al. (1996) and Neto (2006). A thick layer of straw litter is likely to be important for foraging, which often take place close to the water surface (Winkler & Leisler 1985). It is also believed that an extensive litter layer is crucial for proper nest positioning.

Typical territories of Savi's Warblers in Lake Tåkern are characterized by being situated at reed edges or in fragmented areas consisting of several reed isles, observations consistent with a previous study conducted in Lake Velence, Hungary (Báldi 2004). These areas are typically influenced by edge effects, which are the combined biotic and abiotic factors affecting the presence and distribution of various organisms along edges (Murcia 1995). In general, many reed living passerines show preferences for edge zones (Báldi & Kisbenedek 1999). This is believed to be a result of the properties of reed edges, typically exhibiting higher and denser vegetation (Báldi 1999). Reed edges have a drier microclimate than interior reed beds, potentially offering more food for insectivorous birds. Although there are some contradictory results (e.g. Lahti 2001), many studies suggest that edges have higher rates of nest predation (Báldi & Batáry 2005). Fragmented reed beds might as well exhibit high nest predation due to prominent edge effects. In a study on Reed Buntings *Emberiza schoeniclus*, a weak positive association between degree of fragmentation and nest predation rates was found (Pasinelli & Schiegg 2006). Nest site selection is believed to favor those individuals that reduce the risk of nest predation (Martin 1998). Having demands for habitats with high predation pressures, the Savi's Warbler needs to find a way to compensate for the increased risk of depredated nests. A thick basal stratum of reed litter is believed important as a substrate for nests. Unlike most warblers of the genus *Acrocephalus*, the Savi's Warbler builds its nest well hidden at low levels in dense vegetation, possibly as a way of limiting the risk of nest predation (Neto 2006). Equivalently, this can be seen in the Bearded Reedling *Panurus biarmicus*, a species dependent upon reedbeds having a dense cover of thin, dry reed stems to conceal its nests (Poulin et al. 2002; personal observations). The extensive and dense structures of basal reed litter are more prominent in reed edges and partly a result of mechanical abrasion from winds and ice.

At a local scale, habitat selection is a function of a species' habitat preference, population density and landscape heterogeneity (Fretwell & Lucas 1970). Because of its early state of establishment in Lake Tåkern, the density of Savi's Warblers is considered low compared to areas within the species' general range. This implies that the distribution of males is not yet limited by lack of suitable territories. Most territories might therefore still be situated in areas of significantly high quality, suggesting that the results from our study reflect only the vegetation parameters of the best territories among those available in this region. The Savi's Warbler territories in Lake Tåkern exhibited an unequal spatial distribution during the spring of 2012, in accordance with previous years (Tåkern Field Station, unpublished material). Despite large areas of suitable reed edges, males tend to be aggregated in clusters within areas of just a few hundred meters of reed. This pattern can easily be interpreted as areas having different quality are unequally distributed in Lake Tåkern. This might not, however, be the only explanation; conspecific attraction is known to play an important role for habitat selection and territory establishment in many songbirds (Ward & Schlossberg 2004, Hahn & Silverman 2006, Nocera & Betts 2010). Vocal attraction to areas including territories of conspecifics might have important implications for breeding success. Laiolo & Tella (2008) showed, in their study on Dupont's Larks *Chersophilus duponti*, that the intensity of vocal activity was associated with the likelihood of receiving immigrants to an area, securing population persistence.

Considering the recent increase of territories in Lake Tåkern, as well as confirmed breedings in Lake Kvismaren in 2009 (Stervander et al. 2010) and Lake Krankesjön in 2010 (the Species Gateway; http://svalan.artdata.slu.se/birds), we believe that the species will continue to increase in suitable reed habitats of southern Sweden. Because presence of thick basal strata of broken reed stalks has been shown important, this trait might, over time, be a limiting factor in Lake Tåkern. In order to provide the Savi's Warblers with this vegetation parameter, continuous recruitment of reed is required. How the increased population of Greylag Geese, which feeds particularly on reed sprouts during the moulting period, affects reed passerines in Lake Tåkern has not yet been evaluated. Recruitment of willows is believed to be favored by disturbance, creating spots of bare soil in reed edges. Mechanical abrasion, mostly from ice in early spring, is probably the most important factor influencing the occurrence of such traits. Before we can assess the number of potential territories that areas of the reed habitats of Lake Tåkern can hold, further mapping of reed areas and studies on the correlation between vegetation structures and territory quality is needed.

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Sammanfattning

Vassångaren *Locustella luscinioides* är ett nytt tillskott till den svenska fågelfaunan, som under de senaste årtiondena invandrat från sitt huvudsakliga utbredningsområde i södra och mellersta Europa. Efter en första konstaterad häckning i Hammarsjön, Skåne, 1992, har arten etablerat en liten häckande population i sjön Tåkern, Östergötland. Antalet revir har ökat stadigt de senaste åren och som mest hittades där 16 sjungande hanar under vårsäsongen 2012. På grund av begränsad utbredning och liten populationsstorlek riskerar arten att försvinna från södra Sverige till följd av slumpfaktorer. För att kunna förutsäga eventuella hot och utvärdera framtida populationsutveckling i Sverige är studier av artens habitatkrav och häckningsbiologi nödvändiga. Några större studier av arten i Sverige finns dock sedan tidigare inte publicerade. I syfte att ta reda på artens habitatkrav på en viktig svensk häck-

ningslokal utfördes under våren 2012 vegetationsmätningar i sju etablerade revir i sydvästra delen av Tåkern. Fyra parametrar undersöktes specifikt: vasshöjd, vasstäthet, tjockleken på förnaskiktet och förekomsten av videbuskage och träd. Vegetationsparametrarna jämfördes med sju slumpvist utformade pseudorevir inom samma område, dock med skillnaden att dessa saknade vassångare. Etablerade revir hittades uteslutande i kantzoner och fragmenterade områden dominerade av bladvass *Phragmites australis* med visst inslag av smalkaveldun *Typha angustifolia*, läkevänderot *Valeriana officinalis* och svärdslilja *Iris pseudacorus*. Inga signifikanta skillnader i vasshöjd eller vasstäthet påvisades, även om etablerade revir i genomsnitt hade något högre vassmedelhöjd. Karaktäristiskt för de flesta etablerade revir var signifikant tjockare basala strukturer av liggande fjolårsvass, i genomsnitt hela 83.6% tjockare än motsvarande strukturer i pseudorevir. Sannolikt är tjocka basalskikt av förna viktiga som substrat för bon, vilka ofta förläggs i täta tuvor eller fjolårsvegetation på låg nivå i vassen. Eftersom arten huvudsakligen söker föda nära vassbottnen kan dessa strukturer också vara viktiga för födosök. Signifikant fler videbuskage *Salix* spp. hittades i etablerade revir jämfört med pseudorevir. Förekomst av buskage för betydelsen av revirkvalitet har ännu inte utvärderats, men vid några tillfällen noterades hur hanar sjöng från toppen av buskage, sannolikt som ett sätt att höras över ett större område och öka chansen att attrahera honor. I denna studie fann vi vassångaren knuten till kantzoner, områden som generellt påverkas av tydliga kanteffekter och som också kan ha högre bopredationsrisk. I likhet med studier av Aebischer m.fl. (1996) och Neto (2006) drar vi slutsatsen att arten väljer områden med vegetationsstrukturer som minskar risken för bopredation, och därmed kompenserar för den ökade risken för bopredation i kantzoner. Med tanke på artens sentida ökning i Tåkern, liksom konstaterade häckningar i Kvismaren, Närke 2009 och Krankesjön, Skåne 2010, talar det mesta för att arten kommer att fortsätta att öka så länge inga plötsliga förändringar sker i artens habitat. Hur den ökade grågåsstammen, som under ruggningsperioden lokalt betar på årsskott av vass och därmed hämmar tillväxten, påverkar vassångaren och andra vasslevande tättingar har ännu inte studerats i Tåkern. Innan vi kan förutsäga hur många revir av vassångare som potentiellt skulle kunna rymmas i Tåkerns vassar krävs vidare kartläggning av vegetationsstrukturer och häckningsbiologiska studier med inriktning på revirkvalitet.

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Population trends of birds in alpine habitats at Ammarnäs in southern Swedish Lapland 1972–2011

Beståndsförändringar hos fåglar på kalfjäll runt Ammarnäs i södra svenska Lappland 1972–2011

SÖREN SVENSSON & THOMAS ANDERSSON

Abstract

All birds were counted along six permanent routes (total length 90 km) located in the low alpine zone (800–1000 m.a.s.l.) at Ammarnäs, southern Lapland, during forty-years, 1972–2011. Eighty-three species were recorded; average 41 species and 1677 birds per year. Number of species as well as population size increased for waterfowl, waders and other non-passerines but not for passerines. Thirteen of the thirty-eight most regular species had significant population trends, twelve of them positive. The route counts correlated well with the number of pairs in two adjacent territory mapping plots. The trends also correlated positively with those found in all mountain routes of the Swedish Bird Survey. Although not quite significant this similarity indicates that common large-scale factors are involved in governing the local population changes. Several of the species that have their main distribution at lower levels are expanding their ranges into the alpine zone. Despite the predominance of positive trends some species have more or less severe problems, requiring deeper studies or conservation measures: *Melanitta fusca, Aythya marila, Philomachus pugnax, Eremophila alpestris* and *Plectrophenax nivalis.*

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Birds of alpine habitats have long featured among the least known as to population densities and trends in Sweden. As late as in the Red List of 2000 (Gärdenfors 2000), two out of four bird species that were classified in the DD (data deficient) category belonged to the alpine region (Long-tailed Duck *Clangula hyemalis* and Red-throated Pipit *Anthus cervinus*). The reason for this was that surveys had been conducted at only a few sites, and usually not over many years. When writing the most up-to-date book on bird numbers (Ottosson et al. 2012) it was found that very little new information had been added after the 1980s. Ammarnäs, where the current study was conducted, remains the only site with continuous long term coverage of alpine bird communities (territory mapping of two plots of one square kilometre each since 1964 (Svensson 2006) and of a thirteen square kilometre plot since 1984 (Svensson 2007; only partly published but still going on)). It is only during the most recent decade that the general coverage of the whole alpine region has improved, thanks to the permanent route project of the Swedish Bird Survey (Svensson 2000, Lindström et al. 2012; also well described in Ottosson et al 2012). There is another long term study in alpine habitat that was active for eighteen years (at Hardangervidda in southern Norway; Østbye et al. 2007), but that study was concluded already in 1984. Recently, Byrkjedal & Kålås (2012) compared two surveys thirty years apart (1980 and 2010–2011), also at Hardangervidda, and another study with two counts far apart (1978 and 2001) was made by Berg et al. (2004) in the Rautas area in Lapland. Regrettably, these two latter studies are difficult to interpret as the counts have no known variation, and if one of the years is aberrant the conclusions are void from a long term point of view.

The eastern part of the Vindel River Nature Reserve, where Ammarnäs is situated, is by far the most intensively studied part of the alpine and subalpine biomes in Sweden. A long term project started here in 1963 (in several forest types; Enemar et al. 1984, 2004; Andersson & Sandberg 1996). Apart from surveys of bird abundance, also numerous studies of the ecology and biology of species have been completed; a list of publications from the project can be found at www.luvre.org.

When the surveys of the two alpine plots had been done for a few years time, it became evident that the results from such small plots would not be sufficient to monitor the long term trends of more than a handful of species. Nor could it be taken for granted that the small plots were representative for the whole Ammarnäs region or the whole nature reserve and of course much less so for the whole alpine region of Scandinavia. The resource-demanding territory mapping technique precluded expansion with similar plots all over the mountains. In 1972 we therefore established a number of survey routes (also called line transects) that covered much wider areas than the small plots but were walked only once a year. They sample about four hundred square kilometres of the alpine habitats in the eastern part of the reserve. In this paper we report the result of these surveys during the forty years 1972–2011. In the subalpine birch zone, such routes had been used since the project started in 1963 so we already knew that route surveys would add much important information (Enemar & Sjöstrand 1967, Enemar et al. 2004).

All bird names are listed in Appendix 3: scientific, English and Swedish names. In the running text below we use only English names.

Methods

Eight routes were established in 1972 within an area of about 30×40 kilometres with Ammarnäs village approximately in the centre. Of this area, about 400 square kilometres are alpine habitat, that is open heath and mire above the tree line; the routes were distributed within this habitat. Two of the routes, located at Björkfjället north-east of Ammarnäs, were surveyed only in 1972–1974 and are excluded from this analysis (however, counts along these routes were resumed in 2009). The other six routes, with a total length of about 90 kilometres, were surveyed in most of the forty years that have elapsed: in twenty-eight years all routes were surveyed, in five years five routes, in two years two routes, in three years three routes, and in one year (1999) only one route. In 1984 no route at all was surveyed. Figure 1 shows how the routes cover the area. A detailed description of the routes, including

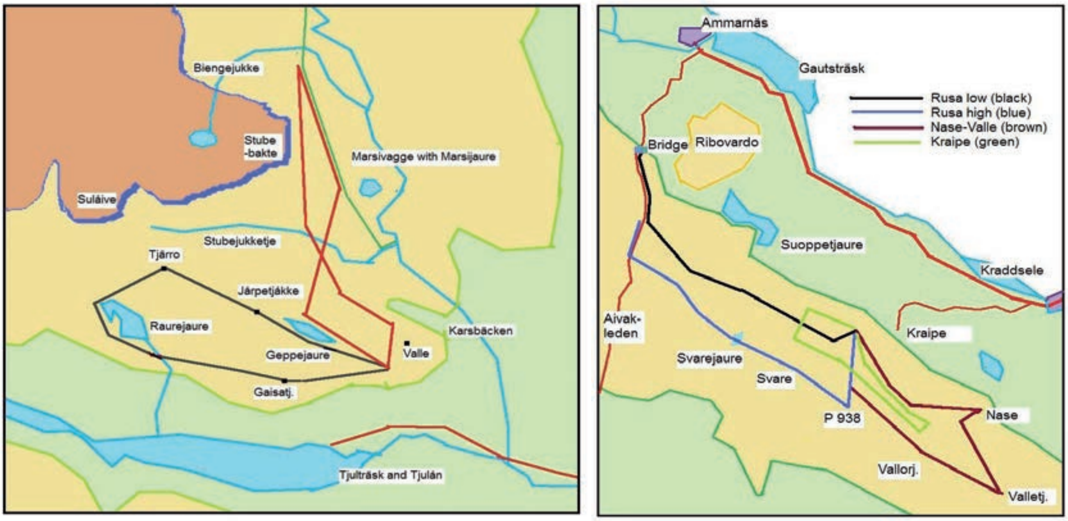


Figure 1. Simplified maps showing the location of the survey routes northwest (left) and south-east (right) of Ammarnäs. Green colour is woodland, blue lakes and streems, light brown alpine areas at elevation less than about 1000 m, and dark brown at higher elevation. The thick, dark blue line in the left map indicates steep cliffs. The left map shows the Stupipakte (red) and Raurejaure (black) routes. The right map shows Ammarnäs and Kraddsele villages, the road along the Vindel river, the dirt road to Kraipe reindeer corall and the Ammarnäs–Aivak trail; route key inset. Route details and coordinates are given in Appendix 1.

Förenklade kartor över inventeringsrutternas placering nordväst (vänster) och sydost (höger) om Ammarnäs. Grön färg anger skog, blå sjöar och vattendrag, ljusbrun fjällhed under 1000 m och mörkbrun fjällhed på högre nivå. Den tjocka blå linjen i den vänstra kartan anger klippstup. Den vänstra kartan visar rutten Stupipakte i rött och rutten Raurejaue i svart. Högra kartan visar byarna Ammarnäs och Kraddsele, vägen längs Vindelälven, vägen till Kraipe rengärde och leden från Ammarnäs mot Aivak; nyckel till rutterna i kartan. Detaljer om rutterna ges i Appendix 1.

geographical coordinates, is given in Appendix 1. Date, hour, duration and name of the observer is given for each survey in Appendix 2.

The routes were walked slowly and all birds, both males and females, were recorded without any distance limit. Yearlings were automatically excluded as the surveys were made before fledging of young in all species but Raven and Redpoll. No systematic effort was made to include distant birds except when a lake was surveyed or a large or conspicuous bird happened to be discovered far away. Only ordinary binoculars, no spotting scopes, were used. Hence, for most of the smaller land-birds the records emanate from a strip that seldom was more than 200 metres on each side of the route. In spite of that, the detection probabilities of the species are too different to make it possible to compare relative densities of species, and we have not tried to do that in this paper. As all routes went through open heath or mire without taller vegetation, different spatial detection probabilities cannot confound the interpretation of the counts within a species.

If all six routes had been surveyed in all 40 years, 240 counts would have been available. Due to the lack of any surveys in 1984 and the incomplete surveys in other years, the total number of counts is 210 (87.5%). Trends and diagrams are presented for the thirty-eight species that were recorded in at least twenty of the forty years (called regular species). For the remaining species, we only list the records in an appendix.

The trends were calculated with the TRIM programme (Pannekoek & van Strien 2005). As TRIM cannot handle years with a zero count at all routes, we treated such zero counts in the same way as truly missing counts. The number of additional missing values that was introduced this way varied between species but was never less than the percentages given in the next paragraph on the construction of the diagrams.

For the presentation of bar diagrams of the thirty-eight regular species, complete time series were constructed by imputing values in the following way. For a route that had not been surveyed in a particular year we inserted the average value of the two adjacent years. This means that all values for 1984, when no route was surveyed, were interpolated. In terms of individuals, the birds that had actually been observed constitute about ninety percent of the total of observed and imputed values (82–96%, depending on species), and of course close to one hundred percent if 1984 and 1999 are disregarded. The imputed birds are shown with a different colour in the bar diagrams.

We compared the data from the Ammarnäs routes with data from four other relevant sources. (1) The first was the local data set from the two small plots that had been surveyed during all forty years in the same alpine habitats at Ammarnäs (Svensson 2006, and unpublished); ten species had sufficient data in both samples. (2) The second source was also a local comparison with similar counts in the subalpine birch zone at Ammarnäs (Enemar 2004, and unpublished); nine species. (3) The third was a comparison with a subset of data from the Swedish Bird Survey (SBS). These data were extracted with the requirement that at least a part of the SBS route should run through alpine or subalpine habitats. A total of 104 routes fulfilled this requirement and 34 species could be included. In these three first comparisons we correlated the species population trend slopes with each other. The SBS trend slopes were calculated with the TRIM programme (Pannekoek & van Strien 2005) and the slopes based on data from Enemar (2004) and Svensson (2006) with exponential regression (when necessary a zero count was replaced with a small value). (4) The fourth source was the recently published data on waterfowl changes in the mountain range between the early 1970s and 2009 (Nilsson & Nilsson 2012); eight species. In this waterfowl study two different samples were surveyed by aerial counts. One sample was collected by surveying representative transects that covered all of the mountains once in 1972–1975 and again once in 2009. The other sample was ten special areas selected to reflect typical waterfowl habitats in different regions. The data from the transect sample is not easy to compare with the Ammarnäs data as variance is difficult to assess from only two points in time. For this sample we simply compared the direction of change without any test. The special areas, however, had been surveyed in each of the four years in the early 1970s. We selected the data from the special areas 1–3 in Nilsson & Nilsson (2012). These areas are partly identical with areas covered by our own routes or are located adjacent to them. Hence one would expect good agreement. In order to obtain better estimates of variance, we used the five years centred on 2009 for the Ammarnäs routes; hence, the data consisted of four years from each system in the early period and one and five years, respectively, in the late period. ANOVA was used to assess level of significance. After the species accounts we provide the results of and discuss these comparisons.

Temperature data were downloaded from luftweb.smhi.se (Swedish Meteorological and Hydrological Institute) for the position 1525000, 7300000 (RT90 grid) and period 1972–2010. The corresponding values for 2011 were estimated from the SMHI's monthly data sheets.

Statistical test of trends were made with TRIM (Pannekoek & van Strien 2005, VassarStats.net (©Richard Lowry) and Microsoft Excel. P-values >0.05 are considered not significant.

Results

Number of species and individuals: general patterns

A total of 83 species was recorded during the forty years of study, with on average 41 species and 1677 individuals per year. The most numerous taxon was the passerines with 31 species (37%) and on average 14 species and 1165 individuals (69%) per year. The next most common group was the waders in the strict sense (Charadrii) with 17 species (20%) and on average 12 species and 364 (22%) individuals per year. The ducks (Anatinae) were important in terms of diversity and counted 12 species (15%) but on average they were represented with only 6 species and 31 (2%) individuals per year. The other 31 species (28%) with a yearly average of 9 species and 110 (7%) individuals was a mixture of several taxa: ten raptors (six Accipitriformes, four Falconiformes), six Larii (three gulls, two terns and the Long-tailed Skua), two grouse (Tetraonini), two loons (Gaviiformes), one Gruidae (Crane), one Strigiformes (Short-eared Owl) and one Cuculidae (Cuckoo). But only seven of these other non-passerine species occurred with an average of more than one individual per year: Rock Ptarmigan, Willow Ptarmigan, Rough-legged Buzzard, Arctic Tern, Mew Gull, Long-tailed Skua and Cuckoo.

The general trends in number of species are shown in Figure 2. The total number of species (not shown in the figure) increased significantly (mean 0.36% per year; p<0.001), corresponding to more than six species in a forty year period. This was mainly a consequence of the trend of the group called other non-passerines which was also significant (1.1%; p<0.001), more than three species in forty years. The number of duck and wader species also increased (0.7% and 0.3% per year) but just barely significantly (p<0.05). The passerines did not show any significant trend due to a return to the original number of species towards the end of the period after a long period with fewer species.

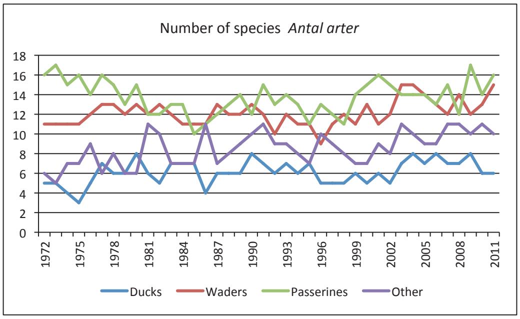


Figure 2. Number of species in different groups: ducks (Anatinae), waders (Charadrinae), passerines (Passeriformes) and other species. The trends are weakly positive (p<0.05) for ducks and waders and strongly positive (p<0.001) for other species.

Antal arter inom olika grupper: andfåglar (Anatinae), vadarfåglar (Charadrinae), tättingar (Passeriformes) och andra arter. Trenderna är svagt positiva (p<0.05) för andfåglar och vadarfåglar och starkt positiv (p<0.001) för övriga arter.

The trend for number of individuals (Figure 3) is positive and significant (p<0.001) for ducks (2.3% per year or about 150% in forty years), waders (1.5% per year or about 90% in forty years) and other non-passerine species (2.8% per year or about 200% in forty years). The trend for the passerines is close to zero and far from significant. And as the passerines are so predominant the trend of the whole community is neither significant. In the group of the twenty-three other non-passerine species twelve occurred in about the same number of

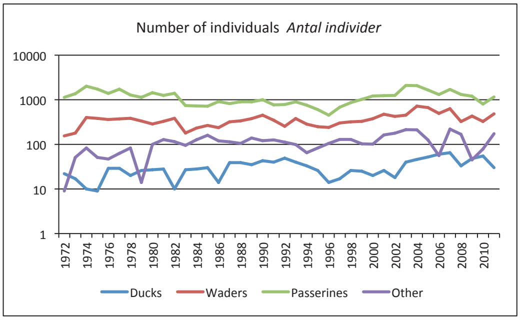


Figure 3. Number of individuals of all species and of species in different groups: ducks (Anatinae), waders (Charadrinae), passerines (Passeriformes) and other species. The linear trends are significantly positive for ducks, waders and other species. The trends for passerines and all species are not significant. The scale is logarithmic in order to show the groups better.

Antal individer av alla arter och av olika artgrupper: andfåglar (Anatinae), vadarfåglar (Charadrinae), tättingar (Passeriformes) och andra arter. De linjära trenderna är signifikant positiva för andfåglar, vadarfåglar och andra arter. Trenderna för tättingar och alla arter är inte signifikanta. Skalan är logaritmisk för att separera kurvorna bättre.

Table 1. Population trends for the 38 species that were recorded in at least 20 of the 40 years 1972–2011. The number of years with the species absent is given in the rightmost column. Non-significant p-values (p>0.05) are denoted ns.
Populationstrender för de 38 arter som registrerades minst 20 av de 40 åren 1972–2011. Antalet år utan observation ges i kolumnen längst till höger. P-värden som inte är signifikanta (p>0,05) markeras med ns.

		Trend	p	0-yrs
1	Rock Ptarmigan *Fjällripa*	1.0337	<0.05	4
2	Willow Ptarmigan *Dalripa*	0.9995	ns	6
3	Common Teal *Kricka*	1.0326	ns	9
4	Tufted Duck *Vigg*	1.0489	<0.01	17
5	Scaup *Bergand*	0.9757	ns	8
6	Velvet Scoter *Svärta*	0.9918	ns	9
7	Black Scoter *Sjöorre*	0.9972	ns	7
8	Long-tailed Duck *Alfågel*	1.0513	<0.01	8
9	Rough-legged Buzzard *Fjällvråk*	0.9954	ns	19
10	Golden Plover *Ljungpipare*	1.0181	<0.01	1
11	Ringed Plover *Sörre strandpipare*	1.0384	<0.01	6
12	Dotterel *Fjällpipare*	1.0112	ns	2
13	Common Snipe *Enkelbeckasin*	0.9909	ns	1
14	Whimbrel *Småspov*	1.0453	<0.01	8
15	Redshank *Rödbena*	1.0532	<0.01	2
16	Greenshank *Gluttsnäppa*	1.0256	ns	18
17	Wood Sandpiper *Grönbena*	1.0683	<0.01	9
18	Temminck's Stint *Mosnäppa*	0.9926	Ns	4
19	Dunlin *Kärrsnäppa*	1.0292	<0.01	1
20	Ruff *Brushane*	0.9934	ns	6
21	Red-necked Phalarope *Simsnäppa*	1.0189	ns	1
22	Mew Gull *Fiskmås*	1.0312	ns	1
23	Arctic Tern *Silvertärna*	1.0100	ns	13
24	Long-tailed Skua *Fjällabb*	1.0332	ns	2
25	Cuckoo *Gök*	1.0251	<0.05	1
26	Raven *Korp*	1.0072	ns	1
27	Willow Warbler *Lövsångare*	1.0093	ns	1
28	Ring Ouzel *Ringtrast*	0.9993	ns	12
29	Fieldfare *Björktrast*	0.9764	ns	5
30	Redwing *Rödvingetrast*	0.9812	ns	1
31	Bluethroat *Blåhake*	1.0012	ns	1
32	Wheatear *Stenskvätta*	1.0163	<0.01	1
33	Meadow Pipit *Ängspiplärka*	1.0005	ns	1
34	Brambling *Bergfink*	1.0270	ns	9
35	Redpoll *Gråsiska*	1.0071	ns	1
36	Reed Bunting *Sävsparv*	1.0225	<0.05	1
37	Lapland Longspur *Lappsparv*	0.9971	ns	1
38	Snow Bunting *Snösparv*	0.9541	<0.01	20

years during the first and second half of the period. Only one species occurred in much fewer years (14 versus 1), and that was the Black-throated Loon; one pair in one lake ceased to breed there. Nine species were not recorded at all in the first twenty years but in one or several years during the second twenty years: Crane (in 4 years), Herring Gull (2), White-tailed Eagle (2), and in one year each Gyrfalcon, Marsh Harrier, Common Tern, Common Buzzard and Black-headed Gull. But it was only one species that was recorded in the first half and not in the second half of the period (Peregrine Falcon). Hence, in this group new species outnumbered lost species. In the duck, wader and passerine groups new and lost species were about equally numerous. For example, in the wader group, Greenshank, Bar-tailed Godwit, Spotted Redshank and Lapwing had 10 and 25 years with records in the first and second part of the period, respectively, versus 22 and 9 for Great Snipe and Common Sandpiper.

Among the thirty-eight species that had been recorded in at least twenty years, thirteen had population trends that were statistically significant (Table 1). Twelve of these significant trends were positive, whereas only one was negative. It was the order Charadriformes (waders and allies) that contained the most successful species. No less than twelve out of fifteen species of this order had positive trends and six of them were significant. Among the six ducks, three trends were positive and three negative. Two of the positive trends were significant. Among the sixteen remaining species, most of them passerines, ten trends were positive (four of them significant) and six negative (one significant).

Hence, the general pattern of the community can be described as having a stable number of species among ducks, waders and passerines and an increasing number other non-passerine species and increasing populations of ducks, waders and other non-passerine species, but no numerical trend among passerines.

Species accounts

The detailed occurrence of the thirty-eight most regular species is described with bar diagrams in Figure 4). For most species, the diagram speaks for itself, but nonetheless we give at least a brief comment about each species. For some, the comments are more elaborate, especially if the population change is of interest in relation to conservation, habitat change or climate change. The trends are given in Table 1 together with levels of significance. The records of the remaining forty-five species are given in Appendix 3, but not considered in detail. In all the species diagrams the imputed birds are shown in red and the actually counted birds in blue.

Rock Ptarmigan *Lagopus muta* (Figure 4, 1)

The Rock Ptarmigan increased rather erratically to a peak in 2004, with much variation between years. Due to the decline after the peak, the increase for the whole period is only weakly significant. There appear to be no regular population cycles, and the variation does not correlate with small rodent numbers; see a more detailed discussion in the account of Willow Ptarmigan below.

Willow Ptarmigan *Lagopus lagopus* (Figure 4, 2)

The two ptarmigans were similar in showing large variation. No correlation between their numbers could be observed (r=0.24; p>0.05; log values with six zeros replaced by 0.1). The Willow Ptarmigan had two peak years, 1982 and 2002. As for the Rock Ptarmigan, it is not possible to see any regular population cycles in the Willow Ptarmigan either. And their major peaks did not coincide. Even with the small samples at hand, one would have expected that some signs of cycles should have been visible in a series of forty years. Data on small rodent abundance at Ammarnäs are available from 1975 (Nyholm 2011). From 1995 there is a new rodent monitoring project at Ammarnäs (Hörnfeldt 2012) with samples collected at more sites and in more habitats than in the Nyholm series. However, during the period 1995–2010, with data available from both, the agreement between the two sampling schemes was almost complete (r=0.98; p<0.001) so we use only the longer series of Nyholm for analysing the number of ptarmigans versus rodent abundance. The result is that there is little or no correlation with rodent abundance in the same year or with assumption of one, two or three years of delay. The only correlation was between Willow Ptarmigan and the number of rodents in the previous year, but the significance was weak (r=0.44; p<0.05).

Teal *Anas crecca* (Figure 4, 3)

This is the only dabbling duck that occurs in any numbers above the tree line. Very small water bodies or streams are sufficient. The trend is positive although not significant. The Wigeon (Appendix 3) may become a second regular dabbling duck in the future since it has been recorded almost annually during the last decade (records in eight of the last ten years versus in only six of the previous thirty years). Nilsson & Nilsson (2012) did not record any significant change in numbers between 1973–1975 and 2009 in their survey. In the whole of Sweden, the Teal population size has not changed since the mid-1980s, but there seems to have been a decline before then (Lindström et al. 2012). However, this decline may have been confined to southern Sweden as only less than one fourth of the population breeds in that part (Ottosson et al. 2012), where most of the data behind the national index were collected.

Tufted Duck *Aythya fuligula* (Figure 4, 4)

After a period of absence, 1993–2000, larger numbers than before were recorded, and for the whole period there is a significant increase. The pattern of the Tufted Duck is somewhat similar to those of the Teal and Wigeon. These three species have in common that they predominantly belong

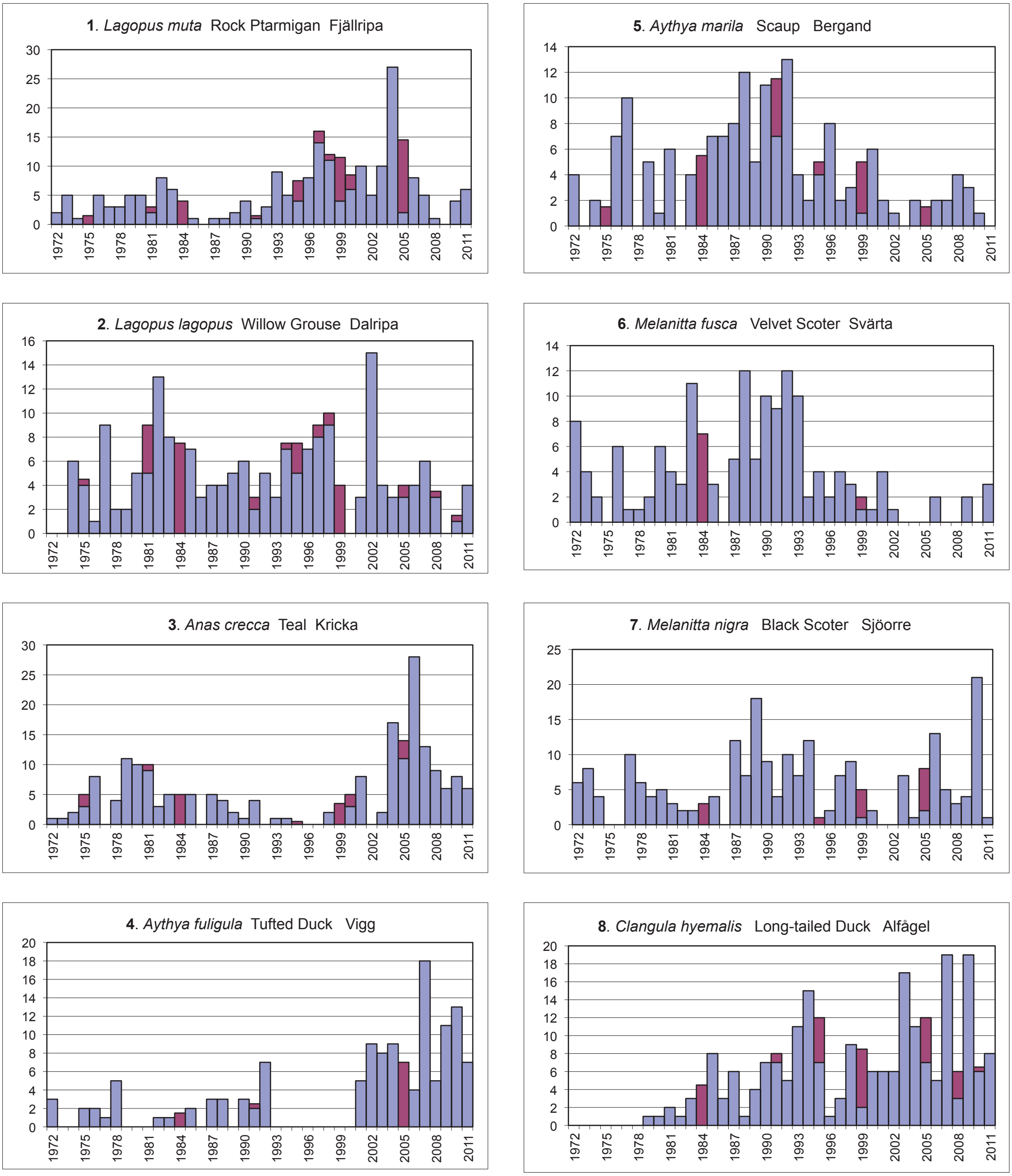
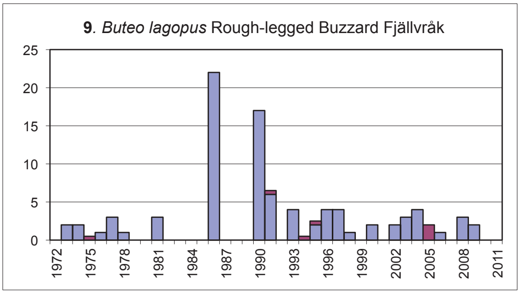
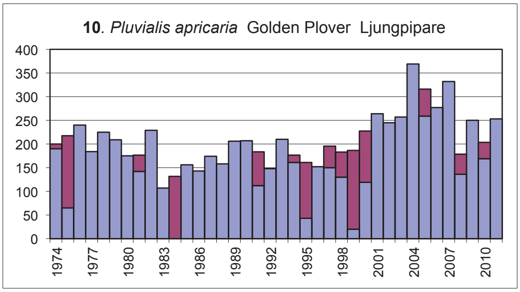
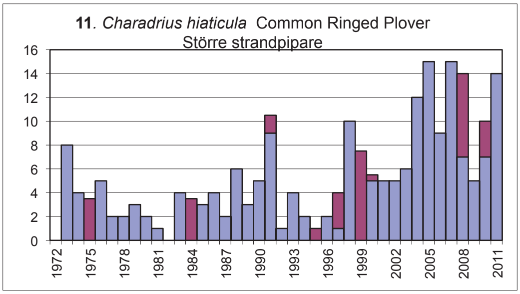
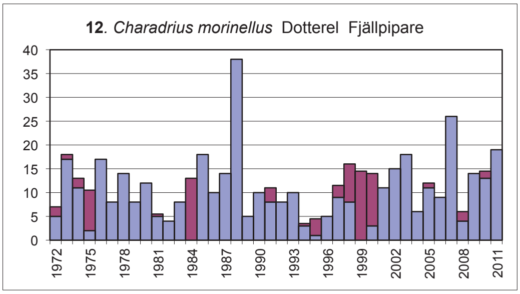


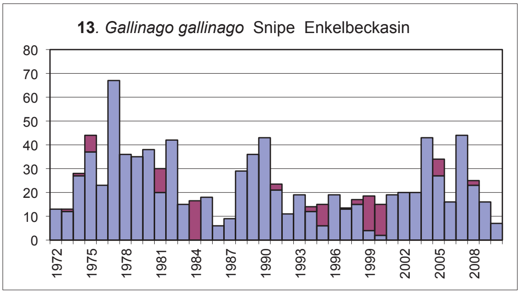
Figure 4. Annual population size for the 38 species that were recorded in at least 20 of the 40 years 1972–2011. Blue: number of individuals actually counted. Red: Estimated additional number of individuals for routes that were not counted.
Årlig beståndsstorlek för de 38 arter som påträffades under minst 20 av de 40 åren 1972–2011. Blått: antal individer som verkligen räknats. Rött: uppskattat antal individer för rutter som inte räknats.

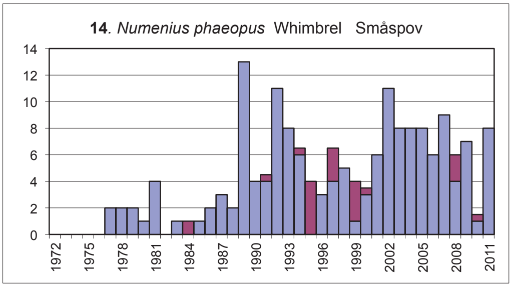

9. *Buteo lagopus* Rough-legged Buzzard Fjällvråk

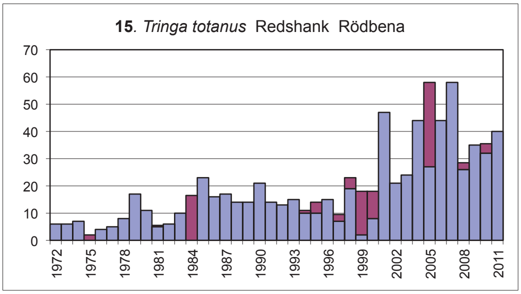

10. *Pluvialis apricaria* Golden Plover Ljungpipare

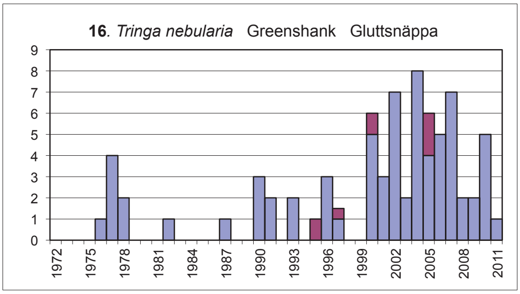

11. *Charadrius hiaticula* Common Ringed Plover Större strandpipare

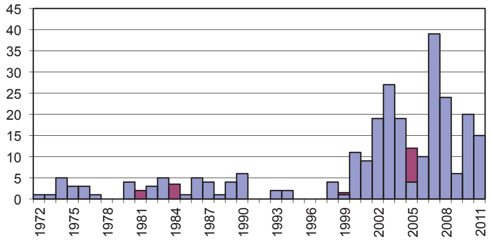

12. *Charadrius morinellus* Dotterel Fjällpipare


13. *Gallinago gallinago* Snipe Enkelbeckasin

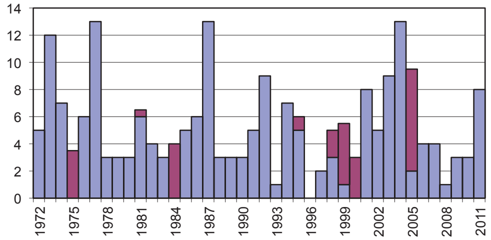

14. *Numenius phaeopus* Whimbrel Småspov


15. *Tringa totanus* Redshank Rödbena

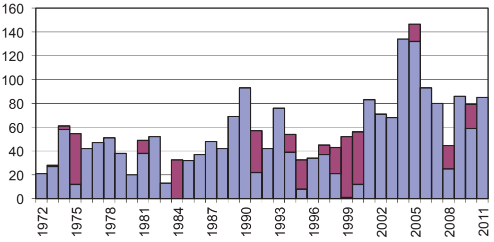

16. *Tringa nebularia* Greenshank Gluttsnäppa



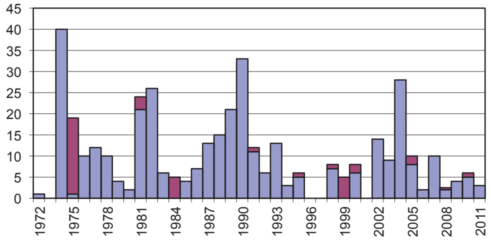
17. *Tringa glareola* Wood Sandpiper Grönbena



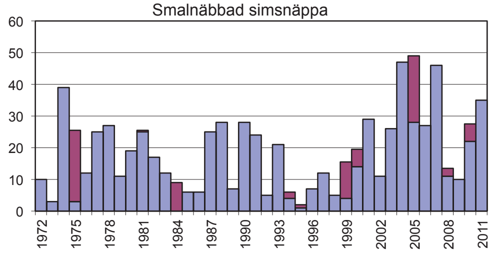
18. *Calidris temminckii* Temminck's Stint Mosnäppa



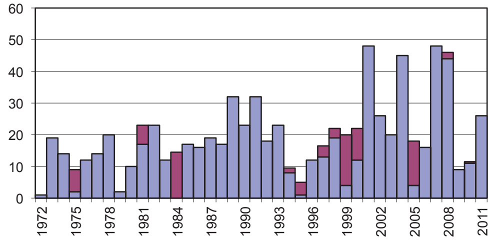
19. *Calidris alpina* Dunlin Kärrsnäppa



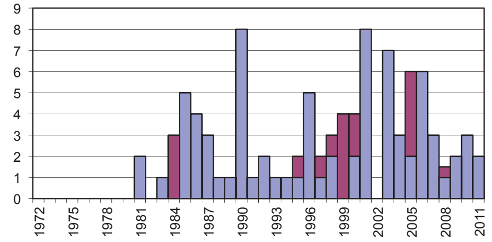
20. *Philomachus pugnax* Ruff Brushane



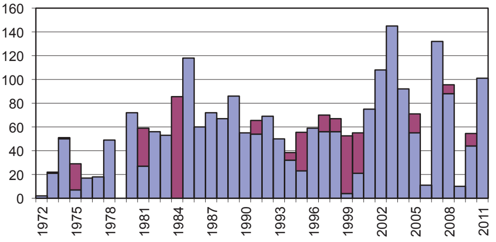
21. *Phalaropus lobatus* Red-necked Phalarope
Smalnäbbad simsnäppa



22. *Larus canus* Mew Gull Fiskmås

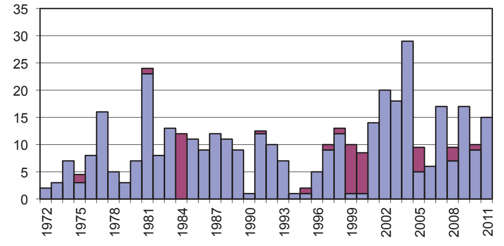


23. *Sterna paradisaea* Arctic Tern Silvertärna

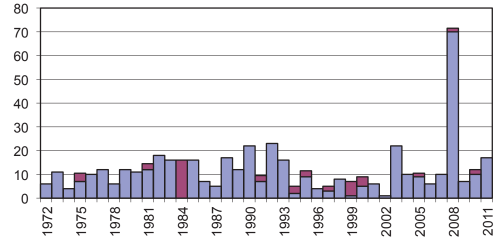


24. *Stercorarius longicaudus* Long-tailed Skua Fjällabb

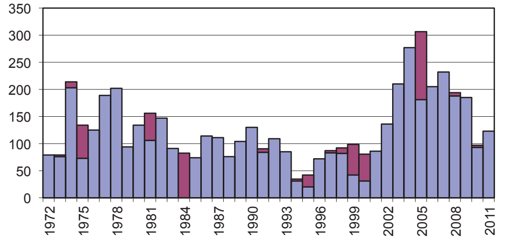
25. *Cuculus canorus* Cuckoo Gök



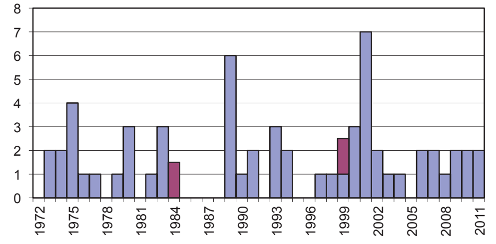
26. *Corvus corax* Raven Korp



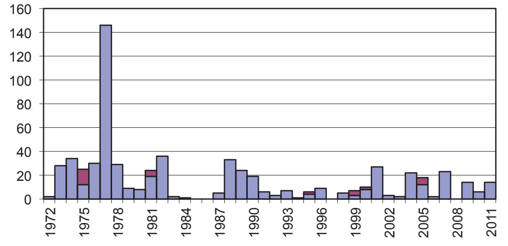
27. *Phylloscopus trochilus* Willow Warbler Lövsångare



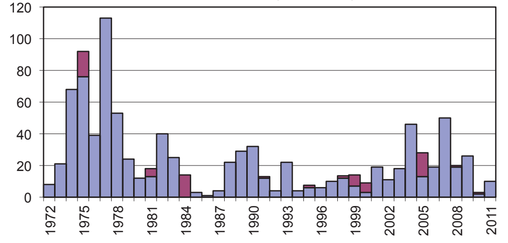
28. *Turdus torquatus* Ring Ouzel Ringtrast



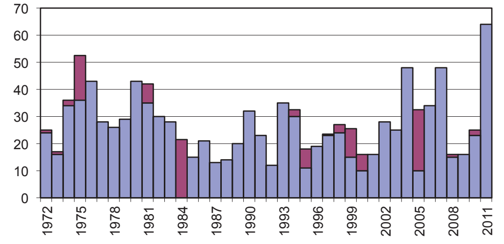
29. *Turdus pilaris* Fieldfare Björktrast



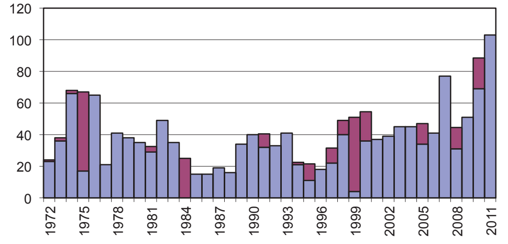
30. *Turdus iliacus* Redwing Rödvingetrast

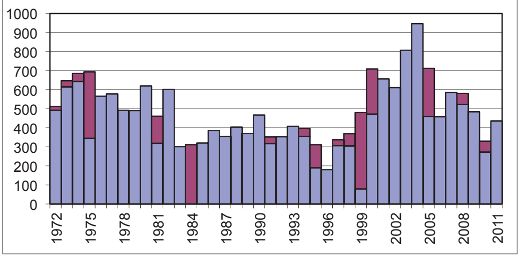


31. *Luscinia svecica* Bluethroat Blåhake

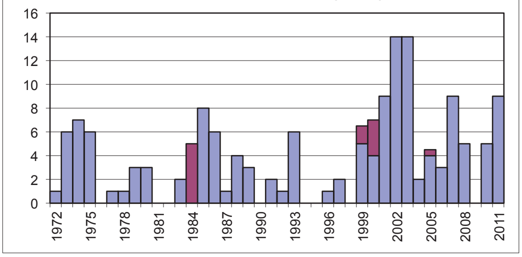


32. *Oenanthe oenanthe* Wheatear Stenskvätta

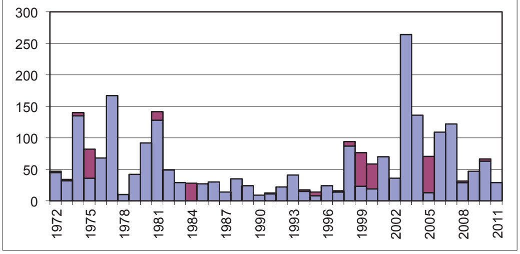




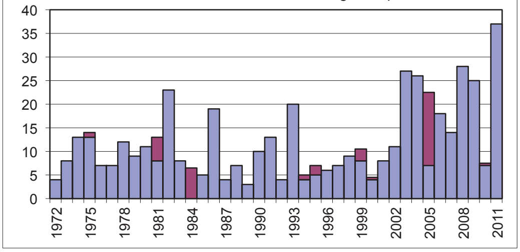
33. *Anthus pratensis* Meadow Pipit Ängspiplärka



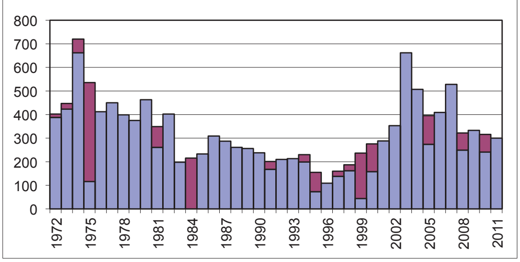
34. *Fringilla montifringilla* Brambling Bergfink



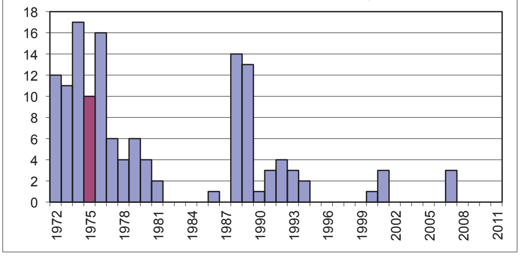
35. *Carduelis flammea* Redpoll Gråsiska



36. *Emberiza schoeniclus* Reed Bunting Sävsparv



37. *Calcarius lapponicus* Lapland Longspur Lappsparv



38. *Plectrophenax nivalis* Snow Bunting Snösparv to lower elevations. It is therefore possible that their increases are responses to a more benevolent climate. However, the strong increase at Ammarnäs does not agree with what Nilsson & Nilsson (2012) found for all alpine and subalpine parts of Sweden, where the change between the early 1970s and 2009 was small. The absence of records during eight consecutive years is surprising. The Teal also had somewhat lower counts during the same period. As both species are more common at lower levels, difficult ice conditions could be a possible explanation. However, we do not have ice records to support such a conclusion. Furhermore, there is nothing peculiar with these years in the September and January counts in southern Sweden (Nilsson & Månsson 2011) so severe losses in the winter quarters is an unlikely explanation.

Scaup *Aythya marila* (Figure 4, 5)

The number of Scaups has declined drastically after the 1992 peak. However, the long term trend is uncertain because numbers were low also in the early years. Reports on the population trends for this species are ambiguous. According to Tjernberg & Svensson (2007), the Baltic population of the Scaup declined during most of the twentieth century but a recent survey of the coastal population in the same province as the Ammarnäs sites (Sundström & Olsson 2005) indicated that the population had increased or remained stable since the 1970s. And Nilsson & Nilsson (2012) found that little change in numbers had occurred between the early 1970s and 2009 in the alpine region, and this fits with our data at Ammarnäs, where the population size in the early 1970s was as low as it has been in the 2000s.

Velvet Scoter *Melanitta fusca* (Figure 4, 6)

The long-term trend is uncertain but the Velvet Scoter has been absent along the routes in several recent years. It has declined along the southern Baltic coast of Sweden, a decline of 70–90% since the 1940s (Tjernberg & Svensson 2007). However, in the Gulf of Bothnia, at about the latitudes of Ammarnäs, the population has increased (Sundström & Olsson 2005), and the authors suggest that 40% of the Swedish coastal population now belong in the province of Västerbotten. As the species has declined in Norway (Bakken et al. 2003), where the population is mainly mountainous, it is probable that the decline at Ammarnäs reflects a general decline of the non-coastal population. This has been corroborated by the counts made by Nilsson & Nilsson (2012) who recorded a massive decline between the early 1970s and 2009 in the whole alpine and subalpine part of Sweden. Formerly, the Velvet Scoter was widely distributed in the forest region of Finland, and although the early Swedish situation is poorly known it has been suggested that the same distribution prevailed in Sweden (Svensson et al. 1999), perhaps in such a way that the distribution was almost continuous between coast and mountains. Winter counts in the Baltic Sea (Nilsson 2012) and elsewhere indicate a general decline, and the species is now considered to be globally endangered by IUCN. It is difficult to understand why the coastal population of the Gulf of Bothnia is doing better than other populations, but a closer study of this exceptional population could perhaps reveal valuable information about the cause of the general decline.

Black Scoter *Melanitta nigra.* (Figure 4, 7)

The Ammarnäs population is stable. For the whole Swedish population, Ottvall et al. (2009) found no change during the preceding thirty years, and the same conclusion was drawn by Valkala et al. (2011) for Finland. The survey by Nilsson & Nilsson (2012), however, shows a remarkable increase since the early 1970s in the whole alpine and subalpine part of Sweden. The increase was fourfold during the period of thirty-five years. This corresponds to an average increase of about four percent per year.

Long-tailed Duck *Clangula hyemalis.* (Figure 4, 8)

The first seven years were without records, but after 1978 this species has been regular and with increasing numbers. Current worries (Nilsson 2012) about the development of the populations that winter in the Baltic Sea may not be relevant for the mountain population and that the reason could be that most birds of this population perhaps winter along the Atlantic coast (Fransson & Pettersson 2001) where no decline has been observed (Bakken m.fl. 2003). Also the new data from the mountain breeding areas in Sweden (Nilsson & Nilsson 2012) did not reveal any important change in numbers in the three southern study areas (on average 11 pairs in 1972–1975 versus 13 pairs in 2009). In the northern areas, however, a drastic decline was recorded (the 2009 count, 56 pairs, was only 40% of that in 1972–1975). But the authors suggest that this low count was a result of the ice situation in 2009, when the high level breeding lakes were not available at the time of the survey. In the absence of good data from other parts of the mountain range we cannot determine whether the increase of numbers at Ammarnäs is a local exception or a reflection of a difference between a healthy Scandinavian mountain population and a global population in difficulty, categorised as vulnerable by IUCN.

Rough-legged Buzzard *Buteo lagopus* (Figure 4, 9)

The Rough-legged Buzzard is the only raptor that we can monitor, but only with a low quality. After peak years in 1986 and 1990, most likely the result of small rodent peak abundance, really prominent rodent peaks have been almost absent, or suffered crashes before the arrival of birds until 2011. But the Rough-legged Buzzard did not respond, and the reason must be that the absence of good rodent years for so long has made the population level too low to permit it to trace food abundance. A weak response was also recorded in 1977 and 1981, two years with rodent peaks. This lack of a consistent response explains why there is only a weak correlation with the abundance of rodents in the same season ($r=0.37$; $p<0.05$; $df=34$ and no correlation with delayed response of one or two years). The number of autumn migrants at Falsterbo may be a better measure of the general abundance of Rough-legged Buzzards in the mountains. These numbers correlate positively with Ammarnäs rodent abundance in the same year and in the year before ($r=0.39$ and $r=0.38$, respectively; $p<0.05$ in both). But with rodent abundance two years before, the Falsterbo migration is negatively correlated ($r=0.45$; $p<0.01$).

Golden Plover *Pluvialis apricaria* (Figure 4, 10)

This is the most abundant wader species in most alpine habitats with typical densities about three pairs per square kilometre (Svensson 2006). The long term trend is positive and significant, and with high numbers during the period 2001–2007. Before that period there was no significant trend. It is one single route, Rusa High, that is responsible for the high totals in the 2000s. We know that the counts along the two high level routes, Rusa High and Nasen, sometimes include flocks of birds that apparently are not involved in incubation or rearing young. They are probably unsuccessful breeders. But these birds must still belong to the local population as migration has not yet started. The recorded increase is likely to be a true reflection of the size shifts of the Ammarnäs population.

Ringed Plover *Charadrius hiaticula* (Figure 4, 11)

This species has increased dramatically during the 2000s. It is widely distributed at scattered sites with little vegetation and open areas of mud or gravel close to water bodies or streams. It prefers the higher levels where such habitats are most common, and it also breeds above the levels of our highest routes. As a consequence of this, most records come from the Rusa High and Nasen routes, whereas not a single record in all years was made along the route of Rusa Low, a bog and willow scrub route. The alpine population of this species is considered to be a subspecies of its own, *tundrae*. It is difficult to evaluate whether this strong increase may be connected with events in the breeding or non-breeding areas as the two subspecies have different timing of their migration (Meissner 2007) and different wintering areas, *tundrae* wintering south of *hiaticula* (Salomonsen 1955). The latter subspecies seems to have declined, at least in distribution if not also in numbers around the Bothnian Bay both in Sweden and Finland (Valkama et al. 2011).

Dotterel *Charadrius morinellus* (Figure 4, 12)

A majority of the records came from the routes Rusa High and Nasen that run at the higher levels that this species prefers. There was no long term population trend. The peak counts in 1988 and 2007, and most of the other variation was most likely variation in display activity. The local population size should not be subject to much variation from year to year as the Dotterel is a long-lived bird and breeding site fidelity is strong (Lücker et al. 2011).

Snipe *Gallinago gallinago* (Figure 4, 13)

The Snipe population has shown long term stability. Periodically the counts suggest declines (during the mid 1980s and after the peak in 1990) but numbers have grown again and have been relatively high in some years in the 2000s. With the exception of 1977, the other five peak years have all reached almost an identical level at about forty individuals. The south Swedish population declined very much (to one third) during the period 1975–early 1990s (Lindström et al. 2012), but has been rather stable since then. Note, however, that the two most recent years had very low counts at Ammarnäs, as low as the previous worst years in 1986–1987. And the national index reached its lowest level ever in 2011 after the two decades of no trend. Against the background of generally increasing wader populations the absence of increase in the Snipe population is interesting.

Whimbrel *Numenius phaeopus* (Figure 4, 14)

This species was formerly breeding at lower elevations where it nested in bogs and forest clearcuts. However, it started to appear above the tree line in the 1970s and has expanded since then, and during the last two decades there has been a rather stable breeding population. The Wimbrel is also increasing nationally (Lindström et al. 2012). Another species of lowland bogs, the Broad-billed Sandpiper *Limicola falcinellus*, has also expanded into the alpine habitat at Ammarnäs. Although not yet recorded along any of the routes, nests have recently been found in the surroundings of the Raure route (Green et.al. 2009, and unpublished).

Redshank *Tringa totanus* (Figure 4, 15)

The Redshank is another wader that has increased its population size in a remarkable way. This increase in the alpine region contrasts sharply with the decline in other parts of Sweden. The point counts of the Swedish Bird Survey, that reflects the development of the population in southern Sweden, suggest an average decline of more than two percent per year since 1975 (Lindström et al. 2012). As about 60% of all Redshanks belong in Lapland and the adjacent mountains (Ottosson et. al 2012), it is comforting that the alpine trend is so positive. The absence of winter recoveries of Redshanks that are known to have hatched or bred in the alpine area of Scandinavia (Bakken et al. 2003, Fransson et al. 2008) makes it difficult to tell where they spend the winter and hence whether they differ in winter range from southern Redshanks. Long ago Salomonsen (1954) suggested, without much concrete evidence, that Redshanks made the same leap-frog migration as the Ringed Plover, and that the northern populations wintered farthest away, south of the Sahara, and southern populations essentially north of that area. Alerstam (1982) accepted this interpretation based on the morphological analysis of Hale (1973). Were it so, differential winter mortality could explain the contrasting population trends. However, Piersma et al. (1990) suggested that also birds from the North Sea area wintered in considerable numbers in tropical West Africa. Their evidence was only indirect, namely two waves of spring migration away from the winter quarters at Banc d'Arguin in Mauretania. They suggested that these waves represented adaptation to the different seasonal requirements for arrival in their breeding areas of southern and northern birds. If this assumption were correct, considerable numbers of both southern and northern Redshanks may share winter quarters, and it would be difficult to interpret the different population trends in terms of winter survival. Instead it has been argued that the decline of the Redshank populations in southern Sweden is governed by severe depredation of nests due to deterioration of breeding habitats (e.g. overgrazing) as adult survival is high (Ottvall 2005). We may conclude from this that nest depredation ought to be low in the alpine habitats.

Greenshank *Tringa nebularia* (Figure 4, 16)

The diagram in Figure 4 gives the impression that the Greenshank should have a significantly increasing trend similar to that of the Redshank and several other waders. However, the trend calculated by using TRIM is not significant. This is a result of the fact that 18 of the first 28 years were without records and that all counts in those years were considered to be missing values instead of zeros. If instead a value of one had been inserted for one of the routes each year the trend would have been significant ($p<0.05$). A significant increase is obtained if the trend is calculated by exponential regression on the totals given in the diagram.

Wood Sandpiper *Tringa glareola* (Figure 4, 17)

The Wood Sandpiper used to be a very rare species along our routes but has increased remarkably during the 2000s, following the pattern of the Redshank and most waders. It is a species of lower elevations that obviously has started to expand uphill.

Temminck's Stint *Calidris temminckii* (Figure 4, 18)

The number of Temminck's Stints varied much but with no long-term trend. Four years with peak counts and with all routes surveyed demonstrated very similar values: 12 (1973), 13 (1977), 13 (1987) and 13 (2004). Raurejaure was the most important route with two thirds of all birds. The mating system of this species (Hildén 1975, Breiehagen 1989), with females that may move in or out of an area between clutches, could complicate the counts. However, males normally stay in their territories to attend the eggs and young of the first brood. The peak years may represent counts that happened to coincide with high display activity at most territories over an extended period, perhaps caused by arrival of new females.

Dunlin *Calidris alpina* (Figure 4, 19)

The highest numbers were recorded on the high level routes Rusa High and Nasen. This was not because the breeding density was highest there but because flocks of Dunlins, probably local birds that had failed to breed successfully or refrained from breeding gathered in flocks to prepare for migration. There was a positive long-term trend, and the trend remained positive also when the two exceptional peaks of 2004 and 2005 were disregarded. The habit to gather in flocks towards the end of the breeding season is similar to that found in the Golden Plover, and we often saw these two species keep together in such flocks.

Ruff *Philomachus pugnax* (Figure 4, 20)

The Ruff showed a non-significant decline. Assuming that the peak numbers in 1974, 1990 and 2004 represent years when a majority of the birds present along the routes were recorded, and using only these three years in the calculation, the decline is about one percent per year. However, counts are sensitive to the time when males display and move about much and the large variation of numbers depends almost completely on this. The dates of the counts coincide with the period of dropping display activity when the males start to leave the area. However, we have no direct indication of a shift to earlier breeding in later years but one must take into account that this may confound the interpretation of the counts (see the general discussion where we deal with temperature changes). We know of no other long-term data from the Swedish mountains. The trend during the last fifteen years has been very negative in the Swedish Bird Survey (Lindström et al. 2012), but the data emanating from the SBS mountain routes are not sufficient to estimate a trend. The Ruff is already almost extinct in southern Sweden so the prospects are really bad.

Red-necked Phalarope *Phalaropus lobatus* (Figure 4, 21)

The Phalarope is a rather genuine alpine and subalpine wader without any long term trend but with some similarity with other wades in having several years with high counts in the 2000s.

Mew Gull *Larus canus* (Figure 4, 22)

The trend of the Mew Gull is uncertain but with particularly high numbers in four years in the 2000s. The Mew Gull expanded rather recently in the western mountains. The main expansion period was 1930–1960 (Svensson et al. 1999).

Arctic Tern *Sterna paradisaea* (Figure 4, 23)

There was no record during the first nine years. During the remaining thirty-one years there was no significant trend. The number of pairs that breeds along the routes is low, and many of the sparse records are birds that feed away from distant nest sites.

Long-tailed Skua *Stercorarius longicaudus* (Figure 4, 24)

The increasing trend is not significant. As for the Mew Gull also this species had comparatively low numbers in the early years. Note that the records represent the number of birds that are present at the time of the counts and not the number of breeding birds. The latter number varies from zero to almost one hundred percent of all birds present. Although visiting their potential breeding grounds every spring, the skuas leave the mountains early in the season when rodent levels are low. Years with few skuas (1972, 1979, 2006 and 2009) are years when they had already left when the routes were surveyed. We refrain from analysing the data in terms of rodent abundance as it would be necessary to know the number of nests versus number of non-breeding pairs, and nest search is normally not done during the route counts.

Cuckoo *Cuculus canorus* (Figure 4, 25)

Has shown some variation of numbers but it is not known whether this depends on real population variation or on different calling activity. The only important host species in the alpine habitat is Meadow Pipit, and this species has not varied at all to the same extent as the Cuckoo, and there is no correlation between their numbers. Since the alpine habitat is marginal to the Cuckoo it is likely that population size is governed more by events in the forest zone, if at all in the breeding area. Regrettably, we do not have reliable long term data from the Ammarnäs woods for this species. In southern Sweden, the point counts of the Breeding Bird Survey shows a fifty percent decline between 1975 and the late 1980s. The national index from the permanent BBS routes that include also northern Sweden from 2010 indicates some recovery during the most recent decade. BBS data from Lindström et al. (2012).

Raven *Corvus corax* (Figure 4, 26)

No long term trend. The aberrantly high number in 2008 depended on large flocks at the routes Stupi and Rusa High. At the time of the counts most Ravens have their young fledged and the birds we record may be visitors from rather far away.

Willow Warbler *Phylloscopus trochilus* (Figure 4, 27)

The Willow Warbler is the most common species in the birch zone but may be rather common also in the lower part of the alpine zone where fields of willow or junipers cover extensive parts. The number of birds first declined with low numbers in the mid 1990s but then returned to a high level in 2003–2008. Our alpine data agree well with the SBS data from north Sweden (the range of the *acredula* subspecies; r=0.67; p<0.001) but not at all with the corresponding data from southern Sweden (the range of the *trochilus* subspecies.

Ring Ouzel *Turdus torquatus* (Figure 4, 28)

This less common species breeds both in the transition zone between the alpine habitat and the birch zone and at rocky sites in the alpine habitat itself. There are several suitable sites along the Stupi and Raure routes where most of the observations were made. No long-term trend could be observed, and no information suggests any population change in a wider geographic perspective.

Fieldfare *Turdus pilaris* (Figure 4, 29)

The Fieldfare is abundant in the birch zone where it breeds in colonies (Arheimer & Svensson 2008). In the alpine zone, where there are no trees, some of the birds are visitors from the forest, but a small number of pairs also breed, and the few nests that have been found have of course been located on the ground. In 1977 numbers were high along all but one route. This was a year with high abundance of *Epirrita* caterpillars in the alpine zone (Selås et al. 2001). It is likely that this attracted birds from the birch woods. There is no significant long term trend.

Redwing *Turdus iliacus* (Figure 4, 30)

Was a rather common breeder in the lower part of the alpine zone in the 1970s but then declined. Somewhat higher numbers have been recorded in the 2000s but the peaks are far from those of the 1970s. The long term trend is not significant.

Bluethroat *Luscinia svecica* (Figure 4, 31)

This species is almost endemic to the birch zone but penetrates above it as high as taller willows and junipers grow. In the birch zone, this species has had a negative trend of about four percent per year, with most of this decline in the 2000s. Hence the development of the population in that habitat is different from what we have recorded in the alpine zone where there was no trend.

Wheatear *Oenanthe oenanthe* (Figure 4, 32)

The long-term trend is significantly positive but passed through periods of lower numbers in the mid-1980s and mid-1990s. About three fourths of the total Wheatear population breed in the alpine and subalpine part of Sweden (Ottosson et al. 2012). In south Sweden, the population has declined, particularly in farmland, but that decline ceased in the early 1990s; the population has been rather stable since then (Lindström et al. 2012).

Meadow Pipit *Anthus pratensis* (Figure 4, 33)

The Meadow Pipit was by far the most common species. There was no long-term trend but lower numbers prevailed in the 1980s and 1990s compared with before and after this period. After the good years in the early 2000s the numbers declined to one of the lowest levels ever in 2010.

Brambling *Fringilla montifringilla* (Figure 4, 34)

The Brambling does not breed above the tree-line but is the next most common species in the subalpine birch zone (Enemar et al. 2004). However, it often visit scattered birches or groups of birches that occur along the lower transects. Other records refer to birds that have been heard singing from a distance at the edges of the wood zone. Since it is not an alpine species, it is also possible that different observers have paid different attention to the Brambling, explaining the variation that is much larger than one would expect from the variation found in the birch zone. The Brambling is clearly a "spill-over" species from the woods, but nonetheless the alpine routes may show a more general pattern as the alpine records correlate well with those from the woodland, mainly because peaks occur in years with much *Eppirita* larvae (Selås et al. 2001, Lindström et al. 2005).

Redpoll *Carduelis flammea* (Figure 4, 35)

Numbers fluctuate much in the birch zone where it breeds abundantly in some years. It also breeds, but with a low density, above the tree line. The birds counted along the routes are a combination of locally breeding birds and probably a larger proportion of birds from the forest. There is much movement of birds whose origin is unknown, and at the time of the counts fledged young from forest habitats below the alpine zone are already on the move. Hence, the numbers do probably not reflect changes in local abundance. Interestingly, however, the pattern shows similarities with several other forest birds with comparatively high numbers in the early and late parts of the survey period. This is one of the very few species in which the alpine and woodland counts correlate significantly.

Reed Bunting *Emberiza schoeniclus* (Figure 4, 36)

The overall trend was positive. This was due to a sudden increase in the period 2003–2011. In southern Sweden a strong decline of two percent per year has been observed since 1975 (Lindström et al. 2012). As much as one half of the national population seems to breed in the alpine and subalpine habitats and adjacent northern areas (Ottosson et al. 2012). This may suggest that it is habitat deterioration in southern Sweden that has caused the decline there.

Lapland Longspur *Calcarius lapponicus* (Figure 4, 37)

The Lapland Longspur is one of very few species that is almost exclusively confined to the alpine zone. In many parts of that zone it is one of the most common species; at Ammarnäs it was the next most common one, after the Meadow Pipit. As shown by Svensson (2006) this is not always the case. Although the distribution ranges through the whole mountain chain, local density in habitats that look superficially similarly suitable to the human eye, may vary from zero to high; the densities found at Ammarnäs are the highest recorded in Sweden. It has been suggested that growth of young in this species may depend more on availability of calcium rather than of food (Seastedt & MacLean 1977). If rich availability of minerals is important for the Lapland Longspur we may have a parallel to the Great Snipe. This species depends on soft basic soils because earthworms thrive there and constitute the most essential kind of food (Løfaldi et al. 1992, Kålås et al. 1997). Longspurs depend on seeds and insects, so the mechanism cannot be the same. However, invertebrate abundance in general is better in basic than in acid habitats. Hence, if Longspurs are particularly sensitive to food variation mediated by minerals the distribution patchiness may at least partly be explained by soil acidity, and the Ammarnäs region is characterized by large areas with calcium-rich bedrock but also by exposure to acid rain (Nyholm 1981). The long-term trend was not significant. The decline from the start of the survey ended in 1996 and turned into a remarkable recovery to the same level as in the 1970s. This same pattern has been observed in several other species.

Snow Bunting *Plectrophenax nivalis* (Figure 4, 38)

Our routes run at rather low levels in relation to the main breeding zone of this species, and there are few suitable rocky habitats. Nonetheless, there are a few optimal places for breeding where small colonies existed earlier. These colonies are now gone, and the species is no longer regular along the routes. We believe that the local decline may indicate a more general decline of the species, but we have little information except our own. As the routes do not sample the levels where most birds are breeding we cannot be confident that our counts reflect the real development. Even a small shift of the lower level of occurrence could make a large difference in the counts.

General discussion

We found good agreement between the results from the Ammarnäs line transects and those from the two territory mapping plots that are situated in close connection with four of the routes (Svensson 2006, and later unpublished counts) for the common period 1972–2011. The small number of pairs and frequent years with no records of most species in the plots made it possible to compare only ten spe-

Table 2. Number of individuals of waterfowl at the routes in Ammarnäs and number of pairs in the three southernmost special study areas in Nilsson & Nilsson (2012).
Antal individer av sjöfåglar på rutterna i Ammarnäs respektive antal par i de tre sydligaste specialområdena i Nilsson & Nilsson (2012).

	Ammarnäs routes			Southern 3 special areas		
	mean 1972-75	mean 2007-11	p-value	mean 1972-75	2009	p-value
Teal *Anas crecca*	2.25	8.4	**<0.01**	8.75	18	>0.10
Wigeon *Anas penelope*	0.00	2.6	**<0.05**	9.75	30	**<0.05**
Scaup *Aythya marila*	1.75	2.0	>0.10	55.25	49	>0.10
Tufted Duck *Aythya fuligula*	1.25	10.8	**<0.01**	13.50	85	**<0.01**
Long-tailed Duck *Clangula hyemalis*	0.00	11.0	**<0.05**	11.25	13	>0.10
Velvet Scoter *Melanitta fusca*	3.50	1.0	>0.10	46.00	45	>0.10
Common Scoter *Melanitta nigra*	4.50	6.8	>0.10	56.00	275	**<0.01**
Goosander *Mergus merganser*	0.00	2.8	0.07	2.25	30	**<0.001**

cies. All ten correlations (between actual numbers, not de-trended residuals) were positive, and five of them were significant (Meadow Pipit, Lapland Longspur, Willow Warbler, Bluethroat and Ruff). The correlations were approaching significance for Wheatear, Snipe and Dotterel, but close to zero for Dunlin and Golden Plover. The trend slopes of the line transects also correlated significantly with the slopes of the plots (r=0.74; p<0.05). We conclude from this that the results from the routes and plots corroborate the gross patterns of each other.

In order to explain the local trends one would like to know whether they are similar to those of the whole alpine region. Data for the Swedish part of the mountains were obtained from the Swedish Bird Survey. Trend slopes of 35 species could be compared for the common period 2002–2011 (SBS data before 2002 not sufficient). The correlation between the slope values of the two data sets is not significant (r=0.29; p>0.05). A confounding factor in this comparison is that the data from the BBS has been collected in three different habitats, namely alpine tree-less areas (same as in the current study), subalpine birch woods, and upper parts of the coniferous zone. And the period of comparison is brief. But in spite of this we are somewhat surprised that the correlation was not stronger. We have observed no apparent changes of the breeding habitats and all but three of the thirty-eight regular species are only summer visitors. The Ammarnäs populations, therefore, ought to be governed to a large extent by factors outside the breeding season and by large scale factors such as weather. One would have expected such factors to cause different local populations to change in similar ways.

At Ammarnäs we also have reliable data from the subalpine birch zone. A priori one could not predict which of two alternative relations between alpine and woodland birds of the same species that one would find. If density in both habitats were governed by common external factors, the correlation between the habitats would be positive. But it would also be possible that birds shift habitat between years, for example that woodland species tended to breed at higher elevations in years when the conditions there were particularly benevolent, and vice verse. Were this the case, a negative correlation would be expected. Nine species are common enough in both the alpine and subalpine zones for comparison. Five species showed negative, though not significant, correlations (Bluethroat, Willow Warbler, Reed Bunting, Fieldfare and Meadow Pipit). The other four species showed positive correlations, three of them significant: Brambling (r=0.47; p<0.01), Redpoll (0.51; p<0.001), Redwing (r=0.39; p<0.05) and Ring Ouzel (r=0.25; 0.05<p<0.10). The correlation between alpine and woodland trends was far from significant. The most likely explanation of the pattern is that fluctuations in the alpine and woodland zones are independent of each other. The significant correlations for two species, Brambling and Redpoll, is likely to depend on the fact that Bramblings do not belong in the alpine habitat but are heard from a distance when they sing in the woodland edge zone and because Redpolls move about so much with their already fledged young that a large proportion of the birds that we count along the alpine routes are birds from the forest zone.

The data from the transect sample of the waterfowl survey of Nilsson & Nilsson (2012) is not easy to compare with the Ammarnäs data as variance is difficult to assess from only two points in time. But the direction of change, irrespective of the size of change, was different in only one of eight waterfowl that could be compared; the number of Long-tailed Ducks had increased at Ammarnäs but declined in the all mountain transects. The comparison with the special areas in Nilsson & Nilsson (2012) is summarized in Table 2. Although the sign of change was the same in seven of the eight species, the significant changes were not in the same species to the same degree. However, there is sufficient agreement between the Ammarnäs routes and the three southern special areas to conclude that the results corroborate each other.

In the alpine region, spring weather is a critical factor for the birds. Areas free of snow and, for the waterfowl, open water in lakes and ponds is essential. Wind-exposed hilltops often become free of snow early but the flat heaths and moors below may be covered with thick snow well into June. There is no information on the snow-cover of the alpine area around Ammarnäs, but temperature is an alternative indication of spring arrival. And likely it also indicates the time of snow melting and breake up of ice. At Ammarnäs there was no trend of temperature change for May and June for the period 1972–2011. However, for April there was a significant warming trend. This trend depended exclusively on high temperatures during the most recent ten years. In the thirty years 1972–2001, mean April temperature was –4.6 degrees (s.d. 1.69) without any trend. Then a sudden increase occurred to a mean of –2.6 degrees in 2002–2011, with little variation between years (s.d. 0.92). This difference of two degrees is statistically significant (t-test; p<0.001).

This temperature pattern may be the explanation for the similar timing of higher numbers of three ducks (Wigeon, Teal and Tufted Duck). These three ducks, in contrast to the other ducks, are the least "arctic" ones, belonging predominantly to lakes in the forest region below the tree line. Higher April temperature may make the alpine areas accessible at an earlier date although it is not until a month or so later that the alpine lakes become fully accessible. The declining numbers of Velvet Scoter and Scaup are unlikely to be caused by the recent April temperature increase but rather reflect a general population decline. Another more mountainous species, the Long-tailed Duck, has increased in numbers, and this increase started long before the sudden temperature increase. Whether this April temperature increase can explain the positive trends among the waders is also worth consideration. In five species, Golden Plover, Ringed Plover, Redshank, Greenshank and Wood Sandpiper, higher levels of population numbers occurred almost at the same time as April temperature increased. In the Wimbrel, however, the increase occurred earlier, and in Dunlin, Phalarope and Mew Gull, there is some increase but not equally well timed with the temperature increase. Higher numbers of Willow Warbler and Reed Bunting also coincide with the increasing early spring temperature. It is important to emphasize that the agreement between population increase and April temperature increase could be only a coincidence without causal connection. It remains to be explained how warmer Aprils can affect the number of birds starting to breed a month or more later. Dates of ice brake and melting of snow at the alpine level are needed, and of course a better understanding of how even a small addition of days for breeding can cause a substantial increase in bird numbers.

Date, hour, time spent counting, observer's skill and attention, weather, and activity of the birds affect how many birds that are recorded. For each route we know the first four variables (Appendix 2). All four changed during the forty years. Mean date shifted to be five days earlier, hour of start to four hours earlier, and the time spent counting to one hundred minutes longer. Ideally, one should make a count during the same phase of the breeding cycle and diurnal activity in all years to ensure that birds are equally detectable. This has not been possible because the dates when the counts could be done have been determined by other scheduled activities. Ideally, we should also have determined the relative efficiency of the observers. Since this was not done, we can only hope that the errors introduced by the absence of full standardization only increases stochastic variation without introducing systematic biases.

Although the majority of species of the alpine habitats in the Ammarnäs region are doing well it is important to make clear that some species are doing so badly that they may go locally extinct. Two species, both passerines, belong to this category, namely the Horned Lark and the Snow Bunting. In the former species the case is well known and has been described earlier (Svensson & Berglund 1994). As our survey transects go through several areas where the Horned Lark was formerly breeding, the results presented in this paper only confirms the earlier conclusions. In the case of the Snow Bunting, the situation is less clear. The surveys do not cover the levels of the typical habitat of the species; only in a few sections the routes touch the lower limit of its altitudinal range. This means of course that even a very insignificant retreat uphill of the range would appear as a drastic decline in our data even if the total numbers in the whole area has remained rather unchanged.

An important question is how our results affect conservation and management of alpine species in the light of the little evidence of deterioration of the bird fauna in the Ammarnäs region. As we did not find any strong correlation between the Ammarnäs time series and the time series from the mountaneous routes of the Swedish Bird Survey, we cannot conclude that similar positive trends would prevail in the whole alpine region. However, in combination with other evidence, we are more confident about at least some of the negative trends. The following species deserve special attention: Velvet Scoter, Scaup, Ruff, Horned Lark and Snow Bunting, either with conservation measures or deeper studies. Generally, our new data from Ammarnäs confirm the current position of the alpine species in the most recent red-list (Gärdenfors 2010). The Scaup, Ruff and Horned Lark are listed as vulnerable, and the Velvet Scoter as near threatened. The Snow Bunting, however, is among the species of least concern. But, as just explained, we are uncertain about its true status in our region.

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Sammanfattning

Under fyrtio år, 1972–2011, räknade vi alla fåglar längs sex permanenta rutter på kalfjället runt Ammarnäs i södra Lappland. Rutternas sammanlagda längd är ungefär 90 km. Deras läge framgår av Figur 1 och detaljer om dem finns i Appendix 1. Rutterna upprättades 1972 för att komplettera två provytor som inventerats i samma område sedan 1964. Provytorna är tillsammans bara två kvadratkilometer och utgör därför inte ett tillräckligt stickprov för att mer än ett fåtal allmänna arters populationer kan följas. Med hjälp av rutterna kunde vi få med en större variation av biotoper och därmed få med flera arter samt större stickprov räknat i antal individer.

Rutterna inventerades genom att vi gick långsamt och räknade alla fåglar vi såg och hörde oberoende av avståndet till dem. Alla individer räknades oberoende av kön. Ungfåglar blev automatiskt uteslutna eftersom de inte var flygga när inventeringarna utfördes. Alla detaljer om själva inventeringarna är samlade i Appendix 2: datum, klockslag, tidsanvändning och inventerarens namn.

Om alla sex rutterna hade inventerats alla fyrtio åren hade vi haft 240 inventeringar att analysera. Emellertid missade vi en del inventeringar av olika skäl. Inga rutter inventerades 1984 och bara en rutt 1999. Sammanlagt blev 210 av de 240 möjliga inventeringarna utförda (87,5%).

Totalt registrerade vi 83 arter. I Figur 2 och Figur 3 sammanfattas resultaten för samtliga arter, uppdelat på huvudgrupperna andfåglar, vadarfåglar, tättingar samt övriga icke tättingar. Tättingarna var den mest betydande gruppen med 31 arter (37%) och i medeltal 14 arter och 1161 individer per år (69% av den årliga summan av individer). Den näst mest betydande gruppen var vadare (i strikt mening) med 17 arter (20%) och i medeltal 12 arter och 369 individer (22%). Andfåglarna var betydelsefulla när det gäller antalet arter (12 arter, 14%) men inte när det gäller antal individer (i medeltal 6 arter och 31 individer, 2%). Övriga 23 arter utgjorde en blandning av tio rovfåglar, sex måsfåglar, två ripor, två lommar, trana, jorduggla och gök. Trenderna för antal arter och antal individer totalt och inom var och en av grupperna har analyserats med exponentiell regression. Totala antalet arter ökade med 0,36% ($p<0{,}001$) per år, vilket motsvarar sex arter på fyrtio år. Denna ökning var huvudsakligen en följd av att blandgruppen övriga arter ökade (1,1% per år, $p<0{,}001$), motsvarande tre arter på 40 år. Antalet arter ökade också bland andfåglar (0,7% per år) och vadare (0,3% per år) men dessa ökningar var bara nätt och jämt signifikanta ($p<0{,}05$). Antalet tättingarter förändrades däremot inte, vilket berodde på att antalet i slutet av fyrtioårsperioden återgick till ungefär samma nivå som i början efter många år med lägre antal.

Trettioåtta av arterna registrerades under minst tjugo av de fyrtio åren. Dessa presenteras i diagram och deras beståndstrender har beräknats. Diagrammen är samlade i Figur 4. Eftersom det finns luckor i inventeringarna har uppskattade värden satts in för dessa luckor. Dessa uppskattade värden har beräknats på följande sätt. För ett år då en viss rutt inte inventerats har vi satt in medelvärdet för de angränsande åren. Det betyder exempelvis att alla värden för 1984 är skatta på detta vis. Efter att dessa skattningar införts har varje års antal summerats. I Figur 4 har staplarna för de verkligen räknade individerna gjorts blå medan staplarna för de skattade individerna gjorts röda. För att beräkna trenderna har analysprogrammet TRIM använts (*Trends and indices for monitoring data*; Pannekoek & van Strien 2005). Detta program beräknar de statistiskt mest sannolika värdena för de rutter som inte inventerats och beräknar därefter populationstrenden och dess signifikans. De arter som registrerats under färre än tjugo år analyseras inte närmare men samtliga observationer finns summerade i Appendix 3.

Analysen av de numerära trenderna för de 38 vanligaste arterna redovisas i Tabell 1. Det var klar övervikt för positiva trender, 25 positiva och 13 negativa. Tretton av trenderna var signifikanta och bland dessa var övervikten för de positiva trenderna ännu större. Hela 12 av dessa trender var positiva och bara en negativ. Det var bland vadarna och deras närmaste släktingar som de mest framgångsrika arterna fanns. Inte mindre än tolv av femton arter bland dessa hade positiva trender och sex av dessa ökningar var signifikanta. Bland änderna var det lika många positiva som negativa trender, men de två signifikanta trenderna var positiva. Bland tättingarna och övriga icke tättingar var det svag dominans för ökande trender (10 resp. 7) och av fem signifikanta trender var fyra positiva.

Diagrammen för de enskilda arterna i Figur 4 talar i huvudsak för sig själva och behöver knappast mer än några få kommentarer. Hos riporna finns det inga tydliga variationer som skulle kunna tolkas som tre- eller fyraårigt cykliska. Ändå erhölls för dalripan en svagt positiv korrelation med förekomsten av smågnagare ($r=0{,}44$; $p<0{,}05$), vars cykler dock under en lång följd av år varit dämpade. Ändernas variationer är svåra att tolka eftersom deras förekomst kan bero på lokala isförhållanden, och dessa har vi inte registrerat. Sjunkande tal för bergand och svärta, åtminstone under senare år, speglar sannolikt på en allmän och vida spridd trend, som tidigare är känd från kustområden. Ökande antal för änder som främst finns på lägre nivåer (kricka, vigg och bläsand) verkar sammanfalla med högre vårtemperaturer (april) under 2000-talet, men orsakssambandet är tveksamt. Bläsanden hör inte till de trettioåtta regelbundna arterna, men har varit nästan årlig det senaste decenniet. Alfågeln har ökat starkt vilket kontrasterar mot utvecklingen av Östersjöns vinterbestånd; möjligen övervintrar fjällens alfåglar i Atlanten utan att beröras av det som händer i Östersjön. Bland vadarna är det överlag ökande eller stabila bestånd. En del av dessa ökningar kan kanske liksom för några änder bestå i att de börjar häcka på högre nivåer. Även om nedgångarna för enkelbeckasin och brushane inte är signifikanta finns skäl att dra uppmärksamhet till dessa två arter som haft negativa trender i södra Sverige; brushanen är praktiskt taget utgången. Fjällabben uppvisar inte de stora variationer mellan ”många” och noll som man skulle ha kunnat vänta sig. Så hade varit fallet om vi räknat häckande par. Men vi räknar alla individer. Fjällabbarna besöker häckningsområdet varje år, men stannar gnagarfria år bara en kortare tid innan de återvänder till Atlanten. Att det ändå finns år med mycket låga värden beror på att labbarna dessa år redan lämnat Ammarnäs när vi gjort inventeringarna. Blåhaken har klarat sig bra och har ett stabilt bestånd på fjällheden. Det är motsatsen till vad som hänt i fjällbjörkskogen i Ammarnäs, där man noterat en fortlöpande nedgång. I början av 1970-talet var tätheten av blåhake i fjällbjörkskogen tre till fyra gånger högre än på fjällheden men har därefter sjunkit till samma låga nivå. Att stenskvättan har ett gott bestånd på fjällheden är glädjande eftersom arten minskat kraftigt i södra Sverige. De två numerärt dominerande arterna, ängspiplärka och lappsparv, uppvisar liknande drag sett över hela perioden. De var talrikare i början och slutet och fåtaligare många av åren däremellan. Snösparven har minskat kraftigt och registreras numera inte varje år. Vi vet dock inte om nedgången beror på en lika kraftig generell nedgång eller om det är fråga om en mindre uppflyttning av nedre förekomstgränsen. Våra rutter går nämligen på lägre nivåer än där snösparvens huvudförekomst finns. Även en marginell nedgång på de lägre nivåerna kan då misstolkas som kraftig även om beståndet högre upp är vid god hälsa.

Vi har jämfört data från våra rutter med data från fyra andra inventeringar.

Ända sedan 1964 har två provytor om vardera en kvadratkilometer inventerats mycket noga med revirkartering. Dessa provytor ligger i anslutning till fyra av rutterna. Tio arter var tillräckligt vanliga för att jämföras. Samtliga tio korrelationer var positiva och fem av dem signifikanta. Korrelationskoefficienten mellan trenderna var också signifikant positiv. De två inventeringarna stöder alltså varandra och vi kan därför anta att de väl beskriver fågelfaunans förändringar på fjällhedarna runt Ammarnäs.

För att undersöka om dessa resultat från Ammarnäs stämmer med var som händer i fjällkedjan i stort jämförde vi trenderna för rutterna med de som erhållits från Svenska Fågeltaxeringens standardrutter. Ännu är det bara ett ganska litet antal rutter som ger användbara data från ren fjällterräng och för att få ett tillräckligt stickprov valde vi att använda alla rutter som till åtminstone någon del gick genom alpin eller subalpin terräng. Antalet rutter som uppfyllde kriteriet var 104 och antalet arter som kunde jämföras var 35. Vi fick en svag positiv korrelation mellan trenderna (r=0,29; p>0,05). Att den inte blev signifikant kan bero på att standardrutterna inkluderar stora mängder fåglar från fjällbjörkskogen och de övre barrskogarna, och det är inte säkert att förändringarna där är desamma som på fjällheden. En annan faktor som försvagade jämförelsen var att bara tio år kunde användas, 2002–2011, eftersom det inte fanns tillräckligt med data från tidigare standardrutter.

I Ammarnäs finns också inventeringar av den subalpina björkskogen sedan 1963. Eftersom få arter är gemensamma kunde bara nio arter analyseras. Fem arter visade negativ korrelation, ingen dock signifikant. De andra fyra arterna visade positive korrelation, av vilka tre var signifikanta: bergfink, gråsiska och rödvingetrast. Utmärkande för dessa tre är att de tillhör björkskogens fauna men ofta rör sig eller fåtaligt även häckar på fjällheden. Ofta flyger de över eller hörs från skogen när man inventerar rutterna. Den positiva korrelationen kan därför helt enkelt spegla det faktum att det egentligen är skogen som vi indirekt inventerar även på fjällheden.

En fjärde jämförelse gjorde vid med en sjöfågelinventering som genomfördes i fjällkedjan 1972–1975 och som sedan upprepades 2009 (Nilsson & Nilsson 2012). Resultatet redovisas i Tabell 2. Vi fann flera signifikanta överensstämmelser mellan våra rutter och de sjöfågelräkningar som hade utförts i den sydligaste delen av fjällkedjan, där några av områdena för sjöfågelräkning ligger nära Ammarnäs.

I den alpina regionen är vårvädret en kritisk faktor för fåglarna. Snöfria områden och för änderna isfria vatten är nödvändiga. Vi saknar data om snösmältningen och islossningen. Temperaturen bör dock kunna vara ett surrogat. Vi fann att det för Ammarnäs inte fanns någon temperaturtrend för perioden 1972–2011 varken i positiv eller negativ riktning för månaderna maj och juni, de månader som borde vara mest kritiska. Däremot fanns en signifikant positiv trend för april. Denna trend berodde dock helt på höga aprilvärden under de senaste tio åren. Under 30-årsperioden 1972–2001 fanns ingen trend och medeltemperaturen var –4,6 grader (s.d. 1,69). Sedan ökade medeltemperaturen plötsligt och under 2002–2011 var den –2,6 grader med ringa variation (s.d. 0,92). Skillnaden på två grader är signifikant (t-test; p<0,001).

Man kan spekulera om, som redan antytts, att denna temperaturhöjning är orsaken till att en del arter ökat i antal samtidigt som andra arter som tillhör lägre nivåer börjat flytta upp på fjällheden. Men bilden är minst sagt mångtydig. Och det är inte lätt koppla väderförändringar som sker i april med fåglarnas häckningsstart som inte sker förrän i juni. Nästan alla arter på fjällheden är flyttfåglar och det som händer i vinterkvarteren kan därför vara viktigare än förhållandena på fjället. Sambandet mellan högre apriltemperatur och ökande bestånd hos många fjällfåglar i Ammarnäs kan därför vara en tillfällighet utan orsakssamband.

Trots den positiva utvecklingen av fågelfaunan på fjällhedarna runt Ammarnäs är det viktigt att påpeka att det går så dåligt för vissa arter att de kan försvinna lokalt. Två tättingar, berglärka och snösparv, hör till denna kategori. Berglärkans nedgång är känd sedan länge. Vad gäller snösparvens nedgång är den tydligt i vårt material, men som nämnts tidigare vet vi inte om nedgången även gäller högre fjällterräng. Utvecklingen måste dock ses som en varningssignal och kräver närmare studium. Om vi ser till den svenska rödlistan stämmer resultaten från Ammarnäs tämligen väl. Berganden, brushanen och berglärkan är upptagna som sårbara och svärtan som nära hotad. Snösparven listas dock som en art som inte är utsatt för någon risk, men som sagt är uppgifterna från Ammarnäs osäkra.

Appendix 1. Description of the permanent survey routes with coordinates of waypoints

Beskrivning av de permanenta rutterna med koordinater för orienteringspunkter

The coordinates refer to the Swedish national grid (RT90) with the N–S coordinate first.

Stupipakte

This route runs at elevations between 700 and 840 m. Most of the route is scrub heath, partly with dense and tall willow but mostly with rather low willow and dwarf birch. A few sections are rather dry without taller scrub and there are many small bogs. A few scattered birches occur at two patches. The total length of the route is c. 18 km. A part of the route runs just east of the border to the Marsivagge bird protection area. There are only two lakes that affect the counts, contributing some waterfowl, namely Geppejaure and Marsijaure, the latter only marginally because of great distance from the route. Coordinates: 7320170, 1512055; 7320967, 1512137; 7321279, 1512131; 7321681, 1511383, 7322060, 1510882; 7323616, 1510023; 7327577, 1509711; 7324673, 1510706; 7321570, 1510230; 7320170, 1512055.

Raurejaure

This route is about 15 km long and the elevation varies between 814 m (Raurejaure) and 1034 (peak of Tjärro). The scrub is lower than along the Stupipakte route but there are some sections with fairly tall willow, juniper and dwarf birch scrub. In addition to Raurejaure and Geppejaure there are numerous smaller water bodies, making this route the one that contributes the greatest number of waterfowl. Coordinates: 7320000, 1512000; 7320100, 1508650; 7320200, 1506950; 7320600, 1506000; 7321700, 1505200; 7322500, 1506900; 7320000, 1512000.

Rusa low

The first section runs almost along a straight line at an elevation of 800–850 m. The habitat is a mosaic of bogs, dry heath and sections with tall willow. The second section continues along a trail that slowly drops towards the forest line, so that the last section also collects birds that are typical for the birch zone. The route is c. 15 km long. Coordinates: 7304000, 1525900; 7303800, 1524500; 7306500, 1520300; 7307500, 1517700; 7309500, 1516200; 7312800, 1516200.

Rusa high

Apart from the first section that runs through bogs with much scrub and willows at elevations between 800 and 900 m, the remaining part of the route runs at 900–1000 m with poor wind-exposed vegetation. There is only one lake, Svarejaure, with a few waterfowl. The route is 15 km long. Coordinates: 7303920, 1525840; 7301400, 1524600; 7304600, 1520400; 7305400, 1518500; 7306600, 1517700; 7304000, 1525900; 7309500, 1516200.

Nasen

The route is c. 18 km long. The first part runs over boggy habitats with patches of dry scrub heath. The rest of the route has mostly low and rather dry scrub. There is very little tall willow vegetation. Elevation is between 790 and 918 m. Coordinates: 7303920, 1525840; 7303650, 1525800; 7302400, 1526300; 7301200, 1527100; 7301150, 1529700; 7300800, 1529400; 7297620, 1530800; 7299250, 1527500; 7302200, 1524470.

Kraipe

This is a rather short route, only 9.5 km, running at elevations between 790 and 880 m, and in rather boggy terrain with mostly a well developed scrub layer and rather large patches of taller willow fields. Coordinates: 7303920, 1525840; 7303650, 1525800; 7302250, 1526300; 7301340, 1527380; 7300900, 1527600; 7302600, 1525700; 7303530, 1524340; 7304700, 1524800; 7304200, 1525200; 7303920, 1525840.

Appendix 2. Basic surves data

Grundläggande inventeringsdata

Date (D), hour of start (S), duration in minutes (M), and the name of the observer (C) for each survey. Date is given as day from 1 June; thus date values larger than 30 refer to July dates.
Datum (D), timme för start (S), tidsåtgång i minuter (M) och observatörens namn (C) för varje inventering. Datum anges som dag från 1 juni, datum större än 30 avser således juli.

Year	Stupipakte				Raurejaure				Rusa low				Rusa high				Nasen				Kraipe			
	D	S	M	C	D	S	M	C	D	S	M	C	D	S	M	C	D	S	M	C	D	S	M	C
1972	24	11	300	S	24	11	320	C	28	10	270	S	28	13	235	C	31	9	385	C	33	10	210	S
1973	26	11	295	S	26	10	370	C	31	11	255	S	32	11	235	C	31	11	385	C	36	11	195	S
1974	22	10	305	S	22	10	370	C	29	10	265	S	29	11	240	C	31	9	385	C	32	10	195	S
1975	29	11	300	S	30	10	360	H	30	10	285	S	-	-	-	-	-	-	-	-	-	-	-	-
1976	21	10	315	S	21	10	380	C	32	9	255	S	26	10	320	C	32	9	400	C	26	10	200	S
1977	28	9	345	S	28	9	385	C	26	10	280	S	32	9	310	C	33	10	405	C	32	10	200	S
1978	22	9	395	S	22	9	385	C	32	10	280	S	31	9	325	C	32	10	410	C	31	9	180	S
1979	23	10	345	S	23	10	395	C	24	9	275	S	29	9	310	C	35	9	400	C	29	9	185	S
1980	22	9	345	S	22	9	390	C	23	10	275	S	23	10	315	C	25	7	420	C	25	10	185	S
1981	20	9	370	S	22	9	315	N	-	-	-	-	21	9	320	L	20	9	405	L	-	-	-	-
1982	28	9	325	S	28	9	415	C	33	9	280	S	29	9	320	C	26	9	445	C	29	9	200	S
1983	23	9	360	S	20	4	300	S	22	10	245	S	25	9	310	L	23	9	345	L	25	9	180	S
1984	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1985	26	8	335	S	33	8	295	S	29	10	260	S	22	11	290	L	24	9	340	L	22	11	195	S
1986	22	9	365	S	27	8	280	S	31	10	295	S	22	10	305	L	20	9	345	L	25	11	185	S
1987	29	9	320	S	24	9	275	S	31	10	275	S	23	7	315	L	24	9	335	L	23	11	190	S
1988	21	8	375	S	24	7	390	L	27	6	285	S	22	7	305	L	19	10	295	L	29	8	175	S
1989	28	7	385	S	27	7	395	L	32	6	300	S	25	7	305	L	22	6	385	L	27	7	215	S
1990	21	6	375	S	19	5	415	S	24	8	295	S	34	9	310	S	16	7	400	G	28	10	230	S
1991	23	6	395	S	24	6	370	S	29	6	350	S	-	-	-	-	24	6	495	L	27	6	205	S
1992	19	6	380	S	24	7	340	S	31	7	305	S	25	6	325	L	24	6	375	L	18	10	210	S
1993	22	6	405	S	27	7	345	E	27	6	270	S	27	6	300	L	24	8	365	L	22	6	225	S
1994	18	7	440	S	16	8	360	I	21	7	355	I	33	8	360	E	29	10	335	L	-	-	-	-
1995	20	7	405	S	31	9	390	Y	-	-	-	-	-	-	-	-	-	-	-	-	28	5	235	S
1996	19	6	405	S	24	8	330	I	24	6	310	S	25	6	345	S	28	6	360	S	22	10	210	S
1997	23	6	360	P	19	7	380	I	26	6	405	R	24	7	330	A	-	-	-	-	25	5	240	S
1998	28	6	345	P	22	6	370	S	25	6	375	S	-	-	-	-	24	6	390	S	20	10	255	S
1999	23	5	375	Q	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	34	8	430	A	29	9	375	R	-	-	-	-	-	-	-	-	36	7	415	A	-	-	-	-
2001	25	5	480	S	25	6	465	A	31	5	465	A	27	5	450	A	34	5	450	A	24	5	200	A
2002	28	6	470	A	19	9	345	S	26	5	390	A	25	6	445	T	25	6	450	A	21	7	256	S
2003	27	6	460	T	27	6	420	A	25	6	345	A	23	6	480	T	29	8	450	A	21	11	205	S
2004	22	6	500	T	22	6	470	A	20	6	460	A	20	6	500	T	28	6	445	A	19	6	245	S
2005	-	-	-	-	-	-	-	-	23	5	410	A	23	5	265	T	29	5	350	A	19	7	240	S
2006	27	5	445	T	27	5	480	A	21	6	405	A	21	6	425	T	29	6	400	A	24	7	200	A
2007	25	6	470	T	25	6	382	M	20	6	410	A	20	6	445	T	25	6	445	A	24	6	180	A
2008	22	6	525	T	22	6	455	A	27	5	405	A	27	6	490	T	-	-	-	-	19	7	301	S
2009	21	6	555	T	21	6	470	A	18	6	410	A	18	6	440	T	24	6	390	A	21	6	255	S
2010	24	6	490	A	24	6	420	M	16	5	345	A	16	5	410	M	-	-	-	-	20	6	260	S
2011	26	6	510	A	26	6	480	X	23	5	390	A	28	5	375	A	30	6	405	A	19	4	235	S

A = Thomas Andersson (37 surveys), C = Ulf T. Carlsson (27), E = Sophie Ehnbom (2), G = Martin Gierow (1), H = Lars Helsborn (1), I = Ingvar Lennerstedt (4), L = Göran Liljedahl (22), M = Anders Mathiasson (3), N = Lars Nilsson (1), P = Göran Paulson (2), Q = Ingvar Lennerstedt & Alexander Hellquist (1), R = Roland Sandberg (2), S = Sören Svensson (91), T = Leif Lithander (14), X = Martin Green (1), Y = Magnus Stensmyr (1)

Appendix 3. List of all bird records

Lista över alla fågelregistreringar

Number of individuals of all species that were recorded along the survey lines in 1972–2011. For the rare species (name in bold), all records are listed in detail in this appendix. For the 38 most regular species (recorded in at least 20 of the forty survey years) the list shows number of years with records and total number of individuals actually counted, whereas the details are shown with diagrams in Figure 2. Code for the routes NA = Nasen, KR = Kraipe, RL = Rusa Low, RH = Rusa High, R = Raurejaure, ST = Stupipakte.

Antal individer av alla arter som noterats längs inventeringslinjerna 1972–2011. För de sällsynta arterna (namnet i fetstil) listas samtliga fynd i detta appendix. För de 38 mest regelbundna arterna (observerade minst 20 av de 40 inventeringsåren) visar listan antal år med observation och totala antalet individer som verkligen räknats, medan detaljerna visas i diagrammen i Figur 2. Ruttkoder: NA = Nasen, KR = Kraipe, RL = Rusa Low, RH = Rusa High, R = Raurejaure, ST = Stupipakte.

Acrocephalus schoenobaenus* Sedge Warbler *Sävsångare: 1 ST 2011.

Actitis hypoleucos* Common Sandpiper *Drillsnäppa: 22 inds 1972–1983 (3, 1, 2, 0, 0, 4, 3, 3, 3, 1, 1, 1 inds respectively), 1 ind in each year 2003–2005, and 2 ind 2011. All routes represented but 16 of the individuals at the NA route in the first 12 years.

Alauda arvensis* Eurasian Skylark *Sånglärka: 1973(2), 74(3), 78, 83(2), 2001.

Anas acuta* Northern Pintail *Stjärtand: 2 RH 1977; 2 RA, 1 RH 1979; 1 NA 2001.

Anas crecca Common Teal *Kricka*: 34 years, 193 individuals.

Anas penelope* Eurasian Wigeon *Bläsand: 34 individuals in 14 years; almost all at RA and NA. Almost regular during the most recent decade.

Anas platyrhynchos* Mallard *Gräsand: 2 NA 1972; 2 RL 1993.

Anthus cervinus* Red-throated Pipit *Rödstrupig piplärka: 1 RL 1997; 1 RA 2000; 2 NA 2001; 1 KR 2003; 1 ST 2009.

Anthus pratensis Meadow Pipit *Ängspiplärka*: 40 years, 17 572 individuals.

Anthus trivialis* Tree Pipit *Trädpiplärka: 2 RL 2005.

Aquila chrysaetos* Golden Eagle *Kungsörn: 17 ind in 11 yrs: 1975, 76, 82(2), 83(2), 89, 92(2), 98, 2003(2), 06, 07(3), 08.

Asio flammeus* Short-eared Owl *Jorduggla: 18 inds in 9 yrs: 1981, 82, 86, 90(3), 91, 2001, 04(6), 05, 08(4), 10, 11(15). Note the peak year 2011.

Aythya fuligula Tufted Duck *Vigg*: 25 years, 124 individuals.

Aythya marila Greater Scaup *Bergand*: 35 years, 152 individuals.

Bombycilla garrulus* Bohemian Waxwing *Sidensvans: 5 NA 2004, 5 NA 2005.

Bucephala clangula* Common Goldeneye *Knipa: 18 1972–1989, 11 1990–2008, difference not significant, 20 of the 29 at RA.

Buteo buteo* Common Buzard *Ormvråk: 1 ST 2009.

Buteo lagopus Rough-legged Buzzard *Fjällvråk*: 24 years, 89 individuals.

Calcarius lapponicus Lapland Longspur *Lappsparv*: 40 years, 11 830 individuals.

Calidris alpina Dunlin *Kärrsnäppa*: 40 years, 1945 individuals.

Calidris temminckii Temminck's Stint *Mosnäppa*: 39 years, 192 individuals.

Carduelis flammea Common Redpoll *Gråsiska*: 40 years, 2165 individuals.

Carduelis hornemanni* Arctic Redpoll *Snösiska: 1 ST 1982; 1 ST 1988; 2 RH 1994.

Carduelis spinus* Eurasian Siskin *Grönsiska: 1 RH 2009.

Carpodacus erythrinus* Common Rosefinch *Rosenfink: 1 RA 2001; 1 RL 2002.

Charadrius hiaticula Common Ringed Plover *Större strandpipare*: 38 years, 184 individuals.

Charadrius morinellus Eurasian Dotterel *Fjällpipare*: 40 years, 407 individuals.

Chroicocephalaus ridibundus* Black-headed Gull *Skrattmås: 1 ST 2009.

Cinclus cinclus* White-throated Dipper *Strömstare: 1 1981, 1 1993, 1 1996; all at RA.

Circus aeruginosus* Western Marsh Harrier *Brun kärrhök: 2 ST 2004.

Circus cyaneus* Hen Harrier *Blå kärrhök: 16 inds in 11 yrs: 1976, 79, 82, 86, 90(3), 91, 93, 2003(2), 04, 06(3), 10.

Clangula hyemalis Long-tailed Duck *Alfågel*: 33 years, 210 individuals.

Corvus corax Common Raven *Korp*: 40 years, 451 individuals.

Corvus corone* Hooded Crow *Kråka: 37 inds in 15 yrs: 12 in 5 yrs 1972–1978, 0 in 1979–80, 5 in 3 yrs in 1991–2001, 20 in all years 2002–2008; thus more common in the first and last years of the survey period.

Cuculus canorus Common Cuckoo *Gök*: 40 years, 367 individuals.

Emberiza schoeniclus Common Reed Bunting *Sävsparv*: 40 years, 93 individuals

Eremophila alpestris* Horned Lark *Berglärka: 36 inds in 7 years: 1972(9), 1973(11), 1974(2), 1975(3), 1976(4), 1977(6), 1980(1). 16 records at RH and 13 at RA.

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Appendix 3, continued

Falco columbarius* Merlin *Stenfalk: 17 inds in 13 yrs: 1971, 82, 86, 88(3), 89, 91, 92, 93, 94(2), 96(2), 2002, 03, 09 (records in 5 routes).
Falco peregrinus* Peregrine Falcon *Pilgrimsfalk: 1 RL 1986.
Falco rusticolus* Gyr Falcon *Jaktfalk: 1 NA 2000; 1 RA 2009, 1 RA 2010.
Falco tinnunculus* Common Kestrel *Tornfalk: 1 ind. in each of 1972, 76, 78, 81, 97, 2002, 07, 08, and 2 inds. in 2010, records at all routes.
Fringilla montifringilla Brambling *Bergfink*: 32 years, 147 individuals.
Gallinago gallinago Common Snipe *Enkelbeckasin*: 40 years, 872 individuals.
Gallinago media* Great Snipe *Dubbelbeckasin: 22 individuals in 15 years without trend and with records in all routes. There are several leks in the Ammarnäs area and the province is one of the best for the species (Ekblom & Carlsson 2007), but as it is active at night we tend to miss many of the lekking individuals and record mainly the few that we flush.
Gavia arctica* Black-throated Loon *Storlom: 24 inds. in 15 years, all but one at RA in 1972–1992, representing one breeding pair in Raurejaure.
Gavia stellata* Red-throated Loon *Smålom: 2 ST 1996; 1 ST, 2 RA 2001; 2 RA 2003; 1 ST 2007; 1 RA 2010; 2 RA 2011.
Grus grus* Common Crane *Trana: 2 ST 2007; 1 ST 2010; 2 ST 2011.
Haliaeetus albicilla* White-tailed Eagle *Havsörn: 2 RH 2007; 2 RA 2008.
Hirundo rustica* Barn Swallow *Ladusvala: 1 RL 2009; 1 RH 2009.
Lagopus lagopus Willow Ptarmigan *Dalripa*: 36 years, 176 individuals.
Lagopus muta Rock Ptarmigan *Fjällripa*: 38 years, 197 individuals.
Larus argentatus* Herring Gull *Gråtrut: 1 NA 1996; 1 KR 2001.
Larus canus Mew Gull *Fiskmås*: 40 years, 708 individuals.
Limosa lapponica* Bar-tailed Godwit *Myrspov: 1 ST, 1 NA 1988; 1 RH, 1 NA, 1 KR 2003; 3 RH 2004; 1 ST, 1 RH 2006; 1 ST 2008; 2 ST, 3 RA, 1 NA 2011.
Loxia sp.* Crossbill *Korsnäbb obestämd: 1 NA 1972.
Luscinia svecica Bluethroat *Blåhake*: 40 years, 1012 individuals.
Melanitta fusca Velvet Scoter *Svärta*: 32 years, 143 individuals.
Melanitta nigra Black Scoter *Sjöorre*: 35 years, 211 individuals.
Mergus merganser* Goosander *Storskrake: 28 individuals in 14 years: 1977, 80, 83, 85, 86, 89, 90, 93(5), 97, 99, 2007(5), 08(2),09,10(6).
Mergus serrator* Red-breasted Merganser *Småskrake: 1 NA 1980; 1 RA 2003–04; 2 RA 2006.
Motacilla flava* Yellow Wagtail *Gulärla: 1 RH 1980; 2 RL 1987; 1 KR 1989; 2 RL, 1 RA 1992; 1 RA 1995; 1 ST 1999; 1 KR 2002; 1 ST 2007.
Numenius phaeopus Whimbrel *Småspov*: 34 years, 158 individuals.
Oenanthe oenanthe Northern Wheatear *Stenskvätta*: 40 years, 1428 individuals.
Phalaropus lobatus Red-necked Phalarope Smalnäbbad *simsnäppa*: 40 years, 692 individuals.
Philomachus pugnax Ruff *Brushane*: 36 years, 363 individuals.
Phoenicurus phoenicurus* Common Redstart *Rödstjärt: 1 ST 2010; 1 ST 2011.
Phylloscopus trochilus Willow Warbler *Lövsångare*: 40 years, 4697 individuals.
Plectrophenax nivalis Snow Bunting *Snösparv*: 21 years, 126 individuals.
Pluvialis apricaria European Golden Plover *Ljungpipare*: 40 years, 7053 individuals.
Prunella modularis* Dunnock *Järnsparv: 1 RA 1973; 2 (ST, RA) 1975; 1 ST 1978; 2 RA 2009; 3 RL 2011.
Saxicola rubetra* Whinchat *Buskskvätta: 1 NA 1972; 1 RL 1991; 1 ST 2009.
Stercorarius longicauda Long-tailed Skua *Fjällabb*: 39 years, 2116 individuals.
Sterna hirundo* Common Tern *Fisktärna: 1 RA 1997.
Sterna paradisaea Arctic Tern *Silvertärna*: 29 years, 78 individuals.
Tringa erythropus* Spotted Redshank *Svartsnäppa: 1 RA 1982; 1 KR 1987; 1 RA 1998; 1 KR 2008; 2 ST 2010.
Tringa glareola Wood Sandpiper *Grönbena*: 33, 259 individuals.
Tringa nebularia Common Greenshank *Gluttsnäppa*: 23 years, 72 individuals.
Tringa totanus Common Redshank *Rödbena*: 40 years, 701 individuals.
Turdus iliacus Redwing *Rödvingetrast*: 40 years, 902 individuals.
Turdus philomelos* Song Thrush *Taltrast: 3 1997 at ST, RA, NA.
Turdus pilaris Fieldfare *Björktrast*: 36 years, 610 individuals.
Turdus torquatus Ring Ouzel *Ringtrast*: 29 years, 60 individuals.
Vanellus vanellus* Northern Lapwing *Tofsvipa: 1 RA 1997.

Korta rapporter – *Short communications*

Commensal use of Mute Swans *Cygnus olor* by Common Coot *Fulica atra* and of Canada Geese *Branta canadensis* by European Wigeon *Anas penelope*

Sothöns Fulica atra *kommensala utnyttjande av knölsvanar* Cygnus olor *och bläsänders* Anas penelope *utnyttjande av kanadagäss* Branta canadensis

HANS KÄLLANDER

It is well known that various waterbird species may associate with Whooper Swans *Cygnus cygnus* and Bewick's Swans *C. columbianus bewickii*, benefitting from the swans' feeding activities (Bauer & Glutz von Blotzheim 1968, Merilä & Ohtonen 1987, Källander 2005). Thus, Common Pochard *Aythya ferina*, Tufted Duck *A. fuligula* and Common Goldeneye *Bucephala clanga* dive under the swans, and an experimental study has recently shown that Common Pochards thereby may double their intake rate (Gyimesi et al. 2012). Dabbling ducks such as Mallard *Anas platyrhynchos* and European Wigeon *A. penelope*, but also Common Coot *Fulica atra*, regularly associate with these two species of swan. They swim, mostly behind the swans, and peck pieces of plant material from the surface. Mute Swans *Cygnus olor*, however, usually seem not to be attended by these commensals (but see Beven 1980).

In one study (Källander 2005), 41% of 558 Whooper Swan individuals and 56% of swan groups had attendant commensals. Corresponding figures for Bewick's Swans were 51% and 71%, but sample sizes were much smaller (25 and 38, respectively). For Mute Swans, however, only 2.6% (N = 1481) had commensals and mostly for a very short period of time. This difference in attractiveness of the swan species seems to depend on their different feeding methods and diets. Both Whooper Swans and Bewick's Swans "foot-paddle", i.e. use their feet to stir up bottom mud in order to expose the nutritious tubers on the rhizomes of fennel pondweed *Potamogeton pectinatus* (Sherwood 1960, Nolet et al. 2002). Mute Swans, in contrast, usually do not foot-paddle and feed mostly on other types of plant material (Bauer & Glutz von Blotzheim 1968). In August 2012, it was therefore quite surprising to find a group of Common Coots at Lake Krankesjön, southern Sweden (55°42‘ N, 13°28‘ E), closely attending a pair of feeding Mute Swans.

The swan pair was feeding close to a bird observation tower on the southern shore of the lake and the coots were closely associated with them (Figure 1). Closer examination showed that these two swans were food-paddling, but it is uncertain what kind of food they were taking. Clearly, however, they stirred up plant fragments on which the coots fed. The coots were attentive to the behaviour of the swans and although swimming around the swans, most of the time they kept behind them. Also, when a swan's neck and head surfaced, they kept a safe distance to the swan only to advance towards it when it again submersed its head. The number of coots varied constantly from just one or two up to ten. When the swans ceased feeding, the coots immediately left them. The fact that I have spent many hundreds of hours at Lake Krankesjön during the last eight years counting and observing waterbirds without ever before having noticed the described association, suggests that it either is very uncommon or that it only occurs in specific situations.

Figure 1. Common Coots using Mute Swans commensally, Krankesjön 14 August 2012.
Sothöns utnyttjande knölsvan kommensalt, Krankesjön den 14 Augusti 2012.

During studies of commensal associations between Common Goldeneyes and European Wigeons with Whooper Swans and Bewick's Swans on the northern coast of the Falsterbo Peninsula (55°26' N, 12°52'30" E) in November 1994, a commensal association of European Wigeons with Canada Geese *Branta canadensis* was also observed. Out of 24 Canada Geese seen on 3 November, seven had associated Wigeons and on 19 November, out of 350 geese, 23 (6.3%) had Wigeons attending them. Although relatively few Canada Geese were attended by Wigeons, this association is a bit surprising considering that Canada Geese seem to forage more like Mute Swans than like Whooper Swans or Bewick's Swans, but clearly the geese made food particles available to the ducks. Wigeons have also been reported to use Brent Geese *Branta bernicla* commensally (Bauer & Glutz von Blotzheim 1968).

As an aside, on 30 November Canada Geese were themselves using Whooper and Bewick's Swans: seven swans had one or two Canada Geese pecking items from the surface behind them.

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Sammanfattning

Flera arter simfåglar associerar sig med sångsvanar *Cygnus cygnus* och mindre sångsvanar *C. columbianus bewickii* och drar nytta av dessas födosök

(Bauer & Glutz von Botzheim 1968, Merilä & Ochtonen 1987, Källander 2005). Gräsand *Anas platyrhynchos,* bläsand *A. penelope* och sothöna *Fulica atra* utnyttjar uppvirvlat material på vattenytan, medan knipa *Bucephala clanga*, vigg *Aythya fuligula* och brunand *Aythya ferina* dyker in under de födosökande svanarna. En nyligen publicerad experimentell studie (Gyimesi m.fl. 2012) har visat att brunänder härigenom kan fördubbla sitt näringsintag per tidsenhet. I en studie (Källander 2005) hade ungefär häften av 583 sångsvanar och mindre sångsvanar associerade simfåglar (nästan uteslutande bläsänder) mot endast 2,6% av 1381 knölsvanar *C. olor*. Denna skillnad tycks bero på svanarternas olika förosöksmetod: sångsvanen och mindre sångsvanen ”fot-paddlar” i bottenmaterialet för att exponera lagringsknölar på borstnatens *Potamogeton pectinatus* rhizomer, medan knölsvanen sällan tycks ”fot-paddla” och lever av andra submersa växter (Bauer & Glutz von Blotzheim 1968). Det var därför något förvånande när jag i augusti 2012 fann en grupp sothöns, vilken nära associerade sig med ett knölsvanpar och pickade uppvirvlat material från ytan (Figur 1). Antalet sothöns i anslutning till en svan varierade, fåglarna höll sig företrädesvis bakom svanarna och simmade undan en smula när svanarna drog upp halsen, blott för att omedelbart simma fram igen när svanhalsen på nytt försvann under ytan. De hundratals timmar jag räknat och observerat simfåglar på Krankesjön under de senaste åtta åren utan att tidigare ha noterat någon kommensal associering med knölsvan tyder på att den sannolikt är relativt ovanlig.

Under studier av kommensalt utnyttjande av svanar på nordsidan av Falsterbohalvön hösten 1994, upptäcktes att bläsänder också i viss utsträckning utnyttjade kanadagäss *Branta canadensis*. Sålunda hade den 19 november 23 av 350 (6,3%) kanadagäss bläsänder, som utnyttjade dem. Iakttagelsen är en aning förvånande, eftersom kanadagäss verkar födosöka mer som knölsvan än som sångsvan och mindre sångsvan, men bläsänder har också rapporterats utnyttja prutgäss *Branta bernicla* (Bauer & Glutz von Blotzheim 1968).

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Northern Wheatear *Oenanthe oenanthe* prey on newt

Stenskvätta Oenanthe oenanthe *tar salamander som byte*

MICHAŁ CIACH

The diet of Northern Wheatear *Oenanthe oenanthe* is composed with invertebrates – mainly arthropods (insects and spiders), earthworms, and snails – and a much smaller fraction of plant material. Information on vertebrate prey is exceptional (Cramp 1998) and only a single record of Sand Lizard *Lacerta agilis* intake has been noted (Grössler 1959).

On 7 April 2012 in the Ustrzyki Dolne town (Carpathians, SE Poland) I saw a unique behaviour of Northern Wheatear. On a meadow a group of four birds (three females and one male) were foraging. While watched, one of the females attacked a newt (Figue 1.). The bird stroke the prey against the ground several times, handling its head or tail (Figure 2.). Having difficulties in prey managing (or due to observer presence), the bird flew ca. 200 meters with the prey in its bill and landed on the ground, where it finished the consumption. The entire time of prey handling and consumption was about five minutes. The observation was conducted at noon, in good, cloudless and windless weather.

The observation described in this note is the second record of a Northern Wheatear foraging on a vertebrate and also the first record an amphibian was seen to be part of the diet of this species. Four species of newts are recorded in southern Poland (Juszczyk 1987, Głowaciński & Rafiński 2003). The prey species was difficult to determine. However, based on size and coloration it probably was Common Newt *Lissotriton vulgaris* or Carpathian Newt *Lissotriton montandoni*.

The diet of several Wheatear species occurring in arid or semi-arid regions may occasionally include vertebrates – small lizards and geckos (Cramp 1998). However, to prey on newt by Northern Wheatear is surprising in light of what is known about the diet of this species. Northern Wheatears arrive in Poland at the end of March and singles or small groups of birds are seen in a variety of habitats, e.g. on plowing fields and meadows (Tomiałojć & Stawarczyk 2003). The use of vertebrates by Northern Wheatear may be related to the cold spring weather, when ectothermic (cold-blooded) species leaving hibernation shelters are

Figure 1. Northern Wheatear *Oenanthe oenanthe* prey on newt (7 April 2012, Carpathians, SE Poland). *Stenskvätta fångar salamander.*

easy to catch. My observation indicates that the Northern Wheatear is an opportunistic forager, having broader dietary niche than suspected.

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Sammanfattning

Stenskvättans föda utgörs av främst av insekter, spindlar, maskar och sniglar och en ringa del växtmaterial. Att stenskvättor tar ryggradsdjur hör till undantagen. Den 7 april 2012 såg jag dock ett unikt beteende. På en äng födosökte tre honor och en hane och medan jag följde fåglarna tog en av honorna en salamander (Figur 1). Hon slog bytet mot marken flera gånger medan hon höll det i huvudet eller stjärten (Figur 2). På grund av problemen med bytet eller på grund av min närvaro flög hon iväg ungefär två hundra meter med salamandern i näbben. När hon landat igen svalde hon bytet. Hela processen tog ungefär fem minuter. Stenskvättearter som lever i torra områden livnär sig mera regelbundet på ödlor och geckoer, men att en vanlig stenskvätta tar en salamander är oväntat med hänsyn till vad som är känt om dieten. Min observation är bara det andra rapporterade fallet.

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Figure 2. Handling the newt by Northern Wheatear *Oenanthe oenanthe* (7 April 2012, Carpathians, SE Poland). *Stenskvätta hanterar salamander*

Rasen *hornemanni* av snösiska *Carduelis hornemanni* aldrig säkert anträffad i Sverige

Subspecies hornemanni *of Arctic Redpoll* Carduelis hornemanni *never recorded in Sweden*

LARS SVENSSON

Snösiskan *Carduelis hornemanni* förekommer i två olika underarter, den mindre *exilipes* som häckar i nordligaste Fennoskandien och vidare österut i norra Ryssland och Sibirien, och som uppträder sällsynt men relativt regelbundet vintertid i södra och mellersta Sverige, och den mer storvuxna *hornemanni* som häckar på norra Grönland och i delar av arktiska Nordamerika, men som av allt att döma även häckar på norra Island. På Island betecknas den dock av hävd som en extremt ljus lokal gråsiska (*Carduelis flammea* '*islandica*', ljus morf), men dessa ljusa isländska fåglar skiljer sig inte från snösiskor i andra trakter mer än i så måtto att de är intermediära i storlek mellan *exilipes* och *hornemanni* (Shirihai & Svensson in prep.). Rasen *hornemanni* är stann- eller strykfågel och gör blott kortare vintertida förflyttningar, men den är rätt regelbundet anträffad i Skottland som tillfällig besökare under vinterhalvåret, och vissa år i större antal än annars.

Av underarten *hornemanni* finns ett svenskt fynd rapporterat i litteraturen, en ung hane insamlad av Sigvard Sjöberg den 27 april 1934 i Gällivare, Lule lappmark (Lundevall 1941). Exemplaret förvaras som skinn på Naturhistoriska Riksmuseet i Stockholm (NRM S 1). Det upptäcktes 1941 av Lundevall vid genomgång av Riksmuseets samling av grå- och snösiskor och sändes senare samma år till Finn Salomonsen i Köpenhamn för verifiering, vilket skedde efter jämförelse med Köpenhamnsmuseets samling.

Fågeln är stor och har lång vinge, 82 mm, men ser annars ut som en gråsiska. Lundevalls beskrivning innehåller ingen närmare analys av hur grå- och snösiskor skulle skilja sig åt eller varför denna individ måste vara en *hornemanni*. Där står bara att

Figur 1. Exemplaret NRM S1, en gång föreslagen att vara en snösiska av rasen *Carduelis hornemanni hornemanni*, men som inte längre bör anses vara säkert art- eller rasbestämd.
The specimen NRM S1, once suggested to be an Arctic Redpoll of subspecies Carduelis hornemanni hornemanni *but that should no longer be considered to be safely determined to species or subspecies.*

den hade ”en från de övriga i flera avseenden avvikande dräkt”, men några preciseringar lämnas inte. Om övergumpen sägs något vilseledande att denna var ”smutsvit, dock bakåt rent vit”, men intet sägs om att hela övergumpen är kraftigt mörkfläckad. Man får utgå från att den avvikande långa vingen varit avgörande, och att Salomonsens utlåtande sedan fällt avgörandet.

Vid tiden för Lundevalls rapportering var veterligen inte vikten av teckningen hos de längsta undre stjärttäckarna känd. Snösiskans båda raser har endera helvita sådana täckfjädrar eller vita fjädrar med ett smalt och spetsigt mörkt skaftstreck, medan gråsiskan i 99% av fallen har ett brett mörkt skaftstreck; blott enstaka gråsiskor har ett något smalare streck. Denna skillnad publicerades långt senare (Svensson 1970), och man måste ha förståelse för att Lundevall gjorde bästa möjliga bestämning utifrån den tidens kunskaper och litteratur. Gällivare-fågeln i fråga har mycket breda och kraftiga centrala streck på undre stjärttäckarna och är alltså i det avseendet av gråsiskeutseende.

Jag har undersökt ett större antal skinn av samtliga taxa inom grå- och snösiskekomplexet. Gällivare-fågeln avviker från typiska *hornemanni* insamlade på Grönland eller i Quebec genom sin något mörkare helhet orsakad av kraftigare och mer omfattande streckning, genom sin helt fläckade låt vara ljusa övergump samt genom de kraftigt streckade längsta undre stjärttäckarna. Om man vill iaktta en sund försiktighet vid bedömning av förstafynd för landets fauna bör enligt min mening denna fågel inte bestämmas till en säker *hornemanni*. Den ser mest ut som en gråsiska men är för stor.

Vad rör det sig då om? Innan man kan svara på detta bör man komma ihåg, att variationen inom hela grå- och snösiskekomplexet är stor och möjligen i vissa avseenden ännu outredd. Det finns en rik litteratur om detta. Frågan om huruvida gråsiskan och snösiskan hybridiserar är t.ex. omdebatterad. Ingen sådan samhäckning har konstaterats i naturen, men att döma av rätt talrika mellanformer i museisamlingarna (kanske 2% av alla skinn), eller som fångas för ringmärkning, kan det inte uteslutas att viss hybridisering pågår. Den alternativa förklaringsmodellen är att den naturliga variationen hos yngre fåglar av båda arterna gör att ytterligheterna överlappar i karaktärer och skapar de svårbestämda individerna.

Framtida forskning får utvisa vilken av teorierna som är korrekt – kanske är det båda. Det räcker att konstatera att det irriterande ofta bland typiska fåglar dyker upp kniviga mellanformer, och att alla siskor inte går att säkert bestämma med nuvarande kunskaper.

Gällivare-fågeln är av allt att döma en sådan svårbestämd fågel. Med vinge 82 mm (Lundevall: 82), stjärt 63 mm (65,5), tars 16,0 mm (16), näbb till skallen 11,0 mm (10,0), näbb till fjäderfästet 8,3 mm (8,6) och näbbhöjd 7,1 mm (6,6) är den för stor för normala snösiskor av rasen *exilipes* och också för stor för normala gråsiskor av rasen *flammea*. Båda dessa har en vinglängd som inte överstiger 80 mm, stjärtlängden är hos de två maximalt 62 respektive 61 mm, och näbbhöjden är hos *exilipes* högst 7,0 mm.

Det finns en möjlighet att förklara fågeln som en varietet *holboellii*. Gråsiskor med denna beteckning är något mer storvuxna än normala gråsiskor, kan ha en vinglängd av 83 mm (35 sådana var. *holboellii* undersökta i Riksmuseets samling) och har framför allt en längre och litet kraftigare näbb. De är ofta också aningen kraftigare pigmenterade, även om detta är svårt att säkert fastställa eftersom de flesta insamlade är i sliten sommardräkt, som naturligt är något mörkare än vinter- och vårdräkter. En tolkning som var. *holboellii* skulle förklara Gällivare-fågelns storlek, men stämmer inte helt beträffande näbbens format.

Mitt förslag är att fågeln betraktas som en obestämbar aberrant gråsiska, möjligen med drag av var. *holboellii*. Den bör inte gälla som säkert bestämd *hornemanni*, vilken ras därmed fortfarande saknas på den svenska listan.

Litteratur

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Summary

Two subspecies have been described of the Arctic Redpoll *Carduelis hornemanni*, the smaller *exilipes* in northern Eurasia and the larger *hornemanni* in Greenland and North America. One record of the subspecies *hornemanni* has been published for Sweden (Lundevall 1941): a young male collected at Gällivare in Lapland on 27 April 1934 (specimen NRM S 1). The bird is large with a long wing, 82 mm, but looks otherwise as a Common Redpoll *Carduelis flammea* (Figure 1). Both the upper and under tail-coverts are heavily streaked. At the time when Lundevall published the record it was not known that Arctic Redpolls of both subspecies have under tail-coverts that are purely white or white with only a very narrow and pointed shaft streak whereas almost all Common Redpolls have coverts with broad dark shaft streaks. I have examined a large number of specimen of all taxa within the redpoll complex. The focal bird simply looks like an unusually large Common Redpoll.

The measurements of the Gällivare bird are as follows (Lundevall's within parenthesis): wing 82 (82) mm, tail 63 (65.5) mm, tarsus 16.0 (16) mm, bill to skull 11.0 mm (10.0), bill to feathering 8.3 (8.6) mm, bill depth 7.1 (6.6) mm. Normal Arctic Redpolls of subspecies *exilipes* and Common Redpolls of subspecies *flammea* are smaller with wing length not exceeding 80 mm and tail length not exceeding 62 mm. Bill depth at feathering of *exilipes* is less than 7.0 mm. The specimen could possibly be a variety of *Carduelis flammea* called *holboellii*. However, although the large size would indicate this, the bill shape is not perfect for var. *holboellii,* and the specimen is best regarded as an aberrant bird with no definite identification. The record of ssp. *C. h. hornemanni* should therefore in my opinion be removed from the Swedish list.

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Short-tailed Shearwaters *Puffinus tenuirostris* forage in Grey Whale *Eschrichtius robustus* mud plumes

Kortstjärtade liror Puffinus tenuirostris *födosöker i sedimentmolnen efter födosökande gråvalar* Eschrichtius robustus

HENRIK KYLIN

The terrestrial ecology research expedition "Beringia 2005" used the icebreaker Oden to transport researchers between field sites along the coast of Chukotka and Wrangel Island. In addition, some oceanographic work and chance bird observations

Figur 1. Short-tailed Shearwater *Puffinus tenuirostris*. *Kortstjärtad lira*. Photo: Jonas Bonnedahl.

were carried out during transit between stations.

On 6–7 August 2005, in the Bering Strait and Chukchi Sea, approximately between 66° 40’ N, 170° 50’ W and 67° 16’ N, 173° 50’ W the Oden passed an area with large flocks (>10 000 in each flock) of Short-tailed Shearwaters *Puffinus tenuirostris* (Figure 1 and 2) and many feeding Grey Whales *Eschrichtius robustus* and Humpback Whales *Megaptera novaeanglie*. The shearwaters were feeding mainly at the surface, but were attracted to both whale species as soon as they surfaced. Only foraging Grey Whales that emitted mud plumes held the attention of the birds for more than a few seconds; the birds rapidly lost interest in Humpback Whales and Grey Whales that were not actively foraging. The first birds arriving to a mud plume would pluck prey at the surface for up to approximately 30 seconds before other birds aggressively replaced them. Birds continued to be attracted to the mud plumes for more than one minute, but birds that arrived later seemed to spend less time in the mud plume than the first arrivals. In total, several tens of shearwaters (up to at least 54) would seek out an individual mud plume. A few Black-legged Kittiwakes *Rissa tridactyla* were also present and would actively seek out the mud plumes. These would stay in a plume longer than the shearwaters and would not be replaced by other birds, but behave aggressively against the shearwaters.

At three occasions shearwaters were also seen attracted to Grey Whale mud plumes in areas without large flocks of shearwaters. In these cases 5–6 shearwaters and as many kittiwakes would attend a feeding whale, successively moving to the next mud plume when the whale surfaced again; both

Figur 2. The local density of Short-tailed Shearwaters *Puffinus tenuirostris* in the Chukchi Sea may be very high. *Kortstjärtade liror kan förekomma i hög täthet i Tjuktjerhavet*. Photo: Jonas Bonnedahl.

the Shearwaters and Kittiwakes would remain in the previous mud plume until they could move to the next one.

Grey Whales are the only large cetaceans that are specialised bottom feeders (Evans 1982, Jones et al. 1984). When a Grey Whale surfaces after a feeding dive, sediment is strained out between the baleen creating a mud plume at the surface. Several species of seabirds are known to forage in these mud plumes (Harrison 1979, Obst & Hunt 1990), but there appears to be no previous account in literature that short-tailed shearwaters do so.

Short-tailed Shearwaters nest in the southern hemisphere and winter in the northern up to the Bering and Chukchi Seas. While wintering, the shearwaters feed mainly on euphausiids (Krill), but also consume some copepods and fish (Hunt et al. 2002). The actual food organisms used by the shearwaters foraging in mud plumes is not clear. But comparing areas with and without large flocks, the waters with large flocks contained much higher levels of chlorophyll and zooplankton as apparent from the water samples of the on-board oceanographic programme. It seems likely that the shearwaters were attracted to the area primarily because of a generally high availability of food items. As the birds were competing fiercely for a good feeding spot in a mud plume, the mud plumes must carry a substantial added foraging benefit.

It is notable that birds foraging in the mud plumes outside of the large flocks spent more time in the mud plumes and did not actively forage outside the mud plumes while the whale was at the bottom. As Obst & Hunt (1990) note, birds attending mud plumes that derive from Grey Whales foraging on benthic amphipods, either quickly lose interest in a mud plume as the larger particles of food sink, or they remain to forage on very small particles of food that remain near the surface. The difference in the behaviour of the shearwaters under the two circumstances described above may reflect differences in the types of prey fed upon by the whales. Also, the oceanographic measurements indicated that there were fewer food items outside of the mud plumes in these areas, and as the number of birds was low there was less competition for good spots in the mud plumes.

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Sammanfattning

Gråvalar *Eschrichtius robustus* är de enda stora valar som är söker föda genom att filtrera bottensediment. Då valen återkommer till ytan uppstår ett sedimentmoln då sediment pressas ut mellan barderna.

Under den svenska expeditionen “Beringia 2005” sågs flockar om flera 10 000 övervintrande kortstjärtade liror *Puffinus tenuirostris* i Tjuktjerhavet. I områden där även födosökande gråvalar förekom, sökte lirorna aktivt föda i sedimentmolnen. Kortstjärtade liror lever i första hand på krill, och i de områden där de stora flockarna av liror observerades förekom höga koncentrationer plankton. Eftersom lirorna trotts tillgången på plankton dras till sedimentmolnen måste dessa innehålla organismer som är extra attraktiva som föda. Det är sedan tidigare känt att andra havsfåglar dras till sedimentmolnen, men detta är första gången det beskrivs för kortstjärtad lira.

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