

Local movements of Greylag Geese *Anser anser* in South Sweden during the non-breeding season

Lokala rörelser av grågäss Anser anser i södra Sverige utanför häckningstiden

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Abstract

During 1984–2009, Greylag Geese *Anser anser* were neck-banded at two lakes six kilometres apart in southwest Scania, southernmost Sweden: 2308 at lake Yddingen and 633 at Klosterviken (part of lake Börninge). Through 2013 we recorded 51 132 and 29 937 re-sightings, respectively. We analyse the distribution patterns within Scania during the post-breeding months July–March. In spite of the short distance between the breeding sites, marked differences in the local distributions were found. In late summer and early autumn, Greylags from Klosterviken stayed longer inland close to the breeding lake than geese from Yddingen, the availability of good inland feeding sites close to Klosterviken explained the difference. In late autumn, when many re-

sightings were made along the western coast, it seemed that the distance from the breeding lake explained some of the differences, geese from Yddingen dominated in the northern part, whereas geese from Klosterviken were found further south. There was also a time difference in that the birds from Yddingen moved to the coast earlier than those from Klosterviken

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Introduction

Fifty years ago, the Greylag Goose *Anser anser* was a rare breeding bird in southernmost Sweden, but during the 1970s a marked increase in the population started here as in other parts of Sweden, and in other countries as well (Kampe-Persson 2002). Large flocks of non-breeding geese started to appear in different areas and were experienced as a management problem in relation to agriculture. To get better information about the situation the Nordic Collegium for Wildlife Research (NKV) started a Nordic Greylag Goose project in 1984 (Andersson et al. 2001). One of the main aims of the project was to study the migration patterns of the species by neck-banding a large number of geese from different areas. In the same year, a monitoring program of Greylag Geese started in Sweden and other countries (Nilsson 2013).

In Sweden, the neck-banding of Greylag Geese was mainly undertaken in two areas, a lake area in southwest Scania, southernmost Sweden and an area in Södermanland, south of Stockholm (Andersson et al. 2001). The studies in South Sweden

were concentrated to an area in southwest Scania (Figure 1). Based on the neck-banded popula-

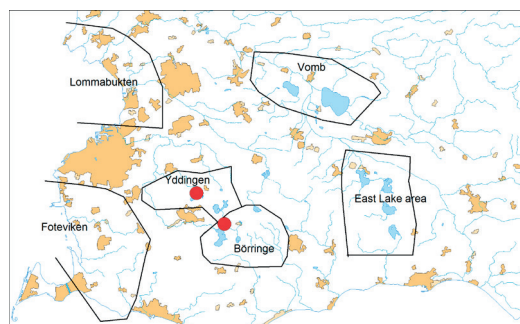


Figure 1. Map of southwest Scania, South Sweden, showing the main goose areas used in the study. Red dots show the geographical position of the marking areas at Lake Yddingen and Lake Klosterviken (in the Börninge area). Urban areas marked with yellow colour.

Karta över sydvästra Skåne, södra Sverige, med de viktiga gäsområdena markerade. Röda markeringar visar märklokalerna vid Yddingen och Klosterviken (i Börningeområdet). Bebyggda områden markerade med gul färg

tion different aspects of the breeding ecology and population dynamics were studied as was moulting ecology, dispersal, field choice, habitat selection and effects of different wintering and spring staging strategies (Nilsson & Persson 1992, 1994, 1996, 1998, 2001, Nilsson et al. 1997, 2001, 2002, Persson 1996a, 1999).

The local distribution and field choice of the Greylag Geese in south-western Sweden was studied during 1984–2010 based on censuses of staging and wintering geese (Nilsson & Persson 1992, 1998, Nilsson & Kampe-Persson 2013). In the present study, the local distribution of the non-breeding Greylag Geese in the area was studied based on re-sightings of individually marked geese to establish home-ranges of the geese from two different but neighbouring breeding lakes.

Material and study area

The study was undertaken in southwestern Scania, southernmost Sweden (Figure 1). Neck-banding of breeding Greylag Geese were mainly undertaken at Lake Yddingen and Lake Klostersviken (part of Börringe area) but catching was also undertaken in some years at Lake Fjällfotasjön (in the Yddingen area), Lake Börringe (in the Börringe area) and at Lake Snogeholm (in the East Lake area) (see Figure 1). In this study, we compare the local distributions of re-sightings of Greylag Geese marked at Lake Yddingen and at Lake Klostersviken, the two marking sites that were used regularly during the entire study.

The lakes are situated in a rolling landscape with agricultural land and smaller forest patches. Lake Klostersviken has a border of reed and there are some shore meadows offering good feeding opportunities during brood-rearing. Lake Yddingen is somewhat larger and has extensive reed beds in the bays plus some islands that are used for breeding. There are shore meadows in some areas and part of the lake borders to a golf course that offers good feeding conditions during brood-rearing. For more detailed description of the breeding lakes see Nilsson & Persson (1994).

Families of Greylag Geese were caught during early summer by driving them into nets mounted on the shore meadows and the golf course (Andersson et al. 2001, Persson 1994). Marking started in 1984 and the last geese were marked in 2009. In all, 136 adults and 497 goslings were neck-banded at Lake Klostersviken and 361 adults and 1 947 goslings at Lake Yddingen.

The areas around the breeding lakes were

checked for the occurrence of neck-banded geese several times a week during spring and early summer. From July to late autumn regular controls for marked geese were undertaken in the main feeding areas of the Yddingen and Börringe areas and the coastal areas at Foteviken (Figure 1). The other goose areas outlined in Figure 1 were checked at least once a month during the non-breeding season. The use of feeding areas in the lake areas and at Foteviken were discussed by Nilsson & Persson (1992, 1998) where information about available food types can be found.

In all, 29 937 re-sightings of Greylag Geese neck-banded at Lake Klostersviken and 51 132 re-sightings of Greylag Geese neck-banded at Lake Yddingen were made in the study area in southwest Scania during the years 1984–2013.

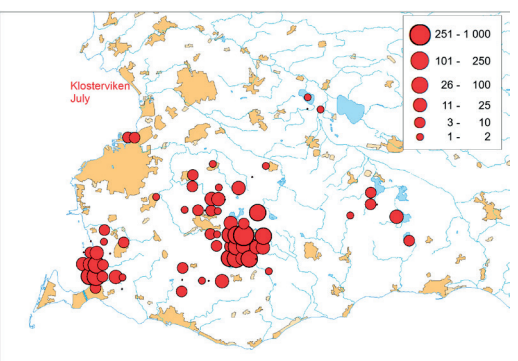
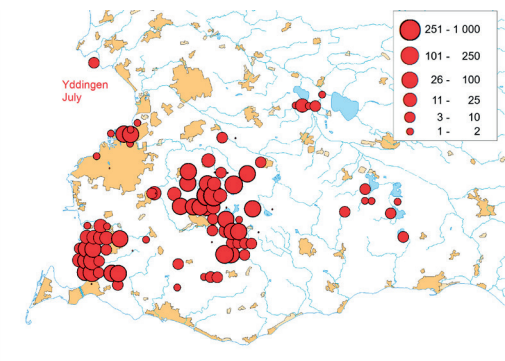
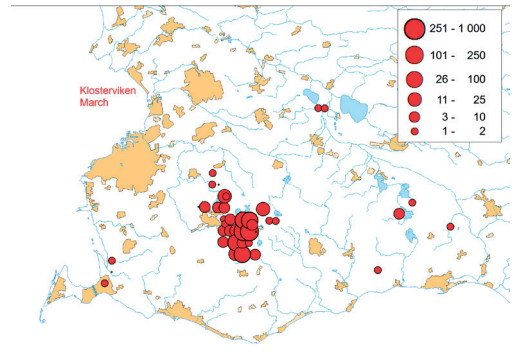
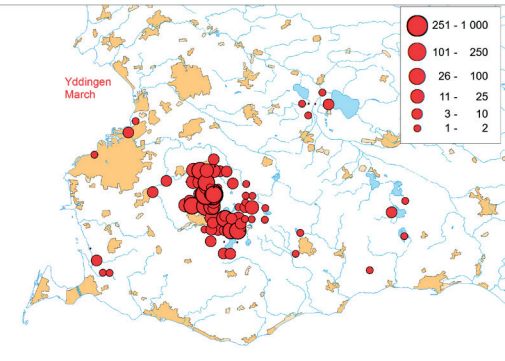
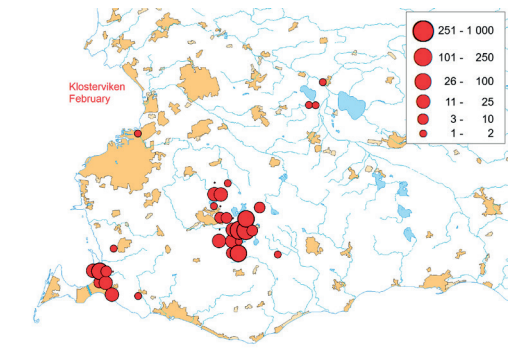
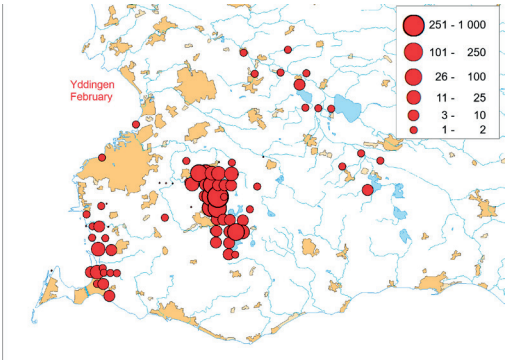
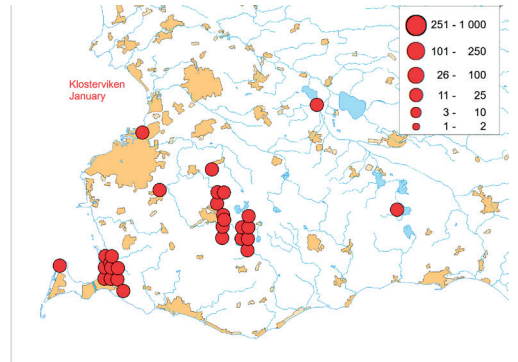
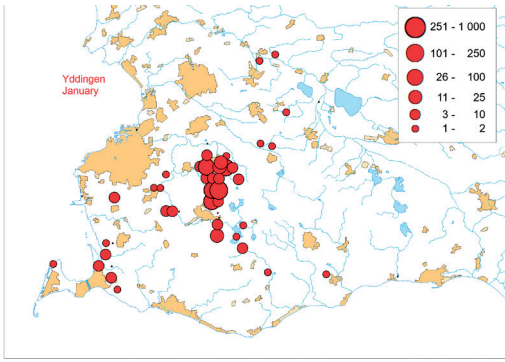
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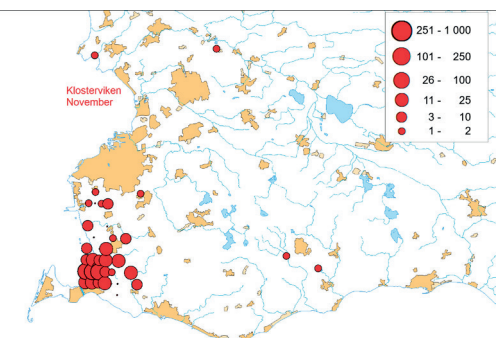
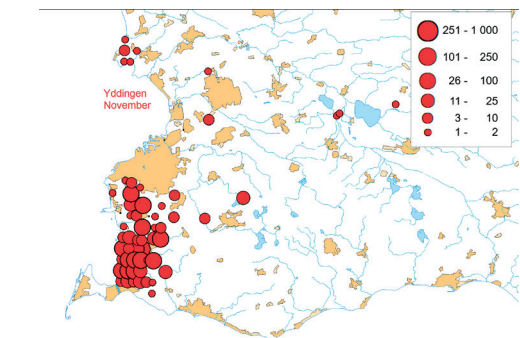
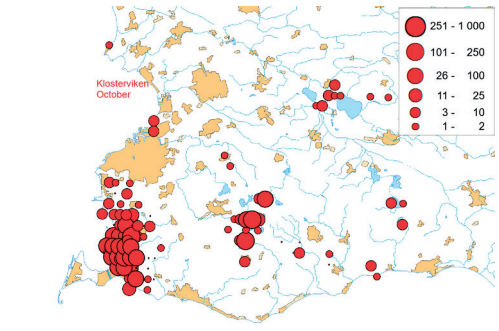
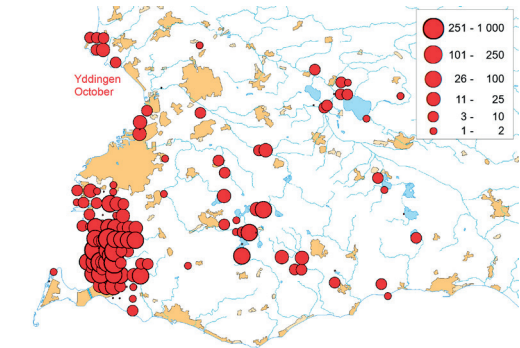
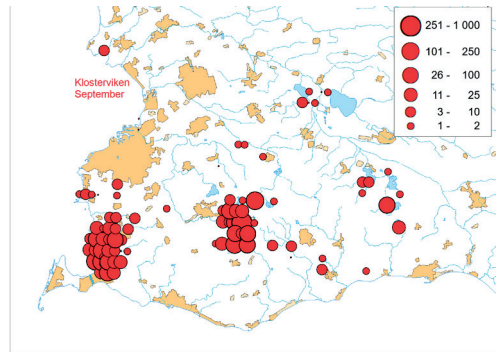
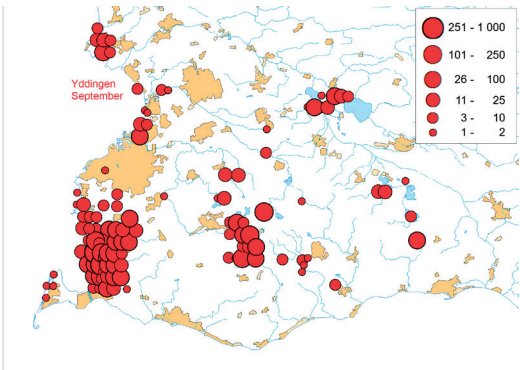
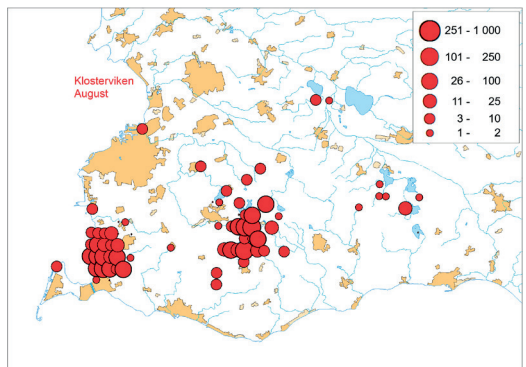
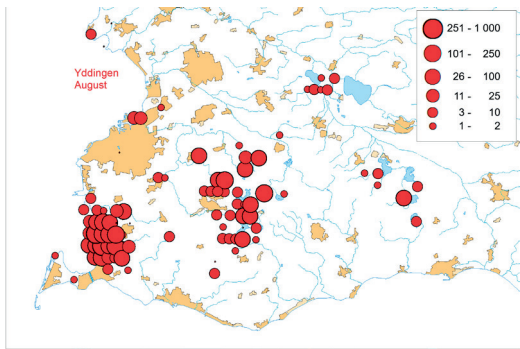
During the breeding season in April–June, the fieldwork was concentrated to the breeding areas and accordingly only few re-sightings were obtained from other areas (Figure 2). The flocks gathering before the migration to the moulting areas were mostly found close to the breeding lakes, but before late May there were still some non-breeding geese moving around.

In July, the families were fledged and moulters had returned from the moult migration. Large numbers of re-sightings were made in the inland areas around the breeding lakes but also some at Foteviken on the coast (Figure 2, 3, Appendix 1, 2). Greylag Geese from both marking areas were found in the inland areas and at Foteviken. There was a difference between the two marking areas however, as several re-sightings of Yddingen-geese were made in the Börringe area, whereas only few Klostersviken-geese were seen in the Yddingen-area. In July, 14% (of 2186) of sightings of Yddinge Greylags were from the Börringe area, whereas only 4.7% (of 1348) of the sightings of Börringe Greylags were made in the Yddinge area.

August showed a similar overall picture as July, but a larger proportion of the geese from Lake Yddingen (>50%) had left for the Foteviken area, whereas this proportion was only about 30% for the geese marked at Klostersviken. In August, 23% (of 1859) sightings of geese from Yddingen were in the Börringe area compared to 2.4% (of 1155) sightings of Börringe geese from the Yddingen area.

In September, the same trend continued for the Yddingen-geese, whereas the geese from Lake





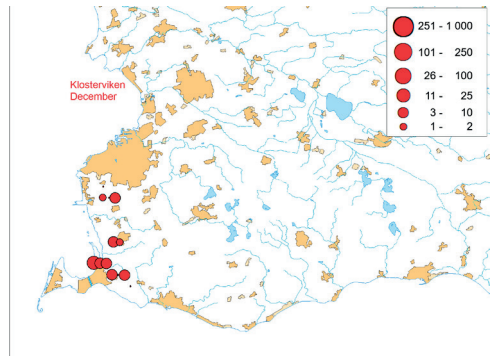
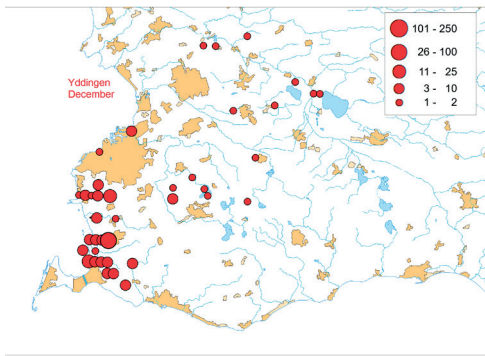


Figure 2. Monthly distribution of local re-sightings of neck-banded Greylag Geese *Anser anser* marked at Lake Yddingen (left) and Lake Klostersviken (right), accumulated for the years 1984–2009.

Månadsfördelning av lokala observationer av halsmärkta grågäss Anser anser märkta vid Yddingen (vänster) och Klostersviken (höger) åren 1984–2009.

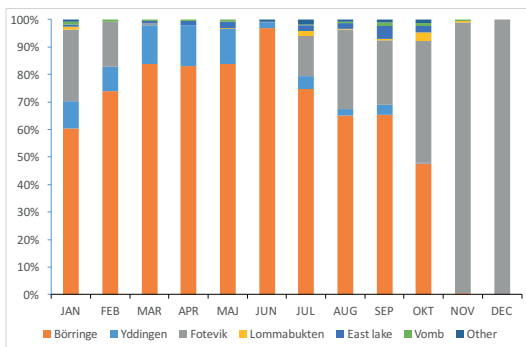
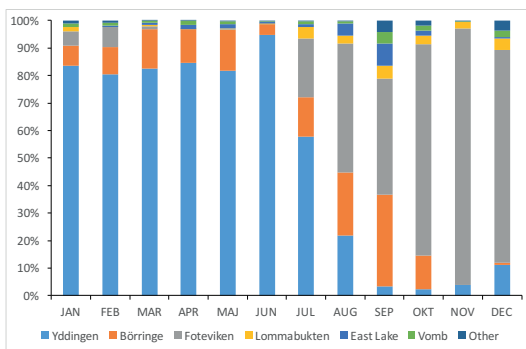


Figure 3. Monthly distribution (per cent) of re-sightings of neck-banded Greylag Geese *Anser anser* marked at Lake Yddingen (upper diagram) and Lake Klostersviken (lower diagram) in the different areas outlined in Figure 1.

Procentuell månadsfördelning av observationer av halsmärkta grågäss Anser anser märkta vid Yddingen (övre diagrammet) och Klostersviken (nedre diagrammet) i de olika områdena, som visas i Figur 1.

Klostersviken showed a similar picture as in August. Very few re-sightings of Yddingen-geese were made in the Yddingen area. In September, close to 20% of all re-sightings were obtained from areas outside the three main study areas.

In October, the movement to the coast continued and Foteviken was the main site for re-sightings of geese marked at Lake Yddingen with almost 80% of the re-sightings made here. Most of the Greylags from Yddingen remaining inland were still reported from the Börringe area. Greylag Geese marked at Lake Klostersviken remained in the inland to a higher frequency than the Greylags from Yddingen, about 45% of the re-sightings came from the Börringe area with a similar percentage noted at Foteviken.

During the autumn, smaller numbers of marked Greylag Geese from both lakes were seen in the Vomb area and the East Lake area. Especially in later years, marked geese were also reported from Lommabukten, both from the Barsebäck area in the north and Sjölund in the south. As the tradition to use the Öresund areas was established later than the tradition to use the Foteviken area, there are fewer observations from the earlier years. Even if the proportion of birds using the Öresund area was quite low, more Greylags marked at Lake Yddingen were found here compared to birds from Lake Klostersviken.

By November and December, almost all re-sightings of Greylag Geese marked at Lake Klostersviken were from the Foteviken area. The majority of the geese from Lake Yddingen were also concentrated to this area but in December close to 10% of the re-sightings were reported from other

areas. Due to departures for the winter quarters, the total number of geese (and re-sightings) was much lower in December than in November.

Especially in later years, the Greylag Geese started to return to southwest Sweden already in January in mild winters, whereas smaller numbers were found here in colder winters. In both cold and mild winters, marked Greylag Geese from both areas were seen both at Foteviken and in the inland areas. About 80% of January re-sightings of Yddingen-geese were from the Yddingen area, whereas the proportion of geese marked at Lake Klosterviken seen in the Börringe area in January was about 60%. February showed a similar picture to January but there was some variation between years related to weather conditions. During periods with snow in south Sweden there was often areas with no (or only little) snow cover close to the coast and a concentration of Greylags present to these areas was noted.

In March, finally, the vast majority of the re-sightings were from the breeding areas even if some individuals were lingering around. As later in spring, some Yddingen-geese were found at Börringe and vice versa.

When studying the maps of neck-band re-sightings (Figure 2), a marked difference in the distribution pattern of re-sightings of Yddingen-geese and Klosterviken-geese within the Foteviken area becomes obvious. Splitting the re-sightings accord-

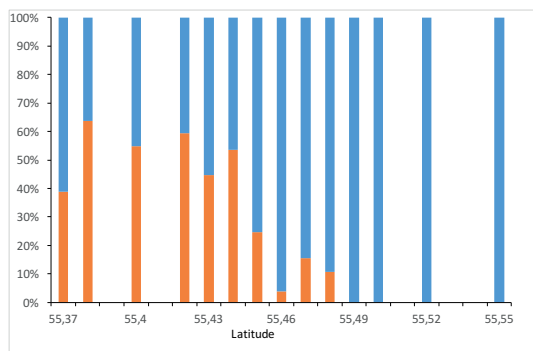


Figure 4. Percentage distribution of neck-band re-sightings of marked Greylag Geese *Anser anser* from Lake Yddingen (blue) and Lake Klosterviken (orange) in different parts of the Foteviken area (Figure 1). Different positions in the area are given by the latitude of the re-sightings shown in intervals of 0.01 degrees.

*Procentuell fördelning av observationer av märkta grågäss *Anser anser* från Yddingen (blå) och Klosterviken (orange) i olika delar av Foteviken-området (figur 1). Olika läge i området anges med latitud visad i intervall om 0,01 grader.*

ing to latitude it is clearly seen that re-sightings of geese from both areas were more or less equally common in the southern part of the Foteviken area, whereas almost all geese seen in the northern part of the area were from Lake Yddingen (Figure 4, Appendix 3).

Discussion

Even if the two marking areas (breeding lakes) were situated quite close to each other (less than six km from shore to shore), there were some clear differences in the utilization of the different areas by the geese, both during late summer and early autumn, and later in the autumn before the geese left the area on autumn migration. When discussing these differences between the two areas it is important to consider the marked changes in the number of Greylag Geese that has occurred during the long study period. The breeding population of the lake area has increased from little more than 100 pairs, reaching a peak of 1400 pairs in 2004 before decreasing to about 800–900 pairs. At the same time, the total number of staging Greylag Geese in southernmost Sweden has shown a very marked increase (Nilsson 2013) and new staging areas were established within the province.

At a larger scale, the migration patterns of the species have changed as a reaction to climate change and milder winters with the Greylag Geese wintering further north and migrating south later in the autumn (Andersson et al. 2001, Nilsson 2006, Ramo et al. 2015), a change that was accelerated by large differences in hunting exploitation among winter quarters (Persson 1996b). In Sweden, moreover a wintering tradition was established in later years (Nilsson 2013).

In summer, after the breeding season, the majority of the Greylag Geese stayed inland close to the breeding lakes, even if there were some movements and some geese already in July turned up at the coast. Comparing geese from the two marking areas in summer and early autumn it is clear that the geese from Lake Klosterviken remained for a longer period inland than the geese from Lake Yddingen. Moreover, quite a number of the marked geese from Lake Yddingen remaining inland, were found in the Börringe area in the same flocks as the locally marked geese. One main difference between the two inland areas was the availability of good feeding areas close to the lakes (Nilsson & Persson 1992, 1998), which was much better in the Börringe area.

The earlier arrival to the coast of the geese from

Lake Yddingen compared to the geese from Lake Klosterviken is probably also related to the availability of suitable feeding areas close to the roost. Whereas there were fewer good feeding areas close to Lake Yddingen compared to Lake Klosterviken, there was a good availability of feeding areas close to the roosts at Foteviken (Nilsson & Persson 1992, 1998). Usually, Greylag Geese shift to another roost in another gathering area, when they cannot find suitable feeding grounds within five km of their first roost (Nilsson & Persson 1992).

There was also a tendency for the Greylag Geese from the two study lakes, when moving to the coast, to move to the closest part of Foteviken. Thus, the proportion of marked geese from the two lakes was similar in the southern part of the Foteviken area in spite of the numbers marked at Lake Yddingen were three times higher than the numbers marked at Lake Klosterviken, whereas no geese from Lake Klosterviken were found in the northern parts of the Foteviken area. In the same way, geese marked at Lake Yddingen were seen in the newly established staging areas in Lommabukten, where only singly individuals from Lake Klosterviken were found.

With the change in wintering habits and migration patterns, some marked geese were found in Sweden in January, with early arrivals in the breeding areas in this month. Most January records were from the southernmost part of Foteviken with a higher proportion of birds from Lake Klosterviken seen here in January compared to birds from Lake Yddingen. For newly-arrived geese, Lake Yddingen probably offered better feeding conditions in early spring with highly nutritious grass on the golf course, which was available early compared to the shore meadows at Lake Klosterviken. Foteviken on the other hand offered large areas of grassland for the geese when arriving early in the season.

Even if differences were found in the local movement patterns of the Greylag Geese from two neighbouring lakes in southwest Sweden, no clear differences in the migration patterns were found between the two groups of geese.

Acknowledgements

The Greylag Goose project started as a joint Nordic program supported by the Nordic Council for Wildlife Research (NKV). Over the years, the project was supported by different grants from the Swedish Environmental Protection Agency and the

Swedish Sportsmen's Association ("Jägartjugan"). During some years, neck-banding was supported by the Öresund Bridge Company as a part of one of their control programs. The second author was responsible for the catching and marking operations during the first 24 years, with the help of a large number of voluntary "goose-catchers".

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Sammanfattning

För femtio år sedan var grågåsen en sällsynt häckfågel i Sverige, men från 1970-talet noterades en markant ökning av beståndet samtidigt som arten spreds till nya områden och betydande flockar av icke-äckande gäss kom att etableras i olika områden. För att få bättre information om utvecklingen hos grågåsbeståndet, dess flytningsvanor och rörelsemönster mm startades därför ett gemensamt nordiskt grågåsprojekt av Nordiskt Kollegium för Viltforskning, som bl.a. innefattade omfattande märkningar med halsringar i olika områden (Anderson et al. 2001). I Sverige var ett av huvudområdena sydvästra Skåne, där undersökningarna också kom att omfatta olika aspekter på grågåsens ekologi (Nilsson & Persson 1992, 1994, 1996, 1998, 2001, Nilsson et al. 1997, 2001, 2002, Persson 1996a, 1999).

I föreliggande studie analyseras de lokala rörelserna hos de märkta gässen från två närliggande häcknings sjöar i sydvästra Skåne.

Undersökningsområdet omfattade sydvästra Skåne (Figur 1). Fångst och märkning skedde huvudsakligen vid Yddingen och Klosterviken, de sjöar som omfattas av denna undersökning, men märkningar förekom också i mindre omfattning på andra lokaler. Grågåsfamiljer fångades genom att drivas in i nät monterade längs strandängarna eller golfbanan vid Yddingen under den period då ungarna var tillräckligt stora för att märkas, men innan de och föräldrarna kunde flyga. För närmare beskrivning av metodiken hänvisas till Andersson et al. (2001) och Persson (1994).

Området kring häcknings sjöarna kontrollerades efter förekomsten av märkta gäss flera gånger i veckan under våren och den tidiga sommaren. Från och med juli kontrollerades sjöarna och angränsande födosöksområden här och vid Fotevikens regelbundet, medan andra gåsområden kontrollerades åtminstone en gång per månad.

Totalt märktes 136 gamla fåglar och 497 ungar vid Klosterviken, medan motsvarande antal för Yddingen var 361 gamla och 1 947 ungar. Under perioden 1984–2013 erhöles 29 937 observationer av gässen märkta vid Klosterviken, medan 51 132 observationer erhöles av gässen märkta vid Yddingen.

De lokala observationerna av halsmärkta gäss från de båda sjöarna presenteras månadsvis i en serie kartor (Figur 2), medan den procentuella fördelningen av observationerna på olika delområden för gässen från de båda sjöarna framgår av Figur 3. Tidigt på säsongen observerades de flesta gässen i närheten av häckningsområdena (märkplatserna), men redan i juli noterades en rörelse ut mot kusterna, där merparten av gässen återfanns under senhösten.

En jämförelse mellan de båda märkområdena visar att gässen från Klosterviken i större utsträckning fanns kvar i närområdet under sommaren och den tidiga hösten jämfört med Yddinge-gässen som tidigare lämnade detta område. En betydande del av Yddinge-gässen förekom under den tidiga hösten också i Börringeområdet, medan endast få gäss från Klosterviken noterades vid Yddingen. Orsakerna till dessa skillnader kan förmodligen sökas i skillnader i tillgången på bra födosöksområden i inlandet (Nilsson & Persson 1992, 1998), vilka var avsevärt bättre i Börringeområdet än vid Yddingen.

Under hösten utgör Foteviken ett viktigt område för grågässen innan de lämnar landet på flyttningen. Gässen från Yddingen anländer normalt tidigare till Foteviken än de gäss som märkts vid Klosterviken (Figur 3). I Foteviken finner man också skillnader i uppträdande mellan gässen från de båda sjöarna (Figur 4). I södra delen av Foteviken är observationer av gäss från de två sjöarna ungefär lika vanliga, trots att det märkts ungefär tre gånger så många gäss i Yddingen, medan gäss från Klosterviken helt saknas i norra delarna. Likaledes är den absoluta merparten av de märkta gäss som ses i Lommabukten från Yddingen. Således en tendens att flytta till den del av de kustnära rastområdena som ligger närmast häckningsområdet.

Under senare år har en betydande del av grågässen övervintrat i Sverige. Dessutom anländer de som flyttat tidigare och det ses regelbundet betydande antal grågäss i Sverige i januari. Majoriteten av de anländande gässen ses vid häckningsområdena, men även här finns skillnader i fördelningen av gässen och en större del av observationerna av Klosterviks-gäss i januari kommer från Foteviken än vad som är fallet för Yddingegässen.

Appendix 1. Number of sightings of Greylag Geese *Anser anser* neck-banded at Lake Yddingen made in the different areas in SW Scania marked out on the map in Figure 1. Note each individual only included once per month, year and area.

Antal observationer av grågäss Anser anser halsmärkta vid Yddingen från olika områden i SV Skåne markerade på kartan i Figur 1. Observera varje individ noterad endast en gång per månad, år och område.

	Yddingen	Böringe	Foteviken	Lommabukten	East Lake	Vomb	Other	Total
JAN	240	21	15	4	0	4	3	287
FEB	590	73	53	1	3	9	5	734
MAR	784	135	11	3	9	6	1	949
APR	756	109	0	1	12	14	1	893
MAY	758	138	3	1	15	10	2	927
JUNE	911	37	1	1	5	3	3	961
JULY	1263	313	467	92	25	23	3	2186
AUG	406	425	874	53	80	18	3	1859
SEP	70	686	873	100	168	83	87	2067
OCT	32	162	1013	44	24	23	24	1322
NOV	25	0	596	15	0	3	1	640
DEC	19	1	131	7	1	4	6	169

Appendix 2. Number of sightings of Greylag Geese *Anser anser* neck-banded at Lake Klosterviken made in the different areas in SW Scania marked out on the map in Figure 1. Note each individual only included once per month, year and area.

Antal observationer av grågäss Anser anser halsmärkta vid Klosterviken från olika områden i SV Skåne markerade på kartan i Figur 1. Observera varje individ noterad endast en gång per månad, år och område.

	Böringe	Yddingen	Foteviken	Lommabukten	East lake	Vomb	Other	Total
JAN	67	11	29	1	1	1	1	111
FEB	308	37	68	0	0	3	0	416
MAR	421	70	4	0	5	2	0	502
APR	394	71	0	0	7	3	0	475
MAJ	406	61	1	1	11	4	0	484
JUN	477	11	0	0	1	0	4	493
JUL	1008	64	194	26	27	3	26	1348
AUG	751	28	335	3	23	5	10	1155
SEP	944	53	339	9	68	17	17	1447
OKT	392	2	365	26	18	9	11	823
NOV	1	0	196	1	0	1	0	199
DEC	0	0	42	0	0	0	0	42

Appendix 3. Number of sightings of Greylag Geese *Anser anser* neck-banded at Lakes Klosterviken and Yddingen seen in different parts of the Foteviken area (Figure 1) defined from the latitude of the observations.
Antal observationer av grågäss Anser anser halsmärkta vid Klosterviken och Yddingen från olika delar av Foteviksområdet (Figur 1) definierade efter latitud för observationerna.

Latitude	Klosterviken	Yddingen
55,37	7	11
55,38	14	8
55,39	0	0
55,4	34	28
55,41	0	0
55,42	311	213
55,43	991	1226
55,44	15	13
55,45	571	1758
55,46	3	76
55,47	405	2208
55,48	126	1045
55,49	0	1
55,5	0	396
55,51	0	0
55,52	0	122
55,53	0	0
55,54	0	0
55,55	0	64