Analysis of historical observations of Fennoscandian Lesser White-fronted Geese *Anser erythropus* in Sweden and the West Palearctic

Johan H. Mooij, Per Hansson, Hakon Kampe-Persson & Leif Nilsson

1. Introduction

The Lesser White-fronted Goose *Anser erythropus* is an exclusively Palearctic species, originally breeding in the southern part of the tundra and forest tundra in Russia as well as in the northern birch forest and mountain tundra in Fennoscandia. Since the first population estimates of the 1950s, a drastic decrease in numbers was recorded from about 100,000 birds (Uspenski 1965) to less than 25,000 in the 1990s (Fox & Madsen 1999). During the 1930s, local concentrations of c. 50,000 Lesser White-fronted Geese were recorded in the Western Palearctic (Ringleben 1957) and during the 1950s, this population was still estimated at more than 50,000 birds (Uspenski 1965), but in the 1990s numbers recorded in this region during midwinter counts never exceeded 10,000. The Fennoscandian population was estimated at more than 10,000 birds in the first half of the 20th century, with only 300–500 birds and less than 50 breeding pairs counted in the 1990s (Aarvak et al. 1996, 1997; Scott & Rose 1996; Rose & Scott 1997; Tolvanen et al. 1998, 1999, 2000a, 2001; Fox & Madsen 1999; Lorentsen et al. 1999), and about 20 breeding pairs in 2006 (Otten et al. 2007).

The Lesser White-fronted Goose population is the smallest goose population in Eurasia and is among the most endangered bird species in the world. The species is included in Appendix I of the African-Eurasian Waterbird Agreement (AEWA) under the Bonn Convention, in Appendix II of the Bern Convention and in Appendix I of the EU Birds Directive.

In 1976, under the lead of Lambart von Essen, the Swedish Association for Hunting and Wildlife Management started a project to release Lesser White-fronted Geese in Swedish Lapland to support the remnants of the natural population. Since its start in 1981 the project was supported by WWF Sweden. In the scope of this project, Lesser White-fronted Goose eggs were hatched by semi-domestic Barnacle Goose foster-parents. To study if this view is correct, historical literature sources as well as observations of Lesser White-fronted Geese in Sweden were collected and analysed. To exclude birds of the re-established Swedish population only data of the period 1900 – 1981 were used. A total of 353 observations of more than 3,600 individuals were collected and analysed. These data were insufficient to delineate exact migration routes within the Atlantic flyway, south of the former breeding range. Regular occurrence at frequently checked sites, and numbers involved as well, still in the 1960s, strongly indicated, however, that such routes have existed. Consequently, there is no scientific basis to state that the Swedish re-established Lesser White-fronted Geese follow an unnatural migration route. Instead, it is likely that these birds revived a traditional migration route.

One of the criticisms of the Swedish re-establishment project is that the released birds have not followed a traditional migratory route. Instead, they are said to be led along a newly installed route, to wintering areas where

**Key words**: Lesser White-fronted Goose *Anser erythropus*, historical migration patterns, migration over Sweden.
they did not traditionally occur on a regular basis. In order to get more information about the traditional migratory patterns of Lesser White-fronted Geese in Sweden, we gathered and analysed data on observations of the species in Sweden from 1900 to 1981.

2. Methods

Data for this study were collected by Åke Andersson and the authors, from literature, the Swedish databank "SVALAN" (a reporting system for bird observations in Sweden) and other contacts. During the years 1977/78–1980/81 all important wintering and staging areas for geese in South Sweden were covered on a monthly basis from September to April. Moreover, intensive studies, including daily counts, were performed on most important staging areas in the spring seasons of 1977–1979 (Nilsson & Persson 1984).

3. Results

3.1. Literature data

3.1.1. Occurrence in the West Palearctic according to older literature

The Lesser White-fronted Goose was described as a species in the 18th century (Linnaeus 1758), but at most wintering sites the species was overlooked until the middle of the 20th century and the migratory routes, staging areas and wintering sites were poorly known.

In the middle of the 19th century, Nilsson (1858) reported that two white-fronted goose species occurred in Scandinavia, of which one, "the true mountain goose", was breeding there. The breeding species migrated over South Sweden in autumn (September and October) and in spring (March and April), partly along the coast and partly along watercourses in the inland. It was mostly seen in smaller flocks. The other species, said to migrate mainly eastwards, was at times found in the southern part of the peninsula, along the shores of the Baltic Sea, but also hunted inland.

Schlegel (1877) described the Lesser White-fronted Goose as a subspecies of the Greater White-fronted Goose Anser albifrons, but noted that it also could be described as a separate species. He wrote that the smaller taxon was much rarer than the greater one and that during migration it was observed everywhere in Europe – including the Netherlands – in small numbers.

Alphéraky (1904) stated that there cannot be any doubt about the fact that the Lesser White-fronted Goose is a separate species, but that the delineation of its flyways is difficult, because the species is not separated from the Greater White-fronted Geese at most sites by hunters and ornithologists. From the description of the white-fronted geese at some sites as being "very small sized" Alphéraky concluded that these must have been Lesser White-fronted Geese. He further wrote that the species appeared rarely in Great Britain, more often in Germany, the Netherlands, Belgium, France and Spain (Seville region) in autumn and winter and more regular in Greece and Turkey in winter. He also quoted Swedish and British ornithologists, who found that Lesser White-fronted Geese were breeding and moulting in Lapland and Finnmark in considerable numbers.

Niethammer (1938) stated that the Lesser White-fronted Goose mainly wintered along the coast of the Black Sea in Turkistan, and Iran, India, China, Egypt, Greece, Romania and Hungary, where the species frequently was confounded with the Greater White-fronted Goose. Furthermore, it was a rare winter guest in the Western Mediterranean countries, in France, Belgium, the Netherlands, Switzerland, Great Britain, Germany and Denmark and was found more often in southern Scandinavia, the Baltic states, Poland and Bohemia.

Witherby et al. (1939) described the species as a very rare vagrant for Great Britain, and stated for the distribution of the species outside the British Isles: "Breeds in N. Norway to 70° N., Sweden (south to Jamtland), N. Finland south to 68° and N. Russia. Also N. Siberia from R. Ob to Taimyr and R. Kolyma (rare), but breeding range south of White-fronted and Bean-Geese. In winter in Europe to France, Germany, Czech-Slovakia, Hungary, Yugo-Slavia, Greece and S. Russia; also in Asia Minor, Iraq, Persia, Aralo-Caspian region, Turkestan, India, China and Japan. Accidental in Spain, Holland, Belgium, Switzerland, Italy, Egypt; also Novaya Zemlya." Furthermore, it was stated that if further research would show that the breeding ranges of Greater and Lesser White-fronted Goose did not overlap, it should be considered to treat both species as forms of one species.

Dementiev & Gladkov (1952) described the breeding area of the Lesser White-fronted Goose from the Scandinavian Peninsula to Anadyr and stated that in winter the species was found in low numbers and rare in Germany, Belgium, England, France, Hungary and other places in Europe, but frequently on the Balkan Peninsula.

Bannerman (1957) presented information about the Fennoscandian breeding grounds of the Lesser White-fronted Goose and mentioned two possible migratory routes along the Bothnian Bay, one passing Oulu and the other Umeå. He described the species as "A winter visitor, which for long went unrecognized, but which appeared fairly regularly in recent years in certain localities, especially in south-west England and south-west Scotland." From 1945, as Peter Scott started Lesser White-fronted Goose monitoring in Great Britain, until 1980 the species was annually recorded with one to three birds, associated with Greater White-fronted Geese at Slimbridge in Gloucestershire as well as in Bean Goose flocks in Norfolk and Scotland (Davis & Scott 1946; Davies 1949; Watson 1955; Smith 1974). These were "undoubtedly wild birds" (Ogilvie & Wallace 1975).

Ringelben (1957) stated that in winter Lesser White-fronted Geese are regularly recorded in middle and southeastern Europe, more seldom in western Germany and western Europe, very numerous along the coast of the Caspian Sea, regularly in an area from Irak via Iran and China to Japan and seldom in northern India and Egypt.

In Naumann (1842) and Stresemann (1961), the Lesser White-fronted Goose was described as rare and in Frielings (1936) and Niethammer (1938) as a "not rare" and regular migrant and winter guest in Germany, while Bauer & Glutz von Blotzheim (1968) stated that the Lesser White-fronted Goose was a regular migrant.
in the eastern part of the northern European lowlands, in some years in large flocks. In spite of the fact that the species seemed to be a rare migrant in most of Germany, the species was recorded in most parts of the country.

USPENSKI (1965) wrote that Lesser White-fronted Geese wintered in a considerable number of West European countries, southwestern Asia, south of the Caspian Sea, in the delta of the Nile, southern Japan, Korea and southeastern China.

In all these publications, a follow-up of NILSSON (1858), regular breeding in Fennoscandia and regular wintering in western Europe is documented, but – with BANNERMAN (1957) as an exception – without any information about the migratory routes of the Fennoscandian birds.

In Finland, different opinions about the migratory routes of the Lesser White-fronted Goose population breeding in Finnish Lapland and northern Norway, existed in the early 20th century. According to one opinion, the spring migration passed east of Finland, along Ladoga and Onega, to the White Sea, and then to the breeding areas, while the main route in autumn passed Oulu (MUNSTERHJELM 1911, 1913). Other researchers stated that the migratory route passed Oulu both in spring and autumn (SANDMAN 1892; MERIKALLIO 1915, 1920). According to HORTLING (1929a), the Lesser White-fronted Geese in spring reached the Finnish coast after crossing the Gulf of Finland. The main part of the northern Fennoscandian population migrated along the Finnish west coast, whereas smaller numbers migrated on a broader front across the Finnish inland, or northeastwards to the White Sea.

Based on counts in the neighbourhood of Oulu in the spring of 1913, the (northern?) Fennoscandian population was estimated to number at least tens of thousands (MERIKALLIO 1915). During 3–4 hours of daily counts and no counts over the sea, a total of 1,841 migrating Lesser White-fronted Geese was counted at Kumnäs and Ytterö in the spring of 1928 (HORTLING 1929b). At Pori, on the Finnish west coast, the number of migrating and staging birds in spring declined from 1,065 in 1953 to nil in 1970 (SOIKKELI 1973). In autumn, the decline came earlier, and the species was observed only occasionally by the 1950s (SOIKKELI 1960). In the 1960s, only three birds were observed in autumn, compared to more than 800 in spring (SOIKKELI 1973).

3.1.2. Occurrence in Western Europe

In the late 19th and early 20th century, the Lesser White-fronted Goose was more often reported during autumn migration from Denmark, e.g. from Møn, Fyn, Jutland and Bornholm, than from South Sweden (ROSENİUS 1937). In the 1960s, the species was a regular migrant through Denmark in small numbers, where they were observed in flocks of Taiga Bean Geese Anser fabalis fabalis ringed in Finnmark and the Netherlands, as well as among Greater White-fronted Geese ringed in the Netherlands and England. In that period, up to 16 Lesser White-fronted Geese were reported shot annually by hunters (FOG 1976, 1977; JEPSEN pers. comm.).

Formerly, the Lesser White-fronted Goose was found everywhere in Poland during migration (September–November and April–May), with the largest numbers in the eastern part of the country, where flocks of up to 100 individuals were recorded. Since the 1950s, numbers decreased considerably and today only few birds are recorded (TOMIAŁOJČ 1990).

In Germany, the species was a regular but more or less rare migrant and winter guest in the 19th and first half of the 20th century, but in some years rather large flocks were observed, especially in the eastern part of the country, which now partly belongs to Poland (NAUMANN 1842; FRIELING 1936; NIETHAMMER 1938; STRESEMANN 1961; BAUER & GLUTZ von BLOTZHEIM 1968). Recent analysis of Lesser White-fronted Goose observations in Germany between 1900 and 2004 showed that the species is still a regular migrant through Germany and can be found on most important goose staging areas in small numbers (HEINICKE & MOOI 2005; MOOI & HEINICKE 2008). Only about one third of the observed individuals could be identified as birds belonging to the re-established Swedish population and were only observed since the 1980s at Barnacle Goose sites along the North Sea coast of Lower Saxony and Schleswig-Holstein. Only from the sites of these birds hybrids with Barnacle geese have been reported. Most of the other Lesser White-fronted Geese were observed among staging Greater White-fronted and Bean Geese at the most important goose staging areas in the lowland areas of the northern part of Germany.

In the Netherlands, the Lesser White-fronted Goose was regarded as a regular guest in small numbers during the 19th century (SCHLEGEL 1877), and as a rare species in the period 1900–1968, with a total of 41 records during this period, at least another 12 between 1969 and 1975 and further 14 between 1976 and 1980. Besides, a considerable number of observations was never submitted to the Avifauna Commission for approval (EYKMAN et al. 1941; KIST et al. 1970; VAN IMPE 1982; VAN DEN BERG & BOSMAN 1999). Since the 1980s, the number of Lesser White-fronted Geese observed in the Netherlands increased considerably and today only few birds are recorded (KOFFIJBERS & HARTMANN 2009). Since the 1980s, the number of Lesser White-fronted Geese observed in the Netherlands increased considerably due to the re-established Swedish population, wintering in the Netherlands. Although the majority of the observed birds without doubt belong to the re-established Swedish population, a small part of them is considered to belong to other wild populations (KOFFIJBERS et al. 2005).

In Belgium, the Lesser White-fronted Goose seems to be a traditional winter guest in small numbers from December to February. In the winter 1959/60 regular goose counts started in the coastal area. Since then, single birds, pairs or families were recorded annually. After its start, birds of the Dutch re-establishment project were also observed in Flandern (VLAAMSE AVIFAUNACOMMISSIE 1989; DE SMET 2005).

In France, the Lesser White-fronted Goose is a rare species from mid November to mid March. There is one record from the 19th century, nine records from the period 1900–1980 and between 1981 and 1997 another four observations were reported. One bird was ringed in June 1956 in northern Sweden and shot in November 1959 in southwestern France. Another bird was ringed in northern Lapland in July 1981 and found dead in December of the same year along the Atlantic coast of France (YEATMAN-
Data from Spain (Persson 2000, 2004; Kampe-Persson 2004) showed that the Lesser White-fronted Goose still is a winter guest in the country in low numbers. One of the haunts, near Seville, was already mentioned by Alphéraky (1904).

3.1.3. The “commonly accepted knowledge” of today

Largely based on the afore-mentioned Finnish literature data and observations from Finland and northern Sweden between 1900 and 1980 (Fig. 1), Norderhaug & Norderhaug (1982, 1984) delineated a migratory route of the species over Finland, which has been quoted in more recent literature. In these studies, remarkably few data from southern Swedish Lapland, Västerbotten and no data from southern and central Sweden were included, probably due to the fact that the Lesser White-fronted Goose was already gone from the southwestern part of its breeding range at that time. However, the authors stated that ‘outside the breeding areas and migration routes, a few Lesser White-fronted Geese are observed more or less regularly elsewhere in Fennoscandia. One area where the species is more regularly observed in small numbers is Scania. From this part of Sweden there are at least 19 observations from the period 1977–1979. Also a few spring observations from the Bothnian coast of Uppland and Hälsingland indicated the existence of migration along the Swedish coast. However, the overwhelming majority of the data indicated a main migratory route along the Finnish coast of the Bothnian Bay used by the remaining (and northernmost) breeders of that time. Therefore, these authors confirmed the statement of older Finnish literature that the main migratory route of Lesser White-fronted Geese from Finnish Lapland followed the Finnish west coast, whereas the breeding birds of northern Norway and Russia followed a more easterly route through the inland of Finland. In their opinion, the birds reached Sweden by crossing the Bothnian Sea between Åland and Oulu.

More recent studies on marked birds and birds with satellite transmitters indicated that the remaining Fennoscandian Lesser White-fronted Geese staging in northernmost Norway at first migrate in an easterly direction to the Kanin Peninsula or the mouth of the Ob river and some of them even fly as far as the eastern part of the Taimyr Peninsula to moult (Aarvak & Øien 2003). Subsequently, they migrate via Kazakhstan and Ukraine to Greece (Øien et al. 2007) or via Northern Russia and the Baltic States to eastern Germany and from there via Hungary to Greece (Lorentsen et al. 1998). Based on these results it was stated that there is no traditional Lesser White-fronted Goose migratory route (for the northernmost population?) along the Swedish coast, and that western Europe is not a traditional wintering area of the species. As a consequence, it was concluded that the birds of the re-established Swedish population were imprinted on a completely new migratory route by their Barnacle Goose foster-parents (Lorentsen et al. 1998, 1999; Aarvak & Øien 2003).

3.1.4. Unconsidered information from Västerbotten, Sweden

Hansson (2005) made a literature review of Lesser White-fronted Goose references from the county of Västerbotten, in southern Swedish Lapland, and interviewed at least ten old reindeer herders, active in the 1930–1960s. From that review it was obvious that the decline at Pori coincided with the dramatic decrease of the breeding population in the county of Västerbotten, representing the southwestern part of the Fennoscandian population (Delin et al. 1957; Curry-Lindahl 1963; Anon. 1981). During the first part of the 20th century, the Lesser White-fronted Goose was a characteristic species in Västerbotten and Norrbotten. Still in the 1950s, flocks of at least 50 birds were reported from late April to mid May in the delta lands of Ume River and Skellefte River (Wachtmeister 1958; C.-F. Wachtmeister pers. comm.; Ö. Andersson pers. comm.). The main migration route of the southwestern


Fig. 2: Observations of the Lesser White-fronted Goose in Sweden, 1900–1981, divided into three classes: single birds (small dot), 2–5 birds (medium-sized dot), more than 5 birds (big dot). – Beobachtungen von Zwerggänsen in Schweden, 1900–1980, verteilt über drei Häufigkeitsklassen: Einzelvögel (kleine Punkte), 2–5 Vögel (mittelgroße Punkte), >5 Vögel (große Punkte).
Fennoscandian Lesser White-fronted Geese followed a southeasterly direction over the "Norra Kvarken", the narrowest sound of the Bothnian Sea between Umeå and Vaasa (Jägerskiöld & Kolthoff 1926; Haglund 1937, 1940; von Post 1946). As late as the 1970s, the mountains of Vindelfjällen held the largest Lesser Whitefront population in Sweden (Anon 1981).

### 3.2. Observations in Sweden

Releases of Lesser White-fronted Geese started in Sweden in 1981 (von Essen 1982a, 1991, 1996). To exclude the birds of the re-established population, only data of the period up to 1981 were used for this study. In spite of this restriction, a total of 353 observations with more than 3,600 individuals was collected and analysed (Fig. 2).

### Table 1: Distribution of group size classes, observations and observed individuals of the Lesser White-fronted Goose in Sweden over the decennia of the study period, 1900–1981.

<table>
<thead>
<tr>
<th>Group size – Gruppengröße</th>
<th>1–50</th>
<th>51–100</th>
<th>101–500</th>
<th>501–1000</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dekade – Jahrzehnt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900–1910</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1911–1920</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1921–1930</td>
<td>13</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>1931–1940</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>1941–1950</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>1951–1960</td>
<td>37</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>1961–1970</td>
<td>87</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>87</td>
</tr>
<tr>
<td>1971–1980</td>
<td>150</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>1981</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Σ</td>
<td>344</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>353</td>
</tr>
</tbody>
</table>

| Share (%) – Anteil (%)      | 97.5 | 0.8   | 1.4     | 0.3      | 100 |

### Table 2: Temporal and regional distribution of observations and of observed individuals of the Lesser White-fronted Goose in Sweden, 1900–1981 (main areas in bold).

<table>
<thead>
<tr>
<th>Month – Monat</th>
<th>Main regions of observation – Haupbeobachtungsgebiete</th>
<th>Observations – Beobachtungen</th>
<th>Birds – Vögel</th>
<th>Birds/observation – Vögel/Beobachtung</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Skåne, Öland</td>
<td>4</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>Skåne</td>
<td>2</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>Skåne, Halland, Västergötland (Lake Östen), Småland</td>
<td>16</td>
<td>19</td>
<td>1.2</td>
</tr>
<tr>
<td>4</td>
<td>Halland, Västergötland (Lake Östen), Småland, Uppland, Västerbotten (Skellefteå, Umeå)</td>
<td>46</td>
<td>88</td>
<td>1.9</td>
</tr>
<tr>
<td>5</td>
<td>Uppland, Västerbotten (Skellefteå, Umeå), Norbotten (Luleå), Södra Lapland</td>
<td>157</td>
<td>2,864</td>
<td>18.2</td>
</tr>
<tr>
<td>6</td>
<td>Östergötland (Lake Täkern), Västergötland (Lake Östen), Södra Lapland</td>
<td>26</td>
<td>75</td>
<td>2.9</td>
</tr>
<tr>
<td>7</td>
<td>Östergötland (Lake Täkern), Södra Lapland</td>
<td>12</td>
<td>138</td>
<td>11.5</td>
</tr>
<tr>
<td>8</td>
<td>Södra Lapland</td>
<td>5</td>
<td>213</td>
<td>42.6</td>
</tr>
<tr>
<td>9</td>
<td>Södra Lapland, Norbotten (Luleå), Västerbotten, Västergötland (Lake Östen), Östergötland (Lake Täkern), Öland</td>
<td>14</td>
<td>93</td>
<td>6.6</td>
</tr>
<tr>
<td>10</td>
<td>Västerbotten (Skellefteå, Umeå), Uppland, Östergötland (Lake Täkern), Småland, Halland, Skåne, Öland</td>
<td>47</td>
<td>72</td>
<td>1.5</td>
</tr>
<tr>
<td>11</td>
<td>Västergötland (Lake Östen), Östergötland (Lake Täkern), Småland, Halland, Skåne, Öland</td>
<td>18</td>
<td>24</td>
<td>1.3</td>
</tr>
<tr>
<td>12</td>
<td>Östergötland (Lake Täkern), Skåne</td>
<td>6</td>
<td>13</td>
<td>2.2</td>
</tr>
<tr>
<td>Σ</td>
<td></td>
<td>353</td>
<td>3,605</td>
<td>10.2</td>
</tr>
</tbody>
</table>
3.2.1. Group size

Group size per observation varied from single birds up to 800 individuals. In 43% of all observations, only single birds were recorded, observations of up to 10 birds were reported in 87% and of up to 50 birds in more than 97% of all records (Table 1). Groups of more than 100 birds were observed on only six occasions (1.7%).

The number of observations increased since the beginning of the 20th century. Almost 90% of all observations were recorded since 1940, but more than 60% of all birds were recorded before 1940. The average number of birds per observation dropped dramatically from more than 50 in the 1920s and 1930s to about 10 in the 1940s and 1950s, about 5 in the 1960s and 2–3 in the 1970s and 1980s (Table 1).

3.2.2. Temporal and regional distribution

The number of observations as well as the number of Lesser White-fronted Geese per observation differed during the annual cycle. Most observations and most individuals were recorded at the end of spring migration and the start of the breeding season in May. Most birds per observation were recorded at the start of the breeding season in May and at the end of the breeding season in August. The smallest number of observations, of birds and of birds per observation was recorded during late autumn, winter and early spring (Table 2).

The distribution of observations showed clear focal points during the year, shifting from northern Sweden in summer via central Sweden in autumn to southern Sweden in winter, and back again in spring (Table 2, Fig. 3–6).

During the breeding season, the highest concentration of observations came from the western part of Västerbot-
ten (Fig. 3), which is the southern part of Swedish Lapland and the southwestern part of the former breeding range of Fennoscandian Lesser White-fronted Geese. In autumn, Lesser White-fronted Geese were mainly observed in central and southern Sweden (Fig. 4): between September and October, the focal point of observations shifted from southern Lapland and the area around Luleå in Norrbotten, to Västerbotten in northern Sweden, Uppland in central Sweden as well as Östergötland, Småland, Halland and Skåne in South Sweden, whereas in November observations were concentrated in South Sweden, especially in Östergötland, Halland and Skåne.

Winter observations mainly originated from Skåne (Fig. 5). During spring migration, the focal point of observations shifted again from South Sweden (Skåne, Halland, Västerbotten, Östergötland, Östergötland and Småland) in March and April to Uppland and Västerbotten in May (Fig. 6). In May, the first birds were observed in the breeding area in the western part of Västerbotten.

4. Discussion

A well-known fact regarding the Lesser White-fronted Goose is that it often occurs unnoticed. It is, for instance, frequently overlooked in flocks of other goose species. As a consequence, the number of observed individuals is not necessarily the number of individuals that is actually staging in an area. In spite of the fact that up to 16 Lesser White-fronted Geese were reported shot annually by hunters in Denmark during the 1960s (Fog 1977) – i.e. the actual bag was higher – there are hardly any records of observations of the species from this period. And even from the Baltic states, where according to the commonly accepted main migratory route of the Fennoscandian population all birds must have passed in autumn and spring, information is extremely poor.

In Estonia, the species was reported as a scarce but regular visitor until the 1960s. In the years 1957–1967, a total of 346 individuals were recorded in the Matsalu Nature Reserve (Kumari & Jögi 1972). Since then, the species has been an irregular migrant in the country. No records were confirmed in the 1970s but since 1985 single birds and small groups have been observed in western Estonia, mainly in flocks of Barnacle Geese, and many of these were carrying Swedish colour rings (Leibak et al. 1994). During surveys in the 1990s, up to 51 birds were recorded and it seems that a small number of Lesser White-fronted Geese regularly migrates through western Estonia (Tolvanen 1999; Tolvanen et al. 2000b, 2004; Pynnönen & Tolvanen 2001).

From Latvia, there are only eight records of altogether 12 individuals for the period 1900–1981 (LOB 2007).

From Lithuania there are no records of mass migration of the Lesser White-fronted Goose. According to Rudonis & Švazhas (1991), Švazas (1996) and Švazas et al. (1997), historical information about the migration of the Lesser White-fronted Goose in Lithuania is poor until the 1960s, but in “most publications the species was characterized as a very rare and irregular migrant, with only several single birds or small flocks recorded”. In the 1960s, staging flocks of up to 600–800 birds were recorded in Lithuanian coastal areas, but since then only smaller flocks were observed there (Švažas 1996, Žalakevičius 1998).

So, when Norderhaug & Norderhaug (1982, 1984) described an easterly migration of the remaining population of the species, it was based on poor information and done in spite of the large gap of records of staging sites along the Central European flyway. Besides, they did not take into consideration the possibility of a smaller proportion of Lesser White-fronted Geese migrating along a westerly route as indicated in older literature, e.g. Schlegel (1877), Alphéraky (1904), Niethammer (1938) and Witherby et al. (1939).

In the early 1980s, when we tried to delineate the migratory route(s), the Fennoscandian population already had lost at least 95% of its former size and most of its southern breeding range. In the 1970s, the breeding population of southern Lapland in principle was already gone, even if some pairs might have remained in the northwestern part of Västerbotten. A large proportion of the population further north in Sweden was also gone. For this remnant population in northernmost Sweden, Norway and Finland, the most natural migration went (and still goes) through Finland, whereas a southward migration through Sweden was a possible option for Lesser White-fronted Geese breeding in Southern Lapland and Jämtland until the mid 1960s.

It seems not to be unusual for the Lesser White-fronted Goose to migrate in quite small groups. In Finland in the early 20th century, flock size varied from about ten individuals to 60–70, occasionally more than 100 (Hortling 1929a), in Hungary in the period 1942–1966, most migrating flocks numbered 10–20 birds (Sterbetz 1968) and in Leningrad Oblast in the 1960s and 1970s, flock size reached 30–40 birds (Rezvyi in Noskov 2002). In Sweden, with the exception of a spring flock of 75 individuals, the largest migrating flock in autumn numbered 36 birds and in spring 16 birds during the period 1900–1981 (this study), while the average group size was six birds in spring and 20 in autumn. The largest flocks were observed along the coast, mainly in Västerbotten. This rather small flock size makes it difficult to observe Lesser White-fronted Geese in groups of other goose species and makes them easily overlooked.

With a few exceptions all Lesser White-fronted Geese recorded in Sweden were observed in known and regularly monitored goose staging areas by highly motivated goose observers. For that reason, the sites where Lesser White-fronted Geese were reported were not necessarily the only or most important sites for the species.

The considerable increase in observations is no indication of a real increase in numbers, but without doubt is due to the fact that from the mid 1970s an increasing number of ornithologists equipped with telescopes was checking goose flocks for neckbands, which enhanced the chances to observe rare geese.

The commonly cited sentence on page 312 in Merikallio (1915) “Antalet af de flyttande fåglarna måste räknas åtminstone i tiotal tusen” (“The number of migrating birds must at least be estimated in tens of thousands”) should be understood in the light of the dispute between him and
Munsterhjelm. Probably due to criticism on his vague estimation, Merikallio felt obliged to present the exact data in his subsequent publication (Merikallio 1920). Only on two occasions 100 birds or more were seen in this „main stop over site“ around Oulo. It was „still approx 100“ on 26th May 26 1914 and then during this well-known period on 16th–19th May 1913. On the 18th May he writes (translated from Swedish) „During the entire day, almost without interruption, small flocks or separate pairs (in autumn larger flocks) fly towards the north. Some fishermen, according to whom the Lesser White-fronted Geese migrate every year even in spring, had not until now observed the arrival. I estimated the number at 500 individuals“. It seems questionable to estimate a passing population of more than 10,000 individuals from this peak number of 500 birds, especially since we know that spring migration of arctic geese is very concentrated in time.

About the Ume River Delta Haglund (1937) reported that Taiga Bean Geese were relatively scarce and did not stay for a long time, while the Lesser White-fronted Geese during three weeks (late April to mid May) were common in the area. During peak occurrence, flocks of up to „some hundred“ individuals were observed. Based on this information a maximum of 200 individuals was estimated for the area for that period and included in the data base “SVALAN“. Considering the fact that there must have been larger and smaller flocks, the actual maximum day count might easily have reached 400 individuals. Taking into account that the species was common during three weeks, the total staging population at the Ume River Delta probably reached at least 1,000 individuals. Considering the fact that the staging population of Taiga Bean Goose in the 1950s was estimated at about 5,000 individuals (C.-F. Wachtmeister pers. comm.) and the Lesser White-fronted Goose outnumbered this species, this Swedish area might, at that time, have been as important as the Oulo area.

The relatively big average flock size observed in August indicates that a considerable number of the southwestern subpopulation of the Fennoscandian Lesser White-fronted Geese moulted in Swedish Lapland, in the direct vicinity of the breeding area, as stated by Ekman (1922). Such a view is supported by the records of moulting concentrations of up to 1,000 birds (Cnattingius 1868), records from Padjelanta of locals catching large numbers of Lesser White-fronted Geese during moults in the 1930s and of sites where up to 400 slaughtered moulters were found (Curry-Lindahl 1959; von Essen 1982b). These records differ markedly from the results of the studies on birds from northern Norway, which were followed by satellite-telemetry and moulted in Norway, or migrated to Siberia to moul (Aarvak et al. 1997, 2000; Lorentsen et al. 1998; Aarvak & Øien 2003). However, it cannot fully be ruled out that this behaviour was a speciality of the northernmost Fennoscandian breeding birds, or is the result of a rather recent change in mouling behaviour, probably due to the fact that the relict of the Fennoscandian population “imports” at least about 50% of its males from the neighbouring Russian breeding population (Ruokonen et al. 2004).

With the exception of the breeding sites and one migration spot, all observations collected for this study originated from goose staging areas, which are still known as traditional goose haunts. The seasonal distribution of the observations over the year indicates migratory movements of the Lesser White-fronted Geese from the (former) breeding areas in Swedish Lapland in summer, along the Swedish coast, crossing via central Sweden to South Sweden in autumn and back again along more or less the same routes in spring. Between 1930 and 1980 Lesser White-fronted Geese frequently were reported migrating through or wintering in South Sweden, especially in Halland, Öland, Skåne, Småland and Västergötland. Winter records focused mainly on Småland and Skåne. The overwhelming majority of these birds were observed in flocks of Taiga Bean Geese (Curry-Lindahl 1959; Edberg 1960, 1961, 1965; Lennerstedt 1962; Markgren 1963; SOF 1978; Alatalo et al. 1985; Huyskens 1986; Ekberg & Nilsson 1994). The Taiga Bean Geese of these sites were a mixture of breeding birds from Swedish Lapland, Finland and western Russia (Nilsson 1984; Nilsson & Persson 1984; Nilsson & Pirkola 1991), which could be an indication of the origin of the Lesser White-fronted Geese observed at these sites.

Norderhaug & Norderhaug (1984) collected data of Lesser White-fronted Goose from the period 1900–1980, which is comparable with the period of this study. A combination of both data sets shows a more complete picture of the distribution of observations during the period 1900–1981 (Fig. 7). The main difference between these data sets is that Norderhaug & Norderhaug (1984) only considered data of the last phase of spring migration (May) and the first phase of the breeding season (June), which could explain the lack of data from central and southern Sweden in their data set. By missing several references from Västerbotten, they overlooked the importance of the flyway across Norra Kvarken and the interesting correlation between population trends in the southwestern breeding range, western Finland, the Baltics, Hungary and Greece.

![Fig. 7: Distribution of Lesser White-fronted Goose observations in Fennoscandia during the period 1900–1981, composed of data from NORDERHAUG & NORDERHAUG (1984; red dots) and this study (blue dots). – Verteilung der Zwerggans-Beobachtungen in Fennoskandien von 1900–1981, zusammengestellt aus Daten von NORDERHAUG & NORDERHAUG (1984; rote Punkte) und dieser Untersuchung (blaue Punkte).](image-url)
The distribution of observations according to Fig. 7 clearly shows that the Lesser White-fronted Goose besides migrating over the Bothnian Sea and along the Finnish coast also migrated over South Sweden to some extent. Of our data set of 353 observations in Sweden, 140 are from the area south of Norra Kvarken, and 51 of these are from spring migration.

Data indicate three historical flyways; two passing Finland, one via Ume Delta and crossing the Norra Kvarken and the other passing the Oulo area, and one along the Swedish Bothnian coast to the south. From the available data it is not possible to decide which migration route was most important, as the species had disappeared from important parts of the breeding areas in the south before the boom of field ornithologists. Nor is it possible, from the observations presented here, to decide whether the southwestern subpopulation of the Fennoscandian Lesser White-fronted Goose migrated along the Baltic on the Swedish side, as the breeding Taiga Bean Goose from Sweden still do, or whether some birds (after crossing Norra Kvarken) followed the Finnish coast southwards and then migrated back to Sweden over Åland from SW Finland. This passage over Åland and southern Bothnian Sea is followed by the Taiga Bean Goose from Finland wintering in Sweden and further to the southwest (Nilsson 1984; Nilsson & Persson 1984; Nilsson & Pirkola 1991).

5. Conclusion
Available data were insufficient to delineate migration routes within the Atlantic flyway, south of the former breeding range. However, regular occurrence at frequently checked sites, and numbers involved as well, still in the 1960s, strongly indicate that such routes have existed. Consequently, there is no scientific basis to state that the Swedish re-established Lesser White-fronted Goose follow an unnatural migration route. Instead, it is likely that these birds revived a traditional migration route.

6. Zusammenfassung


7. References


Johan H. Mooij, Biologische Station im Kreis Wesel, Freybergweg 9, D-46483 Wesel, Germany; E-Mail: johan.mooij@bskw.de

Per Hansson, Swedish University of Agricultural Sciences SLU, Dept. of Forest Ecology and Management, S-901 83 Umeå (Sweden); E-mail: per.hansson@ssko.slu.se

Hakon Kampe-Persson, University of Lund, Department of Animal Ecology, Allarp 414-19, S-295 91 Bromölla (Sweden); E-Mail: kampe.persson@hotmail.com

Leif Nilsson, University of Lund, Department of Ecology, Ekologihuset, S-223 62 Lund, (Sweden); E-Mail: leif.nilsson@zoeken.lu.se