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Conservation of Lesser White-fronted Goose on the European migration route

Final report of the EU LIFE-Nature project 2005–2009

Edited by
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EU LIFE-Nature project 'Conservation of Lesser White-fronted Goose on the European migration route' 2005–2009

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Petteri Tolvanen, Yannis Tsougrakis & Ingar Jostein Øien

The Lesser White-fronted Goose male Imre (right) just before being released, after being tagged with a satellite transmitter. Five months later, Imre was shot in the Volgograd region in Russia. The case was extensively used in the media work by the LIFE project to illustrate the challenges in the conservation of the species. © Morten Ekker, May 2006

© Morten Ekker

The Lesser White-fronted Goose Life-Nature project 2005☒2009

This report presents the main results and conclusions of the EU Life-Nature project titled 'Conservation of Lesser White-fronted Goose on the European migration route' (April 2005 – March 2009). In addition, monitoring results of the year 2004 from the traditional staging sites along the European migration route are reported.

The 'European migration route' in the name of the project refers to the primary route of the Fennoscandian Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) population – especially the pairs that have succeeded to produce offspring (see Øien et al. 2009) – from the Fennoscandian breeding grounds via eastern Hungary to the wintering sites in northern Greece (see the map on p. 8).

The ultimate objective of the LWfG Life project was to stop the decline of the Fennoscandian population. The most important negative factor causing the population decline is hunting and poaching (Jones et al. 2008). The LWfG resembles very much the White-fronted Goose (*A. albifrons)* that is an important quarry species in most countries within the range of LWfG. Thus, in practice the only effective way to protect LWfG is to ban hunting of all white-fronted geese in the periods when LWfG are present at the very limited key sites. Conservation actions in the already known key sites need to be implemented urgently, and there is also an urgent need to uncover the still unrevealed sites along the flyway.

The main actions of the Life project were satellite tracking and colour ringing of LWfG to map the key sites; preparation of national Action Plans for the species in Norway, Finland and Estonia; habitat restoration and management to keep LWfG in safe and favourable sites in Estonia and Hungary; and public awareness campaigns, most of all for hunters and farmers in the key areas, to reduce the risk for LWfG of being shot. The project established a web site (www.wwf.fi/lwfg) where further information on the actions and results of the project can be obtained.

The Life project involved ten partner organisations in Norway, Finland, Estonia, Hungary and Greece (see inner cover for the list of the partners and co-

A shotgun cartridge case found inside the strictly protected part of the Evros Delta National Park during the visit by the LIFE project team in the area. © Morten Ekker, November 2006

financiers), i.e. in all countries with known important sites along the European flyway, except for Russia. In Russia, the Fennoscandian LWfG population has an important autumn staging site in the north-western part of the Kanin Peninsula, and the Life project was eventually able to organise conservation-oriented field work also there (see Tolvanen et al. 2009). Other countries along the complicated migration routes of the Fennoscandian LWfG population like Lithuania, Poland, Bulgaria, Turkey, Ukraine and Kazakhstan were not included in the project either because no specific sites for the species were known, or because the Life-Nature was not a feasible funding instrument for the country in question.

A wing of an unidentified white-fronted goose was found near the shotgun cartridge case (see above). © Morten Ekker, November 2006

Status of the Fennoscandian Lesser White-fronted Goose population

The LWfG is the most endangered breeding bird species in the Nordic countries. The current, up-dated estimate of the natural population in the Nordic countries is only some 20 breeding pairs, or respectively 60–80 individuals after the breeding season in August (see Aarvak et al. 2009). Thus, the Fennoscandian population is facing an immediate risk of extinction, and more effective conservation efforts covering all key breeding, staging and wintering sites are required urgently. At the Valdak Marshes, Norway, the most important staging site for the Fennoscandian population, spring monitoring data from the years 1993–2008 shows an average annual decrease of more than 4%, with a total decrease of 50% of the population during this 15 year period (see Aarvak & Øien 2009).

However, a detailed analysis based on individual recognition of LWfG on spring migration in Estonia, Finland and Norway (see Aarvak et al. 2009) shows, that in the latest years some 16% of the population was not observed at the Valdak Marshes at all. Contrary to the situation at the Valdak Marshes, at the other regularly monitored spring staging sites (Greece, Hungary, Estonia and Finland), the number of LWfG has remained stable or slightly increased during the years 2004–2008 (Figure 1). In the best case this is a first sign of a turning point in the trend of the population, but it is still too early to draw conclusions.

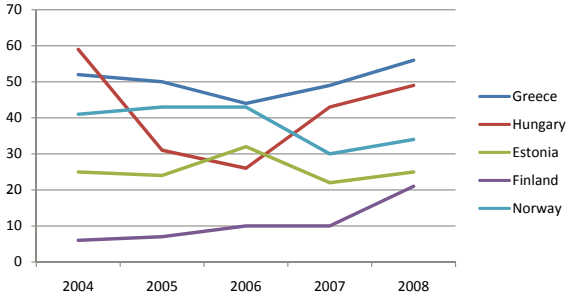


Figure 1. Numbers of Lesser White-fronted Geese in spring at the key monitoring sites in the years 2004–2008. In Greece and Hungary, the numbers are the highest daily counts, while in Estonia, Finland and Norway they are total numbers of different individuals based on individual recognition. In the latter three countries, the numbers based on individual recognition are regularly higher than the highest daily counts because of the turnover of individuals.

As a part of the monitoring actions of the LIFE project, Lesser White-fronted Geese were recorded on digital video for individual recognition. © Morten Ekker, Valdak Marshes, Norway, June 2008

Results of the Lesser White-fronted Goose Life project actions

The LWfG Life project reached the goals set for the actions, and above all, the project had marked positive effects on the LWfG conservation status of the species at the project sites.

The satellite tracking study revealed a whole new 'loop migration' route from Fennoscandian breeding grounds to moulting sites of non-breeding birds in Siberia, and from there back to the wintering sites in Greece along an eastern route via Kazakhstan, southern Russia and Ukraine. Several formerly unknown important staging sites were also revealed (Øien et al. 2009).

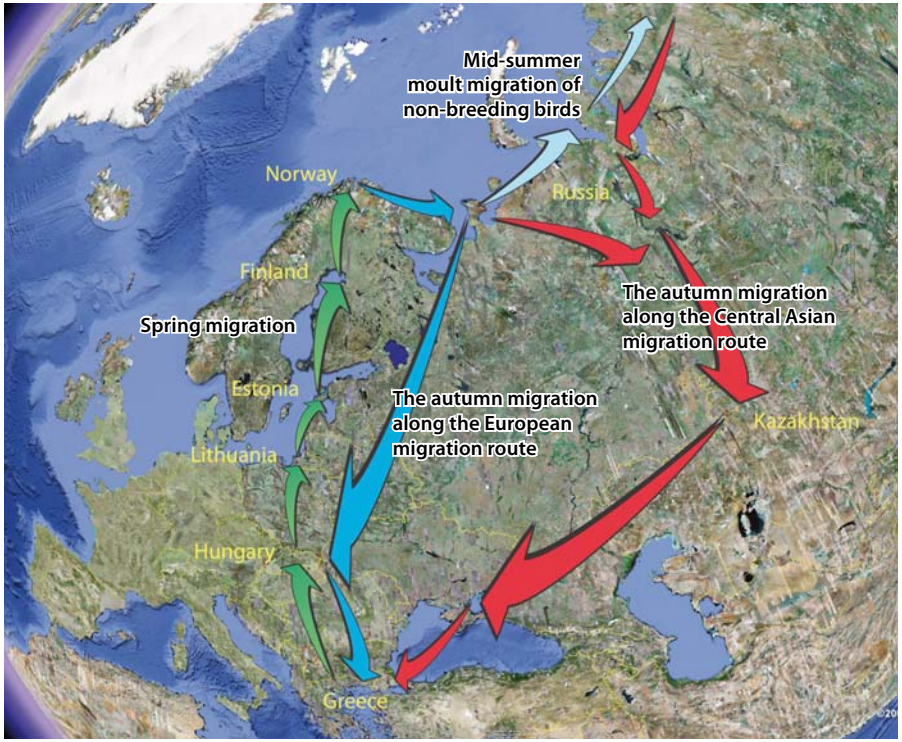
As a result of the habitat management actions, the LWfG started to use sites restored and managed by the project in the Hortobágy National Park, Hungary (see Ecsedi et al. 2009) and in the Matsalu National Park, Estonia (see Toming & Tolvanen 2009). Towards the end of the project, in Hortobágy National Park, Hungary, the LWfG used practically only the safe and favourable feeding and roosting sites within the national park managed by the project.

New National Action Plans for the LWfG were prepared by the project and adopted by the national authorities in Norway, Finland and Estonia (see Bø 2009, Lehtiniemi & Tolvanen 2009 and Toming 2009a). In Norway, conservation actions proposed in the national plan were started already during the project: hunting of all geese is now banned in the autumn staging area in the Inner Porsangen Fjord area, and control of the Red Fox (Vulpes vulpes) population in the core breeding area started in 2007 (see Bø 2009, Øien & Aarvak 2009). The Life project also took actively part in the preparation of the new International Single Species Action Plan for the conservation of the Western Palearctic Population of the LWfG, that was adopted by AEWA in 2008 (see Martin 2009).

It is too early to assess the real conservation effect of the public awareness campaigns, but in Estonia and Hungary, the co-operation with hunters' associations has been good both at national and regional levels (see Toming 2009b, Ecsedi et al. 2009), while in Greece it proved to be very difficult and was fruitful only at the local level (Tsougrakis et al. 2009). A male LWfG colour ringed by the project in Norway in 2006, and later shot dead inside the hunting free zone of a strictly protected area in Greece showed that much more protection work needs to be done urgently for securing the LWfG from hunting, especially in Greece.

Conclusions and implications for further Lesser White-fronted Goose conservation work

The Life project has been a timely boost for the LWfG conservation work at a critical phase. The project has demonstrated that international flyway approach is inevitable for protecting such a critically endangered migratory species. However, the Fennoscandian LWfG population is now at immediate risk to be wiped out, even by single stochastic events, without effective and prompt conservation measures along the whole flyway.



Overview of the main flyways of the Fennoscandian Lesser White-fronted Goose population. For more details, see the text and Øien et al. (2009). © Lesser White-fronted Goose LIFE project, satellite image © Google Earth

In particular, we want to emphasize the following four issues that have been pointed out by the Life project:

1. Within the EU, Greece seems to be the bottleneck in the conservation of the species at the moment. As shown by the case of the LWfG male Mánnu (see Tsougrakis et al. 2009 for details), poaching and accidental shooting is a serious threat for the LWfG in Greece even inside the strictly protected areas. Loss of one single adult male represents ca 5 per cent of the breeding males of the Fennoscandian population, and has a significant negative impact on the recruitment of the population. The Life project informed the Greek authorities as well as the European Commission (EC) about the case, and appealed to them to take necessary measures to ensure (a): that the international and national Action Plans for the LWfG are implemented in Greece, (b): that conservation measures related to hunting, illegal hunting and accidental shooting are strictly implemented especially in the protected areas, and (c): that the hunting of look-alike species is banned in a safe area around the protected sites that the LWfG are known to use regularly. All the four Greek LWfG sites are Ramsar sites, Specially Protected Areas (SPA), Sites of Community Importance (SCI) as well as National Parks according to the national legislation. There is an urgent need for the Greek authorities to increase the effort to safeguard the protected areas, to prevent illegal hunting of LWfG even inside the protected areas, as well as to increase the level of national law enforcement in order not to jeopardize the international conservation efforts to save the species. The EU plays a central role in pressing its member states to fulfil their nature conservation obligations. By the time of finalising this report (mid-March 2009) the Life project had not received any answer or reaction to the appeals from the Greek authorities or from the EC.

2. Urgent international conservation efforts need to be carried out in Russia, Kazakhstan and other countries along the eastern branch of the autumn migration route of the Fennoscandian LWfG. The case of the LWfG male Imre (see Øien et al. 2009 for further details) that was shot in the Volgograd region in Russia was the second case during the LWfG Life project, when a bird ringed by the project was confirmed shot. Thus, two out of the seven adults ringed by the project (i.e. 29%) were confirmed shot during the project! It has to be taken into account that a shot LWfG is very unlikely to be reported or found, and thus the actual mortality caused by hunting and poaching is probably considerably higher than recorded. It is evident that the eastern autumn migration route across Russia, Kazakhstan and Ukraine is even more risky for the LWfG than the European migration route.

The regulation of the water level of the Kondás fish pond in the Hortobágy National Park, Hungary benefits also the Common Cranes, which also use the fish pond as a roosting site. © Petteri Tolvanen, Hortobágy, Hungary, October 2008

3. The Life project discovered that successful breeding has a 'double importance' for the Fennoscandian population. As explained in further detail by Øien et al. (2009), it appears that the LWfG use the safer European autumn migration route in years with successful reproduction, while in the years with failed breeding attempt they are likely to choose the more risky Central Asian autumn migration route, that leads to the same wintering areas in Greece. Also the discovery of this 'loop migration route' via Kazakhstan to Greece was a result of the Life project. This finding has a crucial implication for the LWfG conservation actions: it is very important to try to 'support' successful breeding of the LWfG in Fennoscandia e.g. by controlling the Red Fox (*Vulpes vulpes*) population and by limiting the human disturbance in the breeding areas. Successful breeding contributes to recruitment of new individuals to the small population and – at the same time, even more important – to increased adult survival.

4. It is very important that the national governments and international organizations immediately start implementing the new international and national action plans for the LWfG, and also that adequate financial resources are allocated for the LWfG conservation work. The new International Action Plan (Jones et al. 2008, see also Martin 2009) provides a good framework for co-ordinated international action. Many central LWfG countries like Hungary, Russia, Kazakhstan and Ukraine do still lack national action plans, and developing of national plans based on the international plan is an urgent task for the governments of these countries. In Greece, a National Action Plan for the LWfG was prepared already in 1999 by another LIFE-Nature project and submitted to national authorities, but it has so far not been implemented by the state; it is urgent to up-date and implement this plan. It is also important for Greece to become a contracting party of AEWA, as it is has only signed the agreement without ratifying it.

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A flock of Lesser White-fronted Geese in the Inner Porsangen Fjord in northern Norway. As a result of the LIFE project, national action plans for the species were made in Norway, Finland and Estonia. In the Inner Porsangen Fjord area, hunting of all geese is now banned during the autumn staging period of the Lesser White-fronted Geese. © Morten Ekker, August 2008

Teemu Lehtiniemi (BirdLife Finland), Pekka Sulkava and Ari Rajasärkkä (Metsähallitus), János Tar (Hortobágy National Park), Maria Panayotopoulou, Theodoros Naziridis and Eleni Makrigianni (HOS) as the responsible persons for running the project actions. In Greece, the management authorities of Lake Kerkini and Evros Delta National Parks played an active role in facilitating the implementation of the project locally without being partners to it. A large number of persons took part in the implementation of the project as volunteers or part of the staff of the project partners: Risto Karvonen, Ari Leinonen, Jyrki Pynnönen, Minna Ruokonen, Juha Merilä, Petri Lampila, Heikki Holmström, Aappo Luukkonen, Petteri Polojärvi, Juha Markkola, Torkjell Morset, the staff of Stabbursnes Nature House and Museum, Pekka Rusanen, Timo Asanti, Ivar Ojaste, Merle Lepik, Kirsten Martin, Attila Szilágyi, Gábor Tihanyi, László Lontay, Tamás Zalai, all professional and financial employees of the Hortobágy National Park Directorate, Lavrentis Sidiropoulos, Kostas Papadopoulos, Gordon Ramel, Sylvia Zakkak and Didier Vangeluwe to name some of them. Many more persons are acknowledged in the individual articles of this report. Finally, we want to thank all the people who contributed to this report as authors or by other means, especially Kalle Ruokolainen, Seppo Leinonen and Jari Kostet.

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Ecologically sustainable level of grazing of the natural grasslands is one of the most important ways to manage the habitats of the Lesser White-fronted Goose. In the LIFE project, such management actions were carried out in the Hortobágy National Park in Hungary, and in the Matsalu National Park in Estonia. © Petteri Tolvanen, Hortobágy, Hungary, October 2008

As a part of the public awareness campaigns, the LIFE project organised many training meetings for the hunters in the key areas for the Lesser White-fronted Goose. Here the Hungarian project co-ordinator Szabolcs Lengyel is presenting the project for hunters in a meeting in the Hortobágy village. © Petteri Tolvanen, September 2006

Just before the sunset, the LIFE project team has managed to locate the main flock of the Fennoscandian Lesser White-fronted Geese on the vast mudflats of Lake Kerkini, Greece. © Morten Ekker , November 2006

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YT and IJØ were the national co-ordinators of the project in Greece and Norway, respectively.

Mapping of migration routes of the Fennoscandian Lesser White-fronted Goose breeding population with profound implications for conservation priorities

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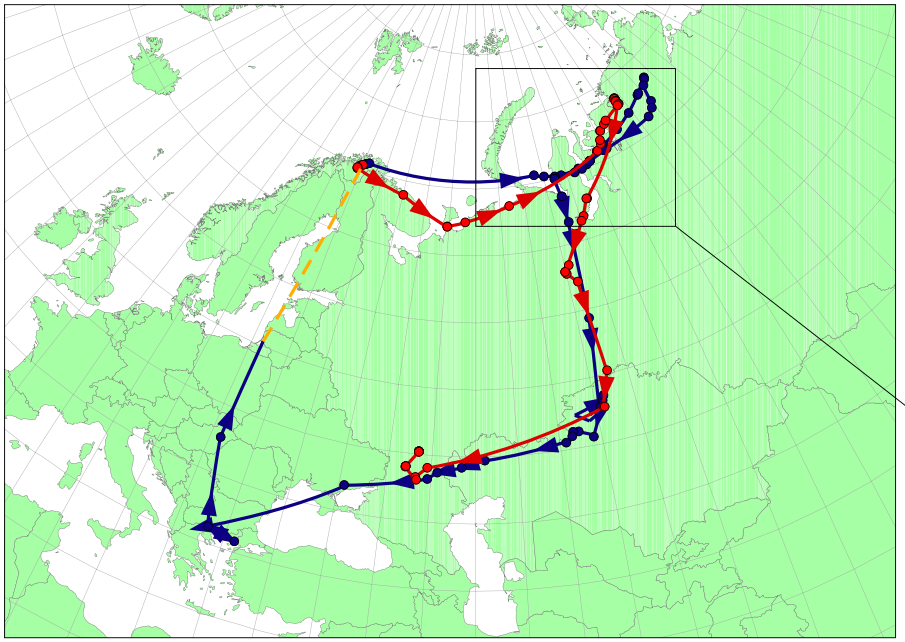


Figure 1. Satellite tracks of the Lesser White-fronted Geese Finn and Nieida (blue track) and Imre (red) in 2006. Yellow stippled line shows the supposed spring migration track as based on colour ring observations.

1. Introduction

By use of light weight GPS satellite transmitters, NOF-BirdLife Norway and WWF-Finland have mapped migration routes and wintering grounds of the critically endangered Fennoscandian population of Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) as part of the EU LIFE-Nature project "Conservation of LWfG on the European migration route".

Previous satellite tracking studies (in 1995–1996) documented that the Fennoscandian population use two different migratory routes, but the final destinations (wintering sites) for parts of the population remained mainly unknown. In the previous studies, the satellite tracking data showed that the main migration route went from their breeding areas in the Fennoscandian mountains, through the Kanin Peninsula in Russia, south-west through Hortobágy in eastern Hungary and finally to wintering grounds in Lake Kerkini and the Evros River Delta in Greece (Lorentsen et al. 1998). However, these studies also documented that some of the Fennoscandian LWfG use another migration route from the Kanin Peninsula further eastwards, crossing the Ural Mountains and southwards along the Ob River valley all the way to a central staging area in the Kustanay region in northern Kazakhstan (Figure 1).

In 2004 satellite tracking of LWfG breeding in the Polar Urals (Russia), revealed that birds breeding in this area migrated similarly to northern Kazakhstan through the Ob River valley and proceeded southwards along the western coast of the Caspian Sea and the journey terminated in wintering areas in the historical Mesopotamia in Iraq (Morozov & Aarvak 2004, Øien & Aarvak 2005). This finding led to the belief that the part of the Fennoscandian LWfG that utilizes the same migration route through Central Russia and Kazakhstan also could winter in this area, or at least more generally in the Caspian Sea region and the Middle East.

Already in 1997, satellite transmitters fitted on LWfG at the Valdak Marshes, Finnmark, Norway – a key stop-over site for the Fennoscandian LWfG – showed that non-breeding birds from this population may accomplish a long distance moult migration to Siberia (Aarvak & Øien 2003). A variable number of the adult pairs present during springtime at the Valdak Marshes had been documented absent during autumn staging (Aarvak & Øien 1999, 2000), suggesting that they possibly had left the breeding area (for moulting elsewhere) during the summer. Syroechkovski Jr. (1996) reviewed available information from Northern Russia, and found that regular aggregations of moulting, non-breeding LWfG could be found at several locations on the Russian Taimyr Peninsula to the north of the breeding habitats in the forest tundra zone (see also Aarvak et al. 1997). The most recent observation was a flock of 500 individuals in August 1989, of which about half were able to fly (Prokosch & Hötker 1995). Morozov (2000) found that LWfG that did not breed in the tundras of the Bolshaya Rogovaya River left for moulting sites in early July, although this might have been a consequence of unfavorable weather conditions that year. In addition, in the Polar Urals, some of the geese left for moulting areas during mid-summer (Morozov 2000).

2. Results

2.1. Catching

In both spring and autumn throughout the whole LIFE-EU project period (2005–2008), considerable effort was carried out in order to catch LWfG at the Valdak Marshes in the Porsangen Fjord in North Norway (for a more thorough description of the catching site, see Aarvak & Øien 2009) in order to ring the birds and to tag them with satellite transmitters. We used two cannon-nets each covering an area of 300m^2 (25m x 12m) and one larger cannon-net covering an area of 1350m^2 (50m x 27m). Only in spring 2006 birds were successfully caught: two adult LWfG (a pair), were caught on 18 May, and provided with satellite transmitters (the male with a GPS-satellite transmitter and the female with an ordinary satellite transmitter). The male was ringed and colour-leg-ringed, whereas the female was already colour-leg ringed at the Valdak Marshes in spring 2002, and was well known with many observations from stopover sites in Hungary and Greece on the European migration route. The birds were named as "Finn" (male) and "Nieida" (female). On 23 May, five more LWfG were caught, ringed and colour-leg-ringed. One of these was a 2nd calendar year bird, while the others were two adult pairs. The male in one of these pairs was also provided with a satellite transmitter with GPS plotter and he was named "Imre".

The male Lesser White-fronted Goose Imre is being released after receiving colour leg rings and satellite transmitter at the Valdak Marshes 23 May 2006. © Ingar Jostein Øien

2.2. Moult migration and autumn migration

After staging at Valdak, the satellite tagged LWfG left for the breeding areas. However, all of the three satellite tagged individuals failed in their breeding attempts, and having in mind the results from satellite transmitter study in 1997, it was no surprise that all the three birds shortly after midsummer left the breeding area (Imre left on 29 June, and Finn and Nieida on 6 July) and started an impressive moult migration 2800 km directly eastwards to the gathering places for moulting LWfG at the tundra areas near the Malaya Logata river on the Taimyr Peninsula where Finn and Nieida arrived on 8 July, and at the Pyasina River Delta, also on the Taimyr Peninsula, where Imre arrived on 6 July. Along the route, Imre made short stopovers on the coast of the Kola Peninsula, Kanin Peninsula, the Malosemelskaya and Bolshesemelskaya Tundras and the Gydanskiy Bay, while the transmitters of Finn and Nieida did not provide much detailed information during the short and probably more or less direct flight to the moulting areas (Figure 1). After commenced moulting in mid August, all three individuals headed back westwards. The pair Finn and Nieida arrived at a stopover site in a small lake on the Gydanskiy Peninsula on 25 August, but after some few days there they carried on westwards and arrived at Zaliv Vebarkapakha bay on the western shore of

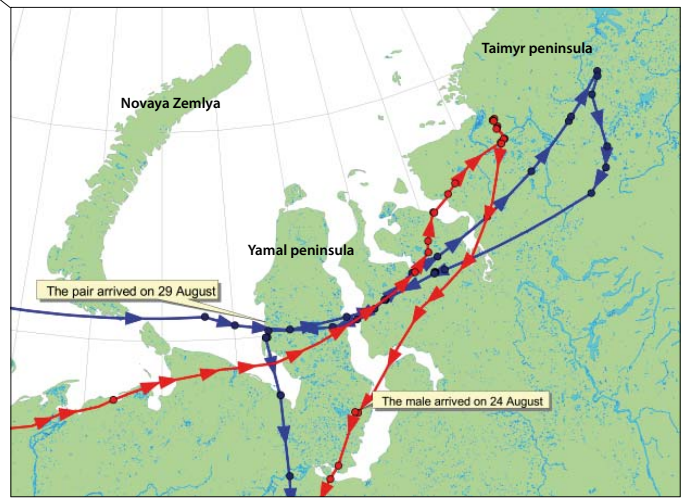


Figure 2. Satellite tracks of Finn and Nieida (blue line) to and from the moulting site at Malaya Logata River, Taimyr, and of Imre (red line) to and from the moulting site in the Pyasina River Delta, Taimyr, in 2006.

A mixed flock of (mainly) Lesser and Greater White-fronted Geese at Lake Kerkini, Greece. Kerkini is the main wintering site of the Fennoscandian Lesser White-fronted Geese in November-December. © Ingar Jostein Øien, November 2008.

the Yamal Peninsula on 29 August (Figure 2). Imre started from his moulting site in the Pyasina Delta on 21 August, and arrived on the southeastern shore of the Yamal Peninsula on 24 August (Figure 2).

In early September they all turned southwards. Finn and Nieida moved to Baydaratskaya Bay in the Kara Sea on 2 September, while Imre migrated already on 3 September directly to a stopover site in the Ob River valley (near the settlement Sherkaly). Here he stayed until 27 September. Finn and Nieida stayed in the Kara Sea until 18 September and then moved directly to the well known staging area for LWfG in the Kustanay area in Northern Kazakhstan where they were located at Lake Koybagar on 19 September. On 28 September Imre migrated further south from the Ob River Valley, and after a short stopover in the Lakes Maloye Stepnoye and Bolshoye Stepnoye close to the Kazakhstan border in the Kurganskaya region in Russia, he also arrived near Lake Koybagar in Kustanay on 1 October. At the same time Finn and Nieida moved ca 45 km north to Lake Kak, where they stayed until 10 October. In this period, northern Kazakhstan faced hard winter conditions with snow cover and low temperatures, which led to a southward movement of geese. Finn and Nieida moved the same day (10 October) to Lake Ayke (70 km southwest) where they stayed for some days in the border areas between Kazakhstan and Russia.

Imre started the southward movement from the Lake Tontegir in these days and on the way further southwards from the Kustanay region he made a movement that was unexpected based on the earlier satellite tracking studies on the LWfG originating from the Russian breeding populations: he turned westwards again. He passed far north of the Caspian Sea and arrived in the Tsimlyansk Reservoir in the Volgograd Region in Russia on 18 October. He was soon followed by Finn and Nieida who were located at the same reservoir on 20 October, and on 24 October they were located on the northwest side of the Azov Sea in Ukraine where they spent some time in the Lake Sivash. On 28 October Finn and Nieida were both located in Lake Kerkini in Northern Greece. Lake Kerkini is one of the LWfG Life project sites and is known as a main wintering area for the LWfG that follow the European migration route.

Imre did not succeed in finalizing his autumn migration to Greece. On 30 October, his satellite transmitter stopped transmitting in a position near the village Bolshoy, not far from Volgograd, Russia, and after some weeks our Russian co-operation partners confirmed that Imre was shot in this area in the last days of October.

2.3. Wintering in Greece

Finn and Nieida stayed in Lake Kerkini at least until 19 December. Due to interference from other radio signals, there had been a long time without signals from their transmitters. By 28 December they had moved to the Evros Delta on the border between Greece and Turkey. This site is also a site targeted by the LWfG LIFE project and it is known as the main wintering site for the Fennoscandian LWfG population. Here Finn and Nieida were visually observed by the Greek LWfG LIFE project team. Nieida had lost her transmitter and no signals were received from her transmitter after November, but she was identified by the colour leg rings. She was regularly observed at the Evros Delta together with Finn and they stayed at the Evros Delta until 6 March. On 7 March, plots from Finns transmitter at Lake Kerkini confirmed that the spring migration had started, and also that the LWfG may visit Lake Kerkini during the spring migration. A field survey was organised immediately at Lake Kerkini, but no LWfG were observed.

2.4. Spring migration

On 12 March, Finn and Nieida arrived in the Hortobágy National Park in Hungary, where they were regularly observed both at the Hortobágy fish ponds as well as at the Dinnyes Lapos by the Hungarian LWfG LIFE project team until 17 April. From 18 April to 24 April, Finn was located in the Nemunas Delta in Lithuania (see Kaartinen et al. 2009). A long expected missing stopover site between Hungary and Estonia on the spring migration route was finally documented. The very last signal we received from Finns transmitter came from the Nemunas Delta on 24 April. As no signals were received throughout the first weeks of May, it became obvious that Finn had either lost the transmitter or had been shot at this last site. However, on 18 May during spring monitoring, both Finn and Nieida were observed together at the Valdak Marshes by the Norwegian LWfG Life project team - both without the transmitters.

3. Implications of the results for further conservation work

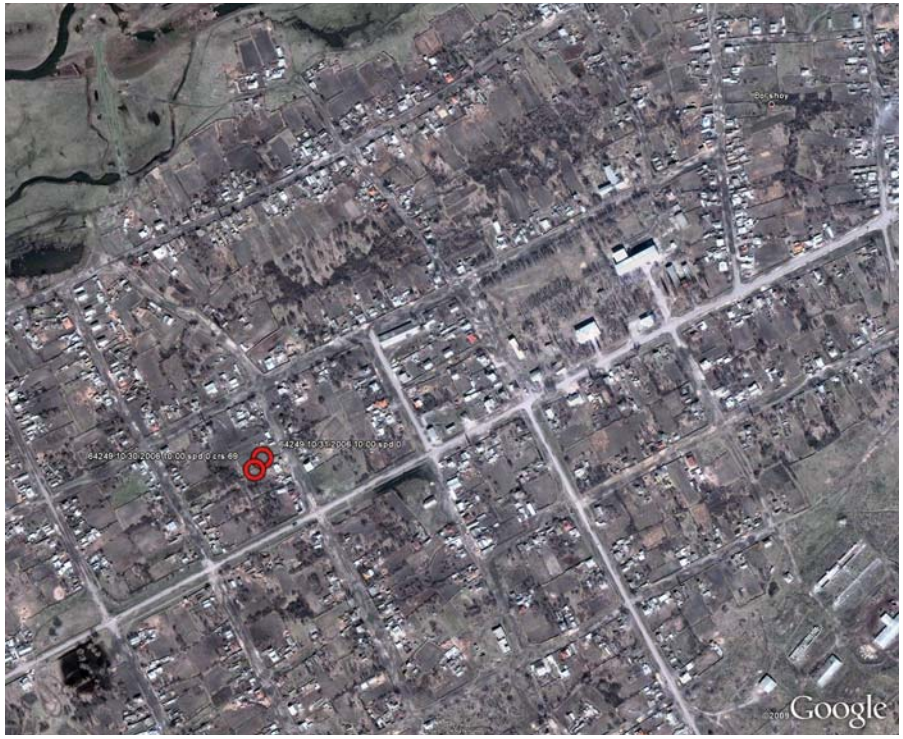
The satellite tracking of Finn, Nieida and Imre provided critically important new information on the migration of the Fennoscandian LWfG population. In addition to localizing previously undocumented stopover sites both on autumn and spring migration, these findings show that the two migration routes are not separate as assumed earlier, and that the geese that use the eastern migration route most probably don't follow the Russian LWfG from their common staging grounds in Northern Kazakhstan to the wintering grounds for Russian LWfG in the Middle East.

The fate of the male Imre, together with other documented cases of hunting and poaching of LWfG, demonstrates that the Central Asian autumn migration route incur a much higher risk of being shot for the Fennoscandian LWfG than the European autumn migration route, and confirms that the threat from (illegal) hunting along this route is significant.

This new detailed information on migration routes and staging sites for the Fennoscandian LWfG now provide a better basis for implementing conservation actions also along the Central Asian autumn migration route.

As mentioned above, the female Nieida was already an old acquaintance for us when she was caught and instrumented with the satellite transmitter in May 2006. She had been trapped and colour ringed at the Valdak Marshes already in 2002, and observed regularly along the European migration route in the years between. When combining the data from her satellite transmitter with earlier colour ring observations, it appears that Nieida used the European autumn migration route in years with successful reproduction (2003 and 2005). In these years, she was observed both at the Valdak Marshes with goslings in late August, in Hortobágy (Hungary) in late autumn and in Greece during midwinter. The years when she failed in producing offspring (2002, 2004 and 2006), she was not observed neither at the Valdak Marshes nor in Hungary during late autumn, but also in these years she showed up in Greece during midwinter.

This strongly indicates that in years with failed gosling production she performed the 'loop migration' via Northern Kazakhstan in the same way as in 2006. If this migratory behaviour is common for a significant proportion of the Fennoscandian LWfG breeding population, it means that they will follow the far safer European autumn migration route to the wintering areas in Greece in years with successful gosling production. A logical explanation to this is that failed breeding encourage



The last signals of the transmitter of the Lesser White-fronted Goose male Imre were received in the last days of October 2006 from the backyard of a house in a village in the Volgograd area, Russia. Later on, the transmitter was received back and refurbished for further use.. © Google Earth

Spring staging site of Fennoscandian Lesser White-fronted Geese revealed in the Nemunas delta, Lithuania

In April 2007, a new spring stopover site for the Fennoscandian breeding population of the Lesser White-fronted Goose (*Anser erythr opus*, hereafter LWfG) was found with the help of satellite tracking in the Nemunas River delta, western coast of Lithuania. The satellite tracking was as a part of the LWfG EU Life project. Three LWfG were equipped with transmitters in May 2006 in the Inner Porsangen Fjord, Finnmark, Norway. Their movements were tracked from May throughout summer, autumn and winter across Norway, Russia, Kazakhstan, Ukraine, Greece, Hungary and further north. Before 2007, the spring migration route between Hungary and Estonia has been a puzzle, since in some years the LWfG seem to leave from Hungary for a while before arriving in the Estonian spring stopover sites. The Nemunas delta and the surrounding vast agricultural fields and meadows has been known as a potential stopover site for LWfG, based on old and/or unconfirmed observations, but before 2007 this has not been confirmed by direct, well documented observations.

On 18 April 2007, the male carrying a satellite transmitter named as Finn was located in flight over north-eastern Poland on its way northwards. Later the same day it was located flying along the border between Lithuania and the Kaliningrad region (Russia), then turning west following the Nemunas River valley, and finally located in at the Nemunas River delta. The last location of the transmitter was received on 24 April, when the bird was still in the Nemunas Delta. After this, the bird apparently managed to get rid of the transmitter and the transmitter stopped sending, but the bird has been observed alive (identified by colour rings) later on several times at several locations.

An adult Lesser White-fronted Goose was observed in the Nemunas Delta on 19 April 2008, here in flight in a large flock of White-fronted Geese. The short and dark brown neck, all-dark head, stubby bill and high white frontal blaze are the best identification characters to separate it from the surrounding White-fronted Geese. © Petteri Tolvanen, Nemunas Delta, April 2008.

Already when the bird was still present in the Nemunas Delta in April 2007, the area was shortly surveyed by two field teams organized by the LWfG LIFE project. No LWfG were observed during these quick surveys in April 2007. In the following spring, a LWfG survey was arranged in the area by the LWfG LIFE project, covering the period 18–21 April 2008. The survey was carried out right after the main flock of the Fennoscandian LWfG had left the staging site in Hortobágy, Hungary, but before the main flock had arrived in Estonia. All potential staging sites of geese in the area were surveyed around the Nemunas delta, including the fields west of the Silute town and on the Rusne Island.

On 19 April 2008, one unringed adult LWfG was observed in a flock of ca 4000 White-fronted Geese (*A. albifrons)* on a field ca 2 kilometers south-west of the Silute town. This remained the only observation of LWFG during the survey. This record constitutes one of the very few well documented observations of the species in the country in recent years. In total around 25000 White-fronted Geese were observed staging in the area during the survey. The area is well suited as a staging area for LWfG and other geese and there are no obvious threats to geese, like poaching or habitat change. Further surveys in mid-April, as well as continued satellite tracking of the Fennoscandian LWfG, will be needed to shed more light on the importance of the area as a spring staging area for LWfG.

Locations of the satellite transmitter of the Lesser White-fronted Goose male Finn in 22–24 April 2007 (yellow dots) and location of the Lesser White-fronted Goose observed in the survey in 19 April 2008 (red dot). © Satellite image, Google Earth 2009

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The Nemunas Delta is an important spring staging area for geese. During the three-day survey in mid-April 2008, ca 25,000 White-fronted Geese were counted staging in the area, and 30 different neck-collars of them were read. © Petteri Tolvanen Nemunas Delta, Lithuania, April 2008.

the LWfG to accomplish the moult migration to Siberia, and from there, the shortest migration route to the wintering areas in Greece is via the Ob River valley, Kazakhstan and the northern coast of the Black Sea. When the LWfG produce goslings successfully, they "are forced to" take care of their offspring and moult in the breeding area in Fennoscandia simultaneously as the goslings become fledglings. In late August the family groups are prepared to leave the breeding grounds and for these birds it is much shorter to follow the European autumn migration route via eastern Hungary to the wintering area in Greece.

This important additional effect that reproductive success exerts on the adult survival may also explain the significant drop in the Fennoscandian population between 2000 and 2001 (see e.g. Aarvak & Øien 2004). Before onset of autumn migration from the breeding area in Finnmark, Norway, the LWfG pairs that have bred successfully gather at the Valdak Marshes. In the autumn 2000, only one brood was produced, and only 8 adults and two goslings in one brood were observed at Valdak in August. This season, most probably the major part of the Fennoscandian breeding population accomplished moult migration to Russia and followed the Central Asian autumn migration route. As a consequence, a significantly higher proportion of the population than normally faced the high hunting pressure along this migration route that autumn. The fact that a similarly low number of LWfG was observed in Hungary during autumn migration that year supports this theory. The monitoring data show that the number of LWfG on spring staging at Valdak the following year was reduced by 35% between 2000 and 2001 and kept on that level until 2007.

Through the results from this study, new light has been shed on the migratory movements of the critically endangered Fennoscandian LWfG population showing that the two flyways are not separate and they lead to the same wintering grounds. This does not exclude the possibility that birds form the Fennoscandian population could winter in the Middle East together with the Russian LWfG, but there is no evidence on wintering there from satellite tracking or ringing data of the Fennoscandian LWfG. The birds using the eastern route, rejoin with the other Fennoscandian LWfG in northern Greece after undertaking the impressive 'loop-migration' via the Russian Taimyr Peninsula in northern Siberia, northern Kazakhstan and northern coast of the the Black Sea. The results from this study are therefore of vital importance for the LWfG conservation work in several ways. The documentation shows the importance of conservation actions on the breeding grounds in order to "support" successful breeding that both represents recruitment of new birds to the small population and – even more important – contribute to increased adult survival. The very detailed and precise geographical information revealed by the GPS satellite transmitters furthermore enable necessary conservation actions along the entire flyway of the population.

4. Acknowledgements

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The pair Finn and Nieida in the Evros Delta 5 January 2007. Colour rings are well visible as well as the satellite transmitter on the back of the male (at right). White-fronted Geese on the background. © Didier Vangeluwe

Luukkonen, Ari Leinonen and many others) for valuable observations and excellent co-operation throughout the tracking period of the birds. Konstantin Litvin provided invaluable help in the investigation of the faith of Imre in the Volgograd region and finally in rescuing the transmitter for further use. Permission to catch and instrument the LWfG with transmitters was provided by the Norwegian Directorate of nature management and the Committee for experiments on animals in Norway (Forsøksdyrutvalget). In addition to the LIFE-Nature funding, financial support was provided by the Department of Environmental Affairs – Office of the County Governor of Finnmark and the Norwegian Directorate for nature management.

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Monitoring of Lesser White-fronted Goose in Estonia in 2004–2008

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1. Introduction

In the beginning of the 1900's, the Lesser White-fronted Geese (*Anser erythropus*, hereafter LWfG) was a common breeding bird in mountain regions of northern Fennoscandia, and a major migration route passed through the north-western parts of Estonia (Norderhaug & Norderhaug 1984). The crash of the Fennoscandian LWfG population during the first half of the 1900's surely affected the numbers of LWfG migrating through Estonia. Until the 1960's, LWfG was a scarce but regular visitor in Estonia during the spring and autumn migration (Leibak et al. 1994). In the 1970's, no confirmed observations of the species were made in Estonia (Leibak et al. 1994). Since 1985, single individuals and small groups originating from the Swedish reintroduction programme were observed in western Estonia, mainly in flocks of Barnacle Geese (*Branta leucopsis*) and thus it was presumed that all the LWfG seen in western Estonia would originate from the Swedish reintroduction programme (Leibak et al. 1994).

An important spring staging area for the Fennoscandian population of LWfG was revealed at Matsalu, western Estonia in 1996–1998, and at least 32 individuals were observed in the area in April–May 1998 without systematic monitoring (Tolvanen 1999). Since 1999, the spring monitoring in western Estonia has been carried out annually by WWF Finland's LWfG conservation project and the staff of Matsalu Nature Reserve. During the LWfG Life project "Conservation of Anser erythropus on the European migration route" in 2005–2008 Estonian stopover sites were monitored both during the spring and the autumn migration period in western Estonia in the territory and surroundings of Matsalu National Park, Silma Nature Reserve and the Haapsalu Bay. All surveys were carried out in co-operation between WWF Finland, Matsalu National Park and Silma Nature Reserve.

The main aim of the monitoring was to count, age and identify individually the LWfG staging in the area, to monitor the impact of the LWfG Life project actions and to assess possible threats for LWfG in the area.

2. Methods

2.1. Spring monitoring

In the years 2004–2008, the stopover sites for staging LWfG in Estonia were monitored annually in order to achieve estimates on the population development, demographic aspects, space use of the LWfG and the effect of the LWfG Life project actions (primarily the influence of the restoration and management activities on the historical roosting sites of Haeska Islets, see Toming & Tolvanen 2009). Recording LWfG individuals on digital video for individual recognition (see Aarvak et al. 2009) was carried out when possible.

The monitoring started in mid-April and lasted until mid-May (see Table 1). All sites known to be visited by LWfG in previous years were surveyed by the established methods described by Tolvanen et al. (2000). In addition, several visits were made to survey the other potential staging sites in Pärnumaa and Har-

The Finnish-Estonian Lesser White-fronted Goose team monitoring geese in Haeska village. The Lesser White-fronted Geese are also being recorded by digital video camera mounted on a spotting scope (on the left). © Maire Toming, April 2006

jumaa counties and valuable observations were received annually also from Finnish ornithologists birding in the area.

When possible, the staging LWfG were recorded by digital video camera mounted on a telescope. This combination enables us to record the geese at much longer distance than would be possible with traditional photographic equipment. The main purpose of the video recording was to improve the identification of individuals and pairs, which eventually helps to reveal migratory movements and life history of individuals by comparing the belly patch patterns on the video tapes from different staging sites (see Aarvak et al. 2009). The monitoring areas are shown in Figure 1.

2.2. Autumn monitoring

Autumn surveys were carried out in September–October in the years 2004–2008. The monitoring period was on average two weeks, except for the autumn 2005 when low intensity monitoring was carried out during seven weeks in September–October, (see Table 1 for the timing of the monitoring period each year). The usual spring staging areas of LWfG were visited more or less daily, and in addition the monitoring covered the potential staging areas in south-western Estonia (Häädemeeste-Nigula area), in southern Estonia (in the surroundings of Tartu) and in south-eastern Estonia (near Lake Peipsi).

3. Results

3.1. Spring monitoring

LWfG were observed mostly at two traditional sites, at (Ridala) Haeska and (Noarootsi) Tahu. In most of the years they preferred the Haeska site, but the use of the sites differed quite a lot between the years. For example in 2007, the LWfG were staging in Haeska and visited the Noarootsi sites only on one day. In 2008, the LWfG behaved in the opposite way and staged in Noarootsi, and were seen only once in Haeska (on the first day of monitoring). For the first time during the monitoring history in Haeska, LWfG also used the Haeska islets (managed by the LWfG Life project, see Toming & Tolvanen 2009) for feeding and roosting in spring 2007.

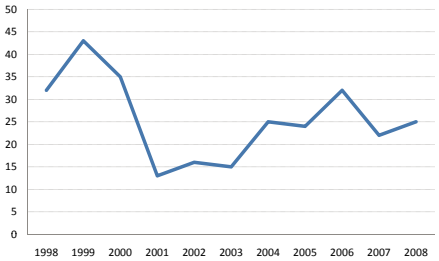

Figure 2. The number of observed Lesser White-fronted Geese in Estonia in springs 1998–2008.

The total number of LWfG observed during spring monitoring varied from 13 individuals in spring 2004 to 32 individuals in 2006, without any clear trend in the period 2004–2008 (see Figure 2).

The length of the staging period of LWfG in western Estonia has been quite stable during the last decade. On average it was 18–19 days, the maximum length was 25 days in 2008 (Table 1) and the minimum was 13 days in 2003 (Tolvanen et al. 2004). The length of the staging period was calculated from the first observation until the last observation at the main sites; occasional observations of single birds from other sites clearly before the arrival of the main flock, or clearly after their departure are not included in the calculation.

The birds were mostly adults (see Table 1). Birds with Norwegian colour-rings were observed every spring during the Life project years 2005–2008 (see Table 1).

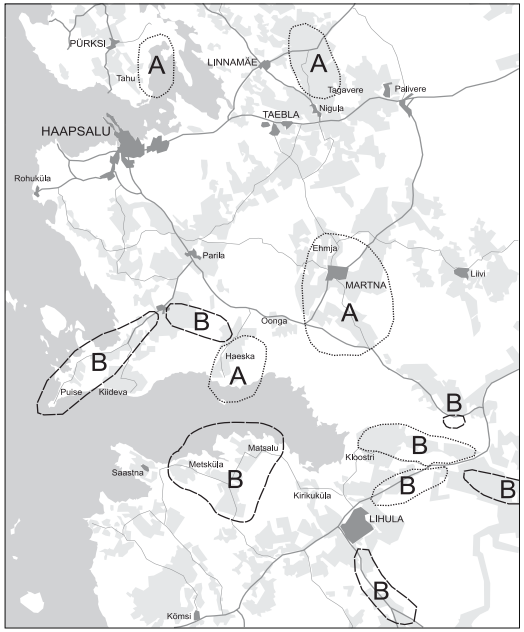

Figure 1. The areas marked by A are the sites that are most regularly used by the Lesser White-fronted Geese, and these were monitored (in spring) almost daily. The areas marked by B are less frequently used by the geese, and these have were surveyed (in spring) less often but at least ca once a week.

3.2. Autumn monitoring

Only a few individuals of LWfG were observed during the autumn migration period. In autumn 2004 there was no observation of LWfG at all. In 2005 three birds were seen (all of them at Ridala, Haeska), in 2006 there were two observations of three birds (two adults at Noarootsi, Tahu on 22 September, and one adult at Puhja,Tännassilma on 28 September) and in 2007 there was one observation of 5 birds (two adults at Noarootsi, Tahu on 22 September, and one adult at Puhja,Tännassilma on 28 September) (see Table 1).

4. Discussion

The spring staging population of LWfG was rather stable in the report period, but use of the two main spring staging sites varied a lot between the years. The spring staging period in Estonia is relatively safe for the LWfG, there is no hunting and the human disturbance at the sites (that are situated within protected areas) is very low. Based on the autumn observations it seems that the major part of the Fennoscandian population of LWfG is passing Estonian staging areas or using a different migration route during the autumn migration. Nevertheless, small numbers of LWfG still regularly occur in Estonia also in autumn. As the autumn migration happens during the hunting season of waterfowl, and as the geese use to feed mostly on arable land, mortality of LWfG due to hunting cannot be excluded. For example in one occasion during the report period, a flock of five LWfG was observed outside the protected areas on an agricultural field together with other goose species and some ten hunters, probably tourists, were shooting geese around the same field. However there are no confirmed cases of hunting, poaching or accidental shooting of LWfG in Estonia during the last decade.

Table 1. Monitoring periods and the main results of the Lesser White-fronted Goose monitoring in Estonia in the years 2004–2008 In autumn, no colour ringed birds were observed, and the autumn observations are too few to conclude the length of the staging period. 2-cy = 2nd-calendar-year bird.

	2004	2005	2006	2007	2008
Spring					
Monitoring started	Apr 16	Apr 10	Apr 16	Apr 14	Apr 16
Monitoring ended	May 8	May 10	May 12	May 13	May 12
First observation of LWfG	Apr 16	Apr 19	Apr 21	Apr 24	Apr 16
Last observation of LWfG	May 11	May 8	May 11	May 11	May 19
Lenght of staging period	20	19	18	18	25
Total number of LWfG	25	24	32	22	25
Age distribution	All adults	One 2-cy ind, the rest adults	One 2-cy ind, the rest adults	Two 2-cy ind, the rest adults	All adults
Number of colour-ringed individuals	–	1	2	1	3
Autumn					
Monitoring started	Sep 20	Sep 1	Sep 20	Sep 22	Sep 13
Monitoring ended	Oct 2	Oct 20	Oct 4	Oct 7	Sep 21
First observation of LWfG	–	Sep 25	Sep 22	Sep 25	Oct 13
Last observation of LWfG	–	Oct 5	Sep 28	Sep 25	Oct 13
Total number of LWfG	0	3 (+ 11 possible)	3	5	2
Age distribution	–	All adults	All adults	4 adults, 1 juvenile	All adults

5. Acknowledgements

Many persons were involved in the LWfG monitoring actions in Estonia in 2004–2008. Our special thanks are due to all observers that carried out the field work and reported their observatiosn during these years: Heikki Holmström, Risto Karvonen, Riikka Kaartinen, Seppo Ekelund, Aivar Veide, Kaarel Kaisel, Tarvo Valker, Marko Valker, Renno Nellis, Trinus Haitjema, Miranda Klaij, Olev Mihkelmaa, Jukka Hauru, Mika Bruun, Gustaf Nordenswan, Frans Silvenius and Jarmo Ahveninen, to name some of the people who have contributed to the monitoring.

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Restoration and management of the Lesser White-fronted Goose habitats in Matsalu, Estonia

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The extensive reed beds of the Väike Rahu Islet on the Matsalu Bay were first mowed down and then burned during the voluntary restoration camp that was part of the Lesser White-fronted Goose Life project actions. © Petteri Tolvanen, August 2006

1. Introduction

During the Lesser White-fronted Goose (*Anser erythr opus*, hereafter LWfG) LIFE-Nature project (2005–2009), habitat management actions were carried on the Haeska Rahu Islets in the Matsalu Bay, within the Matsalu National Park. The aim of the actions was to remove reed bed from parts of the islets, and after the removal of the reed, re-introduce continuous grazing on the islets after a break of half a century. The Haeska area is known since the end of 1990's as an important staging site of the Fennoscandian LWfG population (see Tolvanen 1999, Toming & Pynnönen 2009).

Historically (until the mid-1900's) the Rahu Islets were regularly used for hay making by the local people, and due to constant mowing, the Rahu islets were kept as open, low-growth coastal meadows. During the last decades of the 20th century the land use (hay making and collecting of reeds) on the islets decreased rapidly, and the former open meadows were gradually overgrown by the extensive reed beds or bushes, and thus a valuable staging and roosting area for geese and other migratory wetland birds was lost. Nowadays stopping the habitat loss and securing the management of coastal areas and islets is one of the most important tasks of the Matsalu national park. Continuation of the management is significant not only for LWfG but also for many other bird species.

In the planning phase of the LWfG LIFE project it was concluded that the Haeska Rahu islets would be a perfect roosting and feeding place for LWfG, as the islets are situated next to their favourite feeding grounds on the Haeska coastal meadows, and on the islets there is remarkably less disturbance than on the mainland. It is also notable that from the Haeska bird watching tower, situated on the coastal meadow on the mainland side, it is possible to observe the geese staging on the Haeska islets without any disturbance for them.

Highland cattle, that is particularly effective in grazing on reed on coastal meadows, take care of the continuous management of the Lesser White-fronted Goose habitat restored by the Life project. © Petteri Tolvanen, Matsalu, Estonia, August 2006

2. Methods

The habitat management on the Haeska islets started by a voluntary restoration camp in order to remove the reed bed on Väikerahu Islet. The camp was arranged in mid-August 2006 in co-operation between WWF Finland and Matsalu National Park together with Estonian Fund for Nature (ELF) and Estonian Seminatural Community Conservation Assosiation (ESCCA). During the camp, the reed-bed was mowed and burned on 8 ha of Väikerahu and on 40 ha of Suurrahu Islet, exceeding clearly the targets defined.

Grazing on both islets was started simultaneously with the restoration actions and was since then implemented during the whole project period. More than 80 cows grazed on both islands in summer in the years 2006–2008. Beef-cattle were chosen for grazing because the islets are very low and often flooded by the sea-water (cattle can resist such conditions much better than sheep). Seven individuals of beef-cattle was bought by project in order to make the grazing of the islets more effective and to secure continuation of the management of the islets after the LIFE project period.

Major part of the mowing on the Haeska Rahu islets was carried out by tractor. In some places the reed beds were more than four meters high and very dense. © Petteri Tolvanen, August 2006

An electric fence (1300 meters) of was built around the Väikerahu islet in the years 2007 and 2008. The weather and ice conditions during autumn and winter in the area are usually rough, and storms and ice can damage the fence if left in place over the winter. Therefore, the fence has to be removed for winter and the cattle have be brought back to the mainland before the autumn storms.

3. Results

During the LIFE project period, in total 11.2 ha of meadow area opened and managed by grazing on the Väikerahu Islet, and 60 ha on the Suurrahu Islet.

Both of the islets were in favourable condition for staging geese and other birds already in the first spring after the restoration camp (i.e spring 2007) and since then the sites were frequently used by birds. For the first time during the LWfG monitoring history in Matsalu, the LWfG used the managed part of both the Haeska Rahu islets for feeding and roosting in several occasions in spring 2007. The managed part of Väikerahu is now covered by a low coastal meadow vegetation. In 2007 and 2008, several pairs of meadow birds like Dunlin (*Calidris alpina*), Redshank (*Tringa totanus*) and Lapwing (*Vanellus vanellus*), and some females of Ruff (*Philomachus pugnax*) were found breeding on the islets. On Väikerahu, a pair of Marsh Sandpiper (*Tringa stagnatilis*) was breeding in the summer 2008. This is the first breeding record of the species in Matsalu National Park.

4. Discussion

It can be concluded, that the restoration of a coastal meadow – and a new safe and favourable staging site of the LWfG – was successfully implemented within a relatively short time period (2006–2008) and at relatively low expenses. However, all the effort will be in vain, if the management of the site will not be continued annually, and by adequately high grazing pressure. The Estonian nature conservation authorities will be responsible for this, as defined in the new Estonian Action Plan for the species (see Toming 2009).

5. Acknowledgements

We would like to thank all those who have contributed and worked hard during the project to make the Rahu Islets suitable for LWfG and other bird species: WWF Finland restoration camp organizers and participants, Margo Vichterpal for building fences and grazing his animals on the islets, sometimes in very complicated conditions, and Ants Ale for understanding cooperation.

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Public awareness campaign for the Lesser White-fronted Goose in Estonia

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1. Introduction

One of the key objectives in conservation of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) is to make hunters, landowners and birdwatchers aware of the vulnerability of the species and the problems in identification, especially separating the LWfG from the White-fronted Goose (*A. albifrons*), which is a common hunting species and very similar to the LWfG.

2. Aims and target groups

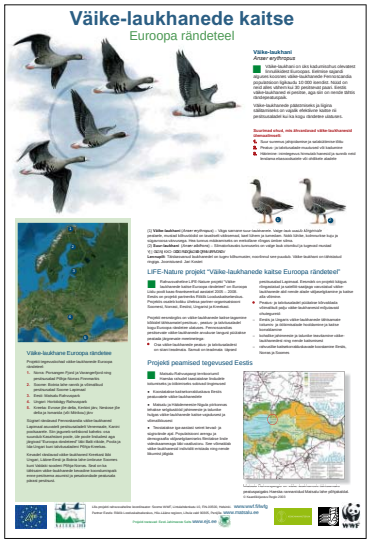
The Estonian public awareness campaign aimed at increasing the knowledge about LWfG as a globally threatened species, separating the LWfG from other goose species and introducing the most important threats to the species as well as describing possibilities to avoid them. The main target groups were hunters, farmers and stakeholders involved in the management of the coastal meadows important for the staging LWfG both inside the national parks and nature reserves and in the region generally.

3. Results

The farmers and other central stakeholders in the project area were informed about the habitat management activities of the LWfG LIFE project in order to manage the Rahu islets in Haeska (see Toming & Tolvanen 2009), one of the two main staging sites for LWfG in Estonia. Several agreements between Matsalu National Park and the landowner of Väikerahu islet, as well as with the farmer keeping livestock within the project area were made, and the objectives of the LIFE project activities were explained.

A booklet introducing the LWfG and the LIFE project in Estonian language (1000 copies) and a sticker showing LWfG in colour (1000 copies) were printed. An article on the LWfG conservation was published in the Estonian hunters'magazine 'Eesti Jahimees' (Toming 2007). The article focused mainly on the threatened status of the LWfG, the challenges in separating it from the other goose species, and on the objectives of the LWfG LIFE project. The magazine is disseminated free of charge to all members of the Estonian Hunters Society (ca 10 000 persons). The other printed materials were disseminated to the hunters in Läänemaa and Pärnumaa counties, the employees of the County Environmental Department of Läänemaa, specialists of Matsalu National Park, Silma Nature Reserve and Nigula Nature Reserve as well as the Nature Protection Department in the Ministry of Environment.

Three educational meetings for hunters were arranged. The first meeting (for hunters of Läänemaa and Hiiumaa counties) was held in the visitor center of Matsalu National Park, the second meeting (for the employees of the County Environmental Department of Läänemaa) was held in Tooraku near Haapsalu, and the third meeting was held in Hunters Association of Pärnumaa, including Häädemeeste-Nigula area. A Powerpoint presentation, describing the occurrence of LWfG in Estonia, identification issues and threats for the LWfG were presented in these meetings. Also, local goose-hunting problems, hunting tourism, connections between Barnacle Goose (*Branta leucopsis*) hunt in Western Estonia and threats for LWfG, and possibilities for establishing a voluntary, temporary 'red light system' for goose hunting in case LWfG will occur during the hunting season (see also Toming 2009) in the autumn were discussed.



One of the information signs of the Lesser-White-fronted Goose Life project is placed in the Haeska bird watching tower in the Matsalu National Park.

4. Discussion

Cooperation between the hunters and the nature conservation organisations in Estonia in the LWfG LIFE project has been successful. No major arguments against limitations for goose hunting n case of LWfG occurrence have risen, and Estonian Hunters Society has declared its full support to the protection of LWfG.

However, accidental shooting and the growing hunting tourism in Western Estonia, including the new possibilities to hunt also Barnacle Geese by a special permit from EU, can still constitute a possible threat for LWfG in Estonia.

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The spring migration of the Lesser White-fronted Goose on Bothnian Bay coast, Finland, in 2004–2008

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1. Introduction

The number of Fennoscandian Lesser White-fronted Geese (*Anser erythropus*, hereafter LWfG) is only some 20 breeding pairs (see Aarvak et al. 2009). The data collected within the last 10–15 years shows a declining trend of some 4% annually in the population (Tolvanen et al. 2004). The aim of the spring monitoring of LWfG on the Finnish Bothnian Bay coast is to collect data on the population size and age structure as well as on the ecology of the species. The annual spring monitoring of LWfG started in this area in 1985, and thus this site has been monitored by constant methods longer than any other LWfG staging site. These coastal meadows on the Bothnian Bay coast makes up the only remaining Finnish staging area for LWfG.

2. Methods and data

2.1. Aim of the study

The primary aim of the monitoring was to collect data on the population size and age structure of the Fennoscandian LWfG. The estimate of the population size is based on individuals observed during the spring migration at the constantly monitored traditional sites. All LWfG observations were collected from the study area, not only those made by the monitoring team. The LWfG were also recorded on digital video in order to identify the individuals by their individual different belly patches (see Aarvak et al. 2009 for further details).

2.2. Study area and years

The monitoring focused on the traditional staging areas of LWfG at Siikajoki, Hailuoto and Liminka (Figure 1). The sites in Liminka and Hailuoto are Natura 2000 areas (Isomatala-Maasyvänlahti and Liminganlahti). The sites in Siikajoki are only partly included in the Natura 2000 area of Säärenperä and Karinkannanmatala. The monitoring sites consist of coastal meadows and agricultural fields (Markkola 2001). Formerly the main staging sites were situated on the island of Hailuoto, but after 2000 the LWfG have mainly used the Säärenperä–Karinkanta area on the mainland in the municipality of Siikajoki. Therefore the sites in the Bay of Liminganlahti and on Hailuoto were not monitored as intensively as the sites in Siikajoki in this study (Table 1).

2.2.1. Spring 2004

The monitoring period started in Säärenperä on 30 April, and on Hailuoto on 2 May. In both areas the monitoring continued until 18 May, i.e. five days after the last sighting of LWfG. Bean Geese censuses preceded in the same areas on previous weeks. Thus, early arriving LWfG would probably have been detected. An observation hide was used in Säärenperä. The field work was carried out by 11 voluntary observers.

2.2.2. Spring 2005

Monitoring in Siikajoki started on 25 April, when an observation hide was constructed. Daily monitoring routines began on 29 April and ended on 17 May, three days after the last observation of LWfG. In this period, the only day without monitoring was 7 May, otherwise the monitoring was continuous.

The first monitoring visit to Hailuoto was made on 26 April and continuous monitoring there lasted from 30 April to 16 May, but the monitoring was not as intensive as in Siikajoki. The potential LWfG sites in Liminganlahti were only irregularly visited, and the visits in this area were made in the period 30 April – 10 May. The field work was carried out by eight voluntary observers.

2.2.3. Spring 2006

The monitoring in Siikajoki started on 24 April when an observation hide was constructed. Daily monitoring began on 2 May and ended on 18 May. Altogether seven volunteers participated the monitoring in Siikajoki. The monitoring on Hailuoto consisted of two periods (6–10 May and 12–16 May). The Bay of Liminganlahti was visited by the monitoring team only for a couple of times.

2.2.4. Spring 2007

Continuous monitoring in Siikajoki began on 27 April and ended on 19 May; in this period the monitoring was continuous except from 28 April and 6 May. Already before this, short visits to Säärenperä were made during 18–26 April. On Hailuoto the monitoring covered the periods 30 April–2 May, 7–11 May and 15 May. The poten-

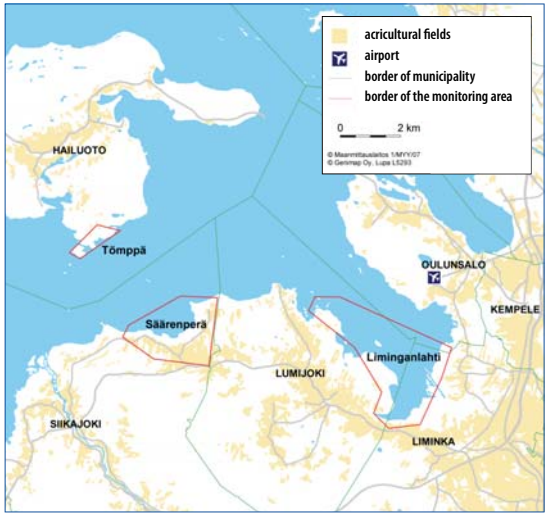

Figure 1. During spring, the Lesser White-fronted Geese use three different coastal meadow areas for staging on the Finnish Bothnian Bay coast: the Tömppä meadows (Hailuoto), the Säärenperä meadows (Siikajoki) and the meadows in the Bay of Liminganlahti (Lumijoki and Liminka). Of these, the Säärenperä site is nowadays clearly the most important.

Table1. Monitoring periods on Bothnian Bay coast, Finland, in 2004–2008.

	Hailuoto			Siikajoki		
Year	Start of monitoring	End of monitoring	Duration in days	Start of monitoring	End of monitoring	Duration in days
2004	May 2	May 18	ca 10	Apr 30	May 18	19
2005	Apr 30	May 16	ca 10	Apr 29	May 17	19
2006	May 6	May 16	9	May 2	May 18	17
2007	Apr 30	May 15	9	Apr 27	May 19	21
2008	May 1	May 20	5	Apr 29	May 21	23

Table 2. Timing of the staging periods of Lesser White-fronted Geese on the Finnish Bothnian Bay coast in 2004–2008.

	2004	2005	2006	2007	2008
First observation	1 May	9 May	7 May	3 May	27 April
Last observation	13 May	13 May	17 May	12 May	20 May

tial LWfG sites in Liminganlahti were visited roughly every second day in the period 28 April 2 – 16 May.

2.2.5. Spring 2008

As in the previous years, the monitoring focused on Siikajoki. The monitoring started on 19 April, and the daily continuous monitoring began on 29 April and ended on 21 May. On Hailuoto there was no regular observation effort, but only short visits were made during the first weeks of May. The potential LWfG staging sites in Liminganlahti were visited irregularly in May.

3. Results

3.1. Hailuoto

No LWfG were seen on Hailuoto in the years 2004–2007. On 20 May 2008 one individual was observed migrating north at Lahdenperä. This was the first LWfG observation on Hailuoto since May 2002 (see Markkola et al. 2004).

3.2. Liminganlahti

No LWfG were seen in 2004. In 2005 one 2-cy individual was seen at Pitkänokka on 18 May with together Pink-footed Geese (*Anser brachyrhynchus*).

Also in 2006, one 2-cy individual was seen in Limiganlahti, on the delta of River Temmesjoki in the end of May. It is worth mentioning that shortly after this, one LWfG was observed migrating west above sea on the Swedish coast at the latitude of the study area. In 2007, one 2-cy LWfG was seen on 5 May in Virkkula. In 2008 no LWfG were seen.

3.3. Siikajoki

3.3.1. Age structure and numbers of LWfG

Spring 2004: In total, six adult birds were recorded. This was the lowest number ever recorded during spring monitoring on the Finnish Bothnian Bay coast.

Spring 2005: Altogether seven individuals were observed in the Säärenperä-Karinkanta area. Six of them were adults and one was a 2-cy bird.

Spring 2006: 10 adult LWfG in five pairs were observed.

Spring 2007: Adult birds in five pairs were observed. In addition, one adult was observed migrating north in 17 May at Tauvo, Siikajoki.

Spring 2008: 20 LWfG were recorded, including 16 adults (7 pairs + 2 single adults) and four 2nd-calendar-year birds. The total number of LWfG was the highest since 2000.

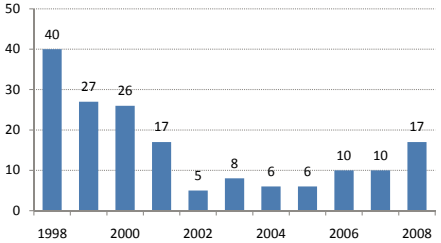

Figure 2. The number of Lesser White-fronted Geese on the Bothnian Bay coast, Finland, during spring migration in 1998–2008.

3.3.2. Timing of migration and habitat use

Spring 2004: The first pair arrived in Säärenperä already on 1 May. Three days later, two new adult pairs joined the first pair. On 12 May two of these pairs continued the migration and the last pair disappeared next day, 13 May. The LWfG were feeding mainly on agricultural fields, especially in the early part of the staging period. Coastal meadows were favoured in the end of the staging time.

Spring 2005: The first LWfG were observed on 9 May. Most likely the birds had arrived already on 8 May (when this area was not covered by the monitoring) because the weather conditions were unsuitable for migration on 9 May. The last observation of adults was made on 13 May and the 2-cy bird disappeared on 11 May. It is possible that this 2-cy individual was the same individual that was observed in Liminganlahti on 18 May. The staging period of LWfG was only five days, shorter than ever before. This was probably caused by the early spring.

In Säärenperä, the LWfG spent most of the time in the dryer parts of the natural coastal meadows (200–300 meters from the shore line). E.g. in spring 2000 it was estimated that the LWfG spent ca 10% of their time feeding on agricultural land, but in 2005 the LWfG were observed on the fields only once when staying overnight in the fields close to the forest edge, sheltered from cold northerly winds.

Spring 2006: The first LWfG pair was observed in 7 May in Savilahti (Siikajoki). Two unidentified small Anser-geese were seen in flight in the area already on the previous day. Two new LWfG pairs arrived on 10 May, when they were found staging with the first pair in Savilahti. The fourth pair was found on 13 May on the fields of 'Kivikasa' (a large and open field which is favoured by the geese for grazing). The fifth LWfG pair was observed only once: in Savilahti on 15 May. The last observation of LWfG was made on 17 May (the pair which arrived on 13 May). The three pairs that arrived first (during 7–10 May) disappeared on 13 May. Coastal meadows and agricultural fields nearby were used equally.

Spring 2007: The first adult pair was observed on the fields of 'Kivikasa' on 3 May. This pair spent only three days in the area. Two new adult pairs arrived on 7 May, spending only two days in the area. A similar pattern was repeated with the following pairs: the fourth adult pair arrived on 10 May and left on 12 May, and the fifth adult pair arrived and left on 12 May. This spring the LWfG staged mainly on the coastal meadows, and they were seen only twice on fields nearby.

Spring 2008: The LWfG observations during the monitoring period consisted of three flocks. Two flocks were composed by adults, with five individuals in both flocks. The third flock consisted of three adult pairs and four young (2nd-calendar-year) birds. The first flock was found in the same day as the monitoring period started, i.e. 27 April, and thus it cannot be excluded that these birds could have arrived already earlier. The flock departed on 29 April, setting a new earliness record for the departure of LWfG from the Finnish Bothnian Bay coast. The second flock, five adults, arrived on 2 May, and left on 12 May. The third flock arrived in Säärenperä on 16 May and departed on 20 May. The first two flocks staged mainly on the coastal meadows, while the third flock was observed only on agricultural fields.

4. Discussion

The numbers of spring staging LWfG on the Finnish Bothnian Bay coast increased markedly during the period 2004–2008 back to the level of early 2000's (Figure 2). This is, however, more probably related to the changes in the timing and routes of the spring migration rather than a real increase in the population size, because e.g. at the Valdak Marshes in Finnmark, Norway, the spring numbers decreased in the same period (see Aarvak & Øien 2009). It is worth noting, however, that some 10–15 % of the LWfG individuals recorded on spring migration are seen in Estonia and/or in Finland but not at the Valdak Marshes, which implies that part of the population possibly breeds in other areas than the Norwegian core breeding area (see Aarvak et al. 2009).The proportion of young (2nd-calendar-year) birds was very low in the study period 2004–2008, with an exception for spring 2008. The springs with higher share of young birds on the Finnish Bothnian bay coast (years 1998, 2001 and 2007) coincide with very good juvenile production in the Fennoscandian population in the previous summer (cf. Aarvak & Øien 2009).

The space use of LWfG within the study area has varied quite a lot over the past decades: in the period 1985–1988 the Liminganlahti Bay was the most important staging area, in the period 1988–1998 the LWfG used mainly the coastal meadows of the south-eastern part of Hailuoto (Markkola et al. 2004), but since then the LWfG have almost exclusively used the sites on the coast of Siikajoki. The reasons for these changes are not known, but a part of the explanation could be that White-tailed Eagles (*Haliaeetus albicilla*) have become more and more numerous, especially on Hailuoto and in the Liminganlahti Bay. Even within the present staging area in Siikajoki, the habitat use (feeding on natural coastal meadows vs. agricultural fields) of the LWfG varies between the years.

On 20 May 2008, a rare episode was witnessed by Ari Leinonen, one of the volunteers of the LIFE project field team on the Finnish Bothnian Bay coast. He was recording a flock of seven Lesser White-fronts at 04:30 a.m. on a field near Säärenperä in Lumijoki. Suddenly, a wolf trotted forward from the bushes and chased off a flock of 70 Pink-footed Geese and five of the Lesser White-fronts. One pair of Lesser White-fronts remained on the field for a while, only 50 meters away from the wolf. After a while the wolf chased them off as well. The next day this pair was seen at the Valdak Marshes in Norway. © Elina Seppänen

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Monitoring of staging Lesser White-fronted Geese in the Inner Porsangen Fjord, Norway, in 2004–2008

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Aerial view of the inner part of the Porsangen Fjord, facing south towards the bottom of the fjord and the town of Lakselv. The outlet of the Stabburselva river and the rectangular Stabbursnes headland in the front. The Valdak Marshes are visible as a triangular area behind Stabbursnes headland. The cape Oldereidnesset which is an important site for the Lesser White-fronted Geese in autumn is visible on the left in the background. © Ingar Jostein Øien

1. Introduction

The Fennoscandian Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) conservation project run by WWF Finland and NOF has annually monitored the staging areas for LWfG in Varangerfjord (since 1995) and in the Inner Porsangen Fjord area, especially at the Valdak Marshes (since 1990). At present only the traditional staging area in the Inner Porsangen Fjord seems to be critically important for the small remaining population in the northernmost areas of the Nordic countries. The Valdak Marshes is situated in the inner part of the Porsangen Fjord in western Finnmark, and this area is utilised by the LWfG as the last spring staging area before the onset of breeding and as the first autumn staging area after the moulting period. The results of the monitoring during spring and autumn staging in the years 2004–2008 at the Valdak Marshes and in the Inner Porsangen Fjord are reported here. The article also reiterates results presented in previous reports (see Aarvak et al. 1996, 1997, Aarvak & Øien 1999, 2000, 2001 and 2004) from the monitoring and research work, but more comprehensive discussions are omitted, and is restricted to a short discussion on the results from the years 2004 to 2008. Results from the monitoring work in the same period in the Varangerfjord area and at the late spring stop-over sites in northernmost Finnish Lapland are reported by Sulkava et al. (2009).

2. Study area and methods

The Valdak Marshes (N70°09' E24°54') is part of the Stabbursnes Nature Reserve which also is a Ramsar site. The reserve was established in 1983 and covers an area of 16 km², of which approximately 2.3 km² is dry land. The site is a particularly important part of the shallow inner part of the Porsangen Fjord, which by itself makes up one of the most important wetland areas for birds in northern Scandinavia. It is also classified as a BirdLife International Important Bird Area (IBA) (Norwegian IBA 012, Lislevand et al. 2000). The Valdak Marshes is one of the largest salt and brackish marshes in northern Norway (Elven & Johansen 1982), and represents an extremely important feeding/fattening area for the LWfG in Fennoscandia where the arctic salt grass (*Puccinellia phryganodes*) is the most abundant species as well as the most important food item for the LWfG (for diet preferences, see Aarvak et al. 1996, Markkola et al. 2003).

Table 1. Monitoring periods at the Valdak Marshes in the years 2004-2008. Earlier years are reported in Aarvak & Øien 2004.

Year	Spring	Autumn
2004	9 May - 4 June	21 August - 4 September
2005	8 May - 5 June	20 August - 6 September
2006	8 May - 4 June	20 August - 2 September
2007	8 May - 5 June	20 August - 4 September
2008	9 May - 4 June	20 August - 4 September

Valdak is demarcated inwards from the fjord by Stabbursnes, which is a headland made up of glaci-fluvial depositions. The headland constitutes a natural watching point with a height of approximately 25 metres above the mires and the salt marshes of Valdak. During the studies, the observers sit close to the edge of the headland. Under such circumstances, the foraging birds can easily be studied at a distance of 250–500 metres without any disturbance to the birds by using a telescope (20–60 x magnification).

Since 1998 we have used a video camera to record the geese through the telescope. This method has increased the possibilities for accurate individual identification significantly and may also be supportive in age determination of the staging geese (Aarvak et al. 1999, 2009). By 'sub-adults' we refer to those supposedly 3rd-calendar-year individuals with adult plumage, but 'non-adult' behaviour and generally less extensive black belly markings than in (breeding) adults. Young (2nd-calendar-year) individuals can be reliably aged in spring by their plumage (see Øien et al. 1999).

The Stabbursnes headland constitutes a natural watching point above the Valdak Marshes. During the Lesser White-fronted Goose studies the observers sit close to the edge of the headland. © Morten Ekker, May 2006

The aim of the spring monitoring was to follow the progress of migration and register the total number of staging LWfG in the area (Table 2). As in former years, the individuals were identified by the individual patterns of the belly patches following a thorough description of the method given by Øien et al. (1996). We monitored the number of staging individuals and staging time of the pairs (turnover rates), and in addition, we carried out behavioural studies of dominance and of daily activity of individuals and flocks, food preferences, tolerance to- and level of disturbance, habitat use and migratory movements.

During autumn monitoring (Table 3), the emphasis was put on carrying out counts of families and social groups in order to obtain estimates on brood size, productivity and proportion of juveniles in the population. The staging geese with goslings were recorded by video camera to increase the efficiency of identification.

Since 1995, a number of LWfG has been caught in Norway, Finland and Russia to map the migration routes by use of satellite telemetry (cf. Lorentsen et al. 1998, Aarvak & Øien 2003 and Øien et al. 2009). A number of individuals have also been colour ringed. This has added further knowledge to the results obtained by the satellite telemetry (see Aarvak et al. 1999, 2000). In both spring and autumn in the years 2004–2008, considerable effort was spent on attempts to catch LWfG for colour ringing. We have used a combination of various sized cannon-nets from a small net covering an area of 180 m² (15 x 12 m) to a much larger net covering an area of 1350 m² (50 x 27 m). The former is sufficient for catching during spring staging when individual pairs defend feeding territories and only 1–2 pairs can be caught at the same time in one shot. While the latter, can be used both during spring and autumn.

Trends in population development was tested with Monte Carlo simulations (>100 000 repetitions) – see chapter 3.5.

Table 2. Numbers of Lesser White-fronted Geese at the Valdak Marshes during spring staging in 1993–2008. The table shows the maximum number of staging geese at the best day, distribution of adult pairs, subadult pairs, single subadults, single adults and immatures, as well as total number of staging individuals each spring. Abbreviations: ad = adult, subad = subadult (see Chapter 2 for definition), 2-cy = 2nd-calendar-year individual, imm = immature, non-adult (2–3–cy individual).

Year	Max on one day	no. of ad pairs	no. of subad. pairs	no. of 2-cy.	no. of single subadults	no. of single adults	% imm	Total no. of ind.
1993	32	32	–	4	–	–	5.9 %	68
1994	24	26	–	4	–	–	7.1 %	56
1995	48	> 25	–	> 10	–	–	> 16.7 %	> 60
1996	31	23	–	10	–	–	17.9 %	56
1997	32	26	–	7	–	–	11.9 %	59
1998	37	33	5	5	3	–	21.4 %	84
1999	35	22	3	7 [1]	–	1	25.9 % [2]	58
2000	44	25	2	6 [3]	3	–	23.8 % [4]	63
2001	22	18	1	0	–	3	7.3 % [5]	41
2002	29	13	–	14	1	2	34.9 %	43
2003	25	14	5	9	–	–	34.1%	41
2004	18	9	2	13	5	1	53,7%	41
2005	29	18	1	3	1	2	13,6 %	43
2006	20	16	–	10	–	1	23,3%	43
2007	16	12	–	2	2	2	13,3%	30
2008	16	11	–	10	1	1	35.3% [5]	34

[1] Not including two 2-cy individuals in pair with adults which is included in the "no. of ad. pairs" column.
[2] Also including two 2-cy individuals in pair with adults which is included in the "no. of ad. pairs" column.
[3] Not including two 2-cy individuals in pair with subadults which is included in the "no. of subad. pairs" column.
[4] Including two 2-cy individuals in pair with subadults which is included in the "no. of subad. pairs" column. Three subad. are included in the ad pairs column, and not in the subad pair column.
[5] Including one subadult in the "ad. pairs" column.

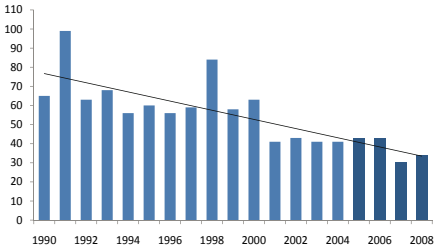

Figure 1. Total number of Lesser White-fronted Geese observed at the Valdak Marshes in the years 1994–2008 (estimated from drawings of belly patches and video analyses). A linear trend line is shown to illustrate the observed decrease. The EU-LIFE project years (2005–08) are marked with a darker colour.

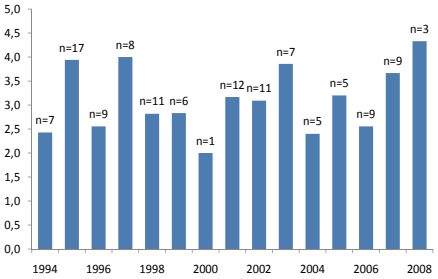

Figure 2. Mean annual brood size of Lesser White-fronted Geese at the Valdak Marshes in autumn in the years 1994–2008.

3. Results

3.1. Spring staging

Total spring numbers are given in Table 2. In 2004, the LWfG spent all the time at Valdak Marshes. The first four birds were observed 9 May, thereafter increasing slowly reaching a peak of 18 birds on 16 and 19 May. Totally 41 individuals were staging, distributed as 9 adults pairs, two subadult pairs, 13 juveniles (2-cy) , 5 single subadults and 1 single adult.

In 2005, the LWfG spent all the time at Valdak Marshes. The first LWfG (one pair) arrived on 13 May. Thereafter the numbers increased slowly, reaching a peak of 29 individuals on 25 May. Totally 43 individuals were staging, distributed as 19 adult pairs, one subadult pair, three juveniles (2-cy) , one single subadult and one single adult.

In 2006, the LWfG spent all the time at Valdak Marshes. The first LWfG (one pair) arrived on 12 May. Thereafter the numbers increased, reaching a peak of 20 individuals on 19 May. A total of 43 individuals were staging, distributed as 16 ad pairs, one single ad and 10 immature birds (2–3 cy).

In 2007, the LWfG spent most of the time at Valdak Marshes, but due to high density of Sea Eagles, they were close to Banak Airport in the period 25–28 May. The first LWfG (one pair) arrived on 10 May. Thereafter the numbers increased slowly, reaching a peak of 16 individuals on 20 May. Thereafter the numbers decreased and the Valdak Marshes were almost abandoned by LWfG from 25 May onwards (only 1–5 individuals visiting the site every day). Totally 30 individuals were staging at the Valdak Marshes, distributed as 12 adult pairs, two subadult individuals, two juveniles (2-cy) and two single adults.

In 2008, the LWfG spent most of the time at Valdak Marshes, but due to extremely late spring most birds only visited the marshes briefly. Alternative staging areas were not localised this year. The first LWfG (five ind.) arrived on 14 May. Thereafter the numbers increased slowly, reaching a peak of 16 individuals on 27 May. Totally 34 individuals were staging at the Valdak Marshes, distributed as 11 adult pairs, 11 immature (2–3 cy birds) and one single adult.

Table 3. Autumn age ratio and annual brood sizes of Lesser White-fronted Geese in 1981–2008 at the Valdak Marshes (see also Table 4 for distribution of broods and number of pairs with broods). No data exists from the years 1982–1986, 1988–1991 and 1993.

Year	n adults	n juveniles	n total	% juveniles	n flocks	Mean brood[1]	Mean brood[2]	Mean brood[3]
1981	10	18	28	64.3	1	–	3.6	–
1982–86	..	..	..	..	..	..	..	..
1987	10	18	28	64.3	1	–	3.6	–
1988–91	..	..	..	..	..	..	..	..
1992	24	34	58	58.6	?	–	2.8	–
1993	..	..	..	..	..	..	..	..
1994	31	33	64	*51.6	3	2.4	2.2	1.3
1995	61	67	128	52.3	3	3.9	2.2	2.7
1996	16	23	39	59.0	1	2.6	2.9	1.0
1997	25	32	57	56.1	1	4.0	2.6	1.2
1998	29	31	60	51.6	3–1	2.8	2.4	0.9
1999	26	17	43	39.5	6	2.8	1.3	0.8
2000	8	2	10	20.0	1	(2)	(0.7)	(0.04)
2001	24	38	62	61.3	3	3.2	3.2	2.0
2002	28	34	62	54.8	2	3.1	2.4	2.6
2003	20	27	47	57.4	1	3.9	2.7	1.9
2004	15	12	27	44.4	1	2.4	1.7	1.3
2005	16	16	32	50.0	1	3.2	2.0	0.8
2006	20	23	43	53.5	1	2.6	2.1	1.4
2007	33	33	66	50.0	1	3.7	2.0	2.8
2008	28	13	41	31.7	1	4.3	0.9	1.2

[1] Counts of pairs with broods in autumn.
[2] Number of juveniles divided by number of adults (pairs) in autumn.
[3] Number of juveniles in autumn divided by number of pairs in spring
* Assumed that the observations are three independent flocks.

All the 41 Lesser White-fronted Geese that were observed in the Inner Porsangen Fjord in autumn 2008. © Morten Ekker, August 2008

Percentages of juveniles and subadults are given in Table 2. However, these percentages are not directly comparable between the periods 1993–1997 and 1998–2008, since subadults were registered as adults before 1998. The comparable juvenile (2-cy) percentages for the years 1998–2008 are 6.0, 12.1, 12.7, 0.0, 32.6, 22.0, 31.7, 7.0, 23.3, 6.7 and 29.4 respectively.

Catching: Catching succeeded only in 2004 and 2006. In 2004 four young birds (2-3cy) were caught on 28 May. All got colour rings, but no satellite transmitters. In 2006 two adult LWfG, a pair named as Finn (male) and Nieida (female), were caught on 18 May, and provided with satellite transmitters (male with GPS-plotter, female with ordinary satellite-transmitter). The male was ringed and colour-leg-ringed, whereas the female was already colour-leg ringed at Valdak Marshes in spring 2002 (and already well known from stopover sites in Hungary and Greece on the European autumn migration route). On 23 May, five more LWfG were caught and ringed and colour-leg-ringed. One adult male in a pair (named as Imre) was provided with satellite transmitter with GPS-plotter (see Øien et al. 2009).

Both 2007 and 2008 turned out to be years with very difficult catching conditions. One of the reasons for unsuccessful catching attempts in spring 2007 was surely the fact that LWfG were scared away from the Valdak Marshes by a large number of White-tailed Eagles (*Haliaeetus albicilla*) during the peak staging time (max count of 26 birds at the marshes). The spring tide covered all natural sitting rocks for White-tailed Eagles, forcing them ashore. The influx of White-tailed Eagles coincided with very high spring tide and the peak of the staging period for LWfGs. Neither in 2008 LWfG were caught. We had several possible catching possibilities on young birds, but due to a decision on giving priority to catch adult males for fitting satellite transmitters, the caching possibilities was not made use of due to risk of scaring away the adult birds. The low number of LWfG present at the Valdak Marshes due to cold weather and late spring surely influenced the possibilities of catching adult birds. The alternative staging places this year are still unknown.

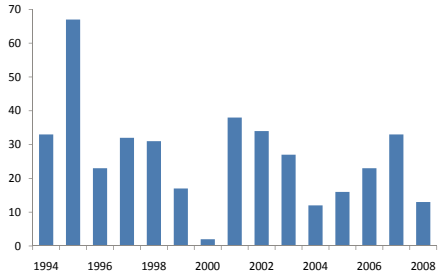

Figure 3. Total annual number of Lesser White-fronted Goose goslings observed at the Valdak Marshes in autumn in the years 1994–2008.

3.2. Autumn staging

As in all previous years, the autumn observations date from the period 16 August – 10 September (Aarvak & Øien 2004). This yields a range of 26 days of autumn staging. However, in most years continuous observation effort has been limited to the period from 20 August to the first days of September, and we assume that the actual staging period could start earlier and in some years it might end later than observed.

As compared to the spring staging period when the geese spend all their time at the Valdak Marshes, the LWfG utilise the marshes much less during autumn, and then mostly during late evenings, nights and early mornings. The most common pattern is that they only rarely stay at the marshes during daytime, which is normally spent on the adjacent small islands in the innermost part of the Porsangen Fjord. However, this pattern is varying between years.

In 2004, the LWfG typically spent only some few hours every day (usually in early morning) at the Valdak Marshes. The rest of the time they were in the islets of Porsangen Fjord, but the

Tomas Aarvak is mounting a lightweight satellite transmitter on an adult Lesser White-fronted Goose. © Morten Ekker, May 2006

Table 4. Distribution of brood sizes (post-moult) at the staging area at Valdak Marshes (VM) in 1994–2008, Skjåholmen Island (SI) in 1995–2003 and in the breeding grounds in 1994 and 1995. No data exists from the breeding areas in Norway in 1996–2008 (see also Table 3).

Area	Brood size						Mean brood size	n	Year
	1	2	3	4	5	6			
Breeding area	3		1	1			2.0	5	1994
Staging area VM	1	2	4				*2.4	7	1994
Breeding area	1	1	3	1	2		3.3	8	1995
Staging area SI		2					2.0	2	1995
Staging area VM		4	3	2	6	2	3.9	17	1995
Staging area SI					1		5.0	1	1996
Staging area VM	1	3	4	1			2.6	9	1996
Staging area SI		2	1				2.3	3	1997
Staging area VM		2	1		5		4.0	8	1997
Staging area SI		3					2.0	3	1998
Staging area VM	2	4	2	1	1	1	2.8	11	1998
Staging area SI		2					2.0	1	1999
Staging area VM	1	1	2	2			2.8	6	1999
Staging area VM		1					(2.0)	1	2000
Staging area VM	3		3	5		1	3.2	12	2001
Staging area VM		5	1	4	1		3.1	11	2002
Staging area VM		1	2	1	3		3.9	7	2003
Staging area VM	2	1		2			2.4	5	2004
Staging area VM	1		2	1	1		3.2	5	2005
Staging area VM	4	1	2	1	1		2.6	9	2006
Staging area VM	1	1	2	1	4		3.7	9	2007
Staging area VM			1	1		1	4.3	3	2008

* One flock of 32 individuals (16 goslings) has been omitted, because the distribution of broods is unknown (see also Table 5).

exact locations where unknown. Only 27 LWfG was registered in 2004, of which only 12 were juveniles.

In 2005, the LWfG only spent 6 days out of 16 at the Valdak Marshes with no exact daily rhythm. Most time was spent in the islets of Porsangen Fjord, but the exact locations where unknown. The period 22 August – 30 August they spent on the islets in the innermost part of the Porsangen Fjord. On 28 August, we surveyed the Porsangen Fjord, and localized the flock on the island Stuorra Saivva. On 21 August, the flock consisted of 9 adults with the 5 clutches of 16 juveniles, altogether 25 individuals.

In 2006, the LWfG were observed only one day (21 August) at the Valdak Marshes. The rest of the time was spent in the inner part of the Porsangen Fjord (on the islets and at Oldereidet), but the exact locations were unknown. On 30 August, we surveyed the inner part of the Porsangen Fjord, and localized the LWfG flock on the cape Oldereidnesset. The flock then consisted of 23–25 individuals. On 31 August, one pair without goslings was observed at the Valdak marshes.

In 2007, the LWfG were observed some hours every day at the Valdak Marshes with no defined daily rhythm. Most time was spent in Cape Oldereidnesset. The flock was observed for short periods at the Valdak Marshes approximately half of the days in the monitoring period. On several occasions we surveyed the Porsangen Fjord together with State Nature Inspectorate (SNO), and localized the LWfG flock on the cape Oldereidnesset on all these surveys.

In 2008, the LWfG were observed at Valdak only on four occasions during the staging period. Most time was spent in Cape Oldereidnesset, but some time was also spent on the innermost

Table 5. Observed colour ringed Lesser White-fronted Geese at the Valdak Marshes in 2004–2008. Abbreviations: S = spring, A = autumn, M = male, F = female

Colour code	Sex	Season	Year obs.	Ringed date	Name	Comments
Black-Red (left) - old	M	S	2004	11.05.2002		Overlap of codes, see below
Black-Red (left) - new	M	S	2005	28.05.2004		
Black-Red (left) - new	M	S	2006			
Black-Red (left) - new	M	A	2007			
Black (left)	M	A	2008			This is Black-Red (left) - new - that has lost the red ring
Green-Black (right)	F	S	2004	25.05.2000		
Orange-Red (left)	M	S+A	2007	28.05.2004	Finn	Carrying satellite transmitter May 2006-April 2007
Orange-Red (left)	M	S+A	2008			
Orange-Yellow (right)	M	S	2005	28.05.2004		
Orange-Yellow (right)	M	S	2006			
Red-Orange (right)	M	A	2006	23.05.2006	Mánnu	
Red-Orange (right)	M	S+A	2007			
Red-White (left)	F	S + A	2005	27.05.2002		
Red-White (left)	F	S	2006		Nieida	Re-captured and provided satellite transmitter May-December 2006
Red-White (left)	F	S+A	2007			
Red-White (left)	F	S	2008			
Red-White (right)	F	A	2006	22.05.2006	Máddu	
Red-White (right)	F	S+A	2007			
Red-White (right)	F	S+A	2008			
White-Green (left)	M	S	2004	27.05.2002		
White-Green (left)	M	S	2005			
Yellow-Red (right)	F	S	2004	25.05.2000		
Yellow-Red (right)	F	S + A	2005			
Yellow (right)	F	S	2006			This is Yellow-Red (right) that has lost the red ring
Yellow (right)	F	S+A	2007			
Yellow (right)	F	S+A	2008			

islets. On several occasions we surveyed the Porsangen Fjord together with State Nature Inspectorate (SNO) or went by foot from Laksely, and localized the LWfG flock near or at the cape Oldereidnesset on all these surveys.

All data from the autumn monitoring are given in tables 3 and 4.

3.3 Breeding success

Breeding success is monitored during the post breeding period at the Valdak Marshes, which represent the first staging area before the onset of autumn migration. Mean brood size (weighted by year) observed at the Valdak Marshes in the years 1994 –2008 is 3.1 (sd=0.7, n=15), with a mean for the report period (2004–2008) of 3.2 goslings per pair with an average of 6.2 pairs per year bringing goslings (range3–9) (Table 3 and 4, Figure 1).

No young LWfG were seen in the Varangerfjord area in the years 2004–2008 (see Sulkava et al. 2009) (Table 4).

Estimates on brood size can be derived in different ways. The probably best estimate is based on number of juveniles compared to the number of pairs observed (potential breeders) in the pre-breeding period (Mean brood3 – cf. Aarvak et al. 1997), which yields an estimated average of 1.52 for the report years 2004–2008 (goslings per potential breeding pair). For all years (1994–2008) the mean is 1.48. Based on the number of juveniles produced during summer in relation to all birds present at Valdak the previous spring we get a ratio of 22.6%, 27.1%, 34.8, 52.4 and 27.7% juveniles in the autumn/winter population for the years 2004–2008. The mean for all years is 33.6% (SD=13.1, n=15).

3.4. Colour ring observations

Most LWfG ringed at the Valdak Marshes are being resighted in subsequent years. Altogether 47 LWfG has been ringed at the Valdak Marshes and three in the core breeding area, a total of 50 birds during the years 1995–2008. A larger amount of these have been resighted either at the Valdak Marshes or abroad, such as in staging and wintering areas in Hungary or Greece. In the years 2004–2008 altogether nine different individuals have been resighted at the Valdak Marshes. The distribution of these resightings can be viewed in Table 5.

3.5. Population trend

We have earlier shown that the spring numbers of LWfG utilising the Valdak Marshes decreased on average by 5% annually in the period 1992–1997, as estimated by Monte Carlo simulation (Øien et al. 1996, Aarvak et al. 1997). A Monte Carlo simulation based on total numbers during the spring staging period for the years 1993–2008 shows an average negative trend of -4.60% annually for this population (p=0.010, n=16), with a total decrease of 50.7% (see also Figure 1) in this 15 year period. Within the report period (2004–2008) the decrease was on average 7% annually, but this is not statistically significant. Since 2000, the population has decreased with 5.4% annually, totally

Overview of the Valdak Marshes in mid-May. © Morten Ekker, 15 May 2006

36.1% (p=0.026, n=9). However, the majority of the decrease took place between 2000 and 2001 with a decrease of 35%, but also the decrease of 30% between 2006 and 2007 is of significance. The large drop in population size between 2000 and 2001 has been attributed to the very bad breeding season where only two goslings were produced. Because of that, the majority of the population probably migrated on the eastern migration route and thereby increasing also the mortality rate for the adults (see Øien et al. 2009 for a more thorough discussion on this).

4. Discussion

The number of juveniles registered during the autumns 2004–2008 was fluctuating, with good gosling production in 2006 and 2007, and relatively low production in the other years. The survival of the goslings in 2004–2008 seems to have been good. However, for the overall population development, gosling production does not have as significant impact as do adult mortality (Lampila 2001). As discussed by Aarvak & Øien (1999), it is of vital importance that conservation measures are undertaken to reduce the adult mortality rate in the Fennoscandian LWfG population. Minor changes would most certainly have a considerable impact on the population trend. The population size is at present at such a low level, that it cannot stand several consecutive years of low reproduction and high adult mortality. It is therefore important to identify all factors that may limit reproduction. Above all, it is of crucial importance that all necessary protection measures are carried out quickly to secure the core breeding area in Norway from disturbance and habitat destruction. This is especially important since it is the last regularly used breeding area in Fennoscandia, and it may possess up to 80% of the breeding birds that utilise Valdak as staging ground. Based on new knowledge on the influence of breeding success on the choice of autumn migration route, securing gosling production in the breeding area will also increase adult survival among Fennoscandian LWfG (see Øien et al. 2009).

An increased focus on safeguarding of the staging and wintering grounds on the European migration route through a common European initiative, could thus be crucial for the survival of the Fennoscandian LWfG population.

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Monitoring of the late spring staging sites and breeding areas of Lesser White-fronted Goose in Finnish and Norwegian Lapland in 2004–2008

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Adult Lesser White-fronted Goose at the Tana River mouth, Finnmark, Norway. © Jari Peltomäki, June 2008

1. Introduction

The Fennoscandian Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) population has traditionally bred widely in sub-arctic tundra and forest-tundra zones in northern Finland, Sweden and Norway. The breeding population in the Nordic countries was estimated at ca 10,000 individuals in the early twentieth century (Norderhaug & Norderhaug 1984). In Finland, the municipalities of Enontekiö, Utsjoki and Inari were the main breeding areas, but scattered breeding also occurred in mountain areas of the more southern municipalities of Sodankylä and Kittilä, that are situated in the boreal zone. The decrease of the population started from the early 1900´s and has continued until recent days. During the 1980´s and the 1990´s there were only a couple of breeding records annually in the north-eastern parts Enontekiö and Utsjoki municipalities (Øien et al. 2001). Since a confirmed breeding in 1995 there is no confirmed breeding records in Finland and the latest published estimate for the Finnish breeding population is 0–5 breeding pairs (Väisänen & Lehtiniemi 2004). The dramatic decline is considered to be caused most of all by high hunting pressure and habitat loss (e.g. Madsen 1996; UNEP/WCMC 2003; Fox 2005, Jones et al. 2008). In Finland, LWfG are still seen close to potential breeding areas annually, but since the previous Finnish LWfG LIFE-Nature project 1997–2000 (Markkola 2001) there have been only few organised surveys in order to find breeding birds in the vast potential breeding grounds in Finnish Lapland.

The migration routes between Nordic breeding grounds and wintering areas in Greece are still only partially known (see Øien et al. 2009). Non-breeding birds start to leave the breeding grounds already in the end of June and fly east to the Kanin Peninsula, Kolgujev Island or Taimyr Peninsula in northern Russia for moulting (Aarvak & Øien 2003, Øien et al. 2009). Successful breeders migrate later, also first towards east to the Kanin Peninsula (see Tolvanen et al. 2009). The Varangerfjord area was a regular autumn staging area of LWfG breeding in eastern parts of Finnmark and/or northernmost Finland until the end of the 1990's (Tolvanen et al. 1998), and there is an observation of staging LWfG in the area still in 2003 (Kaartinen & Pynnönen 2004). On the spring migration LWfG are staging in low numbers for short periods on the marshes along the rivers Tana in Utsjoki and Könkämäeno – Lätäseno in Enontekiö in northern Finnish Lapland. These are the last spring staging sites before the LWfG are heading towards the breeding areas in the mountains, but there is also observations of LWfG that have been seen in the Tana River valley and that later on during the same spring has been observed at the Valdak Marshes.

Table 1. Surveys and observations of Lesser White-fronted Goose in Finnish and Norwegian Lapland in 2004–2008.

Year	Season, area	Monitoring started	Monitoring ended	First observation	Last observation	Total number	Age distribution
2004	Spring, Tana River Valley	11 May	21 May			–	
2004	Autumn, Varangerfjord	19 Aug	2 Sep			–	
2004	Summer, Norwegian core breeding area	not surveyed				–	
2005	Spring, Tana River Valley	13 May	30 May	29 May	29 May	2	2 ad
2005	Summer, Finnish Lapland	20 Jul	31 Jul			–	
2005	Summer, Norwegian core breeding area	not surveyed				–	
2005	Autumn, Varangerfjord	12 Aug	29 Aug			–	
2006	Spring, Tana River Valley	22 May	10 Jun	15 May	16 May	1	1 subad
2006	Summer, Finnish Lapland	24 Jul	30 Jul			–	
2006	Summer, Norwegian core breeding area	30 May	7 June			ca 21–23	10–11 ad pairs + 1 subad
2006	Autumn, Varangerfjord	15 Aug	30 Aug			–	
2007	Spring, Enontekiö	20 May	21 May			–	
2007	Spring, Tana River valley	16 May	5 Jun	16 May	16 May	3	2 ad + 1 subad in one flock
2007	Summer, Finnish Lapland	9 Jun	6 Jul			–	
2007	Summer, Norwegian core breeding area	15 Jun	2 July			20–28	10–14 ad pairs
2007	Autumn, Varangerfjord	22 Aug	3 Sep			–	
2008	Spring, Enontekiö	16 May	19 May			–	
2008	Spring, Tana River valley	6 May	20 May	16 May	16 May	4	2 ad pairs
2008	Summer, Finnish Lapland	11 Jun	6 Jul			–	
2008	Summer, Norwegian core breeding area	2 Jun	12 Jun			24–32	12–16 ad pairs
2008	Autumn, Varangerfjord	18 Aug	30 Aug			–	

2. Material and methods

During the LWfG EU Life-Nature project (2005–2009) the Lapland Natural Heritage Services of Metsähallitus implemented surveys of spring staging as well as breeding LWfG in Finnish and Norwegian Lapland with help of volunteers organised by WWF-Finland. The surveys were directed to the most promising areas based on earlier data, as described above. Monitoring of the late spring staging sites was carried out in the Tana River valley (Utsjoki) and in the Könkämäeno - Lätäseno River valley (Enontekiö) in late May for ca two weeks annually. During the breeding season, a team of one to three persons surveyed annually (2005–2008) at least one potential breeding area in Finnish Lapland, based on available recent information and reported recent sightings. In addition, WWF-Finland and Metsähallitus organised, in cooperation with the Norwegian Ornithological Society, field surveys of the Norwegian core breeding areas of the LWfG. This area was re-located as a result of the satellite tracking conducted by the LWfG Life project (see Øien et al. 2009) in 2006, and the breeding area surveys have been arranged annually since then. In late August, a two-week survey was arranged annually (2005–2008) in the Varangerfjord area (see e.g. Tolvanen et al. 1998).

3. Results

3.1. Monitoring of the late spring staging sites

LWfG were observed at the late spring staging sites in Finnish Lapland annually: two adult birds in flight in the Tana River valley on 29 May 2005, one sub-adult bird in the Tana River valley on 15–16 May 2006 (15 May on the Sirbma fields and the same individual on 16 May on Teppanansaari, Nuvvus, Uts-

One of the late spring staging sites that the Lesser White-fronted Geese still use in northernmost Finnish Lapland is the Teppanansaari islet in the Tana River on the border between Finland and Norway. © Petteri Polojärvi, May 2006

joki), two adults together with one young bird in the Sirbma fields, Tana River valley on 16 May 2007, and two adult pairs in the Sirbma fields Tana River valley on 16 May 2008 (Table 1). In addition, several unconfirmed LWfG observations in Finish Lapland were received in the LWfG Life project period: 12 LWfG were reported in Karigasniemi (Utsjoki) in May 2005, four birds from Enontekiö in May 2006, and three different observations reported by non-specialists in 2007: two individuals in Utsjoki on 6 May, two individuals in Kolari on 21 May, and 8 individuals in Kittilä on 28 May.

3.2. Surveys of the breeding areas

3.2.1. Finland

In the annual surveys of the potential breeding areas in Finland, covering also the former core breeding area used by the LWfG at least until 1995, no LWfG were observed. However, in 2005 a survey trip was directed to the former Finnish core breeding area based on an unconfirmed report/rumour of a LWfG brood in the area in recent years. This report could not be confirmed by further details to be reliable. Also other rumours of breeding LWfG pairs/LWfG broods were received during the project period and field surveys were directed accordingly, but no signs of LWfG were found. In one case (in the Kaldoaivi wilderness area in Finland) such a report could be confirmed to a brood of Bean Goose (Anser fabalis).

3.2.2. Norway

The surveys of the Norwegian core breeding area covered all the sites located by the satellite transmitters in the summer 2006, and the LWfG pairs found were breeding within an area of ca 20 km x 30 km (i.e. ca 600 km2). Within this area there appears to be three rather separate loose congregations of breeding pairs. The exact location of the breeding area is not published for conservation reasons. The main emphasis in the surveys was on locating the most important sites for the LWfG, and on assessing the potential threats for LWfG in the area, especially the disturbance from human activities and reindeer herding, and the population levels of possible predators such as the Red Fox (Vulpes vulpes). Extreme caution was exercised in the surveys not to disturb the LWfG and not to approach the LWfG and their nests too close. The main survey method was observing by telescope at long distance from suitable elevated points with good view.

In the surveys, 10–16 breeding pairs were found annually in 2006–2008 (Table 1). In 2006, 10-11 pairs were observed (4 pairs in the southern part + 3 in the middle part + 3–4 in the northern part of the survey area), 10–14 pairs (2–3 pairs + 4–5 pairs + 4–6 pairs) in 2007, and 12–16 pairs (5–6 pairs + 2–3 pairs + 5-7 pairs) in 2008.

There is a lake in the southern part of the area, and by the lake there is a number of fishing huts. Traffic to and from the lake by all-terrain vehicles was observed to cause disturbance for the LWfG breeding in the southern part of the area, as the track to the lake shore is crossing one of the three core breeding areas of LWfG within the survey area. According to the observations, the disturbance increased in 2007 (as compared to the situation in 2006), because use of 4-wheel-drive cars was permitted. To reduce the disturbance, it would be important not to allow motorized traffic in the area before LWfG broods are fledged. In the 2008 survey, when there was still quite a lot of snow cover left, also traffic by snow scooters was observed to cause disturbance for the LWfG in the southern part of the area.

4. Discussion

According to the results of the surveys it seems that the Tana River Valley is a permanent late spring staging area of the Fennoscandian LWfG population, but the numbers of LWfG visiting these sites (mainly the Sirbma fields on the Norwegian side, ca 20 km north-east of the Utsjoki village and to lesser extent the Teppanansaari island on the Finnish side, ca 45 km north-east of the Karigasniemi village) are very low. Both of these sites are also known as regular spring staging sites of other goose species. The breeding areas of the LWfG visiting these sites are not known, but based on the late spring observation dates it is assumed that they are breeding in the surrounding mountain areas either on the Norwegian or Finnish side. In 1999 there was, however, one observation of a colour ringed adult LWfG that was first seen (14–17 May) staging at the Sirbma fields in the Tana River valley, and later the same spring (18–31 May) at the Valdak Marshes, Porsangen Fjord, Finnmark, Norway. Sirbma is situated ca 100 km east of the Valdak Marshes, and Teppanansaari is situated ca 65 km south-east of the Valdak Marshes.

The surveys of the potential breeding areas on the Finnish side did not result in observations of LWfG. On the other hand the potential breeding areas in the mountain areas are vast and extremely difficult cover by field surveys. Based on the annual observations in late spring close to potential/historical Finnish breeding areas, and also on the regularly received but unconfirmed sightings from the breeding areas, we consider the Finnish population estimate of 0–5 breeding pairs (Väisänen & Lehtiniemi 2004) still valid.

Our knowledge of the status and distribution in the Norwegian core breeding area has improved significantly during the LWfG Life project, thanks to the results of the satellite tracking (2006) and the subsequent annual field surveys (2006–2008). For conservation reasons no site-related details or proposals of the management of this highly valuable area are given here. However, the LWfG Life project has provided the Norwegian nature management authorities with all the data on the LWfG occurrences in the area, and stressed that the off-road traffic and other human disturbance in the area may be a serious threat for the critically endangered Fennoscandian LWfG population. This relates also to the new findings on the importance of a successful breeding season for the whole population (see Øien et al. 2009) for further details. Also, annual and effective control of the Red Fox (*Vulpes vulpes*) population in this area is of vital importance for the LWfG.

No observations of LWfG were made in the annual autumn surveys in the traditional autumn staging area in the Varangerfjord area in 2004–2008, and it can be concluded that the part of the population that used to stage in this area (especially the Skjåholmen island) until the end of the 1990's has most likely gone extinct.

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Lesser White-fronted Goose survey on Kanin Peninsula, Russia, in September 2008

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1. Introduction

In autumn 1995, a previously unknown autumn staging site of Fennoscandian Lesser White-fronted Geese (*Anser erythropus*, hereafter LWfG) was located on the White Sea coast of the Kanin Peninsula, north-western Russia (Figure 1). Five individuals tagged with satellite transmitters on Finnish and Norwegian breeding grounds spent several weeks in September in the area around the mouth of the Mesna River, ca 15 km north of the Shoina settlement (see Lorentsen et al. 1998). Earlier it was assumed – based on little if any real evidence – that the Fennoscandian LWfG would migrate in autumn directly towards south or south-east from the breeding grounds. A migration leg of some 800 km to east in the beginning of the autumn migration from the Porsangen Fjord and Varangerfjord, Finnmark, Norway was therefore unexpected. Vinogradov (1995) reported LWfG on Kanin Peninsula also on spring migration, but so late in June that this could have been non-breeders from more western areas migrating for moulting sites further east (Aarvak & Øien 2003). No breeding areas for the LWfG are known on the Kanin Peninsula (Jones et al. 2008), and this supports the conception that the autumn staging LWfG on Kanin Peninsula are of Fennoscandian origin. A colony of Barnacle Geese (*Branta leucopsis*) is breeding close to the survey area.

In autumn 1996, the Finnish LWfG conservation project organized a field survey of this area (Luukkonen & Tolvanen 1996, Tolvanen 1998). The survey covered the period 26 August – 12 September. During the survey, some 80 LWfG were recorded, including two individuals colour ringed in Finland in 1995. It was concluded, that practically the whole Fennoscandian population use this area as a staging site in September. Satellite tracking studies have shown that the autumn migration route of the Fennoscandian LWfG divides in two branches when they leave the Kanin Peninsula (see Lorentsen et al. 1998). A part

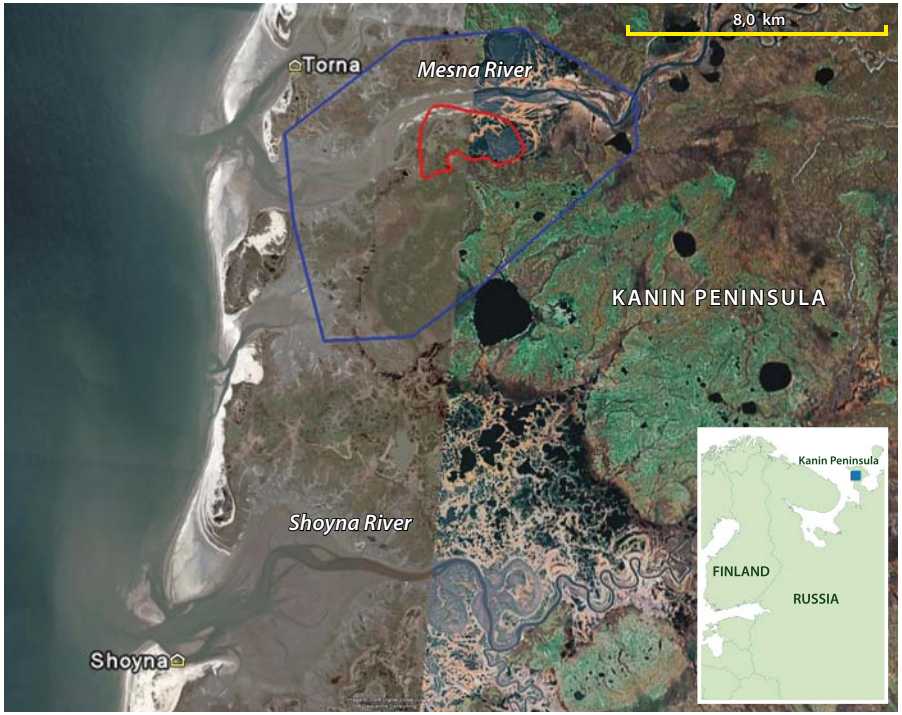

Figure 1. Aeriel view of the study area. The area covered by the survey of September 2008 is outlined by blue, and the core area used by the Lesser White-fronted Geese in autumn 1996 is outlined by red. The area outlined by blue also represents the proposed area of hunting ban and restricted entrance in the period 20 August – 20 September (see Discussion). © Satellite image, Google Earth 2009

Table 1. Daily counts of geese and swans during the survey, 5–13 September 2008.

		September								
Species	Scientific name	5	6	7	8	9	10	11	12	13
Tunda Bean Goose	Anser fabalis rossicus	250	700	500	450	560	400	300	300	400
White-fronted Goose	Anser albifrons	80	20	150	50	250	200	40	100	50
Lesser White-fronted Goose	Anser erythropus	1	–	–	–	2	–	–	–	–
Bar-headed Goose	Anser indicus	–	–	–	1	–	–	–	1	–
Unindentified grey geese	Anser sp.	–	–	–	–	–	–	–	300	150
Barnacale Goose, resident	Branta leucopsis	1000	2300	2000	4000	4000	4000	3000	4000	4000
Barnacale Goose, migrating	Branta leucopsis	–	–	–	400	1580	–	–	–	–
Brent Goose	Branta bernicla	–	–	–	–	–	–	2	–	–
Canada Goose	Branta canadensis	1	–	–	–	–	–	–	–	–
Unidentified geese, resident	Anser/Branta	–	1000	2500	1000	1000	–	–	1500	500
Unidentified geese, migrating	Anser/Branta	–	–	–	–	630	–	–	–	–
Geese, in total	**Anser/Branta**	**1330**	**4020**	**5150**	**5900**	**8020**	**4600**	**3340**	**6200**	**5100**
Whooper Swan	Cygnus cygnus	210	250	270	290	360	300	250	350	300
Bewick's Swan	Cygnus columbianus bewickii	–	–	–	–	–	–	–	–	1

of the population (supposedly more than half, and supposedly most of the families with juveniles) take the European autumn migration route towards south-west to Hortobágy, Hungary and further south to Northern Greece for winter. The other part of the population take a south-eastern route from Kanin Peninsula crossing the Ural mountains to the Ob River valley and further south to northern Kazakhstan, and use here the same staging areas as the Russian breeding population. Based on the satellite tracking of three Norwegian LWfG in 2006–2007 (Øien et al. 2009) it seems that the Fennoscandian LWfG divide from the Russian birds in Kazakhstan, turn west and finally end up at the wintering sites in Northern Greece where also the European autumn migration is ending.

2. Methods

In 2008, a new survey on the Kanin Peninsula was carried out by the Directorate of Protected Areas of the Nenets Autonomous Region, Russia; NOF-BirdLife Norway; Institute of Ecological Problems of the North of the Ural Branch of the Russian Academy of Science, Archangelsk, Russia; Metsähallitus, Finland; and WWF-Finland. The survey covered the period 4–14 September, 2008. The area covered by the survey is shown in Figure 1. The survey team flew to the area by helicopter from Archangelsk via Mezen, and a base camp was established near a hill on the southern edge of the coastal meadows (so-called "laida" vegetation) on the southern side of the Mesna River (see Figure 1). This proved to be the best observation point in the 1996 survey, since the LWfG gathered daily to drink in the freshwater ponds on the laida meadow next to the observation point.

The main survey method was continuous observation by binoculars and telescopes from the base camp, covering the whole day light period. The daily observation started ca one hour before the sunrise and ended ca half an hour after the sunset. This method proved to be the most effective way to cover the study area. The surrounding areas were also surveyed by foot and by boat, but because of the flat and very difficult terrain and wet and muddy conditions, it was not possible to cover considerably larger areas than what was possible to cover by telescope from the base camp. The early morning flight of the geese from the roosting sites on the coastal meadows around the Mesna River to the feeding sites on the surrounding tundra and palsa mires was counted daily. Major part of the morning flight took place at dawn when it was too dark to identify the geese by species.

In 2008, the circumstances for staging geese – and for observing them – were considerably different from the preceding survey of the same area 12 years earlier. At the time of arrival of the survey team on 4 September 2008, the whole coastal

Counting the morning flight of geese from the coastal meadows to the feeding areas on the surrounding tundra. © Petteri Tolvanen, September 2008

meadow south of the Mesna River was flooded by sea water. In 1996, the same area was a mosaic of extensive low growth "laida" meadows, brackish water ponds (closer to the river), fresh water ponds (towards the southern edge of the meadow) and tidal channels. The flooding of the meadow in 2008 was probably due to a combination of spring tide and westerly storm some days before the arrival of the survey. This assumption was supported by the fact that water level on the meadow gradually decreased during the survey period, and fresh green coastal meadow vegetation appeared from under water. Because of the lack of freshwater ponds on the outer parts of the meadow, the grey geese (*Anser spp.*) did not gather to drink there, but most of them stayed the whole daylight period feeding on the tundra and palsa mires, too far away to be observed. This behaviour, completely different from the situation in 1996, made it much more difficult to observe the geese.

The weather during the survey period was dominated by low pressures, westerly winds and overcast with daily maximum temperatures around 8–12 degrees Celcius and night minimum

Aerial view of the "laida" meadows on the southern side of the Mesna river, facing west. The permanent observation point of the survey was situated on the triangular cape on the left. The Mesna river is visible as a curved water course on the background. The picture is taken on 14 September, when patches of the coastal meadow vegetation had started to emerge after the flood. © Petteri Tolvanen, September 2008

Table 2. Maximum daily counts of staging geese and swans in the area in the 1996 and 2008 surveys.

		1996 26 Aug – 12 Sep	2008 4 – 14 Sep
Tundra Bean Goose	Anser fabalis rossicus	1500	700
White-fronted Goose	Anser albifrons	200	250
Lesser White-fronted Goose	Anser erythropus	80	2
Bar-headed Goose	Anser indicus	0	1
Greylag Goose	Anser anser	2	0
Barnacle Goose	Branta leucopsis	30000	4000
Brent Goose	Branta bernicla	20	2
Canada Goose	Branta canadensis	0	1
Whooper Swan	Cygnus cygnus	500	360
Bewick's Swan	Cygnus columbianus bewickii	1	1

temperatures well above 0 degrees C. In many days it was rainy and the visibility was limited due to mist. During 8–11 September north-easterly winds prevailed, and there was slight night frost in the night 7–8 September.

In the end of the survey, a visit was made in the Shoina village, and a meeting with the local residents was held there in order to inform the local goose hunters about the conservation and identification of the LWfG.

3. Results

Seven species of geese and two species of swans were observed (Table 1). LWfG were observed only in two occasions: one adult bird arriving from the east to roost by the Mesna River in the evening of 5 September, and two adults in flight towards west over the coastal meadow close to the base camp in the afternoon of 9 September.

The numbers of other grey geese, i.e. Tundra Bean Geese (*Anser fabalis rossicus*) and White-fronted Geese (*A. albifrons*), were relatively low and rather stable during the whole survey period, while the numbers of the staging Barnacle Geese increased from ca 1000 individuals in the beginning of the survey to ca 4000 individuals towards the end of the period. Westwards migration of some 2600 Barnacle Geese was observed on 8–9 September. Two Brent Geese (*Branta bernicla*), one Canada Goose (*B. canadensis*) and one Bar-headed Goose (*Anser indicus*) were recorded. The number of Whooper Swans (*Cygnus cygnus*) increased from ca 200 to some 350 during the survey period. Only one Bewick's Swan (*C. columbianus bewickii*) was recorded.

The daily pattern of the movements of the geese was regular. In the morning, starting ca 45 minutes before the sunrise, and ending ca one hour after the sunrise, practically all grey geese and part of the Barnacle Geese flew to feed on the tundra and palsa mires. During the afternoon, the first flocks of geese started gradually to turn back to the coastal meadows and ponds, but the main part of the geese turned back to the roosting site only in the end of the day. The evening flight back to the roost continued after dusk. Roughly half the amount of the Barnacle Geese, contrary to the grey geese, stayed the whole day on the coastal meadows close to the roosting site, also feeding there.

Because of the difficult observation conditions, it was possible to collect only anecdotal data on the age ratio of the geese. In one random sample of 91 Barnacle Geese, 2.2 % were juveniles and 97.8 % adults. Mean abdominal score for a sample of 28 of these adults was 3.4 (scale 1–6, as used in the LWfG studies).

Human activity and disturbance for the geese and other birds in the area during the survey was very low. No people were seen during the survey, and only a few very remote gunshots (supposedly goose hunters) were heard in some evenings. Only very few cartridge cases were found. There is a couple of fishing huts along the Mesna River, and these huts are regularly used by the locals.

Of mammal predators only two red foxes (*Vulpes vulpes*) and one wolverine (*Gulo gulo*) were seen. More surprising was the total absence of arctic foxes (*Alopex lagopus*). A complete annotated checklist of the bird species observed in the area in the 1996 and 2008 surveys is available in Appendix.

The LWfG staging grounds in the Inner Porsangen Fjord, Norway, were surveyed simultaneously with this survey to make sure that the LWfG had left from there, and no LWfG were recorded in Norway during the survey period.

4. Discussion

The main finding of the survey was that the numbers of LWfG were dramatically lower than expected. A consequent conclusion is that in flooded conditions like in autumn 2008, the Fennoscandian LWfG flock is apparently forced to choose another unknown staging site, instead of this traditional site. The observation effort (continuous observation for ten days in the peak migration time during the whole daylight period by four experienced birdwatchers, covering daily the whole supposed core area for LWfG) was comprehensive enough to conclude, that larger numbers of LWfG were not present in the area during the survey. It cannot be excluded that the Fennoscandian flock may have passed by and scouted the area (e.g. during night time) during the survey without being observed, and discovered that due to the flood on the meadow the site was not suitable for them this year.

This has also direct implications for the LWfG conservation: now we are "one step backwards" knowing that we don't have full control on the September staging sites of the Fennoscandian LWfG. In years like 2008 the LWfG may use another staging site where they may face threats like hunting, and thus there is need for more satellite tracking in order to locate the unknown staging areas.

However we still assume, based on earlier records, that the Fennoscandian LWfG tend to use the Mesna River site as the next autumn staging site after the Inner Porsangen Fjord in Norway. In other parts of the flyways, the LWfG are very clearly confined to certain traditional staging and wintering sites, as long as the habitat is suitable.

The numbers of staging geese were considerably lower than in autumn 1996 (see Table 2). Especially, the numbers of Barnacle Geese and LWfG were only a minor part of the numbers counted 12 years earlier. We assume this was mainly due to the flooding of the coastal meadows, and – for the Barnacle Goose – also partly because of the warm early autumn in 2008: the major part of the birds breeding on Russian Arctic coasts east of Kanin Peninsula may still have been staging in the east, closer to the main breeding areas, and the major part of the Barnacles present in the survey area probably belong to the local breeding population. Obviously the late spring and cold summer in 2008 influenced the timing of breeding and the breeding success of arctic geese.

Although the area seems to be safe for autumn staging geese – i.e. very low if any hunting pressure and other human activity observed during this survey and also in the 1996 survey (Tolvanen 1998) –, the status of the Shoininsky Reserve established in the area in 1997 (Prokosch 1997) is unclear. The Shoininsky hunting refuge (zakaznik) was officially established (on paper) in 1997, but the exact borders of the reserve have still not been defined. It seems that there are no effective limitations for hunting in the reserve. In practice, there is no hunting inspection in the area, but most of the goose hunting by the local population takes place in vicinity of the Shoina village. The administration of the Shoininsky Reserve is nowadays situated in Archangelsk, and a new management plan is currently being developed. Our proposal is to ban hunting of geese and other waterfowl and also to restrict the entrance to the Shoininsky Reserve in the period 20 August – 20 September in the area defined in Figure 1. The proposal is based on the combined 1996 and 2008 survey data. Another practical conservation proposal for the LWfG in this area – that we brought up also in the meeting with the local community in Shoina in the end of the expedition – is to direct the goose hunting to the Bean Goose, because separating LWfG and White-fronted Goose is practically not possible in a hunting situation.

5. Acknowledgements

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Conservation measures to protect Lesser White-fronted Geese in the Hortobágy in 2004–2008

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1. Introduction

This article presents the main conservation measures conducted within the framework of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) LIFE project in the Hortobágy region in eastern Hungary. The practical conservation measures had been previously tested before the project through various activities funded by different sources. The experience gained during these pilot activities was used to design and implement the tasks carried out during the LIFE project under the supervision of János Tar as project manager and with the help of Hortobágy National Park Directorate (HNPD), and with the assistance of project coordinators Szabolcs Lengyel and Zoltán Ecsedi.

The primary aims of the conservation measures were to provide an optimal staging site for LWfG and to increase the number of individuals and the duration of time LWfG spend in safe, hunting-free areas of Hortobágy National Park. The success or failure of conservation measures, however, can be evaluated only if their effects are followed up by regular monitoring activities (Pullin & Knight 2003, Sutherland et al. 2004). Based on this principle, we have studied both the effect of the habitat management actions described above and the occurrences of LWfG in regular monitoring (see Tar et al. 2009).

The impressive, ancient Hungarian Grey Cattle perfectly utilizes the various vegetation types of the alkali steppe and that is why it can be well applied in grazing with nature conservation purposes. © János Tar

2. Conservation measures: design and implementation

As a first step in the design of the project, we assessed the most important threats to LWfG during their staging in the Hortobágy area using experience gained in previous conservation activities. In line with the previous International Action Plan for the species (Madsen 1996), we explored three distinct threats. First and most important was the mortality of LWfG due to hunting and poaching. Second was the loss and deterioration of habitats used by the species for roosting and feeding during staging. Finally, the third threat was the disturbance arising from various human activities, e.g. agriculture, hunting and eco-tourism. To address these threats, we explored solutions that can be maintained in the long-term. We defined our general goal as to keep LWfG in protected areas of Hortobágy National Park, where neither hunting nor other disturbances occur. As a first step, we studied in detail the traditional staging sites using historical and recent data from the period 1970–2006. We designated the project area as 10,000 ha within Hortobágy National Park. The entire National Park is a Special Protection Area designated under the Birds Directive of the European Union (Natura 2000 code: HUHN10002), an Important Bird Area designated by BirdLife International, a UNESCO World Heritage site and most of the project area belongs under the Ramsar Convention for the protection of wetlands.

The project area is located in the northern parts of Hortobágy National Park and encompasses the most important roosting sites of LWfG on Hortobágy Fishponds and feeding and resting sites (marshes, meadows, grasslands and croplands) within a range of 6 km of the Fishponds (Figure 1.). Most (ca. 90%) of the project area is owned by the state and managed by HNPD, and is managed either by grazing and mowing by farmers leasing the areas long-term or is used for extensive fishery. The project area consists of habitats preferred by other species of conservation importance (e.g. Crane *Grus grus*), therefore, the project also contributes largely to the conservation of bird species other than LWfG. Habitat management actions (see below) were concentrated in the core project area. In areas that are less frequently used by LWfG (e.g. Virágoskúti, Elepi, Bivalyhalmi fishponds, Egyek-Pusztakócs marshes, Tisza Lake, Kis-Hortobágy) only monitoring and awareness-raising activities were planned.

After designating the project area, we summarised available knowledge on the ecological status of the project area and identified the most important conservation measures and management tasks that provide for the requirements of LWfG over the long-term and which ensures that LWfG less frequently leave the project area during their 6–8-week long autumn and 4-week-long spring staging periods in Hortobágy. The ideal mosaic of habitats for LWfG was identified as one comprising several hundred hectares (ha) of fishponds maintained at low water levels, 100–200 ha of short grasslands with fresh growth of grasses preferred by LWfG after days of precipitation in the spring and autumn. The latter can be maintained by ecologically sustainable grazing, where the density of native grazers reaches one animal per ha. In addition, it is necessary to maintain the intensively grazed shorelines of shallow flooded meadows and marshes, especially in years of drought. Because LWfG occasionally use croplands when they join flocks of other goose species, it was also important to provide such croplands with available food grown or offered on them within the project area. In order to provide for all these requirements, we designed and implemented habitat management actions (actions D1, D2, D3, see Results) during the project.

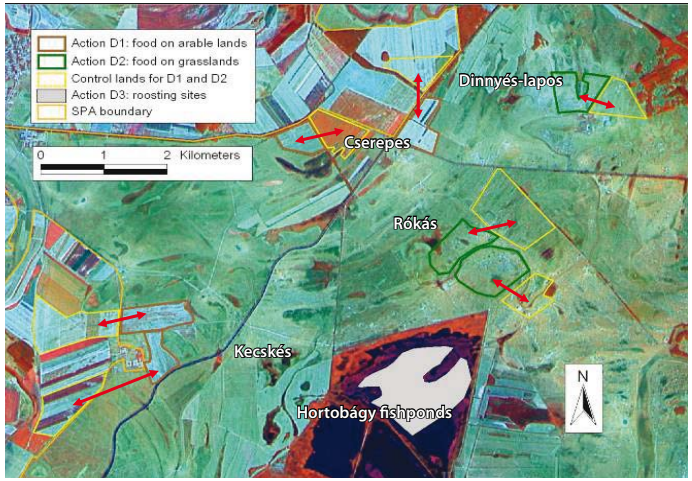

Figure 1. Map of the core project area showing the major locations of habitat management actions and the pairs of managed and control sites monitored to evaluate the eﬃciency of the habitat management efforts.

3. Results

3.1. Establishing safe feeding sites on hunting-free croplands

The aim of this action (action D1) was to provide safe, hunting-free feeding sites for LWfG on croplands within the borders of Hortobágy National Park. This activity included two sub-actions. First, we extensively cultivated crops (corn and wheat) preferred by LWfG and other geese on 44 ha managed by HNPD in each of three years between 2006 and 2008. The grown crops were mowed and left in place on the lands for forage for geese. These areas have been used by Cranes and geese in high numbers and we also have observed LWfG feeding on these lands on several occasions. In HNPD-managed lands leased by local farmers within the project area (100 ha), we negotiated and introduced in the leasing contracts additional rules for continued cultivation by the farmers, which ensured undisturbed use of these lands for LWfG and other goose species. For example, farmers agreed to leave their crops unharvested (and undisturbed) until late November-early December if goose flocks used their lands for feeding in October-November.

Secondly, we offered crops grown and purchased elsewhere on croplands to attract geese to feeding on lands within the project area. We purchased 30 tonnes of crops (corn and wheat) annually between 2006 and 2008 from farmers cultivating lands outside the National Park. We then transferred these crops to the target lands and offered them for geese on 25–30 ha croplands annually in the Kecskés area, where the crops otherwise grown that year (e.g. sunflower) would not have attracted geese. The crops offered attracted Cranes, Greylag Geese (*Anser anser*) and Greater White-fronted Geese (*Anser albifrons*) in high numbers, and we have also observed both the main flock and individuals of LWfG feeding on these lands on several occasions.

3.2. Management by grazing and irrigation to provide safe feeding sites on hunting-free grasslands

The aim of this action (action D2) was to improve the condition of grasslands likely to be used by LWfG before their arrival to the Hortobágy area in the autumn. The most important forage of LWfG in the Hortobágy area are new shoots of *Festuca pseudovina* and other grasses and halophyte plants (e.g. *Matricaria chamomilla, Plantago tenuif ora, Myosurus minimus, Puccinellia limosa, Festuca pseudovina, Er ophila verna, Cerastium dubium, Poa bulbusa* from spring to autumn, plus *Spergularia media* and *Chenopodium spp*. in the autumn). To induce fresh growth of these species by the time of LWfG arrival, we first allocated cattle-grazing on c. 70 ha land fenced off by installing temporary (mobile) electric fences around the preferred sites for 4–5 weeks beginning in mid-July until the end of August. This management was carried out on a total of 70 ha in three sites (Dinnyés-lapos, Cserepes and Rókás) annually between 2006 and 2008. In addition, we established grassland feeding sites for the early spring migration by allocating ecologically sustainable, intensive grazing by cattle on 120–230 ha dry grasslands and meadow or marsh shoreline zones depending on year. The latter activity was not planned in the original project and the farming company and other local farmers provided this service at no cost to the project.

After the grazing ended, in late August and early September in each year (2006–2008), we irrigated the grasslands within the temporarily fenced-off area for 2–3 weeks to induce fresh growth after the summer inactive period of the target plants. The duration of grazing and irrigation was adjusted to the local status of the sites as assessed in July and to weather in each year. For the successful implementation of this action, we have purchased four mobile units of electric fences and three units of irrigation equipment that will be used for LWfG conservation after the project.

3.3. Maintaining roosting sites by f ooding

The aim of this action (action D3) was to provide roosting sites where water levels are optimal for LWfG and other geese. The target sites for this action were the Hortobágy Fishponds (Kondás-pond: 5 million m^3 water volume and fishpond units 5 and 6: 2.5 m^3 total volume), which are primarily important as roosting sites in the autumn and on Dinnyés-lapos (0.2 million m^3), which is also important in the spring. To achieve this goal, we purchased water to keep the target water bodies at half water

Table 1. Summary of planned and completed conservation actions. (fp. = fishpond)

Action	Plan	Results in 2006	Results in 2007	Results in 2008
D1 / 1	Goose food grown on 140 ha each year	Goose food grown on 140 ha	Goose food grown on 140 ha	Goose food grown on 140 ha
D1 / 2	Goose food offered on 25 ha each year	37.8 tons corn offered on 44 ha	38.8 tons corn offered on 63 ha	30 tons corn offered on 44 ha
D2	50 ha grazed and irrigated each year	300 ha grazed, 70 ha irrigated	190 ha grazed, 70 ha irrigated	200 ha grazed, 70 ha irrigated
D3	Either Kondás pond or Fishpond units 5-6 (Hortobágy fp.) (alternating years) plus Dinnyés-lapos (each year) regulated to optimal water levels	Kondás pond (Hortobágy fp.) regulated to optimal level (enough water from precipitation in Dinnyés-lapos)	Kondás pond and unit 6 (Hortobágy fp.), plus Dinnyés- and Bocza-lapos regulated to optimal level	Kondás pond (Hortobágy fp.) and Dinnyés-lapos regulated to optimal level

levels, which has proved optimal for geese based on experience gained in the years. Flooding was conducted in the late summer annually between 2005 and 2008 on Kondás or fishpond units 5 and 6. Keeping water levels half also induced the growth of early successional herbaceous plants on the dry, exposed parts of the lakebed, which proved to be a preferred feeding site for LWfG. As a result, on many days, LWfG did not leave the fishpond even for feeding.

Dinnyés-lapos was filled up in late summer in 2007 and 2008 so that water has also flooded the short-grass feeding sites near the marsh, creating a roosting site that was also a preferred feeding habitat for LWfG. In addition, in years of extremely dry winter and early spring (2006, 2008), we also filled up Dinnyés-lapos in February-March to provide a roosting site for LWfG during their spring migration. Because LWfG almost exclusively used these managed sites for roosting in practically every year of the project, this action successfully provided undisturbed, protected roosting sites within the safe, hunting-free areas of Hortobágy National Park.

With the application of mobile electric fences and by grazing livestock enclosed there, short-grass conditions were rapidly achieved in the most preferred feeding sites of Lesser White-fronted Geese. © János Tar

3.4. Awareness-raising activities

In the last decade, conservationists have achieved significant results in the protection of birds in Hungary. However, as in most other areas of life, conservation also appears to have 'stars', such as raptors (Imperial Eagle *Aquila heliaca* , White-tailed Eagle *Haliaeetus albicilla* or Saker Falcon *Falco cherrug*) or spectacular large species (e.g. Great Bustard *Otis tarda*, Cranes) for which much greater attention, energy and money is directed than to most species. Through our awareness-raising presentations, articles, press materials and website, we strived to add the LWfG to this increasing group of conservation 'stars' and to draw the attention of conservationists and decision-makers to this globally endangered species.

The primary aim of our awareness-raising activities was to present our project to the hunters, the stakeholder group that is essential to involve in the protection of a species that is very similar to one that can be legally hunted. We aimed to teach how to determine the species, to draw attention to the conservation status of LWfG and to the expected local occurrence of the species. Our primary target group, therefore, were the hunting associations operating around the project area and Hortobágy National Park. Beginning in 2006, we have organised several meetings with these hunting associations before the start of the hunting season. We have presented our results on the space use of LWfG in the Hortobágy area and discussed the possibility of joint actions, e.g. releasing locations and times of goose-hunts to further reduce the risks to LWfG. We have added to this cooperation by preparing and circulating 1000 copies of an A4-format informative leaflet written exclusively for hunters. At the national level, we approached hunters through an article in the Nimród hunting magazine in which we wrote about the conservation status of the Fennoscandian LWfG population, the identification of the species and the possibilities of joining the conservation activities.

Our second target was to present the current critically endangered status of the species, the conservation measures implemented in this project and the results achieved to conservationists and decision-makers. We specifically aimed to highlight the vulnerability of the species and the fundamental importance of conservation measures in Hungary in the maintenance of the Fennoscandian population of LWfG to all people involved in nature conservation. As a first step, we have prepared and regularly updated a website for the Hortobágy part of the international LIFE-project (kislilik.hnp.hu). We published a general awareness-raising booklet on the project (1600 copies), which is available for free to all those who are interested. In November 2008, we organized a scientific workshop with the importance of staging sites in the conservation of long-distance migrant birds as its central theme. The project was also presented twice at the annual Hortobágy meeting of field ornithologists, twice at

Pupils visiting the Hortobágy National Park studying the information sign of the Lesser White-fronted Goose LIFE project by the Hortobágy fishponds. © Petteri Tolvanen , October 2008

regional conservation conferences and four times in invited lectures to university students. After an individually marked LWfG was found shot in Greece in April 2008, we published an article in the most read local newspaper, and on several news portals (e.g. the national news channel HírTV) in a shorter form. During the awareness-raising activities, information on LWfG and our project has reached close to 2000 conservationists and interested decision-makers and 6000 hunters in the project duration. As a result, awareness to the extraordinary threatened status of LWfG has increased considerably in Hungary and it will have a favourable effect on the support and implementation of further conservation activities to save LWfG from extinction.

4. Discussion: summary and remaining threats

In summary, we completed each of the three major habitat management actions as planned and in several cases we could also achieve more than planned within the budget allocated to the actions (Table 1). The most important lessons learned were that roosting sites are central to the habitat use of LWfG. Fishponds and marshes with low water-level were used almost exclusively for roosting and these sites served as the main centre of activity for both the main flock and individuals of LWfG. Feeding and resting sites around the roosting sites were similarly important. Ecologically sustainable grazing by cattle was primarily important in maintaining halophyte plant associations, which provide the main food source for LWfG. Irrigation, coupled with flooding in extremely dry autumns also proved effective in providing feeding sites. The southern end of Dinnyés-lapos was highly preferred, where shallow water and halophyte plants growing on the intensively grazed shoreline offered excellent feeding, drinking and resting places. Offering crops, either grown on-site or transferred to the site, has proved moderately effective in attracting LWfG. It has to be noted, however, that in the years preceding the project, we more often observed LWfG on croplands than during the project years. Therefore, it is likely that offering food on croplands is more successful in certain years. Offering food on croplands, however, worked greatly for other goose species and cranes. Consequently, the conservation measures aimed for geese and cranes can be coupled, along with the management of the water levels on nearby roosting sites. These conservation measures will need to be continued for the long-term protection of the species, especially in the core project area, which is the most traditional staging site of LWfG in Hungary.

5. Acknowledgments

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Monitoring of Lesser White-fronted Geese in Hortobágy, Hungary, in 2004–2008

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János Tar, the manager of the LIFE project in Hungary, kept the most important sites for the Lesser White-fronted Geese in Hortobágy under continuous observation. © Petteri Tolvanen, October 2008

1. Introduction

This article presents the results of the monitoring activities conducted within the framework of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) EU Life project in the Hortobágy region in eastern Hungary. Also results of the (lower intensity) monitoring activities in 2004 are presented here. The success or failure of all conservation measures can be evaluated only if their effects are followed up by regular monitoring activities (Pullin & Knight 2003, Sutherland et al. 2004). Based on this principle, we have allocated significant and consistent effort to monitoring activities in the Hungarian part of the LWfG Life project.

The primary aims of the monitoring activities were: (i) to gather information on the effectiveness of habitat management actions carried out in the project (see Ecsedi et al. 2009) and (ii) to collect detailed data on the occurrences and space use of LWfG in the Hortobágy area and to record colour-ringed or satellite-tagged individuals. The monitoring system established in the project had been previously tested through various pilot activities. Furthermore, a detailed analysis of LWfG occurrences in the Hortobágy area also provided relevant insight into the design of the monitoring system (Lengyel et al. 2009). The experience gained during these previous activities was used to design and implement the monitoring system under the supervision of János Tar as project manager and with the help of Hortobágy National Park Directorate (HNPD), and with the assistance of project coordinators Szabolcs Lengyel and Zoltán Ecsedi, and with the help of numerous ornithologists in Hortobágy and Hungary.

2. Methods

The monitoring activities of the LWfG Life project in Hungary have been a continuation and extension of monitoring activities that have been started in the early 1990's and which has been and is being coordinated by Project Manager János Tar with the contribution of other ornithologists from Hortobágy and Hungary. János has kept the most important sites of LWfG occurrence (Hortobágy Fishponds, Cserepes, Ludas-rét, Dinnyés-lapos, Virágoskút fishponds) under continuous observation. Other ornithologists helping him were HNP rangers Attila Szilágyi and Gábor Tihanyi, who regularly studied the goose flocks in the general project area and the neighbouring relevant areas (Elep fishponds, Vókonya: A.Sz., Kecskés grasslands and Bivalyhalmi fishpond: GT). Several volunteers from HNPD, Hortobágy Nature Protection Association and BirdLife Hungary have also contributed to the monitoring system. To aid the conditions of searching for and observing LWfG, we installed five new observation towers, purchased a videocamera and a tele-lens to document LWfG individuals. Based on previous observations and the results of the space use study (Lengyel et al. 2009), we also extended the monitoring system to the Egyek-Pusztakócs marshes, Tisza Lake and Borsodi Mezőség ("Kis-Hortobágy") in 2008.

The effect of habitat management actions of the LWfG LIFE project was studied in detail by weekly censuses of all birds on managed grasslands and croplands and a similar non-managed, control site (see Figure 1. for locations) in 2006. The general occurrence, flock size, flock and age structure of LWfG staging in the Hortobágy region was studied by regular checks of the wetlands and grasslands that have proved the most important for LWfG based on previous observations (see Lengyel et al. 2009). The most important tasks were to find the birds, to identify the areas used, to determine the threats present at the areas of occurrence, to obtain an exact count of the birds (adults and juveniles separately, when possible), to read colour-rings or to photograph/videotape individual birds for later identification. Our main aim was to keep the main, Fennoscandian flock under constant, almost daily surveillance. Obviously, the monitoring activity was divided into two distinct seasons, a spring and an autumn monitoring, although we covered also those few individuals that overwintered in milder weather in some years.

Table 1. Mean (+ S.E.) number of individuals counted on lands managed in the project and on similar, non-managed control lands (grazed vs. control grasslands and cultivated vs. control croplands). Data are from pairs of managed vs. control sites (see Fig. 1 for locations) collected in weekly censuses over 13 weeks in the autumn of 2006.

Habitat	Species	Managed [a]	Control [a]	Z [b]	P [b]
Grassland	Anser albifrons	4.7 ± 20.00	0.0 ± 0.00	-2.201	0.028
	Anser anser	39.3 ± 108.45	0.0 ± 0.00	-3.300	0.001
	Anser fabalis	0.3 ± 1.60	0.0 ± 0.00	-1.000	0.317
	All geese	44.3 ± 109.56	0.0 ± 0.00	-3.297	0.001
	Grus grus	139.2 ± 231.73	11.4 ± 30.53	-3.976	0.000
Cropland	Anser albifrons	353.6 ± 1085.35	12.1 ± 41.62	-2.062	0.039
	Anser anser	149.1 ± 328.13	7.6 ± 34.18	-2.912	0.004
	Anser fabalis	1.4 ± 4.01	0.0 ± 0.00	-2.032	0.042
	All geese	504.1 ± 1374.39	19.6 ± 64.47	-2.979	0.003
	Grus grus	692.8 ± 1362.28	19.2 ± 48.86	-3.405	0.001

[a] mean number of individuals observed on 13 occasions
[b] Wilcoxon matched-pairs test

3. Results

3.1. Effect of habitat management actions

The monitoring of the habitat management actions showed that even in the first year of habitat management, managed lands hosted more birds, both geese and cranes, than did similar but non-managed control areas. There was an important differ-

Lesser White-fronted Geese grazing on the mudflats of the Kondás fish pond. As a result of the habitat management actions by the LIFE project, Kondás is not only a roosting site, but also a feeding site for the Lesser White-fronts. The geese can stay the whole day here, feeding on the hardly visible pioneer plants growing on mudflats on the margins of the fish pond. Two of the individuals wear leg rings. © János Tar, September 2008

Table 2. Main characteristics of the spring migration of Lesser White-fronted Geese in the Hortobágy region, 2004–2008 (fp. = fishpond, [a] for the main (Fennoscandian) flock, [b] few individuals overwintered).

	2004	2005	2006	2007	2008
Duration of stay [a]	2 weeks	5 weeks	4 weeks	6 weeks	4 weeks
Maximum flock size [a]	59	31	26	43	49
First LWfG observation	January 13 [b]	March 13	February 22	February 5	Janurary 26
Last LWfG observation	April 12	April 18	April 22	April 26	April 15
No. of marked individuals	4	None seen	None seen	7	None seen
Preferred areas	Cserepes, Dinnyés-lapos, Hortobágy fp., Rókás	Kecskés, Kondás	Kecskés, Cserepes, Dinnyés-lapos, Kondás	Hortobágy fp., Rókás, Dinnyés-lapos, Máta	Hortobágy fp., Rókás, Dinnyés-lapos, Ludasrét

Table 3. Main characteristics of the autumn migration of Lesser White-fronted Geese in the Hortobágy region, 2004–2008 (fp. = fishpond, [a] for the main (Fennoscandian) flock, [b] some few individuals overwintered).

	2004	2005	2006	2007	2008
Duration of stay [a]	5 weeks	8 weeks	6 weeks	6 weeks	7 weeks
Maximum flock size [a]	31	33	22+11	54	33
First LWfG observation	September 18	September 22	September 21	September 16	September 22
Last LWfG observation	December 31 [b]	November 29	December 22 [b]	November 2	November 3
No. juveniles	3	9	7	30	4
No. marked individuals	4	3	2	6	4
Preferred areas	Hortobágy fp.	Kondás, Virágoskúti & Bivalyhalmi fp.s, Cserepes	Hortobágy fp., Virágoskúti fp., Dinnyés-lapos, Kecskés	Hortobágy fp., Dinnyés-lapos, Kecskés, Rókás	Hortobágy fp., Dinnyés-lapos, Ludasrét

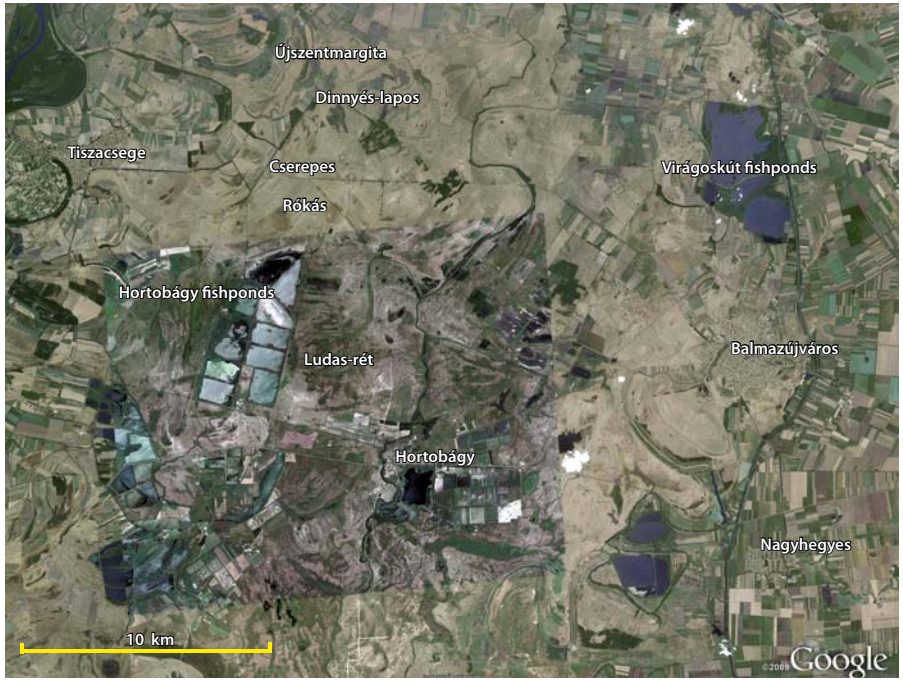

Figure 1. Locations of the most important sites for the Lesser White-fronted Goose in the Hortobágy National Park: the Hortobágy and Virágoskút fish ponds are roosting sites; Cserepes, Ludas-rét, Dinnyés-lapos are the main feeding areas. The northernmost and largest of the Hortobágy fish ponds units is Kondás, which is the main roosting site, but – as a result of the habitat management actions of the LIFE project – also a feeding site. © Satellite image, Google Earth 2009

ence between grasslands and croplands. Non-managed grasslands seemed to be totally unsuitable for geese because we did not observe any individual on non-grazed control sites (Table 1.). Some cranes used such non-managed grasslands, but their numbers were significantly larger on the managed grasslands (Table 1.). In contrast to grasslands, geese used non-managed cropland, however, their numbers were significantly lower in such sites than in managed sites (Table 1.). Although we did not observe LWfG on the managed sites during the regular weekly bird censuses, both the main flock of LWfG and separate individuals were observed on the managed grasslands and croplands outside the census periods. These results suggest that habitat management actions of the LIFE project were highly effective in attracting geese, including LWfG, and cranes to the sites; therefore, it is worth continuing these actions. There was an important difference between grasslands and croplands because management seemed mandatory to attract geese on grasslands, but not on croplands. Therefore, the management of grasslands should enjoy higher priority during the design of future habitat management actions.

3.2. Regular monitoring of Lesser White-fronted Geese

3.2.1. Spring

During the mild winters in 2004–2008, several LWfG, possibly originating from the Russian breeding populations, overwintered in the flocks of Greater White-fronted Goose (*Anser albifrons*) staging in Hortobágy, e.g. 6 individuals in Hortobágy in 22 December 2006. In the spring migration, the main Fennoscandian flock usually arrived in Hortobágy in the second week of March (except for 2006, when the flock arrived in late February) from their wintering sites in Greece. The main flock mostly used Hortobágy Fishponds (Kondás and Unit 6) for roosting and the neighbouring partially flooded grasslands (Cserepes, Rókás, Ludas-rét, Kecskés, Dinnyés-lapos) for feeding, and visited agricultural croplands very rarely. The main flock left the area usually between 16–26 April, but single individuals (of unknown origin) often stayed until the first week of May.

The maximum spring flock size showed some variation with 59 individuals as the highest record (2004) and 31 individuals as the lowest record (2005) (Table 2.). During this period, no disturbance (e.g. from hunting) threatened the birds. The flock preferred to roost and feed in the sites managed by the LIFE project (see above), especially in areas of alkali grasslands close to water (such as edges of alkali meadows).

3.2.2. Autumn

On the autumn migration in 2004–2008, the first LWfG families arrived in the area between 16–22 September. The maximum number of individuals was usually reached by early October. The maximum number was 33 individuals in most years except in 2007, when it was 54 individuals, and in 2004 when the maximum number was 31 individuals (Table 3.). The number of juveniles ranged from three (in 2004, a year with poor breeding success) to 30 birds (in 2007, a year with excellent breeding success). The families grouped in the main flock usually stayed in Hortobágy until the end of October; thus they spent generally 5–6 weeks in the Hortobágy area.

During the autumn staging, LWfG mostly spent time and fed in the areas managed by the LIFE project (see Ecsedi et al. 2009). In the extremely dry autumn 2007, the northern part of the Kecskés-puszta grassland was also irrigated by the Life project, and this area was highly preferred by LWfG. In addition, LWfG often visited agricultural lands (harvested cornfields, freshly germinating wheat) when they joined flocks of other goose species in the autumn, and they were seen several times on the croplands managed by the project. Although croplands were important in the autumn (in contrast to the spring), LWfG more often preferred grasslands for feeding. Moreover, the fresh growth of herbaceous plants (esp. Chenopodium spp.) in the bed of fishponds that were kept half dry in this project also attracted LWfG so that sometimes they did not leave the fishponds for days. In each year, newly arrived individuals appeared in the goose flocks, which individuals are likely to originate from the western main population breeding in Russia. These birds usually stayed until the first substantial frosts, and in mild winters, some individuals also overwintered. These individuals have been spotted all over Hortobágy, but they mainly used the Virágoskút, Elep and Bivalyhalmi fishponds.

During the LIFE project, we made an effort to increase awareness of LWfG and the associated conservation problems among ornithologists from all over Hungary. As a result, the monitoring effort to search for staging or overwintering geese in Hungary increased considerably. These observations have been regularly published on the national ornithological website (www.birding.hu) and on the LWfG website (www.piskulka.net). These observations also suggested that LWfG occurred rather regularly during the LIFE project in the following areas (in order of importance): Biharugra fishponds and Begécs fishponds (E Hungary), surroundings of Fertő-Lake (NW), Büdös-szék at Pusztaszer and Kiskunság alkali lakes (S-central), Öreg-tó at Tata (NW), Bihar-Sárrét (E), Lake Balaton (W), Fehér-tó at Szeged, Fehér-tó at Kardoskút (SE) and Tisza Lake. We assume, however, that most of the LWfG overwintering in Hungary belong to the Russian breeding populations because these birds usually arrive later in the autumn with the flocks of Greater White-fronts.

3.3. Lesser White-fronted Goose occurrences in other parts of Hungary in 2004–2008

In the decades before the mid-1990s, the status of the species in Hungary was based on estimates rather than actual counts. Since mid-1990s, ornithologists started to monitor the most important goose staging sites using high-quality spotting scopes. As a result, observations have been made even in regions from where the species had not been reported previously, such as the region west of river Danube. In the Great Plains area (east of river Danube), observations of LWfG in larger goose flocks have become more frequent, albeit not regular. Outside the Hortobágy region, the observations need to be reported to the Nomanclator Committee of BirdLife Hungary for verification. Due to this requirement, the evaluation of the current status of LWfG in Hungary is based on accurate and credible accounts. The species has been observed in the following areas: Pusztaszer, Lake Fertő, Biharugra, Lake Tisza, Öreg-tó (Tata). There are rare reports from the alkali lakes of the Kiskunság, the Kis and Nagy-Sárrét and near Rétszilas. Apart from these sites, there are numerous occasional observations from different areas. These observations are almost exclusively from single individuals in larger goose flocks, which individuals usually do not stay in the area for a long time.

From the beginning of the LIFE project, extra attention has been paid onto data provided by observers outside the Hortobágy area. The project personnel have given several presentations and provided information in other forms on LWfG and conservation efforts to save the species, and there was a huge interest in the species and its conservation both from ornithologists in general and from experts on goose species. As a result, the project personnel were in continuous contact with experts from the different regions of Hungary.

In the winter 2005–2006, three individuals were observed in late autumn in the Kis-Balaton region, and probably the same birds were later seen near Lake Fertő. In the same period between 3–9 birds sojourned at Pusztaszeri Büdös-szék. In the

most severe winter weather they migrated on, and no overwintering birds were recorded that winter.

In the late autumn/early winter of 2006–2007, altogether 30–33 LWfG were reported from five different areas outside the Hortobágy (Lake Fertő, Lake Tisza, Biharugra fish ponds, Lake Öreg near Tata, Pusztaszeri Büdös-szék) at the same time, and altogether at least some 8–12 individuals were wintering in the country.

In the autumn/winter of 2007–2008, respectively, 3–4 LWfG at a time were reported from three different areas (Lake Fertő, pusztaszeri Büdös-szék, Biharugra fish ponds) with an estimated total number of at least some 11 individuals, but due to severe weather conditions, they migrated on and no overwintering birds were recorded

In the winter of 2008–2009, 3–13 individuals at a time were sighted at four different locations (Lake Fertő, pusztaszeri Büdös-szék, Biharugra fish ponds, Lake Tisza), and the Hungarian winter population outside the Hortobágy was estimated at a total of 31 individuals. In the vicinity of Lake Fertő the largest flock for decades was counted (13 birds). During severe frosts in winter they left the region and no overwintering birds were recorded.

Most work by these other observers was focused on searching for individually marked LWfG. The observers knew about the colour-ringing and the satellite-tagging programme, and therefore voluntary observers enthusiastically spent extra efforts to read the leg rings of LWfG. However, there were no observations of individually marked LWfG outside the Hortobágy in 2004–2008. There was a characteristic difference in the time periods for the observations within and outside Hortobágy: most of the observations outside Hortobágy were from late October to mid-March (cf. Table 2 and 3 for the Hortobágy observations). In Pusztaszer and near Lake Fertő, there were observations from later in the spring, and these were mostly of second calendar-year birds. There was also a difference in space use because the late-arriving single LWfG or few-individual flocks of LWfG in the Hortobágy used areas different from the stable roosting and feeding sites used by the main Fennoscandian flock of LWfG.

The fact that no LWfG marked in Fennoscandia were observed outside Hortobágy, the difference in the time of staging (winter rather than autumn and spring) and the difference in the sites used make it very likely that the birds arriving late to Hortobágy or those that were seen in the winter outside Hortobágy were not from the Fennoscandian population. Rather, it appears likely that these birds originated from the Russian populations.

4. Discussion

In every Life project year, 96–98% of the observations of the main flock of the Fennoscandian LWfG were made within the borders of Hortobágy National Park, with most observations from the core project area (Hortobágy Fishponds and surrounding grasslands). This high ratio was found even though other sites outside the National Park were also intensively monitored. Based on these results, we estimate that LWfG spent practically all of their time within the national park, where their survival and optimal habitat requirements could be guaranteed. LWfG staging in the Hortobágy area used safe, hunting-free sites most of their time spent in eastern Hungary, and this has been largely a result of the habitat management actions of the LIFE project.

Our data and observations collected during regular monitoring highlighted both the success of the habitat management actions and the central importance of the core project area for staging LWfG in the Hortobágy region and eastern Hungary. When conditions are favourable here (shallow, large surface-area fishponds; short-grass, somewhat wet grasslands, more details are given above), LWfG do not normally leave this area during their 6 weeks of staging in Hortobágy. As a result, the main threats to the population (mortality due to hunting, habitat loss, and disturbance) do not affect LWfG during their stay.

However, smaller flocks or single individuals of LWfG that remain longer in the winter in the area may join flocks of other goose species that use other fishponds (Virágoskút, Bivalyhalmi) as their main roosting site. Geese flying out from these roosting sites looking for a foraging area are very likely to end up in non-protected agricultural areas, where two species of wild geese, one of which is very similar to LWfG, can be legally hunted (albeit with restrictions). In 2004, favourable changes occurred in the legal regulation of hunting in the three counties lying east of river Tisza, because goose-hunting in these counties is not allowed before December 1, by which time the main Fenno-scandian flock of LWfG usually leaves the area at the latest. Although this measure contributes to the protection of LWfG, several hunting associations applied for and were granted an exception from this rule in the northern Hortobágy region in 2005, which shows that there may still be slight risks. As a long-term solution, awareness-raising among hunters in the region and in Hungary is essential

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Space use and exposure of Lesser White-fronted Geese to hunting in the Hortobágy region, Hungary

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The Dinnyés-lapos and the adjacent alkali steppes are one of the most preferred feeding sites of Lesser White-fronted Geese in the Hortobágy National Park. The Dinnyés-lapos pond is visible on the background. © Ingar Jostein Øien, November 2005.

1. Introduction

The life history traits of geese and the fact that many geese are harvested make their population dynamics particularly prone to variation in the mortality of adults (Sæther & Bakke 2000). Adult mortality may be influenced directly by harvesting (legal or illegal hunting) and indirectly by disturbance caused by hunting activities (Tamisier et al. 2003). The Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) has been declining at least since mid-1900's and several studies support the view that the single most important factor in the population decline has been the low survival of adults (Lampila 2001, Tolvanen et al. 2004).

The aim of this study was to to evaluate the space use of LWfG and their past and current exposure to hunting in the Hortobágy area in eastern Hungary. The Hortobágy area has been traditionally famous for goose hunting since the early 20th century. Goose hunting was based on the endless flocks of geese staging in the area on autumn migration. The complex of marshes, fishponds, alkali grasslands and agricultural lands in combination with favourable, cloudy, foggy autumn weather offered excellent opportunities for goose-hunting. Several literature sources before the 1930's attest the high success rate of goose hunts, with several tens of thousands of geese shot each year. The proportion of LWfG harvested was unambiguously estimated by several sources at 10% of all geese shot in these decades (Szomjas 1919, Tarján 1922, Nagy 1924).

Sources also agree that several thousands of LWfG used the Hortobágy area for staging every year before 1930. Goose hunting in the early 1900's has probably largely contributed to the collapse of LWfG populations (Kovács & Tar 2004). Despite decreasing numbers of LWfG, goose hunting was also significant even after World War II; for example, even as recently as 1966, between 30 and 35 LWfG were shot (Sterbetz 1972). Goose hunting was thereafter gradually phased out in the area of Hortobágy National Park, but goose hunts on fishponds within the national park were still regularly conducted as recently as the early 1990's. During some of these hunts, shooting of LWfG has been observed several times (Fekete P., pers. comm.). However, exact data (time, locality) on shooting of LWfG has proved to be impossible to collect during this study. The Hortobágy region continues to be one of the most important staging sites in Hungary and hosts more LWfG than any other staging sites on the European flyway (Tolvanen et al. 2004). During extensive monitoring in the present LIFE project, the number of LWfG was even higher in Hortobágy than the number counted at the wintering sites in northern Greece (see Tar et al. 2009).

In this study, we first aimed to collect data as far back in time as possible on the space use by LWfG in the Hortobágy region by contacting ornithologists and previous literature sources and to digitise all reliable localities of LWfG observations. We analysed these data in a Geographical Information System to identify the areas most frequently used for feeding and other activi-

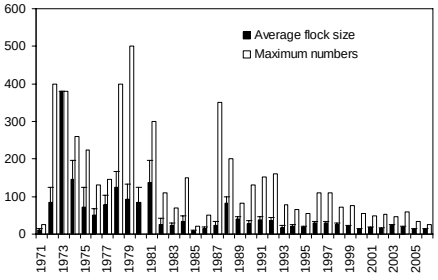

Figure 1. Average (± standard error) flock size and maximum number of Lesser White-fronted Geese in any flock in each year between 1971 and 2006 in the Hortobágy region. A highly unlikely, extreme outlier datapoint from 1980 (3500–4000 Lesser White-fronted Geese reported) is omitted for clarity.

ties, including night roosting. In the second phase, we collected information on where and how frequently goose-hunting had been conducted in the Hortobágy area. By analysing the spatial data, we aimed to determine the areas that LWfG frequently use and where hunting pressure is high. This information is important in the planning and implementation of other actions and in developing further conservation measures. The present article presents the findings obtained in the Action A5 of the LWfG LIFE-Nature project (2005–2009).

2. Methods

Data on LWfG occurrences were collected and provided for this study by the Hortobágy Environmental Association. The Hortobágy Environmental Association has been collecting reliable LWfG observations dating from 1905 in the Hortobágy region since the 1990's. The database contains information from both literature sources and direct reports of ornithologists visiting the Hortobágy region. The total database contains nearly 900 records from the years between 1905 and 2006. Data reliability and accuracy of localities increase with time as the decline of LWfG has become more well-known and interest in the species has increased among ornithologists (since the 1970s). Due to high unreliability of the early part (1905-1970) of the period, we focused our study on the years between 1971 and 2006 (36 years in total). This time period corresponds to the period following the collapse of the Fennoscandian LWfG population and decline in the other LWfG populations (Figure 1.).

We used ArcView 3.2 with the Spatial Analyst extension to digitise data in a Geographical Information System (GIS). We aimed to maximise accuracy of the localities of LWfG observations. When exact sites were available for any record (e.g. Unit 5 on the Hortobágy Central Fishponds), we took the central location of the site as the digitised locality. A more accurate locality would have been unfeasible and unnecessary for our purposes as LWfG often change their exact location within each site and among sites. The general error in digitising localities is estimated at 200–300 m, which was negligible when compared to the scale of the study (10–20 km). We then used the Animal Movement Analysis software (Hooge & Eichenlaub 1997), a free extension under ArcView 3.2 to analyse space use by LWfG. We generated three different datasets: one for all spring observations from each year, another for all autumn observations from each year and a third one for all (spring + autumn) observations from any year. We then used the Animal Movement program to calculate various statistics describing the space use patterns of LWfG. The most important such characteristics were maximum polygon area of observations, the areas of kernels incorporating either 50% or 95% of the observations and the mean northing (latitudinal coordinate) and easting (longitudinal coordinate) values from any given period. We then related these measures with variables describing the intensity of hunting in areas neighbouring Hortobágy National Park.

Data on the time and location of goose hunts were sought from several sources. Local hunting associations were contacted for their own records. The hunting associations that were contacted unanimously stated that all their data are available in the National Game Management Database of Hungary, maintained by the Institute for Wildlife Conservation at St. Stephen University, Gödöllő, Hungary (http://ns.vvt.gau.hu/adattar). Because more detailed data were not available we used the publicly available county-level data for our purposes. We also used maps published by the above institute in their annual reports as a surrogate for data on goose hunting more detailed than the county level. We overlaid on the picture maps the outlines of Hortobágy National Park and drew conclusions on the spatial pattern of goose hunting based on such comparisons. For data on hunting bags, we used what could be retrieved from the national reports of the above database/institute. To obtain qualitative data on goose-hunting, we also conducted interviews with three persons with the necessary knowledge on goose hunting in the past few decades and at present.

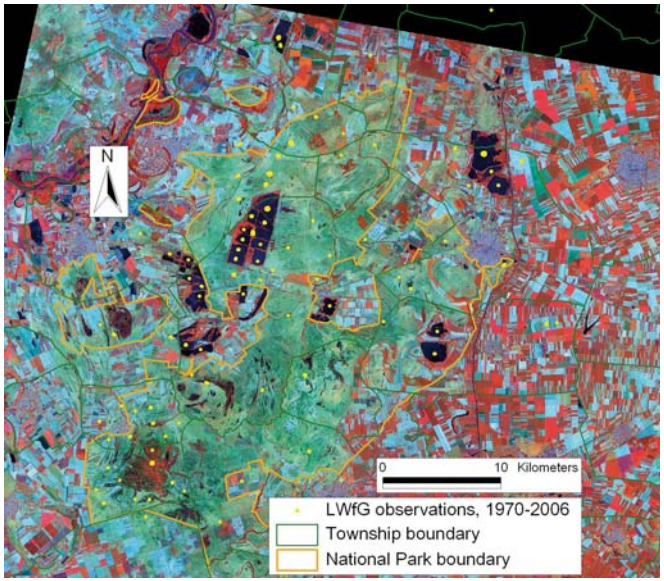

Figure 2. The yellow dots indicate localities where Lesser White-fronted Geese have been observed in the Hortbágy region in east Hungary based on 840 observations between 1970 and 2006.

Aerial view of the Dinnyés-lapos. This site in the northern part of the Hortobágy National Park was successfully restored in 1999. © János Tar

3. Results

3.1. LWfG observations and space use in general

A total of 840 observations of LWfG in the Hortobágy region were available from the time period between 1971 and 2006. Most observations were made within Hortobágy National Park, and some were made in the neighbouring agricultural lands, grasslands or fishponds (Figure 2.).

The space use of LWfG in the Hortobágy area has changed markedly in the 36 years. In the first part of this period, most observations were made either in marshes or grasslands in the south-western part of the national park, in the vicinity of Nagyiván village, or in the Central Fishponds (Figure 3.). In more recent years, since the mid-1990's, most observations are from the Central Fishponds and the areas north of the these fishponds (Figure 3.). This difference was more marked in the autumn (Figure 3B) than in the spring (Figure 3A). These observations suggest that LWfG appear to have abandoned the southern parts of Hortobágy as staging areas.

There are at least three potential reasons for the north-eastern shift in LWfG staging sites:

1. Decreased disturbance by hunting in the Central Fishpond area from the 1960's to the early 1990's.
2. Favourable changes in northern roosting sites and grasslands, and/or unfavourable changes in the southern marshes and grasslands.
3. Increased disturbance or hunting in areas near the southern marshes.

Each of these hypotheses are supported by some observations. First, hunting was eliminated on the Central Fishpond and neighbouring areas by the early 1990's. Even though hunting occurred on the nearby, non-protected fishponds even during and after the mid-1990's (e.g. Ohati and Derzsi fishponds, 3-4 km south-west from the Central Fishponds), disturbance from hunting substantially decreased in the northern areas after 1990.

Secondly, the decrease in hunting also co-occurred with favourable changes in habitats. The reconstruction of the Dinnyés-lapos as goose habitat in 1999 was a good example of successful habitat restoration. LWfG started to use this wetland for feeding and roosting in the autumn 1999. Although no such new habitats opened to LWfG in the southern areas, it is unlikely that the habitats in the southern part of the national park underwent unfavourable changes.

Finally, even though the southern marshes and grasslands within the national park are among the least disturbed, sanctuary-type habitats, goose-hunting appears to have increased in neighbouring areas since 1990, mainly west and south-west of the national park boundaries. We found this both on the long term and in the period between 2001 and 2004 (see below).

Both the average and maximum flock size of LWfG decreased in the 36-year study period (Figure 1.). Besides a general decline, the average flock size showed fluctuations on shorter time scales. For example, there were slight increases between 1985 and 1988, then between 1995 and 1997, and in 2002–2003. The variation in flock size also decreased considerably since 1981, indicating that most observations after this year were likely from one jointly migrating flock, most probably the Fennoscandian breeding flock. This flock has been confirmed to consist of

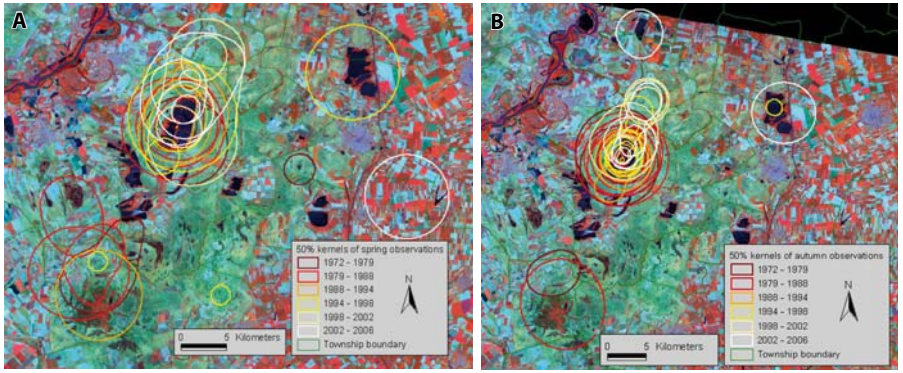

Figure 3. Space use of Lesser White-fronted Geese in the Hortobágy region based on observations on the spring migration (A) and on the autumn migration (B) in the time period between 1971 and 2006. Range estimates (kernels) were calculated from point observations in either spring or autumn of all observations from any given year.

birds of Fennoscandian origin by tracking of birds with satellite transmitters in 1995 (see Lorentsen et al. 1998) and by repeated observations of colour-ringed birds (Tar 2001).

The space use of the main Fennoscandian flock of LWfG both on spring and autumn migration could be characterized as using a central marsh or fishpond for roosting and a neighboring grassland for feeding during the day. Even early in the study period, there were several consecutive daily observations of the same LWfG pairs on neighbouring roosting and feeding sites. These observations suggest that LWfG are reluctant to fly larger distances unless they are disturbed or are in larger goose flocks. Observations of single birds, pairs or small flocks (4–6 individuals) were frequent: in 250 cases of 840 observations, 6 or fewer individuals were observed. Most LWfG observations were made at roosting sites (fishponds), and fewer were made in natural feeding areas (grasslands). It is surprising that there are relatively few observations from arable lands (Figure 2 and 3). Although LWfG is known to prefer natural feeding sites more than the other geese do, they sometimes join other goose flocks feeding on arable lands in the second part of the autum staging period, and LWfG may be more difficult to observe in such large flocks.

3.2. Spatial patterns of hunting

Two species of geese have been allowed for hunting in Hungary in recent years, the Bean Goose (*Anser fabalis*) and the Greater White-fronted Goose (*Anser albifrons*). The hunting of wild geese showed variation between 1970 and 2006 in the five focal counties of eastern Hungary addressed by this study (Figure 4.). Hajdú-Bihar county, where most of Hortobágy National Park lies, is of central importance in goose hunting in the region, and the hunting bag is slowly decreasing despite a recent peak in 2000. Most geese in Hajdú-Bihar county are harvested in agricultural areas just outside the border of Hortobágy National Park. In the other three counties, goose hunting was traditionally less important than in Hajdú-Bihar, but has been increasing since the early 1990's (Figure 4.). In Békés county, goose hunting is mostly confined to the area of the Biharugra fishponds in the north-eastern corner of the county, whereas in Heves county, goose hunting is exclusively conducted on or near Tisza Lake. In Jász-Nagykun- Szolnok county, most goose hunting takes place in the eastern part of the county, in areas bordering Hortobágy National Park (Figure 4.).

Data on the geographical location of goose hunts in or near Hortobágy National Park were available only in the form of maps for three hunting seasons (beginning in 2001, 2003 and 2004 respectively) (Figure 5.). Goose-hunting was intense throughout the three years in the Tisza Lake region (western part of the national park), with considerable hunting pressure also within the national park boundaries in 2001 and 2003 (Figure 5A, B). The intensity of hunting was initially high northeast of the national park (area of Balmazújváros and Hajdúböszörmény), where the important goose roosting site of the Virágoskút fishponds is located, and decreased progressively in later years (Figure 5.). Goose hunting was also intense along the western border of the national park. Hunting was especially intense in the west (Tiszafüred-Kócsújfalu) and south (Nagyiván region) in 2003 and 2004 (Figure 5B, C). The area south and south-west of the national park (area of Karcag and Túrkeve) became progressively more important in goose-hunting by 2004 (Figure 5.). Areas towards the south-east had intense goose hunting in some years. For example, in 2003, intense hunting occurred apparently within the national park itself (areas of Nagyhegyes, Hajdúszoboszló and Nádudvar), and farther away from the national park boundaries (in the area of Nádudvar and Kaba) in 2004 (Figure 5.). Finally, goose hunting was very intense throughout the three years near the Biharugra fishponds farther south-east of the Hortobágy region (lower right corner of maps in Figure 5.), where LWfG also regularly occur.

3.3. Relationship between space use of Lesser White-fronted Geese and hunting pressure

Our analyses suggest that the northeastern shift in annual space use observed in the 36 years was correlated with increasing hunting pressure in Jász-Nagykun-Szolnok county and in Borsod-Abaúj-Zemplén county. The first relationship was mainly because the areas used by LWfG shifted to the north and to the east in those four years when hunting pressure was above 250 geese harvested per year in Jász-Nagykun-Szolnok county (2000, 2003, 2004 and 2006) (Figure 6A, B).

Hunting intensity in Borsod-Abaúj-Zemplén county was positively related to longitudinal variation in LWfG space use (Figure 6C). In years when hunting in this county was intense, space use by LWfG varied more along an eastern-western axis than when hunting was less intense. This result indirectly draws attention to the potential importance of sites in Borsod-Abaúj-Zemplén county. The Borsodi Mezőség, an area consisting of extensive wetlands, grasslands and agricultural areas on the western bank of river Tisza, very close to northern Hortobágy, has long been suspected as a potential LWfG staging site, but there have been no observations from this area.

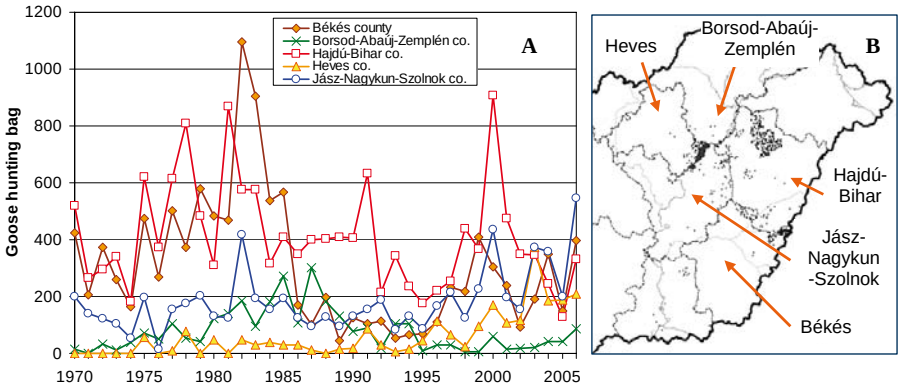

Figure 4. Goose hunting intensity measured by hunting bag data between 1971 and 2006 (A) from the five counties in eastern Hungary where goose hunting is most important (B). Each dot on the map indicates one individual of Greater White-fronted Goose (*Anser albifrons*) harvested in the hunting season of 2001. Source: National Game Management Database, Hungary (http://ns.vvt.gau.hu/adattar).

Surprisingly, hunting in Heves county was not related to any aspect of LWfG space use. This is interesting because Tisza Lake, a complex of wetlands and oxbow lakes, which lies almost entirely in this county, has been previously suspected as a possible staging site for LWfG. The finding that hunting in this area was not correlated with any aspect of space use suggests that this area is less important than others for staging. As a consequence, although goose hunting in this county has been increasing since the early 1990's (Figure 4.), this appears to present no immediate risk to the LWfG staging population.

The size of the area where LWfG were observed in any year was also related to hunting pressure. For example, there was a negative relationship between total area where LWfG were observed and hunting intensity (Figure 7A), which suggests that in years when hunting pressure was high, LWfG were concentrated in smaller areas. Although data from the early years (before 1990) are less reliable, the decreasing hunting pressure after the peak of 1982–1983 resulted in an increase in the area LWfG used in the Hortobágy (Figure 7B). One exception from these tendencies was the year 2000, when hunting pressure was extremely high and the LWfG were also spread out over a large area (close to 60 000 ha, Figure 7.). This can be related to the fact that in 2000 extensive areas in southern Hortobágy were artificially inundated as part of flood control measures, and roosting and feeding sites were available in unprecedented numbers, which in turn attracted a large number of waterfowl, and, consequently, goose and duck hunters to these areas.

These results suggest that one of the most important factors influencing changes in space use is increasing hunting pressure in areas of Jász-Nagykun-Szolnok county neighbouring the south-western part of Hortobágy National Park. Hunting pressure in Borsod-Abaúj-Zemplén county apparently has contributed to the east-west variation of space use of LWfG.

4. Conclusions and consequences for Lesser White-fronted Goose conservation

The results of this study are important for designing and implementing conservation actions for the protection of LWfG in the Hortobágy area. Even though the intensity of goose-hunting is generally decreasing in neighbouring areas, there is still a slight chance that LWfG get shot when they accompany large goose flocks in the autumn and leave the safe, hunting-free areas within the national park. This chance is rather small at present, considering that since 2004, goose-hunting in the areas east of river Tisza is only allowed after December 1, by which time

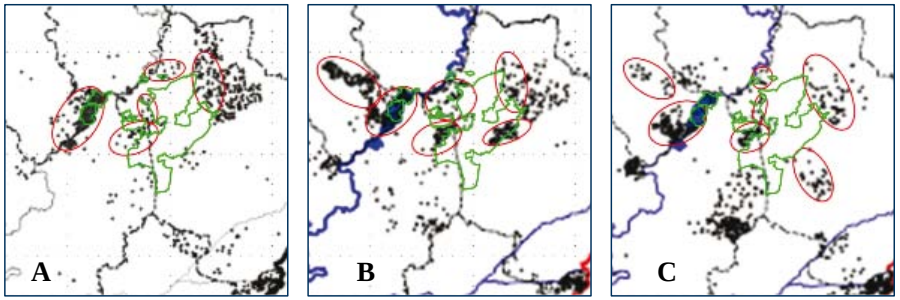

Figure 5. Spatial pattern of the intensity of goose hunting in and near Hortobágy National Park in E Hungary as shown by the geographical locations where Greater White-fronted Geese were harvested (1 dot = 1 individual) in the hunting season of 2001/2002 (A), 2003/2004 (B) and 2004/2005 (C). Counties are as in Figure 7B. Goose-hunting areas of concern are shown in red and the approximate location of national park boundaries are shown in green. Source of data on goose hunts: National Game Management Database, Hungary (http://ns.vvt.gau.hu/adattar).

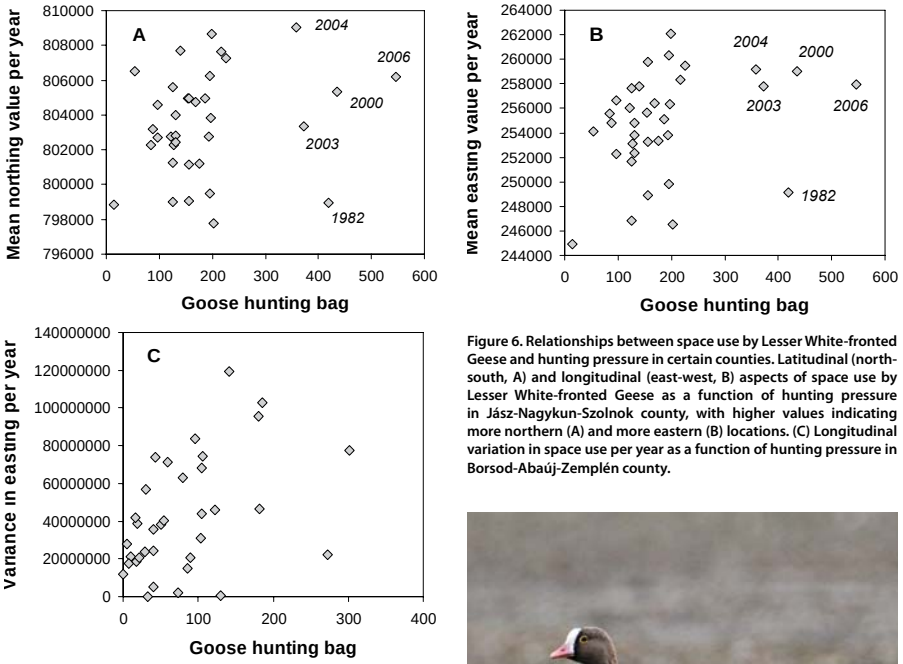

Figure 6. Relationships between space use by Lesser White-fronted Geese and hunting pressure in certain counties. Latitudinal (north-south, A) and longitudinal (east-west, B) aspects of space use by Lesser White-fronted Geese as a function of hunting pressure in Jász-Nagykun-Szolnok county, with higher values indicating more northern (A) and more eastern (B) locations. (C) Longitudinal variation in space use per year as a function of hunting pressure in Borsod-Abaúj-Zemplén county.

most LWfG usually leave the area to staging or overwintering sites further south. Our study of the past, however, shows that goose-hunting in the Hortobágy region may have contributed to the general decline of the Fennoscandian LWfG population. For example, intense hunting in the early 1980's probably contributed to the sharp decline observed in the population during this period. There are signs that LWfG have been shot as recently as the mid-1990's and there was also a high risk in 2000, when goose hunting bags hit record levels in several counties. Hunting in 2000 in eastern Hungary and in other staging sites may have contributed to the further decline of the Fennoscandian LWfG population between 2000 and 2001 (see Øien at al. 2009 for a discussion on the population decrease this particular year).

It is important to emphasise that this study has some limitations. Firstly, the data shown on maps may not be a highly reliable estimate for where goose hunting took place. Hunting clubs have been required to maintain exact records only since 2001, and many of the records are admittedly wrong. For example, hunting by single persons or by small groups are less likely to be recorded in the official books than hunting by large groups. It is regular practice that official books are not updated in a timely manner, which can result in confusion over the exact time and location of the hunt. Secondly, there is often confusion as to the exact identification of the individuals shot. For example, Bean Geese are usually rare in migratory flocks of geese in eastern Hungary, still, considerable numbers of this species are reported shot every year by the hunters (440, 439 and 278 in 2001, 2003 and 2004, respectively, in the four counties altogether). In the Figures 4 and 5. we only present numbers and maps for individuals shot and identified as Greater White-fronted Goose. Finally, goose hunts sometimes go unsuccessful and are thus not recorded in any official format. However, even unsuccessful hunts present considerable disturbance to geese and other

Lesser White-fronted Geese grazing on pioneer plant community growing on the mudflats of the Kondás fish pond. Kondás is most important roosting site of the Lesser White-fronted Geese in the Hortobágy. The bird with the colour rings is the male Finn that was satellite tracked in 2006–2007. © János Tar, September 2008.

waterfowl, therefore, the effect of hunting on geese is probably underestimated by considering only hunting bag data.

The most important conservation implication of these results is that it is necessary to further reduce the chance that LWfG are shot by coordinating several habitat management actions to keep them within safe, non-hunting areas inside the boundaries of Hortobágy National Park. Especially suitable for this purpose are the sites in the northern part of Hortobágy as hunting appears to increase in areas around the southern part of Hortobágy. These habitat management actions need to be extended to providing safe roosting sites and safe feeding sites for the LWfG, both on arable lands and on grasslands (Tar 2004). There is also a further need to collect more data on the space use of the species through monitoring, both in relation to the planned

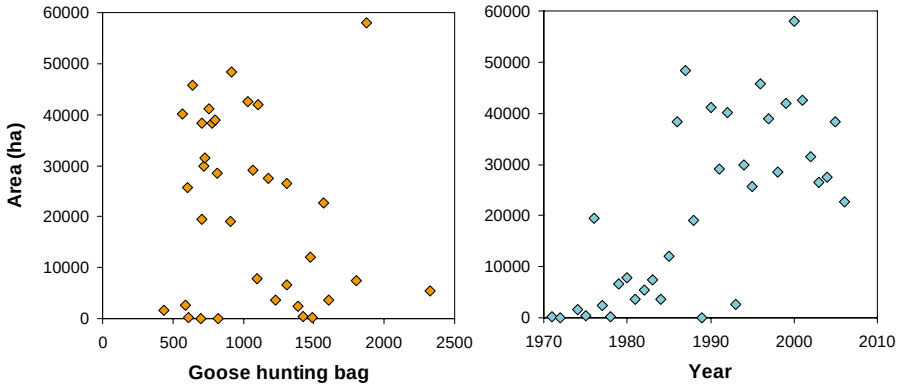

Figure 7. Total area where Lesser White-fronted Geese were observed in the Hortobágy area in the years between 1971 and 2006 as a function of hunting pressure (A) and by years (B). Total area was calculated as the area of the minimum convex polygon that incorporated all observations within a year. Hunting bag data were summed over the five counties in the study region.

habitat management actions and also to gain more knowledge of habitat-preference. This study also identified some areas (e.g. Borsodi Mezőség) that can be important in staging, but have not been monitored regularly. Finally, hunting associations in the general area need to be informed and asked to contribute to the ongoing efforts to save the Fennoscandian population of LWfG from extinction. Our efforts in achieving these goals are described in an accompanying paper (Tar et al. 2009).

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Monitoring of Lesser White-fronted Geese in Greece

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1. Introduction

During the last 12 years efforts for monitoring the wintering Lesser White-fronted Geese (*Anser erythropus*, hereafter LWfG) in Greece have been intensified through various projects, which took place mainly in Lake Kerkini and in the Evros Delta.

The LWfG is a rare but regular winter visitor in north-eastern Greece, with numbers ranging from ca 40 to more than 100 birds during the last three decades (Handrinos & Goutner 1990, HOS & HBRC 2008, Naziridis pers.com, Vangeluwe 2004, 2005, Kazantzidis & Naziridis 1999). The historical maximum of observed LWfG in Greece is 487 individuals in 1973 at the Evros Delta (Johnson & Carp 1973) while an older observation of 1630 LWfG at the Evros Delta in 1963 (Hoffmann et al. 1964) which has been sited by numerous publications and previously considered as a record count, has recently been rejected by the Hellenic Rarities Committee (in press).

Although historical data from the turn of the 19th century show that the range of the species covered a larger part of the Greek mainland (Handrinos & Akriotis 1997), today the species is confined to the major wetlands of central and east Macedonia and Thrace, more specifically to Lake Kerkini and the Evros Delta, and to lesser extent to Lake Ismarida (Mitrikou) and the Nestos Delta (Figure 1).

In the last 20 years several projects aiming at the conservation of LWfG in Greece included regular monitoring and have provided useful knowledge about the species' occurrence in the country.

The aim of this paper is to present monitoring data collected during 2005–2008 in the framework of the present LWfG LIFE project and link it to older data in order to formulate a better picture of the wintering pattern of LWfG in Greece.

2. Materials and methods

2.1. Site description

Monitoring of LWfG took place primarily at Lake Kerkini and Evros Delta and secondarily at Nestos Delta and Lake Ismarida in cases when the wintering LWfG were not all concentrated in the first two sites (Figure 1). All these four wetlands are designated as Ramsar sites, Specially Protected Areas (SPA) and Sites of Community Importance (SCI) as well as National Parks according to the national legislation.

a) Evros Delta: The Evros River forms the natural border between Greece and Turkey, and the Greek part of the Evros Delta (N 40°52', E 26°00') is a protected area of 188 km^2 and includes the lower part of Evros river with coastal lagoons, salt marshes, reed beds, tamarisk shrub, cultivations, riparian woodland, sandbanks and islets as well as wet and dry meadows. The LWfG wintering habitat consists of saltmarshes and natural grassland.

b) Lake Kerkini: Lake Kerkini (N 41°12', E 23°09') is a large, artificial freshwater lake fed by the Strymonas River and is used for irrigation and flood control. The size of the protected area is 830 km^2 and apart from the lake it includes riparian forest, river mouth, wet meadows and flooded areas surrounded by forested mountains. The LWfG habitat here consists of sparsely vegetated alluvial areas revealed by the lowering of the lake's water level and they are located at the northeast part of the lake.

c) Lake Ismarida and the Nestos Delta: Both these wetlands belong to the National Park of East Macedonia and Thrace which covers an area of 950 km^2. Lake Ismarida (N 40°59', E 25°19') is a natural shallow freshwater lake surrounded by cultivations and is located 3 km inland from the Thracian coast. South of the lake there is a series of coastal lagoons, saltmarshes and some few freshwater marshes extending westwards until the Nestos Delta. The LWfG are using the saltmarsh areas east of the Lake and the wheat fields close to the lake as well as the reservoirs north of Ismarida and the areas close to the Elos and Ptelea lagoons. The Nestos Delta (N 40°50', E 25°05') includes the embanked river Nestos, seven coastal lagoons to the west and coastal saltmarshes and freshwater marshes to the east. The LWfG have only been observed at the eastern part of the delta where there are large expanses of low grassland, and a mosaic of wheat fields, natural grassland with ponds and flooded areas.

Figure 1. Map of wintering sites of Lesser White-fronted Goose in Greece.

2.2. Monitoring

Lake Kerkini and the Evros Delta were monitored on a nearly weekly basis between mid October to end of March for four winter periods (2005–2006, 2006–2007, 2007–2008 and 2008–2009; for technical reasons the results of the winter 2008–2009 are not presented here except for a short preliminary note in the end of the chapter 3.1.). Lake Ismarida and Nestos Delta were monitored irregularly when needed, i.e. when some or all the LWfG where not present at Lake Kerkini or at the Evros Delta. The LWfG were observed with telescope 20–60X and 90X and for every flock we recorded position and number of individuals, juveniles and colour-ringed birds. The observation distance varied from 0.4 to 2.8 km.

During the winter 2006–2007, the monitoring was assisted by data from a pair of satellite tagged individuals (see Øien et al. 2009).

3. Results

3.1. Wintering population

During the winters of 2005–2006, 2006–2007 and 2007–2008, the maximum number of wintering LWfG in Greece ranged from 44 to 56 individuals. It is important to note, that these are maximum daily counts of individuals observed simultaneously (i.e. not total numbers of different individuals recognized by the belly patch pattern, cf. Aarvak et. al 2009), Wintering numbers of LWfG appear to have been stable in the period 1974–2008 (r=0.0073, p=0.8988) despite some peak numbers (i.e. 113 LWfG at Evros delta in winter 1998) (Figures 2 and 3). The wintering numbers at Lake Kerkini and the Evros Delta seem to have been stable between the winters 2003–2004 and 2007–2008 with Lake Kerkini always having lower numbers than the Evros delta. The wintering numbers at other sites and especially at Lake Ismarida have dropped drastically.

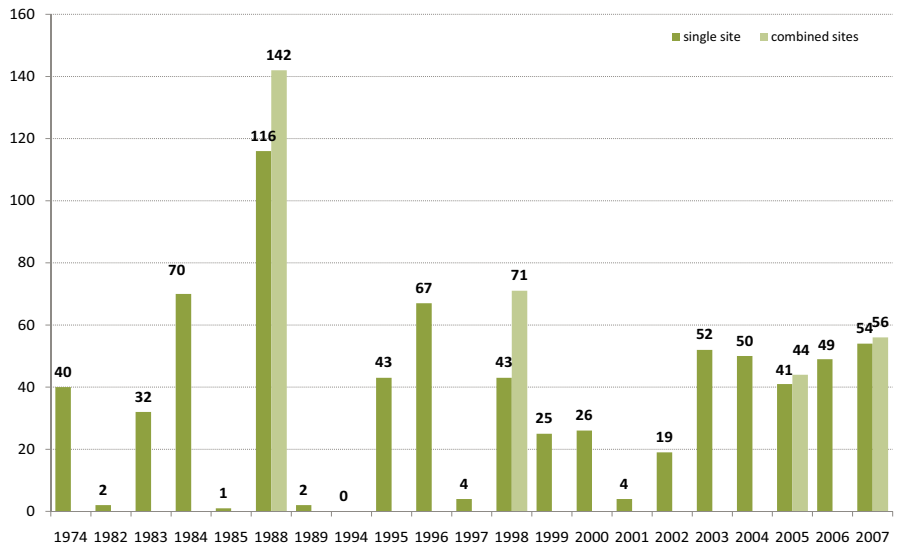

Figure 2. Highest annual counts of wintering numbers of Lesser White-fronted Geese in Greece (1974 – 2008).

It is important to point out that 50–100% of the wintering LWfG are missing for two to more than four weeks each winter from all monitored sites in Greece and this happens within a period between January to end of February, varying each year (Figure 4). In the winter of 1998–1999 part of the birds missing from Kerkini and Evros were observed at Lake Ismarida.

The monitoring of the LWfG in Greece as a part of the LWFG Life project was extended to cover also the winter 2008–2009. The monitoring was still ongoing when this report was finalized (end of February 2009). The preliminary results by the end of February 2009 were that LWfG were exceptionally observed only at Lake Kerkini. The first LWfG (a flock of 30–34 individuals) were observed on 3 November, and the highest daily count of 45 individuals, including 4 juveniles and 4 colour ringed birds, was made in 27 November. The last confirmed observation (of at least 10 individuals) was made on 10 February 2009.

3.2. Wintering period and movements

The LWfG arrive first at Lake Kerkini in late October – early November and stay there until late December – early January. From there they fly ca 250 km further east to the Evros Delta where they stay until late February – mid March (Figure 5). During five complete monitoring winters (1996-1997, 1998-1999, 2005-2006, 2006-2007 and 2007-2008 LWfG wintered

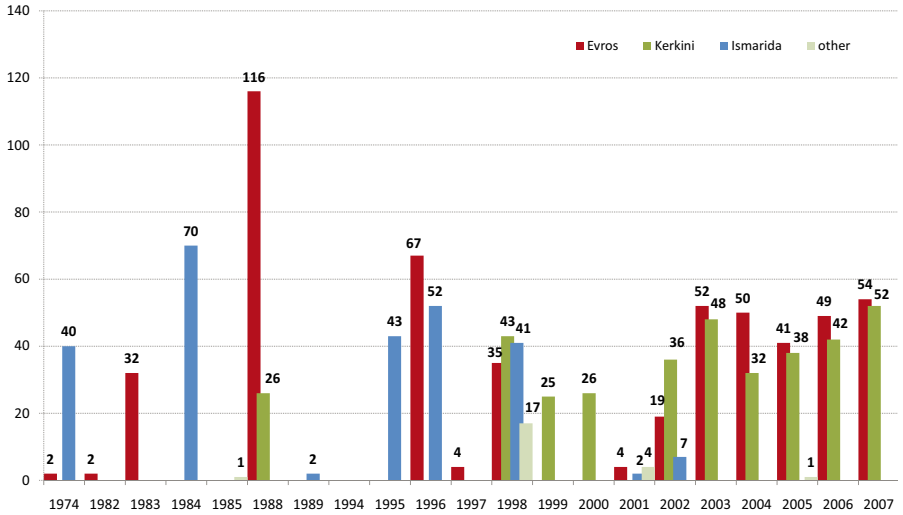

Figure 3. Maximum counts of wintering Lesser White-fronted Goose numbers per site and year (1974–2007). The year refers to the autumn.

in Greece for an annual average of 129 days (± 12.6), of which 62.6 (± 23.8) days were spent at Lake Kerkini and 80.8 (± 20.5) days at the Evros Delta (Figure 6).

Although this is the general pattern of the wintering schedule of the LWfG in Greece, it seems that all the birds do not follow it and various patterns have been observed in years when both Lake Kerkini and the Evros Delta were monitored regularly during the whole wintering season.

In the winter 2005–2006 the LWfG arrived at Lake Kerkini on 1 November and stayed there until 6 December. They were 30 individuals with 4–5 juveniles and no colour ringed individuals were observed (probably because of poor observation conditions with limited visibility). The first LWfG (38 individuals) arrived at the Evros Delta on 17 December, and one week later in mid January they became 41 individuals including 9 juveniles, and 4 colour ringed birds. Between mid-January and mid-February, all wintering LWfG were missing from both the Evros Delta and Lake Kerkini with the exception of one individual that was observed at the Nestos Delta in the beginning of February. Later, 32 LWfG returned at the Evros Delta and the numbers decreased gradually until the last 10 LWfG were seen on 27 February.

In the winter 2006–2007 the first LWfG was recorded on 28 October (signal of satellite tagged individual) at Lake Kerkini. By the end of November the number of LWfG at Lake Kerkini was 42 including 4 juveniles and 3 colour ringed birds, and 31 individuals were present until 21 December. At the Evros Delta the first few LWfG were observed on 26 December. Between December and mid-February, the numbers of LWfG ranged from 4 to 10 individulas at the Evros delta, and no LWfG were observed in the other wetlands. In the end of February 54 LWfG appeared at the Evros Delta, including 3 juveniles, 4 adult pairs and 6 colour ringed birds. In the beginning of March, a signal from a satellite tagged LWfG was received from Lake Kerkini, indicating a short stop there, just one day after they were lastly observed at the Evros Delta (see also Øien et al. 2009).

In the winter 2007–2008, LWfG were first observed (12 individuals) at Lake Kerkini on 4 November. By the end of the month, the flock had increased to 52 individuals including 5 juveniles, 1 adult pair and 3 colour ringed birds. 20 LWfG stayed at Lake Kerkini until 10 February. In the Evros Delta the first LWfG (10 individuals) were observed on 29 November. By mid-February the number ranged between 24–26 individuals including 3 adult pairs and up to 12 juveniles. At the end of February 52 individuals were observed, and the flock increased to 54 individuals by 14 March, which was the last day they were observed at the Evros Delta. In total 3 colour ringed LWfG were observed at the Evros Delta. This winter the total wintering LWfG population was at least 56 individuals in two separate flocks: 33 individuals in Kerkini and simultaneously 23 individuals in Evros (1–3 December).

Table 1. Observations of colour-ringed Lesser White-fronted Geese in Greece 1996–2008. References: 1) Theodoros Naziridis, 2) Didier Vangeluwe, 3) Lesser White-fronted Geese LIFE project, data before 2005 provided by T. Aarvak (pers. com.).

	Code	Area	Years	Ref.
1	Red-Black-Yellow L	Kerkini + Evros	1996, 1997	1
2	Yellow R	Kerkini + Evros	2000, 2002, 2004, 2005–2008	1,2,3
3	Yellow-Green L	Kerkini	2000	1
4	Green-Black R	Kerkini	2000, 2002, 2003	1
5	Red-Black L	Kerkini	2000	1
6	Black-White L	Kerkini	2002	1
7	Black-Red L	Kerkini	2002, 2003, 2004	1
8	Black-Green R	Kerkini	2002	1
9	Red-White L (Nieida)	Kerkini + Evros	2002, 2004–2008	1,2,3
10	White-Green L	Kerkini + Evros	2002–2005	1,2
11	Orange-Yellow R	Evros	2005–2007	2,3
12	Black-Red L	Kerkini + Evros	2005–2008	2,3
13	Red-Black L	Evros	2004–2005	2
14	Orange-Red L (Finn)	Kerkini + Evros	2006–2008	3
15	Red-White R (Máddu)	Kerkini + Evros	2007–2008	2,3
16	Red-Orange R (Mánnu)	Kerkini + Evros	2007	2, 3

3.3 Observations of colour ringed individuals

Colour ringed LWfG were first observed in Greece in 1996 (T.Aarvak pers.com.). In total 16 colour ringed individuals out of 50 ringed in Norway (Table 1) have been observed in Lake Kerkini or at the Evros Delta, of which 7 different birds were observed between autumn 2005 to March 2008. More specifically there are 45 observations of 11 individuals at the Evros Delta in the year 2004–2008, of which 7 individuals were observed. Recording colour ringed birds at Lake Kerkini is more difficult due to long observation distances and often foggy observation conditions. However in the years 1996–2008 there were 29 observations of 16 different colour ringed individuals at Lake Kerkini of which 6 individuals were observed during the LIFE project period (2005–2008) (Table 2).

Some colour ringed LWfG have been present in Greece annually since 2002 or even since 2000 (see Table 1). One individual has only been observed at the Evros Delta for three consecutive years. Maximum continuous stay of any single colour ringed LWfG in the same site was 100 days at the Evros Delta in the winter 2007–2008. It is also noteworthy that in winter 2007–2008 out of six colour ringed birds that were observed in total, three spent the whole winter at Kerkini Lake and three at the Evros Delta.

4. Discussion

During the winters of 2005–2008 the number of LWfG wintering in Greece was in the order of 50 birds. Lake Kerkini is their first stop-over site in Greece where, depending on the year, most or all of LWfG wintering in Greece are observed during November–December. Later in winter the LWfG flock, or a part of it, move to the Evros Delta, but in January and February the

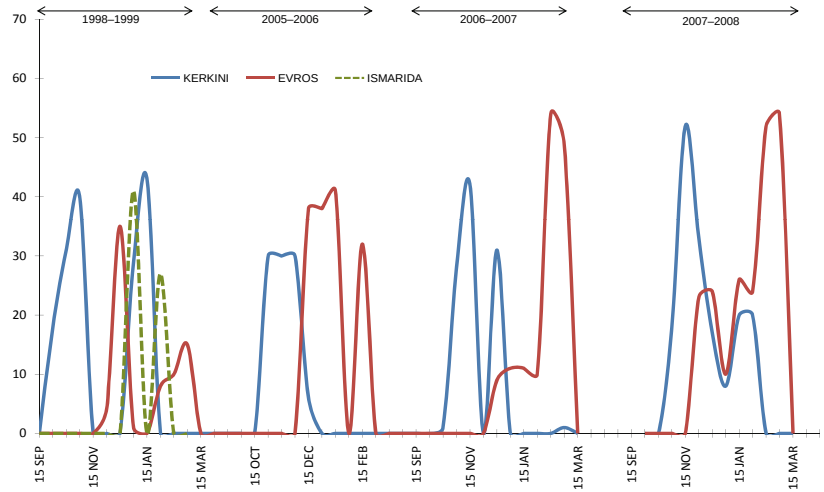

Figure 4. Fluctuations of the number of wintering Lesser White-fronted Geese at Lake Kerkini, Evros Delta and other wetlands during years of regular monitoring (1998–1999*, 2005–2006, 2006–2007, 2007–2008). *1998–1999 data from Kazantzidis & Naziridis 1999.

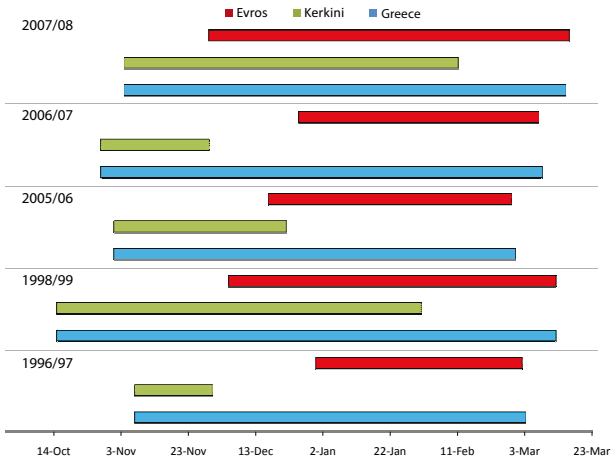

Figure 5. Annual wintering period of Lesser White-fronted Geese in Greece (Lake Kerkini and Evros Delta).

Table 2. Observations of colour-ringed Lesser White-fronted Geese per site and year (October 2005 – March 2008).

	2005–2006		2006–2007		2007–2008	
	Kerkini	Evros	Kerkini	Evros	Kerkini	Evros
Yellow R		+				+
Red-White L "Nieida"		+	+	+		+
Orange-Yellow R		+		+		
Black-Red L		+		+	+	
Orange-Red L "Finn"			+	+		+
Red-White R "Máddu"				+	+	
Red-Orange R "Mánnu"				+	+	
Total observed per site	0	4	2	6	3	3
Total observed per year	4		6		6	

total number of LWfG usually decreases at both sites. This is an indication that all LWfG arriving at Kerkini are not moving (at least directly) to the Evros Delta, which is further supported by the fact that in the winter 2007–2008 three colour-ringed birds observed at Kerkini were not recorded later at the Evros Delta, and on the other hand one colour-ringed bird observed at the Evros Delta during the winters 2004–2005, 2005–2006 and 2006–2007 has never been observed at Lake Kerkini.

It is assumed that the LWfG flock split into smaller groups and use partly unknown sites. Observations from the 1980's and 1990's indicate that Lake Ismarida and the Nestos Delta formerly played a role of a regular stop-over site between Kerkini and Evros. At present, however, despite repeated visits, no LWfG have been observed at the Lake Ismarida wetland complex and we presume that the area has lost its significance for wintering LWfG because of disturbance, heavy poaching and habitat destruction.

Therefore, the observed reduced numbers or complete absence of LWfG in Evros Delta and Lake Kerkini in most years in January – February indicate that the missing birds are using another unknown site(s) either in Greece or in neighbouring counties.

In addition to being an important wintering site for LWfG, the Evros Delta also seems to serve as the first spring staging area in the beginning of the return trip to Fennoscandia. This is because in late February–early March we observed a peak of LWfG at the Evros Delta, sometimes surpassing the total number of wintering LWfG in Greece. The fact that part of the birds observed in late autumn at Lake Kerkini do not show up at the Evros Delta in early spring, might slightly raise the total number of wintering LWfG in Greece. In order to document this, however, more observations of individually identified birds are needed (i.e. belly patch analysis, see Aarvak et al. 2009).

Monitoring of LWfG in Greece in the years 1997–2008 has also helped in raising awareness about the species among ornithologists. It is noteworthy that observations of LWfG have been very scarce during the annual Midwinter Waterfowl Counts because observers were not especially looking for them or they could not identify them. In recent years some LWfG observations have been reported from birdwatchers, which might help in finding the "mystery" wintering site, which is one of the main challenges for future conservation-related research on the critically endangered Fennoscandian LWfG population.

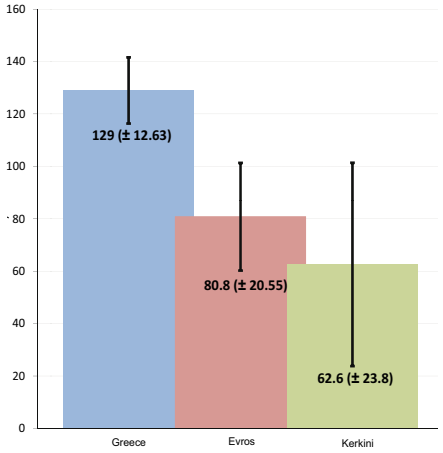

Figure 6. Average duration (days) of Lesser White-fronted Geese wintering period in Greece in the winters 1996/97, 1998/99 and 2005/06–2007/08.

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Public awareness campaign for the Lesser White-fronted Goose in Greece

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Visitors to the Kerkini National Park studying the information sign of the LIFE project at Mandraki. © Petteri Tolvanen, Lake Kerkini, November 2008

1. Introduction

The public awareness actions of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) started in Greece as early as the late 1980s when a poster and a leaflet were published focusing on the conservation of the LWfG and the Slender-billed Curlew (*Numenius tenuirostris*) in the Evros Delta. In the years that followed more such actions were included in subsequent LIFE-Nature projects that were either species or sites oriented. This article presents the public awareness actions implemented in the context of the LWfG LIFE-Nature project (2005–2009).

2. Aims and target groups

The public awareness campaign of the LWfG LIFE project took place from August 2006 until the end of 2008, with preparatory activities starting in 2005. The campaign was mainly focusing on the Evros Delta area, and its main target groups were hunters and farmers.

The key objectives were to make hunters and farmers aware of the reasons for the globally threatened status of the LWfG, of the most important threats for the species and possibilities to avoid them. Furthermore the campaign addressed the serious problems in identification (especially separating LWfG and the Greater White-fronted Goose (*Anser albifr ons*, hereafter GWfG), as well as to provide guidance for implementation of the EU agri-environment measures favourable for the LWfG.

Preparatory activities included an assessment of the farming situation at Evros Delta (e.g. existing crops and farming systems, existing agri-environment measures, crop damages by geese, etc.) and communication with hunters and farmers organisations as well as with officials of competent authorities at both local and national level.

3. Results

3.1. Farming issues

The period of the campaign coincided with the period when the Greek Ministry of Rural Development and Food (MRDF) was preparing the strategy for the forthcoming EU financial framework 2007–2013. This provided us the opportunity to submit proposals for the new agri-environment schemes at an early stage and have them included in the MRDF's Rural Development Plan that was eventually approved by the European Commission (EC). Among others, our proposals included the listing of the LWfG in the protected species which can be targeted by certain agri-environment schemes with wildlife conservation objectives. On the other hand, this period was characterised by

long delays both from the MRDF's and the European Commission's side and as a result all the necessary decisions for the implementation of the agri-environment schemes were still pending by the end of 2008.

In June 2007 we organised a training meeting focussing on the farming issues in relation to LWfG conservation at the Evros Delta, with the co-operation of the management authority of the Evros delta national park. The participants included officials from local public services, the prefecture and local municipalities, farmers' and livestock breeders' unions, environmental NGOs and the MRDF. The main objective of the meeting was to present the problems of the LWfG and the benefits of properly planned agri-environment schemes to key people involved in the agriculture sector of the area and to update them about the forthcoming schemes in order to promote them at a local level. Although the interest of the audience was very high and the discussion very fruitful, their pessimism about the procedures imposed by both the EC and the MRDF was evident. In addition to the local newspapers the meeting was covered by at least two regional TV stations on the evening news.

3.2. Hunting issues

The kick-off of the campaign targeting the hunting issues was very successful as in August 2006 we had an article prepared by the LWfG LIFE project published in a book called "Hunting manual 2006" (320 pages) that was freely distributed to all hunters in Northern Greece (ca. 55,000 copies) together with their annual hunting permit. The article was on three pages with colour illustrations and it mainly covered the problems of identification of LWfG and separating it from the GWfG. However, it also provided general information about the species and its conservation status and about the LIFE project and its objectives and actions.

Unfortunately, soon after that, the co-operation with the hunters' organisations became very complicated as the Hellenic Hunters Confederation (HHC) was involved. The HHC is the top level hunters' organisation in Greece with all others, regional and local, being subordinate to it. The HHC insisted that any co-operation with any lower level hunters' organisation would require their approval and started a lengthy dialogue that proved to be fruitless as eventually in November 2007 they rejected all the proposals by the LWfG LIFE project for co-operation. Our proposals included specific activities such as the co-organising of a training meeting for hunters and of joint bag controls at the Evros Delta as well as the establishment of a joint alert network for monitoring and intensive guarding. Nevertheless, despite the obstacles in the co-operation at the national level, we managed to arrange a meeting with the most important hunters' club of the Evros area where we presented the situation with the LWfG at Evros Delta emphasizing on the problem of its identification for the hunters of this critically important area for the LWfG.

3.3. The Mánnu case

An adult male LWfG named as Mánnu, individually colour-ring-marked by the LIFE project close to its breeding area in northern Norway in May 2006, was found dead at Lake Kerkini. Mánnu was last observed alive on 10 December 2007 in the area, and it was found dead only two days later, on 12 December, inside a non-hunting zone within the Kerkini National Park and very close (ca. 700 m) to the regular feeding area of

The LWfG male Mánnu being released after colour ringing at the Valdak Marshes, Finnmark, Norway in May 2006. © Ingar Jostein Øien

the LWfG. The autopsy performed by the Finnish Food Safety Authority Evira confirmed that the bird was killed with a shotgun and this triggered an important part of the project's public awareness campaign. At national level in Greece many articles in newspapers and magazines were published and the news was also covered by radio and TV at prime time. At the international level the news was published on the web sites of BirdLife International and WWF International. There was also coverage by media in other countries, forwarded by the partners of the LIFE project, i.e. Finland and Norway. Letters of appeal were sent to competent authorities in Greece but also to the EC. The main point in the appeal letters was that the Greek authorities should fulfil their obligations in protecting LWfG (an EU Birds Directive Annex I species) effectively at the known main wintering sites, and also in safeguarding these Natura 2000 (SPA, SCI) sites so that poaching will not threaten endangered species. The Hellenic Ornithological Society (HOS) lodged a complaint at the competent prosecutor demanding the indictment of any wrongdoer and the initiation of preliminary investigation in order for the perpetrators to be traced. Until the end of 2008 we did not receive any reply to our appeals from the Greek authorities or from the EC.

3.4. Published material

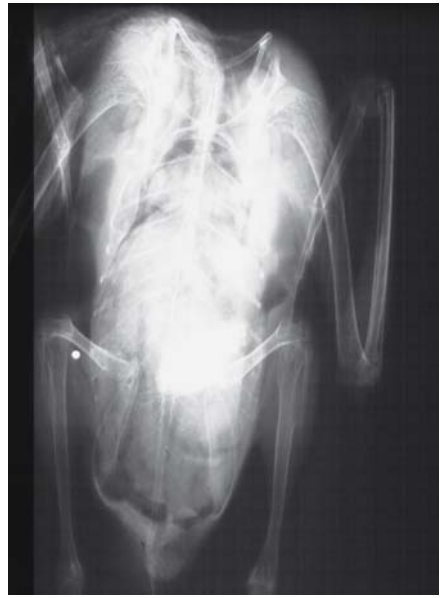
The main printed material of the campaign were an information booklet and an identification poster. The 24-pages booklet was printed in 5,000 copies and included information on the species' distribution and conservation status globally as well as in Europe and Greece. Further, the booklet focused on the threats to the species, identification issues, the LIFE project and its actions, agricultural issues and satellite tracking of LWfG. It targeted primarily the hunters and farmers but also the wider public. The poster on identification was printed at 33x48 cm in 1,500 copies and targeted mainly the hunters. They were both distributed at the meetings with the farmers and hunters, at the information centres of both Evros Delta and Lake Kerkini national parks and to hunters at the Evros Delta during field visits. They were also mailed to selected hunters' local clubs and to all hunters' federations. All the material was also made available on the project web site.

Besides the aforementioned article included in the 'Hunting manual 2006' several articles were prepared and published in newspapers and ecological magazines as well as an extensive 30-pages long special section devoted to the LWfG in the HOS quarterly magazine Oionos. Furthermore, web pages were designed and are hosted as a special section for the LWfG in HOS website.

4. Discussion

Despite the obstacles encountered, the campaign led to results important for the conservation of the species, but also taught us lessons that should be used in future efforts for more efficient campaigns.

Regarding the farming issues the situation is very complicated and extends beyond the time limits of a LIFE project as it involves many factors most of which are external and cannot be handled by a project team on its own. It involves good knowledge of the species' habitat requirements, intensive lobbying of officials of the ministries and local services, lengthy procedures of the MRDF and the EC, very careful planning of measures both in terms of the species conservation and the farmers benefits. In addition it requires and a very good promotion of the agri-environment schemes among farmers but also among the competent authorities. All these by themselves require a long-term constant effort and a great deal of patience.



Radiograph of the body of the Lesser White-fronted Goose male Mánnu, shot at Lake Kerkini in December 2007. The shotgun pellet that is visible on the leg penetrated several internal organs, and the bird died of internal bleeding. © The Lesser White-fronted Goose LIFE project

The co-operation with the hunters is essential for the case of the LWfG not only because of the possible misidentification of the species but also because in Greece the only effective guarding force against poaching is the one run by the hunters' federations while the state hunting control is practically non-existing. At the local and personal level co-operation with the hunters is sincere and productive in most cases but as it shifts to the national and international level it is influenced by general pro- or con- hunting policies that inhibit the treatment of the particular problem in question. Perhaps this shows us the way to the approach of both sides in Greece and also in some other countries; working together locally can build mutual trust and respect which may in turn facilitate an approach at higher level. In our case, the LWfG issue probably was a hot potato in the hands of the HHC which chose not to co-operate.

Apart from the specific key target groups, the general public also has to be targeted by such campaigns. The media in Greece did not respond positively to press releases unless they were linked with a 'hot' news item. In our case we managed to get good coverage mainly when we took advantage of two such cases, namely the aforementioned Mánnu case and one year before that the presence of the satellite tagged LWfG pair in Greece.

Last but not least is the target group of the already aware people, such as birdwatchers and conservationists in general. They are often not included in awareness campaigns. As we saw in our case it is important to provide them knowledge and information and this way stimulate their active participation in conservation activities, e.g. by reporting their observations without delay.

A note on the diet of the Lesser White-fronted Goose wintering in the Evros Delta, Greece

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Droppings of Lesser White-fronted Goose. © Maria Panagiotopoulou, December 2005

1. Introduction

The Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) is a globally threatened species, and its world population size is estimated at 28,000 – 33,000 individuals (Jones et al. 2008). The Fennoscandian population however, is on the verge of extinction. It is estimated that about 20 pairs comprise the total population in the Nordic countries (Jones et al. 2008). The known breeding areas of the Fennoscandian population are located in northernmost Norway, and they usually winter in east-central Europe and the Balkans (see e.g. Jones et al. 2008). The main wintering areas are the Lake Kerkini and the Evros Delta in Greece (Lorentsen et al. 1998, Kazantzidis & Naziridis 1999, Vangeluwe 2004).

There is some knowledge about the diet composition of the LWfG in northern Europe, mainly during spring, summer and autumn (Aarvak et al. 1996, Niemelä & Markkola 1997, Markkola et al. 2003). Grasses were the most important food category for the LWfG, whereas consumption of dicotyledons was at a relatively low level. However, there is a lack of knowledge on LWfG diet in southern Europe during winter. It is well documented that food plays a major role for bird species in order to withstand the harsh weather conditions during winter and also to be prepared for the trip back to their breeding areas (Owen & Black 1990). Thus, it is of vital importance to broaden the scientific knowledge about the diet composition of wildfowl species in Greek wetlands during winter especially for management purposes. In this study, we report some preliminary results about the diet of LWfG wintering in the Evros Delta, Greece. Before the present study, there is not a single report on this topic in the Mediterranean region.

2. Material and Methods

The Evros Delta is a well-known wetland, and more than 300 bird species use this area at least for a specific period of the year; about 30 % of them are characterized as threatened or endangered, such as the LWfG (Goutner et al. 2005). Concerning the LWfG, the two most important sites in the Evros Delta are the Dimitriadi and the Paloukia sites, where up to 54 individuals have been observed during the last winters. Several human activities such as hunting, agriculture, livestock farming, fishing and tourism take place in the Evros Delta. The most important crops are cereals (mainly wheat, barley and maize) and also trefoils for animal feeding. The main livestock species in this area is cattle. Livestock grazing is performed without shepherds (animals are free to graze wherever they like) for a 7–9 month period annually.

This area is dominated mainly by two vegetation communities, halophyte and grass-forb, forming a temporal dynamic mosaic due to many involved factors such as the presence and the quality of the water, salinity etc. Halophytes are the dominant species in this landscape and the most common ones are *Salicornia europaea, Halimione portulacoide* s and *Limonium bellidifolium*. Grasses are the most valuable plants in the Evros Delta, since the major herbivore assemblages in this area, both mammalian and avian, use more intensively the grass communities (Karmiris et al. 2008). In addition, the main dietary items of cattle, feral horses, Brown Hare (*Lepus europaeus*) and White-fronted Goose (*Anser albifrons*) are the grasses (Papachristou et al. 2008). Thus, there is high possibility of emerging competitive interactions among these herbivores for food especially in cases of food limitation. Other vegetation categories, which may encounter in these sites are legumes (mainly medics and trefoils), forbs (with a great diversity of plant species, but they constitute only a minor portion of vegetation composition) and woody species which grow either solitary or in small groups.

We had the opportunity to collect fresh droppings of LWfG in early winter 2005–2006, when a flock of 38 individuals arrived in the Paloukia site. We watched them carefully without causing disturbance and when the birds left the site we went and collected 10 fresh droppings. In addition, the most common plant species present at these two sites were collected and microscope slides were prepared for reference. The diet composition of LWfG was determined by microscopic analysis of 9 droppings (one of the droppings was excluded from analysis due to inappropriate preservation). Five microscope slides were prepared per dropping, and the particle frequency was examined from twenty systematically selected fields. Hairs and trichomes were disregarded (unless they were attached to identified epidermal tissue). Diet composition was determined using the frequency addition procedure, i.e. dividing the frequency of each species by the total number of frequencies for all species (Holechek & Gross 1982). Each plant species was assigned to one of the following forage classes: grasses, other monocotyledons, legumes, other forbs, halophytes, woody vegetation and agricultural crops. This technique has the distinct advantage of estimating diet composition without disturbance for the studied animals (Holechek et al. 1984).

3. Results

Wild grasses were the main food category of the LWfG (Figure 1). Their proportion was up to 68 %. Cultivated grasses (mainly wheat) constituted 6.9 % of the total diet. Thus, wild and cultivated grasses together constituted up to three quarters of the total diet of the LWfG. The importance of the grasses is further underlined by the fact that grasses were not the dominant plant species in the foraging areas. Other monocotyledons (i.e. species belonging to the genera *Carex, Eleocharis, Scirpus* , and others) were also consumed by LWfG, and their proportion was 5.4 %. Legumes and other forbs were of secondary importance for LWfG. Halophytes, despite their dominance in vegetation composition, were consumed in low proportion.

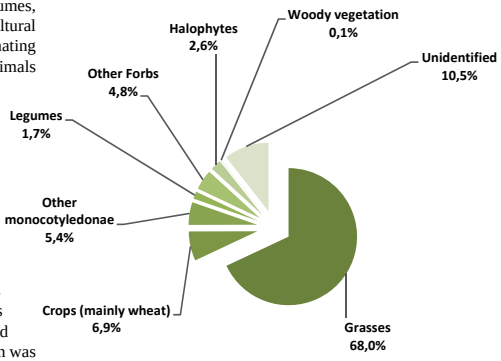

Figure 1. Major food categories of the Lesser White-fronted Goose in the Evros Delta.

4. Discussion

Grasses were by far the most important food category of the LWfG in the Evros Delta. Hence, applied management efforts (livestock grazing management, control of water and salinity levels, regulation of sediment deposition, etc.) aiming at improving the wintering conditions of the LWfG should concentrate primarily on the protection and enhancement of grass communities, in order to ensure dietary needs of the LWfG throughout the wintering period. However, terrestrial habitats surrounding Greek wetlands are usually used as grazing sites for livestock. The interactions between LWfG and livestock in terrestrial habitats have not been studied in detail, even though such studies might reveal valuable solutions for the management of these habitats for multiple purposes (goose conservation and livestock development). Proper livestock grazing influences both the diet breadth and the movement behavior of herbivores (Stuth 1991). Small-bodied herbivores usually require less feeding time than large ones, and spend more time in searching for preferable food items. Hence, when available food is limited, herbivores with small body size, such as the LWfG, are expected to spend less time in a specific feeding site and to move longer distances between available sites (Demment & van Soest 1985). If availability of grasses, which constitute the bulk of the food of LWfG, is limited, then it is very likely that geese may be forced to spend more energy looking for favorable feeding areas and also to use more often sub-optial sites (e.g. sites with an increased mortality risk due to higher hunting pressure). Both of these responses are disadvantages both for the survival ability during winter and for the upcoming reproduction success. The use of grazing livestock as a 'habitat manipulator' in order to favour the LWfG is connected to how similar their feeding niches are. Food partitioning (i.e. partition of available forage resources by livestock and geese) leads to a more efficient use of the available resources and to more stable and productive ecosystems. Otherwise (i.e. if these species target the same forage resources), negative interactions (competition) may emerge and ultimately their coexistence would be at risk, especially in cases of limited availability of resources.

It is important to note that LWfG has been observed to forage exclusively at the Dimitriadis and Paloukia sites during daylight. In these sites (and in all parts of the Evros Delta where hunting is not allowed), there are no wheat fields. The fact that 6.9 % of the total diet of the LWfG consisted of cultivated crops

Cattle grazing on the Dimitriadi grasslands, which are preferred also by the Lesser White-fronted Geese wintering in the Evros Delta. © Petteri Tolvanen, November 2006

The Paloukia grasslands are also preferred by the Lesser White-fronted Geese in the Evros Delta. © Petteri Tolvanen, November 2006

(wheat), shows that the LWfG visit other places (outside the hunting free zone) too, possibly at night. At the moment, it is unknown if the LWfG visit these sites mainly looking for food (which seems very possible, since availability of wild grasses is limited in Dimitriadis and Paloukia sites), or for other reasons (e.g. for roosting, because of disturbance, etc.). However, this raises an important conservation implication, since such movements outside of the protected area is a risk for the LWfG, both because of energy spending and, above all, because of increased mortality risk due to hunting.

The availability and quality of food are considered to be the principal factors influencing the site selection of waterfowl. The abundance, accessibility and nutrient content of potential food may be quite different between Mediterranean wetlands, as a combined result of many environmental factors, such as salinity, water depth and turbidity, light and temperature, nutrient level of the water body, etc. The LWfG may be an opportunistic species, such as the majority of waterfowl, able to adjust its foraging strategy to many temporal and space variant factors, e.g. hunting pressure, protection of adverse weather conditions, human disturbance, etc. Therefore, there is a possibility that individuals of the same species may rely upon different food resources at different sites. As an example, the diet of LWfG in Lake Kerkini may be quite different from their diet in the Evros Delta. This has already been shown for Wigeon (*Anas penelope*) in north-western Europe and it has also been documented for several other dabbling ducks and Coot (*Fulica atra*) in Greece (Papachristou et al. 2008).

The findings in the present study give an incentive for future research in order to understand how the LWfG behave and what are their interactions with grazing livestock and other herbivores; if there is spatial variation in the LWfG diet composition; and especially, to what extent the differences in diet composition are a consequence of food availability and quality. Understanding the mechanisms that define the selection of sites by the LWfG would make our predictions on the dynamics of plant-goose communities more reliable, and consequently the holistic wetland conservation more realizable. This knowledge might result in applications of vital importance for LWfG conservation efforts at the staging and wintering sites.

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Population size estimation of the Fennoscandian Lesser White-fronted Goose based on individual recognition and colour ringing

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1. Introduction

The Lesser White-fronted Geese are recorded on digital video in order to analyse the individual belly patch pattern. The video camera is mounted on a spotting scope. © Morten Ekker, Valdak Marshes, Norway, June 2008

In the early 1900's and until the 1990's the estimation of the numbers of Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) at any site was approximated simply by daily maximum counts at the traditional staging sites. However, this method does not take into account the continuous turnover of individuals; i.e. as the migration proceed some geese will arrive, stage for some days and leave at the same time as others would arrive, even if the daily counts do not vary much. This is well demonstrated e.g. at the Estonian spring staging area of the Barnacle Goose (*Branta leucopsis*): the numbers of staging birds remain more or less similar in a period of a couple of weeks in May, while according to Eichhorn (2008) single individuals are actually staying in the area on average only for a couple of days.

In 1990–1991 NOF – BirdLife Norway developed a method where all the observed LWfG are individually identified based on their black belly patch pattern (Øien et al. 1996). The belly patches of each individual were drawn on readymade sheets in the field. This method allowed individual identification of practically all the LWfG present on a daily basis, and thereby revealing the turnover of geese at the site as well as allowing for a precise estimate of the total number of different LWfG individuals in the area during the whole staging period. It should be noted that the method is rather laborious and if the number of LWfG at the site had been in the order of some hundreds or more, the method would not have been applicable in practice. Later on we started to record the individuals also on digital video shot, through a spotting scope ("videoscoping") in addition to drawing the belly patches. Because the belly patch pattern is changing annually (to a variable extent) in the complete moult in late summer, all individuals cannot be reliably identified by this method in subsequent years.

In 1998 the belly patch drawings and video material from the Valdak Marshes in spring were compared for the first time with photos and drawings made during the same spring on the Bothnian Bay Coast in Finland. This analysis showed that roughly 75% of the geese staging at the Bothnian Bay Coast migrated further to the Valdak Marshes (Aarvak et al. 1999).

2. Methods

Since 1990 all the spring staging LWfG at the Valdak Marshes in Finnmark, Norway were drawn on readymade sheets and from 1998 onwards they were also video recorded through spotting scope in order to improve the individual identification. With the combined magnification of the telescope (20–60x eyepiece) and the zoom of the video camera it revealed the belly patches better and allowed for a more precise analysis. In 2001 this method was extended to be utilized also at the spring staging sites on the Finnish Bothnian Bay coast and in western Estonia. Through the EU-Life project (from spring 2005 onwards) some video tapes have also been collected in the Hortobágy National Park in Hungary and in the Evros Delta in Greece, and the work was intensified in Estonia and Finland. All the tapes and drawings for each spring were analysed consecutively by the same person. In the analyses of belly patch data and video material, only data from Norway, Finland and Estonia were used unless otherwise stated.

In the present article the results are analysed on the basis of the spring monitoring data from the Valdak Marshes, Finnmark, Norway. This is because this site has been monitored intensively annually since 1990 and the site has been believed to hold the majority of the remaining Nordic part of the Fennoscandian breeding population (i.e. the part of the Fennoscandian wild LWfG population that is breeding in the Nordic countries; Norway, Sweden and Finland) before they move to the breeding site.

To standardise the analyses of the video material we only used data from the years 2001–2008, in which period all three important sites (Estonia, Finland, and Norway) have been intensively monitored and most of the LWfG were also video recorded. In general, the share of the staging individuals that

Captures of the digital video material from spring 2007: the same male Lesser White-fronted Goose recorded on 28 April in Haeska, Estonia (on the left), and on 15 May at the Valdak Marshes, Norway (on the right).

Table 1. Total number of individually identified LWfG in Norway (No), Estonia (Es) and Finland (Fi) in the years 2001–2008, categorized according to where the individual has been identified – eg. either only in "Norway" or in all three different countries "No+Fi+Es" within one year. No individually identified LWfG will appear in more than one "site" in the table.

Year	Norway	Finland	Estonia	No+Fi+Es	No+Fi	No+Es	Fi+Es	sum
2001	28	–	–	8	5	–	–	41
2002	35	–	2	2	3	4	–	46
2003	31	–	–	2	3	7	–	43
2004	27	2	9	–	2	12	2	54
2005	35	–	9	4	2	2	1	53
2006	15	2	4	6	2	20	–	49
2007	18	2	4	4	–	8	–	36
2008	14	2	1	8	4	5	3	37

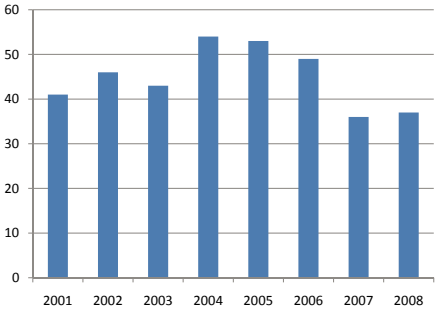

Figure 1. Total numbers of LWfG identified by analyses of belly patches and video during spring migration in Norway, Finland and Estonia in the years 2001–2008.

is recorded either on drawings or video recordings is close to 100% in Norway while a considerably lower and more variable share has been possible to record in Estonia.

To further improve the analysis we incorporated resighting data of colour ringed LWfG during spring migration from four monitoring sites: the Valdak Marshes (Norway), the Bothnian Bay Coast (Finland), western Estonia and Hortobágy (Hungary). We used the spring migration period from March to May to estimate resighting probability of colour ringed LWfG. Altogether 50 LWfG have been colour ringed at the Valdak Marshes in the years 1995–2008, of which 28 individuals ringed as adults were included in the analysis. The analysis was carried out with the program Mark (version 5.1, Cooch & White 2008). No covariates were included in the modelling. The estimate reported here is the one calculated by the model that fitted the data set best, e.g. the model with the lowest Akaike information criterion (AICc). The model should be adjusted for overdispersion by the Median c-hat method (QAICc) in cases where the model is not clearly different from all the three other possible models (varying or constant survival and varying or constant recovery rate), the model averaging procedure should be applied including all models with Delta QAICc ≤ 2. In all cases, sample size was defined as the number of marked individuals contributing to the survival/recovery estimation for the year interval(s) in question (i.e. not including those ringed in the last year because then survival and recovery cannot be distinguished).

3. Results

3.1. Analyses of belly patches

Based on analysis of the belly patches in the years 2001–2008, the mean spring staging population size of LWfG at the Valdak Marshes was 39.5 individuals (se=1.7, n=8). This was 1.9 times as many birds as the maximum daily counts for the same years (mean 21.8, se=0.12, n=8). Within this time period the number of birds decreased on average by 3.4% annually (CV=0.1225, p=0.10, for further trend analyses, see Aarvak & Øien 2009).

A mean of 44.9 individuals (adults and non-adults) per year was identified in the same study period by the belly patches (range 36–54, Figure 1) either in Norway, Finland or Estonia. Of these, a mean of 56.4% were exclusively seen at the Valdak Marshes, Norway (Figure 2, Table 1). However, this percentage decreased with less LWfG being seen only in Norway in the later years (2005–2008). In the first four years of the study period, an average of 66.6% of the individuals were exclusively seen in Norway, while in the last four years (2005–08) this share decreased to 46.1%. Looking at the share of individuals identified at the Valdak Marshes from the total pool of individuals identified either in Norway, Finland or Estonia, the Valdak Marshes accounts on average for 88.4%. This proportion has decreased from 92.9% in the first half of the study period to 84% in the second half of the study period. In Estonia, a mean of 10% of all identified geese were exclusively seen there. In Finland this percentage was as low as 4.4%, and only in three out of eight years there has been observed LWfG in Finland that were not seen elsewhere.

On average 11.6% more individuals are observed during spring migration when data from Finland and Estonia are included as compared to monitoring only at the Valdak Marshes in Norway. In other words, 11.6% of the identified individuals were not observed at the Valdak Marshes at all. This percentage has increased from 7.1% in the first four-year period (2001–2004) to 16.0% in the last four-year period (2005–2008).

Performing the same analysis only for adult pairs (a mean of 16.4 pairs per year) reveals a similar pattern, where 52.8% of all pairs were seen only at the Valdak Marshes (Table 2). At the Valdak Marshes, a mean of 89.8% of all pairs were seen each year. This percentage has decreased from 92.8% (2001–2004) to 86.8% (2005–2008). Thus, on average 10.2% of all pairs observed in Estonia, Finland and Norway were not seen at the Valdak Marshes (Norway). This percentage has increased from 7.2% in the first four year period (2001–2004) to 13.2% in the last four year period (2005–2008).

Interestingly, when comparing the total number of identified LWfG observed during spring migration (in Estonia, Finland and Norway) with the number of LWfG observed in Greece during the previous winter for the years 2003–2008 (i.e. years with good winter counts in Greece), as much as 91.1% (on average) of the winter numbers are observed during the spring migration in Estonia, Finland and/or Norway. However, there is still much to be learnt since this percentage varies from 66.7% (in 2007) to 120.5% (in 2005, when 53 different individuals were identified during spring migration as compared with the highest daily count of 44 individuals during the preceding winter in Greece (see eg. Aarvak & Øien 2009, Panagiotopoulou et al. 2009). Is has to be noted, however, that for Greece (and Hungary) we are delimited to maximum daily counts without comprehensive individual recognition.

3.2 Staging time and missing spring staging sites

Only 11.6% of all the individually identified LWfG were observed at all sites (Estonia, Finland and Norway) within a spring season. This shows that there are still big gaps in the knowledge on the whereabouts of the LWfG, and more spring staging sites in the north remain to be uncovered. Since 2001 we have 15 records of adult pairs using all three sites within the same season, and out of these, one pair was recorded in three different years (a female with a yellow colour ring on left leg). These pairs staged on average in 8.3, 3.5 and 6.1 days in Estonia, Finland and Norway respectively (Table 3). Between these sites, that are situated 680 km (Western Estonia to Finnish Bothnian Bay Coast) and 590 km (Bothnian Bay Coast to Valdak Marshes) from each other, the geese were absent (not observed) for 3.5 and 5.2 days respectively. At the Valdak Marshes the LWfG were observed in a mean of 4.7 days out of the staging period of 6.1 days (days between first and last observation). This has been attributed to the observation that the LWfG leave for the breeding sites during night/early morning and return to feed on the Valdak Marshes later (often in the evening), and it is assumed that the female geese most probably lay an egg before returning to the feeding site (the LWfG start incubating only after the clutch is full). In Finland there is little difference between the staging time (days between first and last observation) and number of days the individuals are actually observed, proving that they use little time there. In Estonia the estimated staging time is much longer, 8.3 days on average, but with an even larger discrepancy with only 4.9 observation days. The dif-

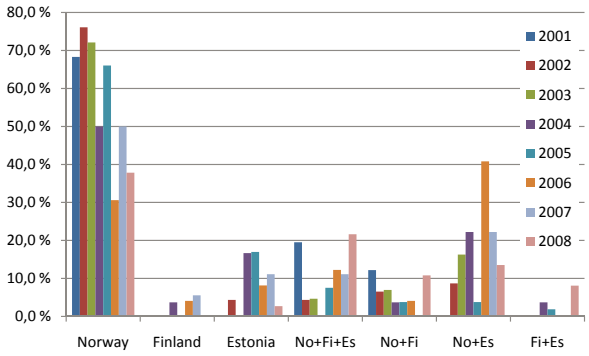

Figure 2. Distribution of individually identified LWfG in Norway (No), Estonia (Es) and Finland (Fi) in the years 2001–2008. The largest group (on the left) is the birds that were recorded only in Norway (but not in Estonia or Finland). Note however, that the share of the birds recorded only in Norway decreased considerably during the study period. This is most likely a consequence of more effective recording of individuals in Estonia and Finland towards the end of the study period.

Table 2. Total number of identified adult pairs of LWfG in Norway (No), Estonia (Es) and Finland (Fi) in the years 2001–2008, categorized according to where the pairs have been identified – eg. either only in "Norway" or in all three different countries "No+Fi+Es" within one year. None of the pairs will appear in more than one "site" in the table.

Year	Norway	Finland	Estonia	No+Fi+Es	No+Fi	No+Es	Fi+Es	sum
2001	13	–	–	4	–	2	–	19
2002	13	–	1	1	1	2	–	18
2003	12	–	–	1	1	2	–	16
2004	4	1	1	–	1	5	1	13
2005	15	–	4	2	1	1	–	23
2006	5	1	1	3	1	7	–	18
2007	6	1	1	2	–	4	–	14
2008	4	–	–	2	2	1	1	10

Table 3. Staging times for those pairs that were observed within a single spring in all three countries (Estonia, Finland and Norway) in the years 2001–2008. The length of staging period at a site is the period from the first observation day until the last observation day.

Location			Estonia	Estonia	Unknown	Finland	Finland	Unknown	Norway	Norway
Year	Colour rings	Pair nb.	Lenght of staging period (days)	Number of days when observed	Lenght of period when unlocated	Lenght of staging period (days)	Number of days when observed	Lenght of period when unlocated	Lenght of staging period (days)	Number of days when observed
2001		3	3	2	12	2	2	1	5	5
2001		4	10	5	8	1	1	3	8	8
2001		6	10	5	6	3	2	3	6	5
2001		7	10	6	8	1	1	3	8	7
2002		1	8	5	6	3	3	7	2	2
2003		15	13	5	3	8	7	7	2	2
2005	WGL	4	11	11	4	3	3	2	10	9
2005		5	5	5	4	3	3	3	11	11
2006	YL	1	13	4	2	2	2	0	8	5
2006		2	2	2	9	5	5	0	15	4
2006		3	12	3	2	4	4	6	1	1
2007	YL	5	2	2	3	2	2	7	5	3
2007		8	10	10	3	2	2	8	7	5
2008	YL	2	11	4	3	8	8	3	1	1
2008		6	4	4	5	5	5	0	2	2
Mean			8.3	4.9	5.2	3.5	3.3	3.5	6.1	4.7

ference is most likely due to the birds spreading out in many different sites.

3.3. Analyses of colour ring resightings

Based on observations of colour ringed LWfG in Hungary, Estonia, Finland and Norway the model that fitted the data best was the one with constant survival and constant recapture rate (AICc =133.1903, of which the second best model with Delta AICc >17). The estimated resighting probability (recapture rate) was 83.3%. This means that on average 16.7% of all LWfG alive were not to be seen during spring migration in Hungary, Estonia, Finland or Norway within any given year.

3.4. Size of the Fennoscandian population

Based on the above results there are various ways to estimate the size of the Nordic part of the Fennoscandian breeding population. One could multiply the maximum daily number of LWfG seen at the Valdak Marshes during the spring by 1.9 (the turnover coefficient derived from the individual recognition data), then multiply this by 1.116 (11.6% of LWfG observed exclusively at other sites during spring) and lastly multiply this by 1.167 (16.7% of individuals within any given year will not be observed even when still alive). In short, this corresponds to multiplying the observed maximum daily count by 2.5. Using the estimate that is based on comprehensive individual recognition, the final estimate (for the Valdak Marshes) would be 1.3 times higher than observed.

Then, again based on the Valdak data, it is possible to estimate a Fennoscandian breeding population with the following numbers from the years 2001–2008:

- A mean of 13.9 adult pairs at Valdak (range 11–18 pairs, i.e. 22–36 paired adult birds) and a mean of 10.7 non-adults in spring (mean total spring number of 39.5 individuals)
- Adding 1.4 pairs (i.e. pairs that are recorded in Estonia and/or Finnish Bothnian Bay coast on spring migration, but not at Valdak)
- Adding 2.6 pairs due to birds not being seen but are still alive (colour ring resighting estimate)
- All this together, rounded to closest "round figures" makes an estimate of 18 adult pairs (with a range of 14–23 pair) during spring. In addition there are approximately 14 non-adults if their resighting rate would be similar to the adult resighting rate (estimated range 3–18).
- Thus, in late spring just before the breeding season, the estimated Nordic part of the Fennoscandian breeding population would be 50 individuals (range 31–64 individuals).
- The corresponding rough autumn estimate would be 28–46 adults + 15–20% of subadults (5–10 individuals) + on average 24.5 juveniles produced, totaling 60-80 individuals in August after the breeding season, but before onset of the autumn migration.

In conclusion, the present Nordic part of the Fennoscandian wild LWfG breeding population is estimated to consist of 14–23 adult pairs.

In addition to the Nordic part of the Fennoscandian breeding population analyzed above in detail, the Fennoscandian population includes also the very poorly studied breeding population on the Russian Kola Peninsula. The size of this part of the population can only be guessed, and a moderate minimum 'guesstimate' based on very limited the available information (see Timonen and Tolvanen 2004) could be 5 breeding pairs. Adding this to the above calculated estimate for the Nordic part of the population would result in (rounded figures to avoid impression of an accurate estimate) 20–30 breeding pairs (40–60 adult individuals) in spring, and ca 70–90 individuals altogether in August after the breeding.

4. Discussion

The present analysis of individual recognition based on the belly patch pattern and recoveries of colour ringed LWfG shows that the present Nordic part of the Fennoscandian breeding population is slightly larger than what would be estimated based only on count data from the Valdak Marshes or any other individual spring staging site alone. Despite this, the population is very small with an estimate of 14–23 breeding pairs in spring, or 60–80 individuals in the autumn. The population is at present on the verge of extinction.

The present estimate has significant consequence for the application of IBA criteria (Heath & Evans 2000). The Fennoscandian subpopulation shows evidence of being a distinct management unit within the western population, with little genetic exchange with the other breeding populations (Ruokonen et al. 2004). This has consequences both for the research priorities and for the management and conservation of the species since the populations of LWfG as management units in reality are smaller than formerly believed. The "1% of a population" criteria that has been applied as a threshold value for defining a staging or wintering area as a BirdLife International Important Bird Area (IBA) for LWfG (Heath & Evans 2000) would turn out differently when these populations are used as units compared with the present situation, where the criteria is used on the total world population. Tolvanen et al. (1999) argued that the threshold value for Europe should be c. 20 birds and not the current 30–78 that implies an unrealistic autumn population of 3,000–7,800 individuals in Fennoscandia. Since the Fennoscandian population at present numbers only 25–30 breeding pairs, all staging areas that are regularly used even by some very few (>5) individuals should have the status as IBAs, and should be protected. Further, by following this line of thinking also for the breeding areas in Fennoscandia, all areas where LWfG is proved to breed apply to the BirdLife IBA criteria, and should be included in the IBA list.

The observed decrease in the share of individuals seen exclusively at the Valdak Marshes, Norway, is most likely a result of a combination of better coverage of field work in recent years (especially during the LWfG LIFE project) in Estonia and Finland, less complete control of the LWfG at the Valdak Marshes due to increased disturbance by White-tailed Eagles (*Haliaeetus albicilla*) and effects of late springs in the timing of the migration (see Aarvak & Øien 2009).

However, the share of individuals seen exclusively at the Valdak Marshes, Norway is still very high (almost half of the individuals even in the second half of the eight year study period). A possible explanation for this is that these birds arrive at the Valdak Marshes along a different, completely separate (supposedly more easterly) spring migration route.

On the other hand, some 10-15% of the population are observed in spring in Estonia and/or Finland but not at the Valdak Marshes. This implies that this part of the population probably breeds in completely other areas than in the Norwegian core breeding area (see Sulkava et al. 2009).

The present analysis shows clearly that there are significant gaps in the knowledge that needs to be filled. Where are the LWfG when they are absent for 5.2 days between Estonia and Finland? Where are the geese when they are absent for 3.5 days between Finland and Norway? The use of video camera and belly patch drawings must be extended and the next step in the analyses needs to look at similar gaps of data between the staging sites further south along the European migration route. With further use of lightweight GPS satellite transmitters in combination with the techniques described here, we will hopefully be able to fill in the remaining gaps in knowledge before it is too late.

Lastly, it is worth noting that all the results presented here have uncertainties that are difficult to circumvent. Inherited in all projects working with rare and threatened species is the problem with attaining statistically large enough samples sizes to minimize sampling and inference errors. An example of this is the estimate on the recapture rate in this study. During 14 years only 50 LWfG have been caught and colour ringed, and of these a number had to be excluded from this analysis since they were not adults at the time of ringing and some of them were never resighted afterwards, possibly because they emigrated from the population. With so few birds in the sample, the error estimate will be large, and it will not be possible to look at age or sex effects, nor variation in recapture (or survival) rate between years.

However, these laboriously collected data by many volunteers are anyway useful in such a way that they can be used in simple analyses and certainly guiding results and conclusions. And, above all, for such a critically endangered population, it is simply the best data set available for conservation.

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The international single species action plan for the conservation of the Western Palearctic population of the Lesser White-fronted Goose

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1. Introduction

The International Single Species Action Plan for the Conservation of the Western Palearctic Populations of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) was adopted at the Fourth Session of the Meeting of the Parties to the African-Eurasian Waterbird Agreement (AEWA) in Antananarivo, Madagascar, in September 2008. The adopted plan concludes several years of negotiation and political debate about the principles and merits of conservation instruments, such as on the supplementation of populations and their introduction into new or historically existing flyways. It now provides a framework for internationally agreed conservation action by the stakeholders to the species, including governments, user groups, scientists, and non-governmental organisations in at least 22 countries where the species regularly occurs.

In the coming months and years, international efforts will increasingly be focused on the implementation of conservation activities outlined in this international plan. New national action plans for the LWfG have already been developed in Estonia, Finland and Norway in the framework of this LWfG LIFE Project. AEWA encourages the international plan to be conveyed into national plans by all the range states to the species, ideally elaborated in the context of conservation and development projects such as this one.

2. Global population status and trends

Currently the Western Palearctic population of the LWfG is estimated to consist of 8,000–13,000 individuals. An estimated 20,000 LWfG form a separate Eastern Paleactic population. Together, these combine to form a global mid-winter population of 28,000–33,000 individuals (Delany et al. 2008; Delany & Scott 2006). This global estimate is comparable with previously published estimates of 22,000–27,000 (Delany & Scott 2002) and of 25,000–30,000 (Lorentsen et al. 1999). Although the global estimate appears to have increased, due to an improvement in knowledge and observation, both Eastern and Western populations are generally considered to be decreasing in number (Delany & Scott 2006; Morozov & Syroechkovskiy 2002).

The global population of LWfG has declined rapidly since the middle of the 20th century. BirdLife International estimates a population decrease in the range of 30% to 49% for the period of 1998–2008. Fragmentation occurring within the breeding ranges is additionally continuing to affect all populations, giving rise to fears that the species may become extinct.

A drop in the number of individuals within the Fennoscandian population and a contraction of their range is well documented (e.g. Tolvanen et al. 2004; Aarvak & Øien 2004; Markkola et al. 2004; Norderhaug & Norderhaug 1984). In spite of good progress made in recent years, little detailed information is available on the exact trends for either the Western main or Eastern main populations of LWfG (Jones et al. 2008; Syroechkovskiy et al. 2005).

3. A framework for action

The International Action Plan addresses two of the three wild LWfG populations, namely the Fennoscandian population and the Western main population. Given that the Eastern main population occurs beyond the AEWA Agreement and European Union Member State area, it is only mentioned in a global context or for comparisons. The Action Plan also takes into account the population derived from captive-bred birds used for restocking in Swedish Lapland. Its priority however remains the conservation of the wild populations.

The International Action Plan's ultimate objective is to restore the populations of LWfG to a favourable conservation status. As a benchmark indicator, it aims to secure a population size of at least 25,000 individuals for its Western main population and at least 1,000 individuals for the Fennoscandian population, with neither of these sub-population declining.

Similar to other action plans for individual species, the LWfG International Action Plan consists of three major parts:

I. A section on the status of the species where biological baseline information is assessed and consolidated for each population, and where available knowledge is summarised for each of its range states. Thanks to the contributions by the LWfG LIFE project (2005–2009), and new observations in countries such as Syria, Iraq and Lithuania, a wealth of new information and updated distribution maps could be included over the past three years.

Table 1. Relative importance of threats to wild subpopulations of Lesser White-fronted Goose (from Jones et al. 2008).

Threat	Fennoscandian	Western main	Eastern main
(a) Factors causing increased adult mortality			
Hunting	Critical	Critical	Critical
Poisoning	Unknown	Local	High
Human disturbance	Medium	Medium	?
(b) Factors causing reduced reproductive success			
Human disturbance	Local?	Local	Local
Predation	Local?	Local	Local
Genetic impoverishment	Low	Unknown	Unknown
(c) Factors causing habitat loss/degradation/conversion			
Agricultural intensification	Formerly High; now Lower	High	High
Construction of dams and other river regulation infrastructure, wetland drainage	Medium?	High	High
Climate Change	Unknown	Unknown	Unknown
Over-grazing	Local	Unknown?	Unknown?
Land abandonment (losses in grain production, of hay meadows, scrub/forest encroachment)	Locally high	High	Unknown?
Pollution of wetlands / waterbodies	Unknown?	Unknown?	Unknown?
(d) Potential genetic introgression of DNA from other goose species into wild population	Potential risk exists	Potential risk exists	?
(e) Knowledge limitations	Fundamental gaps	Fundamental gaps	Fundamental gaps

Index: Critical = factor causing very rapid declines (>30% / 10 years); High = factor causing rapid declines (20–30% / 10 years); Medium = factor causing slow but significant declines (10–20% / 10 years); Low = factor causing fluctuations; Local = factor causing negligible declines; Unknown = factor affects the species but extent is not known.

II. A section on the threats to LWfG along their flyway, which identifies and describes the key challenges to survival and categorises them by their level of impact. Compared to earlier assumptions (Madsen 1996; WCMC 2003), the threats to LWfG populations are categorised in the Table 1.

There is strong evidence that the most important factors driving the continued decline in numbers and fragmentation of the range of the LWfG (both the Fennoscandian and Western main populations), are those that cause high mortality among fully grown birds (UNEP/WCMC 2003). These factors operate primarily on the staging and wintering grounds, given that studies in the breeding range have failed to detect any adverse impacts that are of significant magnitude to explain the population crash.

Lesser White-fronted Geese Mánnu (male) and Máddu (female) being released after catching and colour ringing at the Valdak Marshes in northern Norway. Colour ringing and satellite tracking are important tools in the conservation research of the species. Later on, Mánnu was shot dead in the Lake Kerkini National Park in Greece. © Ingar Jostein Øien, May 2006

Table 2. International Lesser White-fronted Goose Action Plan – Results Framework.

Result	Objectively Verifiable Indicator	Means of Verification	Priority	Timescale
Result 1: Mortality rates are reduced	A 5-year moving average of the number of individuals at regularly monitored spring staging sites	Counts of flocks at Hortobágy/Hungary, at Matsalu Bay/Estonia, at Porsangerfjord/Norway, in the Evros Delta/Greece and in Kustanay oblast/Kazakhstan in spring.	**Essential** (avoid extinction risk)	**Medium / long** (2009–14/19)
Result 2: Further habitat loss and degradation is prevented	All Important Bird Areas and other key sites for Lesser White-fronted Goose are protected and managed with the aim of achieving 'Favourable Conservation Status'.	1. Natura 2000 database up-dated with monitoring data. 2. National government reports to the EC, CMS, CBD, AEWA, Ramsar and Bern Conventions. 3. Periodic independent assessments carried out by BirdLife partners as part of their IBA monitoring.	**High** (avoid >20% decline in 20 years)	**Long** (2009–19)
Result 3: Reproductive success is maximised	Five-year running mean of juveniles reaches 25–30% for both Fennoscandian and Western main populations.	Counts of autumn flocks at Matsalu Bay, Estonia and north-west Kazakhstan in October.	**Medium** (avoid <20% decline in 20 years)	**Long** (2009–19)
Result 4: No introgression of DNA from other goose species into the wild population occurs as a result of further releases and DNA introgression from already released birds from captive breeding programmes is minimised	1. Any future release of captive-bred birds involves only individuals reared from wild-caught stock. 2. Apparent hybrid geese are removed from existing free-flying introduced flock, subject to findings of a feasibility study.	1. National reports from governments. 2. Reports from International Working Group (and captive-breeding sub-group). 3. Papers published in peer-reviewed scientific journals. 4. Review and evaluation of existing studies on the species' genetics is conducted by independent scientific expert. 5. Long-term future of captive breeding programmes is reviewed by a sub-group of the International Working Group.	**High** (avoid >20% decline in 20 years)	**Short** (2009–12)
Result 5: Key knowledge gaps filled	Knowledge gaps filled by 2015	1. Monitoring & expedition reports 2. Papers published in peer-reviewed scientific journals.	**Essential** (avoid extinction risk)	**Medium** (2009–14)
Result 6: International cooperation maximised	1. All Lesser White-fronted Goose Range States are parties to the key international conservation agreements. 2. The International Lesser White-fronted Goose Working Group (and its sub-group) is established and operates effectively. 3. National Action Plans are established, implemented and progress is shared via the International Working Group.	1. Status of Contracting Party lists issued by relevant agreements. 2. Progress reports by the AEWA Secretariat. 3. Reports and assessments issued by the International Working Group (once established)	**Essential** (avoid extinction risk)	**Short / Ongoing** (2009–12/ctd.)

Although the species is formally protected by law, hunting is considered to be the primary cause of mortality and the single most important threat that this Action Plan has to tackle. The loss and degradation of suitable habitat is currently considered to be an important but secondary threat to the survival of full-grown birds. Its significance as a likely driver for historical declines and range changes during the 20th century should not be underestimated.

III. The 'backbone' of the plan is the action framework. The required results, conservation measures and activities necessary for their achievement, are listed here by importance and urgency (i.e. timescale) for execution. Priority results are categorised as 'essential' and/or in need of immediate (i.e. 2009), short-term (period 2009–2012) or ongoing implementation. These priorities, together with a list of principles for implementation (Table 2.), are the basis for range states and stakeholders to work on its operation. The AEWA Secretariat is committed to supporting an international collaboration on practical implementation activities for the LWfG, and to assist individual countries or groups of countries with the elaboration of national action plans where a need for such plans has been expressed.

4. International Cooperation

Within the AEWA region, LWfG regularly occur in at least 22 countries. They are identified as 'LWfG Principle Range States' and include: Azerbaijan, Bulgaria, Estonia, Finland, Germany, Greece, Hungary, Iraq, Islamic Republic of Iran, Kazakhstan, Lithuania, Netherlands, Norway, Poland, Romania, Russian Federation, Sweden, Syrian Arab Republic, Turkey, Turkmenistan, Ukraine and Uzbekistan. A number of these range states are not parties to AEWA, yet their governments have formally

The LIFE project team studying a feeding site of the Lesser White-fronted Geese in the Evros Delta National Park, Greece. The Evros Delta on the border between Greece and Turkey is the most important wintering site of the Fennoscandian Lesser White-fronted Goose population. © Morten Ekker, November 2006

contributed their information to the consultations and finalisation of this plan. The governments of these countries share a major responsibility in the implementation of the action plan, and thus ultimately in achieving its jointly agreed conservation objectives.

4.1. Successful implementation

Previous action plans carried out for this and other species have shown to be effective only when governments, NGOs, international organisations and different user groups work closely together (Nagy & Burfield 2006). In the case of this action plan, the consultations with technical and political contributors from a range of NGOs, government representatives, dedicated projects, scientific specialists, and conservation experts have already established a functional working environment for collaborative implementation.

The 'Principles for Implementation', outlined in the International Action Plan, give further guidance on how international activities can be put into practice (for a complete list, see pages 60–61 of the plan). Accordingly, each range state should:

- support the development of projects and 'on-the-ground' conservation measures, including the fundraising for such activities, and particularly along the species' flyway;
- instigate urgent measures targeted to reduce the high mortality of LWfG caused by hunting, and regularly report on status and progress with these measures;
- maintain and further develop research and monitoring programmes to fill knowledge gaps, inform appropriate site management, and assess the overall progress of the action plan;
- assist in initiating implementation schemes or national taskforces in range states of importance to the LWfG, but which lack either financial means or political momentum for nature conservation;
- participate in an international working group, established by the AEWA Secretariat, to assess the efficiency of conservation activities and regularly share information in order to ensure transparency and accountability whilst effecting the action plan. Ideally, this working group would encompass governments within the species' range and a number of organisations including conservation, research, user groups, development, all holding a stake in the LWfG;
- prepare, if possible by the end of 2010, a national action plan for the species.

4.2. Discussion

In essence, the action plan functions as an overall check list with recommendations for range countries and organisations to conserve the LWfG. In order to address conservation actions at a flyway scale, the plan similarly applies to countries of highly differing economic capacities, and diverse cultural and geographic backgrounds. The economic and political situation in some countries in the Central and South-Western Asian regions (UNDP 2008) often results in a shortage of financial means for nature conservation and, such as in the case of political instability, also in a lack of political momentum for conservation activities (Azerbaijan, Kazakhstan, Turkmenistan, the Russian Federation, Ukraine and Uzbekistan are categorised as 'landlocked developing countries' and/or 'transition countries' by the United Nations Statistics Division, see http://unstats.un.org). Yet the largest part of the Palearctic LWfG population nests in Russia, migrates across several Central Asian states and winters in countries like Azerbaijan, Turkmenistan, Iraq and Iran (Jones et al. 2008). A challenge for LWfG conservation in these regions will be to bridge a general shortage of financial means, and take into account the needs and differing priorities in the respective countries. The LWfG can, however, be seen as a flagship species to promote strong international cooperation and build capacity for wetland conservation between countries in Europe, the Middle East and Central Asia in a both a conservation and sustainable development context.

A Lesser White-fronted Goose has been tagged with a satellite transmitter (visible on the back of the bird) and released at the Valdak Marshes in northern Norway. The breeding sites are situated on the tundra up in the mountains. © Morten Ekker, May 2006

For example, joint work to assure adequate and effective protection of the 'network' of the sites used by the LWfG can include the training of rangers, protection from drainage, pollution, and enforcement of regulations. This is critical in key areas where huge numbers of geese rest for several weeks during their migration or wintering stages.

Hunting is the most complex and urgent problem to be addressed by the countries. Continued engagement and awareness-raising of the species with hunters; identification of the root causes for hunting of LWfG in different locations; and lobbying with politicians to strengthen and revise laws is a complex set of tasks that will rely on activities across different institutional and economic scales. For example, in marginalised and little developed areas where there is often serious hunting pressure and no effective regulations, an assessment into the level at which goose hunting contributes to the subsistence of the local population, or to the local economy in the form of "sport hunting tourism", may be required in order to develop viable hunting alternatives.

5. Conclusion

The 'International Action Plan for the Conservation of the LWfG' provides a comprehensive listing of the recommendations and required results to which the range countries have formally committed themselves in order to halt and reverse the drastic declines in the numbers of this species. It can thus be considered as the 'roadmap' for international actions to be carried out between now and 2014.

Yet this document is of course no guarantee for successful implementation. Its usefulness will need to be proven when governments and diverse organisations are putting the recommendations into practice. As activities for its implementation are getting underway, this plan – just as any other planning instrument – will need continuous tracking, updating and revision.

The LWfG LIFE project has played an instrumental role in the development of this action plan. The fact that the project's work and results are reflected throughout the action framework has already significantly advanced its execution.

Acknowledging the urgent need for implementation of this plan, the AEWA Secretariat is readily supporting governments and stakeholders in carrying out national conservation planning and on-the-ground activities. It particularly encourages collaborative projects between the countries involved in addressing shared issues of concern.

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The effect of Red Fox culling in the core breeding area for Fennoscandian Lesser White-fronted Geese in 2008

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The expansion of the Red Fox in the Fennoscandian mountain areas has affected many arctic species, including the critically endangered Lesser White-fronted Goose. © Morten Ekker, Finnmark, Norway, May 2006

The Red Fox (*Vulpes vulpes*) is a significant egg predator for ground-nesting bird species, and this has proved to be the case also for Lesser White-fronted Geese (*Anser erythropus*, hereafter LWfG). In 2007, the Norwegian Directorate of nature management started culling of Red Foxes in the core breeding area for LWfG in Finnmark, Norway, in order to reduce nest losses. In 2008, the following year, the culling effort was intensified, and the State Nature Inspectorate culled 71 Red Foxes in the period 15 April – 7 May. The LWfG Life project monitored the core breeding area in the period 02–12 June (see Sulkava et. al 2009), and no Red Foxes were observed in the area. All known Red Fox dens were also controlled, and no Red Fox breeding was confirmed in 2008.

During autumn monitoring in the Porsangen Fjord in 2008, 41 LWfG were recorded (Aarvak & Øien 2009). Of these, 13 were juveniles distributed in three clutches, the rest being adults. This is a low juvenile production, as the mean annual production in the period 2004–2008 for the Fennoscandian LWfG population is 26 juveniles (cf. Table 4 in Aarvak & Øien 2009). The poor juvenile production in 2008 was most probably due to bad weather conditions and high depredation of juveniles by raptors after a population crash of lemmings. However, the juvenile production in 2008 would probably have been significantly lower if no culling of Red Foxes had been carried out.

The most important effect of the successful culling effort in 2008 is that adult LWfG that did not succeed in raising juveniles, commenced moult in the breeding areas, and thereby chose the European, more secure autumn migration route to Greece (see Øien et al. 2009). This indicates that unsuccessful breeders in 2008 did not lose their egg clutches due to Red Fox depredation, but lost their juvenile broods at a later stage in the breeding season.

The significance of affecting the adults to migrate the European route is that they will be exposed to a much lower hunting pressure which increases their survival rate as compared to birds migrating through Russia and Kazakhstan (see Øien et al. 2009).

During autumn staging in the Porsangen Fjord there is a significant positive correlation between number of juveniles produced and the number of adult LWfG present (Figure 1). Based on the observed number of juveniles, the expected number of adults present should be only 14 individuals in 2008. The observed number of adult LWfG in 2008 was twice as high as expected (28 ind.), which is a strong indication that the culling of Red Foxes had the desired effect.

When the data is corrected for the population size, the picture becomes even more evident. The data clearly shows that the number of adults observed in autumn 2008 was much higher than expected from the monitoring data from the years 1994–2008 (Figure 2).

The latest year with very poor juvenile production was in 2000, probably due to high loss of nests to Red Foxes during incubation. Due to the double negative effect of the losses during incubation (i.e reduced production and reduced adult survival

Aerial view of the core breeding area of the Lesser White-fronted Goose in Norway. 71 Red Foxes were culled in this area in spring 2008. © Ingar Jostein Øien, 25 May 2007

during the next wintering journey; see Øien et al. 2009), it is likely that the population reductions mostly happens in years with very high depredation on egg clutches. The successful Red Fox culling probably prevented a similar situation for the Fennoscandian LWfG in 2008. Further intensive Red Fox culling in the core breeding area is now probably an extremely important action in order to turn the negative trend in the Fennoscandian LWfG population. Since the population has been more or less stable between the low reproduction years, we expect that continued Red Fox culling in the coming years (combined with securing of key areas on migration and in winter,) can turn the population development from negative to positive in a few years.

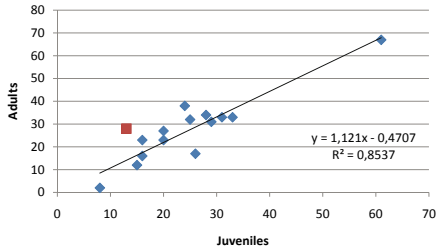

Figure 1. Correlation between numbers of juvenile and adult Lesser White-fronted Geese observed in the Porsangen Fjord in the period 1994–2008, where 2008 is marked with a red square.

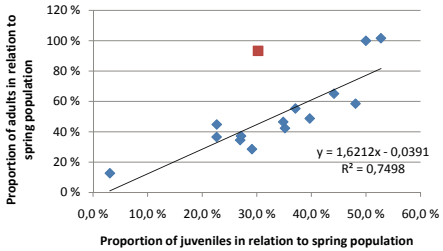

Figure 2. Proportion of adult Lesser White-fronted Geese (of spring population at the Valdak Marshes) observed in autumn at the Valdak Marshes in relation to proportion of observed juveniles (of spring population) in autumn. The year 2008 is marked with a red square.

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SHORT NEWS

Torkjell Morset from the Norwegian State Nature Inspectorate is one of the key actors in protecting the Lesser White-fronted Goose in Finnmark, Norway. © Morten Ekker, May 2008

New National Action Plan for the Lesser White-fronted Goose in Norway

1. Introduction

The fate of the Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) is uncertain. Despite various management actions, the Fennoscandian breeding population is still declining, and it is clear that further efforts are needed both on the local, national and international scale. The species is now non-existent in a large number of previously important breeding and staging areas in Norway. There are a multitude of underlying causes which have resulted in the present status of the population. These can not be addressed one by one and rectified. In several cases previously important areas are not available to the geese, or their value is diminished due to changes in the general area use, and increased disturbance. Different causes are present in different parts of the year-round areas for the geese. Therefore it is not possible to single out one line of action that will bring the population back from the abyss. On the contrary, several state governments and stakeholders will have to make a coordinated and broad scale effort to affect the population positively.

Luckily, the population of LWfG has been on the receiving end of a dramatic increase in interest in the latest few years. This gives both management authorities and other stake-holders a better opportunity to target effective measures towards a stop in population decrease, and slowly turn the situation for the LWfG. In Norway, the use of national action plans are widely used for defining and focusing management actions. The national action plan for the LWfG in Norway aims to give all parties a tool to allocate work-load, and define the administrative and economic strength that is necessary to ensure that Norway does our part of the joint effort to restore a viable population of the species.

2. The National Action Plan process

In 2005, the Norwegian National Action Plan process was initiated as part of the LIFE project on LWfG with Directorate of nature management (DN) as the responsible national partner. A working group chaired by Morten Ekker (DN) was established by the end of the year. The group included representatives from Norwegian Ornithological Society (NOF) (Ingar J. Øien and Tomas Aarvak), State Nature Inspectorate (SNO) (Torkjell Morset), Stabbursnes Nature House (Gry Ingebretsen) and the County Governor of Finnmark (Stig Sandring).

Two National Action Plan meetings were held with all involved institutions in 2006. The first meeting was held in February at Stjørdal, Mid-Norway and the second meeting was held in Porsanger, Finnmark in August. The third national meeting was held in Vadsø, Finnmark in March 2007. All institutions were involved in the planning process by commenting on draft versions of a background document.

An international meeting with the national LIFE-teams preparing the national action plans in Norway and Estonia was arranged in Estonia in November 2007. The final draft of the background document for the Norwegian Action Plan was completed by NOF in June 2008 and then handed over to DN and subsequently published in NOF Report series.

3. Contents of the plan

The plan has an overall short time aim to stop further decline in the population. This should be achieved within a 5-year perspective. In a longer perspective the population should be brought back to a minimum of 1000 individuals.

As Norway now holds the majority of the breeding pairs left in Fennoscandia, the plan clearly states the responsibility Norway has at the moment. The plan also gives specific national actions to be carried out irrespectively of the implementation of management actions in other countries. The actions implemented and planned are comprehensive, both with regard to local, regional and national involvement of bodies, and in tasks to be carried out. The main focus will be on:

- Continued conservation of habitats, both currently in use and of historical value
- Continued and increased monitoring efforts in staging and breeding grounds
- Continued predator-control in breeding areas
- Continued and new awareness campaigns
- Increased cooperation between countries and bodies
- Development of a feasibility study to determine the possible establishment of a captive population for restocking of the wild Fennoscandian population
- Implementing restrictions on actions/disturbance adverse to the LWfG in staging and breeding areas

Those actions are a national responsibility, and will be continuously adjusted according to monitoring results and scientific knowledge. The management authorities in Norway will have to take the costs of those actions.

Anyway, the LWfG will not be saved by actions in Norway alone. The flyway range states are all necessary elements in a joint effort to hinder a further population decline, and restore the population. The national action plan of Norway fully recognizes and supports the value of the International Single Species Action Plan for the LWfG as the main document and guidelines for a multilateral approach between range states. The Norwegian plan also strongly supports the necessity of a strong secretariat under African-Eurasian Waterfowl Agreement (AEWA) coordinating and facilitating multilateral approaches.

The plan also has focus on the bilateral work between states, and especially between Norway and Sweden and Norway and Finland. The Nordic countries have a history of close and coordinated effort to achieve our common goals, and this will be

a specific challenge in the conservation of the LWfG. The plan also points to the possibility of including the LWfG into other bilateral environmental agreements, as an additional financing mechanism, and to raise the interest of other parties.

It is recognized that management actions in Norway may be less efficient than in other range states, partly because some of the main mechanism behind the population decline occur in staging and wintering areas outside Norway. The plan therefore outlines the use of "seed-funds" made available to the AEWA-secretariat if an action in a range state is viewed as beneficial or more effective to the overall aims in the National plan for Norway than actions in Norway alone. The plan also allows for a possible establishment of a captive population to keep ready for future management options if the conservation of the current wild population fails.

3. Implementation of the plan

The plan is implemented immediately by DN. Ongoing actions such as monitoring and area conservation efforts are kept running continuously. Parts of the new actions were implemented already during the National Action Plan process. New restrictions on hunting in inner part of the Porsangen Fjord have been introduced as part of the revision of the national hunting legislation (from 2007). All goose hunting is now prohibited in the whole area used by LWfG in the Porsangen Fjord during the autumn staging period, which reduces considerably the risk for LWfG of being shot (see news on right). In 2007, DN and SNO started the first actions on Red Fox control in the core breeding area (see Øien & Aarvak 2009). The implementation of predation control in breeding areas will be subject to annual evaluation. Other more long term aspects will be reviewed after the first 5-year period. The plan is also considered to be dynamic, and new measures may be implemented directly without revision of the plan. Considering the increase in knowledge in the last few years, it is expected that better monitoring and experience with listed management actions will give further indications as how to target the effective measures.

4. Discussion

The Norwegian national action plan for LWfG is long overdue. This does not mean that actions have been put on wait in Norway. But it seems that the finalisation of the international action plan combined with the results from the joint LWfG LIFE-project, has paved the way for a more effective and targeted plan.

5. References

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Changing hunting regulations to benefit a dwindling population of Lesser White-fronted goose

The Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) has been a protected species since 1970, and after this no legal hunting on the species has occurred. In the last decades the breeding and staging areas in Norway have been restricted to the county of Finnmark, and despite protection, the population have suffered a steep decline. Greylag Goose, Pink-footed Goose and Bean Goose also occur in Finnmark and hunting has been legal for these species.

From year 2002 Bean Goose hunting was banned. The reason for this was uncertainty about the population status, and the risk that Bean Goose hunting would cause accidental killings, or in other ways adversely affect the LWfG population.

From year 2007 Pink-footed Goose hunting was banned. This was done to prevent accidental killings of LWfG. At the same time as hunting on Pink-footed Goose was banned, there were made restrictions on the Greylag Goose hunt. Based on the knowledge of present and past autumn staging areas for the LWfG, a hunting ban on Greylag Goose was introduced to large areas in Finnmark. This was done exclusively to protect the LWfG, as the Greylag Goose itself is a common species. The areas covered include many of the fiords supposed to be of importance to the LWfG.

To prevent detrimental effects on the LWfG population, due to hunting on other species, the hunting regime in areas important to the LWfG will continuously be evaluated in the light of new knowledge.

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Norwegian Lesser White-fronted Goose researcher Tomas Aarvak by the tradional Sami style "lavvu" tent in the field camp at the Valdak Marshes, Finnmark, Norway. © Morten Ekker, May 2008

New Finnish National Action Plan for the Lesser White-fronted Goose

A hundred years ago the Lesser White-fronted Goose (Anser erythropus, hereafter LWfG) was the most common breeding goose species in the Finnish Lapland, and the total Fennoscandian population comprised of thousands of breeding pairs. The LWfG was also the most numerous goose species on the migration at the Finnish Bothnian Bay coast both in spring and autumn. Today the LWfG is one of the most endangered species of Finland and Fennoscandia. The latest confirmed Finnish breeding records dates back to 1995. During spring migration, only 10–20 individuals of the species are nowadays staging in Finland (see Luukkonen 2009) and none during the autumn.

The first ever Finnish National Action Plan for the LWfG was prepared by the present LWfG LIFE project, parallel with preparation of an international action plan for the species (see Martin 2009). As the LWfG is a migratory species, it is essential that countries like Finland in addition to the national conservation measures also support the conservation actions in other countries along the flyways. The parallel preparation of the international and national plans helped us to incorporate international conservation responsibilities and actions into the Finnish plan.

An adult pair of Lesser White-fronted Geese on the coastal meadows of Säärenperä in Siikajoki, Finland. © Ari Leinonen, May 2005

The preparation of the Finnish Action Plan took more than two years. The main responsible partner of the process was BirdLife Finland, in co-operation with the Finnish Environmental institute SYKE. Also WWF Finland and its LWfG conservation project team were deeply involved in the process, as well as Metsähallitus and the Ministry of the Environment. All other relevant authorities and organisations were involved in the planning process by circulating draft versions of the document for comments.

The Finnish National Action plan consists of two parts: a rather comprehensive background information part, and the actual action plan part. The background information part of the plan was drafted first. During this process also unpublished Finnish data was collected and analysed. When the background information part was completed, a specialist meeting was hold and relevant actions were provisionally discussed. An international meeting with the national teams preparing the national action plans in Norway and Estonia (that were also prepared within the LWfG Life project) was arranged in Estonia in November 2007.

Although the LWfG is classified as a critically endangered species in Finland (Rassi et al. 2001), the monitoring and conservation of the species has so far been lead by non-governmental organisations, mainly WWF. Therefore it was obvious that one of the main goals of the action plan would be to move the responsibility for co-ordinating the national LWfG conservation actions to the national nature conservation authorities, most of all the Ministry of the Environment, the Natural Heritage Services of Metsähallitus (Forest and Park Service) and relevant regional environmental centres.

The action part of the plan contains number of measures from annual monitoring of potential breeding areas and staging sites to more complex conservation issues such as participation in international flyway conservation actions. All currently known sites important for the species are proposed to be legally protected (if not fully protected yet), and hunting free zones are proposed to be established. In the potential breeding areas in Finnish Lapland, control of the Red Fox (Vulpes vulpes) population is proposed to be intensified, hiking routes are proposed to be directed out of traditional core LWfG areas, and management plans of the conservation areas are proposed to be made and updated so that LWfG conservation is adequately taken into account. For the staging sites a similar set of actions is proposed to be adopted, as well as certain management actions for the coastal meadows that the LWfG tend to use in spring. In case new breeding sites will be found, there is a special set of immediate stricter conservation actions defined. These actions would contain a ban of hunting, minimising the human disturbance for geese and intensifying the control of Red Fox population.

Information campaigns on the species and threats are proposed to be carried out. It is also proposed to delay the start of goose hunting period by ten days in most northernmost communities in order to reduce the risk for LWfG of being shot.

Issues related to the captive breeding and possible future reintroduction of LWfG are proposed to be left for new Nordic Committee for captive breeding, reintroduction and supplementation, that is part of the new international (AEWA) Single Species action plan (Jones et al. 2008). The international conservation actions are proposed to be implemented primarily through the implementation of the international plan. It is proposed that

Finland will support the AEWA secretariat in this, and that Finland will be active in international LWfG forums. There is also a need to analyse the LWfG data collected earlier in Finland

The final draft of the Finnish Action Plan was completed by the LWfG LIFE project by the end of 2007 and the plan handed over to the Ministry of the Environment in March 2008. The plan was officially adopted by the ministry in March 2009.

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New National Action Plan for the Lesser White-fronted Goose in Estonia

1. Introduction

During the present Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG) Life Nature project (2005–2009) the first National Action Plan for the species was prepared in Estonia. Responsible bodies for the preparation of the action plan were the Matsalu Nature Reserve and the Estonian Ministry of Environment . Some field work was carried out in order to determine the most important coastal meadow areas for LWfG in four counties in western Estonia. Also, information on spring and autumn stop-over sites of LWfG was collected from various sources and several meetings were held in order to elaborate the Action Plan. The plan and the funding decision were officially adopted by the Ministry of Environment in February 2009.

2. Contents of the plan

The National Action Plan for LWfG in Estonia consists of six main text chapters:

- General introduction of the species
- Migration routes and important staging areas on the European migration route
- Wintering grounds
- Present status of the species
- The main threats for LWfG
- Conservation actions in Estonia, including the budget for the next five years

The plan is defining the priorities of the actions needed in the conservation of LWfG in Estonia:

Aerial view of the Haeska Rahu islets (facing northeast) after the restoration camp, that was arranged by the LIFE project in August 2006. The larger islet in the foreground is Suur Rahu, of which the eastern part was cleared and burned by the camp. The smaller islet in the strait between Suur Rahu and the mainland is Väike Rahu, of which the main part excluding the eastern end was cleared and burned. The Haeska bird watching tower is visible by the forest patch next to the shoreline on the left.. © Estonian Inspectorate of Environment, August 2006

- Management of the coastal meadows that are potential staging areas of LWfG. There are 13 different areas listed in the Management Plan, including the known staging areas and potential sites for staging LWfG. The aim of the management is maintain the open coastal meadows by grazing and removing of reed. All these sites are protected by the Estonian Nature Conservation Law, and starting from year 2009 the Environmental Board will be responsible for the management of these sites.
- Training of hunters and implementation of a voluntary system to ban goose hunting in areas where/when LWfG are expected to be present (so-called "red light" system). Nature conservation specialists will give presentations and information for hunters during the training courses organised e.g. by Estonian Hunters Society in order to inform hunters about the species, the threats and necessity of change of information. The aim is to establish an operative system to stop the goose hunting on voluntary basis in limited areas in case LWfG are observed during the hunting season in the autumn.
- Annual monitoring of LWfG in Western-Estonia at the known staging areas of LWfG during the spring (April-May) and autumn (September-October) migration periods. The aim of the monitoring is to determine the number and age of the individuals, reading colorrings, and evaluating the space use and the diet preference of the LWfG.
- Public awareness work; training of nature conservation specialists and birdwatchers in identification of LWfG. Workshops during the spring staging period will be arranged by the environmental authorities in order to practice the identification of LWfG on the field.
- International co-operation: Estonian specialists will take part in the international LWfG conservation initiatives, meetings and surveys. The Nemunas delta in Lithuania is one of the focus areas where Estonia could play a special role.

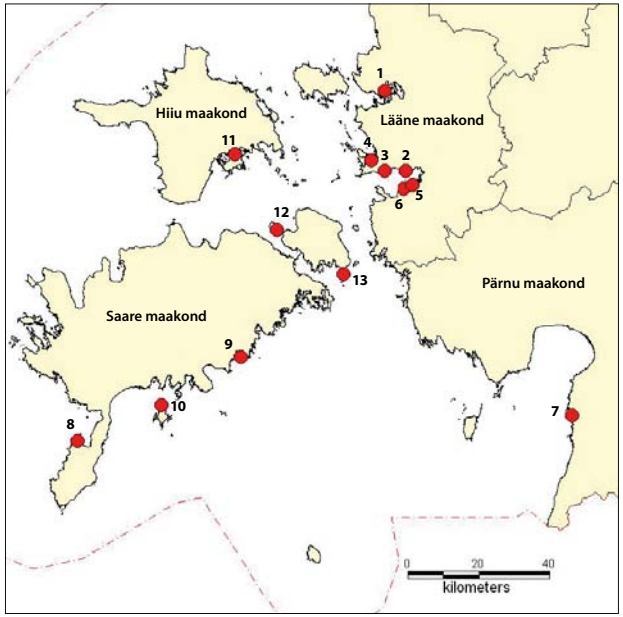

Figure 1. Locations of the Estonian coastal meadow areas listed in the national action plan for the Lesser White-fronted Goose (for site numbers see list below).

3. Implementation of the plan

The Action Plan will be implemented during the next five years. After that it will be reviewed by the Ministry of Environment and complemented accordingly. Management of the large coastal meadow areas suitable for staging LWfG in Western Estonia (Läänemaa and Pärnumaa counties and on the islands, see Figure 1) will be secured and funded probably using a combination of EU agri-environmental measures and the Estonian state budget.

In Läänemaa

1. Tahu coastal meadow (677 ha) in Silma Nature Reserve
2. Haeska coastal meadow (442 ha) in Matsalu National Park
3. Kiideva-Saardo coastal meadow (360 ha) in Matsalu National Park
4. Põgari-Sassi coastal meadow (294 ha) in Matsalu National Park
5. Salmi coastal meadow (383 ha) in Matsalu National Park
6. Pagaranna coastal meadow (35 ha) in Matsalu National Park

In Pärnumaa

7. Häädemeeste coastal meadow (1029 ha) in Luitemaa Nature Reserve

In Saaremaa

8. Rahuste coastal meadow (216 ha) in Rahuste Nature Reserve
9. Siiksaare coastal meadow (81 ha) in Laidevahe Nature Reserve
10. Abruka coastal meadow (59 ha) in Abruka Special Area of Conservation

In Hiiumaa

11. Käina-Vaemla coastal meadow (800 ha) in Käina-Kassari Protected Landscape Area

In Muhumaa

12. Kõinastu sandbancks (120 ha) in Kõinastu Special Area of Conservation
13. Võilaiu coastal meadow (136 ha) in Võilaiu Special Area of Conservation

4. Acknowledgements

Special thanks to Petteri Tolvanen and the team of WWF Finland for providing many good ideas and much useful data for compiling the Estonian Action Plan, and to Norwegian Ornithological Society (NOF) for very nice distribution and migration maps of LWfG.

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A workshop on the conservation of Lesser White-fronted Goose in Russia and neighbouring countries was held in the Moscow Zoo in December 2007. Eugeny Strelnikov from the Yugansky Reserve is giving a presentation on the status of the Lesser White-fronted Goose in the "Double Ob" area in the Russian Ob River valley. © Petteri Polojärvi, Moscow, Russia, December 2007

Joint Russian-Norwegian-Finnish workshop on conservation of the Lesser White-fronted Goose, Moscow, December 2007

A trilateral Lesser White-fronted Goose (*Anser erythropus*, hereafter LWFG) conservation workshop was arranged on 13–14 December 2007 in the Moscow Zoo by the Russian Federation Ministry of Natural Resources, the Finnish Metsähallitus and the Norwegian Directorate for Nature Management. The meeting was attended by Russian, Finnish and Norwegian LWfG experts and representatives from Bird Ringing Centre of Russia, Institute of Ecology and Evolution of the Russian Academy of Science (IEE RAS), VNII Priroda, Goose, Swan and Duck Study Group of Northern Eurasia (RGG), Ecological Inspection of Nenets Autonomous District, Zapovednik Putoransky, Zapovednik Yugansky, WWF Russia, WWF Finland, Norwegian Embassy in Moscow, BirdLife Norway, and Wetlands International, in addition to the organizing bodies.

The workshop was an initiative supported by the Russian–Norwegian Environmental Commission, the Russian–Finnish Environmental Cooperation, and the Habitat Conservation Forum of the Barents Councils Environmental Work Group. The purpose of the workshop was to concretize the threats to the Fennoscandian and western Russian populations of the LWfG and to define appropriate conservation actions and measures to be taken to protect these populations especially on the Russian territory.

The workshop was closely linked to EU LIFE Nature project "Conservation of Lesser White-fronted Goose on the European migration route" that was also presented in the meeting by the project co-ordinator. The AEWA Single Species Action Plan for the species that is now completed and adopted, was also presented in a final draft version and discussed in the workshop. The results of the workshop were made available for AEWA.

The workshop identified priority sites for the conservation of the LWfG in Russia and neighbouring countries and respective threats, key factors and conservation measures, as well as the following concrete proposals on how to intensify the conservation of LWfG in Russia:

- Development of a GIS data base on key areas (Important Bird Areas, IBAs) including: (1) gaps in knowledge; (2) review of threats; (3) possible conservation and management actions. Detailed maps for selected areas and site management plans may be the next stages in this work. It would be also important to make this data available for decision makers (e.g. through a web site in Russian).
- Gap analyses of coverage of key LWFG areas by state protected areas of different level. Recommendations for the Russian Federation Ministry of Natural Resources.
- Development of strategic approach for potential co-operation with oil companies at key LWFG sites. Preparation and distribution of the information letter to the selected companies.
- Preparation of the information package for the regional decision makers (nature conservation and game management agencies), focusing on key LWFG regions. Distribute this information down to the region (raion) level accompanied by the letter from the Russian Federation Ministry of Natural Resources.
- Survey the opportunity of involvement of game management and conservation activities in the Russian-Kazakhstan transboundary co-operation under the umbrella of the Bilateral Agreement on Nature Conservation.

The three at present most important sites for LWfG conservation in western Russia were identified: Kanin Peninsula (Shoininsky Zakaznik), Double Ob staging area (Elizarovsky Federal Refuge, Berezovsky Federal Refuge, Zapovednik "Malaya Sosva") as well as the Kustanay and Orenburg areas (Shalkar lakes, Ayke, Kulykol) in Kazakhstan and Russia.

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The participants of the Kerkini training workshop had the opportunity to observe a flock of 45 Fennoscandian Lesser White-fronted Geese, including four individuals colour-ringed in Norway by the LIFE project, under excellent conditions. © Petteri Tolvanen, November 2008

Lesser White-fronted Goose training workshop for south-east European countries at Lake Kerkini, Greece

Greece has proved to be the most important wintering country for the Fennoscandian population of Lesser White-fronted Goose (*Anser erythropus*, hereafter LWfG). During the LWfG EU LIFE-Nature project 2005–2009 the monitoring of the population provided new important knowledge on the species' wintering pattern but also new questions arose. The most important of those questions is the so called "mystery site": to which site or sites do the main flock or a large part of it disappear during mid-winter (see Panagiotopoulou et al. 2009)? Despite considerable effort it has not been possible to discover the site(s) where the birds are spending these periods.

Furthermore, the lack of knowledge on the occurrence of LWfG in the neighbouring countries brings up the need for more co-ordinated monitoring in south-eastern Europe. As the LIFE project was about to end and the new International Action Plan for the species (see Martin 2009) had recently been adopted, a training workshop to help in dealing with these issues in the future was organised by Hellenic Ornithological Society within the context of the LWfG LIFE project.

The workshop was held at Lake Kerkini on 28–29 November 2008. Under the title "Conservation of the Lesser White-fronted Goose in south-eastern Europe" the workshop aimed at:

- disseminating the results of the LWfG LIFE project to BirdLife partners in Bulgaria, Romania and Turkey as well as to Greek ornithologists collaborating with the Hellenic Ornithological Society in key areas for the species
- promoting the need to increase the level of knowledge about the movements of LWfG in the countries mentioned above and establish a permanent network for LWfG monitoring
- training key ornithologists of the above organizations in LWfG monitoring

About 35 trainees participated, most of them Greeks, but also two persons from each of the aforementioned neighbouring countries. Twelve members of the LIFE project team from all the project countries functioned as their lecturers and instructors. The presentations covered a wide range of topics connected to the LWfG such as conservation status, migration, population trends, threats, monitoring and of course identification issues. The delegates from Romania, Bulgaria and Turkey also presented the available knowledge on the species occurrence in these countries. It is worth noting that Kirsten Martin from the African-Eurasian Waterbird Agreement (AEWA) Secretariat also participated the workshop with a presentation on the new International Action Plan focusing specially on the south-east European countries. However, the probably most important and pleasurable part of the workshop was the field visit where we had the opportunity to observe, under excellent conditions, a flock of 45 Fennoscandian LWfG, including four individuals colour-ringed in Norway by the LIFE project.

The workshop was closed with the establishment of a permanent network for communication on and implementing a monitoring schedule for the LWfG in the south-east European countries and with the commitment of all the participating organisations to put effort on this subject in the future. The commitment includes specific activities that can take place if there is no funding available and activities that require funding.

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Appendix: Annotated checklist of bird observations during the Lesser White-fronted Goose expeditions to the Mesna river mouth, Kanin Peninsula, Russia, in the autumns of 1996 and 2008

The survey area is described in the article on pp. 40–43 in this report. The intensity and area covered by the two surveys are similar, but Torna and the seashore dunes were visited only in 1996. The counts of geese and swans given in Table 2 in the article mentioned above are not repeated here.

Survey periods and observers: 26 August – 12 September 1996: Aki Arkiomaa, Toni Eskelin, Risto Karvonen, Petteri Tolvanen and Aune Veersalu; 4–14 September 2008: Tomas Aarvak, Risto Karvonen, Petteri Polojärvi and Petteri Tolvanen.

Red-throated Diver *Gavia stellata*
1996: Breeding in the area. The total population size in the study area is difficult to estimate, but a maximum of 70 individuals was seen on 27 August. Breeding success seemed to be fairly good, since most of the pairs had at least one young and some pairs even two.
2008: Daily 20-30 adults present. No juveniles observed.

Black-throated Diver *Gavia arctica*
1996: A flock of ca 30 non-breeding ind. was seen daily. On some days few dozens of divers were seen migrating, noticeably on 29 August ca 40 ind. and 3 September 10 ind.
2008: Daily 15–25 adults present.

Whooper Swan *Cygnus cygnus*
1996: See Table 2 on page 42. Breeding was confirmed by the sighting of one brood. A flock of 250 non-breeding individuals on 26 August increased to about 365 on 7 September and indicated the onset of the autumn migration. An adult with blue neck band was observed on 28 August and 5 September.
2008: See Table 1 on page 41. Only two juveniles were observed.

Bewick's Swan *Cygnus columbianus bewickii*
1996: One adult bird, see Table 2 on page 42.
2008: One adult bird, see Table 1 on page 41.

Tundra Bean Goose *Anser fabalis rossicus*
1996 and 2008: See Table 2 on page 42.

White-fronted Goose *Anser albifrons*
1996 and 2008: See Table 2 on page 42.

Lesser White-fronted Goose *Anser erythropus*
1996 and 2008: See Table 2 on page 42.

Greylag Goose *Anser anser*
1996: See Table 2 on page 42.
2008: –

Bar-headed Goose *Anser indicus*
1996: –
2008: 1 individual, see Table 1 on page 41.

Canada Goose *Branta canadensis*
1996: –
2008: 1 individual, see Table 1 on page 41.

Barnacle Goose *Branta leucopsis*
1996 and 2008: See Table 2 on page 42.

Brent Goose *Branta bernicla bernicla*
1996 and 2008: See Table 2 on page 42.

Wigeon *Anas penelope*
1996: The most common duck species. Highest daily counts 300 ind. on 5, 7 and 9 September.
2008: The most common duck species together with Teal and Pintail. Highest counts 250 ind. on 8–10 September.

Teal *Anas crecca*
1996: Daily counts 30-135 individuals.
2008: As numerous as Wigeon and Pintail. Highest count 280 ind. on 13 September.

Mallard *Anas platyrhynchos*
1996: Low numbers, except on 3 September 60 ind. and on 8 September 40 ind.
2008: 30–50 individuals daily.

Pintail *Anas acuta*
1996: Almost as numerous as Wigeon, with highest count 300 ind. on 28 August.
2008: As numerous as Wigeon and Teal, with highest count 200 ind. on 5 September. The numbers decreased to less than 100 ind. towards the end of the survey period.

Shoveler *Anas clypeata*
1996: A flock of 10 ind. on 29 August and single birds on 1, 8 and 11 September (2 ind.) were the only observations.
2008: 2–4 ind. seen almost daily.

Tufted Duck *Aythya fuligula*
1996: Single individuals on 27 August, 28 August (2 ind.) and 9 September.
2008: Not observed daily. Highest count 5 ind. on 5 September.

Scaup *Aythya marila*
1996: Probably breeds in the area. A flock of 68 ind. was seen on 28 August, and another flock of 96 ind. on 5 September.
2008: 4–15 ind. observed daily, with a peak of 30 ind. on 7 September.

King Eider *Somateria spectabilis*
1996: Breeding was confirmed on 2 September, when a female with 3 young was seen in a shallow pond near the village of Torna. On 4 September another brood was sighted in Torna.
2008: – (Torna was not visited)

Long-tailed Duck *Clangula hyemalis*
1996: After 28 August, when a flock of 100 ind. was seen, daily counts varied between 10–20 ind.
2008: 10–30 ind. counted daily.

Common Scoter *Melanitta nigra*
1996: An adult female with 4 young was seen on 27–30 August.
2008: –

Velvet Scoter *Melanitta fusca*
1996: 5 ind. on 4 September in Torna was the only observation.
2008: 20 ind. on 5 September was the only observation.

Goldeneye *Bucephala clangula*
1996: 2–15 ind. present daily.
2008: 15–30 ind. present daily.

Smew *Mergus albellus*
1996: 4–6 ind. observed daily.
2008: 10–15 ind. observed daily.

Red-breasted Merganser *Mergus serrator*
1996: Several broods were seen and a maximum of 40 ind. (including young) was counted on 2 September.
2008: A flock of 20–30 ind. was present daily.

Goosander *Mergus merganser*
1996: 2–5 ind. were seen almost daily.
2008: 1–3 ind. were seen almost daily, with a distinct peak of 30 ind. on 5 September.

White-tailed Eagle *Haliaeetus albicilla*
1996: One adult and 2 subadults were seen intermittently throughout the period.
2008: 1–3 ind. seen daily, including juveniles, subadults and adults.

Hen Harrier *Circus cyaneus*
1996: Breeding of at least two pairs was confirmed. Additionally on most days a couple of individuals were seen on migration.
2008: 1–4 individuals seen daily, including juveniles, adult females and adult males.

Pallid Harrier *Circus macrourus*
1996: Sightings of an adult female and at least 2 juveniles throughout the period raised thoughts about possible breeding in the area. In addition, 5 unidentified female-plumaged Pallid/Montagu's Harriers (*C. macrourus/pygarcus*) were seen on 29 August.
2008: One juvenile bird arrived on 13 September, and on 14 September one adult female with two juveniles were present.

Marsh Harrier *Circus aeruginosus*
1996: Presumably the same female-plumaged individual was seen on 28 August and 7–9 September.
2008: One female-plumaged individual was seen on 14 September.

Goshawk *Accipiter gentilis*
1996: Observations of two ind. were made throughout the period.
2008: –

Golden Eagle *Aquila chrysaetos*
1996: One observation: on 11 September a juvenile on migration.
2008: One observation: on 5 September an adult present.

Rough-legged Buzzard *Buteo lagopus*
1996: Several (15–20) sedentary birds were seen in the end of August. Migration seemed to start in the beginning of September when on most days about 30 individuals were seen. The highest number was counted on 11 September when 55 birds were seen.
2008: 3–8 ind. observed daily, without any clear migration days.

Merlin *Falco columbarius*
1996: 1–5 ind. observed daily.
2008: 3–6 ind. observed daily.

Peregrine *Falco peregrinus*
1996: At least one family party and several other individuals were seen preying in the delta area. Day trip to the surrounding palsa mires revealed additional individuals. Highest daily counts: 11 ind. on 29 August and 10 ind. on 31 August. Birds studied closely belonged to the subspecies *calidus*.
2008: 5–8 ind., including adults and juveniles, were seen daily. Individuals with characters of both *ssp. calidus* and ssp. *peregrinus* were seen.

Gyrfalcon *Falco rusticolus*
1996: Observations were made on the following days: 29 August 2 ind., 1 September 1 ind., 2 September 1 ind., 3 September 1 ind., 6 September 1 ind. and 13 September 1 ind.
2008: –

Willow Grouse *Lagopus lagopus*
1996: Abundant and evenly distributed in willow thickets and dwarf birch bushes. Daily maximums of 70 ind. were counted on 26 August and 8 September.
2008: Daily maximums of 170 individuals on 7 September and 140 ind. on 11 September were counted. The largest single flock was some 90 ind.

Common Crane *Grus grus*
1996: 2–7 ind. seen daily.
2008: 3–5 ind. (a family with one juvenile, and an adult pair) present daily.

Oystercatcher *Haematopus ostralegus*
1996: On 3 September 6 ind. and on 4 September 2 ind. seen on the seashore near Torna.
2008: – (seashore dunes were not visited)

Ringed Plover *Charadrius hiaticula*
1996: In Torna, 2 ind. seen on 3 September and 10 ind. on 4 September. Single birds were observed on five additional days.
2008: –

Golden Plover *Pluvialis apricaria*
1996: Low (2-15) numbers were counted on most days.
2008: Not observed daily. Highest daily count 3 ind.on 13 September.

Juvenile Red-necked Phalarope (Phalaropus lobatus). © Petteri Tolvanen, Kanin Peninsula, Russia, September 2008

Adult Heuglin Gull (Larus fuscus heuglini). © Petteri Tolvanen, Kanin Peninsula, Russia, September 2008

Siberian Golden Plover *Pluvialis fulva*
1996: An influx of 7–8 juveniles was recorded on 11 September. Also in Finland, an exceptional influx of c. 45 individuals was observed in September 1996.
2008: One ind. was heard on night migration on 7 September.

Grey Plover *Pluvialis squatarola*
1996: On 3–4 September ca 500 ind. were counted on the White Sea shore near Torna. In addition, a major part of a flock of 5000 unidentified waders seen on the same days in Torna was probably Grey Plovers.
2008: 5–20 ind. observed daily on the coastal meadows (seashore dunes were not visited)

Knot *Calidris canutus*
1996: During 3–4 September ca 30 ind. were seen in Torna.
2008:– (seashore dunes were not visited)

Sanderling *Calidris alba*
1996: During 3–4 September ca 30 ind. were seen in Torna.
2008: One juvenile was observed on 11–12 September (seashore dunes were not visited)

Little Stint *Calidris minuta*
1996: Highest numbers were counted on following days: 28 August 50 ind., 4 September 50 ind., 9 September 120 ind. and 11 September 220 ind.
2008: Observed on three days, with highest count of 15 ind. on 5 September.

Temminck Stint *Calidris temminckii*
1996: Call of a single individual was heard on 28–29 August.
2008: One individual was observed on 7 September.

Curlew Sandpiper *Calidris ferruginea*
1996: Seen on most days. Highest counts included 70 ind. on 28 August, 40 ind. on 29 August and 30 ind. on 3 September.
2008: 2-10 juveniles observed on most days, with highest count of 12 ind. on 7 September.

Dunlin *Calidris alpina*
1996: In Torna, highest numbers were counted on 3 September ca 400 ind. and 4 September ca 2800 ind.
2008: Observed daily, with highest counts of 300 ind. on 5 September and 200 ind. on 11 September (seashore dunes not visited)

Bar-tailed Godwit *Limosa lapponica*
1996: On 3 September 2 ind. and 4 September 11 ind. were seen in Torna.
2008: – (seashore dunes not visited)

Ru *Philomachus pugnax*
1996: In Torna 3 September 85 ind. and 4 September 400 ind. were counted, otherwise only 10–30 birds were seen daily.
2008: The number decreased sharply from 100 ind. on 5 September to 10 ind. on 12 September; after this the species was not observed.

Jack Snipe *Lymnocryptes minimus*
1996: Single individuals were seen on 27 August, 30 August and 5 September.
2008: Two birds were seen on 12 September.

Common Snipe *Gallinago gallinago*
1996: 1–6 individuals were observed daily.
2008: 1–10 ind. observed daily, with highest count of 18 ind. on 5 September.

Spotted Redshank *Tringa erythropus*
1996: Two individuals were seen on 28 August and a single bird during 1-4 September.
2008: One bird was seen on 5 September.

Redshank *Tringa totanus*
1996: –
2008: One bird was seen on 12 September.

Wood Sandpiper *Tringa glareola*
1996: 1–2 ind. were seen almost daily throughout the whole period.
2008: –

Turnstone *Arenaria interpres*
1996: On 3 September 3 ind. and 4 September 12 ind. were seen on the seashore near Torna.
2008: 2 ind. seen on 7 September (seashore dunes not visited)

Red-necked Phalarope *Phalaropus lobatus*
1996: Large flocks were seen on following days: 28 August 43 ind., 30 August 30 ind. and 6 September 50 ind.
2008: Seen daily on 6–8 September, with highest count of 7 ind. on 8 September

Little Gull *Larus minutus*
1996: A flock of 9 juveniles was seen on 4 September.
2008: –

Common Gull *Larus canus*
1996: Breeding in the area. Maximum daily counts ca 50 ind.
2008: The most numerous gull species, with 30–40 ind. present daily, incl. adults and juveniles.

Lesser Black-backed Gull / Heuglin Gull *Larus fuscus heuglini*
1996: The most numerous gull species. Breeding numbers were estimated to exceed 80 pairs. The numbers started to decline in the second week of September indicating of the onset of migration.
2008: 20–30 ind. present daily, incl. adults and juveniles. Possibly part of the local breeding population had left the area already earlier.

Herring Gull *Larus argentatus*
1996: 2 adults and 3 juveniles on 27 August and 1 juvenile on 3 September were only records.
2008: –

Greater Black-backed Gull *Larus marinus*
1996: –
2008: One adult with one juvenile seen on 7 September.

Glaucous Gull *Larus hyperboreus*
1996: Several breeding colonies were found in the delta of the river Mesna. The number of breeding pairs was estimated at 30-40.
2008: 4–9 ind. present daily, including adults and juveniles that were still begging for food. Possibly part of the local breeding population had left the area already earlier.

Shore Lark *Eremophila alpestris*
1996: On 3 September 2 individuals on seashore in Torna and 11 September 2 migrating individuals were only observations.
2008: One bird seen on 7 September, and 6 ind. on 12 September.

Meadow Pipit *Anthus pratensis*
1996: Maximum numbers of 300 individuals were counted on several days.
2008: 50–250 ind. present daily, with a peak of 400 ind. on 7 September.

Red-throated Pipit *Anthus cervinus*
1996: In the end of August counts of ca 40 ind. were made on several days. In the second week of September already scarce and only a few individuals were observed.
2008: Observed daily. The numbers decreases markedly from ca 10–15 ind. in the beginning of the survey to 2 ind. on 14 September. Highest count 30 ind. on 7 September.

Pied Wagtail *Motacilla alba*
1996: Highest counts were in the end of August when numbers exceeded 400 ind.
2008: Observed daily. The numbers decreases from ca 300 ind. in the beginning of the survey to ca 100 ind. in the end of the period. Highest count 500 ind. on 7 September.

Yellow Wagtail *Motacilla ava*
1996: Single birds were seen on 27 August and 4 September.
2008: One bird seen on 4 September and 10 ind. on 5 September were the only observations.

Citrine Wagtail *Motacilla citreola*
1996: Nine individuals were seen during 27 August - 3 September.
2008: 2 ind. seen on 4 September was the only observation.

Bluethroat *Luscinia svecica*
1996: Low numbers (1–8 ind.) were observed in the end of the period.
2008: 1–5 ind. observed daily, with a distinct peak of 15 ind. on 7 September.

Wheatear *Oenanthe oenanthe*
1996: On 29 August 9 ind. and single individuals seen on 28 August, 1 September and 2 September were only observations.
2008: Seen on four days between 7–13 September, with a distinct peak of 15 ind. on 7 September.

Redwing *Turdus iliacus*
1996: 4–30 individuals observed daily.
2008: 10–40 ind. observed daily, with a peak of 50 ind. on 12 September.

Fieldfare *Turdus pilaris*
1996: –
2008: One ind. seen on 13–14 September.

Sedge Warbler *Acrocephalus schoenobaenus*
1996: Observed on 4 days with altogether 6 individuals.
2008: –

Willow Warbler *Phylloscopus trochilus*
1996: Seen daily in low numbers (2–20 individuals).
2008: Seen daily in low numbers (1–35 individuals).

Hooded Crow *Corvus corone cornix*
1996: Ca 20 ind. observed throughout the period.
2008: 6–12 ind. observed daily.

Raven *Corvus corax*
1996: 1–5 ind. were seen almost daily.
2008: 1–5 ind. seen daily.

Redpoll *Carduelis ammea*, **including unidenti ed Redpolls** *C. ammea/hornemanni*
1996: 10–50 ind. observed daily.
2008: 5–50 ind. observed daily, with a peak of 110 ind. on 7 September.

Arctic Redpoll *Carduelis hornemanni*
1996: One observation: one individual on 7 September.
2008: None observed even when all flocks at close range were carefully checked for this species.

Lapland Bunting *Calcarius lapponicus*
1996: Observed daily, common in suitable habitat. Highest counts exceeded 250 ind. in the end of August.
2008: 20–200 ind. observed daily without any clear trend in the numbers.

Snow Bunting *Plectrophenax nivalis*
1996: A flock of 7 individuals on 26 August was the only observation.
2008: A flock of 3 individuals on 13 September was the only observation

Reed Bunting *Emberiza schoeniclus*
1996: 2–25 ind. observed daily.
2008: 5–50 ind. observed daily, with a peak of 60 ind. on 12 September.

Rustic/Little/Yellow-breasted Bunting *Emberiza rustica/aureola/pusilla*
1996: A "tsik" call of 2 ind. heard on 28 August, 1 ind. on 2 September, and 1 ind. on 9 September.
2008: –

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The Lesser White-fronted Boose Group & The Call of Sirens

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