Feasibility study of a project for the protection of the Lesser White-fronted Goose *(Anser erythropus)* by creating safe migratory routes and wintering sites

Introduction

In the first decades of the 20th century the Lesser White-fronted Goose *(Anser erythropus)* was breeding in large parts of Northern Eurasia. Since then an alarming decline has occurred in its whole distribution range - in particular in Fennoscandia. The Swedish and Finnish natural populations died out in the 1980's and 1990's, respectively. Currently less than 10-15 pairs (about 50 birds) still survive in Norway.
The main reasons for the decline seem to be deterioration of wintering sites (e.g. Caspian and Black Sea coast, SE-Europe) and non-sustainable hunting along the migration routes as well as on the wintering grounds in the former Soviet Union.
The Lesser White-fronted Goose belongs to the most endangered bird species in the world. The species is included in Appendix 1 of the African-Eurasian Waterbird Agreement (AEWA) under the Bonn Convention, in Appendix II of the Bern Convention and in Appendix I of the EU-Birds Directive.
Since the 1980's a number of activities were started in Europe to increase the protection of the Lesser White-fronted Goose. In addition to research and monitoring, reintroduction projects were started in Sweden and Finland.
The project for the protection of the Lesser White-fronted Goose *(Anser erythropus)* by the creation of safe migratory routes and wintering sites was started in order to join the forces of several partners in one common project to realise a more effective co-ordination of all activities aiming at saving the westernmost breeding population of the species from extinction. The project concentrates on reintroduction of the species in Northern Sweden and guiding the reintroduced birds along safe migratory routes to new safe wintering sites.

Because of differences of opinion about the priorities of different activities for the protection of the Lesser White-fronted Goose, it was not possible to unite all Lesser Whitefront activists in one single joint project up till now. But discussions are still going on and at the 7th annual meeting of Wetlands International's Lesser White-fronted Goose Task Force in December 2002 in Spain all experts agreed – in spite of differences of opinion – to combine efforts whenever possible.

In the following the feasibility of the project and its parts will be discussed.

A. FEASIBILITY OF REINTRODUCTION PROJECTS FOR THE LESSER WHITE-FRONTED GOOSE IN FENNOSCANDIA

A.1. Reintroduction by using Barnacle Geese as foster parents

The late Dr. Lambart von Essen started a reintroduction programme in Sweden in 1981. He decided to avoid the main threats by creating a new safe migration route to safe wintering grounds.
He used semi-domestic Barnacle Geese *(Branta leucopsis)* as foster parents for Lesser White-fronted goslings, which in this way learned from their foster parents to migrate to safe wintering grounds in Western Europe.

Eggs of semi-domestic Barnacle Geese - breeding in nature and migrating to wintering sites in the Netherlands - were replaced by eggs of a captive Lesser Whitefront breeding stock. After hatching the mixed family was caught and kept in captivity. Shortly before fledging the families were transported to Swedish Lapland, where they were released. In autumn the young Lesser Whitefronts were lead by their foster parents to the Netherlands to winter. In spring the mixed families returned to Sweden and separated. The Barnacle Geese stayed in their traditional breeding range in Middle-Sweden, whereas the young Lesser Whitefronts returned to the site where they were released, just as intended.

This Barnacle Goose method showed to function well and a new breeding population of Swedish Lesser White-fronted Geese has been established. Today it consists of about 100-150 birds, all migrating to the Netherlands to winter.

A.2. Reintroduction using microlight aircraft

Between 1989 and 1994 the Canadian "microlight-enthusiast" and amateur ornithologist William (Bill) Lishman made the first migration experiments with young geese and a relatively low-speed microlight aircraft. These experiments showed that it was possible to teach young geese a new migratory route by help of a microlight aircraft. The juveniles accepted the microlight aircraft as a foster parent and followed it to new wintering grounds. In spring they returned on their own to the site were they had started and in subsequent years they continued to migrate to the new wintering grounds without any human help.

Although the "microlight-method" is much more expensive than the Barnacle Goose method, it has two considerable advantages:

- A constraint of the Barnacle Goose method is to find enough breeding Barnacle Geese in an early stage of breeding to exchange the Barnacle Goose eggs for Lesser Whitefront eggs. Besides a Barnacle Goose pair can handle only up to five juveniles. The microlight-method is independent of this constraint and one microlight aircraft could lead up to 30 juvenile Lesser Whitefronts.
- After hatching juvenile geese are imprinted on their parents. Therefore the young Lesser White-fronted Geese might learn some behaviour and habits of Barnacle Geese, i.e. the "wrong" goose species. Later they will meet members of their own species and mostly adapt their behaviour and habits, but some keep the wrong imprinting. Since 1991 in the range of the Swedish introduction scheme, a number of hybrids between Barnacle and Lesser-White fronted Geese were recorded (MOOIJ & HEINICKE in prep.). These problems, in particular hybridisation, evidently are impossible with a microlight aircraft!

A.3. Reintroduction schemes in the scope of the IUCN Guidelines for re-introduction and in the scope of the Lesser White-fronted Goose Action Plan

The feasibility of these re-introduction schemes has to be judged against the background of two relevant documents, namely the Guidelines for reintroduction, prepared by the IUCN Species Survival Commissions Reintroduction Specialist Group (IUCN 1995 or http://www.iucn. org/themes/ssc/pubs/policy/reinte.htm) as well as the International Action Plan for the Lesser White-fronted Goose *(Anser erythropus)* compiled for the European Union by Jesper Madsen at the National Environmental Research Institute, of Denmark (in HEREDIA,

ROSE & PAINTER (EDS.) 1996 or http://europa.eu.int/comm/environment/nature/directive/birdactionplan/anser erythropys.htm). However, before doing so, we must point out that neither should be considered as a codex of strict rules. In its own words, the IUCN Guidelines "*are intended to act as a guide for procedures useful to re-introduction programmes and do not represent an inflexible code of conduct.....Thus the priority has been to develop guidelines that are of direct, practical assistance to those planning, approving or carrying out re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather than decision-makers in governments. Guidelines directed towards the latter group would inevitably have to go into greater depth on legal and policy issues.*" On the other hand, the available version of the Action Plan was published already in February 1996. In its own words, "*This action plan should be reviewed and updated every three years*" unless an emergency update is needed even earlier. So the Action Plan is obsolete in some sense.

On the following pages it is checked, whether the reintroduction projects are in accordance with the principles and spirit of the IUCN Guidelines for re-introduction and the Lesser White-fronted Goose Action Plan. Furthermore it is checked, if the microlight method could be a useful tool for the reintroduction of Lesser Whitefronts. Such a check is not necessary for the Barnacle Goose method, which already has shown its effectiveness.

A.3.1. Reintroduction schemes in the scope of the IUCN Guidelines for reintroduction

The feasibility of the reintroduction of Lesser Whitefronts is reviewed here against the background of the recommendations of the IUCN Guidelines for re-introductions, prepared by the IUCN Species Survival Commissions Reintroduction Specialist Group (Quotations of the IUCN recommendations in *italics*.)

BIOLOGICAL

1. Feasibility study and background research

- *An assessment should be made of the taxonomic status of individuals to be reintroduced. They should preferably be of the same subspecies or race as those, which were extirpated, unless adequate numbers are not available. An investigation of historical information about the loss and fate of individuals from the reintroduction area, as well as molecular genetic studies, should be undertaken in case of doubt as to individuals' taxonomic status. A study of genetic variation within and between populations of this and related taxa can also be helpful. Special care is needed when the population has long been extinct.*
- *Detailed studies should be made of the status and biology of wild populations (if they exist) to determine the species' critical needs. For animals, this would include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behaviour, group composition, home range size, shelter and food requirements, foraging and feeding behaviour, predators and diseases. For migratory species, studies should include the potential migratory areas. For plants, it would include biotic and abiotic habitat requirements, dispersal mechanisms, reproductive biology, symbiotic relationships (e.g. with mycorrhizae, pollinators), insect*

pests and diseases. Overall, a firm knowledge of the natural history of the species in question is crucial to the entire reintroduction scheme.

- *The species, if any, that has filled the void created by the loss of the species concerned, should be determined; an understanding of the effect the reintroduced species will have on the ecosystem is important for ascertaining the success of the reintroduced population*
- *The build-up of the released population should be modelled under various sets of conditions, in order to specify the optimal number and composition of individuals to be released per year and the numbers of years necessary to promote establishment of a viable population.*
- *A Population and Habitat Viability Analysis will aid in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management.*

Taxonomic status and genetics

The Lesser White-fronted Goose has traditionally been regarded as a monotypic species with respect to morphology, behaviour and habitat preference. Recently some preliminary results have been published indicating possible racial differences in mitochondrial DNA-markers of Lesser White-fronted Geese as well as hybridisation events with other species.

Based on an analysis of mtDNA RUOKONEN (2001) stated that the Fennoscandian subpopulation could be a distinct genetic unit. At the other hand traditional morphological analysis as well as the results of the genetic tests of nuclear DNA of the wild population of the Lesser White-fronted Goose show no indications at all of the existence of different subpopulations. Besides at least until the middle of the 20th century the species had a continuous breeding range between Fennoscandia and Chukotka and even today a part of the Fennoscandian birds uses the same migratory routes as Siberian birds and mixes up with them. Moreover the genetic tests strongly indicated that based on nuclear DNA all tested birds belong to one closed unit with a clear cline of mtDNA haplotypes from west to east. The two most common mtDNA-haplotypes found in the Fennoscandian Lesser White-fronted Geese (covering almost 90% of all haplotypes) were also found on the other Western Palearctic sites: Bolshezemelskaja Tundra (64%), Yamal Peninsula (64%), Taimyr Peninsula (87%) as well as Kazahkstan (82%) (RUOKONEN et al. 2004).

In the scope of the most recent investigations of the genetic diversity of the mtDNA in Lesser White-fronted Geese 5 different haplotypes were found in the Fennoscandian subpopulation. The tested sample of the regional Fennoscandian subpopulation was the biggest of all investigated local subpopulations (28 samples of a population of 100-150 individuals, i.e. 19 – 28% of the population!). In spite of the much smaller sample size similar samples from other Western Palearctic sites (Bolshezemelskaja Tundra: 14 samples of a population of 3,000-5,000 individuals; Yamal Peninsula: 25 samples of 4,500-6,000 individuals; Taimyr Peninsula: 15 samples of 3,000-4,000 individuals), which means that likely not all haplotypes are found yet, all showed 4-5 different haplotypes per site of which at least 3 were shared with the Fennoscandian subpopulation (RUOKONEN et al. 2004).

Analysis of mtDNA haplotypes showed a clear cline from west to east. From the Fennoscandian birds about 85% of the mtDNA haplotypes belonged to the western type, from the birds of the Bolshezemelskaja Tundra and the Yamal Peninsula about 60% and of the Taimyr Peninsula and China about 27% of the haplotypes belonged to this type. The extremely high proportion of one single Western haplotype in the Fennoscandian birds indicates impoverished genetic diversity.
The two most common mtDNA-haplotypes found in the Fennoscandian Lesser White-fronted Geese W1 and E1 (covering almost 90% of all detected haplotypes) were also found on the other Western Palearctic sites: Bolshezemelskaja Tundra (64%), Yamal Peninsula (64%), Taimyr Peninsula (87%) as well as Kazahkstan (82%). (RUOKONEN et al. 2004).

Furthermore recent genetic analysis revealed that a considerable part of the Fennoscandian males (50%) carried mtDNA haplotypes that were found also in individuals outside Fennoscandia, whereas Fennoscandian females only carried the most common Western Palearctic and Fennoscandian mtDNA haplotype (RUOKONEN 2000 & 2001, RUOKONEN & LUMME 1999, RUOKONEN et al. 2004). These data indicate that the small Fennoscandian breeding population has an impoverished genetic diversity, but still is an integrated part of the Western Palearctic breeding population because it "imports" at least about 50% of its males from the neighbouring Russian breeding population, which at present is likely to reduce the danger of inbreeding.
Genetic tests of nuclear DNA strongly indicated that all tested birds belong to one closed unit (KHOLODOVA 2001).

Fragmentation of the breeding range is rather recent and too short for speciation processes. Moreover studies on marked birds indicate that the remnants of the Fennoscandian breeding population of the Lesser White-fronted Goose have regular contacts to their Russian conspecifics. During autumn migration a part of the Fennoscandian birds flies east as far as the Taimyr Peninsula and uses the same migratory routes as Russian birds as was shown by telemetry (AARVAK et al. 1997).

<u>These facts do not support the hypothesis of the local Fennoscandian subpopulation being "a genetic distinct unit".</u>

Studies on mtDNA-diversity showed that some captive Lesser White-fronted geese do carry a haplotype, which is extremely similar to a haplotype found in Greater Whitefronts (RUOKONEN 2000 & 2001, RUOKONEN & LUMME 1999). According to several geneticists (e.g. FUNK & OMLAND 2003, POWELL 1991) certain alleles in one species may appear more closely related to alleles from different species than to other conspecific alleles. Such deviations from species-level monophyly seem to indicate mtDNA flow between species, but can have a variety of causes and easily could lead to erroneous evolutionary interpretations. The common mtDNA-haplotype shared by Lesser and Greater White-fronted Goose could be a result of hybridisation between both species or of the retention of an ancient shared haplotype of their recent common ancestor. Because it is not possible to resolve this question by means of the present genetic data, no geese with this questionable mtDNA-haplotype should be released by re-introduction projects.

Therefore in reaction on the results of RUOKONEN (RUOKONEN 2000 & 2001, RUOKONEN & LUMME 1999) the Swedish re-introduction programme was stopped and all birds were checked on their genetic composition. Also the birds of the Finnish breeding stock were tested. In both cases not only maternally inherited mtDNA, but also the biparentally inherited nuclear DNA was tested. The analysis of nuclear DNA of Finnish captive Lesser White-fronted Geese brought no indications of hybridisation between Greater and Lesser White-fronted Geese. Besides the analysed Lesser White-fronted geese (wild and captive birds) were clearly delimited as a unit separated from the tested Greater White-fronted geese. Furthermore the results indicated that nuclear DNA of the analysed captive Lesser Whitefronts was close to the wild Lesser Whitefront DNA.

These facts indicates that there is only a minimal risk of negative influences on the remnants of the wild Fennoscandian LWfG subpopulation caused by "hybridisation" to be expected (KHOLODOVA 2001).
Still all birds with the common mtDNA-haplotype shared by both Lesser and Greater White-fronts were removed from the breeding stocks.

In April 2004 the Swedish, Finnish and German re-introduction groups agreed on a close co-operation in breeding Lesser Whitefronts and on a common method to test the genetic composition of these birds. This test programme will be supervised by a group of genetic experts (Prof. Dr. Allan Baker, Dr. Marina Kholodova, Prof. Dr. Michael Wink and Prof. Dr. Martti Soikkelli).

Allan Baker wrote to the common method:
"*The issue of the common haplotype shared by LWF and GWF geese being due to hybridization or retention of a shared haplotype in their recent common ancestor is difficult to resolve with the present genetic data.*"..... "*Those birds in the captive flock that have the shared haplotype should not be used for breeding of a flock for reintroduction. Additionally, the birds that lack this haplotype should be screened for a good panel of 10 or more polymorphic microsatellites or their genomes scanned with AFLPs to make sure they do not have any GWF genes in their nuclear DNA complement. The three RAPD primers that were used to do this in the past are insufficient to ensure that introgression has not occurred. Then this "pure" stock could be used to breed birds in captivity and to reintroduce them in the wild.*
I would not necessarily destroy any putative hybrid birds, as about six or more generations of backcrossing of these birds with "pure" LWF geese would almost eliminate any transpecific nuclear genes from GWF geese. By not breeding any females with the shared mtDNA haplotype the transfer of this 'wrong" organelle DNA could be prevented." (BAKER, pers. comm.).

According to this agreement samples of the German, Finnish and Swedish captive breeding stocks will be sent to the genetic laboratory of the University of Heidelberg (Prof. Wink) for genetic analysis.
This laboratory has developed ISSR protocols for genetic characterisation of birds. STR primers are not available for LWFG. Since the development of specific STR primers would be time and cost extensive, Prof. Wink has chosen the ISSR methods instead.

ISSR (*inter simple sequence repeats*) produces similar fingerprints as AFLP; it demands fewer experimental steps and is therefore easier to carry out. ISSR uses a single PCR primer, whose sequence is identical to common microsatellite motives, such as $(GACA)_4$. Since such loci are widely present in genomes and they occur in both orientations, a single primer is enough to amplify between 10 and 80 loci (i.e. DNA stretches between adjacent microsatellite loci) simultaneously. Since the PCR products differ in size they need to be analysed by high resolution PAGE or capillary electrophoresis. The ISSR loci are inherited dominantly and since some of them are polymorphic they provide information of the genomic makeup of an individual. In practice, several of such ISSR primers are used, so that several hundred loci are available for analysis. The advantage of ISSR is, that the primers work universally in most animal and plant species. There is no need, to define PCR primers for an individual species, such as in microsatellite analysis. The results are plotted in a 1/0 matrix and evaluated by cluster analysis (such as UPGMA) that places individuals together based on the similarity of their ISSR band patterns.
ISSR can reveal population specific DNA bands, which can be useful to trace back individual bird to populations (WINK et al. 2002). Since ISSR loci are inherited by both sexes, this method also allows the analysis of hybrids and of sex (WINK et al. 1998; 2000). ISSR markers can also be used to infer phylogenies of closely related taxa, such as genera (WINK et al. 2002; TREUTLEIN et al. 2003a,b).
The described method is a very powerful tool to evaluate the genetic make-up of LWFG and will be able to detect potential hybrids.

Only birds that show to be genetically "clean" will be used for breeding and re-introduction. Therefore on the basis of the results of these genetic tests, only genetically "clean" birds will be selected for future breeding in captivity and re-introduction.

The ancestors of the birds of the European captive breeding stocks of Lesser White-fronted Geese without doubt originate from different Eurasian breeding sites. According to the late Lambart von Essen virtually all Lesser White-fronted Geese available in European goose farms descend from a few Western Siberian ancestors bought in Russia about one hundred years ago and therefore genetic diversity is rather small (TEGELSTRÖM & VON ESSEN 1996, VON ESSEN pers.comm.). Genetic analyses of birds of the captive population showed that three out of 15 investigated birds (20%) bore the most common Western haplotype and eight (53%) the most common eastern haplotype (RUOKONEN 2001). Both haplotypes were covering 73% in captive and 89% in the wild Fennoscandian subpopulation, which shows a great similarity in the mtDNA composition of both groups (RUOKONEN 2001, RUOKONEN et al. 2004). The results of the analysis of nuclear DNA by KHOLODOVA (2001) confirmed this great similarity between captive and wild birds.
Because of this great genetic similarity it might be almost impossible to separate the free-living descendants of captive birds from the originally wild birds in a natural situation. After a thorough analysis of the results of the genetic tests, the "genetically clean" birds will be used for breeding and the separate breeding lines of Sweden, Finland and Germany will be integrated in one joint European breeding stock.

It showed to be impossible to use descendants of the remnant wild Fennoscandian population for re-introductions. The wild populations of the Lesser White-fronted Goose in Sweden and Finland are extinct and the Norwegian population is much too small to allow catching of birds without negative effects for the remaining population. This fact was stressed several times by the Norwegian authorities, which objected to removing any geese from the wild for breeding purposes more than once. Therefore it is not possible to use birds of Scandinavian origin for reintroduction.
Because of the great genetic similarity of wild and captive Lesser Whitefronts, genetically tested "clean" birds of the European captive breeding stocks are the nearest relatives of the almost extinct Fennoscandian population.

Habitat preferences and constraints.

Studies on migration of the wild population confirmed that wintering habitats still are deteriorating in the important areas around the Caspian and Black Seas, hunting control has collapsed since the fall of the Soviet Union, spring hunting of waterfowl is still legal in Russia, poaching is common even inside nature reserves, etc. Furthermore, because Lesser White-fronted Geese often migrate and winter associated with (Greater) White-fronted Geese *(Anser albifrons)* and hunters confuse both species, a considerable number of totally protected Lesser Whitefronts are unintendedly killed during legal White-fronted Goose shooting.
Most goose hunting happens under poor light conditions and while aiming on the geese in a flock the hunter only has a few seconds to decide to pull the trigger or not. Besides in most countries geese are shot with shotguns, which means that with each bird shot there will be a number of geese in its direct neighbourhood injured by pellets ("cripple loss").
Cripple loss rates in Eastern Europe and Asia are likely considerably higher than in Fennoscandia and Western Europe because of the poor condition of the weapons.
Besides data indicate that Lesser White-fronted Geese seem to be so curious that they fly back to the hunter (ALPHÉRAKI 1904), which could explain the high rates of Lesser Whitefronts in local goose bags (e.g. 1 of 4 Whitefronts near Pulkovo, St. Petersburg and 7 of 31 near Olonetz, Karelia).
This is in sharp contrast to the situation in the countries along the migratory routes of the Lesser Whitefronts of the re-introduction projects (Sweden, Danmark, western part of Germany and the Netherlands) where shooting both on the Lesser and the Greater White-fronted Goose is forbidden in most of the range. During winter the reintroduced birds are under control of a high number of ornithologists and the sites are protected.

Population modelling, number of geese

In the course of former tests several tests and modells were developed to estimate the number of geese to be re-introduced at an annual basis.
Preparatory flights in 1999 and 2003 showed that there are very different characters within a group of geese. Most birds are timid, but some are more courageous and are leading a group of more timid ones.

Without good leaders flight training and the migration flights become much more difficult and the released flocks will have have lower survival chances during wintering and spring migration. The smaller the group of geese the smaller the chance to have enough good leaders. The flock for the pilot project therefore needs to be big enough to have several courageous "leaders" and be capable of loosing some individuals (due to disease, accident or predator attack) during the flights and especially after the groups have been released into the wild.
Experience showed that for a successful migration the minimum number of geese in a flock should be 25-30 geese. This is in consistency with the maximum number of 30 geese which are able to be guided by one microlight aircraft.
Therefore a successful micrilight flight should start with at least 25-30 geese.

With the help of mathematical models, the future development of the reintroduced and remaining natural populations was simulated under different conditions. Furthermore, an analysis of the results of the Swedish reintroduction project concluded that the number of released goslings, 20-30 per year, has been too small. For improved results, more goslings should be released annually in the future. A Finnish model showed that it would be necessary to release at least 50 juvenile Lesser Whitefronts annually to establish a viable population in the next few years.
For that reason Sweden (Barnacle Goose method), Finland (Barnacle Goose method) and Germany (microlight aircraft method) should join efforts, to be able to release more than 50 juvenile Lesser Whitefronts per year.

Viability of released birds.

The results of the Swedish reintroduction programme indicate that these descendants of captive birds are very well viable. The breeding birds of the population show an average broodsize (c. 3.0 juv./pair), which is very well comparable to that of the natural Norwegian population (3.2 juv./pair, according to AARVAK & ØIEN 2001 in TOLVANEN et al., 2001) and these reintroduced birds show high survival rates.
Besides the high reproductive success as well as the population increase (in spite of the release moratorium) of the Swedish re-introduced population indicate a viability comparable to or even higher than the viability of the remnant wild population. This fact should dispel the concern that the captive birds could cause an "outbreeding depression" in the wild population because of "reduced fitness".

2. Previous Reintroductions

Thorough research into previous reintroductions of the same or similar species and wide-ranging contacts with persons having relevant expertise should be conducted prior to and while developing reintroduction protocol

All literature about the Swedish and Finnish re-introduction efforts as well as the publications about microlight aircraft experiments with migratory birds were reviewed, followed by long personal discussion with the persons, who did the work (e.g. Lambart von Essen†, Bill Lishman).

Subsequently, a test-flight with 33 Lesser Whitefronts from middle Sweden to the wintering site in the German Lower Rhine area was made in 1999. In 2003 local test flights were implemented in Brandenburg. All results and experiences were evaluated and used for the planning of this new project.
The current method of using Barnacle Geese as foster parents is well established and practised in Sweden for almost 20 years. Known constraints of the method are the problem to find enough suitable foster parents and the probable imprinting problems of the goslings. On the other hand, the Lesser Whitefronted goslings probably benefit from their foster parents, because the Barnacle Geese are stronger and more aggressive parents than Lesser White-fronted Goose parents, which seems to reduce juvenile mortality.
In the re-introduction project by help of a microlight aircraft, the goslings are kept in human care until they reach the winter site in autumn. This reduces the juvenile mortality rate considerably and prevents hybrids. A disadvantage of the method is that the young geese have to winter and fly back in spring without experienced parents. The high survival rates of the birds of the 1999 microlight test-flight indicate that this disadvantage is not essential.

3. Choice of release site and type

- *Site should be within the historic range of the species. For an initial re-inforcement there should be few remnant wild individuals. For a reintroduction, there should be no remnant population to prevent disease spread, social disruption and introduction of alien genes. In some circumstances, a reintroduction or re-inforcement may have to be made into an area which is fenced or otherwise delimited, but it should be within the species' former natural habitat and range.*
- *A conservation/ benign introduction* (to a site outside the original range) *should be undertaken only as a last resort when no opportunities for reintroduction into the original site or range exist and only when a significant contribution to the conservation of the species will result.*
- *The reintroduction area should have assured, long-term protection (whether formal or otherwise).*

The planned release sites are part of the historic Lesser Whitefront breeding range, where the species got extinct some decades ago. From these sites no habitat factors are known that would have caused extinction. All Lesser Whitefronts will be checked for diseases before they are brought to the release area. The release area is protected.
Migratory routes and wintering areas of the Lesser White-fronted Goose have been investigated thoroughly by scientists and nature conservation authorities in the involved countries. In the 1980's NORDERHAUG & NORDERHAUG (1982) stated that the main migratory route of the Fennoscandian population passes along the Finnish west coast. It also was stated that this route surely was not the only one. At that time the size of the Fennoscandian population already had decreased from estimated 10.000 around 1915 at 500 – 1,000 individuals around 1980, which could have resulted in the desertion of traditional flyways. Currently a number of duck and goose species breeding in Northern Fennoscandia use a migratory route along the Swedish coast, e.g. Greylag, Barnacle and Canada Goose as well as Mallard, Pintail and Tufted Duck. These

species migrate to Western Europe. The northern part of Germany is a traditional staging area and wintering site for Lesser White-fronted Geese (HEINICKE & MOOIJ 2005 & in prep.) and even today a part of the remaining Fennoscandian Lesser Whitefronts passes over Northeastern Germany, although their migratory route passes over Northern Russia, the Baltic states and Poland. These data indicate that it is very well possibly that at least a part of the Fennoscandian Lesser White-fronted Geese formerly also migrated along the Swedish coast. The Swedish re-introduction project revived this former migratory route, which means that today it is not possible to check if this traditional migratory route is still used by the remnants of the original Fennoscandian population of the Lesser White-fronted Goose.
The planned microlight-project therefore will not create a new migratory route, but use this most probably traditional and revived migratory route along the Swedish coast.

The geese of this project would share about 80% of their migratory route with the birds of the Swedish reintroduced population, which means that both populations will mix in the near future. There has been a lot of discussion about the genetic composition of the Swedish reintroduced birds, because a part of this population is derived from ancestors with a questionable genetic background. The mixture of a genetically checked and clean population with a population with a questionable genetic background would "dilute" the alien genes, as about six or more generations of backcrossing of these birds with "pure" LWF geese would almost eliminate any transpecific nuclear genes, which means the current Swedish reintroduced population will be "purified" by the geese of the microlight project.
Because of the genetic test and selection as well as the purifying effect on the current Swedish population a future spread of the Swedish reintroduced birds will not endanger the genetic pureness of the remnants of the original Fennoscandian population, if they ever meet. Moreover the reintroduced birds could enrich the impovered genetic diversity of the original population.

4. Evaluation of reintroduction site

- *Availability of suitable habitat: reintroductions should only take place where the habitat and landscape requirements of the species are satisfied, and likely to be sustained for the for-seeable future. The possibility of natural habitat change since extirpation must be considered. Likewise, a change in the legal/ political or cultural environment since species extirpation needs to be ascertained and evaluated as a possible constraint. The area should have sufficient carrying capacity to sustain growth of the reintroduced population and support a viable (self-sustaining) population in the long run.*
- *Identification and elimination, or reduction to a sufficient level, of previous causes of decline: could include disease; over-hunting; over-collection; pollution; poisoning; competition with or predation by introduced species; habitat loss; adverse effects of earlier research or management programmes; competition with domestic livestock, which may be seasonal. Where the release site has undergone substantial degradation caused by human activity, a habitat restoration programme should be initiated before the reintroduction is carried out.*

As mentioned in section 4, the planned release sites are part of the historic Lesser Whitefront breeding range, where no known habitat factors have caused extinction. The selected areas have the carrying capacity to sustain growth of the reintroduced population and to support a viable population in the long run. All release sites will have or become a protected status by law or contract with the land-owners. The sites will be monitored and all measures necessary to support the reintroduced population will be taken.
The selected wintering site is a traditional wintering site of the species and currently wintering site of high numbers of White-fronted, Bean and Greylag Geese and protected as nature reserve, Ramsar site and SPA.
Elimination and avoiding of previous causes of decline, in this case over-hunting and habitat loss, are guaranteed.

5. Availability of suitable release stock

- *It is desirable that source animals come from wild populations. If there is a choice of wild populations to supply founder stock for translocation, the source population should ideally be closely related genetically to the original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference) to the original sub-population.*
- *Removal of individuals for reintroduction must not endanger the captive stock population or the wild source population. Stock must be guaranteed available on a regular and predictable basis, meeting specifications of the project protocol.*
- *Individuals should only be removed from a wild population after the effects of translocation on the donor population have been assessed, and after it is guaranteed that these effects will not be negative.*
- *If captive or artificially propagated stock is to be used, it must be from a population which has been soundly managed both demographically and genetically, according to the principles of contemporary conservation biology.*
- *Reintroductions should not be carried out merely because captive stocks exist, nor solely as a means of disposing of surplus stock.*
- *Prospective release stock, including stock that is a gift between governments, must be subjected to a thorough veterinary screening process before shipment from original source. Any animals found to be infected or which test positive for non-endemic or contagious pathogens with a potential impact on population levels, must be removed from the consignment, and the uninfected, negative remainder must be placed in strict quarantine for a suitable period before retest. If clear after retesting, the animals may be placed for shipment.*
- *Since infection with serious disease can be acquired during shipment, especially if this is intercontinental, great care must be taken to minimize this risk.*
- *Stock must meet all health regulations prescribed by the veterinary authorities of the recipient country and adequate provisions must be made for quarantine if necessary.*

It showed to be impossible to use descendants of the remnant wild Fennoscandian population for re-introductions. The wild populations of the Lesser White-fronted Goose in Sweden and Finland are extinct and the Norwegian population of about 50 birds is much too small to allow catching of

birds without negative effects for the remaining population. This fact was stressed several times by the Norwegian authorities, which objected to removing any geese from the wild for breeding purposes more than once. Therefore it is not possible to use birds of Scandinavian origin for reintroduction.

The ancestors of the birds of the European captive breeding stocks of Lesser White-fronted Geese without doubt originate from different Eurasian breeding sites. According to the late Lambart von Essen virtually all Lesser White-fronted Geese available in European goose farms descend from a few Western Siberian ancestors bought in Russia about one hundred years ago and therefore genetic diversity is rather small (TEGELSTRÖM & VON ESSEN 1996, VON ESSEN pers.comm.).

Genetic analyses of birds of the captive population showed that three out of 15 investigated birds (20%) bore the most common Western haplotype and eight (53%) the most common eastern haplotype (RUOKONEN 2001). Both haplotypes were covering 73% in captive and 89% in the wild Fennoscandian subpopulation, which shows a great similarity in the mtDNA composition of both groups (RUOKONEN 2001, RUOKONEN et al. 2004). The results of the analysis of nuclear DNA by KHOLODOVA (2001) confirmed this great similarity between captive and wild birds.
Because of this great genetic similarity it might be almost impossible to separate the free-living descendants of captive birds from the originally wild birds in a natural situation.

After a thorough analysis of the results of the genetic tests, the "genetically clean" birds will be used for breeding and the separate breeding lines of Sweden, Finland and Germany will be integrated in one joint European breeding stock. It is planned collect eggs from the wild Russian population to re-enforce the breeding stocks and to enrich their genetic diversity.
All Lesser Whitefronts will be checked for diseases before they are brought to the release area.

6. Release of captive stock

- *Most species of mammal and birds rely heavily on individual experience and learning as juveniles for their survival; they should be given the opportunity to acquire the necessary information to enable survival in the wild, through training in their captive environment; a captive bred individual's probability of survival should approximate that of a wild counterpart.*
- *Care should be taken to ensure that potentially dangerous captive bred animals (such as large carnivores or primates) are not so confident in the presence of humans that they might be a danger to local inhabitants and/or their livestock.*

Between hatching and fledging the goslings of the microlight project are not only trained to follow the microlight aircraft, but also learn to survive in their habitat and to escape dangerous situations and predators. After release their teachers are the wild (Greater) Whitefronts of their wintering area. In the scope of the Barnacle Goose method the goslings are trained by their foster parents.

The goslings of the Swedish Barnacle Goose reintroduction programme and of the microlight test-flight of 1999 showed a considerably higher survival rate than the goslings of the wild population. Also the long-term survival rates of the Swedish reintroduced birds were significantly better than those of their wild conspecifics.

SOCIO-ECONOMIC AND LEGAL REQUIREMENTS

* *Reintroductions are generally long-term projects that require the commitment of long-term financial and political support.*
* *Socio-economic studies should be made to assess impacts, costs and benefits of the reintroduction programme to local human populations.*
* *A thorough assessment of attitudes of local people to the proposed project is necessary to ensure long term protection of the reintroduced population, especially if the cause of species' decline was due to human factors (e.g. over-hunting, over-collection, loss or alteration of habitat). The programme should be fully understood, accepted and supported by local communities.*
* *Where the security of the reintroduced population is at risk from human activities, measures should be taken to minimise these in the reintroduction area. If these measures are inadequate, the reintroduction should be abandoned or alternative release areas sought.*
* *The policy of the country to reintroductions and to the species concerned should be assessed. This might include checking existing provincial, national and international legislation and regulations, and provision of new measures and required permits as necessary.*
* *Reintroduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country. This is particularly important in reintroductions in border areas, or involving more than one state or when a reintroduced population can expand into other states, provinces or territories.*
* *If the species poses potential risk to life or property, these risks should be minimised and adequate provision made for compensation where necessary; where all other solutions fail, removal or destruction of the released individual should be considered. In the case of migratory/mobile species, provisions should be made for crossing of international/state boundaries.*

All Lesser Whitefront reintroduction projects, especially the microlight project, have a high acceptance in the society. A television film about the Swedish reintroduction programme with the Barnacle Goose method as well as the microlight test-flight of 1999 was shown several times in most European countries, including Finland and Sweden, and reached millions of people. In the Swedish reintroduction site Swaipa and the Netherlands' wintering sites in Anjum and Petten as well as in German wintering site Bislicher Insel regional/local people are proud of "their" Lesser White-fronted Geese. These projects – and in particular the microlight method – are especially qualified to increase public awareness for the problems of the Lesser White-fronted Geese and the acceptance of protective measures and facilitate to find sponsors for nature conservation activities. In the last few years green tourism to observe the Lesser White-fronted Geese has developed in the Netherlands' and German wintering sites.

These projects - in particular the use of microlight aircraft – are supported by the governments of Germany, Denmark and Sweden, as well as the local governments of Västerbotten county (S) and the German federal states Nordrhein-Westfalen, Niedersachsen and Schleswig-Holstein, the nature conservation agencies of Germany (BfN) and Nordrhein-Westfalen (LÖBF) and the landowner of the German release site RVR.

PLANNING, PREPARATION AND RELEASE STAGES

- *Approval of relevant government agencies and land owners, and coordination with national and international conservation organizations.*
- *Construction of a multidisciplinary team with access to expert technical advice for all phases of the programme.*
- *Identification of short- and long-term success indicators and prediction of programme duration, in context of agreed aims and objectives.*
- *Securing adequate funding for all programme phases.*
- *Design of pre- and post- release monitoring programme so that each reintroduction is a carefully designed experiment, with the capability to test methodology with scientifically collected data. Monitoring the health of individuals, as well as the survival, is important; intervention may be necessary if the situation proves unforseeably favourable.*
- *Appropriate health and genetic screening of release stock, including stock that is a gift between governments. Health screening of closely related species in the reintroduction area.*
- *If release stock is wild-caught, care must be taken to ensure that: a) the stock is free from infectious or contagious pathogens and parasites before shipment and b) the stock will not be exposed to vectors of disease agents which may be present at the release site (and absent at the source site) and to which it may have no acquired immunity.*
- *If vaccination prior to release, against local endemic or epidemic diseases of wild stock or domestic livestock at the release site, is deemed appropriate, this must be carried out during the "Preparation Stage" so as to allow sufficient time for the development of the required immunity.*
- *Appropriate veterinary or horticultural measures as required to ensure health of released stock throughout the programme. This is to include adequate quarantine arrangements, especially where founder stock travels far or crosses international boundaries to the release site.*
- *Development of transport plans for delivery of stock to the country and site of reintroduction, with special emphasis on ways to minimize stress on the individuals during transport.*
- *Determination of release strategy (acclimatization of release stock to release area; behavioural training - including hunting and feeding; group composition, number, release patterns and techniques; timing).*
- *Establishment of policies on interventions (see below).*
- *Development of conservation education for long-term support; professional training of individuals involved in the long-term programme; public relations through the mass media and in local community; involvement where possible of local people in the programme.*
- *The welfare of animals for release is of paramount concern through all these stages.*

All relevant Ministries and government agencies as well as involved landowners have approved the re-introduction project. One of the greatest nature conservation organisations of Germany, BUND, German partner of "Friends of the Earth" is partner of the project. At present the partners of the re-introduction project still negotiate with further NGO to co-ordinate all conservation activities for the species.

Since the test-flight of 1999, a multidisciplinary team was founded and several parts of the logistics of the project were prepared and trained. Before a bird is included in a breeding and re-introduction stock, it is safeguarded that it is free from infectious or contagious pathogens and parasites and has an accepted genetic composition.

Transport of the birds to the release sites is carefully planned and already tested in Finland and Sweden, because losses of goslings would jeopardise the aims of the project. Strategies on how best to release the goslings were developed and tested. Before release goslings will be marked with satellite transmitters (up to 6 birds/year) and telemetry transmitters (up to 20 birds/year) to track the birds after release. Population development will be subject of a long-term study. The wintering as well as the breeding site are protected and regularly monitored. The whole project will be documented on picture, film and paper.

POST-RELEASE ACTIVITIES

- *Post release monitoring is required of all (or sample of) individuals. This most vital aspect may be by direct (e.g. tagging, telemetry) or indirect (e.g. spoor, informants) methods as suitable.*
- *Demographic, ecological and behavioural studies of released stock must be undertaken.*
- *Study of processes of long-term adaptation by individuals and the population.*
- *Collection and investigation of mortalities.*
- *Interventions (e.g. supplemental feeding; veterinary aid; horticultural aid) when necessary.*
- *Decisions for revision, rescheduling, or discontinuation of programme where necessary.*
- *Habitat protection or restoration to continue where necessary.*
- *Continuing public relations activities, including education and mass media coverage.*
- *Evaluation of cost-effectiveness and success of re- introduction techniques.*
- *Regular publications in scientific and popular literature*

In the scope of the project it is planned to mark individuals with satellite-transmitters (up to 6 birds/year) and telemetry transmitters (up to 20 birds/year). Later their population development will be subject of a long-term study. The wintering site is (nature reserve, SPA, SCI) and the breeding site is protected (Nature Reserve). After each reintroduction the whole action will be evaluated and if necessary procedures will be revised. The whole project will be documented on pictures, film and paper.

From the preceding reflections and statements it can be concluded that the re-introduction projects for the Fennoscandian population of the Lesser White-fronted Goose do follow the IUCN Guidelines for re-introductions.

A.3.2. Re-introductions in the scope of the Lesser White-fronted Goose Action Plan of 1996

The feasibility of the reintroduction schemes of Lesser Whitefronts should also be reviewed against the background of the Lesser White-fronted Goose Action Plan as published in 1996 by the Council of Europe in Strasbourg (Quotations from the Action Plan in *italics*.)

To reintroduce and restock populations when other conservation measures fail.
Reintroduction and restocking may be accepted as an alternative way to minimise the risk of extinction of the species but should be applied only when other efforts to conserve the wild population appear to fail and the IUCN criteria for reintroductions are met (Kleiman et al. 1994). Reintroduction should only be carried out in areas where the species has disappeared and measures should be taken to minimise risks to natural populations. As long as captive stocks of Lesser White-fronted Geese exist and can be maintained there is no urgency for reintroduction and restocking. Therefore these activities should have lower priority compared to measures focusing on the remaining wild populations. Reintroduction and restocking should be discontinued if a natural recovery of the wild population can be verified.

In the Action plan there is a priority for research, monitoring, conservation and public awareness actions. The first aim of the outdated IAP 96 is: "*In the short term to maintain the current population...*".
This aim should be realised by means of monitoring of key areas and population size, promotion and implementation of legal protection of the species and its key sites, reduction of hunting pressure as well as research on the biology of the species and raising public awareness particularly amongst hunters and landowners.
In the middle of the 1990's as the IAP 96 was published the Western Palearctic population of the LWfG was estimated at 15.000 – 35.000 individuals (ROSE & SCOTT 1997) and in 2002 at 8.000 – 13.000 individuals (DELANEY & SCOTT 2002).
This negative development is indicated at most sites that were regularly monitored: e.g. Valdak Marshes: from 60-80 individuals in the 1990's to c. 30 2003/2004, Varanger Fjord from 40-50 in the 1990's to 0 in 2003/2004, Finnish Bothnian Bay Coast from 40-50 in the 1990's to less than 10 in 2003/2004, Hortobagy from 80-100 in the 1990's to 30-50 in the past years etc. The size of the local Fennoscandian subpopulation was estimated to be 200-300 individuals in the middle of the 1990's but nowadays hardly will exceed the level of 50 birds.
In 2004 the Fennoscandian Lesser White-fronted Goose Conservation Project concluded that there is a statistically significant negative population trend of about 5% annually since 1990. It was furthermore stated that the most important threats are still hunting and poaching as well as habitat losses and disturbances on the staging and wintering grounds (AARVAK & TIMONEN 2004). These data indicate that the first aim of the IAP 96 was clearly missed and that the methods to reach this aim have failed!
In such a case the IAP 96 states: "*Reintroduction and restocking may be accepted as an alternative way to minimise the risk of extinction of the species but should be applied only when other efforts to conserve the wild population appear to fail and the IUCN criteria for reintroductions are met.*"

After reviewing all running activities in the scope of the Action Plan, the objectives of the plan as well as the results until now, we have come to the following conclusions:

- Research, monitoring, conservation and public awareness actions should be continued with a high priority, but these actions are not sufficient to rescue the Fennoscandian breeding population of the Lesser White-fronted Goose from extinction. This opinion was confirmed by Russian scientists on the Meeting of the Lesser White-fronted Task Force in Spain in December 2002 as well as by scientists and representatives of the former Soviet Union's hunter's organisations at the 2:nd Conference of the Goose, Swan and Duck Study Group of Northern Eurasia (RGG) in Olonets, Russia in April 2003. Even the opponents of every kind of re-introduction now confirmed that the Lesser White-fronted Goose population shows a steady decrease of 5% annually (AARVAK & TIMONEN 2004)

- The Lesser White-fronted Goose Action Plan makes clear that if other measurements fail, re-introductions will be *accepted as an alternative way to minimise the risk of extinction of the species*. After a decade of monitoring, raising public awareness, activities to improve protection etc. and having observed a steady decrease of the remaining wild population by about 5% annually, these *other efforts to conserve the wild population appear to fail* and re-introduction should start in the western part of the former range of the species before the species actually becomes extinct.

- As discussed above, the re-introduction projects for the Fennoscandian population of the Lesser White-fronted Goose are in accordance with the IUCN Guidelines for re-introduction.

Based on the preceding reflections and statements, it can be concluded that the re-introduction projects for the Fennoscandian population of the Lesser White-fronted Goose are in accordance with the wording and even more with the spirit of the Lesser White-fronted Goose Action Plan.

It must be emphasised that the Action Plan does not define what is meant by the "failure of other measurements". Therefore, there is always room for disagreement, if wanted. In spite of different opinions on this matter, the annual meeting of Wetlands International's Lesser White-fronted Goose Task Force of January 2000 in Belgium agreed upon that re-introductions are in accordance with the Action Plan and gave them a priority of second category.

A.3.3. Reintroduction schemes in the scope of the nature conservation policy of the European Union

The European Union has decided to stop the decrease of biodiversity until 2010. The Lesser White-fronted Goose belongs to the most endangered bird species in the world and is included in Appendix 1 of the African-Eurasian Waterbird Agreement (AEWA) under the Bonn Convention, in Appendix II of the Bern Convention and in Appendix I of the EU-Birds Directive.

Within the EU the species was a breeding bird of Northern Sweden and Finland. In both countries the species is extinct since the 1990's and should be brought in a favourable condition again, at least since the beginning of the 1980's, since the Birds Directive got in power in 1979.

Since 1979 all necessary measures should be taken to bring the species in a favourable condition again. But in spite of all measures taken, the population of the species still decreases

with about 5 % annually, which means that current measures did not succeed to stop the dramatic decrease.
In consideration of the failure of the present conservation policy and the expected implementation of the EU-2010-aim alternative measures should be used, to fulfil the 2010-aim. The currently best alternative seems to be to reintroduce the species in their traditional, but almost completely deserted living range in Fennoscandia.

A.4. Feasibility of the reintroduction project for Lesser White-fronted Geese by help of Barnacle Geese

Under the leadership of the late Dr. h.c. Lambart von Essen, the Swedish Hunters' Association started a project to reintroduce Lesser White-fronted Geese in Swedish Lapland in 1979 to support the remnants of the natural population.
Since 1981 the project was supported by WWF-Sweden. In the scope of this project Lesser Whitefront eggs were bred by semi-domestic Barnacle Geese (*Branta leucopsis*), known to winter in the Netherlands. During moult of the Barnacle Geese and before the goslings were fledged, the young Lesser Whitefronts were released together with their foster-parents in an original Lesser Whitefront breeding habitat in Lapland. In autumn the families migrated to the wintering sites of the Barnacle Geese in the Netherlands, and in this way the young Lesser Whitefronts adapted a new migratory route. Until 1999 almost 350 Lesser White-fronted Geese were released in Sweden. As a result of the project, a first breeding pair (the female was a reintroduced bird) was recorded in Sweden in 1987 (VON ESSEN 1982, 1991 & 1999; VON ESSEN et al. 2000).
In 1998 the total Swedish breeding population of reintroduced birds was estimated at about 50 individuals of which until 1999 about 30 breeding attempts have been observed - 23 of them successful. A total of about 70 young have fledged, e.g. about 3 juvenile/successful brood. The total breeding population was estimated at about 5 breeding pairs and the annual mortality was estimated at about 35% in the first year and lower in subsequent years (LORENTZEN et al. 1999; VON ESSEN 1999; VON ESSEN et al., 2000). With his reintroduction project Von Essen showed, that geese are imprinted on the area where they learn to fly and that young geese must be guided by their parents to the winter quarters as assumed by FABRITIUS (1983).
In 1989 also WWF-Finland started a reintroduction programme for Lesser White-fronted Geese. In this project artificially bred young Lesser Whitefronts were released in the breeding area of the then remaining small wild Finnish population. No manipulation of migration routes was attempted. Until 1998 a total of 143 birds were released of which 123 were juveniles, five were 2nd calendar-year birds and 15 adults. The released groups were no families, but usually a family with a number of more or less adopted additional juveniles. It turned out that less than 10% of the released Lesser Whitefronts were reported back in Finnish Lapland and only one single individual was observed at the introduction area. These introduced birds seemed to suffer an extremely high annual mortality of about 80% in the first year and an average of 65% over 5 years. Until 1999 (and until today) no breeding pairs are reported (LORENTZEN et al., 1999; MARKKOLA et al., 1999).
Until 1999 in a total of about 455 Lesser White-fronted Geese was released in Fennoscandia. In Finland there is no breeding offspring of the reintroduced birds, whereas the Swedish population of reintroduced birds and their offspring was estimated at at least 70-80 individuals of which at least 5 breeding pairs in 2003.

A.5. Feasibility of the reintroduction project for Lesser White-fronted Geese by help of microlight aircraft

In 1999 a joint French-German-Swedish project tested a new technique (developed in Canada and the USA) to reintroduce Lesser White-fronted Geese (*Anser erythropus*). A group of 33 Lesser Whitefronts was artificially bred and raised and imprinted to follow a microlight aircraft. After a first flight training in late summer in Öster Malma in central Sweden, 30 juvenile Lessers followed the microlight aircraft during autumn migration. At the end of this migration over a distance of 1,800 km, 27 birds reached the Bislicher Insel nature reserve, a SCI and a core area of the German Ramsar site and SPA "Lower Rhine area". There the microlight aircraft was taken apart and the birds were left on their own to winter associated with 25,000 – 30,000 White-fronted Geese (*Anser albifrons*) wintering in the area every year. In spring 2000, 16 project geese were observed in Sweden, one of them near Uppsala obviously on its way to the breeding areas of the Lesser Whitefront in Swedish Lapland and 12 at Öster-Malma, the place where they had learned to fly.
Because part of the project birds has been observed associated with unmarked Lesser Whitefronts in the wintering area, it is likely that some of them followed their wild conspecifics to the Fennoscandian and Russian breeding areas. With an observed return-rate of at least 40 - 50 % of the Lesser Whitefronts released in middle-Sweden and a high probability for some additional ones in the North, the microlight project showed to be rather successful.
This test-flight showed that the microlight aircraft method is a serious, science based method to reintroduce endangered species, which is comparably successful as the Swedish Barnacle Goose method. The microlight plane method is a broadly accepted method in the USA, Austria and Russia, where several microlight projects were implemented in the past few years: e.g. Whooping Crane in the USA (180 birds remaining), Siberian Crane in Russia (with support of CMS; in Western and Central Asia only 10-20 birds left) and Bald Ibis in Austria (extinct).

A.6. Conclusion about the feasibility of re-introduction projects for the Lesser White-fronted Goose in Fennoscandia.

From the preceding facts and reflections it can be concluded that re-introductions are a functional tool to re-inforce the Fennoscandian population of the Lesser White-fronted Goose, to re-introduce the species in Sweden and Finland and to prevent extinction of the species in the westernmost part of its former breeding range.

B. CONSTRAINTS

Although the feasibility of all parts of the applied Lesser White-fronted Goose project seems to be guaranteed, there could be some constraints that possibly could impair the success of parts of the project:

1. The whole project cannot be implemented if at present available funds cannot be used due to further delay of the project start
2. The whole project cannot be carried out as planned because full funding is not available and cannot be organized by media activities, sponsors or foundations.
3. In spite of high hygienic standards, concentrations of captive birds always bear the risk of an outbreak of infectious diseases. Such outbreaks could cause high mortality and reduced

reproductive success in the captive breeding stocks and seriously affect the reintroduction efforts. Keeping captive breeding stocks in Sweden, Finland and Germany could minimise the effect of such risks.

4. The genetic composition of all birds of the captive breeding stock will be checked. Only birds proofed to be genetically "clean" will be used for reintroduction. In case that a considerable number of captive geese shows to be of a questionable genetic composition, there is a risk that the project will not have enough young geese to build up migratory flocks.
5. In case the German, Finnish and Swedish captive breeding stocks will not produce enough fertile eggs, it will have an impact on all reintroduction efforts. The co-operation between the Swedish, Finnish and German captive breeding stocks could minimise such risks.
6. A longer period of bad weather could stop the microlight migration. In periods of heavy rain and strong wind it is too dangerous to fly with a microlight aircraft. Under such conditions a microlight aircraft has to stay on the ground. If such weather conditions stretch over a long period, the success of a microlight migration flight is seriously endangered.
7. Unexpected actions of opponents of the reintroduction of Lesser White-fronted Geese could have an impact on the success of the reintroduction efforts.

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