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Censuses of autumn staging and wintering goose populations in Sweden 1977/1978–2011/2012

Inventeringar av höstrastande och övervintrande gåspopulationer i Sverige 1977/1978–2011/2012

LEIF NILSSON

Abstract

Goose counts have been made in September, October, November and January since September 1977. Staging Greylag Geese *Anser anser* increased from 19 000 in 1984 to 250 000 in 2008–2010, mainly due to a corresponding population growth, and a wintering tradition was established with a maximum of 50 000 in 2008. Staging and wintering White-fronted Geese *Anser albifrons* increased from less than 3 000 to up to 40 000 and 25 000, respectively, due to a northward shift of the sites. Wintering Canada Geese *Branta canadensis* increased from less than 10 000 to a peak of 70 000 in 2009–2010, mainly an effect of the growing Swedish population. Staging of the Barnacle Goose *Branta leucopsis* is a new tradition established in autumn 2000, with no less than 150 000 in 2011. Sweden is the autumn staging area for almost the entire Taiga Bean Goose *Anser fabalis fabalis* population that has decreased in recent years. During the same period Tundra Bean Geese *A. f. rossicus* have started to stage in larger numbers, the overall counts of Bean Geese giving an impression of stability in recent years.

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Introduction

Most goose populations in Europe have shown very marked increases during recent decades (Madsen et. al 1999, Fox et al. 2010) reaching such levels that some were considered as a problem for the agriculture by causing crop damages (Hake et al. 2010, von Roomen & Madsen 1992) but this does not apply to all species. The Lesser White-fronted Goose *Anser erythropus* had decreased dramatically and disappeared as a naturally breeding species in Sweden (Andersson & Holmqvist 2010). The Taiga Bean Goose *Anser fabalis fabalis* breeding in Fennoscandia has also decreased since the early years of the 1900s (Mathiasson 1963, Nilsson & Fog 1984, Nilsson & Persson 1984). A Nordic Goose Research Group was therefore established in 1975 by the Nordic Council for Wildlife Research (Nordiskt Kollegium för Viltforskning, NKV). The main aim of the group was to study the two decreasing populations, but the Greylag Goose *Anser anser* was also included in the project (Nilsson & Fog 1984). As the Greylag Goose had started to increase in the Nordic countries as well as elsewhere in Europe a special Nordic Greylag Goose Project was later started as a continuation of the first Nordic goose research program (Anderson et al. 2001).

One important part of the work of the Nordic group was to organize regular censuses of staging and wintering geese. After a pilot study in the autumn of 1976, regular goose counts started in Sweden in September 1977 (Nilsson 1988a). The main aim was to cover all important staging and wintering areas for the Bean Goose but the counts covered all species using these areas (Nilsson & Persson 1984). A special Greylag Goose survey was included in the counts in September 1984 to obtain a proper coverage also of this species.

The Swedish goose counts like the waterfowl counts (Nilsson 2008) are now part of the census program of Goose Research Group of Wetlands International (http://www.wetlands.org/ being coordinated by national organizers in the different countries.

In the present contribution, the goose counts in Sweden during 1977/1978–2011/2012 are analyzed to elucidate the changes in numbers and distribution that has occurred over this 35 year period both nationally and regionally. I will also put the results of the Swedish Goose Counts into the international perspective to elucidate the importance of Sweden for the European goose populations. Data from the first years of the counts have previously been analyzed on a national level by Nilsson (1988a, 2000).

The counts from the earlier years of the study have been included in a major analysis of the goose populations on a European level (Madsen et al 1999), which was updated by Fox et al. (2010).

Material and methods

During the first years of goose counting in Sweden, 1977/1978–1986/1987, monthly counts were undertaken from September or October through April. The counts were concentrated to the southern parts of the country up to and including the provinces of Dalarna and Uppland (Figure 1), i.e. the part of Sweden where most major staging (and all winter) areas were found. From 1987 onwards the counts in September, October, November and January have been made in all years and in this report I will only include these months. Results including also other months have been published by Nilsson (1988a). The main aim of the September counts has been to get a full coverage of the sites used by staging Greylag Geese, whereas the October and November counts have had the same aim for the Bean Geese. The January counts are parts of the general Midwinter Counts of waterbirds. However, all species are counted at all occasions. The main emphasis on Greylag Goose in September and Bean Goose in October and November implies that the coverage of the country for some of the other species is not so complete for these months as for January. White-fronted Geese are well covered in October and November as they appear in the same areas as the Bean Geese. Coverage of the Barnacle Geese is also quite complete during these two counts. The Canada goose is less completely covered during the autumn counts than the other species, as this species stage and winter at many sites where the other species do not occur.

During later years, the counts, especially in September have been extended north along the coasts of the Bothnian Sea and the Bothnian Bay to cover relatively newly established early autumn staging sites for especially Greylag Geese.

The counts are performed on the weekend closest to the 15th of the respective month, i.e. following the rules established by Wetlands International. The counts are mostly undertaken by volunteers with a good experience of goose counting and are made as a combination of daytime counts in the feeding areas and counts of the feeding flights in the morning (or evening). In several important areas the counts are performed by a several counters that cover different parts of the total feeding area

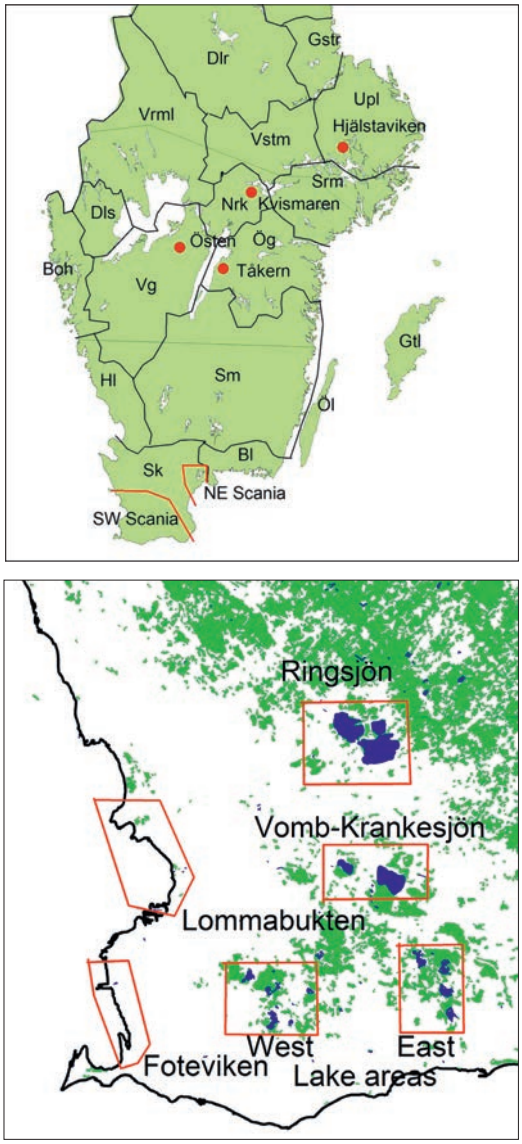


Figure 1. Map of south Sweden with the geographical position of some important goose areas and the division into provinces. A detailed map of the goose areas in SW Scania is given separately.
Sk = Skåne, Bl = Blekinge, Hl = Halland, Sm = Småland, Öl = Öland, Gtl = Gotland, Boh = Bohuslän, Dls = Dalsland, Vg = Västergötland, Ög = Östergötland, Srm = Södermanland, Upl = Uppland, Vstm = Västmanland, Nrk = Närke, Vrm = Värmland, Dlr = Dalarna, Gstr = Gästrikland.
Karta over södra Sverige med det geografiska läget för de viktigaste gåslokalerna och en indelning i landskap. En detaljkarta över gåslokalerna i SV Skåne visas separat.

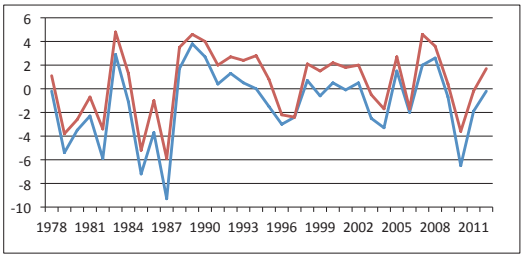


Figure 2. Monthly mean temperatures in January for ten meteorological stations in south Sweden (blue) and for Malmö, SW Scania (red).
Månadsmedeltemperaturen i januari för tio meterologiska stationer i södra Sverige (blått) samt för Malmö (rött).

in a standardized way. In areas like Lake Tåkern, where counts are made during the morning flight, several counters cover different sectors together counting all geese flying out from the lake to the feeding areas.

Counts on the evening and morning flights are biased towards the more common species especially as the geese fly to and from their nighttime roosts in dense flocks when it is quite dark. Thus a species like the Pink-footed Goose *Anser brachyrhynchus* will be underestimated at these sites. Moreover it is difficult or almost impossible to separate the Taiga Bean Geese *Anser fabalis fabalis* from the Tundra Bean Goose *A. f. rossicus* during such conditions. Accordingly the two forms of Bean Goose are not separated in the presentation below even if the appearance of Tundra Bean Geese in the flocks will be addressed based on special surveys in the feeding areas aiming to separate the two forms.

To supplement the results from the regular counts, the Species Gateway (Artportalen.se) has been searched for information on newly established staging and wintering areas leading to some new sites being included in the network of covered sites.

Details of the counts during the first ten years can be found in Nilsson (1979, 1981, 1984b, 1986, 1988a, 1988b), whereas details for later years are to be found in the annual reports from the projects. These can be downloaded from the project homepage, where also more detailed information of the results can be found: http://www.zoo.ekol.lu.se/waterfowl/index.htm

In presenting the results, the sites in SW and NE Scania are mostly presented as two units but the analysis has sometimes been based on separate sites. The delimitation of the two regions in Scania and the geographical position of some other important goose sites mentioned in the text are found in Figure 1.

The weather and especially the snow cover is an important factor influencing the distribution of the geese during winter. It is especially the depth of snow over feeding areas and freezing of the snow surface that is of great importance. Details on the weather situation during the goose counts are to be found in the different reports referred to above.

As a proxy to the hardness of the winter I present monthly mean temperatures for January (Figure 2) for ten different stations in the southern part of Sweden (north to Stockholm–Örebro) and for Malmö in southernmost Sweden. The temperatures for Malmö will represent the province of Scania where most wintering geese in Sweden are found.

During the first years of the goose counts, there was a series of cold winters with low January temperatures: 1979, 1982, 1985 and 1987. After that there was no real cold winter until 2010 and 2011 but there were some winters that also had monthly means below zero for the southernmost part of the country. The winters 1979, 1982 and 2011 (and to some extent 2012) were especially hard for the geese with the surface layer of the snow freezing for some periods.

When the year of a whole winter is given in this paper the year of the month of January is intended (the period September–January). Hence the winter 1978 is the winter 1977/1978. Note, however, that when time series of single months are dealt with, it is the actual year that is intended.

Results

Since the start of the regular goose counts in 1977/1978, the total number of geese staging in Sweden has increased markedly. For October, the five-year means of the counts have increased from 49 000 to 350 000 and for the November from 45 000 to 194 000 (Table 1). As the number of staging Canada Geese was quite low when the counts started and as many important sites have not been surveyed in more recent years the increase has probably been larger. Taking coverage of species like Canada Geese into account, the increase was probably larger than shown by these figures. However, note that this increase is governed by three species, Greylag, Canada and Barnacle Goose whereas the fourth numerically predominant species, the Bean Goose, has had a rather stable population. A still

Table 1. Five-year means of the total number of geese of different species counted in south Sweden in September (only *Anser anser*), October, November and January 1977/1978–2011/2012
Femårs medeltal för antalet inräkade gäss av olika arter i södra i september (enbart grågås), oktober, november och januari 1977/1978–2011/2012.

First winter	**1977/78**	**1982/83**	**1987/88**	**1992/93**	**1997/98**	**2002/03**	**2007/08**
Last winter	**1981/82**	**1986/87**	**1991/92**	**1996/97**	**2001/02**	**2006/07**	**2011/12**
September							
Anser anser	No count	22771	38234	55117	96958	168509	210163
October							
Anser anser	136	2028	6767	23604	47889	85265	131717
Anser fabalis	44418	53900	63667	60733	52284	46425	61487
Anser brachyrhynchus	30	50	13	17	92	124	537
Anser albifrons	1625	10970	3952	5754	10931	8864	9324
Anser erythropus	3	4	2	3	27	14	6
Branta canadensis	2837	3827	5376	8825	13004	17047	30064
Branta leucopsis	103	53	322	2405	10051	36846	117415
Branta bernicla	73	222	87	358	149	292	799
Branta ruficollis	+	+	0	+	+	+	0
Total October	49225	71054	80186	101699	134427	194877	351349
November							
Anser anser	26	593	1278	1997	9032	35275	55096
Anser fabalis	40091	35058	41395	38617	34169	45563	37725
Anser brachyrhynchus	21	24	13	26	54	121	172
Anser albifrons	1966	12559	2857	6918	18033	17991	18425
Anser erythropus	1	2	+	4	12	+	0
Branta canadensis	2697	3737	4669	8446	21131	29859	38933
Branta leucopsis	58	55	252	744	14198	19841	43947
Branta bernicla	6	4	4	12	33	36	53
Branta ruficollis	+	0	0	+	+	0	0
Total November	44866	52032	50468	56764	96662	148686	194351
January							
Anser anser	22	26	146	425	3071	14599	33419
Anser fabalis	12697	11990	28917	19279	20974	25700	29001
Anser brachyrhynchus	3	9	24	12	32	70	82
Anser albifrons	403	391	1130	2067	3388	5851	6079
Anser erythropus	+	0	+	0	X	+	+
Branta canadensis	5106	9916	13771	12151	27756	39151	50021
Branta leucopsis	2	7	23	46	117	1254	4837
Branta bernicla	1	0	0	+	+	1	1
Branta ruficollis	0	0	+	0	0	+	0
Total January	18234	22339	44011	33980	55338	86626	123440

larger increase has been noted for the number of wintering geese, from 18 000 to 123 000. However, this larger increase probably depends on the larger number of really cold winters during the early compared to the later years of the survey.

Greylag Goose *Anser anser*

At the first national survey of the Greylag Goose in September 1984 a total of about 19 000 individuals was counted. In the following September years marked increases were found (Figure 3) and a peak was reached with about 237 000 individuals in 2009. However, the actual peak total was most probably about 250 000 or even more, taking coverage of the counts into consideration. The total for 2010 was on the same level, but much lower in 2011, about 180 000. This decrease might be related to the cold winters in 2009/2010 and 2010/2011, affecting the condition of the geese and their breeding result. January 2011 was not so cold as January 2010 but it was preceded by a very cold December 2010 and had difficult snow conditions for the geese. Even if some Greylags were counted in October during the first years, the coverage was not adequate before 1984. October counts were low in the early eighties, but as for September an increase was found although it started somewhat later, numbers peaking in 2008 with about 160 000. November totals were long quite low and only during the last 10 – 15 years was there an increase up to a peak of about 68 000 in 2010 (Figure 3). Increasing totals for October and November are related to a later migration of the Greylag Geese in later years.

In a regional breakdown of the September counts (Figure 4), the same tendencies as in the national pattern were found in SW Scania, Östergötland, Södermanland and Uppland, whereas the other regions had very few staging Greylags during the first years of the survey. Later they all showed the same type of increase as in the national total of which they form a part. In some regions numbers leveled off during later years. In Södermanland this happened around 2002.

In Scania, important numbers were found staging in the SW already at the start of the counts in 1984 (Figure 4), whereas very few were found in the NE until the early 1990s and in the NW until 1996. In SW there was a steady increase up to 2005 and in NE until 2000. In NW the increase was more sudden and soon leveled off. The counts in SW Scania, which was completely covered in the same way in all years (being the main study area for the Swedish part of the Nordic Greylag Goose Project (Andersson et al. 2001, Nilsson & Persson 1994), give a good illustration of the establishment of new staging areas in a region (Figure 1 and 5). During the first years of the study, the majority of the staging Greylags were found in the West and East Lake areas (Figure 1), and at Lake Ringsjön whereas only few were found in the coastal area at Foteviken (for details see Nilsson & Persson 1992, 1998). Numbers during autumn in the West lake area, Ringsjön and Foteviken showed a similar increase as in the regional and national totals, but there were marked fluctuations between years. The East lake area showed fluctuations around a relatively low level until 2002, when much larger numbers were found here especially in early autumn.

In the early years, hardly any Greylags were using the Vomb-Krankesjön area and Lommabukten (coastal area) for staging. Numbers at Vomb-Krankesjön started to increase during the early 1990s, whereas a staging tradition in Lommabukten (at least two flocks) was established in the late 1990s. Especially October counts were high in this area with a maximum total of more than 30 000.

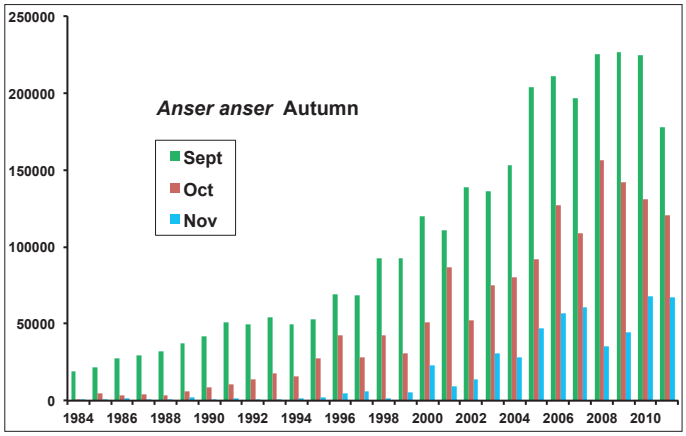
During the first three decades, the September counts were markedly concentrated to the eastern parts, Lake Tåkern and SW Scania (Figure 6). During the years more and more staging areas were established in different parts of the country especially in the major agricultural areas around the large lakes Vänern, Vättern, Hjälmaren and Mälaren. Only few staging areas were found in the forested province of Småland, but over the years the Greylags spread and in September 2010 they were well distributed all over southern Sweden (Figure 6). Greylags also established staging sites along the coasts of the Bothnian Sea and Bothnian Bay (Figure 7).

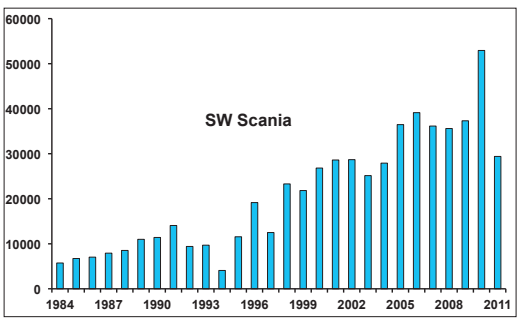
The distribution in October (Figure 8) was similar to that in September, but the flocks remaining north of Scania were much fewer and smaller. Moreover, there were no coastal flocks in SE Sweden in the first two decades in contrast to the situation in September..

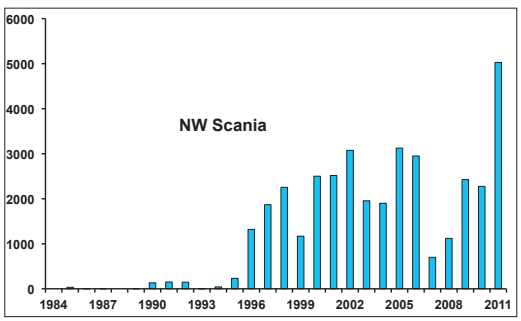
In November few Greylag Geese were counted during the surveys before 2000 (Figure 3), but from that year higher numbers remained. They were concentrated in coastal areas (Figure 9), especially in 2010 when November was a relatively cold month compared to the much milder November 2005.

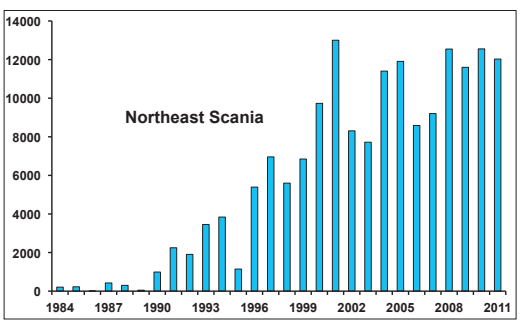
In January, very few Greylags were counted before the late 1990s (Figure 10). The numbers increased rapidly and 40 000 to 50 000 individuals were counted in some of the later winters. The majority of the wintering Greylag Geese were found in Scania and along the coasts of southernmost Sweden (Figure 11). Even in the really cold January of 2011 with freezing snow surface no less than 10 000 Greylags remained (in Scania).

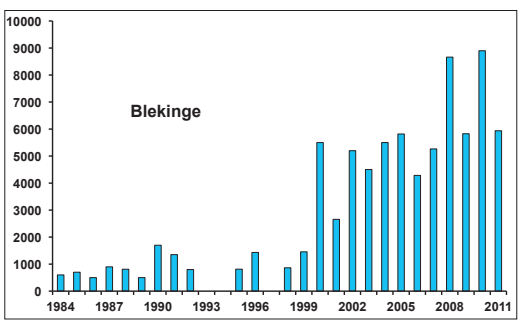
Figure 3. Number of Greylag Geese *Anser anser* counted in Sweden in September, October and November 1984–2011.
Antal grågäss räknade i Sverige vid inventeringar i september, oktober och november 1984–2011.

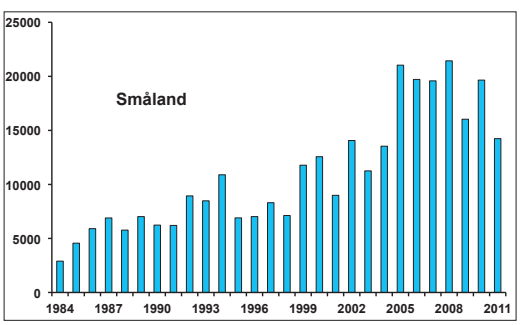


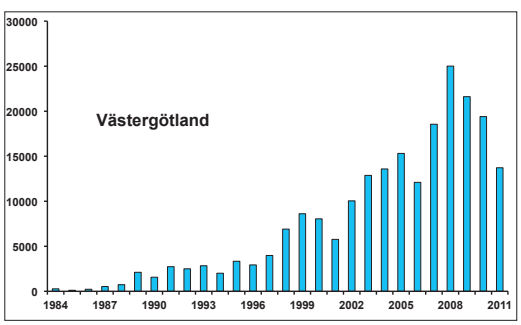


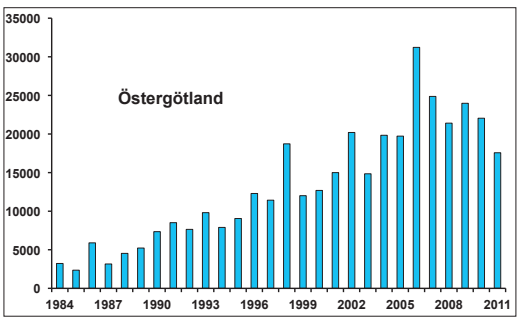


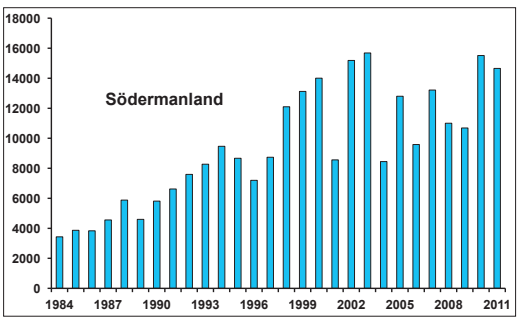


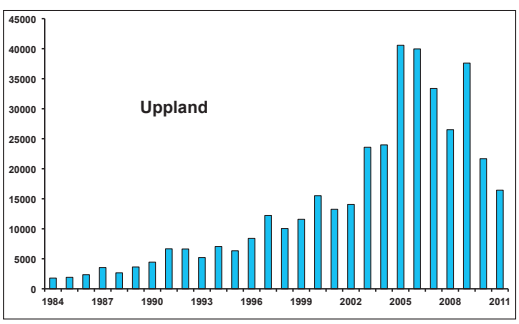


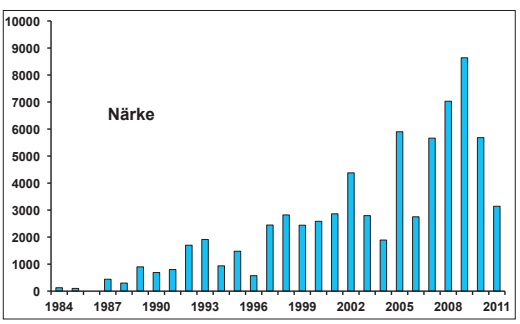


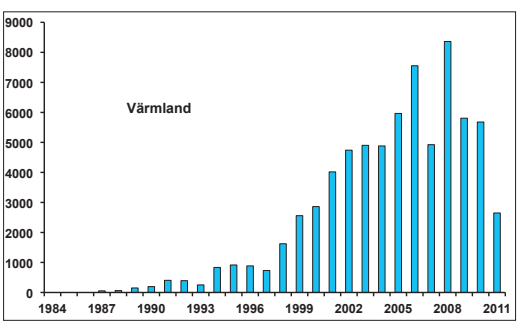












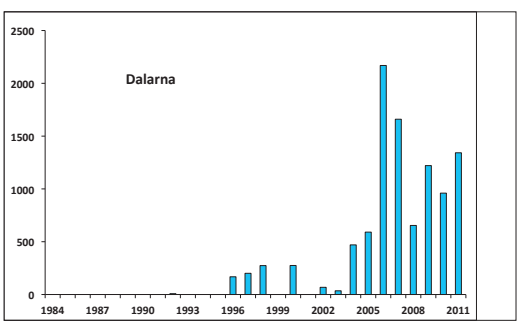


Figure 4. Number of Greylag Geese *Anser anser* counted in different regions of south Sweden in September 1984–2011. *Antalet grågäss räknade inom olika regioner i Sverige i september 1984–2011.*

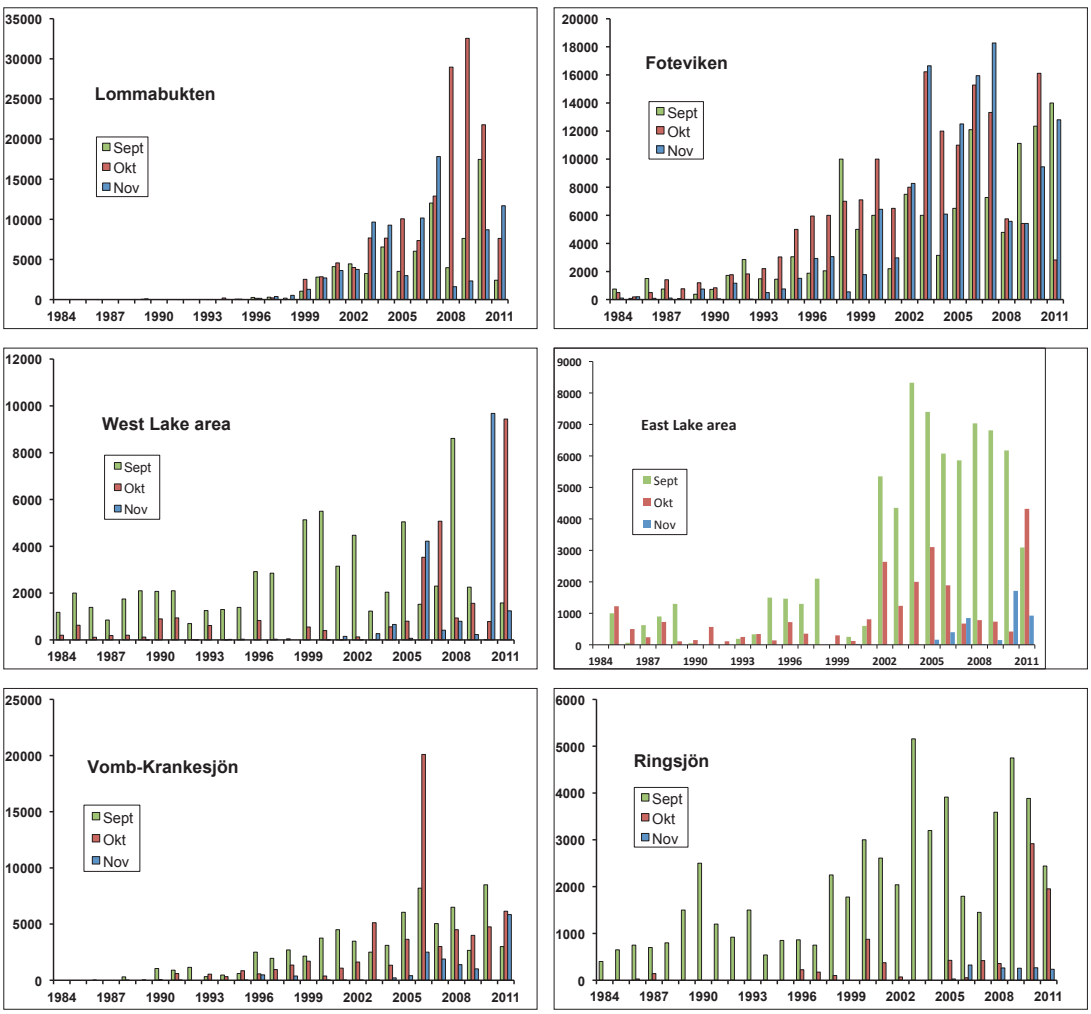


Figure 5. Number of Greylag Geese *Anser anser* counted in different areas in SW Scania in September 1984–2011. For geographical position of the areas see Figure 1.
Antalet grågäss räknade på olika lokaler i SW Skåne i september 1984–2011. Lokalernas läge framgår av Figur.1.

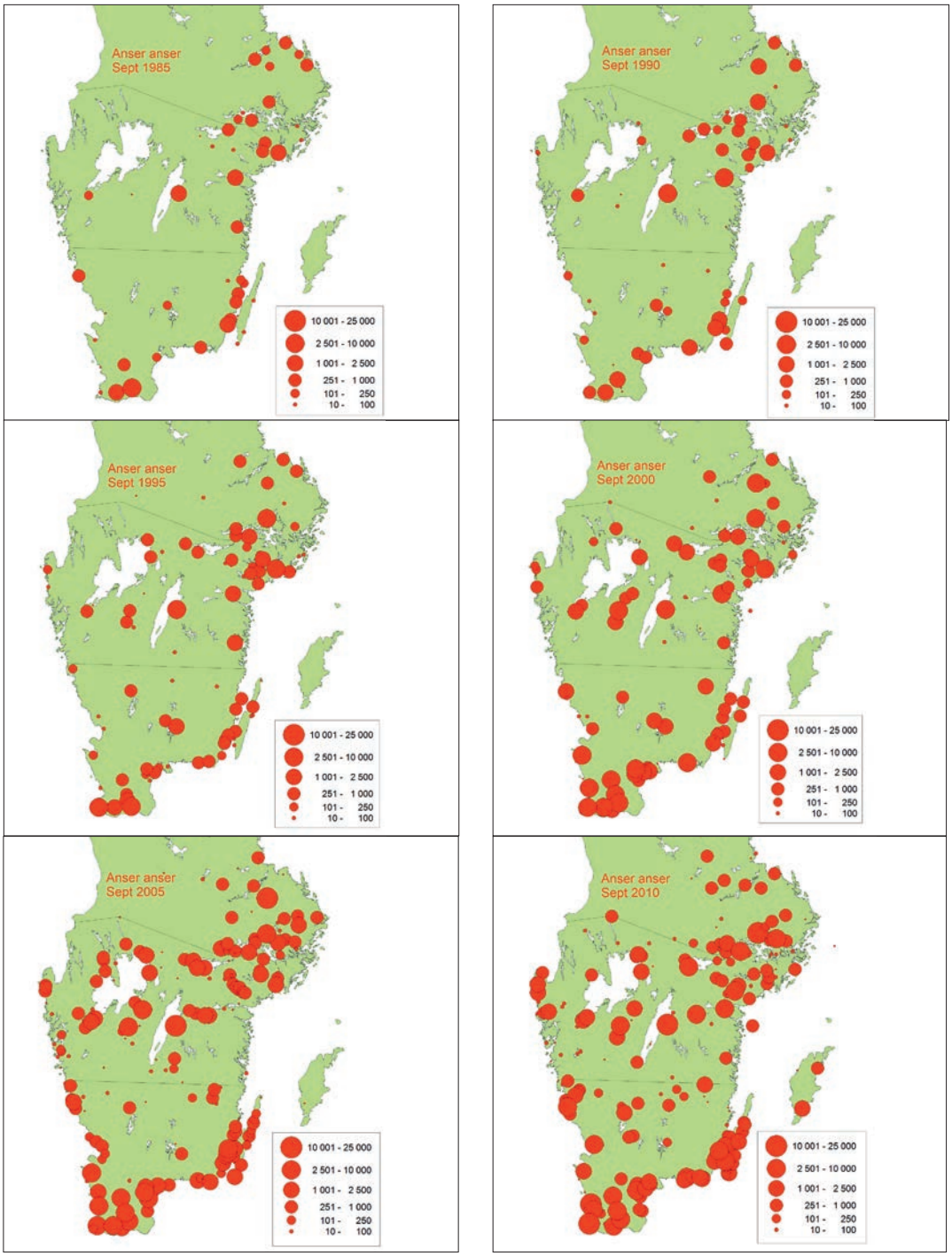


Figure 6. The distribution of Greylag Geese *Anser anser* in south Sweden in September during different years.
Grågåsens utbredning i södra Sverige i september under olika år.

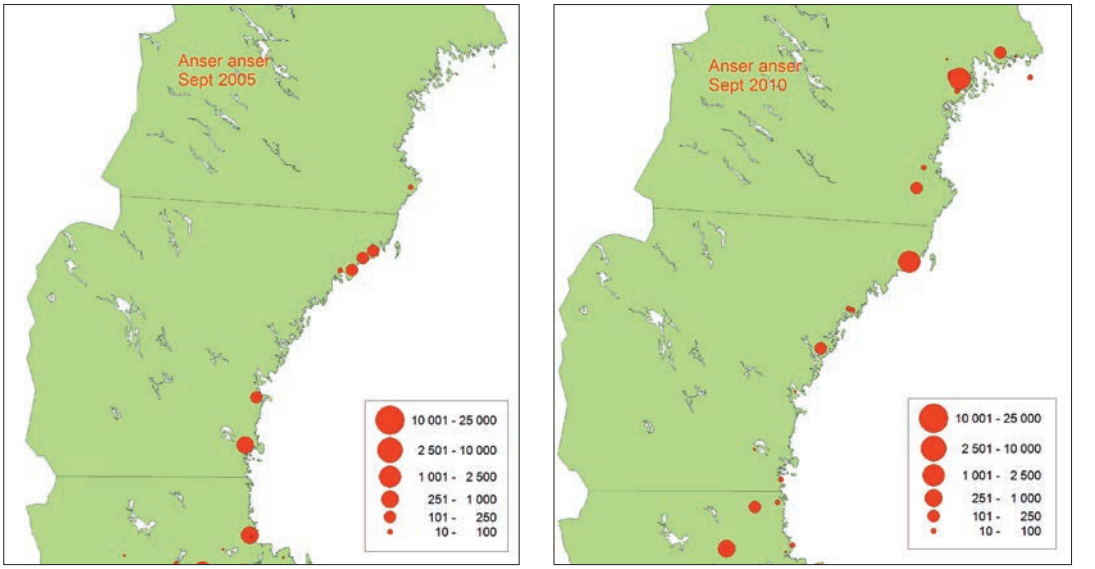


Figure 7. The distribution of Greylag Geese *Anser anser* in Northern Sweden in September 2005 and 2010.
Grågåsens utbredning i norra Sverige i september 2005 och 2010.

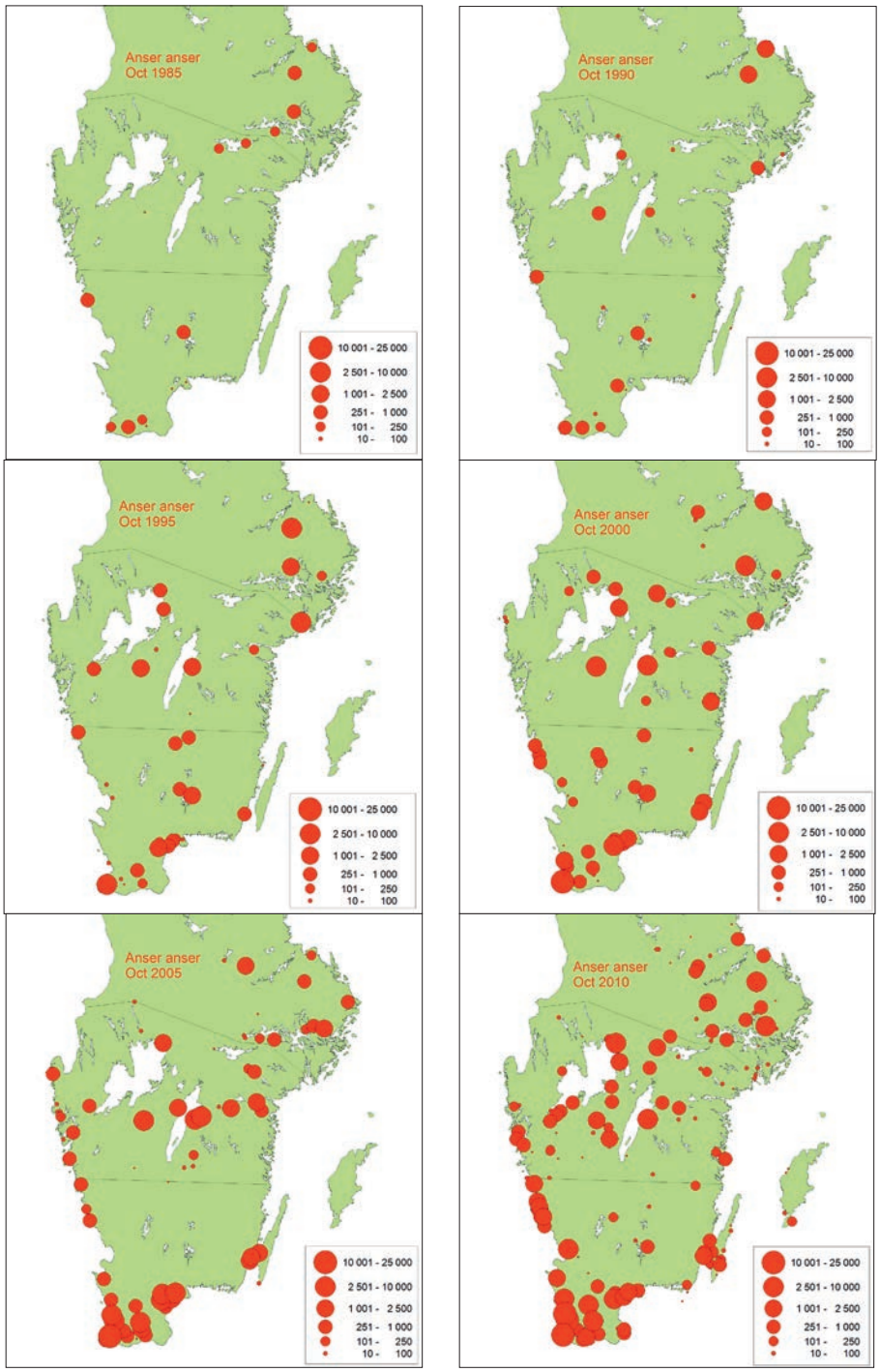


Figure 8. The distribution of Greylag Geese *Anser anser* in south Sweden in October during different years.
Grågåsens Anser anser utbredning i södra Sverige i oktober under olika år.

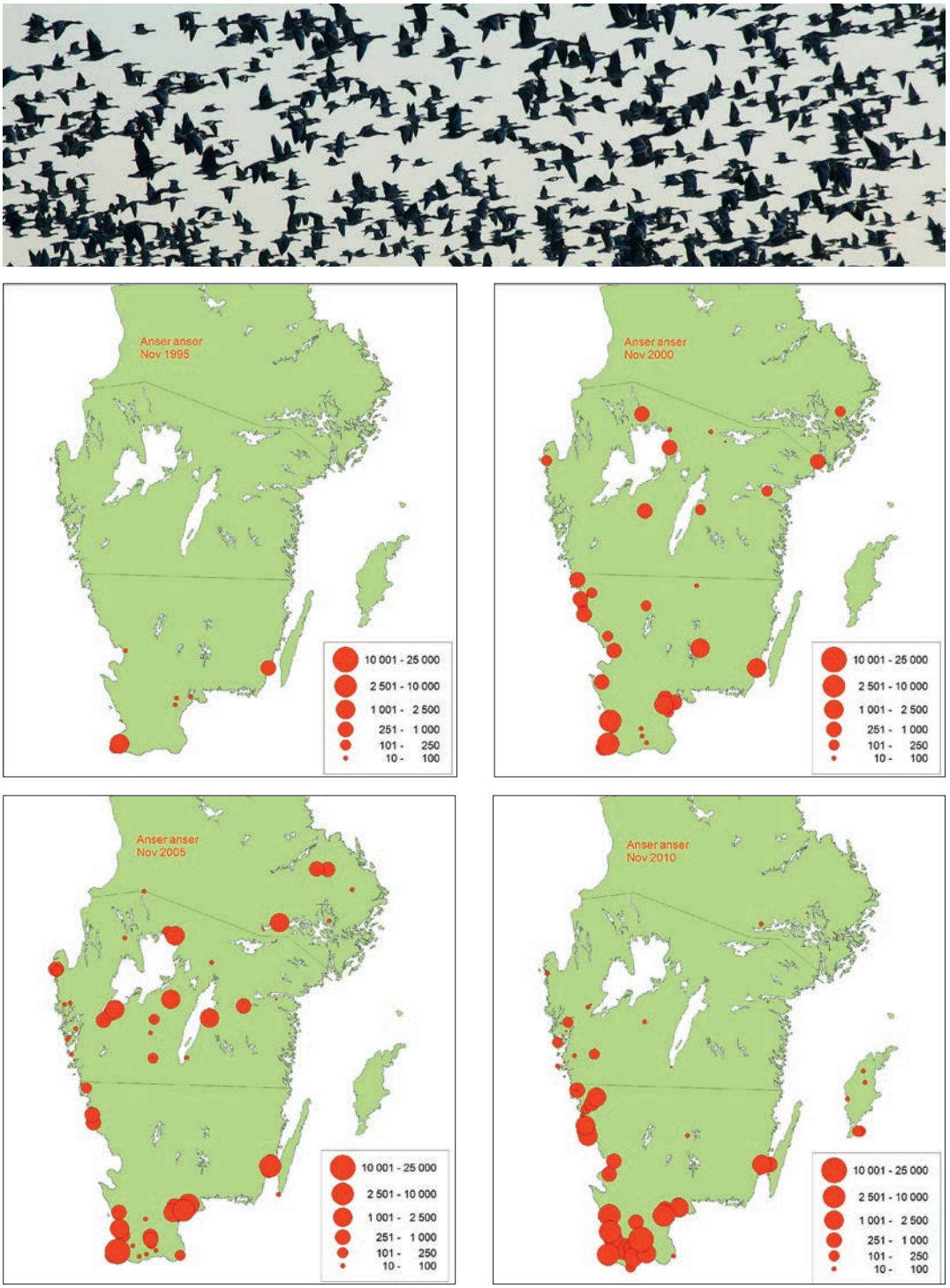


Figure 9. The distribution of Greylag Geese *Anser anser* in south Sweden in November during different years.
Grågåsens utbredning i södra Sverige i november under olika år.

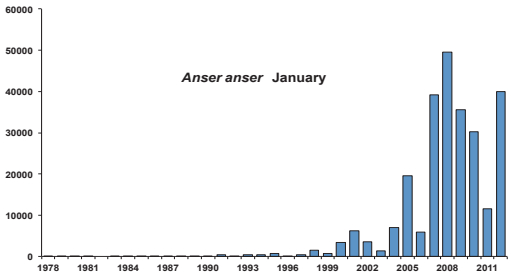


Figure 10. Number of Greylag Geese *Anser anser* counted in South Sweden in January 1978–2012.
Antalet grågäss räknade i södra Sverige i januari 1978–2012.

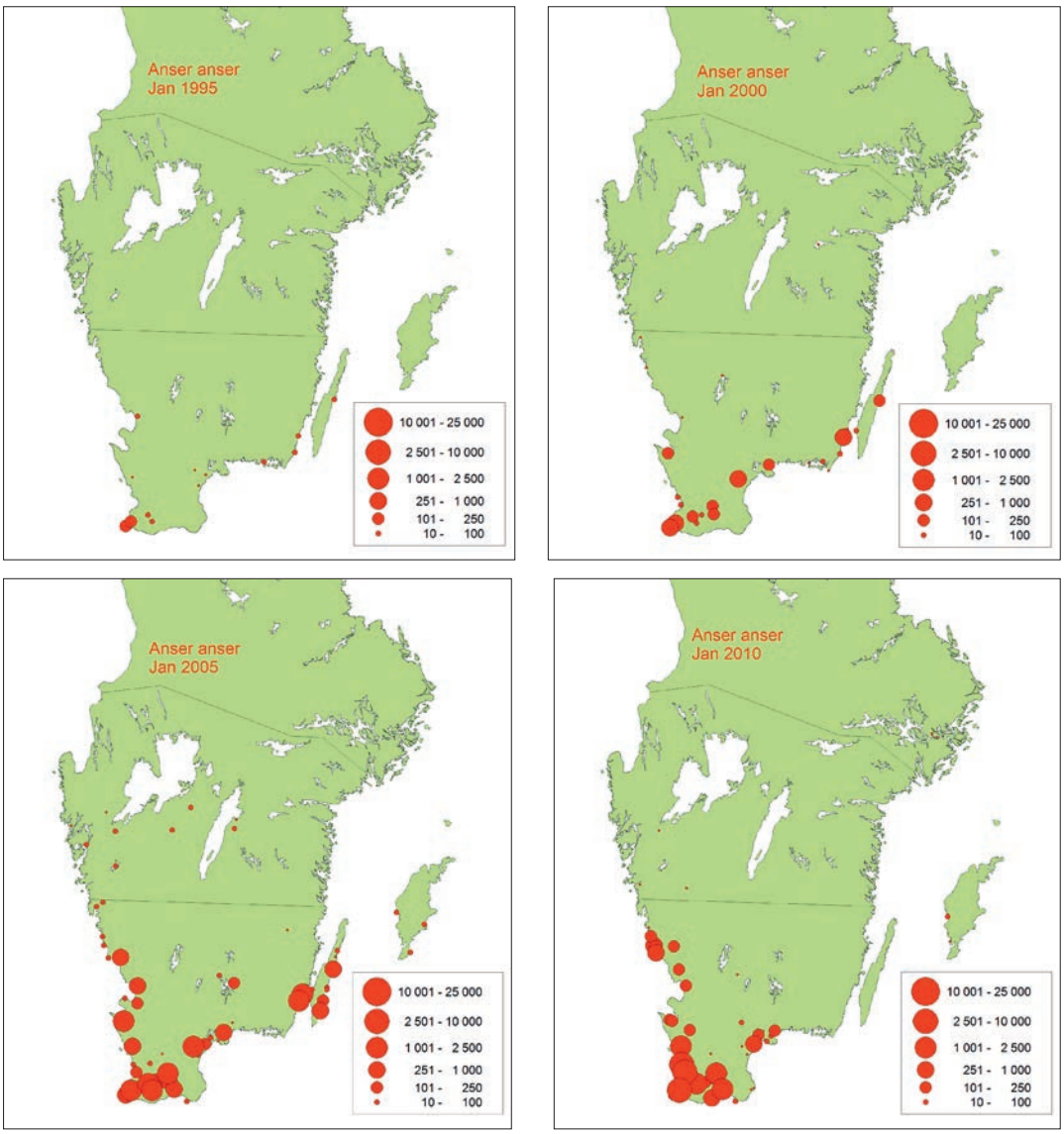
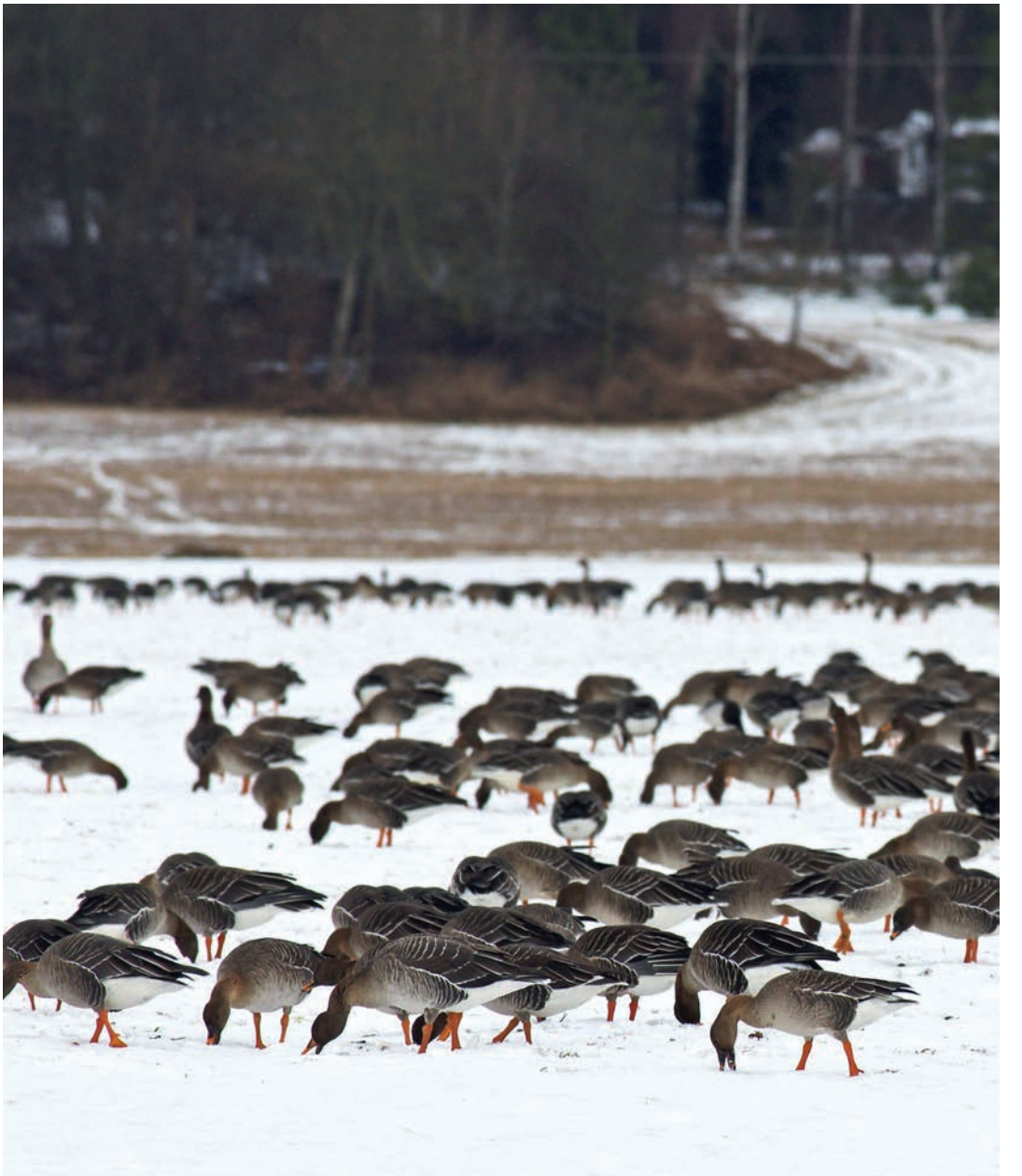


Figure 11. The distribution of Greylag Geese *Anser anser* in south Sweden in January during different years.
Grågåsens utbredning i södra Sverige i januari under olika år.



Bean Goose *Anser fabalis*

The majority of the staging Bean Geese in south Sweden migrate into the country from Finland arriving into the provinces of Uppland and Södermanland, but smaller numbers migrate south through the country from the breeding areas in northern Sweden and maybe also in northernmost Finland (Nilsson 1984a, Nilsson 2011, Nilsson & Pirkola 1991). The first flocks appeared in south Sweden during September, but the counts in this month do not give an adequate coverage of the species as many birds still remain in their breeding areas.

The number of staging Bean geese in south Sweden was highest in October, two years being an exception showing the highest total in November (Figure 12). During the first three years, October totals were somewhat below 50 000, but in November 1978 60 000 was reported. Numbers were appreciably lower in 1980 and 1981, i.e. the years after the exceptionally hard winter 1978/1979, which was characterized by high mortality (Nilsson 1984), the geese probably being in bad condition in following years leading to low productivity. Numbers in October then increased steadily and the highest total in the series, 76 000, was reached in October 1989. After the peak the counts show a decreasing trend until 2006, with one exceptionally high count in October 2001. In the last five years, four years again had appreciably higher October totals than the years before (see below!).

November totals have generally been appreciably lower than the October counts (with two exceptions), numbers normally fluctuating between 30 000 and 50 000, 1978 and 2005 being exceptions with about 60 000 and 58 000 Bean Geese at the November counts (Figure 12).

Until about 1990 SW Scania and Tåkern were the most important staging areas in October (Figure 13 and 14) . After the first years the totals for SW Scania decreased markedly and from the early 1990s only small numbers were counted. October totals for NE Scania were also low.

In the same period as numbers decreased in SW Scania, they increased at Lake Tåkern, where they peaked at close to 50 000 in 1988. Before 1976, data from Tåkern are few, but they seem to have started using the area for staging in the early 1970s (Nilsson & Persson 1984). During the early 1980s Lake Östen and two sites in the province or Närke (the most important being Kvismaren) were established as autumn staging areas (Figure 13), both these areas were well-known as spring staging areas for Bean Geese at least since before the 1960s (Nilsson & Persson 1984). After 1990, numbers staging at Tåkern decreased rapidly, numbers using Lake Kvismaren and to some extent Lake Tysslingen in Närke and Lake Östen increasing during the same period (Figure 13). Another important staging area was also established at Lake Hjälstaviken. The Bean Geese also started to use some other staging areas in south Sweden (Figure 14 and 16).

Even if the November counts on a national level showed marked fluctuations around a national level of about 40 000 (30 000– 50 000 in most years), the regional pattern was different from October and was much influenced by the appearance of the first major frost in Sweden north of Scania. In SW Scania, November counts showed the same decrease as the October counts, but it started later and was not so marked (Figure 14, 15). During the first years, when November counts in SW Scania were still fairly high, counts from NE Scania were relatively low, but then higher totals were found here. There was however a marked variation between years in the November counts in different regions, most probably related to the occurrence of cold weather further north in south Sweden. With the exception of 1978, Tåkern had much lower counts in November than in October as was the also the case for Kvismaren, even if the number of Bean Geese remained high in some years. Östen on the other hand had good numbers in November in most years since the autumn staging tradition here was established in the mid-1980s.

The distribution maps for October (Figure 16) show a concentration to SW Scania during the early period with new sites established in year 1990 and a concentration to areas further north in south Sweden in 2000. October 2010 in general shows a similar picture, but there are more Bean Geese in NE Scania than in the years before. The November counts show a more variable picture between years (Figure 17), but the general tendency for the geese to stay further north than Scania is very clear from the maps.

The number of wintering Bean Geese in (south) Sweden has shown much variation between years from almost none in the hard winters of 1982 and 1987 to about 40 000 in the mild winters 2007 and 2008 (Figure 18). The number of Bean Geese counted in January was positively correlated with the mean temperatures in Scania for that month (Figure 19). Actually the geese are probably reacting more to the snow conditions but the mean temperature can work as a proxy for the hardness of the winter.

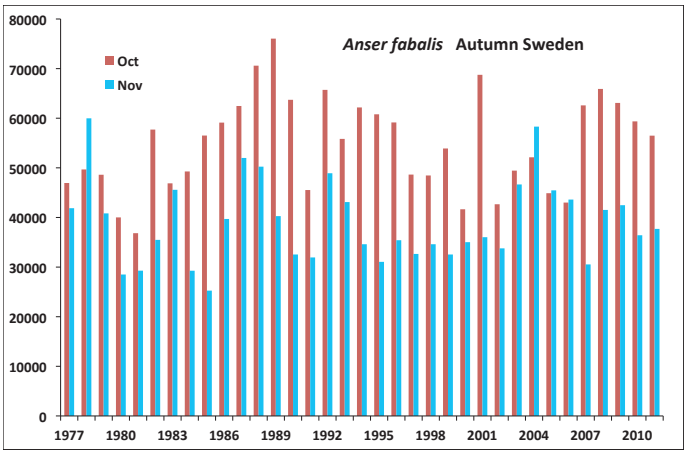


Figure 12. Number of Bean Geese *Anser fabalis* counted in south Sweden in October and November 1977–2011.
Antalet sädgäss räknade i södra Sverige i oktober och november 1977–2011.

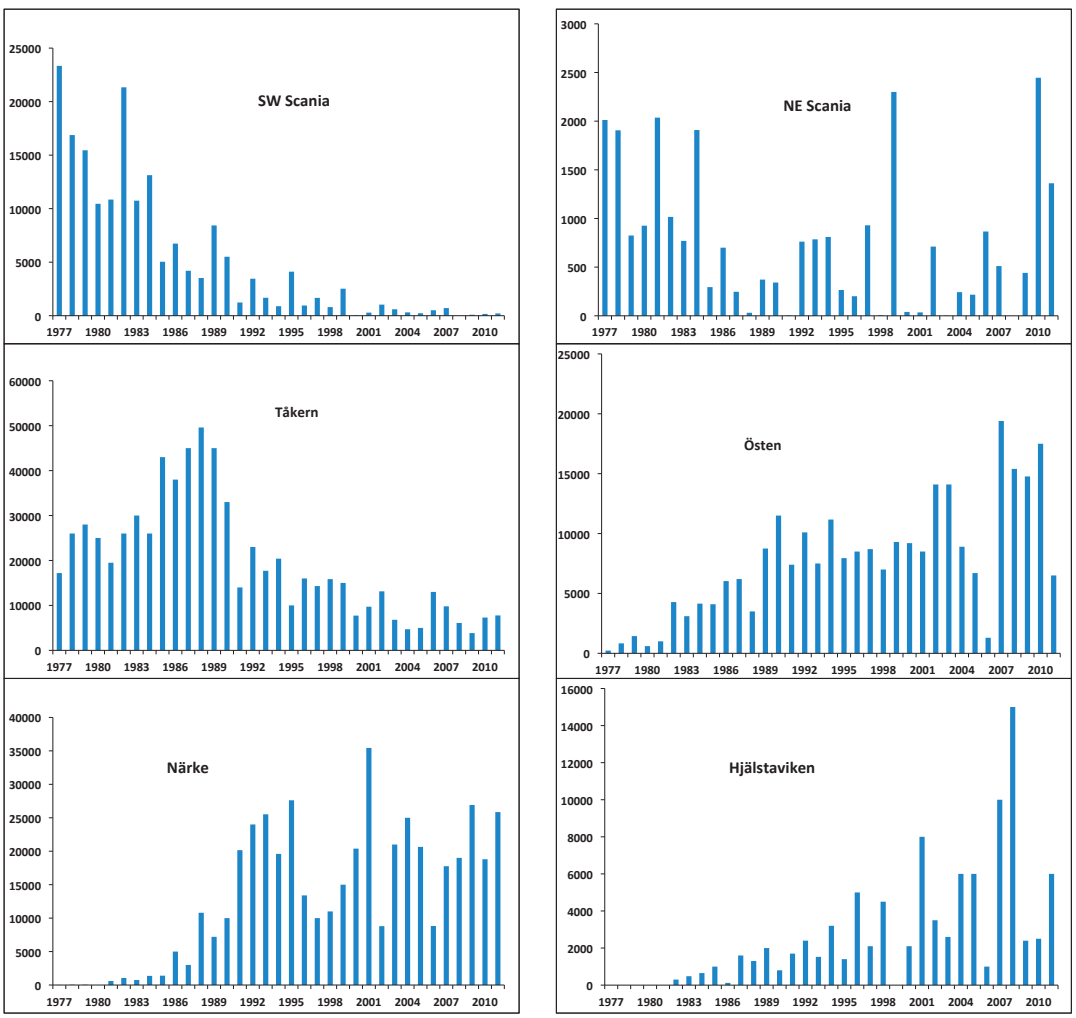


Figure 13. Number of Bean Geese *Anser fabalis* counted in different regions of south Sweden in October 1977–2011.
Antalet sädgäss räknade inom olika regioner i Sverige i oktober 1977–2011.

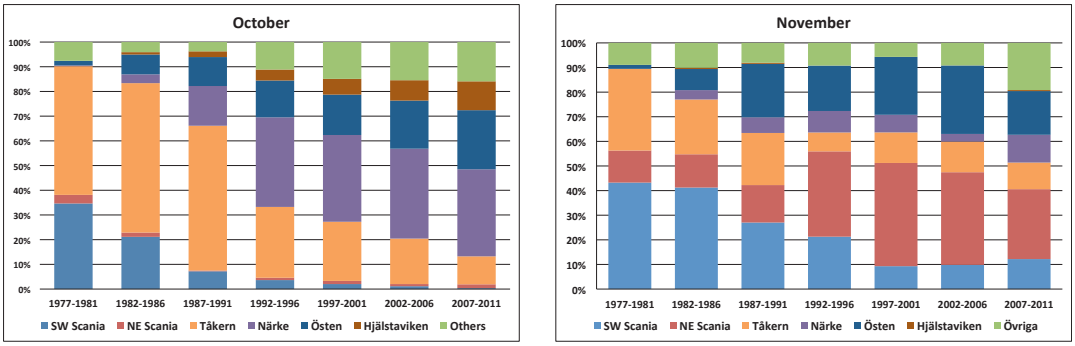


Figure 14. Percentage distribution of the number Bean Geese *Anser fabalis* counted in different regions of south Sweden in October and November in different time periods. For the geographical position of the regions see Figure 1.
Procentuell fördelning av antalet inräknade sädgäss inom olika regioner av södra Sverige i oktober och november under olika tidsperioder. För det geografiska läget av de olika områdena se figur 1.

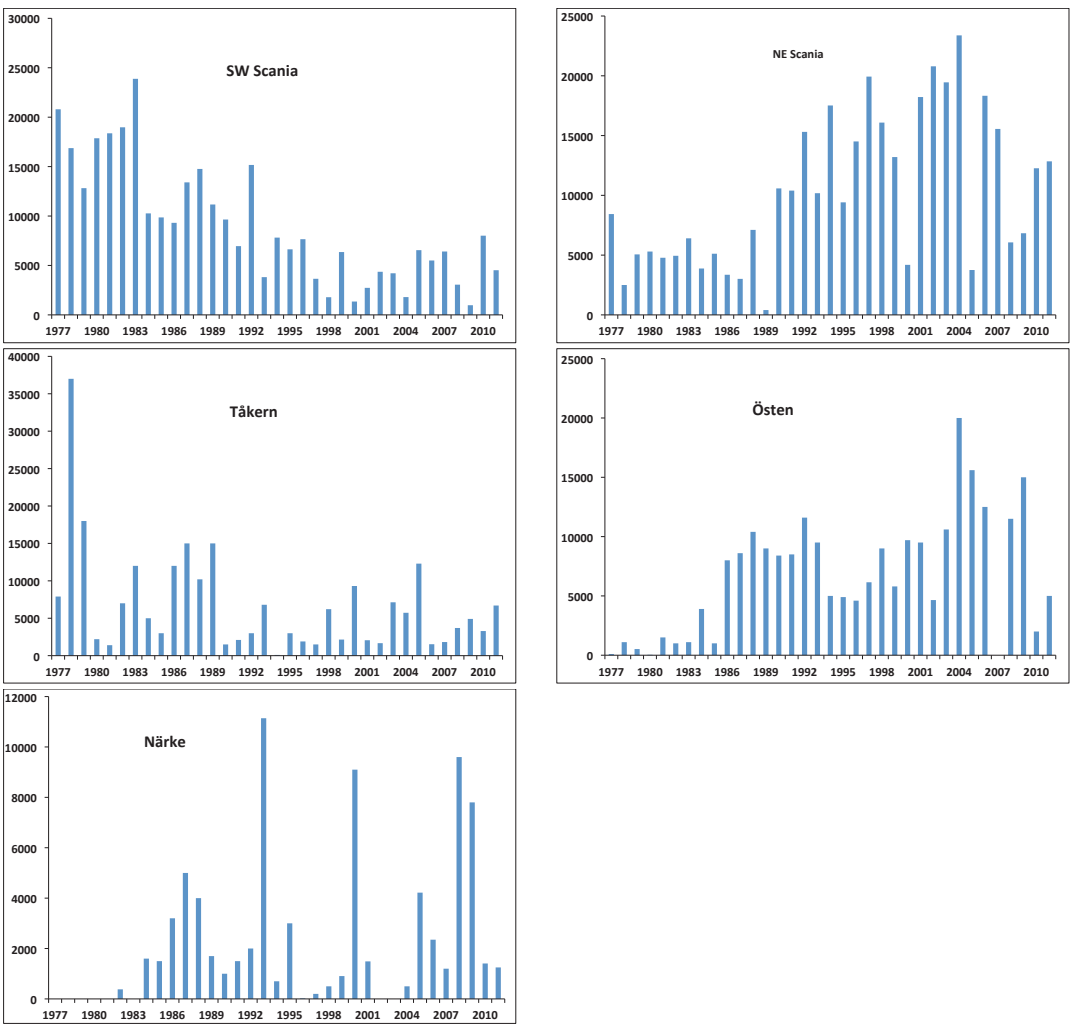


Figure 15. Number of Bean Geese *Anser fabalis* counted in different regions of south Sweden in November 1977–2011.
Antalet sädgäss räknade inom olika regioner i Sverige i november 1977–2011.

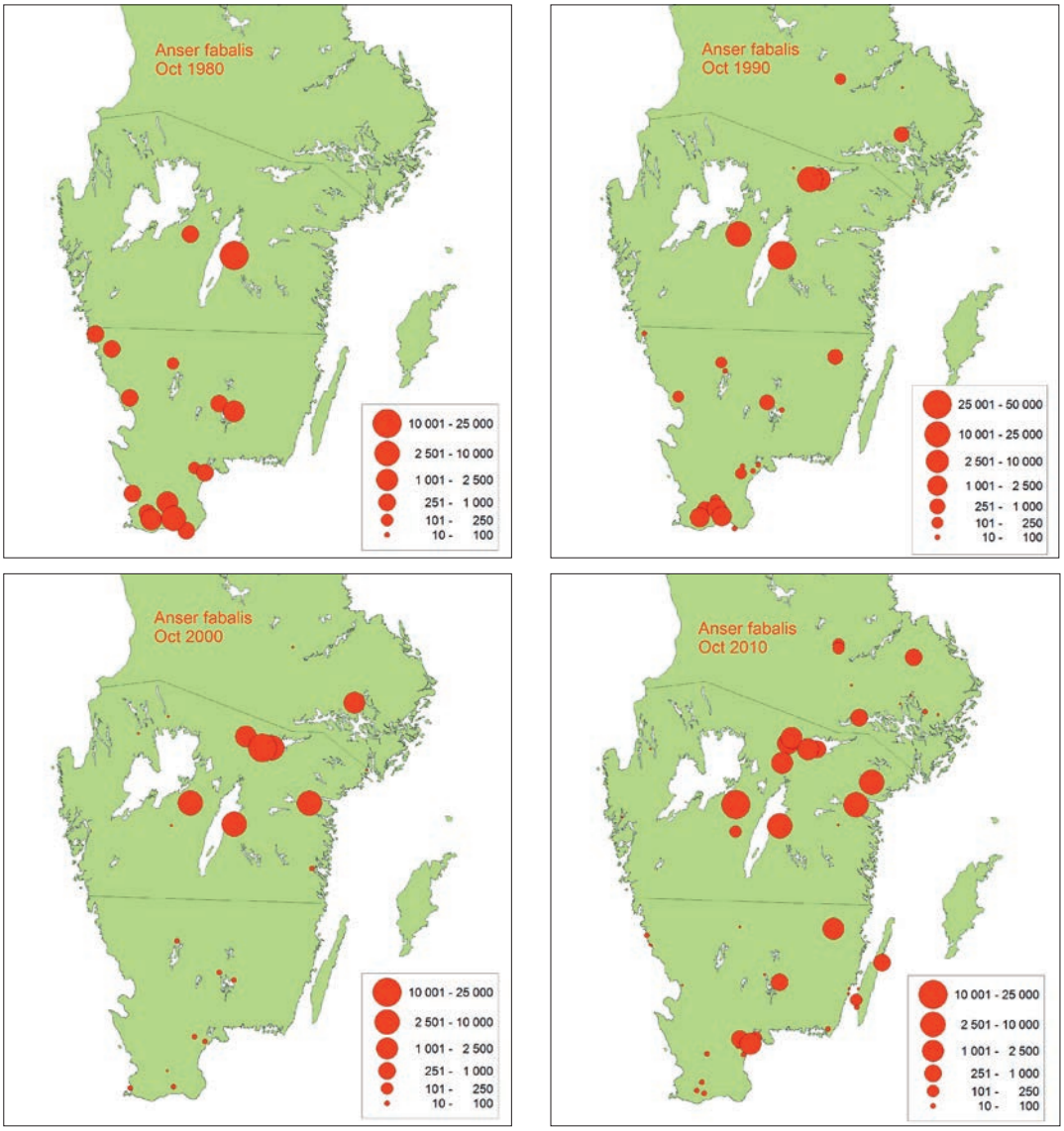


Figure 16. The distribution of Bean Geese *Anser fabalis* in south Sweden in October during different years.
Sädgåsens utbredning i södra Sverige i oktober under olika år.

Outside Scania wintering Bean Geese were sometimes also found on some sites in south Sweden (Figure 20) but the areas in NE and SW Scania dominated markedly (Figure 21). There were no clear changes in the proportion of Bean Geese using the two main areas in Scania (Figure 21 and 22), but the Bean Geese evacuated NE Scania more often than the areas in the SW, where the winters were somewhat more benign and especially there was less snow cover in the SW. The Bean Geese left SW Scania during winter in two years, whereas no or very few Bean Geese were found in NE Scania during three more years.

As already stated above, Tundra Bean Geese cannot be separated from the more common Taiga Bean Geese when the counts are made on morn-

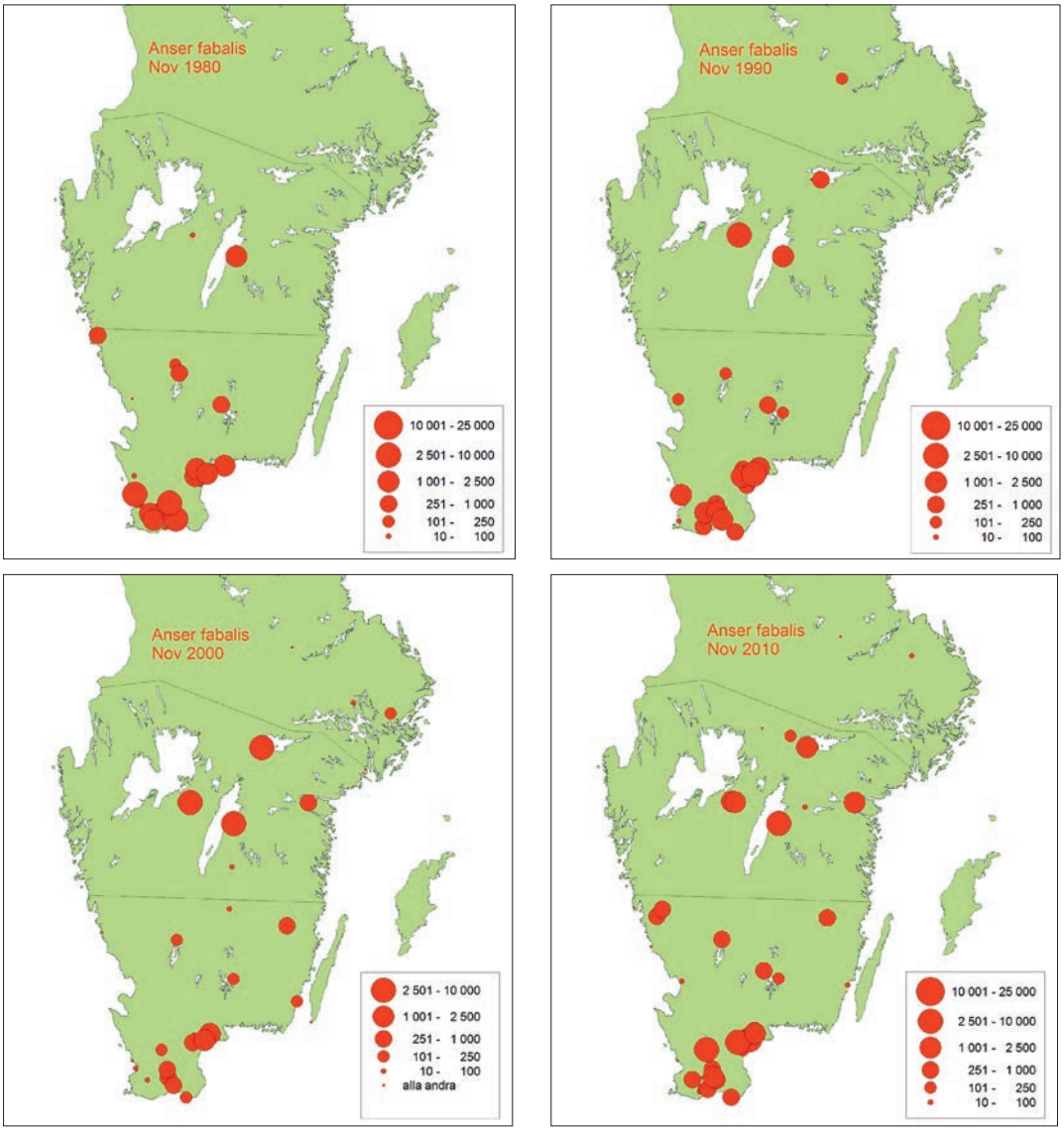


Figure 17. The distribution of Bean Geese *Anser fabalis* in south Sweden in November during different years.
Sädgåsens utbredning i södra Sverige i november under olika år.

ing or evening flights. During the last three seasons special daytime surveys of important Bean Goose sites in south Sweden were undertaken with the aim to check for the occurrence of Tundra Bean Geese and to read neckbands (Thomas Heinicke pers. com.). In the autumns of 2009/2010–2011/2012, between 5 763 and 9 195 Tundra Bean Geese were identified mainly at the three main staging areas Kvismaren, Östen and Tåkern (Table 2, Table 3). Similarly more than 5 000 Tundra Bean Geese were identified in January 2012 mostly in NE Scania (Hammarsjön). In SW Scania, where the counts were undertaken on the fields, very few Tundra Beans were usually encountered (Persson 1990, 1997).

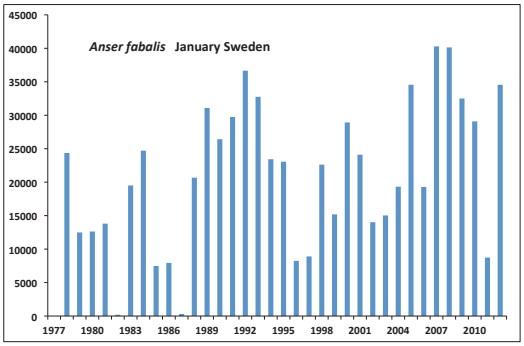


Figure 18. Number of Bean Geese *Anser fabalis* counted in south Sweden in January 1978–2012.
Antalet sädgäss räknade i södra Sverige i januari 1978–2012.

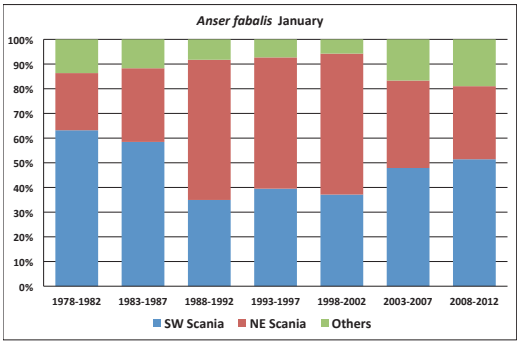


Figure 21. Percentage distribution of the number Bean Geese *Anser fabalis* counted in different regions of south Sweden in January in different time periods. For the geographical position of the regions see Figure 1.
Procentuell fördelning av antalet inräknade sädgäss inom olika regioner av södra Sverige i januari under olika tidsperioder. För det geografiska läget av de olika områdena se figur 1

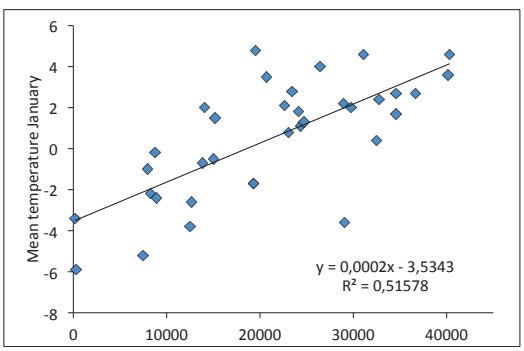


Figure 19. Correlation between the numbers of Bean Geese *Anser fabalis* counted in south Sweden in January 1978–2012 and the mean temperatures for January in Malmö.
Korrelation mellan antalet sädgäss inräknade i södra Sverige januari 1978–2012 och medeltemperaturen för januari i Malmö.

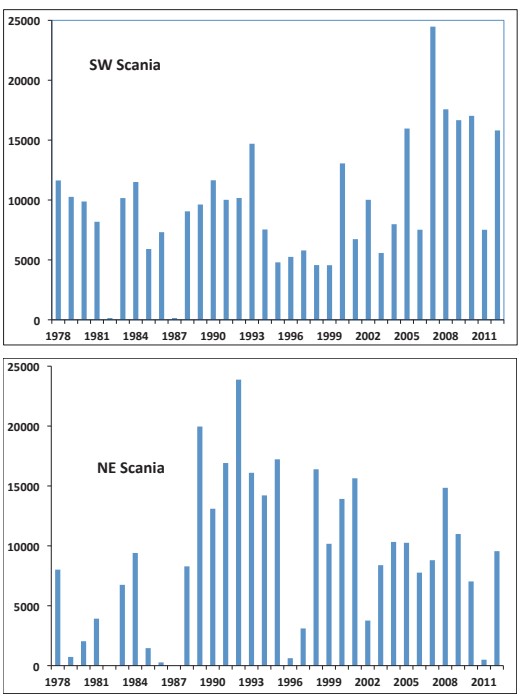


Figure 22. Number of Bean Geese *Anser fabalis* counted in SW and NE Scania (see Figure 1) in January 1978–2012.
Antalet inräknade sädgäss i SW och NE Skåne (se Figur 1) i januari 1978–2012.

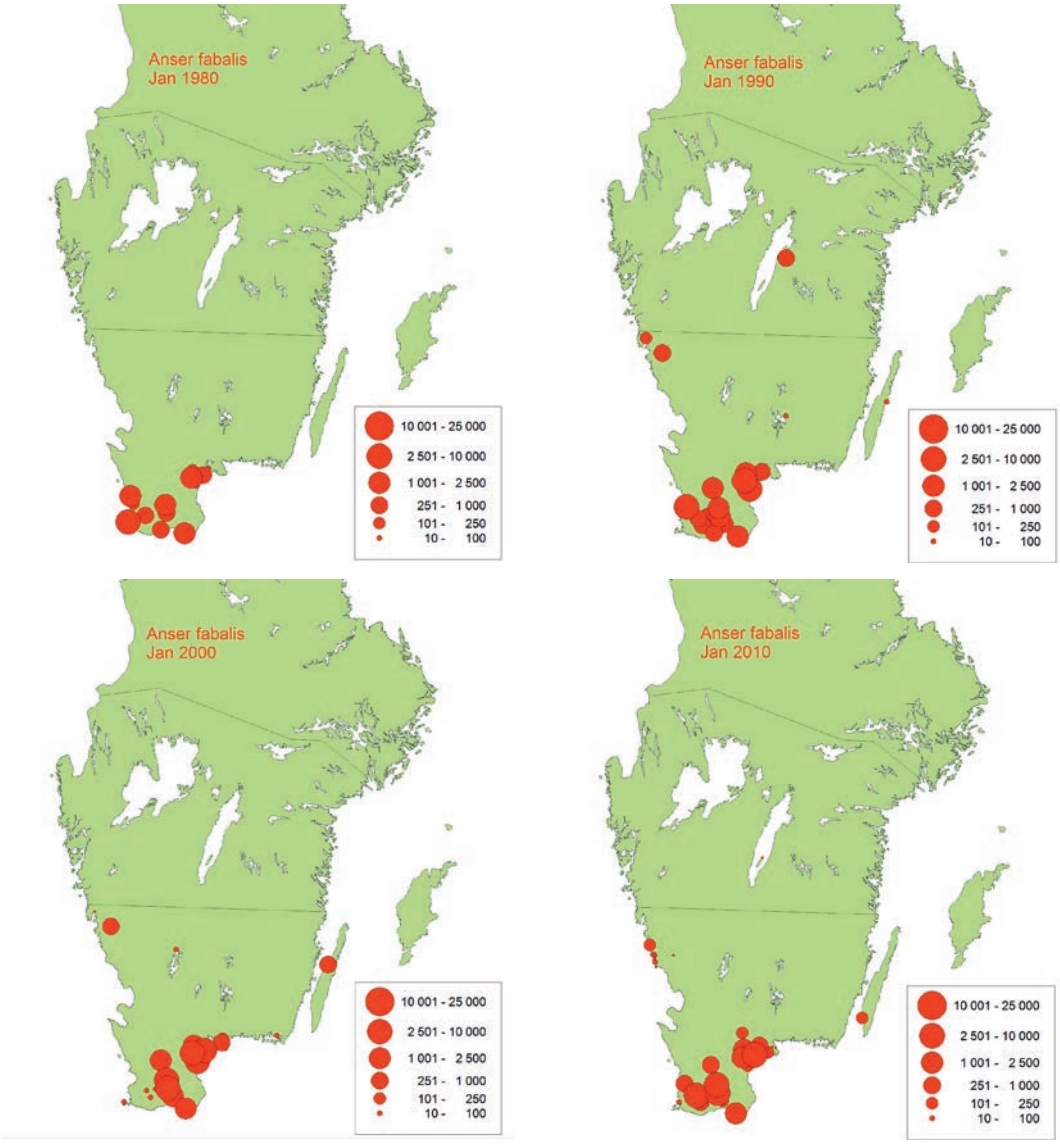


Figure 20. The distribution of Bean Geese *Anser fabalis* in south Sweden in January during different years.
Sädgåsens utbredning i södra Sverige i januari under olika år.

Table 2. Number of Tundra Bean Geese *Anser fabalis rossicus* counted in south Sweden 2009/2010–2010/2011 (Thomas Heinicke pers. com.).
Antalet tundrasädgäss Anser fabalis rossicus inräknade i södra Sverige 2009/2010–2010/2011 (Thomas Heinicke pers. com.).

	October	November	January	Remark
2009–2010	9195		1208	
2010–2011	5763	5433	61	Severe winter
2011–2012	7793	4455	5373	Mild winter

Table 3. Monthly maximum counts of Tundra Bean Geese *Anser fabalis rossicus* at four sites in south Sweden 2009/2010–2011/2012(Thomas Heinicke pers. com).
Månadsmaximum för antalet tundrasädgäss Anser fabalis rossicus på fyra lokaler I södra Sverige 2009/2010–2011/2012 (Thomas Heinicke pers. com.).

	October	November	January
Kvismaren	4090	0	-
Östen	2732	6	-
Tåkern	2340	185	-
Hammarsjön	14	5042	4988

Pink-footed Goose *Anser brachyrhynchus*

Pink-footed Geese occur regularly in small numbers in south Sweden during autumn and winter (Figure 23 and 24) but the species is probably to a large degree overlooked in the counts on several sites, especially in the large concentrations of Bean Geese at areas like Tåkern, Kvismaren and Östen, where the counts are made during the flights from the roosts. Until the mid-nineties only small numbers were counted in October but during the last few seasons up to 800 have been recorded in the survey (Figure 23). When counting large number of Bean Geese in the morning flights e.g. at Lake Tåkern, many Pink-footed Geese are probably overlooked and therefore the counts presented here are most probably underestimates. As an example, in connection with searches for neck-banded Bean Geese at Lake Tåkern in the 1970s it was estimated that up to 500 Pink-footed Geese occurred in the area.

The Pink-footed Geese are found on a number of sites in south Sweden during the October and November counts as exemplified in Figure 25. Most observations are reported from the traditional goose staging areas but there are also records of Pink-footed Geese staging on temporary sites in western Sweden outside the traditional goose sites. There are also reports of staging Pink-footed Geese reported in September from sites in northern Sweden east of the mountain chain.

Midwinter counts of Pink-footed Geese were generally low but in five of the winters 2005 – 2012 more than 100 were counted (Figure 24), almost all in Scania.

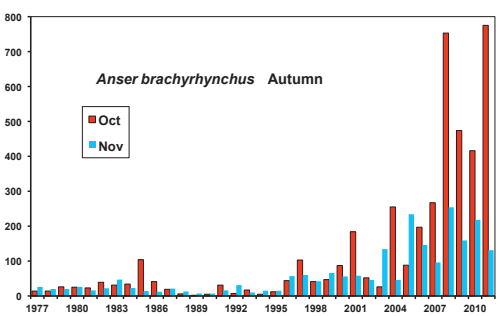


Figure 23. Number of Pink-footed Geese *Anser brachyrhynchus* counted in south Sweden in October and November 1977–2011.
Antalet spetsbergsgäss räknade i södra Sverige i oktober och november 1977–2011.

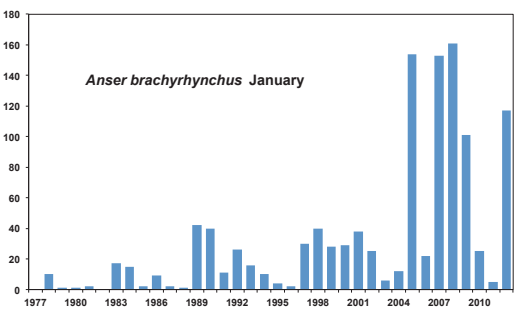


Figure 24. Number of Pink-footed Geese *Anser brachyrhynchus* counted in south Sweden in January 1978–2012.
Antalet spetsbergsgäss räknade i södra Sverige i januari 1978–2012.

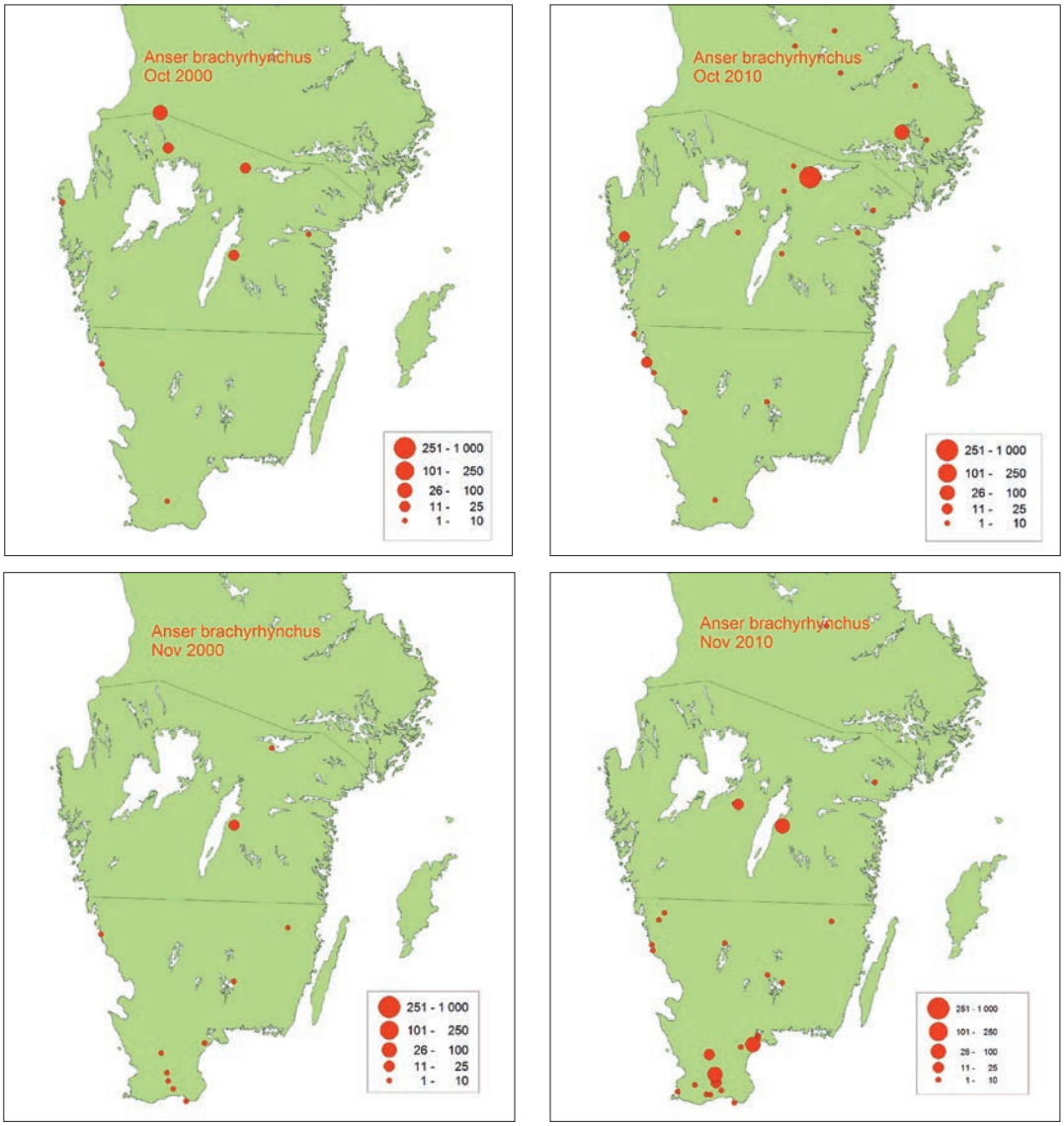


Figure 25. The distribution of Pink-footed Geese *Anser brachyrhynchus* in south Sweden in October and November 2000 and 2010.
Spetsbergsgåsens utbredning i södra Sverige i oktober och november 2000 och 2010.

White-fronted Goose *Anser albifrons*

The White-fronted Goose is a regular visitor in south Sweden during migration periods when large flocks have been staging mainly in SW Scania (Figure 26, 28 and 29). Before 2000, autumn counts were mostly relatively low even if more than 5000 individuals were counted on some occasions but then numbers increased markedly. There was much variation between years both in October and November, totals for the latter month being highest in most years. The maximum total counted was between 35 000 and 40 000 (November 1999). The White-fronted Goose flocks quite often stay in Sweden for a relatively short time and there are several observations of large staging flocks in between the census periods.

In most years only small numbers remained during the winter and the species more or less completely left the country during the hardest winters

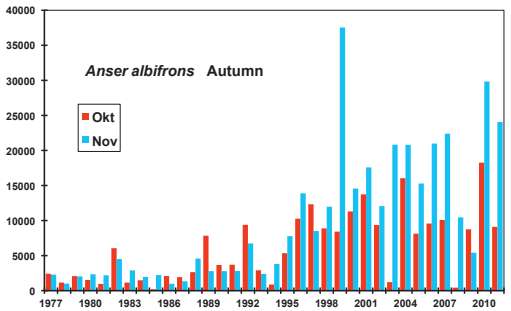


Figure 26. Number of White-fronted Geese *Anser albifrons* counted in south Sweden in October and November 1977–2011.
Antalet blässgäss räknade i södra Sverige i oktober och november 1977–2011.

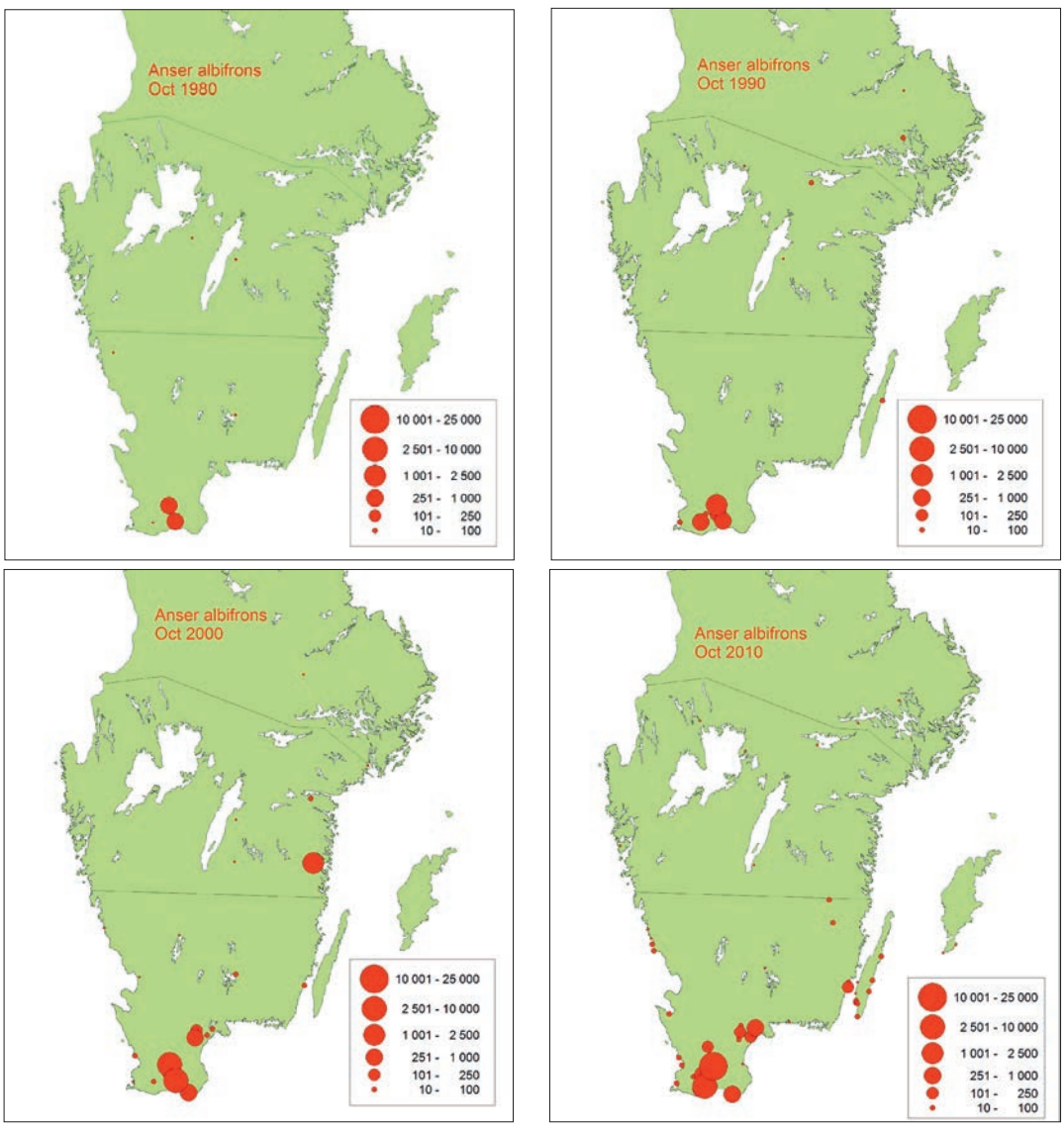
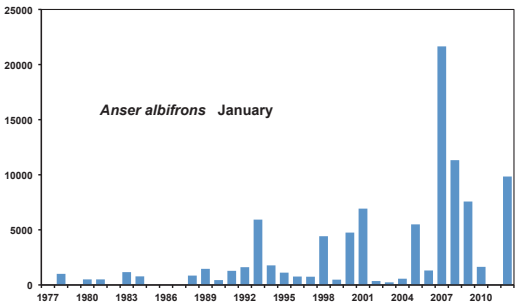


Figure 28. The distribution of White-fronted Geese *Anser albifrons* in south Sweden in October in different years.
Blässgåsens utbredning i södra Sverige i oktober under olika år.

Figure 27. Number of White-fronted Geese *Anser albifrons* counted in south Sweden in January 1978–2012.
Antalet blässgäss räknade i södra Sverige i januari 1978–2012.



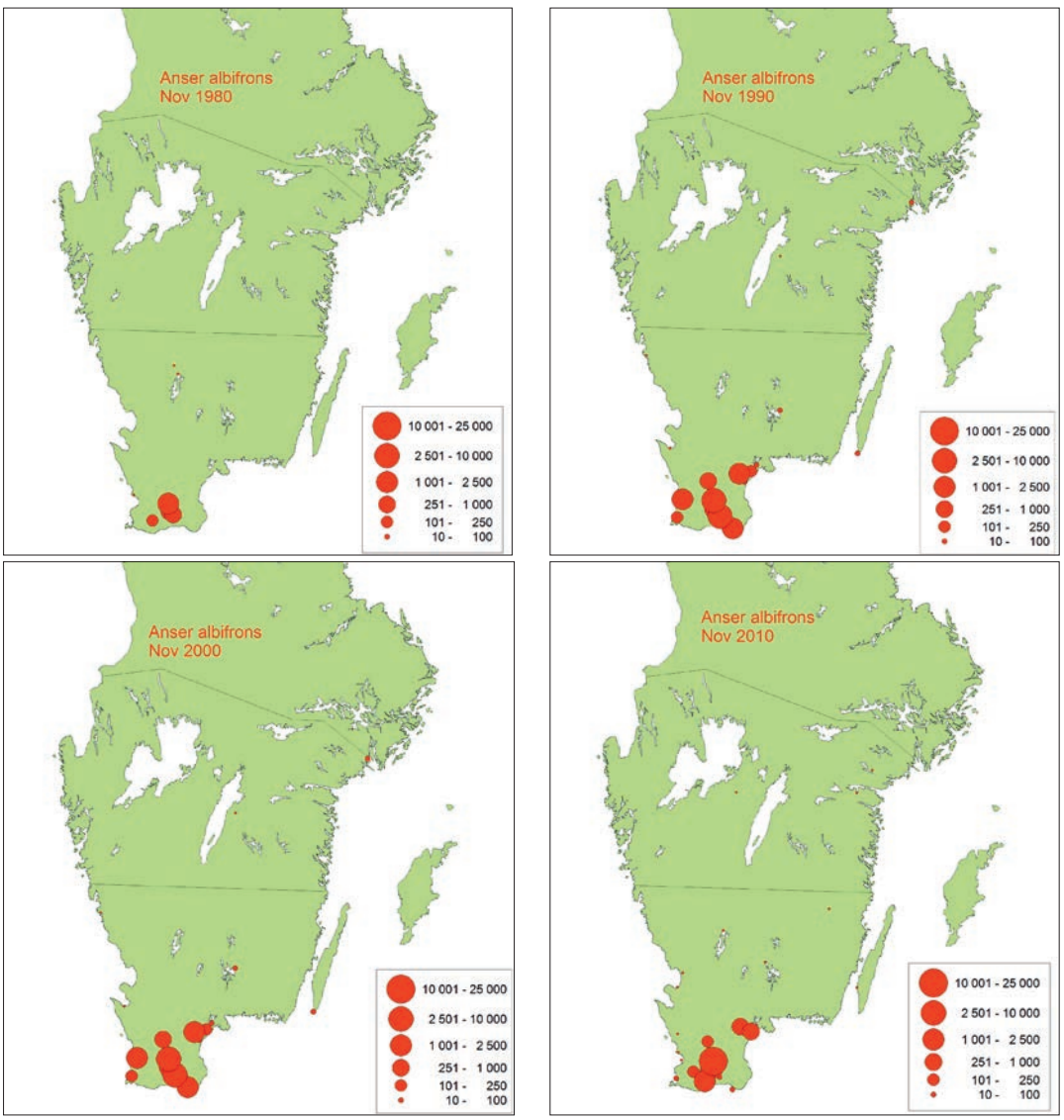


Figure 29. The distribution of White-fronted Geese *Anser albifrons* in south Sweden in November in different years.
Blässgåsens utbredning i södra Sverige i november under olika år.

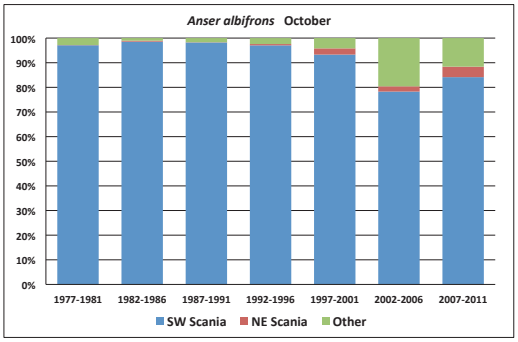


Figure 30. Percentage distribution of the number White-fronted Geese Anser albifrons counted in different regions of south Sweden in October in different time periods. For the geographical position of the regions see Figure 1.
Procentuell fördelning av antalet inräknade bläsgäss Anser albifrons inom olika regioner av södra Sverige i oktober under olika tidsperioder. För det geografiska läget av de olika områdena se Figur 1.

(Figure 27). In milder winters some larger flocks remained and more than 2000 individuals were counted in 9 out of the 35 winters covered by the surveys, all these winters occurred in the latter part of the census period. The highest count for January was noted in the mild winter of 2007 with between 20 000 and 25 000.

The staging White-fronted Geese were markedly concentrated in Scania and during the early part of the census they were only found in any numbers in the SW and central part of the province (Figure 28, 29 and 30). In later years, some October flocks were found in other parts of south Sweden (Figure 30) but in November they were markedly concentrated to Scania with dominance for SW Scania even if they became more common in NE when numbers started to increase in the country.

Lesser White-fronted Goose *Anser erythropus*

The Lesser White-fronted Goose is a rare visitor to the goose staging areas in south Sweden, most of the individuals observed evidently emanating from the re-introduction program (Andersson & Holmqvist 2010). Normally only single individuals or small groups were found at the regular goose counts, but during 1997/1998 – 2006/2007 somewhat more individuals were reported (Table 1).

Canada Goose *Branta canadensis*

The introduced Canada Goose increased markedly since the start of the counts (Figure 31 and 32) and is now common on the staging and wintering sites. In October and November the species is spread over a large part of the country (Figure 33 and 34) but these counts (being organized to cover all important Bean Goose areas) do not give enough coverage to make it possible to calculate reliable national totals. In January on the other hand the species is more concentrated to the southern part of the country and is well covered by the counts (Figure 35).

Both the autumn (Figure 31) and the January (Figure 32) counts indicate more or less exponential increase in the population, peak counts for the autumn sites being close to 40000 in October and between 40 000 and 50 000 in November. In January the highest total was more than 70 000 in 2009.

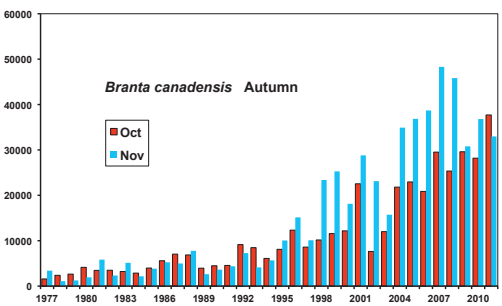


Figure 31. Number of Canada Geese *Branta canadensis* counted in south Sweden in October and November 1977–2011.
Antalet kanadagäss räknade i södra Sverige i oktober och november 1977–2011.

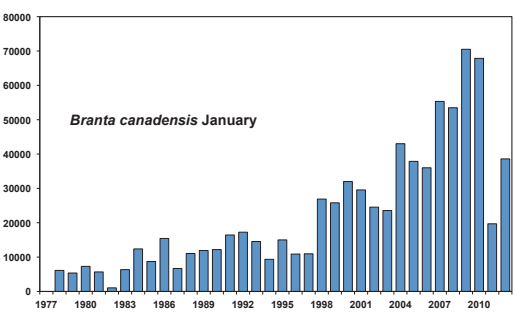


Figure 32. Number of Canada Geese *Branta canadensis* counted in south Sweden in January 1978–2012.
Antalet kanadagäss räknade i södra Sverige i januari 1978–2012.

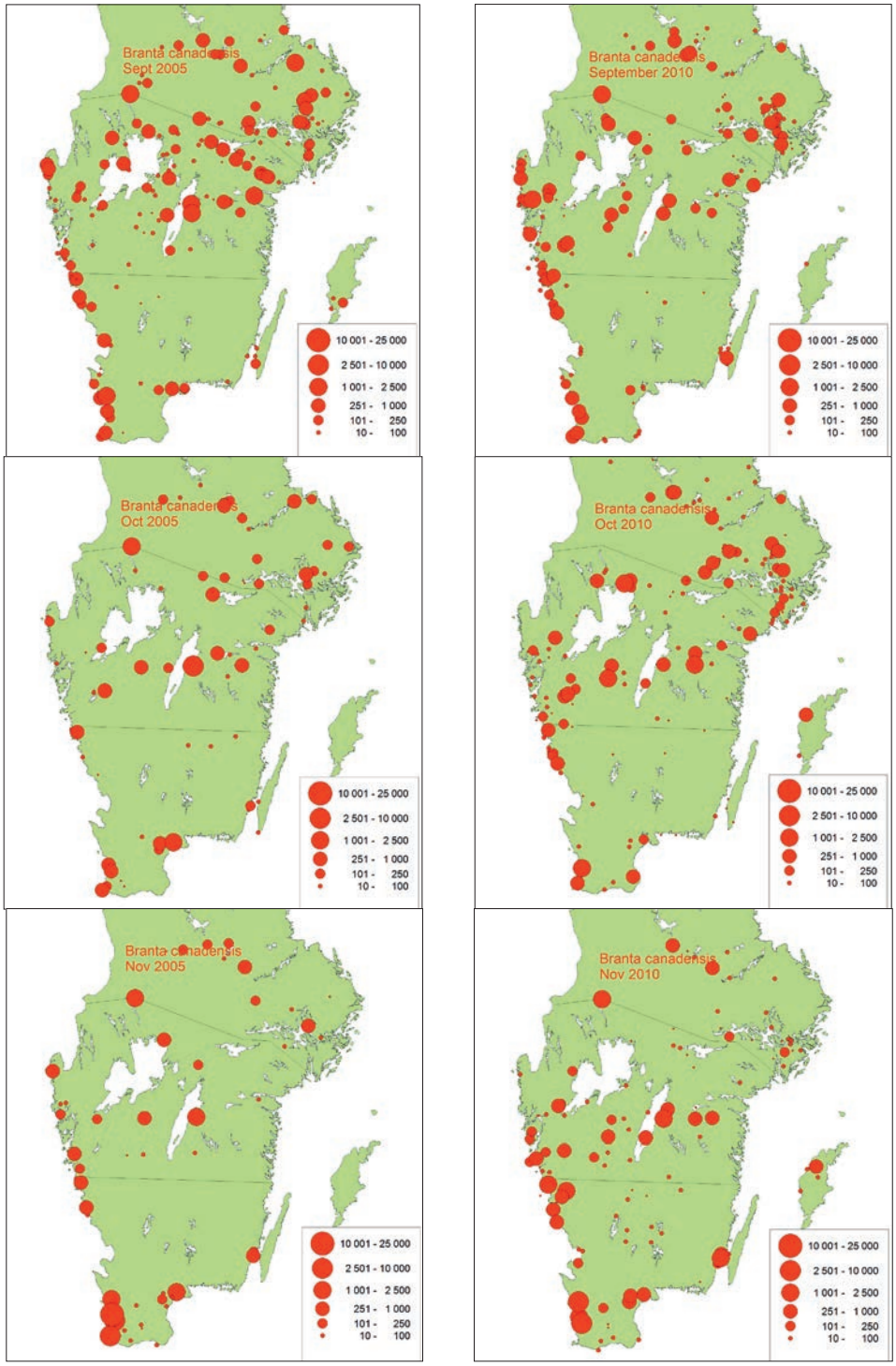


Figure 33. The distribution of Canada Geese *Branta canadensis* in south Sweden in September, October and November 2005 and 2010. *Kanadagåsens utbredning i södra Sverige i september, oktober och november 2005 och 2010.*

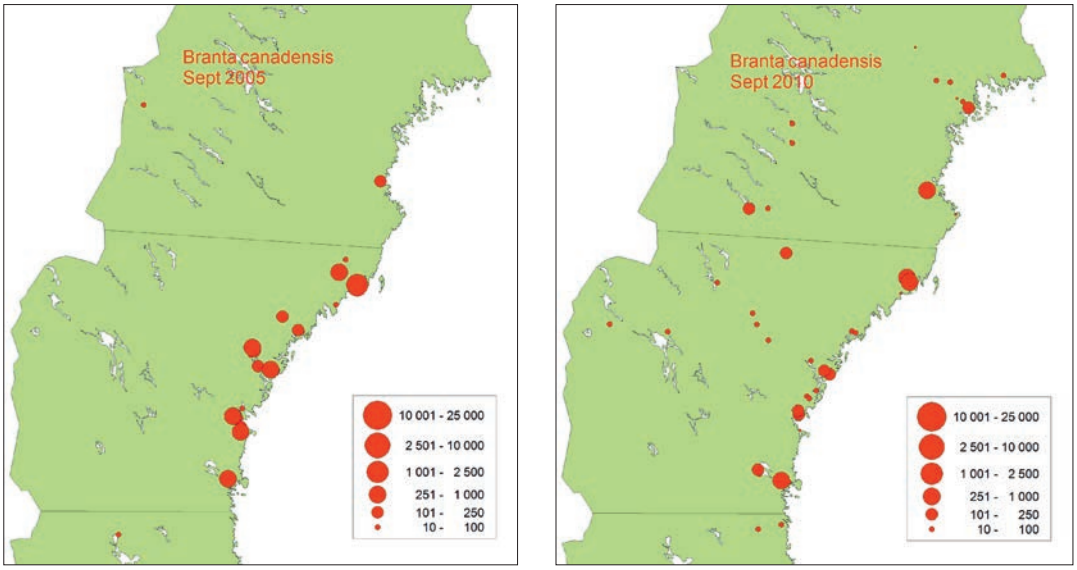


Figure 34. The distribution of Canada Geese *Branta canadensis* in northern Sweden in September 2005 and 2010. *Kanadagåsens utbredning i norra Sverige i september 2005 och 2010.*

The Canada goose does not seem to be as sensitive to cold winters with snow as the Bean Goose. High numbers remained in Sweden during the cold 2010 winter, but most left in the other cold winter 2011. In contrast to the Bean Goose no correlation was found between the January mean temperature for Scania (a proxy for winter hardness) and the counts of Canada Geese.

During the early autumn, Canada Geese were wide-spread over the southern part of the country (Figure 33) but flocks were also found on a number of sites along the coasts of the Bothnian Sea and the Bothnian Bay (Figure 34). Some smaller flocks and groups were also found far inland in north Sweden, even close to the mountain chain, a change being noted between the surveys in 2005 and 2010. The general impression is that many Canada Geese still remain fairly close to the breeding areas at the time of the September counts. It is of interested to note that very few flocks were found in the forested areas of south Sweden and in the southeast corner of the country during the autumn. An exception is the southern part of the Kalmarsund close to the site of the first release of the species in the 1930s (Fabricius 1983).

In south Sweden, where the coverage of the counts was good, the general picture for the October distribution was similar to the September distribution (Figure 33). By November a concentration to fewer sites were found, but still some larger flocks remained in the northern part of south Sweden (province of Dalarna).

In January, the Canada Geese were more concentrated to Scania, especially the southwestern part and the coastal regions of south Sweden (Figure 35). In January 1980 most Canada Geese were found in SW Scania with some smaller flocks on the west coast and in NE Scania. As the species increased in number more flocks were established along the coasts especially in Halland but there were also some new flocks in SE Sweden.

The importance of south Swedish staging areas for the Canada Geese has changed over the years (Figure 36). At the start of the counts almost no Canada Geese were found in SW Scania in October, but in the last five-year period close to 10% of the Canada Geese counted were found here. A similar increase in the importance of SW Scania for the species was also noted in the November counts, from 10% to between 30 and 50 % of the totals counted in November.

Scania has over the years been the most important area for wintering Canada Geese in Sweden with more than 95% of the total during the first five-year period (Figure 36). The proportion of the Scanian Canada Geese staying over winter in NE

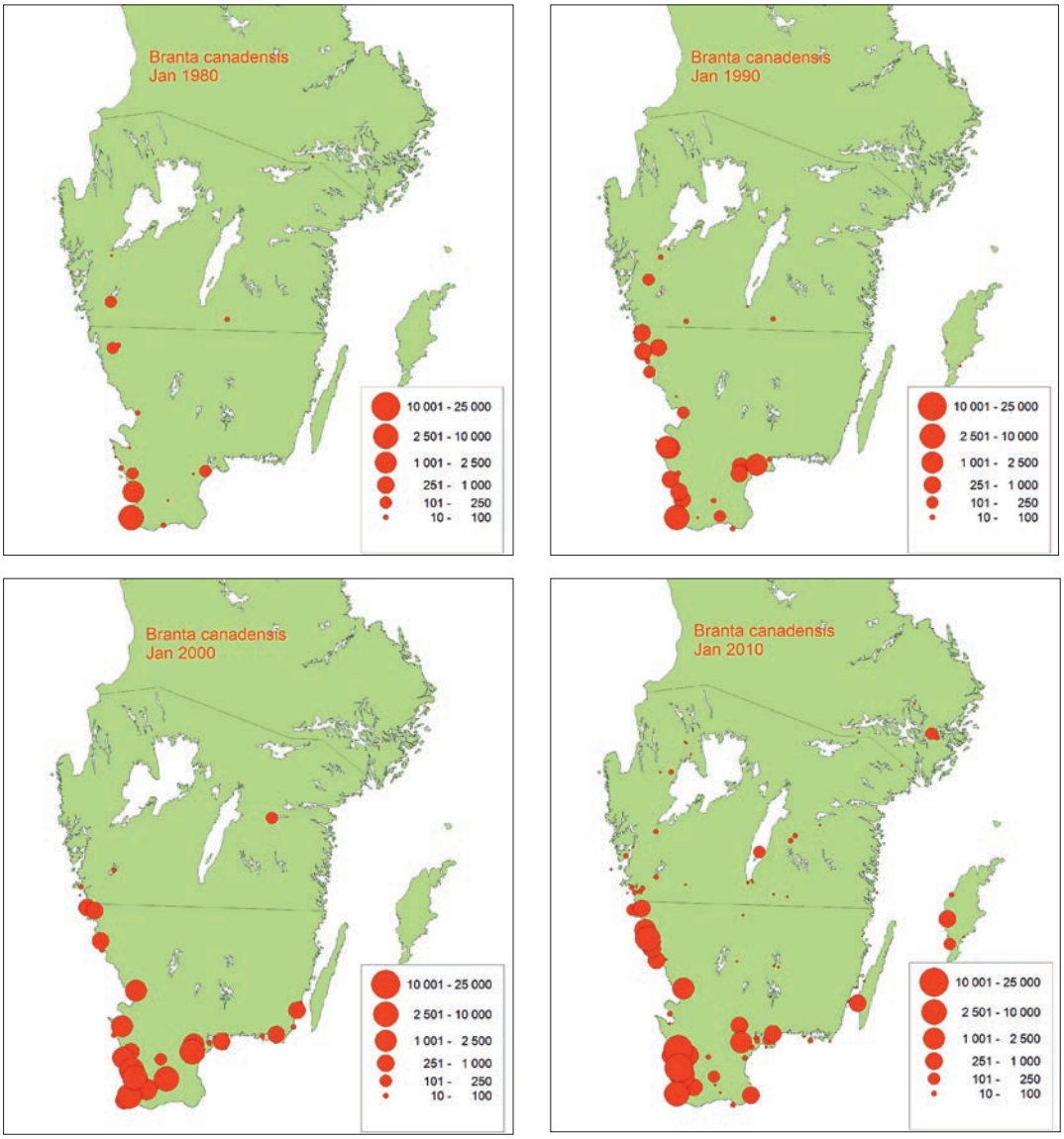


Figure 35. The distribution of Canada Geese *Branta canadensis* in south Sweden in January in different years.
Kanadagåsens utbredning i södra Sverige i januari under olika år.

Scania has been more or less the same over the entire census period, but the proportion wintering north of Scania has increased over the years with somewhat more than 40% being found here during the last five-day period in spite of two winters of five being cold in this period.

Figure 36. Percentage distribution of the number Canada Geese *Branta canadensis* counted in different regions of south Sweden in October, November and January in different time periods. For the geographical position of the regions see Figure 1.
Procentuell fördelning av antalet inräknade kanadagäss inom olika regioner av södra Sverige i oktober, november och januari under olika tidsperioder. För det geografiska läget av de olika områdena se Figur 1.

Barnacle Goose *Branta leucopsis*

The most marked change in the occurrence of staging geese in Sweden during the entire survey period was the establishment of a staging tradition of the Barnacle Goose. During the first fifteen years small flocks were regular on the goose staging areas in south Sweden with up to a few hundred individuals. The first time more than 1000 Barnacle Geese was counted was in October 1993 (4700). With a start in the autumn of year 2000 staging numbers increased rapidly, reaching a peak of 156 000 in October 2011 and 89 000 in November the same year (Figure 37).

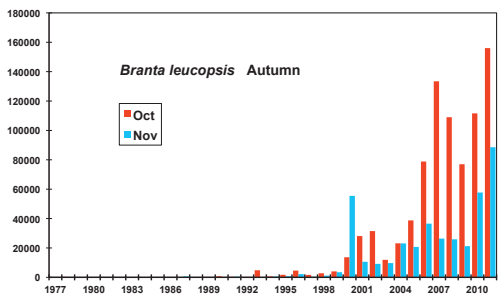


Figure 37. Number of Barnacle Geese *Branta leucopsis* counted in south Sweden in October and November 1977–2011.
Antalet vitkindade gäss räknade i södra Sverige i oktober och november 1977–2011.

January totals remained below 100 until 2001, in most years just a few individuals (Figure 38). The numbers then increased to a peak of 7800 in January 2012 but only about 1000 were counted in the cold winter 2011. .

The distribution is exemplified for the years 2000 and 2010 (Figure 39). During the autumn, the majority was found in Scania, especially in the southwest, but there were also some flocks in other regions, e.g. Bråviken on the east coast. In January the Barnacle Geese were concentrated to SW Scania.

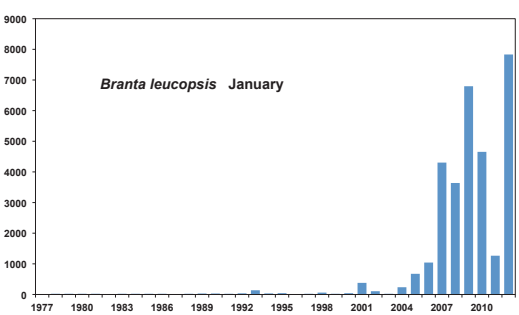


Figure 38. Number of Barnacle Geese *Branta leucopsis* counted in south Sweden in January 1978–2012.
Antalet vitkindade gäss räknade i södra Sverige i januari 1978–2012.

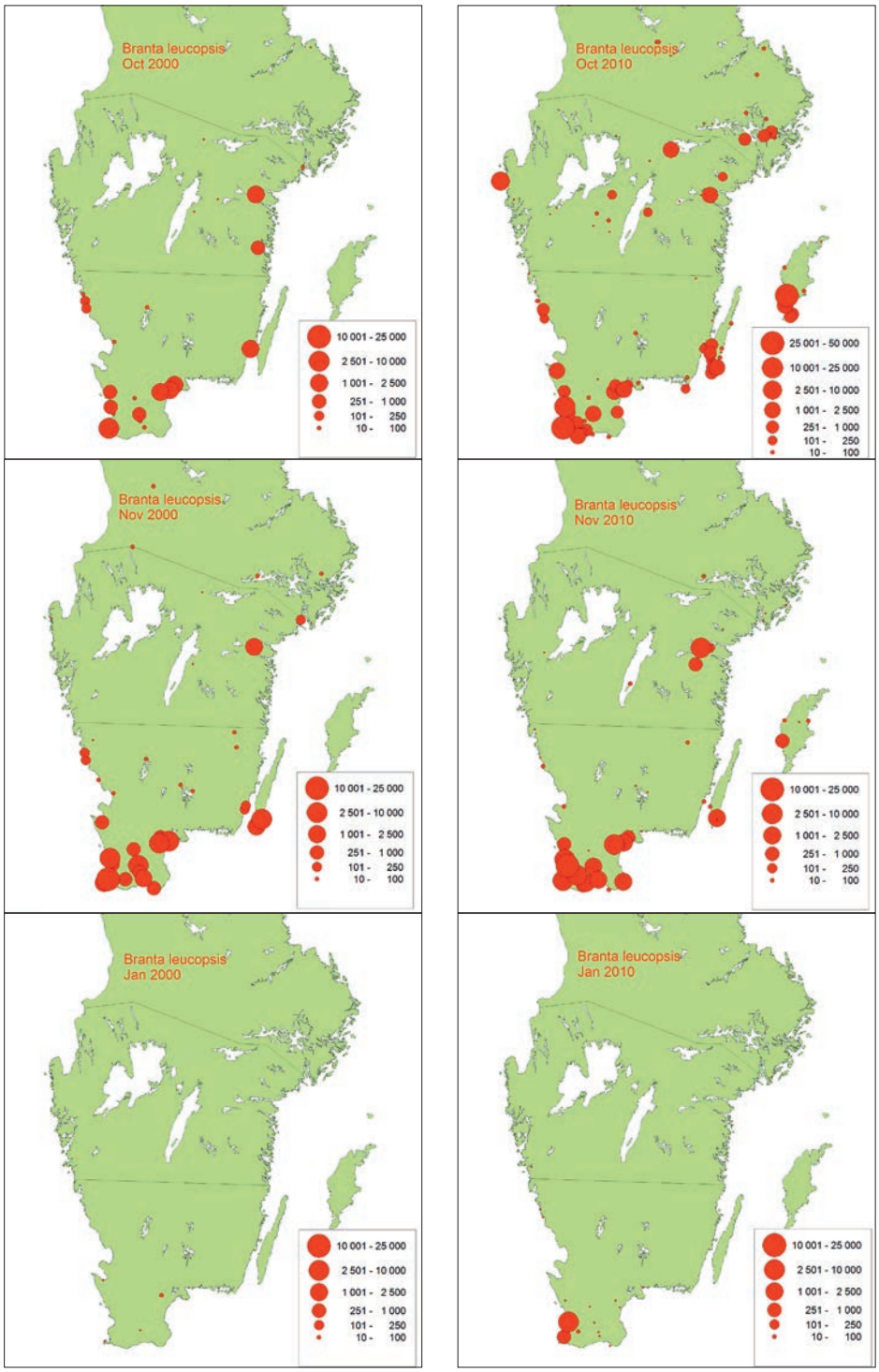


Figure 39. The distribution of Barnacle Geese *Branta leucopsis* in south Sweden in September, October and November 2005 and 2010.
Vitkindade gåsens utbredning i södra Sverige i september, oktober och november 2005 och 2010.

Brent Goose *Branta bernicla*

The Brent Goose is a typical passage migrant in Sweden, small groups and flocks staying for shorter periods at the coasts. Normally, October counts amounted to maximum a few hundred individuals with much lower numbers in some years (Table 1). In two years out of 35 more than 1000 Brent Geese were counted in October with a highest count of 2280 in 2008. November counts are much lower, and in January there are just a number of records of single birds.

Red-breasted Goose *Branta ruficollis*

The species is a rare but regular visitor mostly during migration but also in the wintering flocks of other goose species. During the regular surveys 1–2 individuals were counted in October and November, and single individuals at two occasions in January.

Discussion

Sweden as a staging and wintering area for geese

To establish the importance of the country for the different goose populations, the counts presented here are compared with the most recent estimates (Fox et al. 2010) for the entire European populations whose flyways include Sweden (Table 4). The Taiga Bean Goose shows the highest proportion with 90 percent of the population in recent years using Sweden during at least a part of the non-breeding period. There are some bias attached to the estimates of the number of Taiga Bean Geese occurring in Sweden as most observers do not separate the two subspecies of the Bean Goose, the Taiga Bean Goose, which is the most common, and the Tundra Bean Goose.

In recent years it was established that more than ten percent of the Bean Geese were Tundra Bean Geese (Tables 2, 3, Thomas Heinicke pers. com., see also Persson 1990, 1997), but this is most probably a new feature.

The most recent estimate for the total population of Taiga Bean Geese in Europe (Fox et. al.) was 63 000 individuals based on winter counts mainly in Sweden, Germany and Poland. The highest October count in the last five years for Bean Geese was 66 000 individuals in 2008. In October 2009, 9 000 Tundra Bean Geese were estimated to be present in Sweden (Thomas Heinicke pers. Com.) and assuming that the same number was present the year before, there should have been about 57 000 Taiga Bean Geese in 2008. This estimate is very similar to an estimate by Skyllberg & Tjernberg (2008) based on counts of spring staging Bean Geese in Sweden. During late autumn a large proportion of the staging Bean Geese leave Sweden for areas south of the Baltic, mainly in northern Germany and Poland but also in Denmark. The numbers remaining over the winter show much variation in relation to the strength of the winter with hardly any remaining during the coldest winters and up to 40 000 staying during the mildest winters. Spring staging numbers during the first years of the study were smaller than autumn staging numbers because the Bean Geese staying for the winter south of the Baltic apparently took another route to the breeding areas (Nilsson & Persson 1984).

The Swedish breeding population is estimated to be about 850 pairs (Ottosson et al. 2012) or an autumn population in the order of 6 000 individuals. A proportion of these migrate through Jutland in Denmark to Great Britain (Parslow-Otsu 1991) without being included in the counts in south Sweden. In recent years the Greylag Goose has been the

Table 4. Maximum totals for different goose species staging and wintering in Sweden during the last five years in comparison with the estimates for the total population of the flyway (from Fox et al. 2010).
Maximantalet för olika gåsarter rastande och övervintrande i Sverige under de senaste fem åren jämfört med skattningarna för beståndet i hela populationen för aktuell flyway (efter Fox et al. 2010).

	Flyway estimate	Maxima for Sweden	Per cent for Sweden
Anser fabalis fabalis	63 000	57 000 (Oct 2008)	90
Anser fabalis rossicus	600 000	9 100 (Oct 2009)	2
Anser anser	610 000	227 000 (Sep 2009)	37
Anser albifrons	1 200 000	30 000 (Nov 2010)	3
Anser brachyrhynchus	63 000	775 (Oct 2011)	1
Branta canadensis	90 000	70 500 (Jan 2009)	78
Branta leucopsis	770 000	156 000 (Oct2011)	20

most common staging species. The estimated total of 250 000 geese is more than 40% of the most recent estimate of the total population using the northwest European flyway to winter areas along the Atlantic coast south to Spain (but see below). The Greylag Geese counted in Sweden during the autumn come from the Swedish breeding population (Andersson et al. 2001).

The Barnacle Geese in Sweden belong to the Baltic–Russian population that has increased markedly during recent years. Fox et al. (2010) estimated the population to 770 000 in 2009 (Table 4), but the increase has apparently continued. Up to 20% of these have been counted in Sweden during one survey, but there is a large turnover in the flocks and a much higher proportion apparently use the country for a shorter or longer period during autumn migration. The spring passage is more direct with smaller numbers staging in Sweden. Sweden is not an important winter area for the species although there are some flocks staying over winter in the southernmost part of the country. A small part of the staging Barnacle Geese in Sweden come from the Baltic breeding population, which was established on Gotland in 1971 (Bengtsson 2007, Larsson et al. 1988) and now amounts to 4900 pairs (Ottosson et al. 2012).

The Canada goose was introduced into Sweden in 1933 when a few pairs were set out in Kalmarsund in the southeast part of the country (Fabricius 1983). Over the years there have been many releases of the species in different parts of the country and it has been established as a breeding species in large parts of the country. Populations have also been established in Norway and Finland (Kampe-Persson 2010).. Based on the winter counts in these countries, the total January population was estimated to be in the order of 90 000 (Table 4) with close to 80% in Sweden during a mild winter. It should be noted that these estimates are based on midwinter counts and as the species is much hunted, the post-breeding population is higher (Kampe-Persson 2010).

The development of goose populations in Sweden and Europe

During the early part of the 1900s until about 1950–1960 a general decrease in the number of Bean Geese was reported from Western Europe (Mathiasson 1963). During the 1950s Mathiasson (1963) organized counts in Skåne and found between 12 800 and 16 800 Bean Geese. A national survey in the autumn of 1960 gave a total of 16 000 (Jensen et al. 1962) with 13000 of these counted in Scania. From less than 20 000 in 1960 the number of autumn staging Bean Geese in Sweden increased to about 30 000–40 000 in the early seventies and about 40 000–60 000 in 1977–1980 (see Nilsson & Persson 1984 for details).

Due to the problems with separating the two forms of Bean Geese there are no good data to establish the overall trend for the Taiga Bean Goose, but an autumn population between 80 000 and 100 000 was probable for the 1980s (Nilsson et al. 1999a). The present estimate (Fox et al. 2010) is about 63 000 individuals indicating a marked decrease in the population of Taiga Bean Geese. The total counts of Bean Geese in Sweden for October do also show a decrease except for the last few years when higher totals were found again. This was probably due to a new habit of larger numbers of Tundra Bean Geese using Sweden during autumn.

The most marked increases in the number of geese staging in Sweden was noted for the Greylag Goose and the Barnacle Goose, these increases also being found for the entire flyway populations (Fox et al. 2010, see also Nilsson et al. 1999b, Ganter et al. 1999). The flyway populations for these two species have increased in parallel, whereas there are marked differences within Sweden. The number of staging Barnacle Geese in Sweden increased dramatically during the last decades, whereas the Greylag Geese increased more steadily since the counts started in 1984. In the Barnacle Goose a marked change in the migration pattern led to the very high counts in Sweden in recent years. Changes in the migration pattern over the years have also influenced national counts for the Greylag Goose but not to the same extent as for the Barnacle Goose (Nilsson 2006). Thus October and November counts have increased and Greylag Geese have started to winter further north and in some recent years no less than 25% of the autumn population remained in Sweden in a mild winter.

The marked increase in staging numbers reflects the development of the breeding population of Greylags in Sweden and elsewhere. In the early 1800s, the Greylag Goose was a common and wide-spread species along the Baltic coast (Curry-Lindahl 1959, Sveriges Ornitologiska Förening 1970). Due to heavy hunting it disappeared from most areas and was reduced to only 200–300 pairs in 1953–1954, in spite of having been protected

since 1938. Several introductions were done starting in the 1930s (Sveriges Ornitologiska Förening 1970), but the present rate of increase did not start until the 1960s. The early development of the Greylag Goose populations in all Nordic countries was summarized in Fog et al. (1984) and the Swedish breeding population was estimated to between 1 700 and 2 200 pairs in 1979–1980. The most recent estimate for the breeding population in Sweden is 41 000 pairs (Ottosson et al. 2012).

The Barnacle Geese of the Baltic-Russian population belong to the goose populations which on the European scale have shown marked increases during the last 50 years. In the 1960s this population was estimated to be in the order of 20 000, increasing to about 270 000 in the 1990s (Ganter et al. 1999) and to the present estimate of 770 000 individuals (Fox et al. 2010). The sudden increase in numbers in the late 1990s was most probably related to changes in migration patterns as discussed below. It may be noted that the Swedish breeding population established on Gotland in 1981 (Larsson et al 1988) increased during the same period to reach 4 900 pairs in recent years (Ottosson et al. 2012).

The introduced population of Canada Geese in NW Europe, with the majority wintering in Sweden but also in the other countries around the Baltic Sea has shown an increase similar to that of the naturally occurring species. (Fabricius 1983, Fox et al 2010, Kampe-Persson 2010).

Factors behind the population development of goose populations

The two most important factors behind the very marked increase in most European goose populations are probably changes in the hunting practices and changes in the agriculture. Before the 1950s most goose populations were clearly over-exploited by hunting (Madsen et al. (eds.) 1999 and references therein). When hunting regulations were introduced, the majority of goose populations started to increase, many to such an extent that they are considered as an agricultural management problem (Roomen & Madsen 1992).

Changes in agriculture have markedly affected the food situation for the geese during the annual cycle (Nilsson & Persson 1991, 1992, 1998, 2000, Nilsson & Kampe-Persson 2013). Three different aspects are of special importance: changes in field size, changes in crops used and changes in harvesting methods.

The modernization of agriculture has led to an overall increase in the sizes of individual fields in the agricultural landscape of Sweden and other countries (Wretenberg et al. 2006, 2007). As most geese have a tendency to avoid coming to close to forest edges, buildings, busy roads etc., this has led to a larger proportion of the agricultural land being possible to use for the geese.

The changes in harvesting methods have probably had an even larger impact on the goose populations. In the old days when root crops were harvested manually there was hardly any spill, but mechanical harvesting methods produce large amounts of spill on the fields where sugar beet, potatoes and carrots have been grown. Mechanical harvesting of cereal crops also produced a lot of spill that could be used as food for the geese.

The importance of these mechanical harvesting methods for the geese can be exemplified from Scania. When Markgren (1963) made his study during the 1950s, sugar beet was still harvested manually and was not available for the geese to feed on, whereas mechanical harvesting provided a rich supply of sugar beet spill for the geese when the staging geese were studied during the 1970s (Nilsson & Persson 1984, 1991, 2000, Nilsson & Kampe-Persson 2013). In some districts spill from the potato and carrot harvest also turned out to be an important food source new to the geese.

In Sweden, there has been a decrease in the area of spring-sown cereals over the last decades, whereas the area of autumn-sown cereals has shown a different pattern. During the first part of the 1970s there was a marked increase in the area grown with winter wheat especially on the plains, this area decreased to the early eighties but started to increase again (Wretenberg et al. 2007). At the same time the total production of winter wheat increased markedly in Sweden, probably with the result that there was much more food available for the geese.

Changes in crop types can also be important for the geese. Earlier varieties of oilseed rape were unpalatable for wildlife but changes to another variety gave a more palatable rape that could be used as food for geese (Nilsson & Kampe-Persson 2013). Other crops are also important as goose food for periods, e. g. peas grown for animal food are important for especially Greylag Geese in Scania during late summer.

The situation for the geese in the agricultural areas of Scania (and other agricultural areas in south Sweden), and how changes in agriculture have influenced the geese will be discussed in a com-

panion paper in this volume (Nilsson & Kampe-Persson 2013).

Changes in migration patterns

During recent decades marked changes in the migration patterns have been recorded for several of the European goose populations resulting in changes in numbers at staging and wintering areas that are not directly related to changes in the size of the populations, these changes however being important to consider when evaluating the census data from different countries.

When neck-banding started in the Nordic countries in 1977, the Taiga Bean Geese staying in SW Scania during late autumn after the main exodus south migrated to SW for Denmark, NW Germany and the Netherlands in case of cold winter periods (Nilsson 1984a), but in later years the Bean Geese leaving Sweden during such conditions have not moved farther than to Denmark (Nilsson 2011, Nilsson & Pirkola 1991).

Within Sweden, almost all autumn staging Bean Geese were concentrated to Scania before the late 1970s (see Nilsson & Persson 1984 for details of the early story). Later on the geese stayed at Lake Tåkern, Kvismaren and other sites further north in south Sweden and arrived much later to Scania (related to frost periods). Some spring staging sites started to be used also in autumn and some new staging sites were established.

The timing of the migration has also changed, not only that the Bean Geese arrive later to the wintering areas in Scania then before, their migration to the breeding areas in the north has also been advanced by about two weeks (Nilsson & Persson 1984, Skyllberg et al. 2009, Nilsson unpubl.).

According to Mooij et al. (1999) the Western Palearctic population of White-fronted Geese has been more or less stable during recent decades but there has been a marked redistribution of the species leading to a marked increase in numbers wintering in NW Europe (Mooij et al. 1999, Fox et al. 2010). The increase in Sweden reflects this redistribution of staging sites to the north.

In the Greylag Goose, successively fewer birds of the neck-banded Swedish population migrate to the Guadalquivir delta in southern Spain, which formerly was the traditional winter quarter for the Greylags of Western Europe (Andersson et al. 2001, Nilsson 2006, unpubl.). Instead an increasing proportion of the Greylag Geese from SW Scania stay for the winter in the Netherlands, NW Germany and also in Sweden. Not only has there been a change in winter quarters, but the timing of migration has also changed, the Greylags leaving Sweden much later in autumn and arrive back much earlier in spring, some already in late January. These changes have clearly been reflected in the counts, larger numbers have regularly been counted in Sweden during the October and November. The change in autumn migration was gradual, the increase in October totals started in the early 1990s, that for November numbers a few years later. Finally, during the last decade a wintering tradition was established in south Sweden with close to 50000 (or 25% of the September total) wintering in the peak year.

Another goose species which has changed migration habits markedly during recent years is the Barnacle Goose from the Russian – Baltic population. Traditionally, it was a common passage migrant passing south Sweden in autumn and spring, a high proportion of the Russian population passing the country. There has also been a spring staging tradition on the inland of Gotland for a long time (Beinert 1982), but the main staging areas in spring were situated in the Baltic States (Ganter et al. 1999.). During autumn, the Barnacle Geese mostly passed south Sweden rapidly.

In recent years the overall pattern of migration has changed markedly and the Barnacle Geese have started to leave their winter quarters in the Waddenzee much later overflying their former staging areas east of the Baltic (Eichhorn et al. 2009). This change has been related to land-use changes in the Baltic States after their independence from the Soviet Union, cattle grazing being given up in large areas making habitat availability for staging Barnacle Geese much lower.

The marked changes in migration patterns of European goose populations are probably caused by a combination of climate change and changes in land-use and agriculture. The trend towards milder winters with less snow clearly creates better possibilities for the geese to stay further north than before. Moreover, the changes in agricultural practices have provided the geese with better food resources during the autumn and winter, making it possible for them to stay further north. In some cases it may also be possible that some traditional goose areas have reached their capacity with increasing competition leading to the establishment of new traditions.

Sweden is situated on the northern limit of the winter distribution for geese but still SW Sweden and especially the province of Scania is an important wintering area for geese in normal winters. During the first years of goose counts Bean Geese and Canada Geese were counted in good numbers, whereas other goose species were only found in small numbers.

As shown by the counts discussed in this contribution, the number of geese staying in Sweden is much influenced by the strength of the winter, and longer periods with sub-zero temperatures will cause many geese to leave the country. The snow cover seems to be the most important factor in this respect, especially with a freezing surface. Too much snow will cut off the geese from important feeding areas.

Comparing the Bean Goose and the Canada Goose, the former was more sensitive to cold weather in winter, the number of Bean Geese counted in January being correlated with mean temperatures (as a proxy for winter hardness), whereas no such correlation was found for the Canada Goose. An important factor in this respect is the availability of food resources (see Nilsson & Kampe-Persson 2013) and differences in utilization of different food sources by the two species.

The recent trend towards milder winters have led to other species wintering in larger numbers in south Sweden such as Greylag Goose, White-fronted Goose and Barnacle Goose (since the establishment of the staging tradition in recent years). Among these three species the Greylag Geese were more hardy then the other two species staying in larger numbers in south Sweden even during cold winters in later years since the wintering tradition here was established. Differences in winter hardiness of the species were most certainly related to differences in food choice (Nilsson & Kampe-Persson 2013).

The changes in migration patterns discussed above for the Greylag Goose on a European scale (Nilsson 2006, Nilsson et al. in prep.) has also led to changes in winter distribution and the establishment of a wintering tradition in Sweden. In the early years up to 80% of the neck-banded Greylag Geese from Scania wintered in southern Spain (Nilsson 2006), but now hardly any go there, those not staying in Sweden mainly wintering in the Netherlands and Germany.

Similar changes in winter quarter has also been found for the Bean Goose (Nilsson 1984, 2011), neck-banded Bean Geese were found to migrate to Germany and the Netherlands in cold winters during the early part of the studies, but in later years they did not migrate further than to Denmark in such conditions.

The changes in winter quarters does not only affect the number of geese counted at the surveys in different countries but can also have an effect on the population development. Greylag Geese from SW Scania were found to have different survival patterns related to the choice of winter quarters (Nilsson & Persson 1996, Nilsson et al 1997). The geese that went to Spain had a lower survival rate than those wintering in the Netherlands and further north. Moreover, geese wintering further north were found to return to the breeding areas earlier than those wintering in more distant areas. Early arriving Greylags were found to have a higher breeding success than those arriving later (Nilsson & Persson 1994, Nilsson et al. 1997).

Some changes noted in the staging populations in Sweden could be related to factors influencing the geese in the winter quarters. A leveling off in the number of staging Greylag Geese in the September counts in Sweden in 1992–1995 was probably related to the situation in the winter quarters of the Greylag Geese, which in those years was mainly in the Coto Donana National Park in SW Spain (Andersson et al. 2001). The Greylags were much dependent on *Scirpus*-rhizomes in this area. In the late 1980s and early 1990s the situation changed when the water level in the Donana increased and a too high water level made the rhizomes unavailable for the geese which forced them out of the national park to rice fields, where they were much affected by heavy hunting (Nilsson et al 1999b). Too dry conditions were also negative for the geese that arrived back to the breeding areas in too bad condition to produce any young.

In the Bean Goose increased mortality was found among neck-banded wintering birds in south Sweden in the cold winter 1978/79 (Nilsson 1984, Nilsson & Persson 1984) being reflected in lower counts in the following year. Similarly lower September counts of Greylag Geese in 2011 (and 2012) are probably related to the cold winters of 2009/2010 and 2010/2011. The number of young per pair in a long term study in SW Scania was very low after these two cold winters (Nilsson unpublished).

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Sammanfattning

De flesta gåspopulationer i Europa har ökat markant under senare år (Madsen et al. 1999, Fox et al. 2010) och har nått sådana nivåer att de upplevs som ett problem för jordbruket (Hake et al. 2010, von Roomen & Madsen 1992), men detta gäller inte all arter. I Skandinavien har fjällgåsen minskat drastiskt och är föremål för återinplantering (Andersson & Holmqvist 2010) och taigasädgåsen som häckar i Fennoskandia har också minskat drastiskt. Ett nordiskt forskningsprogram rörande gäss startades därför 1975 av Nordiskt Kollegium för Viltforskning, NKV (Fog et al. 1984). Huvudsyftet var att studera de båda minskande gåspopulationerna, men grågåsen kom också att innefattas i undersökningarna (Nilsson & Fog 1984). Grågåsen blev senare föremål för ett speciellt nordiskt grågåsprojekt (Andersson et al. 2001).

En viktig del av gåsundersökningarna var regelbundna inventeringar av rastande och över-

vintrande gäss. Dessa startade 1977/78 (Nilsson 1988a) och pågår fortfarande, numera som en del i de internationella gåsinventeringarna samordnade av Wetlands International. I denna uppsats analyseras inventeringarna sedan starten 1977/78 till och med 2011/12 för att följa förändringar i antal och utbredning hos gässen över 35-års perioden. De första årens inventeringar har tidigare analyserats på nationell nivå (Nilsson 1988a, 2000). Inventeringarna från de tidiga åren ingår också i en sammanställning av utvecklingen av gåsbestånden på en europeisk nivå (Madsen et al. 1999), vilken uppdaterades av Fox et al. (2010).

Material och metodik

Under åren 1977/78 – 1986/87 genomfördes månatliga inventeringar under september/oktober – mars/april. Inventeringarna koncentrerades till den södra delen av landet (Figur 1). Inventeringarna inriktades på att täcka alla lokaler för sädgås, men samtliga arter räknades på alla besökta lokaler. Resultat från dessa tidiga inventeringar har publicerats i olika rapporter (Nilsson 1979, 1981, 1984a, 1984b, 1986, 1988b). I september 1984 kompletterades programmet med en landstäckande grågåsinventering.

Från och med 1987 har inventeringar genomförts i september, oktober, november och januari. Septemberinventeringarna koncentreras på grågåsen, medan oktober (och i viss mån) november koncentreras på sädgåsen. Januari inventeringen är en del av den internationella midvinterinventeringen och täcker alla arter. Bläsgåsen återfinns på samma lokaler som sädgåsen, men kanadagåsen täcks mindre bra under hösten. Till en början inventerades främst den södra delen av landet, men från 2005 har mer omfattande inventeringar under hösten bedrivits längs norrlandskusten.

Räkningarna genomförs i mitten av de aktuella månaderna, dvs. veckoslutet närmast den 15:e, med kringliggande dagar som reserv. Inventeringarna genomförs av amatörer med god och ofta mångårig erfarenhet av gåsräkningar. Vid en del större lokaler såsom Tåkern, Östen och Kvismaren räknar en grupp observatörer gässen när de flyger ut från nattplatserna för födosök. På dessa lokaler är det därför svårt att skilja ut mer sällsyntare gäss från majoriteten. Spetsbergsgåsen blir därför lätt underrepresenterad, vilket också gäller för tundrasädgåsen, som inte kan skiljas från den talrikare taigasädgåsen vid räkningar av flygande gäss.

Som ett komplement till de organiserade inventeringarna har rapportdatabasen SVALAN genomsökts. På detta sätt har nya eller tillfälliga lokaler kunnat fångas upp. Detaljerade årliga rapporter från gåsinventeringarna kan laddas ner från projektets hemsida http://www.zoo.ekol.lu.se/waterfowl/index.htm.

Gässens utbredning och antal särskilt under vintern påverkas starkt av väderleksförhållandena och då speciellt av snödjupet. Snöförhållandena är därför viktiga för att tolka inventeringsresultaten. Som ett riktvärde för vinterns hårdhet visas månadsmedeltemperaturen för ett antal väderleksstationer i södra Sverige i Figur 2. Under de första årens gåsinventeringar noterades en serie hårda vintrar: 1979, 1982, 1985 och 1987. Därefter förekom inga riktigt hårda vintrar förrän 2010 och 2011.

Resultat

Sedan de regelbundna gåsinventeringarna startade i Sverige har antalet rastande och övervintrande gäss i Sverige ökat markant. Femårsmedeltalen för oktober ökade från 49000 till 350000, medan motsvarande ökning för november var från 45000 till 195000 (tabell 1). Om hänsyn tas till den dåliga täckningsgraden för kanadagäss under hösten blir ökningen än mer markant. Vinterbeståndet av gäss har ökat på samma sätt från 18000 till 123000.

Resultaten för de vanligaste gåsarterna diskuteras separat nedan. Utöver dessa noteras regelbundet tillfälligt rastande prutgäss samt mindre antal av fjällgäss och ibland rödhalsade gäss (tabell 1). Detaljer för dessa arter återfinns i de årliga rapporterna från projektet. För de vanligare arterna presenteras diagram över beståndsutvecklingen för olika månader i hela landet och i vissa fall för olika delar av landet. De olika arternas utbredning illustreras av valda kartor från olika år.

Grågås *Anser anser*

Vid den första grågåsinventeringen i september 1984 räknades 19000 individer i hela landet, varefter en markant ökning noterades till ett högsta antal av 227000 i september 2009 (Figur 3). Med hänsyn till lokaler som inte inventerats kan man räkna med att det fanns minst 250000 grågäss i Sverige vid detta tillfälle. Antalet inräknade grågäss i september 2011 var väsentligt lägre. Utvecklingen i oktober och november var likartad, men startade senare och maximiantalen var lägre (Figur 3). En uppdelning på regioner (Figur 4) visar i princip samma mönster, men ökningen startade vid olika

tidspunkter. Ökningen har också planat ut i vissa regioner. Grågässen i sydvästra Skåne har varit föremål för specialstudier, som på ett bra sätt illustrerar etableringen av nya rast-traditioner (Figur 5). I början fanns höstflockarna i kärnområdet runt häckningssjöarna, medan de också utnyttjade Foteviksområdet som höstrastlokal. Senare etablerades en ny tradition i Lommabukten samtidigt som grågässens utnyttjande av Vombsjö-området ökade.

När inventeringarna startade var grågässen koncentrerade till de östra och södra delarna av Sverige, men arten visade en klar spridning allt eftersom antalet grågäss ökade (Figur 6) och i september 2010 var de spridda över hela södra Sverige även om de största flockarna fortfarande återfanns i slättbygderna och vid kusterna. Grågässen spred sig också efter Norrlandskusten (Figur 7). I oktober (Figur 8) och november (Figur 9) var utvecklingen likartad, men med den senare ökningen i antal spreds gässen senare över landet. Ännu 2010 fanns sålunda endast mindre flockar av grågäss i Smålands inland.

Antalet övervintrande grågäss var mycket lågt i Sverige fram till slutet av 1990-talet och de första större flockarna noterades januari 2000 (Figur 10). Antalet grågäss ökade sedan markant till en topp på ungefär 50000 i januari 2008. Till och med under den kalla vintern 2011 fanns 10000 grågäss kvar i landet. De övervintrande grågässen var koncentrerade till Skåne samt kusterna av södra Sverige (Figur 11).

Sädgås *Anser fabalis*

Merparten av sädgässen i södra Sverige anländer från Finland till Södermanland och Uppland i september (Nilsson 2011), men septemberinventeringarna ger ingen bra täckning för arten. Det högsta antalet sädgäss noterades normalt vid oktoberinventeringen (Figur 12). Från att ha legat under 50000 när inventeringarna startade noterades det högsta antalet i oktober 1989 med 76000 sädgäss. Därefter har antalet sädgäss i Sverige visat en minskande trend till och med 2006, varefter betydligt högre antal noterats. Detta sammanfaller med att större antal av tundrasädgäss observerats på vissa lokaler i landet med upp till men än 9000 i oktober 2009 (tabell 2,3).

När inventeringarna startade var sädgässen starkt koncentrerade till Skåne i oktober, men under de följande åren skedde en markant omfördelning och i slutet av inventeringsperioden noterades endast få sädgäss i Skåne. Antalet sädgäss vid Tåkern ökade markant och sjön var under några år den viktigaste sädgåslokalen i landet, men senare minskade antalet sädgäss här samtidigt som nya rast-traditoner etablerades vid Östen och Kvismaren, två lokaler som tidigare endast utnyttjades under våren (Figur 13 -17). I november var antalet sädgäss i olika delar av landet mer varierat eftersom särskilt antalet rastande gäss norr om Skåne påverkas av när den första frosten inträffar.

Under vintern har antalet sädgäss varierat markant, med som mest 40000 övervintrande under milda vintrar och nästan inga sädgäss som under de kalla vintrarna 1982 och 1985 (Figur 18, 20). Antalet sädgäss i januari är negativt korrelerat med vintertemperaturen (Figur 19). Under vintern är sädgässen markant koncentrerade till Skåne, även om en del flockar observerats längre norrut under mildare vintrar (Figur 20-22).

Spetsbergsgås *Anser brachyrhynchus*

Spetsbergsgåsen förekommer regelbundet i mindre antal i gåsflockarna i södra Sverige under hösten och vintern (Figur 23, 24). Arten har ökat i antal under senare år och som mest har ca 800 räknats in i oktober 2011. Spetsbergsgåsen är troligen underrepresenterad då den förekommer i flockarna av sädgäss och svårligen kan skiljas ut när man räknar gässen när de flyger ut från nattkvarteren. Spetsbergsgässen var spridda över gåslokalerna i södra Sverige (Figur 25).

Blässgås *Anser albifrons*

Blässgåsen är allmän i gåsflockarna i sydvästra Skåne under höstarna(Figur 26, 28, 29, 30). Fram till och med mitten av 1990-talet var antalet blässgäss ganska måttligt även om upp till 10000 räknats vid några tillfällen. Antalet blässgäss ökade sedan markant, men visade en stor variation mellan olika inventeringar och torde vara beroende av vindförhållandena under flyttningen. Merparten av blässgässen flyttar mot Västeuropa söder om Östersjön, men vid starka vindar från sydost ökar antalet i Skåne. Under senare år har betydande antal blässgäss också noterats vid midvinterinventeringarna i Skåne (Figur 27) med som mest över 20000 2007.

Kanadagås *Branta canadensis*

Den inplanterade kanadagåsen är vanligt förekommande på rast och vinterlokalerna för gäss i Sverige (Figur 31, 32) och har ökat markant sedan starten av inventeringarna. Under hösten är arten spridd på ett stort antal lokaler (Figur 33,34) och

inventeringarna då ger ingen bra täckning av beståndet. Under vintern är kanadagåsen mer koncentrerad till Skåne samt kusterna av södra Sverige och inventeringarna ger en representativ bild av vinterbeståndet. Både höstsiffrorna och midvinterinventeringarna visar en markant ökning och som mest noterades 70000 i januari 2009. Under vintern är den starkt koncentrerad till sydvästra Skåne (Figur 35, 36).

Vitkindad gås *Branta leucopsis*

Under de första årens gåsinventeringar var den vitkindade gåsen en sparsam gäst på rast och övervintringslokalerna i Sverige, även om betydande antal flyttar över landet under höst och vår. Före år 2000 var antalet lågt, men sedan skedde en explosionsartad ökning av antalet rastande vitkindade gäss och som mest noterades 156000 i oktober 2011 (Figur 37). Antalet övervintrare var betydligt lägre, men från 2001 ökade också antalet vitkindade gäss i januari och nådde i januari 2012 över 7000 (Figur 38). De vitkindade gässen var koncentrerade till Skåne, men betydande flockar förekom också i andra delar av landet (Figur 39).

Diskussion

Sverige som rast/övervintringsområde för gäss

Sverige är ett viktigt område för rastande och övervintrande gäss av olika arter. För fastställa landets betydelse för olika gåsarter jämförs de här presenterade resultaten från inventeringarna med de senaste skattningarna av gåsbestånden i Europa, vilka sammanställts av Fox et al. (2010). Under hösten är Sverige det viktigaste rastområdet för taigasädgåsen med upp till 90 % av beståndet vid en av de senaste inventeringarna (tabell 4). Merparten av dessa sädgäss härstammar från östligare bestånd än Sverige.

Under senare år har grågåsen varit den talrikaste gåsarten i Sverige under hösten. Maxantalet grågäss vid inventeringarna i september motsvarar ca 40 % av det beräknade totalbeståndet för det västliga beståndet av arten. Den vanligaste gåsarten i Europa enligt de internationella inventeringarna är blåsgåsen. Den flyttar huvudsakligen söder om Östersjön och de högsta antalen som räknats i Sverige om höstarna motsvarar inte mer än ca 3 % av totalbeståndet. För den sparsamt förekommande spetsbergsgåsen ses högst 1 % av Svalbardbeståndet i Sverige under höstarna. De vitkindade gässen har som nämnts ändrat sina vanor och vid de senaste inventeringarna har ungefär 20 % av det samlade rysk-baltiska beståndet räknats in i Sverige vid en och samma inventering. För den introducerade kanadagåsen som också förekommer i övriga Östersjöländer har Sveriges andel av vinterbeståndet i regionen beräknats uppgå till bortemot 80 % av vinterbeståndet.

Utvecklingen av gåsbestånden i Sverige och Europa

Under de senaste årtiondena har de flesta gåsbestånd i NV Europa visat markanta ökningar i antal även om vissa bestånds ökningstakt har minskat (Fox et al. 2010). Ur svenskt perspektiv finns det två undantag till denna positiva bild: fjällgåsen vars vilda bestånd i princip är utrotat i Sverige (Andersson & Holmqvist 2010) och taigasädgåsen. För det sistnämnda beståndet är situationen något oklar eftersom det först under senare år uppmärksammats att det förekommer en hel del tundrasädgäss i flockarna av sädgäss åtminstone på vissa lokaler.

Rent generellt minskade antalet sädgäss i Europa under början av 1900-talet fram till 1950-1960-talen (Mathiasson 1963). Antalet ökade sedan åter och antalet sädgäss i Sverige (taigasädgäss) nådde 50000 – 60000 i slutet av 1970-talet (Nilsson & Persson 1984) för att sedan öka till en topp närmare 80000 1989 följt av en nedåtgående trend, vilket gäller för det totala beståndet av taigasädgäss. En registrerad ökning i diagrammet för senare år torde motsvaras av en etablering av rastande/övervintrande tundrasädgäss i Sverige.

De mest markanta förändringarna i gåsbestånden i Sverige noterades för grågåsen och den vitkindade gåsen, där bestånden mångdubblats sedan inventeringarna startade både vad gäller de totala europeiska bestånden och antalet rastande/övervintrande i Sverige. När det gäller den vitkindade gåsen han den mycket snabba ökningen av antalet rastande i Sverige under de senaste åren relateras till ändrade flyttningsvanor även om beståndet också ökat under denna period. Även för grågåsen återspeglar inventeringarna till en del ändringar i flyttnings och övervintringsvanorna såsom uppkomsten av ett övervintrande bestånd av grågäss i Sverige under senare år.

Den i Sverige inplanterade kanadagåsen har visat samma ökning som de naturligt förekommande gässen. Från några par som sattes ut vid Kalmarsund på 1930-talet har beståndet nu ökat till ca 90000 individ (Fabricius 1983, Fox et al. 2010, Kampe-Persson 2010).

Faktorer som påverkar gåsbeståndens storlek

De två viktigaste faktorerna bakom den markanta ökningen hos de flesta europeiska gåsbestånd torde vara ändrade jaktförhållanden och förändringar i jordbruket (Madsen et al. 1999, Roomen & Madsen 1992). Medan det ändrade jakttrycket har minskat mortaliteten hos gässen så har de ändrade förhållandena i jordbruket ökat näringstillgången för de rastande och övervintrande gässen och ger dem en säker födokälla under hela året (Nilsson & Persson 1991, 1992, 1998, 2000, Nilsson & Kampe-Persson 2013). Tre olika aspekter är av speciellt stor betydelse för gässens utnyttjande av jordbrukslandskapet: förändringar i fältens storlek och utformning, förändringar i de grödor som odlas samt förändrade skördemetoder.

Eftersom gässen undviker strukturer i landskapet där ett rovdjur kan dölja sig så har förändringen mot större fält i jordbruket medfört att gässen på ett säkert sätt kan utnyttja en större andel av jordbruksmarken för sitt födosök. En annan faktor som kanske är av ännu större betydelse för gässen är de förändrade skördemetoderna. Mekaniska redskap har markant ökat tillgången på spill i jordbrukslandskapet. Rotfrukter förekom inte som föda för gässen när Markgren (1963) studerade dem, medan de mekaniska skördemetoderna medförde en rik tillgång på spill från rotfrukter, särskilt sockerbetor, vid undersökningar på 1970-talet och framåt (Nilsson & Persson 1984, 1991, 2000, Nilsson & Kampe-Persson 2013).

En annan viktig faktor för gässen är den ökande arealen av höstsådda grödor som ger gässen goda födosöksområden under vintern (Nilsson & Kampe-Persson 2013) liksom de nya varianterna av raps, som är mer tilltalande som föda för vilt.

Ändrade flyttningsvanor

Under senare år har betydande förändringar noterats när det gäller flyttningsvanorna hos flera europeiska gåsbestånd, som medför förändringar i antalet rastande och övervintrande individer på olika lokaler utan att detta direkt kan relateras till förändringar i beståndens storlek. För sädgåsen har flyttningsvanorna studerats genom halsmärkning sedan slutet av 1970-talet (Nilsson 1984a, Nilsson 2011, Nilsson & Persson 1984 & Nilsson & Pirkola 1991). I början av undersökningen lämnade sädgässen vinterområdena i Skåne och flyttade till Nederländerna under kalla perioder, men under senare år har de inte flyttat längre än till Danmark. Dessutom noterades stora omfördelningar inom Sverige, där merparten av sädgässen numera återfinns i Mellansverige under den tidiga hösten istället för i SV Skåne. Gässen lämnar också södra Sverige tidigare på vårflyttningen (Nilsson & Persson 1984, Skyllberg et al. 2009, Nilsson unpubl.).

Grågåsen, som nu är den vanligaste gåsarten i Sverige har också visat markanta förändringar i flyttningsvanorna. Tidigare flyttade majoriteten av de svenska grågässen till Spanien för vintern, men under senare år har de börjat övervintra längre och längre norrut (Andersson et al. 2001, Nilsson 2006, unpubl.), vilket också visat sig i de svenska midvinterinventeringarna. Upp till 50000 har visat sig övervintra i Sverige under senare år.

Den vitkindade gåsen från det rysk-baltiska beståndet passerade regelbundet Sverige i betydande antal under flyttningen vår och höst, men rastade endast i mycket begränsad omfattning annat än på Gotland på våren. Den mycket snabba ökningen av antalet rastande vitkindade gäss i Sverige under höstarna är ett annat exempel på en art som på kort tid ändrat sina flyttningsvanor högst markant. Den vitkindade gåsen blev plötsligt den näst vanligaste gåsen i Sverige under hösten.

Trenden mot mildare vintrar är förmodligen en viktig faktor bakom de förändrade flyttningsvanorna, men man kan nog inte utesluta att vissa områden nått sin kapacitet när det gäller det antal gäss som kan härbergeras.

Vinterförhållandenas betydelse för gässen

Sverige ligger vid nordgränsen för gässens vinterutbredning, men ändå utgör SV Sverige och speciellt Skåne ett viktigt område för övervintrande gäss. Under de första årens inventeringar räknades betydande antal av sädgäss och kanadagäss i Sverige under vintern, medan övriga arter var mer sparsamt förekommande. Under senare mildare vintrar har även andra arter som grågås, blässgås och vitkindad gås blivit vanligare under vintern utom under kallare perioder.

Vinterförhållandena har stor betydelse för gässens möjlighet att övervintra i Skåne och då särskilt temperaturer under noll och inte minst snötäcket. De olika arterna är olika känsliga mot hårda vinterförhållanden. En jämförelse mellan sädgåsen och kanadagåsen visar att sädgåsen är mer känslig mot kyla än kanadagåsen. Under senare år har det också visat sig att grågässen sedan de börjat övervintra i Sverige också stannar kvar i betydande omfattning under kallare perioder.

Gässens ändrade övervintringsvanor återspeglas inte bara i inventeringarna under vintern utan på-

verkar också gässens populationsutveckling. För grågäss märkta i Skåne konstaterades en sämre överlevnad för dem som övervintrade i Spanien jämfört med dem som övervintrade längre norrut (Nilsson & Persson 1996, Nilsson et al. 1997). Gäss som övervintrade längre norrut anlände också tidigare till häckningsområdena med bättre resultat som följd (Nilsson & Persson 1994).

När det gäller grågässen kunde också konstateras att antalet inräknade individ påverkades av situationen under föregående vinter. Höstarna 1991 – 1995 planade ökningen ut i septemberinventeringarna något som kan sättas i samband med förhållandena i vinterområdet i Donana i SV Spanien (Nilsson et al. 1999b). För mycket vatten i nationalparken fick gässen att söka föda utanför parken, där jakttrycket var högt, medan gässen under torrår svalt och återvände i för dålig kondition för att kunna genomföra häckningen.

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Field choice of autumn staging and wintering geese in south-western Sweden 1977/78–2011/12

Fältval hos höstrastande och övervintrande gäss i sydvästra Sverige 1977/1978–2011/2012

LEIF NILSSON & HAKON KAMPE-PERSSON

Abstract

Field choice was recorded during counts of geese in South-west Scania, South Sweden in autumn (October and November) and in winter (January), 1977/1978–2011/2012. Sugar beet spill was the most important field type in autumn and during the last ten years also in winter. Bean Geese *Anser fabalis* used this food source when the study started while Canada Geese *Branta canadensis*, Greylag Geese *Anser anser*, White-fronted Geese *Anser albifrons* and Barnacle Geese *Branta leucopsis* followed during the years 1987–2001. Potatoes were mainly used when fields with sugar beet spill were unavailable. Cereal stubbles were mainly used in autumn and to a quite low extent. Winter cereals were heavily used by most species in both autumn and winter during the first 15 years but less so thereafter. Grasslands were mainly used in winter, to a large extent by White-fronted Geese and to a quite high extent by Bean Geese and Barnacle Geese. The total use of oilseed rape was low, mainly by Canada Geese that utilised fields with no-till when the ground was snow-covered.

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Introduction

During recent decades most goose populations in Sweden and other countries in North-west Europe have increased very markedly (Fox et al. 2010, Nilsson 2013 and references therein). At the same time, there have been marked changes in the distribution patterns of different goose populations, partly reflecting changes in migration patterns (see Nilsson 2013 for further references). These changes have been largely related to changes in agriculture, but also to changes in hunting practices (Nilsson & Persson 1984, 1991, 2000, Nilsson 2000, 2013).

The habit of geese to feed in farmland has since long caused conflicts with farmers. Problems with Egyptian Geese *Alopochen aegypticus* are mentioned in a text written already 3 000 years ago (Houlihan 1986). However, it was during the agricultural revolution in the 18th and 19th centuries that the geese turned to farmland in increasing numbers, as vegetation more nutritious than wild grasses was developed and grown intensively. To alleviate crop damage farmers started to scare the birds away from their fields. In north-central Spain, the villages employed boys, so called *ganseros*, to keep the geese from the autumn-sown crops (Madoz 1849). Several studies, both in Sweden and abroad, have tried to prove and quantify crop damage caused by geese, however, often with inconclusive results (Jönsson 1982, Owen 1990). Different measures to mitigate conflicts between geese and farmers have been adopted, such as scaring, shooting license to prevent crop damage, accommodation fields, management plans, refuges and compensation (Owen 1977, van Roomen & Madsen 1992, Edberg 2003, Axelsson & Modin 2006, Oord 2009, Hake et al. 2010). To ascertain which measure to adopt data about the field choice of the geese are needed.

Field choice of staging and wintering geese have been intensively studied in southernmost Sweden from time to time since the late 1950s, making it possible to follow changes in the utilisation of the Swedish farmland by increasing goose populations (Markgren 1963, Mellquist & Nilsson 1968, Persson 1982, 1989, Nilsson & Persson 1984, 1991, 1992, 1998, 2000). The field choice and habitat

selection of staging and wintering geese was studied more extensively in South-west Scania, south Sweden during 1956/57–1958/59 (Markgren 1963) and 1977/1978–1986/1987 (Persson 1982, 1989, Nilsson & Persson 1984, 1991). However, the world is continuously changing for both man and geese. Climate change can improve the conditions for wintering geese (Nilsson 2013), geese can learn new feeding habits (Kear 1990) while new crops, sorts and varieties and new farming techniques can drastically change the feeding opportunities for the geese. These factors urge for an up-date of our knowledge about field choice of staging and wintering geese.

Since the start of regular goose counts in Sweden in 1977/1978 (Nilsson 2013), the field choice of the staging and wintering geese in South-west Scania have been registered during the counts in October, November and January in most years. In this contribution, the field choice of the geese was analysed based on these counts for the entire period since the start of counts to 2011/2012 to elucidate whether any changes had occurred. For information about changes in numbers and distribution in staging and wintering geese see Nilsson (2013).

Study area

The study area comprises the south-western part of the province of Skåne (hereafter SW Scania), the southernmost tip of the Scandinavian Peninsula (Figure 1). The main soil type is moraine with different proportions of clay (Germundsson & Schlyter 1999). The annual precipitation ranges from 550 mm at the coast to 750 mm inland, of which 10–20% comes as snow. The coastal areas are situated south of the -0.5ºC isotherm and the inland areas south of the -2.0ºC isotherm. More than 60% of the total land area is used for agriculture and the main crops are cereals, sugar beet *Beta vulgaris vulgaris* var. *altissima* and oilseed rape *Brassica napus*, while potatoes *Solanum tuberosum* are grown mainly in the northern and eastern parts (Germundsson & Schlyter 1999). Cultivated and natural grasslands are mainly found in the eastern part of the study area and along the coast.

Major changes in farming techniques and practices benefitting staging and wintering geese in SW Scania took place well before the counts started in the 1977/1978 season. Most important among these changes were the introduction of mechanical harvesting methods for cereals, potatoes and sugar beet (Myrdal & Morell 2011), methods producing large amounts of harvest spill for feeding geese. Other important factors for the geese were removal of cultivation obstacles (e.g. hedges, stone walls, ditches and field roads) and amalgamation of fields into larger units (Gerell 1988), creating large fields with good all-round visibility for feeding geese; and an increase in the acreage of winter wheat (Statens jordbruksverk 2011), providing food for the geese during winter.

Some new crops, varieties, techniques and practices of importance for autumn staging and wintering geese were introduced during the study period. In 1993, triticale *Triticosecale rimpauii* was introduced as a new crop in SW Scania (Statens jordbruksverk 2011). Maize *Zea mays* and carrots *Daucus carota* became crops of local importance. More palatable varieties of rape, double-low with low erucic acid and glucosinolate content, were introduced in the 1980s (Ingerup 1992). The proportion of the arable land removed from production as set-asides varied greatly among years (Söderberg 2006, Statens jordbruksverk 2011). After the publication of the results of field tests starting in 1979 farmers started to saw rape with no-till (Pettersson 2009, Gunnarsson 2012). As a consequence of the concentration of the Swedish sugar production to a single factory, at Örtofta in SW Scania, the period during which the farmers could deliver sugar beets was extended to four months, from mid-September to mid-January (www.nordicsugar.se). Several fields of minor importance for feeding geese, both

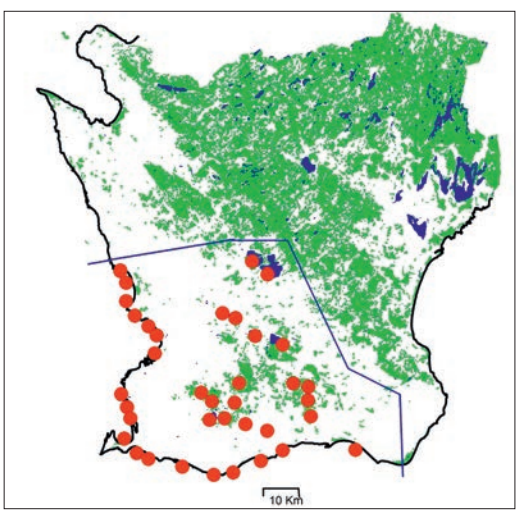


Figure 1. Map of Scania showing the borders of the study area (blue line). Red dots show the geographical positions of the night roosts regularly used by the geese.
Karta över Skåne med undersökningsområdet markerat (blå linje). Röda prickar markerar viktiga nattplatser.

at the coast and inland, were planted with energy forest (Weih 2006).

At the October counts, stubbles were still available to a large extent, together with the first harvested sugar beet fields. In November, the stubbles were mostly ploughed or of little value for the geese. Harvested sugar beet fields, and in some areas harvested fields with carrots and potatoes, offered rich food sources for the geese, together with sprouting autumn-sown cereals. In January, available field types were winter cereals, winter rape and natural grasslands, and in later mild winters, also fields with sugar beet remnants.

Several lakes in SW Scania were drained or the water tables lowered during the period 1840–1940 (Svenskt vattenarkiv 1995). Most of the remaining lakes, as well as a few of the rivers and several sites along the coast, have been used as night roosts by autumn staging and wintering geese (Nordqvist 1947, Mathiasson 1963, Nilsson & Persson 1984, 1991). Lake Näsbyholmssjön, one of the drained lakes, was partially restored in 2004 (Persson 2011). During the study period, several small waters were restored or constructed in SW Scania (Andersson et al. 2005). Most of these waters can be used as day roosts by geese, some of them also as night roosts.

Material and methods

Field choice of geese was determined in connection with mid-monthly counts in autumn (October and November) and in winter (January), 1977/1978–2011/2012. In all but a few cases, the field-work was carried out by one of the authors (HKP) over the entire study period. All areas known to be frequented by geese in SW Scania (Figure 1) were covered and all encountered flocks were recorded separately. Except for a flock of Bean Geese at River Tolånga in January before 2006 (Kampe-Persson 2010), a few flocks of Canada Geese at Landskrona and Barsebäck in January in some years and maybe a few flocks of Barnacle Geese in October during the last six years of the study (Kampe-Persson 2013a), there are good reasons to assume that no flocks of importance were overlooked. For each flock, numbers of the different species (and subspecies) were counted and recorded together with the field type used. The field type was registered as detailed as possible, i.e. not only information about the actual crop but also if it was harvested, if stubbles were harrowed, if oilseed rape was sown with no-till, and so on. To minimise the risk of scaring the feeding geese, field types were identified from the same distance as the geese were counted. For that reason, it was usually impossible to separate stubbles of barley *Hordeum vulgare*, wheat *Triticum aestivum* and triticale. When the feeding grounds were snow-covered, it was often impossible to identify any field types at all. Geese occurring at a roost site during the count were not ascribed to any field type.

When disturbed while feeding on sugar beet remains, the geese usually seek refuge on a stubble field, on a field with an autumn-sown crop, on grassland or at a roosting site. For instance, all hunting affecting large numbers of geese took place in sugar beet fields. In the middle of the day, the geese usually remained on the other field or at the roost for a long time before returning to the sugar beet field. In such cases, the geese might have been noted for the field type of the refuge or no field type at all, even though almost all feeding that day was made on fields with sugar beet remains. Therefore, percentages for sugar beet should be regarded as minimum values, while those for stubble, cereal, rape and grass should be regarded as maximum values.

In the analyses we separated the following six field types: sugar beet (harvest spill and a few cases of un-harvested beets), potatoes (harvest spill), rape (autumn-sown oilseed rape), stubble (cereal stubbles, mainly of wheat but also of rye *Secale cereale*, oats *Avena sativa*, barley and triticale, though the last-mentioned only since 1993), cereal (autumn-sown cereals, mainly wheat) and grass (both natural and cultivated grasslands). Cultivated grasslands were established as sown-in crops, such as clover *Trifolium pratense*, *T. hybridum* and *T. repens*, lucerne *Medicago sativa*, and *M. lupulina*, vetch *Vicia sativa*, sweet-clover *Melilotus sp*., birdsfoot trefoil *Lotus corniculatus*, kidneyvetch *Meliolotus vulneraria* and grass *Phleum pratense*, *Festuca pratensis*, *F. arundinacea*, *F. rubra*, *F. ovina*, *Poa pratensis*, *P. palustris*, *P. trivialis*, *Bromus inermis*, *B. arvensis*, *Dactylis glomerata*, *Cynosurus cristatus*, *Lolium perenne*, *L. multiflorum*, *Arrhenatherum elatius*, *Alopecurus pratensis* and *Agrostis stolonifera* (Bergelin et al. 1959, Halling 2005, Wiman 2012). The overall use of other field types was too low to be shown in the graphs. Instead, the use of red beet *Beta vulgaris vulgaris* var. *vulgaris* (harvest spill), carrots (harvest spill and a few cases of carrots in storage clamps), maize (stubbles and a few cases of un-harvested maize), wheat (un-harvested), peas *Pisum sativum* (harvest spill), newly-sown winter

wheat, set-asides and ploughed fields will be mentioned in the text.

Due to large between-year variations the field choice data were grouped into five-year periods to better elucidate the long-term patterns. Moreover, the data for October and November were grouped together as we did not find any major differences in field utilisation between the two months. For each of the five most numerous species, two graphs illustrating the selection of feeding areas in autumn (October–November) and winter (January), respectively, are shown. Count data for SW Scania are given as five-year means as a background to the field choice data. For details, see Nilsson (2013).

The term Bean Goose in the field choice data refers to Taiga Bean Goose *Anser fabalis fabalis* (Kampe-Persson 2011).

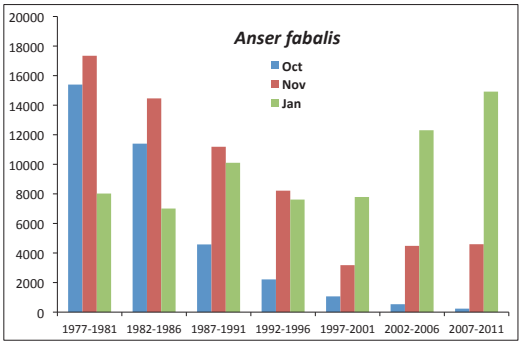


Figure 2. Five-year means for staging and wintering Bean Geese *Anser fabalis* in SW Scania.
Fem-års-medelvärden för antalet rastande och övervintrande sädgäss Anser fabalis i sydvästra Skåne.

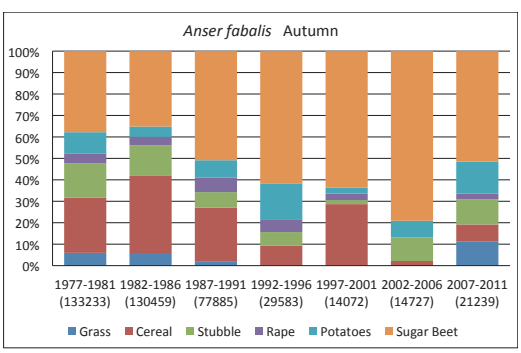
Results

Bean Goose *Anser fabalis*

When the counts started in 1977/1978, SW Scania was still an important staging area for Bean Geese during the autumn (Figure 2, Nilsson 2013). Over the years the numbers seen in October decreased markedly to a very low level. November totals also decreased but five-year means seem to have stabilized at between 2 000 and 4 000 individuals. Means for the winter during the first five five-year periods were around 8 000–10 000 with higher values for the last two five-year periods in spite of two cold winters during the last period.

When autumn counts started about 40% of the Bean Geese were found on harvested sugar beet fields with autumn-sown cereals as the second most important field type (Figure 3). During the years the use of sugar beet fields by autumn staging Bean Geese increased to between 60 and 80% of all feeding inidividuals. In the last five-year period, the use of sugar beet was a little lower but a proportion of the field use was instead on harvested potato fields. Other field types were only used to a small extent. In addition to the field types shown in Figure 3, Bean Goose flocks fed on carrots on a few occasions, but this was a local feature, since carrots were not a common crop in the area.

In January, winter cereals dominated the field choice quite markedly during the first three five-year periods (Figure 3) with other crops except grass being used only to a very small extent. A marked change in field choice followed and during the last twenty years potato and sugar beet spill amounted to 40–50% of the field use. Potatoes dominated during 1993–2002 and sugar beet dur-



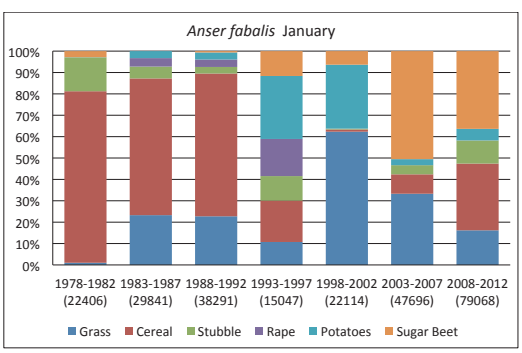


Figure 3. Field choice of staging (October and November) and wintering (January) Bean Geese *Anser fabalis* in SW Scania in different five-year periods. Numbers counted are shown in brackets.
Fältval för rastande (oktober och november) och övervintrande (januari) sädgäss Anser fabalis *i sydvästra Skåne. Antalet inräknade individ visas inom parentes. Sugar beet = sockerbetor, potatoes = potatis, rape = raps, stubble = spannmålsstubb och grass = gräsmarker.*

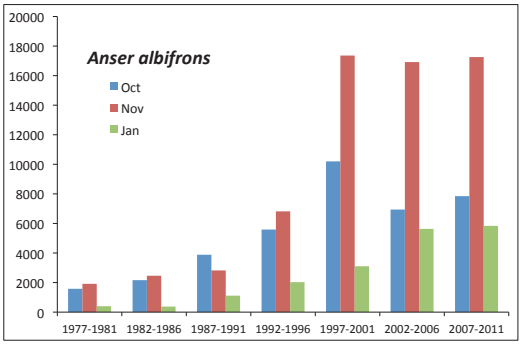


Figure 4. Five-year means for staging and wintering White-fronted Geese Anser albifrons in SW Scania.
Fem-års-medelvärden för antalet rastande och övervintrande blässgäss Anser albifrons i sydvästra Skåne.

ing 2003–2012. Even in January, Bean Geese were on some occasions seen feeding on carrots.

Pink-footed Goose *Anser brachyrhynchus*

The Pink-footed Goose occurred in low numbers, mainly singly, in the Bean Goose flocks during the entire study period. By that, their field choice was very similar to that of the Bean Goose.

White-fronted Goose *Anser albifrons*

The White-fronted Goose belongs to the species of geese where both staging and wintering numbers in SW Scania have increased over the study period (Figure 4). Whereas the mean numbers staging in autumn seem to have stabilized during the last three five-year periods, there has been a steady increase in the numbers staying during the winter, probably due to a series of mild winters (for further discussion, see Nilsson 2013).

During the first ten years of goose counts about 70% of the field use for the White-fronted Geese in autumn was on winter cereals and grassland (Figure 5). A smaller proportion of the White-fronted Geese were also found on stubble fields. When the counts started the use of sugar beet spill was not important, but this field type increased in importance for the staging White-fronted Geese and during 1997–2006, 70–80% were found on sugar beet spill. This proportion was smaller in 2007–2012, when the use of winter wheat and grassland was somewhat higher.

In January, the majority of the White-fronted Geese was found on winter cereals or grassland during the first five-year periods. Rape was used to some extent during 1988–1997 but was rarely used in the other years. During the latter part of the study period winter cereals decreased in importance and a higher proportion of the White-fronted Geese were found on grassland. In 2003–2012, sugar beet spill increased in importance for the wintering White-fronted Geese with 20–40% of the field use.

Greylag Goose *Anser anser*

The Greylag Goose is a common breeding species in SW Scania (Nilsson & Persson 1994) but the area is also an important staging and (in recent years) wintering area for the species. The field choice and habitat utilisation of the Greylag Goose during summer and early autumn have been presented by Persson (1989) and Nilsson & Persson (1992, 1998).

When the regular goose counts started in 1977/1978 very few Greylag Geese were found in

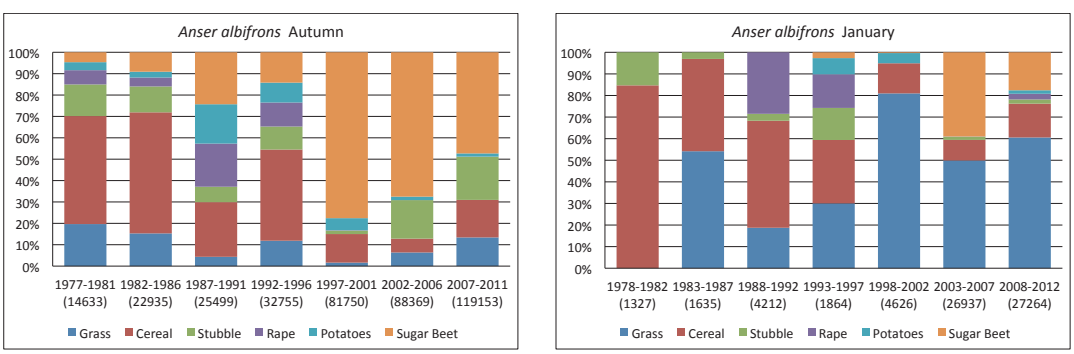


Figure 5. Field choice of staging (October and November) and wintering (January) White-fronted Geese *Anser albifrons* in SW Scania in different five-year periods. Numbers counted are shown in brackets.
Fältval för rastande (oktober och november) och övervintrande (januari) blässgäss Anser albifrons *i sydvästra Skåne. Antalet inräknade individ visas inom parentes. För beskrivning av fälttyper, se Figur 3.*

South Sweden. Special September counts started in 1984 (see Nilsson 2013) but during the first years numbers in SW Scania and the rest of Sweden at the October and November counts were very low. October numbers and later November numbers did, however, start to increase as the Greylag Geese were staying for longer periods in the country (Nilsson 2006) and eventually they also started to winter in larger numbers, especially in SW Scania (Figure 6).

During 1982–1986, only few Greylag Geese were included in the counts, most being found on autumn-sown cereals and stubble. From 1987–1991 and onwards, the majority of the Greylag Geese in autumn were found feeding on spill from the sugar beet harvest (Figure 7), with only a small proportion on other field types. In addition to the field types illustrated in the graphs, a number of Greylag Geese have been found feeding on carrots or unharvested cereals in some areas in some years. In October 2006, no less than 20 000 individuals were feeding in a flooded field with un-harvested wheat at Lake Vombsjön. Recently, Greylag Geese have also been found locally to use fields with maize stubble, but this was not observed so often during the regular surveys.

The habit of the Greylag Geese to stay in Sweden and especially in SW Scania over the winter is new. Very few wintering individuals were found except during the last ten years when wintering birds increased in numbers, with January totals being around 25% of the September count in some years (Figure 6, Nilsson 2013). About 50% of the wintering Greylag Geese were found on fields with sugar beet spill, and other field types commonly used were winter wheat and grassland.

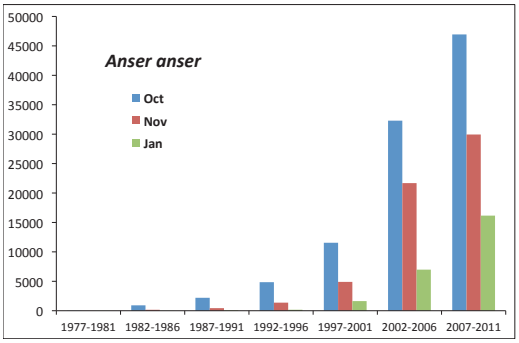


Figure 6. Five-year means for staging and wintering Greylag Geese *Anser anser* in SW Scania.
Fem-års-medelvärden för antalet rastande och övervintrande grågäss Anser anser i sydvästra Skåne.

Canada Goose *Branta canadensis*

During the first years of goose counting in Sweden, Canada Geese were common during winter in SW Scania, whereas few were seen in the area during October and November (Figure 8). As for the other goose species an increase was noted over the years with January five-year means for the area reaching about 25 000 and November means being 11 000–15 000 for the last three five-year periods. October counts also increased but were still quite low.

During the first fifteen years, when only small numbers of Canada Geese were found in autumn, most of them were feeding on fields with autumn-sown cereals. Later, the field choice changed to sugar beet, which has dominated in the autumn for the last twenty years (Figure 9).

In January, the majority of the Canada Geese were feeding on autumn-sown cereals but during

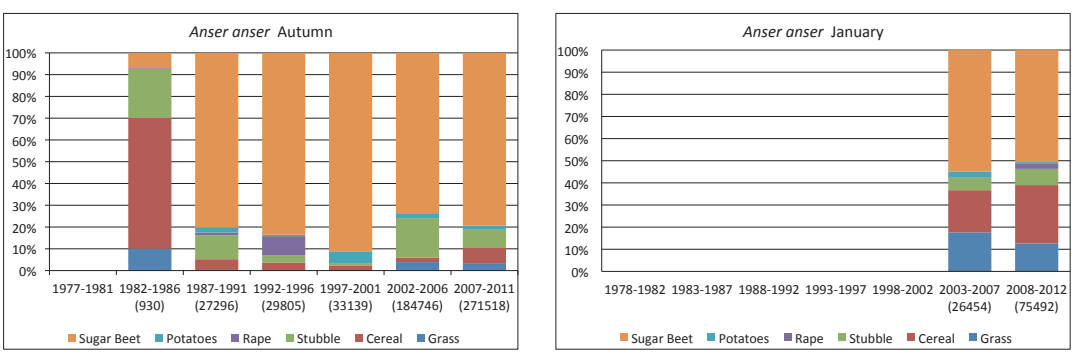


Figure 7. Field choice of staging (October and November) and wintering (January) Greylag Geese *Anser anser* in SW Scania in different five-year periods. Numbers counted are shown in brackets.
Fältval för rastande (oktober och november) och övervintrande (januari) grågäss Anser anser *i sydvästra Skåne. Antalet inräknade individ visas inom parentes. För beskrivning av fälttyper, se Figur 3.*

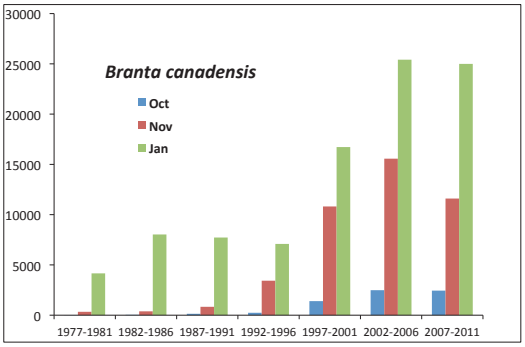


Figure 8. Five-year means for staging and wintering Canada Geese *Branta canadensis* in SW Scania.
Fem-års-medelvärden för antalet rastande och övervintrande kanadagäss Branta canadensis i sydvästra Skåne.

the last fifteen years sugar beet spill increased in importance, with 50 and 70%, respectively, found on sugar beet spill during the last two five-year periods. In 1993–1997, a large proportion of the Canada Geese were reported on fields with rape. Compared to the other species discussed here, rape, especially fields sown with no-till, was of larger importance for the Canada Geese during winter. In January 2010, more than one third of the Canada Geese were feeding on rape.

Barnacle Goose *Branta leucopsis*

During the first fifteen years of goose counts, the number of Barnacle Geese counted in SW Scania during autumn was very low but during the last fifteen years numbers increased dramatically (Figure 10), partly due to changes in the migration patterns (Nilsson 2013). Wintering totals were low except during the last few years, although the five-year mean for the last period was around 3 000 compared to more than 50 000 in October and more than 30 000 in November during the same period.

During the first ten years, when the species was relatively uncommon, most Barnacle Geese were found on autumn-sown cereals and grassland (Figure 11). The use of sugar beet was unimportant during the first years and mostly restricted to small groups of Barnacle Geese in flocks of more numerous goose species. From 1992–1996 and onwards, the use of sugar beet spill increased to between 50 and 80% of the field utilisation. Other field types frequently used were winter wheat and stubbles.

Wintering Barnacle Geese during 2003–2007 were mostly found on sugar beet spill with winter wheat and grassland as their second choice. In 2008–2012, with two cold winters, winter wheat and grassland dominated.

Discussion

The agricultural revolution in the 19th century, with several new crops (Wiman 2012), and the mechanisation during the post-war period (Myrdal & Morell 2011) has largely changed the agricultural landscape in SW Scania. However, it was a slow process and it took at least two decades for each new crop or technique to be accepted by a majority of the farmers. This time aspect is worth keeping in mind when discussing how the geese responded to each of them. Plant breeding and an increased use of fertilizers has substantially improved the productivity of the different crops, without it being possible to relate the effects to a specific period (Statens jordbruksverk 2011).

Owen (1980) discussed the feeding ecology of different goose species and related this to the mor-

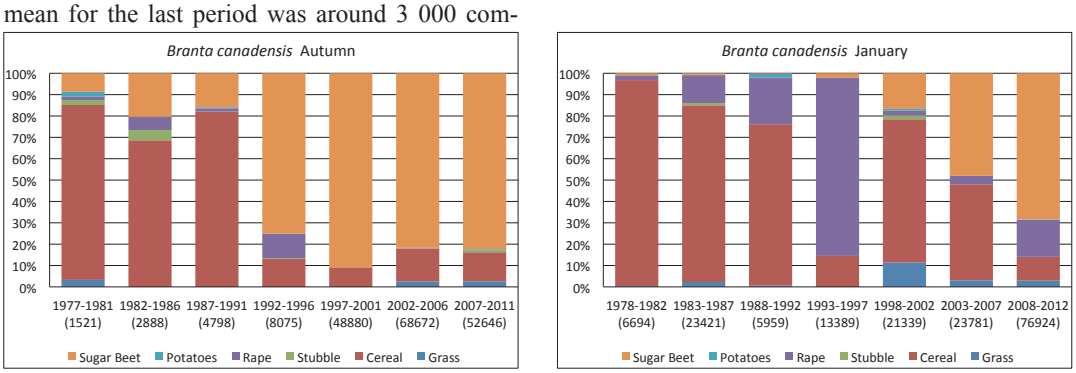


Figure 9. Field choice of staging (October and November) and wintering (January) Canada Geese *Branta canadensis* in SW Scania in different five-year periods. Numbers counted are shown in brackets.
Fältval för rastande (oktober och november) och övervintrande (januari) kanadagäss Branta canadensis *i sydvästra Skåne. Antalet inräknade individ visas inom parentes.*

phology of the bill. According to this classification, the Greylag Goose with its heavy and strong bill was adapted to feed on marshes and mudflats, digging up rhizomes of species like *Scirpus*. Another group of geese were those considered to have all-purpose bills suitable for grazing, grubbing and seed stripping. Of the species discussed here the Bean Goose, White-fronted Goose and Canada Goose were included in this group. Finally, the Barnacle Goose and some other species with short bills were considered to be adapted to rapid picking and very efficient in grazing short grass swards. However, when Owen (1980) published his review the geese had already changed their feeding habits and field choice appreciably and the different species were to a large extent found on agricultural land with different types of crops used for feeding. But to some extent they still used their natural habitats during part of the non-breeding season. For instance, the Greylag Geese of North-west Europe (including Sweden) to a large extent wintered in the Guadalquivir Marismas in South-west Spain during these years (Andersson et al. 2001, Nilsson 2006). In their Spanish winter quarters, Norwegian Greylag Geese fed on natural grasslands, while the other Greylag Geese to a large extent used *Scirpus* areas for feeding (Kampe-Persson 2002). When their normal feeding grounds were flooded both populations switched to winter cereals, the Norwegian birds to fields rich in weeds and the others to fields with luxuriant seedlings. Greylag Geese also used the Dutch Delta for staging and to some extent wintering during those years, mainly relying on *Scirpus* and other marsh plants for food (Loosjes 1974, Castelijns et al. 1998).

When Gunnar Markgren made his classical study of wintering geese in SW Scania in the 1950s, the prevalent opinion was that wintering Bean Geese fed on agricultural fields. However, the geese were mainly feeding on natural grasslands, 51% of the feeding time in autumn and 56% in winter, with another 22% of the time in autumn and 12% in winter in fields of clover (Markgren 1963). The remaining 30% of the feeding time, in both autumn and winter, was equally devoted to feeding in cereal stubbles, winter cereals and ploughed fields. The White-fronted Goose was feeding in natural grasslands to an even larger extent, 80% in autumn and 98% in winter (Markgren 1963).

Cultivated grasslands have been grown in SW Scania since the 18th century (Wiman 2012). Data for natural and cultivated grasslands were lumped together in our study but even so, grasslands were of little importance for all species in autumn. In mild winters, however, large numbers of Bean and White-fronted Geese and quite large numbers of Greylag and Barnacle Geese were found in natural grasslands.

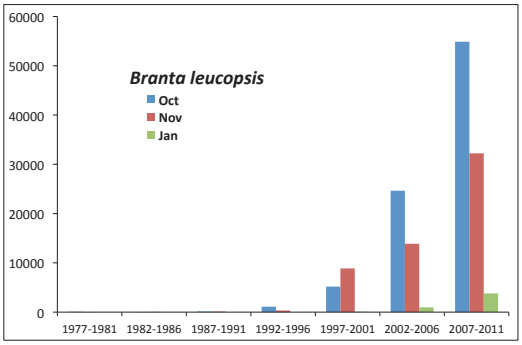


Figure 10. Five-year means for staging and wintering Barnacle Geese *Branta leucopsis* in SW Scania.
Fem-års-medelvärden för antalet rastande och övervintrande vitkindade gäss Branta leucopsis i sydvästra Skåne.

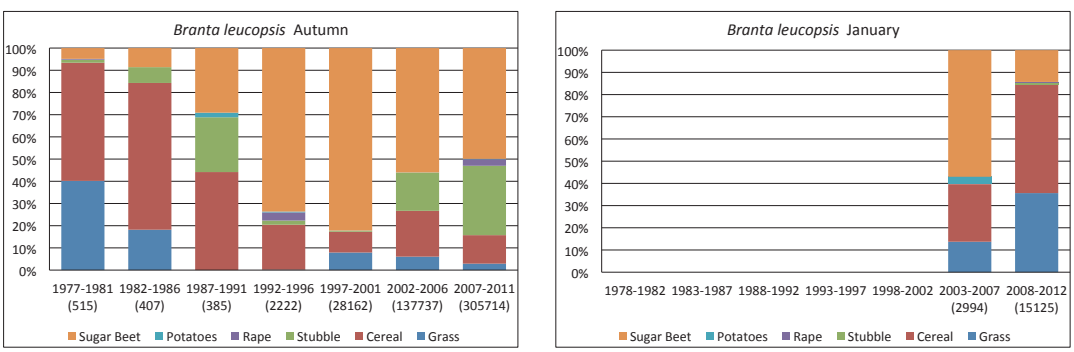


Figure 11. Field choice of staging (October and November) and wintering (January) Barnacle Geese *Branta leucopsis* in SW Scania in different five-year periods. Numbers counted are shown in brackets.
Fältval för rastande (oktober och november) och övervintrande (januari) vitkindade gäss Branta leucopsis *i sydvästra Skåne. Antalet inräknade individ visas inom parentes.*

When the geese started to feed on cereal stubbles in SW Scania is unknown. In the beginning of the 19th century, the Barnacle Goose relied so heavily on oat stubbles during autumn staging that the species was named *Hafregås*, "Oat Goose" (Nilsson 1835). Of unknown reasons the Barnacle Goose ceased to stage in the area in the mid 19th century (Kampe-Persson 2013a). While the Bean Goose is scientifically named after the field bean *Vicia faba*, the Swedish name is *sädgås*, "Cereal Goose". That name strongly suggests that this species started to feed in cereal fields long before the modern harvesters produced an abundance of spilled grain to feed on. Feeding on newly-sown barley, rye seedlings and ripening barley was mentioned by Nilsson (1821). The first harvesters came in the middle of the 1940s but many farmers continued for decades to harvest in a more traditional way. The reason was that they wanted to make full use of the straw for their cattle. But also when harvesters were in common use, there were large differences among areas; wheat stubbles in SW Scania had more spill than in East Germany in the early 1980s (Erich Rutschke pers. comm.).

Cereal stubbles can offer the geese three kinds of food; spilled grain, weeds and sprouting spilled grain, and sometimes also sown-in crops. Add to this that the harvesting time can differ from year to year, as well as the weather conditions during the harvesting period. In other words, cereal stubbles can vary greatly from year to year, especially during the time of year considered here. In the late 1980s, cereal stubbles in SW Scania were heavily utilised by Greylag Geese in September and early October (Persson 1989, Nilsson & Persson 1992). The number of Greylag Geese in the study area has increased substantially since then (Nilsson 2013), so therefore only a little spilled grain is now normally left in mid-October.

In the beginning of the 19th century, Bean Geese were mainly feeding on winter rye during wintering in SW Scania (Nilsson 1835). One and a half century later, the species was not using this field type at all and other winter cereals only to a low extent (Markgren 1963). Thereafter, the feeding pattern changed markedly and during the first 15 years of our study winter cereal was the main field type for Bean Geese, White-fronted Geese and Canada Geese. This field type was also used to a large extent in autumn, especially by the White-fronted Geese, Canada Geese and Barnacle Geese. In recent years, sugar beet spill has taken over as the most important field type in autumn while sugar beet spill and grassland are the most important in winter. The largest importance of the winter cereal is probably its availability. Whenever the harvest spill is depleted or ploughed down there are always fields with winter cereals for the geese to switch to. And also after heavy snow fall, windblown fields continue to offer a rich food supply. Occasionally, winter cereals are utilised as a food source already as newly-sown crops, when Greylag Geese follow the rows and pick the seeds (Persson 1989, Nilsson & Persson 1992). However, as winter cereals usually are sown before the mid-October count, this behaviour was rarely observed during this study.

Potatoes have been grown on light, sandy soils in SW Scania since the first years of the 19th century (Wiman 2012). However, before the farmers started to use modern harvesting machinery, potato fields only attracted feeding geese after that they had been ploughed. In such fields, Bean Geese fed on rhizomes of weeds like *Agropyron repens* and potatoes left in the ground (Nordqvist 1947, Markgren 1963). The first time geese were reported to feed on potatoes in a harvested field was in 1965 (Mellquist & Nilsson 1968). The inclusion of potato in the diet of the Pink-footed Goose *Anser brachyrhynchus* in Britain occurred as a result of their habit of grazing winter wheat seedlings because winter wheat followed potatoes in crop rotation (Kear 1963). The Bean Goose in SW Scania might have learned to feed on potatoes in a similar way. The varying use of potato fields in this study was largely due to the availability of sugar beet spill, because all goose species showed a higher preference for sugar beet remnants than for potatoes.

Sugar beet has been a very important crop in SW Scania since the 1880s (Wiman 2012). However, as long as the harvesting was done manually this crop was of no interest to the geese and Markgren (1963) stated that Bean Geese never visited sugar beet fields. With the introduction of mechanical harvesting methods in the 1960s the Bean Geese quickly learned to exploit this rich food source (Persson 1982). Fields with sugar beet remnants have dominated the field choice of the Bean Goose in autumn since then and during the last ten years also during the winter (this study). The winter use of sugar beet spill reflects a change in the length of the harvesting season in recent years; in some years farmers still harvested sugar beet after the middle of January. Sugar beet remnants have become the most important food source in autumn also for the other four goose species discussed here but it took somewhat longer for them to switch to this field type.

For the Greylag Goose, this switch was possible

to follow in detail.When the regular goose counts started in Sweden during 1977/1978, the number of staging Greylags in SW Scania in October and November was quite small (although increasing) and the first data illustrating the field choice during these months were obtained during the period 1982–1986, although data are also available from studies on a local breeding population, including field choice and local movement patterns studied during 1985–1987 (Persson 1989, Nilsson & Persson 1992). In these years, the Greylags mainly remained in the inland lake areas, feeding on fields with peas, stubbles and un-harvested cereals when available. Sugar beet were not grown in the lake study area. The cold winter of 1987 led to a delayed harvest and the post-breeding flocks moved to Foteviken at the coast, an area with sugar beet fields and some small flocks started to use this food source (Nilsson & Persson 1992). This food preference developed rapidly and in the coming years a large proportion of the geese from the inland area moved to the coast and stayed here feeding on sugar beet spill, which probably led to a much later departure compared to earlier years (Nilsson 2006). It may be noted that the Greylags from the area regularly fed on sugar beet spill during staging in the Netherlands before this habit started in Sweden (see e.g. Phillippona 1985)

Oilseed rape has been grown in Sweden since the 18th century but it was not mentioned as a food source for geese in late autumn or winter before this study (Nordqvist 1947, Markgren 1963, Mellquist & Nilsson 1968, Nilsson 1968). In early autumn in the province of Blekinge, however, Canada Geese regularly fed on rape when the plants had 2–4 leaves (Nilsson 1968). The introduction of more palatable varieties in the 1980s (99% of the Swedish acreage was sown with double-low varieties in 1990; Ingerup 1992), did not lead to a more marked utilisation of rape by feeding geese. Winter rape was mainly used when the ground was snow-covered as rape is often the only crop available above the snow.

Among the new crops in SW Scania, maize has, just as in other countries, the potential of becoming of regional importance for feeding geese. Up to now, mainly Whooper Swans Cygnus cygnus and Greylag Geese have been found feeding in un-harvested and harvested maize fields, and only locally. Carrots and red beet are grown by few farmers, so these field types will most likely continue being of only local importance. It is not known to which extent triticale was used by feeding geese due to difficulties in separating the cereal species during the counts. Crops like grass-seed and peas are usually harvested too early to be of any interest for feeding geese during the time of year considered here, but peas were important for local Greylag Geese during late summer and early autumn in SW Scania (Persson 1989, Nilsson & Persson 1992).

SW Scania seems to fulfil all necessary requirements for a region of importance for staging and wintering geese; availability of safe night roosts, rich food supplies situated not too far from the roosts, feeding grounds with good all-round views, low levels of disturbance and a favourable climate (Owen 1980, Persson 1989). The region is rich in roosting sites and most lakes are large enough to be used as night roosts also when they are covered by ice. As the total number of geese in SW Scania in autumn and winter has increased many-fold during the study period (Nilsson 2013) and the different species use the same field types (this study), often feeding in large mixed flocks, the food supply of each field is depleted much faster now than earlier. Most of the time, however, the geese feed within five km of their roosts, before depletion and ploughing force them to seek food further away. In winter, Canada Geese were regularly found feeding up to 17 km and Bean Geese up to 15 km from their roosts (Nilsson & Persson 1991, this study). However, Greylag Geese were found to fly up to 14 km to reach a very profitable food source, e.g. a field with harvested peas, also in autumn.

A factor reducing the availability of the fields for feeding geese are actions taken by farmers to keep them away from growing crops, mainly winter cereals. Occasionally, farmers actively scared the geese away from the fields but usually they just put up traditional scaring devices, such as scare-crows, a car parked in the middle of the field or raptor silhouettes on high moving masts (cf. Fog 1982a, Fog 1982b). As hunting of geese is very local in SW Scania and the overall hunting pressure is quite low most geese have lost their former shyness. Individuals of all species can nowadays be seen feeding quite close to houses, hedges and forest edges, while they avoid power lines and wind-turbines.

Field choice, as it was presented in this study, does not by necessity show the food preferences of the geese. To achieve that, also data about the availability of the different field types are needed (cf. Persson 1989). However, a strong indication of the food preferences of the geese was obtained by comparing their field choice whenever they had access to more than one field type. By comparing fields with different unused food sources the following preference list was obtained (the most-

preferred food first): un-harvested wheat – spilled grain – sugar beet spill – potato spill – winter cereal – winter rape (in each comparison, acreage of the preferred field type was less than that of the other field type(s), sample size was more than 10 000 birds, of which 95–100% were found on the preferred field type). This preference list can be used to mitigate conflicts between geese and farmers. The most important message is that geese during the months October–January rarely cause any problems for farmers in this part of Sweden. In general, as long as the geese have access to harvest spill they show little interest in autumn-sown crops. And winter cereals can sustain high grazing pressures without negative effects (Jönsson 1982). In oilseed rape, on the other hand, already low grazing pressures can cause large losses of yield (Jönsson 1982). As rape fields are mainly used when no other field types are available, usually because they are snow-covered, a good strategy would be to concentrate efforts of scaring the geese to such circumstances. With regard to feeding on other field types, feeding in un-harvested sugar beet fields has become more common during the autumn in recent years, especially at coastal sites, but that habit is probably of little economic significance except maybe locally. Carrots, on the other hand, are very susceptible to feeding by geese before harvest (Kear 1990) but such feeding was not observed during this study.

The large variety of food sources most goose species utilise in modern agriculture nowadays demonstrates a very large adaptability in these species. Before geese started to feed in improved grasslands and farmland, each species and subspecies occupied its own feeding niche and the winter distributions were almost non-overlapping (Owen 1980, Kampe-Persson 2002). Food availability in winter was probably a limiting factor for most goose populations in those times (Owen 1980). The proportion of the total food intake coming from improved grasslands and farmland during the non-breeding season has increased successively since the mid 18th century (Owen 1980, Kear 1990, this study). In autumn and winter in SW Scania, five goose species have attained a very wide, though not identical, food niche (this study). In this region, the Canada Goose is the only species feeding on bottom vegetation in shallow coastal waters, the Greylag Goose is the only species feeding on *Scirpus*, while the most numerous species on inland natural grasslands in winter were Taiga Bean Goose and White-fronted Goose. A closer inspection of food items taken might show differences between the Taiga Bean Geese and the White-fronted Geese however. Seemingly, the five species have widened their food niches in a similar way at the same time as each species has retained its original niche unintruded. The original feeding niche can, providing it still exists, act as a refuge the day competition excludes a taxon from the shared niche. Whether or not food competition occurs among wintering geese today is not known.

When feeding on harvest spill and autumn-sown crops, as all geese mainly do in SW Scania nowadays (this study), the birds are offered large amounts of food per hectare. However, reliance on a few monocultures for feeding in autumn and winter makes the geese susceptible to changes of varieties grown or farming technique. Agricultural changes can occur quickly and unexpectedly, such as when a decision in the European Union resulted in the cessation of sugar beet production in Latvia (Piskunova & Alsiņa 2010). At the same time, climate change may create new feeding opportunities for staging and wintering closer to the breeding grounds (Nilsson 2013.). If the trend during the study period continues, most Taiga Bean Geese and Canada Geese might remain and winter north of SW Scania in the future while the numbers of wintering White-fronted Geese, Greylag Geese and Barnacle Geese will increase in the study area. Very likely, instead of the Taiga Bean Goose, the Tundra Bean Goose *Anser fabalis rossicus* and maybe also the Pink-footed Goose *Anser brachyrhynchus*, will become a wintering bird in this part of Sweden. The Tundra Bean Goose has started to winter in Denmark during the last decade (Pihl & Vikstrøm 2006, Stefan Pihl unpubl.) and at Lake Hammarsjön in North-east Scania during the last few mild winters (Kampe-Persson 2013b).

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Sammanfattning

Under de senaste decennierna har de flesta gåspopulationer i Sverige och övriga länder i Nordvästeuropa ökat kraftigt i antal. Samtidigt har gässens geografiska utbredning genomgått stora förändringar. Även inom jordbruket har det skett stora förändringar, både vad avser grödor och brukningsmetoder. Av den anledningen fanns det anledning att analysera gässens fältval under hela den period som regelbundna inventeringar genomförts i Sverige. Inte minst eftersom gässens födosök på jordbruksmark sedan lång tid tillbaka orsakat konflikter mellan gäss och jordbrukare. Olika metoder att lindra dessa konflikter har tillämpats, såsom skrämsel, skyddsjakt, viltåkrar, förvaltningsplaner, refugier och ekonomisk kompensation. För att kunna avgöra vilken metod som bör väljas behövs dock aktuella uppgifter om gässens fältval.

Undersökningsområdet utgjordes av sydvästra Skåne, där drygt 60% av den totala landarealen utnyttjades för jordbruk. De viktigaste grödorna var spannmål, sockerbetor och raps medan potatis framförallt odlades på lätta, sandiga jordar i norra och östra delen av området. Gräsmarker fanns framförallt i östra delen av området samt längs med kusten. Som nattlokal utnyttjade gässen de flesta av områdets sjöar, några åsträckor samt ett flertal kustlokaler.

Insamlandet av fältvalsdata gjordes i samband med mittmånadsinventeringar i oktober, november och januari säsongerna 1977/78–2011/12. I varje flock räknades antalet individ av varje art och ras varefter fälttypen bokfördes så noggrant som möjligt, inte enbart vilken gröda det rörde sig om utan även om fältet skördats, om stubbar harvats, om rapsen var direktsådd, osv.

De besökta gåsfälten har grupperats på följande sex fälttyper: sockerbetor (skördespill samt några

fall av oskördade betfält), potatis (skördespill), raps (höstsådda fält), spannmålsstubbar (framförallt vete), höstsäd och gräsmarker (inklusive vallar). Födosök på andra fälttyper än dessa sex omnämns i texten, då det totala utnyttjandet av dessa var för lågt för att visas i diagrammen. För att utjämna mellanårsskillnader presenteras resultaten som medelvärden för femårsperioder. Eftersom vi inte fann några skillnader i fältval mellan oktober och november slogs värdena för dessa månader ihop. Som bakgrund till fältvalsuppgifterna redovisas antalet inräknade gäss i form av medelvärden för femårsperioder.

Sädgås var en talrik höstrastfågel i Sydvästskåne då studien inleddes, men området har successivt förlorat i betydelse och numera inräknas få individer i oktober. Trenden har varit den motsatta i januari, där antalet numera ligger omkring 16 000 individ. En växande andel av sädgässen har om hösten återfunnits på sockerbetsspill och denna fälttyp har under de senaste tio åren även varit väl utnyttjad i januari. Potatis utnyttjades framförallt i januari under perioden 1993–2002. Under de första 15 åren var höstsädesbrodd den helt dominerande fälttypen vintertid och tämligen flitigt utnyttjad på hösten, men uppvisar under de följande 20 åren ett betydligt lägre utnyttjande. Gräsmarker har mest utnyttjats vintertid och då framförallt under åren 1998–2007. Lokalt och tillfälligt, både höst och vinter, har sädgäss ätit morötter, antingen som skördespill eller som lagrade i stuka.

Spetsbergsgås förekom i låga antal under hela undersökningsperioden. Eftersom arten nästan uteslutande uppträdde tillsammans med sädgäss var deras fältval likt den artens.

Bläsgås är en av de arter för vilken såväl antalet rastare som övervintrare ökat markant under undersökningsperioden, även om höstsiffrorna tycks ha planat ut under de senaste 15 åren. På hösten återfanns under de första tio åren en klar majoritet av bläsgässen på antingen höstsäd eller gräsmark. Även under de följande tio höstarna var dessa fälttyper de viktigaste, men därefter har sockerbetsspill varit den dominerande födokällan. Under vintern har höstsäd och gräsmark varit de dominerande fälttyperna under hela undersökningsperioden, även om sockerbetspill fått en ökad betydelse under de senaste tio åren.

Grågås är en annan art för vilken såväl antalet rastare som övervintrare ökat markant under de senaste 35 åren. Under den senaste femårsperioden låg medelvärdena i oktober och januari på drygt 45 000 respektive drygt 15 000 individ. Alltsedan de första grågässen sågs på ett sockerbetsfält vid Foteviken hösten 1987 har sockerbetsspill varit den helt dominerande födokällan under såväl höst som vinter. Lokalt har grågäss även utnyttjat oskördad spannmål, morotsfält och majsstubbar. I oktober 2006 repade inte mindre än 20 000 grågäss oskördad vete i ett översvämmat fält vid Vombsjön.

Även kanadagås har ökat kraftigt i antal under såväl hösten som vintern och medelantalet i januari ligger numera på drygt 25 000. Spannmålsstubb var den helt dominerande fälttypen under såväl hösten som vintern de första 15 åren. Sockerbetsspill tog därefter över helt under hösten samt så småningom även under vintern. Till skillnad från övriga arter har även ett relativt stort antal individ utnyttjat raps, framförallt vintertid, under perioden 1993–1997.

Vitkindad gås saknades nästan helt under de första 20 åren. Sedan dess har arten blivit en talrik rastare med drygt 50 000 individ i oktober och drygt 30 000 i november. Under vintern är arten betydligt fåtaligare. De första tio höstarna återfanns de flesta vitkindade gässen på gräsmark och höstsäd, men sedan kom sockerbetsspill att dominera även denna arts fältval. I januari har de fördelat sig tämligen jämt mellan gräsmark, höstsäd och sockerbetsspill.

Den agrara revolutionen under 1800-talet, med flera nya grödor, samt mekaniseringen efter andra världskriget har markant förändrat det sydvästskånska jordbrukslandskapet. Det tog dock minst två decennier innan en ny gröda eller bruknings-metod blev allmänt accepterad av jordbrukarna, en tidsaspekt att hålla i minnet när gässens svar på desamma diskuteras.

När Gunnar Markgren genomförde sin klassiska studie i slutet av 1950-talet sökte majoriteten av såväl de rastande som övervintrande gässen föda på gräsmark, framförallt på naturliga gräsmarker men även på klövervallar. I vår undersökning däremot var gräsmarkerna av liten betydelse förutom under milda vintrar, då framförallt sädgäss och bläsgäss men även grågäss och vitkindade gäss återfanns på naturliga gräsmarker.

När gässen började söka föda på spannmålsstubb i Sydvästskåne är inte känt. I början av 1800-talet var dock vitkindad gås så nära förknippad med skördade havreåkrar att arten fick namnet *Hafregås*. Med tanke på sitt svenska namn bör även sädgåsen haft en tidig koppling till sädesfält. Eftersom grågås, som är mycket talrik i Sydvästskåne under tidig höst, börjar söka föda på stubbåkrarna så snart fälten har tröskats finns det numera sannolikt endast små mängder spillsäd kvar på dem när det är dags att räkna gässen i mitten av oktober. Däremot kan stubbarna under senhösten ofta erbjuda föda i form av sädesbrodd och ogräs.

Höstsädens största betydelse för gässen är sannolikt dess tillgänglighet. Närhelst skördespillet är uppätit eller nerplöjt finns det alltid fält med höstsäd för gässen att beta. Och även efter kraftigt snöfall erbjuder fält som vinden blåst rena en rik födokälla.

När potatis och sockerbetor skördades manuellt var dessa grödor ointressanta för gässen. Med introduktionen av maskinell upptagning under 1960-talet fick gässen tillgång till två nya rika födokällor, eftersom speciellt betupptagarna producerade mycket spill. Sädgässen lärde sig snabbt att utnyttja detta, varefter övriga arter successivt följde efter. Sockerbetsspill blev så småningom den viktigaste födokällan under hösten för samtliga här behandlade arter. Att sockerbetsspill blivit en viktig födokälla även i januari under de senaste tio åren beror på att betkampanjen förlängts och numera pågår fram till mitten av januari.

Trots att raps odlats i Sverige sedan 1700-talet utnyttjades den inte som födokälla av gäss under senhöst och vinter före vår studie. Övergången till dubbel-låga, mer välsmakande sorter under 1980-talet ledde inte till någon markant uppgång i utnyttjandet. Raps, särskilt den direktsådda, utnyttjas framförallt när fälten är snötäckta, då denna gröda ofta är den enda som sticker upp genom snön.

Bland nya grödor i Sydvästskåne har majs potential att bli av regional betydelse som gåsföda. Än så länge är det mest sångsvan och grågås som setts söka föda på oskördade och skördade majsfält. Eftersom det finns få odlare av morötter och rödbetor kommer dessa även framöver att vara av betydelse för gäss endast lokalt. Vanligtvis skördas gräsfrö och ärtor för tidigt för att vara tillgängliga för gäss under senhösten, men dessa grödor har blivit flitigt utnyttjade av grågäss under sensommar och tidig höst.

Sydvästskåne tycks uppfylla alla nödvändiga krav för ett område av betydelse för rastande och övervintrande gäss; säkra nattplatser, rik födotillgång, goda siktförhållanden, ostördhet och gynnsamt klimat. Eftersom antalet gäss mångdubblats och samtliga arter numera utnyttjar samma födokällor, ofta i stora blandflockar, uttöms tillgången på föda på varje enskilt fält betydligt snabbare idag än tidigare. Trots det kan gässen oftast finna föda inom fem km från nattplatsen. Vintertid sågs kanadagäss regelbundet söka föda upp till 17 km och sädgäss upp till 15 km från sina nattplatser. En faktor som kan reducera fältens tillgänglighet för gässen är de åtgärder som jordbrukarna tar för att hålla dem borta från växande grödor, framförallt höstsäd. Eftersom gåsjakten är av tämligen begränsad omfattning och mycket lokal i Sydvästskåne har de flesta gäss förlorat sin tidigare skygghet. Individer av samtliga arter kan idag ses söka föda även i närheten av hus, häckar och skogsbryn, medan de undviker kraftledningar och vindkraftverk.

Genom att jämföra gässens fältval då de hade tillgång till mer än en fälttyp fick vi fram följande preferenslista (högst preferens först): oskördad vete – spillsäd – sockerbetsspill – spillpotatis – höstsäd – höstraps. Detta tyder på att gässen under månaderna oktober–januari sällan orsakar några problem för jordbrukarna i denna del av landet. Så länge gässen har tillgång till skördespill visar de nämligen föga intresse för höstsådda grödor. Dessutom tål höstsäd ett högt betestryck utan negativa effekter. Det gäller däremot inte raps, där redan ett svagt betestryck kan förorsaka betydande skördeförluster. Eftersom raps huvudsakligen betas då inga andra fälttyper finns tillgängliga, oftast beroende på att de är täckta av snö, skulle det var en god strategi att koncentrera försöken att skrämma gässen till just de tillfällena.

Ursprungligen utnyttjade varje art sin egen födosöksnisch och de geografiska utbredningarna vintertid var nästan helt utan överlapp. Den stora variationen i födoslag som de flesta gäss utnyttjar i det moderna jordbruket visar på en stor anpassningsförmåga. Under höst och vinter i Sydvästskåne har fem gåsarter förvärvat en mycket bred, men ej identisk födosöksnisch. Inom detta område är kanadagåsen den enda art som söker föda på botten av grunda havsområden, grågåsen den enda art som utnyttjar *Scirpus* som föda, medan de talrikaste arterna på naturliga gräsmarker i inlandet vintertid var taigasädgås och bläsgås. Synbarligen har de fem arterna vidgat sina födosöksnischer på ett likartat sätt, samtidigt som de behållit sin ursprungliga nisch oinkränkt. Den ursprungliga födosöksnischen kan därmed, förutsatt att den fortfarande existerar, fungera som tillflykt den dag konkurrens utestänger en art från den gemensamma födosöksnischen. Huruvida konkurrens om födan förekommer idag är okänt.

Den pågående klimatförändringen kan öppna möjligheter för gässen att rasta och övervintra närmare sina häckningsområden. Fortsätter trenden från de gångna 35 åren kan detta leda till att de flesta taigasädgäss (skogssädgäss) och kanadagäss kvarstannar och övervintrar norr om Sydvästskåne, medan antalet övervintrande bläsgäss, grågäss och vitkindade gäss ökar. Istället för taigasädgås kommer tundrasädgås, kanske även spetsbergsgås, med stor sannolikhet att etablera sig som övervintrare i denna del av landet.

Erratum – *Rättelse*

Distribution and numbers of moulting non-breeding Whooper Swans *Cygnus cygnus* in the Baltic States and South Sweden

Geografisk fördelning och antal av ruggande icke häckande sångsvanar Cygnus cygnus *i Baltikum och Sydsverige*

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Abstract

The sentence starting at line 8 should read *(Meningen som börjar på rad 8 skall lyda)*: The majority of the marked birds found moulting as non-breeders in the Baltic States usually originated from within 25 km of the moulting site, the others from countries, including Germany and Poland, situated to the south of the moulting site. The amended words are underlined. *(De rättade orden är understrukna.)*

Figure 1

Five of the sites were connected with the wrong number in the map. The correct links between number and site name are as follow: 9. Birveta fishponds, 10. Visbarai fishponds, 11. Raseiniai fishponds, 12. Akvilegija fishponds, 13. Baltoji Voke fishponds.
Fem av lokalerna var knutna till fel nummer på kartan. Rätt lokal till dessa nummer är följande: 9. Birveta fiskdammar, 10. Visbarai fiskdammar, 11. Raseiniai fiskdammar, 12. Akvilegija fiskdammar, 13. Baltoji Voke fiskdammar.

Table 1

There were several errors in Table 1 for Matsalu Bay, Nagli fishponds and Sātiņi fishponds. The whole table is reprinted with correct values (next page).
Det fanns flera fel i Tabell 1 för Matsalu Bay, Nagli fishponds and Sātiņi fishponds. Hela tabellen trycks här med rätt värden insatta (nästa sida).

Table 1. Number of moulting non-breeding Whooper Swans recorded at different sites in the Baltic States in the years 2003–2012. Number of moulters marked with neck collars is given within brackets. For each site, year when moulting non-breeders were recorded for the first time is given. Lack of data is indicated by a bar. Estimated number of non-breeders in the Whooper Swan population breeding in the Baltic States is given in the bottom row. Sources: Baumanis et al. 1999, Luigujõe et al. 2002, Baumanis 2004, Strazds & Ķuze 2006, Boiko 2008, Morkūnas et al. 2010, Krister Castren pers. comm., Andris Erts in litt., Trinus Haitjema in litt., Zigrīda Jansone in litt., Māris Jaunzemis in litt., Andris Klepers in litt., Jānis Ķuze in litt., Edgars Lediņš in litt., Leho Luigujõe in litt., Ruslans Matrozis in litt., Oleg Mizinenko pers. comm., Egle Pakstyte pers. comm., Peter Raja in litt., Vitas Stanevičius in litt., Māris Strazds in litt.
Antal ruggande ickehäckande sångsvanar registrerade på olika lokaler i Baltikum åren 2003–2012. Antalet av dessa som märkts med halsringar anges inom parentes. För varje lokal anges det år då ruggande icke-häckare för första gången registrerades. Avsaknad av uppgift anges med ett vågrätt streck. Det beräknade antalet ickehäckare i den i Baltikum häckande sångsvanpopulationen anges på den nedersta raden. Källor: Baumanis mfl 1999, Luigujõe mfl 2002, Baumanis 2004, Strazds & Ķuze 2006, Boiko 2008, Morkūnas mfl 2010, Krister Castren muntligen, Andris Erts i brev, Trinus Haitjema i brev, Zigrīda Jansone i brev, Māris Jaunzemis i brev, Andris Klepers i brev, Jānis Ķuze i brev, Edgars Lediņš i brev, Leho Luigujõe i brev, Ruslans Matrozis i brev, Oleg Mizinenko muntligen, Egle Pakstyte muntligen, Peter Raja i brev, Vitas Stanevičius i brev, Māris Strazds i brev.

Moulting site *Ruggningslokal*	First *Först*	Number of moulting non-breeding Whooper Swans *Antal ruggande ickehäckande sångsvanar*									
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hapsalu Bay, EE	1998	0	0	0	0	0	0	0	0	0	0
Matsalu Bay, EE	1993	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50	43	25
Pärnu Bay, EE	1998	0	0	0	0	0	0	0	0	0	0
Kaltene, Riga Bay, LV	2012	0	0	0	0	0	0	0	0	0	10
Lake Kaņieris, LV	1990	0	0	0	0	0	0	0	0	0	0
Skrunda fishponds, LV[1]	1989	50 (2)	69 (7)	70 (19)	43 (12)	56 (15)	49 (11)	44 (14)	45 (7)	43 (7)	15 (0)
Nagli fishponds, LV[2]	1989	5–10	5–10	–	–	–	–	7	–	6	7
Satiņi fishponds, LV	1994	5-15	5-15	5-15	5-15	5-15	7	8	5-15	5-15	20
Baltoji Voke fishponds, LT[3]	1997	3	–	–	10–13	10–15	15 (1)	21 (3)	63 (6)	50 (4)	80 (0)
Raseiniai fishponds, LT	2009	–	–	–	–	–	–	8 (2)	1 (1)	0	0
Visbarai fishponds, LT	2009	–	–	–	–	–	–	5-6 (1)	0	0	2 (0)
Birveta fishponds, LT	2008	–	–	–	–	–	16	15	22	36	23
Akvilegija fishponds, LT	2011	–	–	–	–	–	-	-	–	8	5
Recorded number of moulters *Registrerat antal ruggande*		83–128	99–144	95–135	78–121	91–136	107–137	128–159	156–196	191–201	187
Estimated number of moulters *Beräknat antal ruggande*		820	920	1020	1150	1280	1440	1610	1800	2020	2260

[1] = 30 in 1989, 47 in 1995, 27 in 1997, at least 22 in 1999.
[2] = 18 in 1999.
[3] = 1 in 1997, 3-4 in 1998, 1-2 in 1999, 2-4 in 2000, 8 in 2001, 4-5 in 2002.