

# Terms of Reference

## Independent Expert Review of the Genetic Status of Lesser White-fronted Geese in Fennoscandia

### 1. INTRODUCTION and BACKGROUND

---

#### **Genetic issues with captive-bred Lesser White-fronted Geese**

A wealth of scientific information has been produced in recent decades on the genetics of different goose species, and increasingly also on the genetic status of Lesser White-fronted Goose populations (*Anser erythropus*) in Europe – particularly on the genetic status of birds bred in captivity (e.g. Ruokonen et al. 2007). Relevant genetic information has also been made available via a range of different sources within the so-called ‘grey’ literature.

Scientific articles on the genetics of Lesser White-fronted geese reared in captivity come to widely diverging conclusions, ranging from virtually non-existent to extensive evidence of hybridization. In the past such articles have been used for continued controversial discussion among conservationists and policy-makers on the management implications of the respective genetic conclusions<sup>1</sup>. This controversy together with the lack of an independent scientific review of the genetic make-up of captive-bred Lesser White-fronted Geese impedes the establishment of internationally recognized recommendations for adequate and genetically sensitive management.

From genetic studies of mitochondrial DNA it was suggested that there are three distinctive wild populations of Lesser White-fronted Geese, which can be viewed as separate management units (Ruokonen et al. 2004; Ruokonen & Lumme 2000). Recent studies including micro satellites showed that there is genetic exchange between the Fennoscandian and Western main populations probably mediated primarily by males (Ruokonen et al. 2007). The third subpopulation is the Eastern main population, which nests from the northern Taimyr Peninsula eastwards and winters in China. The three wild subpopulations have all shown dramatic declines in recent decades and continue to decrease rapidly.

A fourth subpopulation, in Sweden, has been supplemented since 1981 by the release of captive-bred birds and a human-modified flyway to the Netherlands has been established. This population seems to be increasing slowly and shows relatively high adult survival rates. No captive-bred geese have been released since 2000, following the discovery that some birds from this captive-bred population showed evidence of genetic introgression of Greater White-fronted Goose (GWfG; *Anser albifrons*) into the breeding stock (A. Andersson 2004).

There are serious doubts by some countries that the genetic purity of captive-bred birds can be assured to such an extent that reintroduction or supplementation initiatives based on descendants from captive-reared stocks could be authorized or endorsed.

---

<sup>1</sup> Expert views differ widely and markedly on the ethical and particularly scientific merits of captive breeding, supplementation, reintroduction and change of flyway as conservation tools. This difference in views particularly within Europe, along with clear and hardening controversy on the genetic aspects of captive breeding and release activities planned for supplementation and re-introduction in the near future, have prompted the Secretariat of the African-Eurasian Waterbird Agreement to commission this genetic review on behalf of Finland, Sweden, Norway and Germany.

### The history leading to this study

In the past there was continued dispute between LWfG range states in Europe on how captive breeding, reintroduction and supplementation of LWfG in Fennoscandia should be approached:

- An international expert workshop in Lammi, Finland (2005)<sup>2</sup> confirmed difficulties between the European range states to agree on the controversial management issues of supplementation, reintroduction, captive breeding and associated issues concerning the Fennoscandian population. The major reason for this was the discovery of genes from the GWfG in the Swedish captive stock, from which the free-flying flock breeding in Swedish Lapland and wintering in the Netherlands had been supplemented. Hybridization also occurred between released LWfG and Barnacle Geese; the latter were used as foster parents to lead LWfG from Sweden to wintering areas in the Netherlands. In order to determine future actions on these controversial issues, participants agreed to request the independent opinion of the Scientific Council of CMS for guidance.
- In November 2005 the Scientific Council of CMS passed a recommendation which concluded, *inter alia*, that “it is desirable to have a wide genetic diversity among wild LWfG” and that “doubts do remain about the genetic make-up of the existing free-flying birds, originally introduced into the wild in Fennoscandia, and which winter in the Netherlands. 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. 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.”
- In early 2007 a compromise agreement between Sweden, Norway, Finland and Germany was reached which included the following elements for amendments in the AEWA International Single Species Action Plan for the LWfG under revision, and which would make it acceptable to all range states:
  1. The long-term future of all reintroduction and supplementation programmes will be reviewed by a Committee for LWfG captive breeding, reintroduction and supplementation in Fennoscandia (short: Recap Committee) taking full account of the success of conservation actions, including revival of the wild Fennoscandian population, and other pertinent factors. Decisions regarding the Swedish free-flying population should also take into account the conclusions of the independent review and evaluation of available LWfG genetic studies.
  2. A review and evaluation of the existing genetic LWfG studies by an experienced and independent scientific expert should be undertaken. Its conclusions will be submitted to the Recap Committee and the International LWfG Working Group for their consideration.<sup>3</sup>

---

<sup>2</sup> Meeting on Action Plan for LWfG.

<sup>3</sup> Sweden also pointed out, that seven Swedish wild birds were caught and were amongst the founders of the captive breeding stock. They quote Tegelström (e.g. Tegelström et al. 2001) who also estimated that 5-10% of released captive-reared LWfG might carry alien genes – while Finland stressed that this estimate is based on unpublished preliminary results and only a few individuals; they deem that a more relevant estimate, which was already published, would be 36% (Ruokonen, M., A.-C. Andersson, H. Tegelström (2007). Using historical captive stocks in conservation. The case of the lesser white-fronted goose. *Conservation Genetics* 8: 197-207). During the course of the meeting Sweden accepted the proposal to undertake, as a matter of priority, a feasibility study for a refinement of the free-flying population. The aim would be to capture the free-flying birds, perform genetic analysis and remove from the wild the apparent hybrids, i.e. presence of any alien genes. It is however not clear, if the currently available methods of analysis allow all hybrids to be revealed. Therefore, no complete refinement may be possible, but the partial refinement would decrease the frequency of alien genes to some extent. Norway agreed on the refinement option with the rest of the birds from the free-flying flock remaining in the wild. At the same time they required the establishment of a Committee for LWfG captive breeding, reintroduction and supplementation in Fennoscandia. The Committee should act as a platform for agreed and coordinated action of the Fennoscandian countries with regard to the

- In May 2008 the AEWA Secretariat established the Committee for captive breeding, reintroduction and supplementation of LWfG in Fennoscandia (short: Recap Committee). The report from the negotiation mission and the recommendations of the CMS Scientific Council (on outstanding issues), form the basis for recommendations by the Committee. The first Committee meeting reiterated the imminent need for an independent scientific review of the current situation with LWfG genetics. It was requested that a desk review be commissioned to a recognized geneticist on the matter.
- The updated International Single Species Action Plan for the Conservation of the Lesser White-fronted Goose (Western Palearctic Population), which was adopted at the AEWA MOP4 in September 2008, has not fully led to resolving all controversies linked to LWfG conservation efforts – even though cooperation between the member states belonging to the Recap Committee is moving in the right direction.

The commissioning of an independent review is based on the belief that joint recommendations on captive breeding, supplementation and reintroduction by the countries, and their implications on ongoing, planned and future activities can only be addressed adequately if independent scientific advice on the genetic aspects of the Fennoscandian population is considered.

As the convener and chair of the Recap Committee, the AEWA Secretariat<sup>1</sup> is commissioning this review.

## **2. OBJECTIVES and SCOPE**

### **Objectives:**

The main objective of the independent review is to obtain clarification on open issues and questions concerning the genetics and in particular the hybridization of LWfG in Fennoscandia, thereby examining the methodological aspects of studies undertaken in this field.

An independent review of the published information on LWfG genetics is required to:

1. Develop a solid information base of the relevant published literature (peer-reviewed and grey).
2. Quantify how genetically close or divergent the LWfG and GWfG are as bird species, and to what extent introgression and hybridization might effect their population viability.
3. Provide an objective expert judgment of the quality of the scientific information obtained (weaknesses and strengths of scientific approach, methods used, conclusions drawn; estimated uncertainty of results versus error margins discussed).
4. Conduct an evaluation of methods employed.
5. Assess progress towards the filling of information gaps on the issues of LWfG genetics: to what extent the genetic introgression poses a threat to population viability and to what extent the genetic methods used so far may reliably classify individuals as pure LWfG, pure GWfG and individuals with hybrid ancestry.
6. Estimate the need and the feasibility of developing new genetic methods for reliably identifying individuals with hybrid ancestry as well as estimate the timeframe within which this could be done.
7. Identify and document lessons learned with genetic analysis and hybridization in similar goose species.
8. Dimension the problem of the genetic introgression in relation to other perceived threats to the Fennoscandian LWfG and to observed hybridization in other Anseriform bird species (e.g. Randler 2006, McCarthy 2007).
9. Estimate genetic implications of the use of birds which are descendants from captive-bred stocks.

---

future of captive breeding and releases into the wild, taking full account of the development of the remaining wild Fennoscandian population. Finland also agreed with the compromise.

10. Estimate genetic implications of spreading of alien genes in free-flying hybridized birds.
11. Estimate effects of a strategy where the Swedish free-flying population continues to be supplemented with birds from a captive stock based solely on wild-caught West-Russian LWfG.
12. Provide the committee with sufficient information on the genetics of captive bred LWfG for recommendations on joint conservation actions (way forward).
13. Help clarify the genetic situation within the existing LWfG in captive stocks in Germany, Sweden, the Netherlands and Finland, including an evaluation of the reliability of the pedigrees of the captive birds.
14. Provide a vision for a genetically sound captive LWfG breeding programme (number of birds needed, time horizon to build sound captive breeding stock etc.).

### **3. Expected OUTCOME AND IMPACT of the study**

---

In the context of adoption and implementation of the International LWfG Action Plan, it is essential that the available knowledge and experience on the genetics of the species is assembled in a comprehensive format and scientifically reviewed to allow further judgment on the timing and appropriateness of potential reintroductions and supplementations. The recommendations of the study should help the countries concerned to define the exact conditions under which further reintroduction or supplementation activities would be authorized and/or carried out and to dimension the problem of the genetic introgression of GWfG. Findings should furthermore directly feed into the planning and design of such reintroduction or supplementation activities, provided that any recommendations would be favorable to that end.

Knowledge generated from the review, including good practices and distinctive contributions towards the clarification of the genetic issues, will be shared among the partners. It will furthermore be made accessible to the public.

### **4. MANAGEMENT of the Review**

---

#### **Independent consultant**

The desk review will be conducted by a consultant, whose work is to be based on Independence, Confidentiality, Scientific Soundness and Objectivity.

#### **Role of AEWA**

The AEWA Secretariat will be managing this desk review on behalf of the Committee for captive breeding, reintroduction and supplementation of LWfG in Fennoscandia. This Committee is formed by the breeding range states Finland, Norway and Sweden. Germany is represented as an observer. Due to the controversial nature of the issue between the represented countries and other stakeholders, the name of the contractor will be kept confidential within the AEWA Secretariat.

The contractor (Recap Committee) and the AEWA Secretariat will be responsible for the selection of review materials. The AEWA Secretariat will be responsible for the coordination of logistical arrangements. The LWfG coordinator within the AEWA Secretariat will assist the lead consultant's work as necessary, and will act as the liaison with the respective governments. The AEWA Secretariat, the designated focal points from each of the four countries, and one representative of the AEWA Technical Committee will be involved in the reviewing of drafts.

#### **Materials to be provided**

For information:

- Recommendations of the Scientific Council of the Convention on Migratory Species (2005)
- Additional Comments by R. Lacy
- Report from the 1<sup>st</sup> and 2<sup>nd</sup> Meetings of the Committee for Captive Breeding, Reintroduction and Supplementation of Lesser White-fronted Geese in Fennoscandia (LWfG Recap1 and Recap2)

- The International Single Species Action Plan for the Palearctic Population of the Lesser White-fronted Goose, *Anser erythropus*
- Final report from the Lesser White-fronted Goose negotiation mission in January 2007
- Minutes of the Lammi workshop (2005), chapter 'Discussion on reintroduction and on the genetic issues related to it'.
- Swedish feasibility study on catching and screening of Swedish Lesser White-fronted Geese
- Preliminary results of the WWT feasibility study for captive breeding of Norwegian Lesser White-fronted Geese
- Comments by the member countries Norway (1 comment), Sweden (1 comment) and Finland (2 comments)
- Genetic analysis of wild LWfG from Russia brought to Sweden for captive breeding (*if available*)
- Genetic analysis of Swedish free-flying flock (*if available*)

For scientific review:

- Paper by *Dr. Marina V. Kholodova*: "Analysis of the captive populations of the Lesser White-fronted Geese", Friends of the Lesser White-fronted Goose, Report 2003 No. 1 ([http://www.math.jyu.fi/~kahanpaa/Kotisivut/AnserErythropus/LWfGLEhti2003\\_1.html](http://www.math.jyu.fi/~kahanpaa/Kotisivut/AnserErythropus/LWfGLEhti2003_1.html))
- Published paper by *Ruokonen & Lumme* (2000): "Phylogeography and population genetic structure of the Lesser White-fronted Goose. Pp. 51-52 in: Tolvanen, P., Øien, I.J. & Ruokolainen, K. (eds.) "Fennoscandian Lesser White-fronted Goose conservation project. Annual report 1999. WWF Finland Report 12.
- Published paper by *Ruokonen et al.* (2004): "Population genetic structure and conservation of the lesser white-fronted goose (*Anser erythropus*)", *Conservation Genetics* 5: 501-512).
- Published paper by *Ruokonen et al.* (2007): "Using historical captive stocks in conservation. The case of the lesser white-fronted goose", *Conservation Genetics* 8: 197-207.
- *Ottvall, R.* (2008) "Feasibility study of catching and genetic screening of Swedish Lesser White-fronted Geese *Anser erythropus*." Dept of Ecology, Lund University. ([http://www.bd.lst.se/publishedObjects/10000909/Fjällgåsrapp\\_Lund2008.pdf](http://www.bd.lst.se/publishedObjects/10000909/Fjällgåsrapp_Lund2008.pdf))
- The Norwegian (WWT) Feasibility study (*as soon as available*)

## **5. ELEMENTS of the Desk review**

---

The desk review will include the following activities:

- Develop a desk review plan, by selecting key questions, by proposing methodology and by defining a work plan for the review.
- Review provided materials
- Conduct interviews with key stakeholders as necessary
- Prepare a final review report elaborating findings, conclusions, uncertainties, strengths and weaknesses, good practices and recommendations

The desk review should also include:

- Acronyms
- Executive summary (background, main recommendations)
- Introduction
- Findings (as per the above 2. Objective and Scope of the Review and 3. expected Outcome of the Review)
- Good practices and lessons learnt
- Emerging issues and issues/areas for further review by other means (if any)
- Annexure (i.e. TOR, list of review materials, survey results, list of people interviewed, etc.)

## **6. Qualifications and Requirements**

---

The assignment will be contracted to a consultant with substantive experience and knowledge in the area of population genetics of birds. Consultant requirements should include, but not be limited to:

- Tertiary university degree (PhD) in biology or medicinal sciences with senior competence in population genetics, or a closely related field of study
- At least 10 years of scientific work experience of which at least 5 years should be in genetic analysis - ideally in molecular DNA analysis of animals, conservation genetics and statistical proficiency
- Knowledge of the relevant scientific literature, and experiences with genetic implications of breeding programmes in diverse manifestations and geographic settings
- A track record of publication, scientific peer-review, and proven experience in conducting desk reviews and science evaluations
- Exposure to working with captive breeding and reintroduction issues an asset
- Competence in literature survey techniques and data processing
- Excellent analytical and report writing skills
- An interest in conservation applications of science
- Fluency in English

## **7. Duration of Contract**

---

To be negotiated.

## **8. Cost Indications**

---

To be negotiated.

## **9. References**

---

- Andersson, Å. (2004). The reintroduction of the Lesser White-fronted Goose in Swedish Lapland – a summary for 2000-2003. Pp. 51-52 in: Aarvak, T. & Timonen, S. (eds.) "Fennoscandian Lesser White-fronted Goose conservation project. Report 2001-2003." WWF Finland Report 20.
- McCarthy, E. (2007). Handbook of Avian Hybrids of the World. Oxford University Press, New York.
- Randler, C. (2006). Behavioural and ecological correlates of natural hybridization in birds. *Ibis* 148: 459-467
- Ruokonen, M., A.-C. Andersson, H. Tegelström (2007). Using historical captive stocks in conservation. The case of the lesser white-fronted goose. *Conservation Genetics* 8: 197-207
- Ruokonen, M., L. Kvist, T. Aarvak, J. Markkola, V. Morozov, I.J. Øien, E. Syroechkovsky Jr., P. Tolvanen, J. Lumme (2004). Population genetic structure and conservation of the lesser white-fronted goose (*Anser erythropus*). *Conservation Genetics* 5: 501-512
- Ruokonen, M., J. Lumme (2000). Phylogeography and population genetic structure of the Lesser White-fronted Goose. Pp. 51-52 in: Tolvanen, P., Øien, I.J. & Ruokolainen, K. (eds.) "Fennoscandian Lesser White-fronted Goose conservation project. Annual report 1999." WWF Finland Report 12.
- Tegelström, H., M. Ruokonen, S. Löfgren (2001). The genetic status of the captive Lesser White-fronted Geese used for breeding and reintroduction in Sweden and Finland. Pp. 37-39 in: Tolvanen, P., Øien, I.J. & Ruokolainen, K. (eds.) "Fennoscandian Lesser White-fronted Goose conservation project. Annual report 2000." WWF Finland Report 13.

---

<sup>i</sup> **The African-Eurasian Waterbird Agreement (AEWA)** is an international treaty administered by the United Nations Environment Programme (UNEP). It fosters cooperation between countries committed to conserving waterbirds along their migration routes across Africa and Eurasia. The LWfG and its distribution of populations across Europe, the Middle East and Central Asia falls directly within the conservation mandate of AEWA. This mandate is to maintain and restore migratory waterbird species and their populations at a favourable conservation status throughout their flyways. In this sense the AEWA Secretariat supports the finding of international agreements between species range states on adequate conservation measures for each of the species listed.

This review contributes to AEWA's strategic objectives 3 and 5: 'to increase knowledge about species and their populations, flyways and threats to them, as a basis for conservation action' and 'to strengthen AEWA's facilitating role in improving international cooperation and capacity towards the conservation of migratory waterbird species and their flyways'.