

**The Plan to Restore  
the Favorable Conservation Status of  
the Lesser White-fronted Goose  
in Finland**



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2. ed. (revised)

Compiled by

The Friends of the Lesser White-fronted Goose, January 25, 2009.  
c/o Dr. Lauri Kahanpää, Torpankuja 3 C 13, Fin 40740 Jyväskylä, Finland  
e-mail: [antti.haapanen@kolumbus.fi](mailto:antti.haapanen@kolumbus.fi) or [lauri.kahanpaa@jyu.fi](mailto:lauri.kahanpaa@jyu.fi)

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To the memory of Lambart von Essen

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## **Foreword**

The goal of this national conservation plan is to make clear which are the actions that can make it possible to restore the favorable conservation status of the Lesser White-fronted Goose in Finland as this aim is stated in the Finnish Nature Conservation Act (1096/1996, 5:3 §). It is generally accepted that overhunting is the crucial factor causing the dramatic decrease of the population during the last century.

The authors of this plan remember very well how illegal hunting of the Whooper Swan came to an end in Finland and what were the consequences. In 1950, the renowned Finnish novelist Yrjö Kokko published his best-selling book “The Whooper Swan, the bird of Ultima Thule”. More than any legislation, the novel influenced people’s attitudes. Poaching ceased and soon the Whooper Swan started to recover. This was the first great success of the nature conservation movement in Finland. Could the problem of Lesser White-fronted Goose be solved similarly? Unfortunately not. In this paper we try to explain why it is so and what could be done instead.

On the following pages, background information is presented only to the extent it is needed for the proposals presented here. General information concerning the biology of the species can be found on the Finnish web page [Selvitys 2008] where also the scientific references are listed. On request, a printed version is available. The plan at hand includes a short list of references mainly containing new information missing in [Selvitys 2008].

To a large extent, what is written in [Selvitys 2008] about the biology of the Lesser White-fronted Goose, in particular in Norway, is based on field work by WWF Finland and BirdLife Norway.

## **Acknowledgements**

The association Friends of the Lesser White-fronted Goose was established 10 years ago in order to restore the favorable conservation status of this species in Finland. During the past decade, the association was joined and supported by the best domestic and foreign experts on this complex endeavour. It is my pleasure to thank them all for their invaluable contribution. The same is true with respect to the volunteers who spent many hundreds of working hours building and repairing the constructions on our breeding site in Hämeenkoski, Southern Finland, where the association maintains a captive population of about 100 Lesser White-fronted Geese. There is one person who deserves to be mentioned by name. Architect Pentti Alho is the person who, since 1984, daily takes care of the flock be it weekday or Sunday. Without his skill and passion, the Finnish Lesser White-fronted Goose reintroduction project would not exist. It is a national shame that one person was burdened with such an enormous task in 1998 without adequate compensation for the work done.

Dr. Antti Haapanen, chairman

## **Executive summary**

### i) The present conservation status

The Lesser White-fronted Goose is a globally endangered species. About 25 000 individuals, at most one quarter of the original, survive. During the past century, the average overall downward trend has accelerated from two to six % annually.

In Finland the last breeding pair was observed in the middle of the 1990's. In Sweden the situation was similar, but thanks to a very original and successful reintroduction scheme, there exists today a viable population of over 100 individuals. This wild population stands under explicit protection by the EU. Also, its parent birds represent not only the same species and subspecies (there is only one) but also the same local population (the "western") as the original, inasmuch as possible. Sweden is the only country, where restoration of this species into the wild was successful.

Except for the Swedish geese and a residual population of five to ten breeding pairs in Norway, all other wild Lesser White-fronted Geese breed in the Russian Federation, mostly on the Asian side of the country. More than 60 % of them overwinter concentrated on Lake Dongting Hu in China, the rest in the Middle East, between Eastern Europe and Afghanistan.

### ii) Conservation history and major threat

During the last century, the formerly plentiful Lesser White-fronted Geese breeding in Norway, Sweden and Finland (>10 000) collapsed as a result of a steady loss of 5%/y. In spring 2008 only two dozen Lesser White-fronted Geese returned to northern Norway and in the autumn just three pairs had produced young. The population may die out any time.

Experts agree on that the main reason for the collapse is unsustainable hunting during migration and wintering in the territory of the former Soviet Union and the Middle East, where little can be done to improve conditions. Here formal protection of the species is impossible to implement in practice, since the most commonly hunted goose in the Palaearctic, the Greater White-fronted Goose, looks identical and appears in mixed flocks with the Lesser.

The successful reintroduction of the Lesser White-fronted Goose in Sweden was made possible by changing their migration behaviour. This can be done using Barnacle Geese (*Branta leucopsis*) or ultra light aircraft as foster parents. The result was the restoration of an original migration route from Scandinavia to the southwest. Now the Swedish geese stay all year round inside the territory of the EU escaping the overhunting.

Since 2004, the Finnish nature conservation Association Friends of the Lesser White-fronted Goose is implementing the Swedish method in Finland on an experimental basis. Earlier reintroduction attempts run by WWF Finland and supported by the Ministry of the Environment were not successful as changing the migration route was not part of the earlier restocking method.

### iii) The final goal

Finland has ratified several conventions and agreements concerning the conservation of the bird fauna. Following these conventions and EU legislation such as the Bird Directive, the duty to attain and maintain the favorable conservation status of each species was adopted to the Finnish Nature Conservation Act (1096/1996). According to (5:3 §), the conservation status of a species shall be taken as favorable when the species proves capable of maintaining itself on a long-term basis as a viable component of its natural habitat. In the plan at hand, it is regarded that the restoration program will take up to 20 years. The favorable conservation status is interpreted as the existence of at least 100 breeding pairs of Lesser White-fronted Geese in Finland. This corresponds roughly to a total spring population of 400 geese which is 40 % of the number declared in [AEWA 2008] (Cf. sec.v) as the aim for all of Fennoscandia.

### iv) Actions

For this plan, all conservation measures proposed in Finland were evaluated. For each measure the required time scale, costs and benefits for restoration were calculated. Not a single one of the action types proposed so far turned out to result in that the Norwegian or the Russian population would extend their breeding range to Finland. It would also take at least 50 years before the reintroduced Swedish population could reach the Finnish borders. Therefore, the only possibility to restore the Finnish population of Lesser White-fronted Geese is by restocking in the former breeding grounds

and guaranteeing the survival of the reintroduced population by reviving the southwest migration route. We estimate that this process will take up to 20 years as the production capacity of the available captive population is limited and financial constraints exist. There are all reasons to start this process immediately since any delay will make reintroduction more difficult and expensive and the methods have already been tested in Sweden and Finland. As reintroduction gains momentum, supplementary conservation measures shall be carried out in the breeding and resting grounds where needed.

#### v) Other action plan drafts

In spring 2008, the Lesser White-fronted Goose working group of WWF Finland submitted to the Ministry of the Environment their proposal for the conservation of this species. Also, the African Eurasian Waterbird Agreement (AEWA) has recently published their own international plan draft for the conservation of this goose species [AEWA 2008]. Neither of these plans includes a feasible restoration program. In particular, there is no mention of urgent restocking although the critical situation of this species is admitted. Refusing to release captive birds is justified in these documents by referring to a recommendation of the Scientific Council of the Convention for the Conservation of Migratory Species (Bonn Convention). This recommendation was given in 2005 and it states e.g.:

- "For the present, we do not support the introduction of Lesser Whitefronts into flyways where they do not occur naturally."
- "Despite genuine efforts to improve the genetic purity of existing captive flocks, we consider that these flocks are not to be regarded as potential sources for release to the wild. It does seem to us that not all, but a large part, of the scientific community will never be completely satisfied concerning the level of genetic contamination from the Greater White-fronted Goose, (*Anser albifrons*) and other species, which many will regard as impossible to eliminate."

Since 2005, both of these arguments were found not to be in accordance with facts: Recent studies show that the Lesser White-fronted Goose migrated in great quantities to Western Europe in the early 1900:s and this tradition still exists to some extent, so the southwestern migration route is not a "flyway where they do not occur naturally". In addition, the research group at Heidelberg University has shown that the proposed contamination by genetic material from Greater White-fronted Geese is a misinterpretation of data. Some other observed genetic contaminations are real but the affected individuals can be securely identified and removed. [Wink 2008] (In spite of this, "not all will ever be completely satisfied", as stated above.)

In Sweden, setting up a conservation plan is in the process. At present, about 100-120 Lesser White-fronted Geese and ten breeding pairs belong to the reintroduced Swedish population staying in summer in Sweden and wintering in the Netherlands. The current Swedish conservation plan draft sets the goal to increase this population to 200 breeding pairs in 2025. This is twice the Finnish aim of 100 pairs for 2028.

#### vi) The proposals

On the grounds presented above, the Finnish official policy concerning the Lesser White-fronted Goose should be updated to meet the present state of knowledge. Accordingly, the Finnish Ministry of the Environment should take relevant measures, in particular inform the EU DG Environment and the Secretariat of the African Eurasian Waterbird Agreement about this progress. This notification should among other appropriate items include the following:

- The long term goal of the Finnish policy on restoring the favorable conservation status of the Lesser White-fronted Goose shall be the existence of a stable population of at least 100 breeding pairs and a spring population of at least 400 Lesser White-fronted Geese in Finland.
- To reach this goal, the Finnish administration on the environment will support the reintroduction of the Lesser White-fronted Goose using the Swedish method developed by Lambart von Essen which has worked well in Sweden and was tested in Finland. No other method to reach the goal is known.
- For this action, a working group chaired by a member from the Ministry will be formed. This working group shall be open for all those interested in this action and agreeing on this policy.

vii) The various actions needed and the allotment of responsibilities

- The Ministry of the Environment will entrust the Finnish Forest and Park Service to take care of practical tasks like finding suitable release sites in the Alpine zone and taking care of the transport of the birds to be released there.
- The number of released goslings should annually be at least 10 and rise to 20 as soon as possible, depending on the productivity of the captive populations. With this volume, it is calculated that it will take 10-20 years to reach a stable population.
- The Association Friends of the Lesser White-fronted Goose will continue to maintain the captive flock in Hämeenkoski. The Ministry of the Environment will channel sufficient financial support for this purpose.
- To guarantee the genetic diversity and purity of the Finnish captive donor population, 15-20 young Lesser White-fronted Geese shall be acquired from other captive flocks. Their genetic background must be flawless. As the Norwegian and Russian native populations are decreasing and already endangered themselves, it is preferred not to further stress them by catching individuals or collecting eggs in the wild.
- The Lesser White-fronted Goose working group shall ask an adequate source to provide suitable telemetric equipment and organize sufficient electronic tagging of the released birds. The working group shall also be in charge of monitoring the geese and of the Finnish survey sites where it is probable to see them either on their migration or during the summer time. The working group shall also be active in promoting the monitoring of the species in countries where it is poorly organized; supposedly the most important of these countries is Kazakhstan.
- The working group shall annually update their detailed working program and short term goals. The group shall also try to obtain external financial support for various activities. Informing the press, the general public and nature conservation organizations, private as well as public, shall be an essential part of its activities, too.

viii) Annual costs

• Maintenance of the Hämeenkoski captive population		
○ Contribution by private organizations		10.000 €
○ Contribution by the Ministry of the Environment		<u>50.000 €</u>
○ Subtotal		60.000 €
• Introduction into the wild		10.000 €
• Purchase of new parent birds	10.000 € in one go.	
• Monitoring and reporting		<u>5.000 €</u>
• Annual activities total		<u>75.000 €</u>

The program schedule could be tighter at correspondingly higher annual costs. The expenses paid by the government / Ministry of the Environment consist of the contribution to the maintenance of the captive population and the labour contributed by the Forest and Park Service in the transport and release of the Lesser White-fronted Geese to the wild. The contribution of the association Friends of the Lesser White-fronted Goose is the labour to maintain the captive population.

In addition to these sums, private organizations are invited to contribute to the conservation of the species on their own cost. In particular, monitoring could be the contribution of other voluntary organizations.

It is difficult to determine exactly how long this project will take. This plan builds on an estimate of 20 years.

## **1. The decreasing of the Lesser White-fronted Goose population**

Most of the total population of the Lesser White-fronted Goose population breeds in the northern part of the Russian Federation. The only exceptions are those about 40 birds staying in summer in Norway and 120 birds belonging to the restocked population in Sweden.

During the last 100 years, the global population of the Lesser White-fronted Goose decreased from 100 000 birds to one quarter of that. This corresponds to an average loss of 2 %/y. The decrease is faster in the western population compared to the eastern population wintering in China (about 16 000). On the other hand, all the eastern geese are wintering within a small area, – Lake Dongting Hu - which is a great risk since the wintering habitat is not well protected and is undergoing massive environmental changes. The western geese overwinter scattered on partly unknown areas, extending from Iran-Iraq-Azerbaijan to the border areas of Turkey and Greece. Small numbers come to stay over winter in Western Europe. Most of the western Lesser White-fronted Geese gather during their autumn migration in the northern part of Kazakhstan on a lake area, where the monitoring of the population is easier than elsewhere.

The decrease of the numbers of these birds has been fastest in the westmost corner of their breeding range. In the early 1920's the Lesser White-fronted Geese probably counted about 10 000 both in Fennoscandia and the same number in the European part of Russia. Nowadays it has been estimated by Russian scientists that there are some 500-800 birds on the European side of Russia in spring before breeding. The decrease rate has been about 3 %/y.

Not so long ago, the Lesser White-fronted Goose still was an integral part of Lappish Nature, alongside with the Bean Goose the most common goose species. Aged persons in northern Lapland can still remember it breeding commonly, and thousands of these geese were seen grazing on the Baltic Sea shoreline meadows both in autumn and in spring. This is deeply reflected in Scandinavian culture – just think of Nils Holgersson's flight.

In Finland the last breeding pair was observed in the mid 1990's. In Sweden restocking was started in 1981 when most of the original geese had disappeared. In Norway there still breed about 5-10 pairs - in 2008 three pairs raised young. There may be some breeding pairs on the Kola Peninsula, the northwest corner of Russia. The average rate of decrease of the Norwegian geese was 5%/y both in the long run and over the last 20 years.

Apart from the restocked population in Sweden, no viable Lesser White-fronted Goose population is breeding on the territory of the EU.

In recent years, less than ten birds are observed in Finland on their spring migration. Autumn migration has ceased.

## **2. The reasons for the decrease**

Experts agree on that the main reason for the dramatic decrease in numbers of the Lesser White-fronted Geese is hunting during their migration and wintering. Many arctic goose species winter in Western Europe where hunting pressure on them is low and their survival rate is high. These goose populations have recently shown an enormous growth. In contrast to this, most Lesser White-fronted Geese migrate through the former Soviet Union's territory to an area extending from the Caspian Sea to the Persian Gulf and Greece. In particular, the geese staying in summer in Norway begin their autumn migration with a direct flight over the White Sea to northern Russia. From there they continue through Russia and/or through Kazakhstan to their wintering sites, many to the Evros Delta between Turkey and Greece. From ring marking and satellite telemetry it is known that hunting pressure on them is great in these areas. This is a very serious threat for two reasons:

- The Lesser White-fronted Goose looks so similar to the Greater White-fronted Goose (*Anser albifrons*) that hunters cannot distinguish between this legal quarry species and the Lesser White-fronted Goose. The Greater White-fronted Goose is the most common and most hunted goose in Eurasia. Both species occur in the same places in more or less mixed flocks but the lesser species seem to behave a little bit more fearlessly. They are shot in clearly higher numbers than their relative numbers in the flock would give rise to [Yerokhov & al. 2008].
- In most countries which these geese pass during their autumn migration, law enforcement is inefficient. So in spite of their formal protection in all countries of their annual range the Lesser White-fronted Geese are hunted both in secret and openly. A typical example of this is the Russian hunting trip organizer Okhotklub, which in its advertisement openly mentions the Lesser White-fronted Goose as a quarry species and includes possible fines in the costs of the trip. (Cf. fig. 1, also: <http://www.okhotklub.ru/eng/piskulka.htm>) Another serious threat to the species is poaching by poisoning as observed in China.



**Fig. 1. Lesser White-fronted and Greater White-fronted Geese on the advertising picture of a Russian hunting travel company, Okhotklub.**

Some other potential threats can be mentioned. The extensive drainage of wetlands in the lower part of Iraq and the extreme variations of the water level in the Caspian Sea have contributed to the loss of winter habitat. At the same time, the increase in human population density in combination with social unrest, poor living conditions and lack of food have had their negative effect on the survival chances for many wetland species. Oil and gas drilling in the North Russian breeding grounds of the Lesser White-fronted Goose as well as other increased human activities may influence their well being in the breeding grounds too but until now no changes in the breeding success are observed – neither in Russia, Norway or Sweden.

In Fennoscandia, the increase of red fox and mink in the breeding areas has raised some concern. Within the Nordic countries the traditional resting sites are nowadays well managed meadows. Local threats are under control.



### **3. History of attempts to conserve the Finnish Lesser White-fronted Goose population**

Since the 1970's, a variety of actions and attempts to conserve the Finnish Lesser White-fronted Goose population were tried out, though no positive results have been seen so far. On the positive side, there is the enhanced information gained by the different surveys. There is a keen cooperation between Finnish and Norwegian researchers to clarify our understanding of the species' biology, in particular their habitats, breeding and migration. Most important for conservation is the question about the distribution of mortality over the whole annual range of the Norwegian geese. On this subject information still is incomplete, but already now the results show that the key threats are found far from Finnish borders: The mortality exceeding the reproduction rate takes place in remote, mostly unknown areas in the East (Cf. fig. 26).

The chronology of conservation efforts of the Lesser White-fronted Geese in Finland is the following:

- In the 1950:s and 1960:s, Martti Soikkeli gathered data on the decrease and disappearing of the Lesser White-fronted Goose. The alarming results of his 20 years long observation period were published in 1973 [Soikkeli 1973]. The observations were made in spring and autumn on a classical resting site in Pori region on the Finnish coast of the Gulf of Bothnia.
- The species was formally protected in Finland in the year 1969. Today it is protected in all countries of its annual range.
- The management of the Finnish former resting sites was begun in the 1980's and today they are regularly grazed or mowed to remain suitable for geese grazing.
- In the 1980's, there still were some pairs of the Lesser White-fronted Goose breeding in Sweden and Finland. On spring migration about 100 geese were observed in each country. In both countries restocking was deemed urgent – and begun. The project was successful in Sweden but not in Finland. There was a difference in method. In Sweden, a new biotechnical method was developed. Dr. Lambart von Essen used Barnacle Geese as foster parents for the Lesser White-fronted goslings. Eggs of Lesser White-fronted Geese were laid in Barnacle Goose nests in Central Sweden. Later the families were caught, raised over the summer in captivity, and released in the North. Since young geese follow their parents on their migration and are imprinted on the route, they would adopt the Barnacle Goose's migration route to the southwest. Next spring, the foster parents would return back to their former breeding area in Central Sweden whereas the young Lesser White-fronted Geese flew back to their releasing sites in Swedish fjells' alpine region. Today there are about 120 wild Lesser White-fronted Geese in Sweden and the population is growing about 5%/y. In Finland foster parents were not used in the 1980's and no breeding was ever observed. In 1998, the Ministry of the Environment and the Lesser White-fronted Goose working group of WWF Finland decided not to correct the defect but to discontinue to finance the project. Only monitoring the decreasing original population was continued, mainly on the Norwegian side of the border in cooperation with BirdLife Norway. (Cf. sec. 4)
- In 1998, when the Finnish captive Lesser White-fronted Geese had become homeless, the Association Friends of the Lesser White-fronted Goose was founded. The Association continued to maintain the captive flock in order to improve restocking using the Swedish method. Since doubts had been raised on the genetic purity of the captive birds, there was an interruption in restocking and it was continued only after the goslings had passed appropriate gene tests. Since 2004, releases to the wild have continued on an experimental basis, following the geneticists' recommendations. Because of financial constraints, the annual numbers of released birds are too small, only up to 5 goslings per year. (Cf. sec. 4) Fortunately some of them have been seen in the Netherlands just as planned. [Koffijberg & al. 2005]

#### 4. The current situation

There is a controversy between the WWF-based protection project and the reintroduction project. At first sight, there is disagreement on two questions:

- Is the migration route to the southwest artificial?
- Does the genetic composition of the captive flock match the genetic composition of the original geese in Fennoscandia?

A third crucial question is:

- Is it possible to enhance conditions in Europe, or anywhere else, so much that the Norwegian population will not only survive but also recolonize Finnish Lapland.

These questions are formally of the Yes or No type, but actually they contain gradations and values and should be put quantitatively:

- What is known about the migration history of the Lesser White-fronted Goose, what historical status is considered ideal, and how can or must our goal differ from this ideal.
- How much and in what respect do the genetic compositions of the following populations of geese differ from each other? How much and what kind of gene flow is or was there between these populations. What, if anything, keeps the populations genetically apart in the wild? What kind of genetic composition could be accepted or wanted as a feasible goal for future Finnish reintroduced geese
  - the original – now extinct - geese in Finland
  - the Norwegian geese
  - the West Russian geese
  - the Swedish geese
  - Greater White-fronted Geese
  - other wild populations
  - various captive populations
- How much, when and how can we enhance conditions in Europe (where exactly!) or in Asia so much that the Norwegian population will survive? When could it recolonize Finnish Lapland? How probably? How fast? What would happen to the rest of the global population before that?

There never was an analytical debate on these questions in Finland. If the scientific content of the questions were at the heart of the matter, the answers given by science, incomplete as they always are (see below in this section), would already have been accepted as a basis for further action. But the difference between the current conservation projects lies more in values and aims than in practical plans. Today the WWF team concentrates all their efforts on rescuing the Norwegian “original Fennoscandian population” and their “original migration route” representing “true Nature” and will not accept any other solution until the last goose is dead [Juha Merilä, pers. comm.]. Simultaneously, the reintroduction project described in this plan aims at “restoring the favorable conservation status of the Lesser White-fronted Goose in Finland” as part of “protecting the entire species from extinction”.

There are no free living Lesser White-fronted Geese staying in Finland in summer. In spring, less than ten birds rest for a couple of days near Oulu during their migration further north to Norway. The WWF project has collected much information on these birds, their breeding area, breeding success, migration routes and mortality. This information can be put in use as a basis when developing methods for improving the conservation status of the species. The project has initiated the management of the staging areas in Finland and Estonia and to some extent in other EU countries, too. However, the WWF project has not been able to improve the conservation status of the species. The WWF project builds on the belief that after having left Norway in late October and having crossed the White Sea to their first resting site on Kanin Peninsula, a high percentage of the Norwegian Lesser White-fronted Geese make a sharp turn to the southwest. The

longest leg of their flight will now go over Russia until they reach eastern EU regions from where there is a short distance to their wintering range in Greece or Turkey. Many of the birds are indeed seen in Hungary in November. Enhanced law enforcement and better habitat management in countries like Hungary and Greece could in the opinion of the WWF project contribute to the better population status of these geese. However, this has not happened. The likely explanation is that the geese are mainly shot earlier in autumn before reaching EU soil. There are quite a few direct observations of this. Satellite telemetry has also revealed that many of the Norwegian geese do not follow the pattern described above but continue eastwards from the Kanin Peninsula passing the Ural mountains as far as to the Yamal Peninsula and even to the Taimyr Peninsula before turning south. Further tagging may give more information but nothing can change the basic fact: No improvement in the mortality of this population has been seen so far.

The Friends of the Lesser White-fronted Goose concentrate on the management of the captive population and on implementing the Swedish method to Finnish conditions. The association has improved the breeding system and the constructions and equipment at the breeding farm. The captive population's size was doubled to 120 geese. Being the largest captive population of Lesser White-fronted Geese in the World it makes one third of all, the other thirds consisting mainly of units in Sweden and Germany.

As described above in sec. 3, the Finnish reintroduction project is using the Swedish method developed by von Essen which has already shown its merits in Sweden. However, the method has been criticized on various reasons, some of them real, some rhetoric:

- Occasional hybridization with the Barnacle Goose is possible as a side effect of imprinting on foster parents. This behaviour was observed in Sweden in a few cases. With one exception, the hybrid families were eliminated. During the reintroduction period 1981-1991 none of the hybrid broods were seen in Swedish Lapland [v. Essen 1996]. The species are known to interbreed in the wild [McCarthy 2006] but there is no evidence for the fertility of their offspring. The risk for harmful genetic introgression into either species is minimal but each hybridization case amounts for losing one Lesser White-fronted Goose. All in all, the Swedish experience shows that this problem is not so serious that it would make Barnacle Geese unfit for practical use as foster parents. (For an alternative, see sec. 10.7)
- The genetic background of the captive population was criticized. The first and most serious suspicion was due to the apparent finding of "almost Greater White-fronted Goose-type" mitochondriae in a large percentage of the captive Lesser White-fronted Geese [Ruokonen 2001]. Later, the same type of mitochondriae were found in several independent wild Lesser White-fronted Goose samples and close scrutiny revealed that these mitochondriae are not typical of either species but of common origin in both; the mitochondriae have diversified earlier than the species [Wink 2008]. This is a natural phenomenon known from other closely related goose species. [Craig Ely, Alaska Science Center, oral at GOOSE 2007 Conf.]. Anyhow, in some rare cases, hybridization in captivity with Graylag Goose or Greater White-fronted Goose was verified. The latter is also known from free-living birds [McCarthy 2006] [Wink 2008]. The amount of "false" DNA in their chromosomes was measured. Birds with low "contamination" are equivalent to late generation offspring of natural hybrids, and may in fact be such. To be on the safe side, the recommendation was given **to eradicate the few Lesser White-fronted Geese with any such signs from the Parent Bird Pool** (but not to kill them. The first misinterpretation of data already resulted in disaster: dozens of unique pure Lesser White-fronted Geese were killed on false premises.)
- There was the criticism that a southwestern migration route is artificial and should not be created. **This was proven manifestly false.** Recent research in archives as well as field observations [Mooij & al. 2008] and [Heinecke & al. 2008] confirm what one can already read in classics like [Kivirikko 1948] and [Ringleben 1957]: the Lesser White-fronted Goose has formerly commonly migrated to Western Europe all the way to England, and the tradition

still exists.

- It was claimed that there is a risk of creating an artificial Barnacle Goose population in Lapland. This risk is zero since the foster parents never return to the release site. They are imprinted on their original breeding area. This is corroborated by long experience in Sweden. [v. Essen 1996], [Andersson 2007].
- The releasing of captive geese opposed to by referring to the so called “precautionary principle” according to which nothing should be done which might later turn out to be harmful. In its literary interpretation this is obviously absurd: nothing at all could ever be done in favour of any endangered species. Interpreted as the common sense claim to consider insufficiently known risks particularly seriously, the principle is followed in this plan.
- Another argument says that no goose must be released as long as it is not unanimously accepted by the scientific community and/or all Nature Conservation organizations. Requiring unanimity is logically equivalent to giving any scientist or organization, including ourselves in both categories, a veto right. This would lead to inhibiting all progress and to the extreme precautionary principle already rejected above. Likewise, referring to “most experts” or the like is unscientific.
- Finally, the reintroduction project was also sued for breaking the law. As a result of the trial, there now exists a formal final court decision on that the Swedish method is legal in Finland and the goslings from the Hämeenkoski farm may be released into the wild.

The merits of the foster parent method are few but strong enough to outweigh all the criticism:

- No other method is available for successful reintroduction of the species in Finland except the foster parent method. Admittedly, there is another choice for foster parents: ultra-light airplanes. They are guaranteed hybridization-free. (Cf. sec. 10.7)
- The system is fairly economical. (Cf. sec. 10.7 and [Paulsch & al. 2008])

## **5. Obligations to international conventions, the EU and national legislation**

The primary aim of the Finnish Nature Conservation Act is to maintain biological diversity (1096/1997, 1:1 §). In order to achieve this goal, nature conservation shall focus on attaining and maintaining the favorable conservation status of natural habitats and of the wild fauna and flora (5:1§). By definition, the conservation status of a species shall be taken as favorable when the species proves capable of maintaining itself on a long-term basis as a viable component of its natural habitat (5:3§).

According to the Finnish Nature Conservation Decree (160/1997), the Lesser White-fronted Goose is listed as a threatened species (21§) and a species under strict protection (22 §). The deterioration and destruction of a habitat important for survival of a species under strict protection, is prohibited (Nature Conservation Act 47:2 §). The Ministry of the Environment is obliged to, as necessary, prepare a program for reviving the population of such species (Nature Conservation Act 1096/1996 47:1 §). At present, there exists no such plan for the Lesser White-fronted Goose. The publication at hand is a private contribution to producing this plan.

Finnish nature conservation legislation meets well the obligations of the international conventions and agreements ratified by Finland. The implementation of the valid EU legislation is as well in place. These valid conventions are the following:

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar convention);
- Convention of the Conservation of European Wildlife and Natural Habitats (Bern convention);

- Convention on the Conservation of Migratory Species of Wild Animal Species (Bonn convention); including the African-Eurasian Waterbird Agreement (AEWA).
- Finland also is the party to the Convention on Biological Diversity.

The Convention on Biological Diversity states: "*Each contracting party shall as far as possible and as appropriate, and predominantly for the purpose of complementing in-situ measures: (a) Adopt measures for ex-situ conservation of components of biological diversity, preferably in the country of origin of such components (Art. 9a).*" This statement includes only an appeal for a certain action. In Finnish legislation there is no mention of ex-situ conservation. Neither has the Ministry of the Environment supported the maintaining of the captive population in Hämeenkoski.

In addition to these conventions there exist some valid recommendations:

- EU Biodiversity Communication and Action Plan
- IUCN/SSC Guidelines for Re-introductions
- International Single Species Action Plan for the Conservation of the Lesser White-fronted goose (Western Palearctic population) [AEWA 2008]

The EU Biodiversity Communication and Action Plan states that the aim is to completely halt the loss of biodiversity by 2010 and beyond.

The IUCN/SSC guidelines are a collection of advice for teams tackling the problems of reintroducing a species on its former habitat or elsewhere. The proposals recommended in the plan at hand do conform to the guidelines: Habitat conservation and management are in place during the whole annual cycle of the geese, the restoration of an old migration route is in line of these ecological requirements and the acceptance of the local society is in place. The method was tested during two decades under Swedish conditions and recently also in Finland

"[AEWA 2008]" refers to the October 2008 version which still is not completely finalized: On page 5 it is mentioned that there is lack of consensus in some issues. There also is a call for further discussion. "*Such reviews should ideally be undertaken by the end of the year 2009.*" Amendments will be needed since, unfortunately, there do remain some serious shortcomings in [AEWA 2008]. The aims of the plan are stated in the foreword as follows: "*The current estimates of the Western Palearctic population of the Lesser White-fronted Goose range from 8,000 to 13,000 individuals. It has declined rapidly since the middle of the 20th century – with an average decrease rate of 30 - 49% in the period 1998 – 2008 (corresponding to 4 - 6 % annually), mainly due to overhunting and habitat loss. The declines have given rise to fears that the species may become extinct unless the downward trend is halted and reversed. The aim of this SSAP is to restore the Western Palearctic population to a favourable conservation status throughout its range and to secure a population size of over 25,000 individuals for its Western main subpopulation and over 1,000 individuals for the Fennoscandian subpopulation.*"

These aims seem reasonable but difficult to reach. [AEWA 2008] correctly identifies the large hunting pressure in autumn, winter and spring as the main threat for the whole species, including the Norwegian relict population. Practically all of this hunting takes place on the territory of the former Soviet Union or in the Middle East. Also autumn flyways of the Norwegian geese pass at least 80 % over such territory. The plan [AEWA 2008] contains no suggestions on how to effectively fight against this threat. Therefore, representatives of the relevant countries, in particular the Russian Federation, the Ukraine and Kazakhstan should be welcomed to take part in the finalization of the international conservation plan [AEWA 2008]. These countries are not parties to the African Eurasian Waterbird Agreement but their contribution would be of crucial importance in assessing the possibilities for protection against illegal hunting. The final plan should include a credible assessment of the possibilities and time scale to reduce the hunting pressure on the Lesser White-fronted Goose in all range

states including at least the Russian Federation, Ukraine, Byelorussia and Kazakhstan. In order to maintain the credibility of the international plan, the support of national hunting authorities and hunters' national and international organizations should also be acquired. We suggest that the AEWA secretariat should enter new negotiations not only with governments but also with these hunting organizations both in the AEWA countries and in other range countries. All this is necessary, since 999 promille of the Western Palearctic population of the Lesser White-fronted Goose breed in Russia, and the problem to be solved by [AEWA 2008] is their continuous decline towards extinction.

Throughout [AEWA 2008] it is stressed that the remnant Lesser White-fronted Goose population in Norway is most acutely endangered. [AEWA 2008] considers saving them as a first priority in its own right. If so, the plan should include an attempt to guarantee their survival by catching and breeding. This has already become urgent, since according to WWF data the Norwegian birds are almost extinct already: In the last 20 years their average number of breedings has fallen from 10 to 6, the number of spring birds from 70 to 35 and the population decrease is going on without change for more than a century. (Cf. fig. 15, fig. 16, sec. 8) The reasons are known and they cannot be reduced within a sufficiently short period of time. (Cf. sec. 2, 10.8) Therefore, catching and breeding is the last and only way to rescue the Norwegian Lesser White-fronted Geese.

In Fennoscandia, the aim of [AEWA 2008] is *"restoring the population to a favourable conservation status and to secure a population size over 1,000 individuals."* The Finnish National Plan at hand is exactly in line with this aim: (400 individuals in Finland.). What is left unmentioned in [AEWA 2008] is the reason why restoring the species in Fennoscandia is of special importance: Fennoscandia is the only geographical location where it is possible for the Lesser White-fronted Geese to survive as a free living species independently of the ongoing fatal development in the formerly Soviet countries. The successful Swedish reintroduction project has demonstrated that it is possible not only to reintroduce the species in the wild but also to restore the westernmost of their original migration routes. Since this route lies completely within the territory of the European Union, protecting the geese during their whole annual life cycle is possible. Fennoscandia is crucial, since reviving a safe migration route is, by geography, possible only here, and this is the only known way to guarantee the continued existence of the species under all circumstances. As a side effect, it gives time to find out methods to decrease hunting pressure in the Russian Federation, Ukraine, Kazakhstan, and other important range areas.

Although these principles are implicitly accepted in the [AEWA 2008] aim cited above, the practical implications for the ongoing programs in Sweden, the international Aktion Zwerggans -project and, relevant for the National Plan at hand, the restoration of the Finnish population to a favourable conservation status, are neglected in [AEWA 2008]. On p. 8 [AEWA] proclaims: *"Supplementing wild populations with captive-bred birds shall be considered if other conservation measures are not as quickly effective as needed and should populations continue to decline"*. [AEWA] does not pay attention to the fact that this condition is satisfied in Finland since the 1980's when WWF Finland deemed reintroduction urgent. Since then, the population has died out in Finland and Sweden. In Norway decline has continued by 70%! Delaying the release of captive birds is justified in [AEWA 2008] by referring to an advisory recommendation of the Scientific Council of the Convention for the Conservation of Migratory Species (Bonn Convention). This recommendation was given in 2005 and it states e.g.:

- *"For the present, we do not support the introduction of Lesser Whitefronts into flyways where they do not occur naturally."*
- *"Despite genuine efforts to improve the genetic purity of existing captive flocks, we consider that these flocks are not to be regarded as potential sources for release to the wild. It does seem to us that not all, but a large part, of the scientific community will never be completely satisfied concerning the level of genetic contamination from the Greater White-fronted Goose, (Anser albifrons) and other species, which many will regard as impossible to eliminate."*



Since 2005, both of these statements were found not to be in accordance with facts: Recent studies like [Mooij & al. 2008] and [Heinecke & al. 2008] confirm that the Lesser White-fronted Goose migrated in great quantities to Western Europe in the early 1900:s and this tradition still exists to some extent, so the southwestern migration route is not a “flyway where they do not occur naturally”. In addition, the research group at Heidelberg University has shown that the proposed contamination by genetic material from Greater White-fronted Geese is a misinterpretation of data. Some other observed genetic contaminations are real but the affected individuals can be securely identified and removed. [Wink 2008] (Cf. sec. 4)

## **6. The conservation aims**

To be in harmony with current legislation (Cf. sec. 5), the primary aim of this plan must be the restoration of the Lesser White-fronted Goose as a breeding species on the Finnish territory and to enhance the status of the population so that it meets the criteria of the favourable conservation status. In this context we understand the situation so that the population should reach at least 100 breeding pairs; this would be 30-40 % of the [AEWA 2008] aim for all of Fennoscandia. (Cf. sec. 5) A feasible time span for the restoration is 20 years. It must be realized without damaging the Lesser White-fronted Goose populations in any other country or any other species.

The second priority is that the geese should be as similar as possible, as far as their genetic composition is concerned, to the original Lesser White-fronted Geese once found in Finland. It would be fortunate if the future Finnish geese would intermix with some Norwegian Lesser White-fronted Geese, preferably in captivity. In this way the possible, though not probable, genetic special features of the Norwegian birds could survive.

An essential part of the conservation of this species is naturally also the due protection and management of their habitats not only in the North but throughout the range of their annual cycle. This will in many cases be of benefit for other wetlands species, too.

The restoration of the Lesser White-fronted Goose population in Fennoscandia is important not only regionally but also for the survival of the species as such. The global population is endangered, and in most of the distribution area no real improvement of conditions seems possible since the economic and social situation is unstable, law enforcement is not possible or there are other obstacles. In contrast, Fennoscandia – in particular Finland - is geographically in the unique position where it is possible to establish a goose population with a migration cycle completely within safe EU territory. If the Lesser White-fronted Goose would die out in the rest of the World it could still survive in the EU countries.

Reaching the favourable conservation status is a goal with two sub-aims. The first is to create a population of 400 free-living Geese into the wild in Finland - one way or other. Since no spontaneous recolonization is possible, this can only mean releases from captivity. The second component consists of guaranteeing that the geese can survive in the wild.

## **7. Numerical and spatial data**

The Lesser White-fronted Goose breeds in remote sub arctic regions where the monitoring of each subpopulation is almost impossible. The only exceptions to this may be the breeding sites in Norway and Sweden which are fairly limited in size. So in general the monitoring shall take place in the concentration areas during migration or wintering:

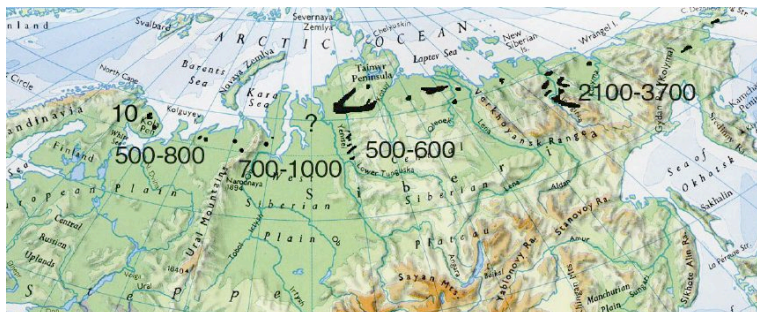
- The East Asian population of the Lesser White-fronted Goose overwinter in China by the great Dongting Hu lake on the lower Yangtze river.
- The geese of the West Eurasian population gather in October in two waves on the lakes of

Kostanay region in Kazakhstan. The exact sites vary from year to year depending on the water level and salinity of the lakes. In some years, the geese are scattered and in some years they are concentrated in great flocks. Finnish ornithologists have participated in census works in Kazakhstan 1996-2007. [Yerokhov & al. 2008]

- The remnant Norwegian goose population can be counted by individual by the Porsanger Fjord and nearby peat lands in northmost Norway.
- Very little is known about the Lesser White-fronted Geese of the Kola Peninsula in northwest Russia. Most probably they join the Norwegian flocks in autumn migrating east and resting on the Kanin Peninsula.
- The Swedish Lesser White-fronted Geese are censused in Sweden and in the Netherlands on their traditional wintering sites.



**Fig. 2. The breeding range and number of the Lesser White-fronted Goose about 1950. [Morozov & Syroechovski 2002]**



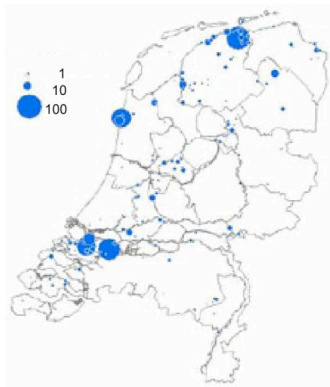
**Fig. 3. The range and numbers of the Lesser White-fronted Goose in 2000. [Morozov & Syroechovski 2002]**



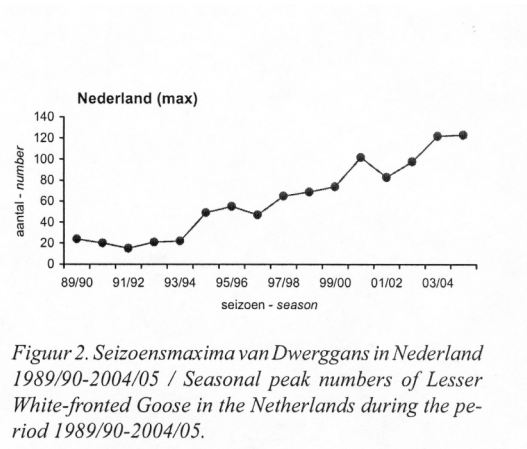
**Fig. 4. The autumn migration routes of the eastern and western populations of the Lesser White-fronted Goose. Of the East Asian population's migration routes only the eastmost is known in some detail but it is confirmed that only one wintering site exists in China. That is Dongting Hu lake. The West Eurasian population has an important autumn concentration in Kazakhstan and probably a large variety of wintering sites. Apparently most Norwegian birds fly a long distance over Russia in autumn. Many winter in Greece and Turkey. Their spring migration goes more directly to Norway. [Morozov & Syroechovski 2002]**



Fig. 5. The migration route of the Lesser White-fronted Geese breeding in Sweden. Data: [Andersson 2007]



*Distribution of Lesser White-fronted Geese in the Netherlands Average seasonal sum according to 5x5 km atlas squares.*



*Figuur 2. Seizoensmaxima van Dwerggans in Nederland 1989/90-2004/05 / Seasonal peak numbers of Lesser White-fronted Goose in the Netherlands during the period 1989/90-2004/05.*

Fig. 6a. The distribution of wintering Lesser White-fronted Geese in the Netherlands [Koffijberg & al. 2005].  
 Fig. 6b. The growth of the Lesser White-fronted Goose population wintering in the Netherlands. The ringed birds show that at least most of them are of Swedish origin. [Koffijberg & al. 2007]

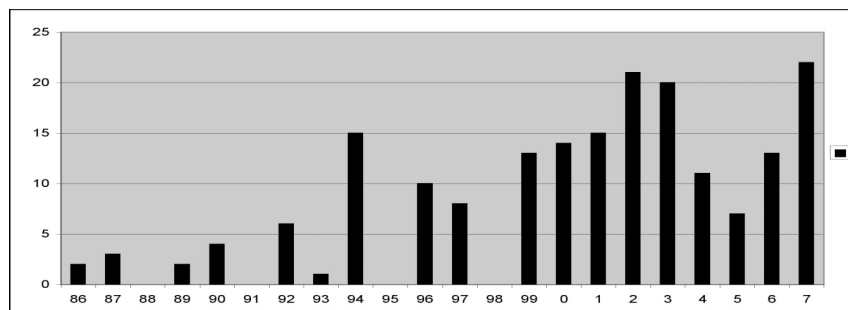
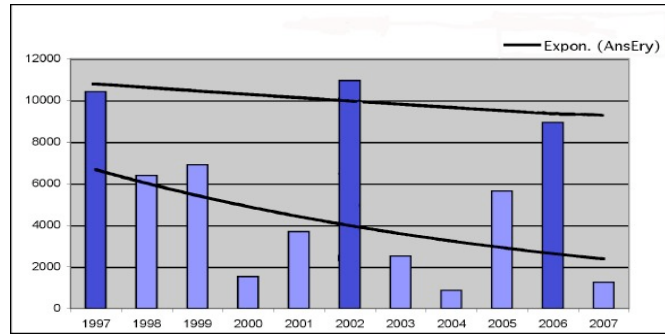
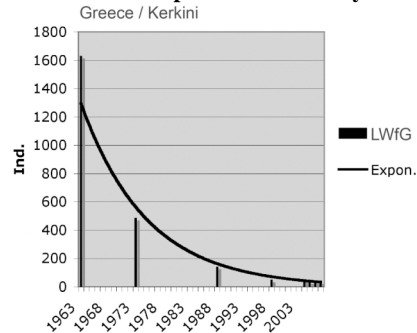


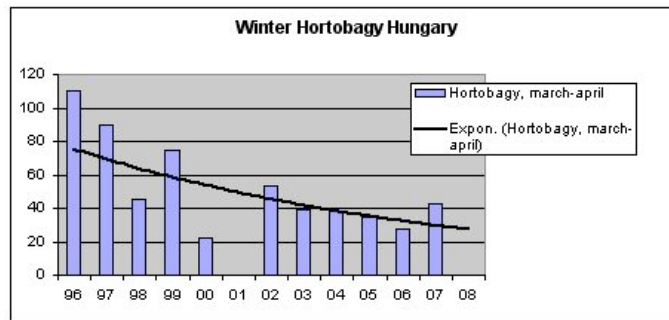
Fig. 7. The numbers of observed goslings under natural conditions in Sweden years 1986-2007. The releasing of geese is interrupted since 1998. [Andersson 2007].



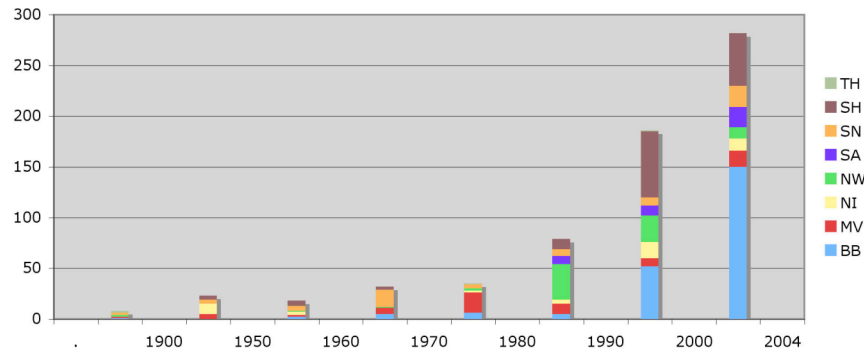
**Fig. 8. The numbers of the Lesser White-fronted Geese in Kostanay region, Kazakhstan, in 1987-2007. The population trend is about -6%. The years with exceptionally high numbers observed may represent a more reliable census. The trend based on that data corresponds to annually -2%. [Yerokhov & al. 2008].**



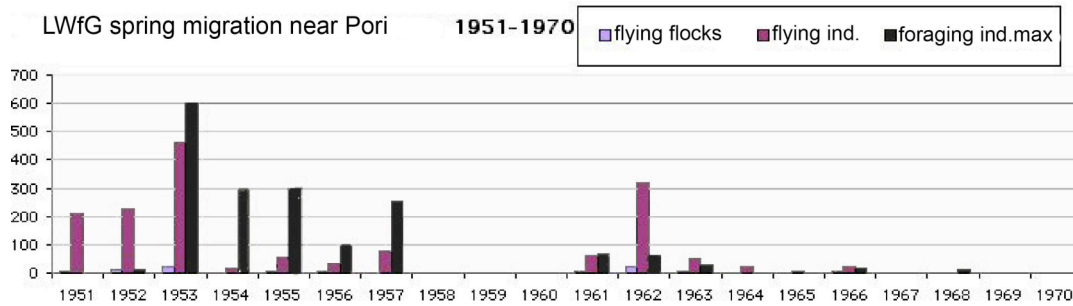
**Fig. 9. Observed numbers of Lesser White-fronted Geese at lake Kerkini, Greece correspond to the effect of a negative 8% trend. [WWF]**



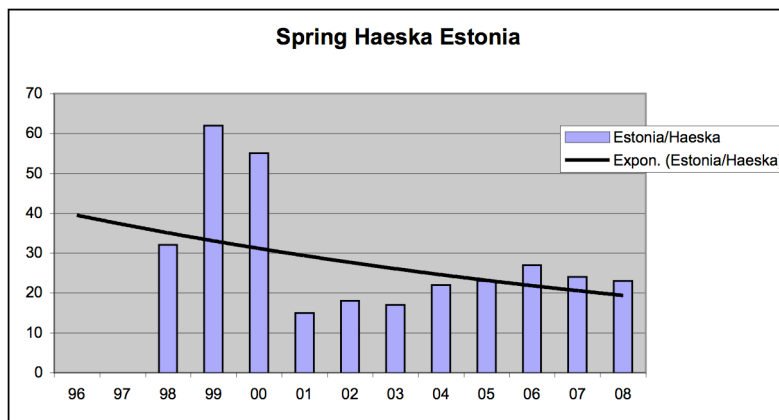
**Fig. 10. The numbers of Lesser White-fronted Geese during the spring migration in Hortobagy, Hungary. The figures show a gross trend of -7%. [WWF]**



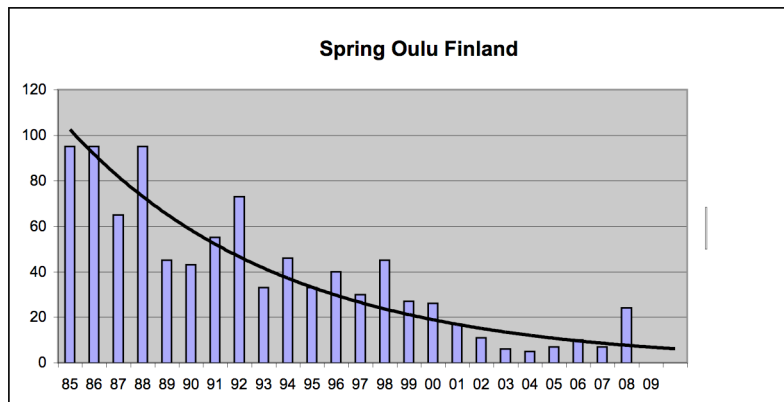
**Fig. 11. Observations of Lesser White-fronted Goose flocks (totally 1139 birds) in various States of the Federal Republic of Germany. The increase is probably due to intensified observation. Most of these geese breed in Russia. [Mooij & al. 2008]**



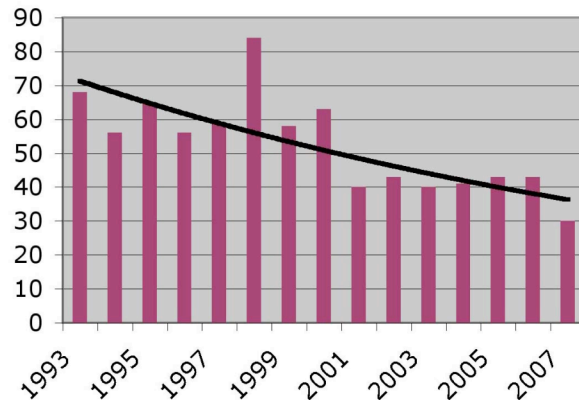
**Fig. 12. The decrease of migrating Lesser White-fronted Geese in Pori region, the central part of the Finnish west coast in 1950-1970. [Soikkeli 1973]**



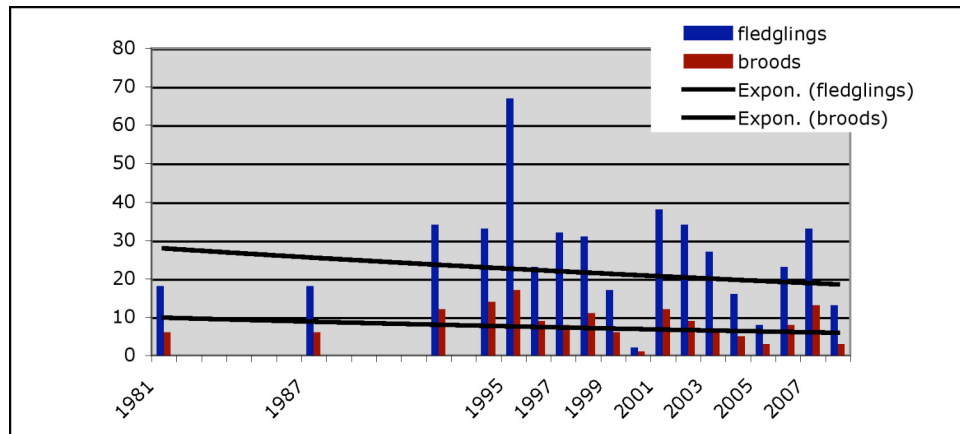
**Fig. 13. The numbers of the Lesser White-fronted Geese in Estonia. [WWF]**



**Fig. 14. The numbers of the Lesser White-fronted Geese observed in Oulu region, northern part of the Finnish west coast since 1985. [WWF]**



**Fig. 15. Numbers of the Lesser White-fronted Geese in the Porsanger Fjord region, northernmost Norway. A minus 5% annual trend is obvious. The birds can be individually identified by their black belly patches. Therefore it is known that almost all of the geese seen either in Estonia or in Finland on their spring migration are later counted in this area in Norway. This proves that the Porsanger Fjord region is the only spring concentration area of this species in Norway, and close to all geese are recorded. [WWF]**



**Fig. 16. Late summer observations of the Lesser White-fronted Goose broods in the Porsanger Fjord concentration area. The average number of broods has decreased from ten to six in 20 years. [WWF]**

## 8. The mortality of the Norwegian Lesser White-fronted Geese during migration

According to monitoring data from the Northern Bothnian Bay in Finland and the Porsanger Fjord region in Norway, the mortality of the goslings during their first migration round is 76 % and that of adults 16 % (Table 1).

### 8.1. The number of remaining Norwegian Lesser White-fronted Geese.

The Norwegian Lesser White-fronted Geese are counted in spring and autumn in the Porsanger Fjord area, northernmost Norway. Since 80 % of the geese which are seen in spring either in Estonia or in Finland are also observed at Porsanger, it can be concluded that practically none of the Norwegian geese escape being recorded in Norway [Markkola & Luukkonen 2004]. A quick look at fig. 15 and 16 makes it clear that there remain six breeding pairs (by no means 20-30). Also it follows that almost no Lesser White-fronted Geese breed on the Kola Peninsula, at least they do not migrate over Estonia or Finland.



## 8.2. The mortality of Norwegian Lesser White-fronted Geese.

According to data collected in the 1990's, there are 11 % young geese in the flocks arriving at the Porsanger Fjord in spring. For an unchanging population, the mortality of adults must not be over this percentage, since otherwise the juveniles do not compensate for the losses. Unfortunately, the adult mortality is 16 %. This corresponds to the observed 5 % annual decrease of the population size. The population could be stabilized on the current level by reducing the adult mortality from 16 to 11 %. In plain words this means avoiding one shooting of three. For real growth, doing better is needed, the adult mortality should be lowered to less than one half of the present value. Since most of the killing goes on in the territory of the former Soviet Union, not even reducing losses to zero on the EU side is sufficient for reaching this goal. (Table 1).

The mortality rate of the juveniles is an important problem as well. According to the present data a very high percentage (76%) of the geese are shot or otherwise killed during their first migration. These numbers may seem embarrassingly poor, but adult mortality may still be the decisive factor, since geese are long-lived birds repeatedly undergoing the dangers of migration as adults. From the view point of choosing the best method of conservation, the distinction between adult and juvenile mortality is irrelevant, since the same conservation activities would improve both. By what was said above and in sec. 2 and sec. 4, reducing mortality can only mean that the migration route is changed to the southwest. In the East mortality cannot be reduced within any overseable period of time.

A Population parameter	B Observed value	C Theoretical maximum or minimum	D Value needed to reach the growth coefficient $\lambda = 1$ i.e. a stable population
Survival rate of juveniles	0,239	0,7-0,8	0,320
Mortality of juveniles	0,761	0,2-0,3	0,680
Survival rate on 2. migration	0,837	0,90-0,97	> 1 (impossible)
Mortality on 2. migration	0,163	0,03-0,10	< 0 (impossible)
Survival rate of adults	0,837	0,90-0,95	0,926
Mortality of adults	0,163	0,05-0,10	0,074 (half of observed)
Breeding success	0,61	<0,7 ?	0,820 (impossible)

**Table 1. Population parameters of Norwegian Lesser White-fronted Geese. Column B lists the observed value for each population parameter. The numbers should be interpreted like this: 23,9 % of the juveniles leaving for migration in autumn will return in spring, of the adults 83,7 %. The breeding success 0,61 stands for an adult female producing an average of annually 0,61 female juveniles. Column C lists estimates for theoretical maxima and minima of the various parameters and column D gives for each parameter the value which is needed to reach the growth coefficient  $\lambda = 1$  corresponding to zero growth, if all the other parameters are left constant. A stable population can obviously only be attained by dramatically reducing mortality – in practice by altering the migration route. Data: [WWF] (Cf. also Table 2)**

	Ring marked in Finland	Ring marked in Norway	Sum	Percent
Reported shot in following winter	3	1	4	36
Probably shot in following winter	1	2	3	27
Killed by bird of prey	1	0	1	9
Fate unknown	2	1	3	27
Sum	7	4	11	100

**Table 2. The causes of death of the Lesser White-fronted Geese ringed in 1995-1996 in Finland and in Norway. (J. Markkola 2005 at the meeting of experts in Lammi, Finland concerning the conservation of the Lesser White-fronted Goose.)**

## 9. The Future

For conservation of the Lesser White-fronted Goose, best possible information about their biology and current status is of vital importance. Today, fairly accurate information on the population dynamic parameters of European Lesser White-fronted Goose populations is available and we can calculate reliable estimates for their future in dependence of the chosen protection measures. Selecting an optimal mix of activities should be preceded by a look at this dependence. In practice, a computer model is useful for calculating and presenting expected effects of protection measures. Such a model is available in the Excel sheet "Effects.xls" at <http://www.piskulkaconf.tk> where also a user's guide including a full description of the scientific background data can be found. The latter document is labelled "Background\_Effects.html". Below we sketch the results of some calculations, draw some consequences of the results and reflect on how to find an optimal protection policy.

### 9.1. The null scenario - Continuation of current trends

Today, there exist two relatively large Lesser White-fronted Goose populations, one wintering in the Far East, the second in the Middle East. A fraction of the latter breeds in Europe. An estimate for their future can be constructed by simply plotting the population sizes assuming no change in their current growth/decrease rates. This makes sense since these rates have been close to constant during several decades.

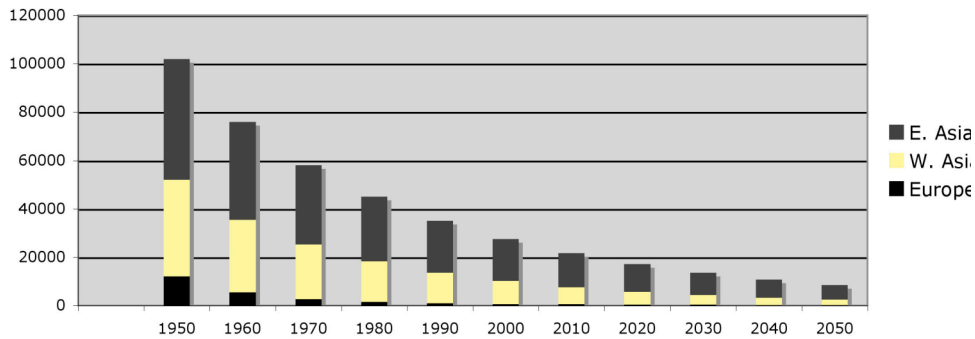


Fig. 17. Global trends of Lesser White-fronted Geese populations

Fig. 17 displays the global decrease, faster in the West than in the East, and fastest in Europe. This relation may change in the future as environmental conditions worsen in China and Russia.

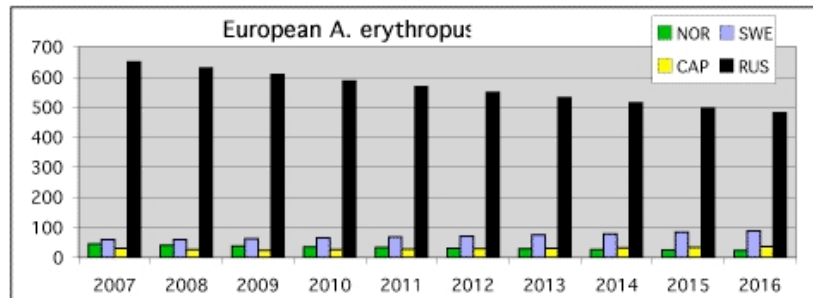


Fig. 18. Expected future for the Lesser White-fronted Goose in Europe, if current trends continue.

In fig 18, CAP stands for the new Swedish captive population with founder parents caught in Russia. The model population NOR imitates the Lesser White-fronted Geese breeding in Norway. These birds are closely monitored, so the population's size and decrease rate are known. Since similar monitoring goes on in Sweden also, the model population SWE represents its real life

counterpart accurately. RUS imitates the sum of all local Lesser White-fronted Goose populations in European Russia. The population parameters of real life RUS are insufficiently known. Estimates vary between 500 and 800 individuals and a decrease rate between 2 and 6 %/y.

Fig. 19 extends the predictions into a distant future. Without changes in conditions, the Swedish Lesser White-fronted Geese will outnumber European Russian ones in 2030, both counting some 300 spring individuals. In Norway one pair might breed in 2050. In practice, bad luck in hunting may already have put an end to their history.

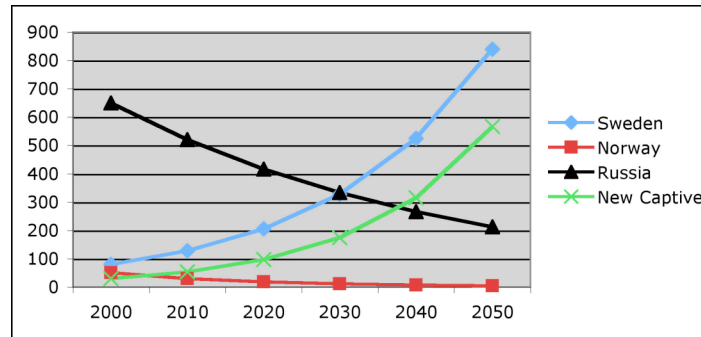


Fig. 19. Long run expectation for the Lesser White-fronted Goose in Europe, if current trends continue

Before 2040, the new Swedish captive population's size will not reach 300, the minimum for sustaining genetic diversity in captivity. In the model, CAP has initially 60 birds. In reality less than 25 freshly caught Lesser White-fronted Geese live in Sweden, and no further import is announced. The breeding success and mortality for captive Lesser White-fronted Geese are well known; the slow growth rate in the diagram is correct by long time experience. In particular, arctic geese cannot be manipulated to lay more eggs in captivity than in the wild.

## 9.2. Better protection - Dependence on human intervention

For a wise allocation of limited protection resources, it is of importance to have a quantitative idea of the potential effects of planned protection measures. All proposed conservation measures are described in Ch 10. The computer model concentrates on catching, breeding and restocking only. Including other activities in a quantitative model would make no sense since public awareness campaigns, protection of known staging grounds, further research etc. have had no measurable effect. The model gives answers to questions like what happens in Russia, Norway and the captive flocks, if we catch a certain number of Lesser White-fronted Geese in Russia or release some captive-born birds in Lapland. What would happen if all birds were kept in captivity instead of releasing some? What combination would promise the best results for Finland? How fast? At what cost? At what damage to the Russian Lesser White-fronted Geese?

In addition to RUS, SWE and NOR, the model includes one more population labelled FIN and imitating a future Finnish Lesser White-fronted Goose population. Also, population CAP is split into two model populations, one representing Swedish, the other Finnish captive Lesser White-fronted Geese. For each population, the model operates with population parameters like

- juvenile and adult mortality
- breeding success
- initial numbers of birds and their age distribution
- natural emigration between populations etc.

Protection measures are modelled by numbers like

- numbers of goslings caught in Russia for breeding in captivity
- numbers of goslings released into the wild in Sweden
- numbers of goslings released into the wild in Finland.

The model "Effects.xls" gives any interested person the opportunity to see what would be the result of his/her choice for a reintroduction strategy. In the non-interactive paper at hand, we can only present some few sample scenarios of the infinitely many possibilities covered by the computer program but the reader is encouraged to test how reducing the mortality of adult Norwegian Lesser White-fronted Geese from 16 to 12 per cent would affect the future of the population (still decreasing). Another test run could be to find out what breeding success is sufficient for doubling a captive population in ten years (the default value will do) or how many captive geese are needed to continuously produce annually 30 goslings to be released (200).

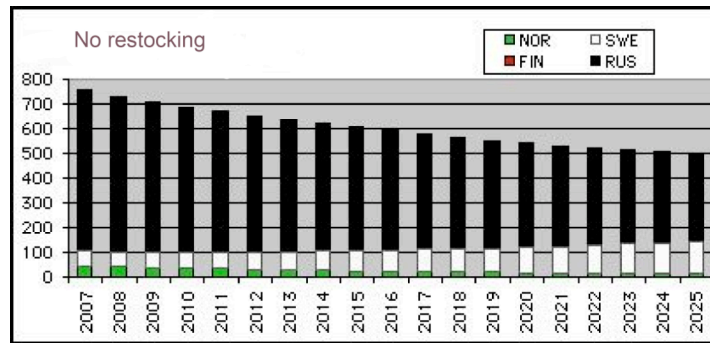


Fig. 20. Without restocking, the Lesser White-fronted Geese will go extinct in Norway and the population be halved in European Russia. The Swedish will increase but not enough to compensate for the losses in Russia.

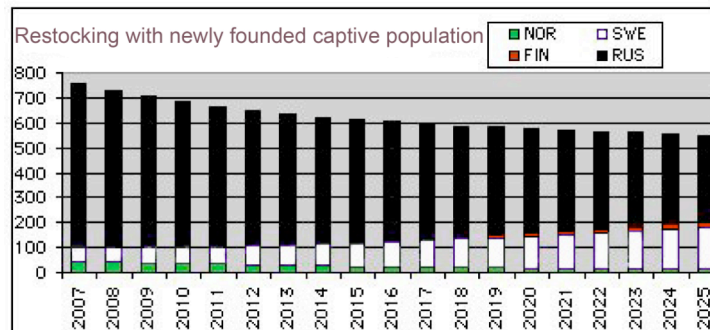


Fig. 21. The Swedish goal of 200 breeding pairs cannot be reached relying solely on a feasible Russian import.

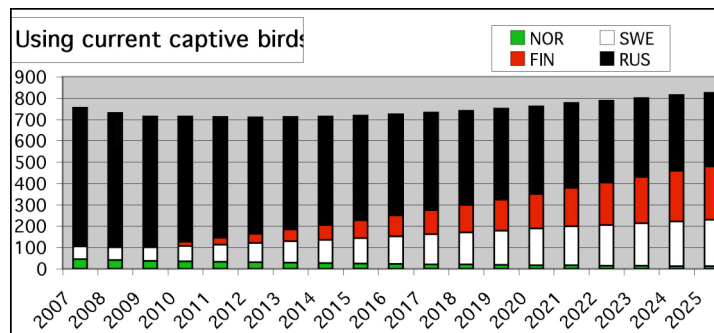


Fig. 22. If available captive Geese are used as parents, the Finnish goal can almost be reached with one breeding farm. In this diagram's scenario, the Swedish population is moderately supported by restocking. We do not know how to rescue the Russian Lesser White-fronted Geese, but we know how to create a free living reserve on the territory of the European Union.

## 10. Evaluation of the different alternatives for future actions

The effectiveness of proposed actions is measured by how much closer they take us to the aim, a favorable conservation status, which is 100 breeding pairs in Finland. Since the species is extinct in Finland, this must be reached by immigration, either by spontaneous recolonization from other countries or by restocking. For evaluating protection measures building on the first alternative, the key numbers are the probabilities for spontaneous recolonization from neighbouring countries:

**Recolonization from Sweden.** The Swedish Lesser White-fronted Goose population counts a little more than 100 individuals and is increasing by 3-5 % depending on when restocking will be continued. Even in the more favorable case, there will not be more than 300 free living Lesser White-fronted Geese in Sweden in 2028. [Andersson 2007] mentions a goal of 600 ind. Even this would not generate any pressure to expand into Finland, 500 km away from the core breeding area in the Scandinavian mountains. The probability for Swedish recolonization is close to 0.

**Recolonization from Norway.** The Norwegian Lesser White-fronted Goose population is continuing their free fall and is now down at an average of 35 spring individuals or 6 breeding pairs. There are annual variations in breeding rates and mortality, due not only to variable conditions like the weather but also to the small number of birds. In the long run, the average decrease rate will probably continue to be 5%/y. If current and future protection measures in Hungary, Greece etc. could succeed completely, one could ideally calculate with theoretical zero mortality in these countries. Even in this case, the decrease of the Norwegian geese would not be halted but its rate would still be about 2%/y. Only half of the current population would survive in Norway in 2028. This corresponds to 2-3 breeding pairs. As the Norwegian breeding area lies close to Finland, a sporadic breeding on our side of the border is thinkable. But this would not change the overall situation, since breeding on the Finnish side would not improve the prognosis for these birds. The probability for permanent recolonization from Norway is zero.

**Recolonization from Russia.** Today 500-800 Lesser White-fronted Geese (120-200 pairs) breed in European Russia without showing any signs of recovery or expansion. Their breeding range is split into fractions, a vast majority breeding east of the White Sea. No effective protection seems possible whereas environmental hazards like oil and gas exploration are increasing in the area. No spontaneous Russian recolonization can be expected.

**Summary.** In the following half century, Finland will not be spontaneously recolonized. The probable development is that the Norwegian population will die out and, in a distant future, the Swedish reintroduced population will grow strong enough to recolonize Norway and Finland.

**Action alternatives** The following pages contain an evaluation of all conservation measures which have been considered in Finland. Their cost, duration and effect is estimated. The results are summed up in section 12 (Table 3). We use the following vocabulary:

- The unit of **gain** for a conservation measure is one pair breeding in Finland
- The total **cost** of a conservation measure is the money needed for implementing the measure during 20 years, in euros €.
- The **price tag** for one pair is the cost divided by the gain.
- The **cost efficiency** of a conservation measure is its cost divided by its gain, i.e. the inverse of the price tag.
- The **duration** of the conservation measure is the time needed for fully implementing the measure, maximally 20 years.
- The **number of breeding pairs** is  $\frac{1}{4}$  of the number of geese returning to the Finnish breeding area in spring. (Cf. sec. 5)
- The **goal** of the action plan is 100 breeding pairs i.e. 100 gain units. (Cf. sec. 5)

### 10.1. Intensified law enforcement

Gain: Hunting pressure decreases in Finland. According to estimates in [Selvitys 2008], zero hunting pressure would annually result in 0 - 0,3 individuals escaping from being shot. Halving the hunting pressure would mean rescuing annually 0 - 0,15 geese corresponding to 0-0,0375 pairs. The gain in 20 years is less than one pair. There is no guarantee that the not-shot pair would breed in Finland.

Cost: On the whole, Finnish hunting legislation is up to date but hunting practices and control can always be improved near sites where Lesser White-fronted Geese may stay. The costs are made up of decision making and administration costs and of control activities in the field. At least two full time controllers are needed for halving potential hunting pressure. This would be necessary at least bimonthly during 20 years. Annual costs 10.000 € sum up to total 200 000 €.

Remarks: When there are more Lesser White-fronted Geese to protect and more potential shootings to avoid, intensified law enforcement begins to pay off better. If there were tens of breeding pairs or hundreds of migrating birds this conservation action could have a measurable effect – one or two pairs could survive because of better control. Under improved conditions, the price tag for one pair could be 10 000 - 100 000 €.

Conclusion: Intensified law enforcement in Finland is expensive and ineffective both under current conditions and after successful reintroduction. Anyway, something could be done in this direction. Hunters' organizations could play an important role in influencing their members' attitudes. In a hunter's view, the showing up of some Lesser White-fronted Geese in his hunting grounds is easily seen as mainly a risk of future hunting restrictions. This kind of thinking should preferably be replaced by the hope of gaining a new game species in the future.

### 10.2. Protection of releasing sites

Gain: The gain depends on the intensity of restocking. Experience from the Swedish reintroduction project tells us that an identical project would in 10-20 years create a population of some 20 pairs. The result depends much on an early start, since geese released now will have time to multiply. One can calculate with ten pairs breeding in the core area. Optimistically we could think that full implementation of this kind of protection measures would reduce brood mortality by one third, from the 15 % observed in Sweden to a remaining 10%. This would increase the number of autumn goslings by about 5% from about 3 to 3.15, an increase of 0.15 goslings for each pair. We agreed upon an average 10 breedings during 20 years. This adds up to 30 autumn goslings. On the "safe" Swedish migration route, juvenile mortality is under 30 %. All in all this means 20 spring birds, the equivalent of 5 pairs.

Cost: The costs are made up of decision making and administration costs and of marking the reintroduction area – as an alternative to secrecy. At least two full time controllers would be needed to patrol a marked restocking area during 2 summer months in 20 years. Just like in sec. 10.1, the annual 10.000 € would make totally 200 000 €.

Remarks: The exact contents of this activity is not well defined, so the cost estimate is also rather vague. If no geese are released, this action is impossible. If so many are released that the goal of 100 pairs is reached in 20 years, then the gain of protecting the release area becomes proportionally larger, up to 25 pairs. Further cost efficiency can be reached by combining protection of the breeding area to reducing predators and other disturbance, since the same persons can do both. The overall magnitude of the cost efficiency is not altered by such measures. Possible administrative measures may be taken in advance, when the reintroduction area is chosen. Field work does not make sense before there are enough geese breeding there. If restocking is started quickly, keeping the location secret in the first years and beginning patrolling only ten years later, when there are tens of nests to be guarded, costs are halved to below 100 000 €. This could reduce the price tag for each breeding pair to something like 20 000 euros.

Conclusion: Marking and guarding the reintroduction area may be a feasible alternative at the time, when the place cannot be kept secret anymore.

### 10.3. Protection of other breeding sites

If a sporadic breeding is found in Finland, a protection plan is set up quickly taking into account all local conditions. The most important aspect is secrecy. Finding a breeding pair in Finland is potentially possible, but it is impossible to guess, where. Protection or even surveying the vast potential breeding areas in Lapland is impossible.

Gain: The gain by protection of a known breeding site can be estimated by comparing to the probability of a nest being destroyed - a number known from the Swedish project, where about 10-15% of the nests/broods are lost due to predators or other disturbance. At best, human protection efforts could lower these risks by one percentage unit which corresponds to increasing the breeding success by one per cent, typically from 3 to 3.03 autumn goslings/pair. An optimist could calculate with one pair breeding and being found in Finland each year. Under such very favorable conditions, the average effect could be as high as 0,03 goslings each year, adding up to half a gosling in 20 years. This would be the count in autumn. The breeding would almost surely belong to the east-migrating population with a mortality of 70 % on first migration. So the overall gain of 20 years protection would be less than one tenth of a goose pair. Even in an unrealistic scenario where protection could eliminate all losses, the gain would be only one pair in 2 decades.

Cost: The cost of the protection measure depends on its exact contents. Keeping the site secret – or just avoiding to find it at all – costs nothing, but no active method of protecting the breeding sites can be imagined to cost under a few thousand euros/year. Calculating with a rather arbitrary number like 2 500 €/y gives a total cost of 50 000 €.

Remarks: Like the measures 10.1 and 10.2, also this protection measure shows any effect only when there are already some Lesser White-fronted Geese breeding in Finland. But inventing any effective protection measures to be applied at a sporadically found breeding site seems difficult.

Conclusion: Keeping the site secret is self-evident. Active protection is a feasible alternative only in the improbable case that the secret leaks out – the nest could be found near a place frequented by humans. In that case, closing the area could become necessary and in principle crucial for total breeding success – corresponding to one spring gosling annually. Under such conditions, the price tag for one spring pair could be in a feasible order of magnitude like 5000 €. Unfortunately, the gained bird would be of the east-migrating type.

### 10.4. Protection of known resting sites

Gain: With one minor exception, all resting sites in Finland are already protected by the bird directive / the Natura 2000 network [Selvitys 2008]. Therefore only minor improvements, mainly intensified monitoring, can be done. As the species doesn't have problems with the breeding results, it is safe to believe that nothing of effect can be reached by further trying to improve conditions on the Finnish resting sites. So the gain is zero. Anyhow, keeping up or even improving the protection status of the habitats can be motivated by the benefit to other species. Also, the calculated gain becomes larger, if a successful reintroduction is assumed. In particular, if ultra-light aircraft are used as foster parents, migration can be directed to the protected areas. On the average, there could be more than 100 Lesser White-fronted Geese resting there if we simply calculate with half the population and linear growth. Additional protection would mainly fall into the category 10.1. of hunting losses. An estimated 1-2 birds could escape being shot. This could add up to 40 individuals in 20 years. That means 10 pairs. As a summary, we can say that the gain would be zero under current conditions but could get much higher, up to 10 pairs if reintroduction succeeds.

Cost: Under current conditions, these activities are limited mainly to monitoring. Since this is mainly done by volunteers, the total cost could stay under 10 000 € for the complete duration.

Remark: If reintroduction succeeds, active hunting control in the field becomes necessary. This could be the case in the second decade. Annual costs for a few guards during the few days of intensive migration at least 1 000 €. This would sum up to a total 10 000 € giving at best a price tag like 1 000 €/pair. However, the total gain would not exceed 10 pairs – the profitable price



would solely be due to the low total cost.

Conclusion: A reasonable additional measure, if/when reintroduction succeeds.

#### 10.5. Surveys of possible breeding sites

Gain: Search or finding does not benefit the Lesser White-fronted Geese unless it is combined with concrete protection of the site. According to the reasoning in 10.3. the gain will stay under one pair in 20 years.

Cost: In summer 2007, more than 1000 km were surveyed. On the basis of this experience, it is a qualified guess that at most one nest can be found on a 1000 km hike. For further cost calculation we assume that one is found. The costs for such a search are at least 5000 €. For real gain, the protection measures in 10.3. must be applied – making the combination not worth choosing.

Remark: Although it is not worth while to hire anybody to search for Lesser White-fronted Geese breedings in the vast area called Lapland, it is clear that other ornithological monitoring is carried out there, both professionally and by amateurs. Their information shall of course be gathered annually, positive findings as soon as possible. That is self-evident.

#### 10.6. Protection of new resting sites

Today, observations of rare migrating birds like the Lesser White-fronted Goose are quickly reported to BirdLife Finland. No particular search for new migration resting sites needs to be arranged. If a new regular site appears, the bird directive implies quick protection as an SPA, potential threats must be evaluated and a protection and maintenance plan must be set up. Of course, surveillance must continue.

Gain: Under current conditions, zero. If reintroduction succeeds completely, approximately 2 pairs. (Cf. sec. 10.4)

Cost: Search / sporadic discovery by volunteers costs nothing. Setting up a new SPA will cost 1000 - 50 000 €, the lower figure for the case when only administrative costs are needed, the higher for possible arrangements with land owners. Other costs are like those in 10.4, i.e. 10 000 € for the complete duration. Subtotal 11 000 - 60 000 €. If reintroduction succeeds, active hunting control in the field becomes necessary. Just like in 10.4, this could be the case in the second decade. On a new area, surveillance and law enforcement would probably be more expensive than on a traditional site, possibly double: 2 500 €. This would sum up to 25 000 € raising the total to 85 000. Since a new resting area would probably not contain more than half of the birds and probably not be found during the next decade, the total gain is estimated at 0-4 pairs. A qualified guess for the price tag lies between 10 000 and 50 000 €/pair.

Conclusion: A reasonable additional measure, if/when reintroduction succeeds and a site is detected sporadically. The SPA will benefit other species as well.

#### 10.7. Maintenance of the captive population and the release of geese into the wild

The Convention on Biological Diversity includes an appeal for adopting measures for ex-situ conservation of components of biological diversity. (Cf. sec. 5) In Finland zoos participate in the preservation of biological diversity.

The world's zoos form a world wide organization consisting of almost one thousand units. Their activities are more and more an integral part of nature conservation; particularly protection of rare and threatened species. Traditionally zoos serve as gene banks, breeding and preserving populations of species which are rare or endangered in nature. The problems threatening the survival of small populations are widely the same in freedom and in captivity. For some species, breeding in captivity is the last straw that can and must be caught to save the species. The ultimate goal of breeding in captivity is restocking of natural populations, reintroduction of a locally extinct species to its former range or somewhere else where it has a chance to prosper.

Goal 1: Breeding Lesser White-fronted Geese in captivity will be extensive enough to guarantee for the existence of the species under ex-situ conditions and for reaching the goals of this plan, i.e. attaining the favorable conservation status in 20 years. Breeding shall also conform to IUCN standards and be appropriately funded.

Means

1. In order to secure the Finnish captive Lesser White-fronted Goose population against epidemics and other disaster, continued operation of the breeding station at Hämeenkoski should not only be secured but also complemented by founding a second breeding station. The new station – eventually both – could be run by Helsinki Zoo. At present, Hämeenkoski station is run by the association Friends of the Lesser White-fronted Goose.
2. International cooperation in breeding Lesser White-fronted Geese is indispensable for various reasons. Maintaining genetic diversity requires a genetically interacting pool of at least 300 individuals with at least 100 independent founder individuals. For successful restocking even more donor birds are needed. Such numbers are not available in any single country. Finland must take part in international planning and research. All involved parties from the West Eurasian range states should cooperate in breeding Lesser White-fronted Geese. Finland has sufficient experience and can advise others in breeding them according to IUCN standards.
3. Ultimately, financial responsibility for these actions belongs to the Finnish government.

Goal 2: Conservation of possible special genetic characteristics of original Finnish Lesser White-fronted Geese is secured in so far as possible.

Remark: The original birds have died out. It seems natural to consider the remaining flock in Norway their nearest relatives. Since the Lesser White-fronted Geese find their mates – in fact their life long partners - in the wintering areas, there is constant interchange of individuals with Russian geese and therefore Norwegian free living Lesser White-fronted Geese are indistinguishable from the Russian birds.

Means: Breeding in captivity shall be based on parent birds originating from the western half of the species' breeding range. (Cf. sec. 1) Birds satisfying this requirement and the IUCN standards are imported to Finland. In particular, some individuals from the newly founded “pure Russian” Swedish captive population are purchased. Direct import from Russia is questionable since the donor population is too small already, not satisfying IUCN requirements.

Goal 3: When restocking, care must be taken to avoid the new birds running into danger by migrating southeast like the Norwegian Lesser White-fronted Geese.

Means: Copying the Swedish methods: use of foster parents, either Barnacle Geese or ultra light airplanes, to guide the juvenile geese to the southwest.

Goal 4: Ensuring a prompt start and securing continuity.

Means: A quick start is possible only by an immediate government manoeuvre. Continuity is secured by furnishing the project – in particular the use of airplanes – with sponsors and media visibility. To assure the project of their support, it must be made sure that decision makers possess all relevant, correct information.

Gain: Operating a Lesser White-fronted Goose breeding station is described in detail in [Selvitys 2008] sec. 6.6.4. According to this, a captive stock of 150 individuals is in the average capable of producing continuously only 20 fledglings to be released. On the SW migration route to the Netherlands, juvenile mortality of freshly released goslings is about 50 %, so one farm of this size could produce about 10 juveniles for next spring - two farms twice as many. Optimally, this would sum up to 400 spring individuals until 2028, if it were possible to start immediately. But this is not the case. Currently there are only about 100 captive Lesser White-fronted Geese in Finland, only one farm exists. For these reasons, reaching full scale in restocking is impossible during at least a few more years. If decisions are made quickly, we could calculate with

something like a 4 years delay. But when the project gains momentum, substantial numbers of birds will be released. Taking into account the full 20 years duration of the project, the birds will have up to 16 years time to multiply in the wild. The effect of this can be calculated assuming a growth rate similar to the Swedish one, optimally 5%/y. Taking into account two production sites, the delay and multiplication, we arrive under optimal conditions at 517 adult Lesser White-fronted Geese in Finland in spring 2028. This means 130 pairs.

Conclusion: acting quickly and decisively, the goal of 100 pairs can be reached. The most expensive part of it all is founding and running a second breeding station. If all breeding were concentrated to Hämeenkoski, and the current breeding station would be run at its full capacity, half of the above number i.e. 65 breeding pairs could be reached. Combining with the methods in 10.2, 10.4 and 10.6 some more pairs could possibly be gained and the result could be seen as an almost satisfactory approximation to the goal.

In comparison with the current Norwegian Geese, the reintroduced birds would have the crucial advantage of migrating to the southwest, thus avoiding excessive hunting pressure.

Cost: The cost is made up of breeding and restocking expenses. The acquisition price for buildings like those at Hämeenkoski is about 150 000 €, not including the geese and the training of the staff. Running the farm costs 10 000 €/y not including the staff salary. For daily care at least one full time person is needed – at least 50 000 €/y. Thus running one farm would cost 60 000 € and running two 120 000 € each year. For the whole duration of 20 years this sums up to 1 200 000 € or 2 400 000 €. The value of volunteers' work can be estimated to 10 000 €/y, for each site, totally 200 000 or 400 000€. Remaining direct funding needs for breeding are 1 000 000 € or 1 800 000 €.

If Barnacle Geese are used as foster parents, experience shows that restocking expenses are in the category of 10 000 €/y corresponding to 2 000 €/brood and adding up to totally 200 000 €. Electronic tagging/satellite monitoring is the most expensive part of restocking. All in all, reintroducing the Lesser White-fronted Goose as a breeding species in Finland in 20 years would cost 1,2 million or 2 million € depending on the goal (65 or > 100 pairs) and whether the risk of running only one single breeding station is taken.

If ultra-light aircraft are used as foster parents, calculations become slightly different. Before calculating, we notice that aircraft have some decisive advantages: Humans can find the most secure migration route and resting sites, and “broods” can be very large, if enough goslings can be acquired. The supreme media visibility makes it easy to find sponsors. The cost for such a flight is known to the cent, since a complete financial plan was recently worked out for a EU project of this kind. A pilot project consisting of two flights in consecutive years plus monitoring and evaluation would cost 1,8 million € and gain 50 autumn juveniles equivalent to 25 spring juveniles. During the 18 remaining years until 2028, they would have time to reproduce almost to the double. When the pilot project phase is over in 2011, action could continue with one intermediate year dedicated to monitoring and evaluation of the results, and in the following years with a full scale operation: releasing 100 goslings each in three consecutive years. For this, the total breeding capacity in Finland, Sweden and Germany would be needed. Having learned from the pilot project, being able to re-use hardware etc. would make it possible to reduce the expenses for the new flights to half of the original in particular as new sponsors are likely to participate. Each flight could now be financed with half a million euros. The cumulative cost for the flights would increase by 1,5 million, from 1,8 to roughly 3,3 millions. These sums are supposed to include the breeding costs in the flight years and before, but it seems, the German project budget makers have underestimated these costs by thinking that breeding costs are proportional to the number of goslings. This is not so since building up the breeding capacity costs money. To be quickly able to produce such large numbers of Lesser White-fronted Goose goslings, an extra 200 000 € must be invested. All in all, restocking with aircraft would cost 3,5 million euros.



**Fig. 23.** Today, using ultra-light aircraft as foster parents is already a routine method with other bird species. It was also successfully tested with Lesser White-fronted Geese. Although initial costs are high, the method becomes cost effective, when large numbers of goslings are released into the wild.

According to the schedule above, reintroduction would begin in 2009 and be done already by 2014. Therefore, more breedings would take place in the wild than with a slower reintroduction scheme. Taking this into account, the total gain in 2028 would be 395 geese - 99 breeding pairs. One extra flight with 100 more goslings could rise this number to 122 pairs. In that case the numerical goal of 100 pairs would be reached already in 2023, a guarantee for reaching the goal of this Action Plan in time. [Paulsch & al. 2008]

Summary of maintenance of the captive population and release of geese into the wild:

Gain: 65-130 breeding pairs (SW-migrating) depending on the choice of foster parent method and the number of breeding sites.

Costs: 1 000 000 – 3 500 000 €

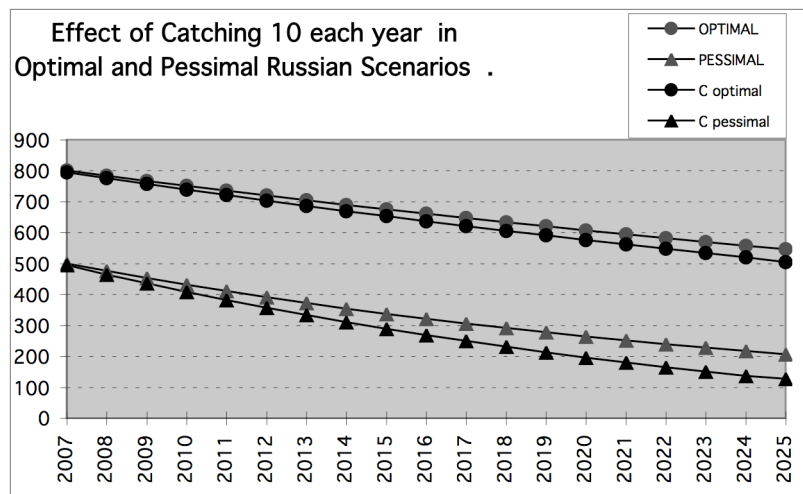
Price tag for one pair: 10 000 – 35 000 €

Duration: 5 - 20 years, depending mainly on the availability of goslings

Remarks:

- 1) Breeding and restocking is a method by which the goal of the plan can be reached.
  - 2) By realizing all other protection measures, approximately the same amount of funds would be spent, but the total gain would be close to zero. Even if a sporadic pair of Norwegian Lesser White-fronted Goose would happen to breed on the Finnish side of the border, they would be east-migrating, therefore not contributing to the creation of a viable population in Finland.
  - 3) The crucial problem is the availability of enough many suitable goslings to be released. Theoretically possible sources are
    - a) Captive geese
    - b) The newly founded Swedish captive population
    - c) Free-living Russian geese
    - d) Free-living Norwegian geese
- a) Captive geese: For carrying out reintroduction in Finland in the scale leading to the goal, almost all known available captive Lesser White-fronted Geese in the World are needed as parent birds. Since Sweden (Cf. b) must reserve most of their production for their own

- program, only Finnish and German geese remain available. (For Russia Cf. c) One way or other, it must be guaranteed that the goslings used for restocking are suitable for the purpose, both legally and biologically. (Cf. sec. 4)
- b) New Swedish geese: Today, the freshly caught Russian-Swedish captive Lesser White-fronted Geese count about 25 individuals. Under favorable conditions, it will take 20 years for these birds to multiply to a flock of 200-300 individuals, enough for a full reintroduction project on a sustainable basis. This is a long time. In addition to that, a sufficiently large founder population should actually encompass at least 100 independent individuals. The current birds are relatives with each other. Importing sufficient numbers of independent individuals from Russia would be in contradiction with IUCN guidelines (Cf. c) Conclusion: In order to build up a large enough genetically healthy captive population of Lesser White-fronted Geese, Sweden must also use some of their earlier birds.
- c) Norwegian geese: No zoo possesses any Lesser White-fronted Geese of Norwegian origin. Catching them in the wild is discussed in sec. 10.8.
- d) Russian geese: All European captive Lesser White-fronted Geese are of West Russian origin, but no Russian zoo possesses substantial numbers of them. Acquiring geese from the wild in Russia is both expensive, damaging to the donor population and a very slow process. In [Kahanpää 2008], the consequences of collecting eggs in European Russia are calculated. To take into account our lack of knowledge, the calculation is done for both a best and a worst scenario. The letters C indicate the removal of eggs ("collecting"). The damage ranges between 10 % and 40% of the remaining European Russian geese.



**Fig. 24. Expected future for European Russian Lesser White-fronted Goose, if 10 eggs are removed annually. The damage will be recognizable in every case and very serious (30 % of the population) in the worse scenario.**

Because of the large damage to the donor population, the high costs and the Swedish interest in the same birds, it is unrealistic to calculate with an annual import of 10 Russian goslings to Finland during two decades. But let us finish this calculation looking at the gain. By the biological data in [Effects.xls] we find out that the offspring of these geese could optimally be used to create a free living population of 20-25 pairs, still less than ¼ of the aim of this plan. This is the overly optimistic estimate. In practice, their proportion of all releases would remain under 10 % in any program aiming at reaching the Finnish goal.

- 4) Here are the alternatives:
- a) Giving up. The goal will not be reached. This is illegal.
  - b) Including only offspring of newly caught Russian geese in the pool of releasable goslings. The computer model presented in sec. 9 makes it possible to calculate the effects of this alternative:
    - Catching sufficiently many birds will damage the donor population in Russia.
    - At most 5 free breeding pairs will breed in Finland after 20 years.
    - These birds will be offspring of relatives of each other.
    - The project will have cost at least one million €.
    - Therefore: This option is illegal as well.
  - c) Using all available adequate parent birds. The criteria for such birds must be internationally decided upon and standardized not only inside the EU but also for use in Norway and Russia. Whether it is possible to reach the goal of this Action Plan or not, completely depends on the availability of sufficiently many acceptable parent birds.

#### 10.8. Protection of the geese breeding in Norway

What can be done to improve the survival rate of the Norwegian Lesser White-fronted Geese can be inferred from the facts referred to in sec. 8: The main, or only, problem is excessive mortality during migration and wintering. More than half of this mortality must be taken away. Deaths occur mainly during autumn migration over Russia and variably over other parts of the territory of the former Soviet Union. Only few of the geese are killed in the territory of the EU. The following actions have been suggested:

- 1) To improve conservation in Hungary, Greece and other EU countries: extended formal protection, longer annual goose-hunting bans, protection areas, law enforcement etc.
- 2) Similar actions in Russia.
- 3) Similar actions in Kazakhstan.
- 4) To catch the Norwegian geese and to breed them in captivity until the situation has improved along the migration routes. Then reintroducing them back into the wild.
- 5) To catch the Norwegian geese and to multiply them in captivity; then reintroducing them with foster parents migrating to the southwest.

#### Assessment of these actions

- 1) The EU. In Hungary and Greece the main sites of Lesser White-fronted Geese are protected already and protection seems to work rather well; the killing of one single Lesser White-fronted Goose in Greece in 2008 was important news. On the other hand, protecting these sites has not had a measurable effect on the survival rate of the Norwegian Lesser White-fronted Geese. This is another indication on that the killing happens elsewhere.
- 2) Russia. On their autumn migration, all Norwegian Lesser White-fronted Geese fly due east at least over the White Sea and continue over former Soviet Union territory where hunting is very poorly controlled and the twin species the Greater White-fronted Goose is commonly and legally hunted. At best will, law enforcement is impossible. There is some need for research. It is theoretically possible that there might exist some very commonly visited unknown resting site in Russia which could be protected. At the time being, no such discovery seems probable, since reported shootings spread on a wide range. In any case research takes time. Improvement of conditions in Russia during the first decade of this plan's time span cannot be expected.
- 3) Kazakhstan. Conditions in Kazakhstan are similar to those in Russia, only better known, since the Lesser White-fronted Geese in some years gather on a known area called Kostanay

Oblast lake district. The area is only the size of Denmark, so counting the geese and estimating their hunting losses is possible and practised. (Cf. fig. 8.)

Summary 1) - 3): Taking into account that recolonization of Finland from Norway requires a much larger population in Norway than the goal in Finland, it becomes proven that actions 1) -3), although very much worth while of support for other reasons, are insufficient to meet the goal of this plan, the favorable conservation status of the Lesser White-fronted Goose in Finland

- 4) Norway - southeast. Protecting the Norwegian geese ex-situ while waiting for improved conditions in Russia is a possible strategy for conserving their genetic material. But by 2) there is no reason to expect their reintroduction to the eastern migration route to become a feasible alternative in any foreseeable future.
- 5) Norway - southwest. Under good conditions, a stable captive Lesser White-fronted Goose population can increase by 10 % annually. The long term effect on reintroduction chances is estimated in subsection 10.7. The multiplication of the birds caught from the remaining Norwegian population fraction to 100 individuals, when releases could begin, would take more than the whole time span covered by this plan. After reintroduction with the Swedish method, the situation in Norway would progress much like in Sweden – only 30 years delayed. In the time span covered by this plan, no effect on Finland can be expected.

Gain: A completely successful catching and breeding without any releases could produce a flock of 150-200 captive Norwegian individuals. Full scale reintroduction could then be started in the early 2030's. If releases were begun already earlier at a time when the captive population would count something like 100 individuals, only a free living population of 40 geese (like today) could be reached by 2028. The difference in comparison with today would be that these birds would migrate to the southwest and there would also exist a captive population of Norwegian origin.

Costs: Breeding from scratch is more expensive than continuation of the Finnish program. Comparison with sec. 10.7 points at a total cost of approximately 2 million € - more than 20 million Norwegian crowns. The main burden would be carried by the Norwegian government but Finland – as a beneficiary in the very long run – could participate with a suitable percentage of these costs.

Remarks: Norwegian Lesser White-fronted Geese are considered suitable for reintroduction programs. Since they already are too few (35 ind.) as sole parents for a future captive population, changing individuals with a future international gene pool could be advisable.

#### 10.9. International cooperation in maintenance of captive population and releasing

By the very nature of the Lesser White-fronted Goose as a migrating bird, its conservation – in particular its reintroduction - is an international affair. Catching geese in Russia for breeding in Scandinavia causes measurable damage to the donor population. Finding an alternative is an international task. Reintroduction with the aid of foster parents and a reconstructed southwestern migration route will in time lead to the creation of a viable population of geese migrating over several countries. International cooperation will be necessary to ensure that these birds are welcome wherever they appear. For comparison, the Dutch were slightly embarrassed in the beginning when the Swedish reintroduced Lesser White-fronted Geese made their appearance in their country and were promptly protected by EU law.

One more opportunity for international cooperation is offered by the possibility to participate in future reintroduction programs in neighbouring countries, in particular on the Kola Peninsula in Russia. Finland could contribute by producing some of the large amounts of goslings needed for any such program or in building up a breeding capacity in Russia. Also, we could assist in both electronic and manual monitoring.



#### 10.10. Influencing international conventions and agreements

Background: Recently, AEWA has published an International Single Species Action Plan for the Conservation of the Lesser-White fronted Goose [AEWA 2008]. (Cf. sec. 5)

##### Recommended Action:

The Action Plan [AEWA 2008] calls for updates before Dec. 2009. Adequate information for such an update should be sent, scientific evidence for each statement included.

As a second step, information on the revised Finnish policy in Lesser White-fronted Goose conservation should be sent to the AEWA Secretariat before Dec. 2009. (Cf. sec. 5) Finland should also push for the following changes in the Principles of Implementation of the AEWA plan [AEWA 2008] p. 8]:

- It should be made explicit, that "*all Range States*" encompass those outside the EU and/or AEWA, in particular Russia, Belarus, Ukraine, Kazakhstan, Azerbaijan, Iraq and Iran.
- The aims of the conservation of the Lesser White-fronted Goose should be mentioned. They are, in order of importance for [AEWA 2008]:
  1. the survival of the species as such
  2. the survival of the species in the wild in the Western Palaearctic
  3. maintaining genetic diversity of the species
  4. keeping large parts of the species' original range inhabited and keeping them suitable as a Lesser White-fronted Goose habitat
  5. preferring offspring of original Lesser White-fronted Geese in each fragment of their original range, as far as not locally in conflict with point 2.
  6. ultimately, strengthening the species to endure some hunting.
- The main priority for the conservation of the Lesser White-fronted Goose should explicitly encompass maintenance of the wild populations, both natural and reintroduced, breeding in Fennoscandia and Russia.
- Supplementing wild populations with captive-bred birds should already now urgently be considered in Finland, Norway and other parts of the former breeding range, where other conservation measures are not as quickly efficient as needed and populations continue to decrease or are extinct already. As with any other captive breeding, reintroduction or supplementation initiatives this project will be subject to consideration and practical advice by the *Committee for captive breeding, reintroduction and supplementation of LWfG in Fennoscandia*. In particular, sufficient funding for promptly starting this activity should be organized by the Committee.

Gain: This is no conservation measure proper. Therefore, the direct gain in goose pairs is zero.

Cost: Low

#### 10.11. Additional research

In the last decades, quite much research on the Lesser White-fronted Goose was carried out. In spite of this, gaps still remain in our knowledge. Some of them are important with respect to planning conservation efforts. Most of these gaps are listed in [AEWA 2008]. Here we just give some comments from the Finnish point of view.

- 1) Of course, the effect of conservation activities must be monitored and assessed. The one and only really important missing information is this: Where and when do the Norwegian/European-Russian Lesser White-fronted Geese get shot. Satellite tagging may give an answer. A preliminary answer is given by the results of colour ringing and previous satellite tracking, see [AEWA 2008] page 16: "After a flight via the Taimyr Peninsula and Kazakhstan, the tagged bird was shot in the lower Don area." All information, in particular the full satellite data withheld by BirdLife Norway, should immediately be made public and

- later completed by further tagging results.
- 2) The second really bothering question is this: Why do the Norwegian Lesser White-fronted Geese do even worse than the West Russian? Or do they? The Norwegian birds decrease by 5%/y. In the long run, the Russian geese seem to have decreased only half that fast, but they may do worse today. At least [AEWA 2008] mentions a decrease rate of 5-6 %/y.
  - 3) A high percentage of the geese seen in Greece and Hungary in winter are found later in their summer range, so they are not shot in spring. This corroborates the information from ringing and satellite tagging that most of the geese are killed during their autumn migration already. Counting separately the juveniles in the European resting sites could give exact information on shootings in Europe, since most of the killed birds are juveniles. Probably, this field data exists already just waiting for to be interpreted.
  - 4) By counting Lesser White-fronted Geese on the Kanin Peninsula and determining the proportion of colour- ringed Norwegian birds, it is possible to find information on the total number of Lesser White-fronted Geese in Fennoscandia including the Kola Peninsula. This should work unless the Kola birds have a different migration pattern from the Norwegian. Knowing the population density on Kola is of importance for the probability of Finnish recolonization from the east.
  - 5) Improving electronic tagging to become more cost-efficient. Applications of GSM-tagging seem economically superior to ARGOS-type satellite tagging.

## **11. Assessment of the implementation of the plan**

The primary indicator for success of this plan is the number of Lesser White-fronted Goose pairs breeding in Finland. Other criteria of success are the number of Lesser White-fronted Goose observations in and near Finland as well as the number and quality of Lesser White-fronted Geese breeding near Finland or in captivity.

For the reintroduction program, two control schemes should be set up. One should control whether each planned conservation measure is implemented in time. The other scheme should keep track of whether intermediate goals, "milestones", are reached in scheduled time. The milestones should be decided in advance. Funding should be secured in advance. Implementation of the plan must begin immediately. Since the duration of the program is 20 years, the detail plan must be updated several times, in practice annually. Mostly, this updating should follow routines agreed upon in advance. This relates to questions like under what conditions / when to replace secrecy by guarding the Finnish breeding area or when to reduce captive breeding to merely keeping up an ex-situ population for safety purposes.

Annual reports should contain the status of realization of each partial component of the plan and the values of the numerical parameters. The main data is the table of the numbers and identified individuals of Lesser White-fronted Geese observed or assumed breeding in Finland, Norway and Sweden, possibly also on the Kola Peninsula. All Lesser White-fronted Goose observations in these areas and on the potential migration routes of these birds should be included and compared with the milestones. Corresponding amendments to the plan must be made explicit.

The report should also include a survey of more general domestic and foreign Lesser White-fronted Goose research results, in particular on the effects of protection measures, both positive and negative.

Finally, the overall cumulative success of the plan should be described in a more informal way. This part could be used as an annual press release. Secrecy should be guaranteed, where appropriate. Land owners and local people should be informed where necessary.

## 12. The ranking of the conservation proposals

Table 3 gives an overview of all proposed measures for reintroducing the Lesser White-fronted Goose as a breeding species in Finland. Their estimated cost, duration and affectivity are listed.

§	Action	Cost in 20 years	Gain in 20 years	Price tag (one pair)	Observe!	Priority
10.1	Intensified law enforcement in Finland	200 000	0-1 pairs	> 200 000		*
10.2	Protection of releasing sites	100 000-200 000	5 pairs	20 000 – 40 000	Requires restocking	**
10.3	Protection of other breeding sites	50 000	0,1 pairs	> 500 000		*
10.4	Protection of known resting sites	10 000	0	-----	Calculated with no restocking	*
10.4	Intensified protection of known resting sites	10 000	10 pairs	1 000	Calculated assuming restocking	**
10.5	Surveys of possible breeding sites	100 000	0-1 pairs	200 000		*
10.6	Protection of known resting sites	10 000 – 85 000	0-4 pairs	> 10 000	Conditional set up SPA	*
10.7	Breeding and restocking using B. leucopsis One breeding site.	1 000000	65 pairs	12 000		***
10.7	Breeding and restocking using B. leucopsis Two breeding sites.	1 800000	130 pairs	13 000		***
10.7	Breeding and restocking using airplanes.	3 500000	114 pairs	30 000	Foreign project	***
10.8	Protection of Norwegian birds in situ	100 000	2 pairs in Norway	50 000	No gain in Finland	Norwegian project
10.8	Protection of Norwegian birds ex situ	2 000000	70 pairs (in Norway)	30 000	No gain in Finland	Norwegian project
10.7	Experimental restocking in Sweden with airplanes	1 710940	13 pairs (in Sweden)	130 000	No gain in Finland	Foreign funding
10.10	International conventions and agreements	---	-----	-----	-----	***
11	Additional research in Finland	-----	-----	-----	-----	**
11	Additional research abroad	-----	-----	-----	-----	***
12	Reports/coordination	50 000				***

**Table 3. Evaluation and ranking of possible conservation measures. The numbering and data are taken from sec. 10. Urgent protection measures are classified \*\*\*. Activities marked \*\* should be realized, when there already are enough Lesser White-fronted Geese breeding in Finland to make them worth while. Activities marked \* have low priority and are only recommended as a hobby for volunteers. The foreign Scandinavian actions fall beyond the scope of this plan. (Concerning their benefits or Finnish involvement, cf. sec. 10.)**

### 13. Conclusions

During less than a century, the formerly numerous Lesser White-fronted Goose population breeding in the alpine and sub alpine regions of Finland, Norway and Sweden collapsed to a residue of no more than 35 birds and an average of six breeding pairs. The remaining birds make a very long autumn migration over mainly Russian territory under which mortality exceeds the annual productivity. The remaining population continue their average decrease of 5 %/y. We do not believe that this situation can be changed in a short period of time as all experts are unanimous that overhunting is the pivotal reason for this decrease. Better law enforcement in the East is impossible for both social and biological reasons.

We do not oppose that everything possible is done for these few birds. **But protecting the Norwegian geese is the responsibility of the Norwegian conservation authorities and international organizations and must not be in conflict with restoring the favorable conservation status of the Lesser White-fronted Goose in Finland. It is a fact that the Lesser White-fronted Goose cannot be restored in Finland in any way except by releasing captive geese into the wild and reconstructing their southwestern migration pattern.**

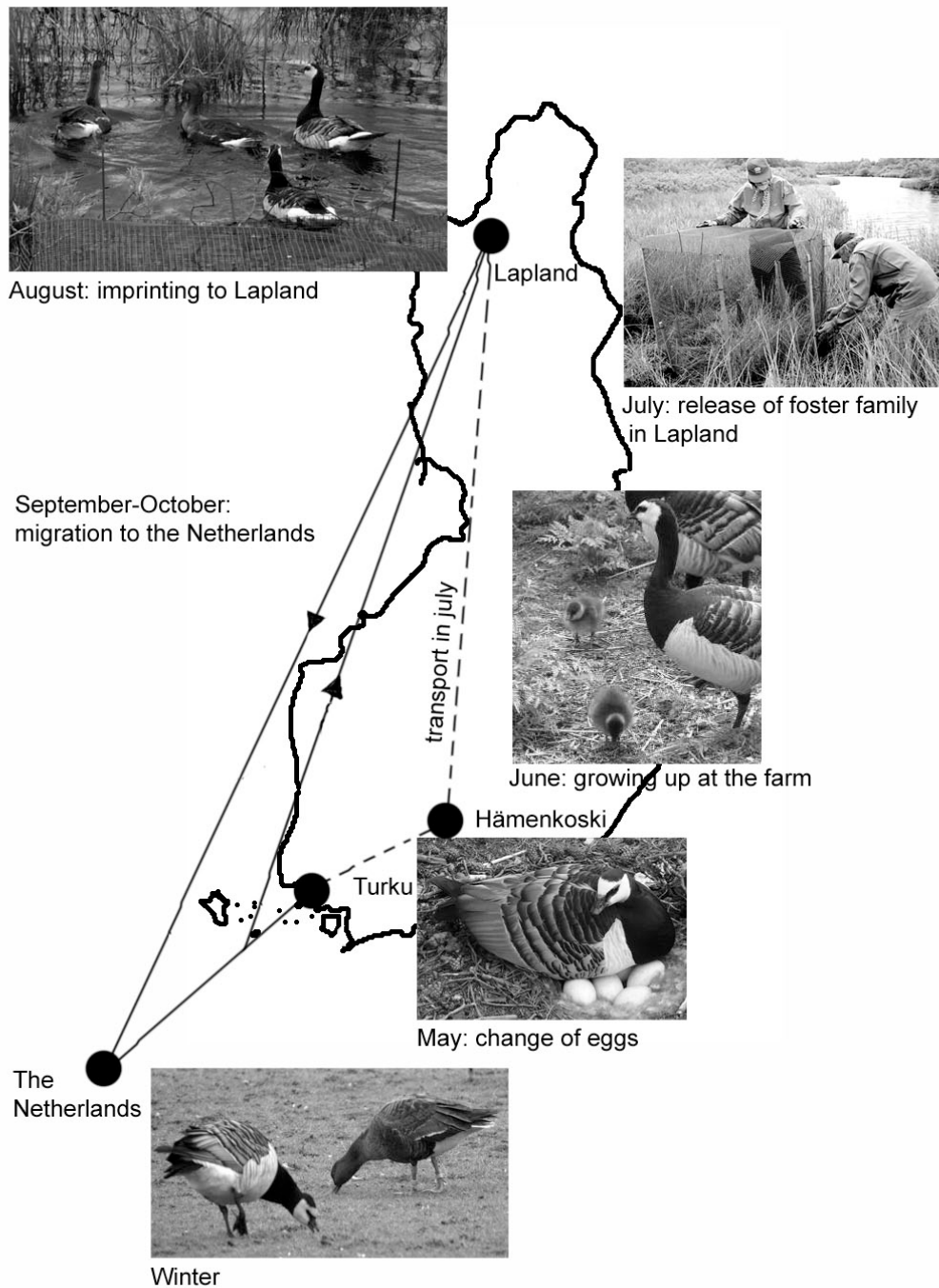
The main bottleneck for restoration is the limited availability of sufficient numbers of goslings to be released. Finding them in the wild is too late; even the IUCN guidelines for reintroduction are against damaging the threatened Russian donor population. Fortunately, there exist captive Lesser White-fronted Geese originating in the population breeding in the Eurasian part of the Russian Federation. The genetic purity of these birds was confirmed by tests representing the latest state of the art. With new data and improved laboratory methods, earlier observations which had been interpreted as large scale hybridization with the Greater White-fronted Goose have found a convincing different explanation.

Since conditions in the East remain untenable, the only known method for escaping unsustainable hunting is by altering the migration route. The now already classical method for this, developed by Lambart von Essen and others in Sweden, has proven to work. Using Barnacle Goose foster parents has only one serious rival, the use of ultra light airplanes as foster parents. Their relative economy and effect depend mainly on the number of annually released goslings. The Barnacle Goose method was already successfully tested in Finland. The airplane method has better chances to find external economical support. It should be pointed out that the migration route to southwest is no more artificial than the southeastern route. Both seem to have been commonly used in the past, but apparently the geese using the southwestern route collapsed earlier in a time when overhunting was worse in the west. The literature until the 1950's knows well their wintering in Western Europe and observations prove that this tradition is still alive.

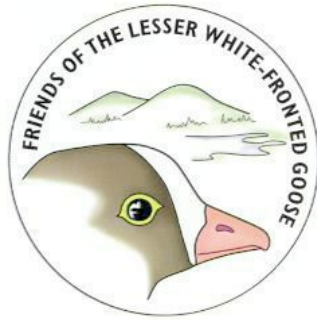
Our proposal is that the Finnish nature conservation authorities should take account of the observations explained in this paper and decide to begin to support the effort to restore the favorable conservation status of the Lesser White-fronted Goose in Finland and to contribute to the restoration of this species in the territory of the EU. The national as well as the international policy concerning the Lesser White-fronted Goose should be accordingly amended in due course.

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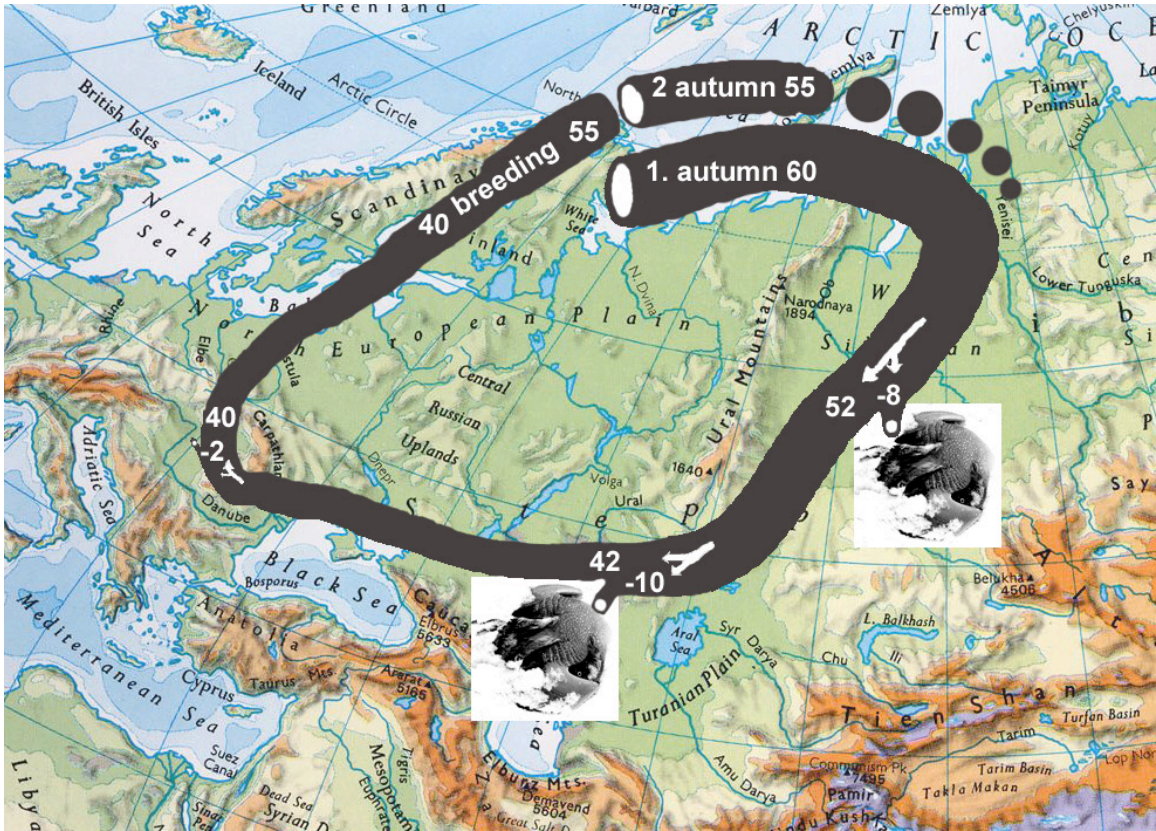


**Fig. 25. The principle of restoring the favorable conservation status of the Lesser White-fronted Goose (*Anser erythropus*) in Finland. In spring, the foster parents return from the Netherlands to Turku and the juveniles to Lapland where they later breed. Ultra-light aircraft are an alternative to Barnacle Geese as foster parents.**



- chairman : PhD Antti Haapanen
  - tel: 358-9-3253804 (home), 358-40-5953313 (mobile)
  - mail: Huhtasuontie 7, 00950 Helsinki, Finland
  - e-mail: antti.haapanen@Kolumbus.fi
- secretary: PhD [Lauri Kahanpää](#)
  - tel: 358-14-2602716, 358-14-253364, 358-50-4652301(mobile)
  - fax: 358-14-2602701
  - e-mail: <kahanpaa@math.jyu.fi>
- bird breeder: Pentti Alho (Preferrably, speak German)
  - tel/fax 358-3 7654 727, mobile 358-440-654727 or 358-50-3441755.
- home page <http://www.ansererythropus.tk/>
  
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  - IBAN account FI6210323000513444
  - Beneficiary:
  - Kiljuhanhen Ystävät ry
  - PO-Box 517
  - FI-13100 HÄMEENLINNA





**Fig. 26. The principle of destruction of the Norwegian Lesser White-fronted Goose population. Mortality in autumn in the East exceeds reproduction in Norway. No action in the territory of the EU can change this.**

The goal of this national conservation plan is to make clear which are the actions that can make it possible to restore the favorable conservation status of the Lesser White-fronted Goose in Finland as this aim is stated in the Finnish Nature Conservation Act (1096/1996, 5:3 §). It is generally accepted that overhunting during migration and wintering is the crucial factor causing the dramatic decrease of the population during the last century.

The international conservation plan by AEWPA proclaims: "*Supplementing wild populations with captive-bred birds shall be considered if other conservation measures are not as quickly effective as needed and should populations continue to decline*". This condition was already satisfied in Finland in the 1980's when WWF Finland deemed reintroduction urgent. Since then, the population has died out in Finland and Sweden. In Norway a decline of 70 % has taken place, and still continues.

Protecting the Norwegian geese is the responsibility of the Norwegian conservation authorities and international organizations and must not be in conflict with restoring the favorable conservation status of the Lesser White-fronted Goose in Finland.

It is a fact that the Lesser White-fronted Goose can only be restored in Finland by releasing captive geese into the wild and reconstructing their southwestern migration pattern.