AGREEMENT ON THE CONSERVATION OF
AFRICAN-EURASIAN MIGRATORY WATERBIRDS

Doc. AEWA/MOP9/Inf.4/Rev.1
Agenda item 17
7 November 2025

9th SESSION OF THE MEETING OF THE PARTIES
11-14 November 2025, Bonn, Germany

"United for Flyways"

Conservation Brief for the AEWA International Single Species Action Plan for the Conservation of the Greenland White-fronted Goose

Agreement on the Conservation of
African-Eurasian Migratory Waterbirds (AEWA)

Conservation Brief for the AEWA International Single Species Action Plan for the Conservation of the Greenland White-fronted Goose

Anser albifrons flavirostris

(To be used in conjunction with the ISSAP published in May 2012 – please access here)

November 2025

Produced by the AEWA Technical Committee
Compiled by the Greenland White-fronted Goose Study

Contents

OVERVIEW AND SUMMARY

The International Single Species Action Plan (ISSAP) for the conservation of the Greenland White-fronted Goose *Anser albifrons flavirostris* was published in May 2012 as a plan of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

The 8th session of the Meeting of the Parties to AEWA in 2022 requested the AEWA Technical Committee to produce a shorter conservation brief for this ISSAP to highlight any new scientific information and/or threats as well as to boost implementation and re-engage relevant Range States since it was lacking an international coordination mechanism. This Conservation Brief shall be used in conjunction with the full ISSAP.

The Greenland White-fronted Goose comprises a single population of a sub-species of Greater White-fronted Goose, now recognised as the most genetically distinct from all other sampled circumpolar forms. Its small declining population is limited to four Range States. It breeds in low arctic west Greenland, migrates through south and west Iceland where it stages in spring and autumn, and overwinters in Ireland and the UK.

It has been assessed as globally Critically Endangered because of a halving (58% decline) of overall population size from 36,000 in spring 1999 to 15,000 in spring 2023, a decline due to chronically low productivity since the mid-1990s.

Monitoring numbers and breeding success of the world population twice each winter has been undertaken since 1983 in Ireland and the UK. Consequently, there is excellent data and information that allows understanding of the demography of the population.

Capture-mark-recapture studies have shown no major long-term changes in annual survival of either birds marked as first winter or adult birds since the 1990s. Annual age ratios show major declines in annual production of young at most wintering resorts, especially in very recent years. Modelling confirms declining productivity is the major cause of overall declines in abundance at the metapopulation level. Research shows this is largely due to heavy spring precipitation (as snow) in west Greenland since the 1990s that affects the abilities of females to recoup energy stores on arrival to the nesting areas to invest in egg-laying and incubation. This extra precipitation is a recent phenomenon, the result of warmer sea-surface temperatures in the North Atlantic pushing frontal systems further north in spring. Competition with Canada Geese *Branta canadensis interior* (arrived since the 1970s from northern Quebec) on the west Greenland breeding areas potentially is another contributory factor to low productivity, although the nature of interaction between the two species is not well established.

Recent research shows other factors affecting local abundance among the c.70 regular wintering sites that affect the likelihood of maintaining the integrity of the current range. Flocks wintering in the south and west (especially in Ireland) are declining faster than those further north (primarily in Scotland and the north), linked to earlier, faster spring green-up of grass in these areas compared to further north. Detailed individual tracking showed geese were generally highly site loyal, but that within winters, geese were more likely to move to or stay in flocks with low land cover of crops and bog in their home range (typically because they deplete finite food resources in stubbles and bogs in autumn and move to grasslands elsewhere). Between successive winters geese were more likely to move to or stay in flocks with high bog cover and greener grass between winters.

Continuing significant levels of illegal shooting occurs, especially in Iceland. This enhances adult mortality with the risk to the few reproductively active adult females as well as being a direct source of mortality for juveniles, thus limiting population recovery and future breeding potential. X-ray studies of live caught geese show 11% of a sample of Islay Whitefronts have embedded shot and indication of the significant extent of illegal shooting.

The ISSAP specifies that an emergency meeting of Range States should convene if, *inter alia*, the population falls below 20,000 individuals, or productivity at Wexford and/or Islay falls below 7.0% for three consecutive years. With the latest (spring 2024) population census finding just 14,997 individuals (Table 3), and productivity at Wexford averaging only 4.7% for summers 2020-2022 and 6.9% at Islay for the same period (section 2), such formal attention from governments in the Range States is now long overdue.

Conservation priorities[1] still include:

- Measures to enhance productivity in Greenland through limiting disturbance to accessible spring arrival areas as well as enhancing knowledge of issues. **[Objective 2: Greenland]**
- Measures to rewet peatlands throughout the home ranges of extant flocks to create novel feeding opportunities, disturbance refuges and nighttime roost sites. **[Objective 2: UK, Ireland and Iceland]**
- Measures to reduce adult and juvenile mortality to the maximum extent possible in order to conserve reproductively successful females, especially through eliminating illegal shooting[2] wherever it occurs and especially in Iceland where it is significant. **[Objective 3: All Range States]**
- Research to provide a better understanding of how well the wintering needs of wintering subpopulations can be met in the current agricultural landscape and how they might be enhanced. **[Objective 5: UK, Ireland and Iceland]**
- Research to better understand how well the wintering needs of wintering subpopulations can be met in the current agricultural landscape and how they might be enhanced. Implement the recommendations from Scottish Natural Heritage's (SNH[3]) Small Sites Project aimed at reversing the decline of the smallest flocks through proactive land management (and in Ireland undertake a similar study focussed on smallest, declining flocks). **[Objectives 4 & 5: Scotland, Ireland and Iceland]**
- Maintain and where possible enhance the high level of numerical and demographic monitoring of the metapopulation and the constituent winter subpopulations. **[Objective 5: All Range States]**
- Implement the recommendations of the Joint Nature Conservation Committee's (JNCC) Review of the UK Special Protection Areas which found the suite of SPAs for Greenland White-fronted Geese is insufficient numerically, for range, and ecologically (inadequate habitat provision). **[Objective 6: Scotland and Wales]**
- Convene an emergency review meeting as three different alert thresholds of the ISSAP have been breached. **[Objective 9: All Range States]**

Ongoing international cooperation is best achieved through the establishment of an AEWA International Species Expert Group (ISEG). No such network has been established although discussions were held in 2013. A Coordinator should be identified by the Range States to lead this network as a matter of priority.

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[1] All actions are considered of equal priority and are ordered by sequence of ISSAP Objectives.

[2] This is one of the most significant issues likely limiting population growth that is within the realms of control (compared to climate driven impacts on breeding). Urgent actions to address and eliminate this source of mortality is needed.

[3] Known as NatureScot since 2020.

1. INTRODUCTION AND BASIC DATA

- Conservation Brief for the AEWA International Single Species Action Plan for the Conservation of the Greenland White-fronted Goose *(Anser albifrons flavirostris)*. Full Action Plan at here.
- Compiled by the Greenland White-fronted Goose Study. Additional experts contributing: Tony Fox, Ian Francis, David Stroud; Carol Fielding and Patrick Lindley (NRW, Wales); Jessica Shaw and Simon Cohen (NatureScot, Scotland); Bart Donato (Natural England); Brian Burke (BirdWatch Ireland); Seán Kelly and Alyn Walsh (National Parks and Wildlife Service, Ireland); and Sigurður Á. Þráinsson, Sunna Björk Ragnarsdóttir and Svenja Auhage (Natural Science Institute of Iceland).
- **Technical Committee adoption**: *Adopted by the AEWA Technical Committee in February 2025.*
- The International Species Action Plan was published in 2012 (drafting had been completed by 2010) and adopted at MOP5 in 2012. It was originally published with timelines for implementation through to 2022. It was extended through Resolution 8.4 at MOP 8 for the period to 2032.

Table 1. Review of Basic Data

Populations covered by the Plan:	**World population**
AEWA Table 1 category, also indicating possible change since ISSAP adoption (Y/N – if yes, indicate new versus old listing)	A2* (no change) CMS Appendix II EU Birds Directive Annex I No change
Change in global, regional and/or sub-regional Red List status	No
Change in Principal Range States, i.e. countries regularly hosting over 1% of the biogeographic population (Y/N). If yes list changes per population.	None

2. ACTION FRAMEWORK REVIEW

Adopted International Action Plan Goal and Purpose in 2012	**2024 assessment of progress**
In the long-term, the goal of this plan is to restore the favourable conservation status of Greenland White-fronted Geese throughout their international range, as demonstrated by their assessment as Least Concern status against IUCN Red List criteria by 2022.	**Long-term goal not achieved**
In the short term, the aim is to identify the causes of current low productivity, the issue which is leading to a rapid decline of the population, and then put in place measures to address these factors so as to:	**Clearer understanding of the causes of decline achieved**
(i) halt the decline (to the extent feasible) and	Declines not halted

Adopted International Action Plan Goal and Purpose in 2012	2024 assessment of progress
(ii) restore the population to late 1990 levels by 2015.	Population levels not restored

Actions need to be taken with respect to four main issues:

a. The top priority action is to investigate the factors acting on geese on the breeding grounds and elsewhere[4] that are responsible for currently reducing the annual production of young.

Even knowing the causes of low productivity however, it is unlikely that reproductive success can be enhanced in the short-term. Accordingly, it is essential that measures are also taken to:

b. ensure that geese arrive in Greenland in optimal condition for successful breeding;

c. minimise additional sources of mortality;

d. minimise impacts on geese at local scales (such as disturbance or changes in habitat) particularly with regard to smaller flocks, or those with restricted distribution, so as to avoid further flock extinctions and thus further contractions of range; and

e. maintain and further develop monitoring and research programmes so as to provide necessary data and information concerning the current conservation status of the population.

Alert Thresholds

A meeting of Range State representatives and other interested parties shall be convened in the event of one or more of the following conditions being met in order to consider responses to the continued deterioration of population status:

	2024 assessment
• if overall population size falls below 20,000 individuals;	Population has been substantially below 20,000 since 2022, and in 2023/24 was the lowest ever recorded
• if overall population size otherwise falls by more than 25% in a period of three consecutive years;	Population declined by 25.7% in the four years 2020 to 2023
• if annual productivity falls below 7%[5] for three consecutive breeding seasons at Wexford and/or Islay; or	Productivity at Wexford averaged only 3.9% for the four summers 2020-2023; and only 6.9% for Islay in the same period
• other unexpected events occur which are likely to significantly affect the population.	

Table 2 below is adapted from the original Action Plan action framework showing the **objectives**, **results** and **actions**. Assessments of progress since 2012 and changes in the prioritization of actions based

[4] Noting the possibility that there may be carryover effects and factors affecting on wintering and spring staging areas can also have an impact on successful reproduction.

[5] This is defined as half the average productivity of c. 14% at these sites since the 1970s.

on the revised threat assessment and additional recommendations for action are shown in red font throughout.

Table 2. Review of Action Framework (adapted from Table 5 of the 2012 ISSAP)

Key to priority ratings[6]:
Critical: a Result that is needed to prevent a large decline in the population, which could lead to extinction. These are shaded in grey for emphasis.
High: a Result that is needed to prevent a decline of more than 20% of the population in 20 years or less.
Medium: a Result that is needed to prevent a decline of less than 20% of the population in 20 years or less.
Low: a Result that is needed to prevent local population declines or which is likely to have only a small impact on the population across the range.

We note that the standard AEWA priority rating above conflates the separate issues of conservation of population size and conservation of range. There are instances, especially for GWfG where small reductions in population size can cause disproportionately large reductions of range. Thus, if the two current GWfG wintering sites in Wales were lost, then because of small numbers involved this would only cause a small reduction in the overall population size and would be considered a 'low' priority but the contraction in range at UK (and international) scales would be very significant.

Other: a Result that is not possible to categorise with the above priority ratings

Key to time scale criteria:
Continuous: an ongoing or annual action
Short-term: completed within the next 1-3 years
Medium-term: completed within the next 1-5 years
Long-term: completed within the next 1-10 years

Objective 1: Investigate the factors acting on geese on the breeding grounds responsible for currently reducing the annual production of young

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
Understanding of the current drivers of population decline	1.1. Investigate and assess factors impacting on productivity, through an international research programme, investigating a) potential competitive interactions with the increasing population of Canada Geese in west Greenland; and b) the consequences of greater spring snow-fall in recent years; and assess feasibility of intervention strategies in the light of this research. Applicable to: **GR with other Range States**	Critical	Short-term	GWGS, AU and others	Recent modelling clearly demonstrates that poor productivity of recent years correlates with poor spring conditions on migration and snow and low temperatures on the breeding grounds due to warm sea surface temperatures in Northern

[6] Note that the AEWA Species Action Plan format categorises priority ratings quantitatively. Knowledge of the population dynamics of Greenland White-fronted Geese does not allow such attribution. Priorities given here are best expert judgements as to the relative importance of each action.

Result	Action	Priority	Time scale	Organisations responsible	Progress
					Atlantic. Several papers currently in prep related to this topic. NPWS in **Ireland** contributing significantly to this research. No information on Canada Geese, but they are suffering breeding failures under the same conditions as GWfG in same years. **Greenland:** GWGS field research on inter-specific competition in Isunngua in 2010 (Mitchell *et al.* 2011).
	1.2. Continue periodically to monitor the distribution and relative abundance of goose species in west Greenland to input to population modelling, as well as giving context to already designated sites, and identifying other sites of nature conservation importance. Applicable to: **GR with other Range States**	Other (important to refresh knowledge of key areas)	short-term (aerial survey at least once every five years)	GWGS, AU, Greenland Institute of Natural Resources and other potentially relevant organisations in North America	Last complete survey was undertaken in 2007 with a possible survey of the southern range planned for 2025. GWGS have undertaken non-systematic, but extensive, ground surveys of Isunngua (in the south of the breeding range) from 1988 to 2024, recording a decline from 189 to zero there (Stroud 2011; Stroud & Stroud 2014; H. Thomas *in litt*.).

Objective 2: Ensure that geese arrive in Greenland in optimal condition for successful breeding

Result	***Action***	***Priority***	***Time scale***	***Organisations responsible***	***Progress***
Annual productivity maximised	2.1. Limit and try to avoid disturbance in the prelude to migration at sites used before and during spring migration so as to optimise the condition of potentially breeding geese. Applicable to: **UK, IE, IS, GR**	Critical	Short-term	Government conservation agencies	On **Islay**, Barnacle Goose *Branta leucopsis* management has been shown not to impact GWfG (Griffin *et al.* 2020; Ozsanlav-Harris 2023a) and this applies to the pre-migration period. Undisturbed feeding provided as part of the Islay and Kintrye goose schemes. In **Wales**, NRW have worked with stakeholders on the Dyfi Estuary/Aber Dyfi SPA to limit disturbance in the pre-migration period including hunting organisations and land managers. In **Ireland**, significant lands at many of key sites are pro-actively managed for GWfG under agri-environment measures (e.g. nationwide ACRES Goose & Swan measure) or under NPWS farm management agreements (e.g. at Wexford Slobs and Lough Swilly). Includes provision of high-quality habitat and minimal/no disturbance. Unknown actions but desirable at all other sites in Ireland, UK, Iceland (see 2.2.) and Greenland.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	2.2. Identify and protect critical sites used in the staging and pre-breeding period. Review and protect previously identified arrival areas in Greenland (Glahder 1999; Glahder *et al.* 2002). Applicable to: **IS, GR**	Critical	Short-term	Government conservation agencies	**Iceland:** Andakill Protected Habitat Area, a designated Ramsar Site, provides year-round protection from shooting. While other important areas have been identified for conservation, they have not yet been formally protected.
	2.3. Manage sites used in the pre-breeding period throughout the flyway to optimise the quality and quantity of food for potentially breeding geese. Applicable to: **UK, IE, IS, GR**	Critical	Short-term	Government conservation agencies	Scottish Small Sites Project (Francis *et al.* 2011) commissioned by SNH in 2010 but no implementation of recommendations. Islay Sustainable Goose Management Strategy (ISGMS) has been the basis for work in the last decade, funding research on disturbance (Griffin *et al.* 2020; Ozsanlav-Harris 2023a). Some small trials of diversionary crops were attempted through the ISGMS (*e.g.* fodder beet), but the crop types are not appealing to farmers. Rush cutting is available in the current Agri-Environment Climate Scheme to enhance GWfG habitat, and there are management agreements covering Islay and Kintyre.

					In **Wales**, NRW have engaged with hunting organisations to minimise shooting disturbance during the winter period (reducing displacement impacts from high quality foraging areas) but specifically during the pre-migration to Icelandic spring staging areas. In addition investigations on the spatial distribution and quality of forage have been undertaken on the Dyfi Estuary / Aber Dyfi SPA with site management actions to be considered. In **Ireland**, significant lands at many of key sites are pro-actively managed for GWfG under agri-environment measures (e.g. nationwide ACRES Goose & Swan measure) or under NPWS farm management agreements (e.g. at Wexford Slobs and Lough Swilly). Includes provision of high-quality habitat and minimal/no disturbance. Primarily of relevance to grasslands and tillage. Andakíll, the single most important pre-breeding site in **Iceland**, is actively managed. That includes reseeding agricultural land and maintaining good quality and nutritious natural and seminatural areas.

Result	Action	Priority	Time scale	Organisations responsible	Progress
					Unknown elsewhere.

Objective 3: Take all possible steps to minimise mortality, thus protecting the critical stock of actual or potential successful breeders

Result	Action	Priority	Time scale	Organisations responsible	Progress
Mortality minimised	3.1. Introduce and/or maintain protection from hunting throughout the year (and critically during the crucial spring migration and pre-breeding period) whilst the population has its currently unfavourable conservation status. Applicable to: **All Range States**	Critical	Short-term	Government ministries and conservation agencies (especially DEFRA & Welsh Government in England and Wales respectively)	Statutory protection provided in 2020 in **England** and **Wale**s following AEWA Implementation Review case. NRW provided a supple-mentary evidential brief to Welsh Gov. to remove GWfG from Schedule 2 of Wildlife & Countryside Act. Accidental take remains a risk in **England** (and **Wales** although general spatial separation of races there) where European Whitefronts remain a quarry species. Occasional wintering birds will adopt flocks of European WfG; or may be mistaken as European WfG in mixed species flocks. Wildfowling take in **England** of European WfG is regulated on many designated sites due to the poor conservation status of the subspecies, but legislation generally does not allow regulation of take of European WfG beyond designated sites other than the timing of the Open season.

Result	Action	Priority	Time scale	Organisations responsible	Progress
					Not a legal quarry species in **Ireland**. Illegal hunting pressure considered very low/ very rare.
	3.2. Work through relevant hunter's organisations to promote knowledge of relevant hunting regulations. Applicable to: **All Range States**	Critical	Medium	Relevant hunting organisations	Efforts by **Icelandic Hunting Association** to promote protection when the shooting ban was first implemented, especially educational programmes (meeting, campaigns and pamphlets). Such initiatives should be revived and refreshed. Unknown actions in **Greenland**. In **Wales**, considerable partnership collaboration with wildfowlers following statutory protection in 2020 (above), through the Welsh Greenland White-fronted Geese Partnership since 2017 (*e.g.* here).
	3.3. Quantify the scale of illegal hunting by undertaking X-ray studies of captured birds as opportunities allow. Applicable to: **All Range States**	Medium	Continuous	Government conservation agencies, ringing groups and NGOs as appropriate (GWGS)	Numbers reported shot in **Iceland** (2018-2023)[7] amount annually to c.1% of the population, and up to 2.5% in 2019-2020 (annual totals reported shot between 192-469). These figures represent a minimum assessment, as they exclude birds that were shot but not recovered or reported.

[7] data from Environment Agency, https://ust.is/veidi/veiditolur/

Result	Action	Priority	Time scale	Organisations responsible	Progress
					Analysis of past telemetry data could enable the identification of instances where birds were definitively shot. Machine learning techniques applied to GPS and accelerometry data may help estimate the proportion of "lost" transmitters in Iceland attributable to this source of goose mortality. X-ray analysis of 110 geese caught on Islay (2016-2020) found 11% with embedded shot indicating significant levels of illegal hunting (McIntosh *et al.* 2023). Other X-ray data collected by WWT at Stranraer, Loch Ken and Wexford but not yet published.
	3.4. Enforce legislation on hunting *e.g.* especially action against illegal spring shooting. Applicable to: **All Range States**	Critical	Short-term	Government ministries, conservation agencies and police	Unknown, possibly **Greenland** (extent unknown). In **Wales**, there are no confirmed records of birds being shot since 2002/03 either during the winter or precluding spring migration.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
					In **Iceland**, no actions have been taken so far to enforce legislation against illegal shooting of GWfG during the hunting season, but hunting has been banned since 2006. Reported numbers shot between 2018 and 2023 suggest continuing, though declining, instances of illegal killing (see above). All spring shooting of waterfowl is forbidden by national regulation. **Greenland** knowledge of illegal killing is unknown. Not legal quarry species in **Ireland**. Illegal hunting pressure considered very low/ very rare; a single known occurrence in recent decade, with local engagement in local shooters ongoing.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	High	Short-term	Government conservation agencies	In **Scotland**, all casework has been dealt with in line with legislation, with all major windfarm developments subject to EIA. No windfarm or other infrastructure has been constructed to date on SPAs. There is an issue of GWfG using land for grazing outwith SPAs, and EIAs have to consider this.	
					Survey of Caithness Lochs SPA roosts and flightlines commissioned by SNH to provide evidence base for renewable energy developments casework (Patterson *et al.* 2013).

Result	Action	Priority	Time scale	Organisations responsible	Progress
					In **Wales**, NRW assess OWF, Solar Arrays and other National Significant Infrastructure Projects where it is considered there may be a possible impact on GWfG. New woodland creation proposals are also considered. NatureScot have no records of any collisions with renewable energy infrastructure. In **Ireland**, all planning applications are considered in line with legislative requirements, with relevant environmental/ecological assessments undertaken by applicants and subsequently reviewed by relevant statutory consultees and/or regulatory bodies, with GWfG considered where relevant. In **Iceland**, all suggested wind-farm projects are required to go through EIA with relevant ecological assessments and considering effects on local and migratory bird species.

Objective 4: Minimise impacts on geese at local scales (such as disturbance or changes in habitat) particularly smaller flocks, or those with restricted distribution, to avoid further flock extinctions, to avoid further contraction of range

Result	***Action***	***Priority***	***Time scale***	***Organisations responsible***	***Progress***
Extent of range maintained	4.1. Seek agreements with land managers at key sites as well as within the locale of smaller flocks important to maintaining range, for example using agri-environment measures so as to secure and optimise the quality of agricultural feeding areas. Applicable to: **UK, IE, IS**	Other	Medium-term	Government ministries and conservation agencies including NatureScot, NRW and NPWS	Scottish Small Sites Project (Francis *et al.* 2011) commissioned by SNH in 2010 but no implementation of recommendations. Need for equivalent studies and initiatives in **Iceland** and **Ireland**. In **Scotland**, agri-environment policy changes underway, but not yet resolved. Goose schemes essentially comprise numerous management agreements covering Islay and Kintyre. Rush cutting agreements remain available through the current Agri-Environment Climate Scheme to enhance habitat for GWfG. Agricultural reform may change the way support is delivered for geese in future. Modelling commissioned to assist with casework assessment in Caithness and Kintyre (Trinder 2015). The **Welsh** agri-environment scheme (Glastir) had GWfG management prescriptions but there was limited adoption of the scheme.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
					Additional knowledge collated in recent winters of the GWfG usage of agricultural land will allow better targeted management in the proposed new agri-environment scheme due to commence in 2025. In **Ireland**, significant lands at many key sites across the country are pro-actively managed for GWfG under agri-environment schemes (*e.g.* nationwide Dept of Agriculture ACRES Goose & Swan measure) or under NPWS farm management agreements (*e.g*. at Wexford Slobs, Sheskinmore, Lough Iron, and Lough Swilly). Both encompass the provision of high-quality habitat and minimal/no disturbance. Primarily of relevance to grasslands and tillage.

Objective 5: Maintain and further develop monitoring and research programmes to provide necessary data and information concerning the current conservation status of the population

Result	***Action***	***Priority***	***Time scale***	***Organisations responsible***	***Progress***
Necessary data for conservation management of population and key sites collected annually	5.1. Support the maintenance of an international population model with accurate estimation of mortality and productivity rates to underpin scientifically based management decisions Applicable to: **All Range States**	Critical	Continuous	GWGS, University of Saskatoon, Canada, AU, NPWS, NatureScot and others	University of Saskatoon have developed an Integrated Metapopulation Model in a Bayesian framework to model population, estimating mortality, productivity and immigration/immigration between subpopulation units.
	5.2. Monitor survival rates and productivity by supporting continued ringing, ring reporting, studies of individually marked birds and maintenance of necessary databases. • Maintain the long-term programme of marking, resighting and counting geese at the main Irish wintering site of Wexford. • Develop a complementary programme of marking in Scotland, at locations which allow for sustained resighting effort. • Strongly encourage the collection of more extensive assessments of productivity at sites throughout the range. Applicable to: **All Range States**	Critical	Continuous	GWGS, NPWS, AU and others	Long-term programme of marking, resighting and counting geese at the main Irish wintering site of Wexford maintained. Ringing regularly undertaken at two Scottish sites (*e.g.* Mitchell *et al.* 2020). All need continuity and funding commitments.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	5.3. Maintain the twice-annual international census (including productivity estimation) at all known wintering resorts; improve coverage where this is deficient; seek to involve Iceland and Norway, and report results to other Range States. • Enhance monitoring of Irish wintering flocks away from Wexford so as to better determine trends in population size and productivity for these sites. • Review the effectiveness and future resilience of the winter monitoring programme. Applicable to: **UK, IE**	Critical	Continuous	NPWS and GWGS with support from BTO/JNCC Goose and Swan Monitoring Programme	International census report produced annually. International census maintained (Table 3) although need for better count coverage and age ratio sampling in Ireland. No evidence of regular wintering numbers in **Iceland** or **Norway**.
	5.4. Undertake extensive surveys of staging and breeding areas to identify further sites of nature conservation importance and secure their adequate protection. Applicable to: **IS & GR**	Critical	Short-term	Government conservation agencies	None. Funding unavailable. **Greenland**: unknown. The National Land Survey of Iceland and the Mývatn Research Station were merged with the Icelandic Institute of Natural History on 1 July 2024 as Icelandic Institute of Nature Research. Surveys not undertaken due to lack of funding.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	5.5. Maintain and further develop national inventories of sites regularly used, especially those of national and international importance, and particularly on the staging and breeding areas in Iceland and Greenland, as a basis for protection and appropriate management. Applicable to: **All Range States**	Other	Medium-term	JNCC, NPWS, NSIIwith GWGS	Delivered on wintering grounds through annual censuses. In **Ireland**, national monitoring database maintained, used for various purposes including coordinated annual census, and data used to inform assessment of development applications etc. In **Iceland** regular counts have been conducted in Andakíll Ramsar Site and other neighbouring areas during the staging period since 2024. **Greenland**: unknown.
	5.6. Undertake research to assess levels of disease and impacts of pollutants (especially levels and consequences of embedded and/or ingested lead shot) and resultant impacts on condition. Applicable to: **All Range States**	Other	Medium	NPWS, GWGS	The 2020-2023 HPAI H5N1 outbreak was monitored on Islay and a network of wetlands in Scotland, and mortality reported on – none found in GWfG: see here. Outwith this major outbreak, no systematic surveillance currently for HPAI as funding unavailable. No evidence of major mortality from HPAI, one euthanised juvenile tested positive at Wexford, despite close proximity to infected Barnacle Geese on Islay and elsewhere.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
					X-ray analysis of 110 geese caught on Islay found 11% with embedded shot indicating significant levels of illegal hunting (McIntosh *et al.* 2023). Restrictions on the use of lead gunshot in or around wetlands came into effect in **Ireland** in February 2023; and in **Iceland** in late 2021.

Objective 6: Ensure that important areas for Greenland White-fronted Geese are appropriately protected and managed

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
Favourable conservation status of important sites established and maintained	6.1. Designate all wetlands of international importance for Greenland White-fronted Geese under the Ramsar Convention and/or the EU Birds Directive as appropriate, promoting especially the conservation of sites necessary to maintain range and encouraging the restoration of habitat at sites which were previously of similar importance. Applicable to: **All Range States**	Medium	Medium-term	Governments of Greenland, Iceland, Ireland and UK	**UK:** Review of UK SPA network in 2016 found that SPA provision is inadequate numerically, for range, and ecologically (inadequate habitat provision) (Stroud *et al*. 2016). Based on this, an advice and options paper to address the level of SPA network insufficiency for GWfG has been sent to UK Governments in 2024. **Iceland:** Andakill Protected Habitat Area designated as Ramsar Site in 2013. No further international designations have been made in IE, UK or GR.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	6.2. At designated sites of importance (including Ramsar sites, SPAs and SACs): • Inform central and local government of the importance and location of protected sites; • Enhance knowledge of sites and requirements among user-groups (*e.g.* hunters, farmers); and • Use sites wisely *sensu* Ramsar Convention and fulfil legal obligations under the Birds and Habitats Directives (Annex 7 [of ISSAP]), through the preparation and implementation of management plans for each site. Applicable to: **All Range States**	Medium	Medium-term	Government conservation agencies including NatureScot and NRW, Iceland and Greenland	**Greenland**: unknown. The most recent information for all designated sites in **Scotland** is publicly available through https://sitelink.nature.scot/home. This also includes conservation objectives or site management statements where applicable to the designation type. The way in which these sites are monitored is currently being reviewed. There are no goose specific plans for these sites. Plans and projects affecting these sites are subject to Habitats Regulations Appraisal. In **Wales**, there is a 2008 published management plan for the Dyfi Estuary /Aber Dyfi SPA intended to be updated in the next two years. In **Ireland**, no management plans currently produced for SPAs in which GWfG is listed. However significant lands within numerous SPAs pro-actively managed for GWfG under agri-environment schemes (*e.g.* nationwide Dept of Agriculture ACRES Goose & Swan measure) or under NPWS farm management agreements (*e.g.* at Wexford

Result	Action	Priority	Time scale	Organisations responsible	Progress
					Slobs, Sheskinmore, Lough Iron, and Lough Swilly). Both encompass the provision of high quality habitat and minimal/no disturbance. Primarily of relevance to grasslands and tillage. **Iceland**: Management Plan is in place for the Andkíll Protected Habitat Area and other protected areas in Iceland. However, under current national legislation, there is no mandate to establish Management Plans for other sites, such as areas listed in the Nature Conservation Registry or identified as IBAs.
	6.3. Ensure that policies for development (*e.g.* tourism) avoid areas where, or periods when, Greenland White-fronted Geese are sensitive to disturbance. Applicable to: **All Range States**	High	Medium-term	Government of Greenland	Plans to footpath from Kangerlussuaq to Sisimiut a drivable gravel track and its potential to disturb geese in spring/summer. **Greenland**: unknown.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
					In **Wales**, all development likely to impact on the Dyfi flock is screened for impact on the SPA under the Habitat Regulations and there are national Welsh Government and local development plan policies which are also protective. For example, the Wales Coastal Path was re-directed away from the area used by GWfG on the Dyfi. Tourism initiatives (such as 'green-ways') are captured under planning systems and regulations in which GWfG are given due considerations under relevant legislation; also captured via engagement with NPWS and other authorities.

Objective 7: Ensure that any interactions with people are sustainable giving special emphasis to the avoidance of agricultural conflicts

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
Avoidance of conflicts with land managers	7.1. Establish adequate disturbance-free refuge zones or time periods in all areas of international importance. Applicable to: **All Range States as appropriate**	High	Short-term	Government conservation agencies including NatureScot, NRW and NPWS	On **Islay**, a maximum of 40% of land entered into the island's goose scheme can be disturbed leaving a minimum of 60% plus reserve and non-scheme land free from disturbance which research shows is an effective measure (Griffin *et al.* 2020). Kintyre Goose Scheme also provides undisturbed feeding. However, the future of the schemes is currently unclear. In **Wales**, extensive work completed to identify sources of disturbance on the Dyfi Estuary / Aber Dyfi SPA and establish disturbance free refuges. An example is the work undertaken with BASC to establish refuges around roosts to ensure they are free of hunting disturbance. In 2016/17 two GWfG were GPS tagged and spatial and temporal use of the Dyfi Estuary was examined. Specifically, advanced spatial modelling techniques to identify home-range and core-areas was undertaken, and how these varied between winters assessed.

					Study also examined and distinguished between the visitation rate and the visitation frequency for sites, in order to gain a clearer understanding of how the site is used by geese. The data helped identify refugia. In Ireland, significant lands at many of key sites across the country are pro-actively managed for GWfG under agri-environment schemes (*e.g.* nationwide Dept of Agriculture ACRES Goose & Swan measure) or under NPWS farm management agreements (*e.g.* at Wexford Slobs, Sheskinmore, Lough Iron, and Lough Swilly). Both encompass the provision of high quality habitat and minimal/no disturbance during the over-wintering period. Other legislative protections to reduce or manage disturbance risk, *e.g.* activities requiring consent within SPAs. **Iceland** has not conducted studies or assessments on wildlife disturbance at important bird or conservation areas, so far. Generally, disturbance is considered to be low, but potentially it could have some affect close to populated areas, areas of intense agricultural land use or popular touristic areas.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	7.2. Ensure that strategies to scare birds from sensitive farmland always include provision of disturbance-free refuges. Applicable to: **UK, IE, IS**	High	Short-term	Government conservation agencies including NatureScot, NRW and NPWS	**Islay & Kintyre** – see above. **Wales** - No formal strategies to scare birds on the Dyfi - localised arrangements with individual farmers.
	7.3. Produce and disseminate advisory materials on the assessment and alleviation of crop damage for those people directly concerned. Applicable to: **UK, IE, IS**	Medium	Medium-term	Government conservation agencies and NGOs	Nothing specifically for GWfG in **Scotland** & **Wales**. **Ireland:** Largely via existing NPWS Farm Plans and national agri-environment Goose & Swan measure at key GWfG sites. **Iceland**: No specific material for GWfG.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	7.4. Work with local farming communities to maintain or establish local management strategies for the alleviation of crop-damage problems in areas with specific difficulties sharing good practice and experience as appropriate. Applicable to: **UK, IE, IS**	Other	Medium-term	Government conservation agencies including NatureScot and NPWS	In **Scotland**, delivered by Local Goose Management Groups in Islay and Kintyre (see above). No reports of GWfG damage to crops in other areas as numbers are so small. In **Wales**, evidence to identify the key foraging areas on the Dyfi Estuary / Aber Dyfi SPA has been collated. Work is in progress to deliver actions to alleviate the impact of crop scaring. **Ireland**: Largely via existing NPWS Farm Plans and national agri-environment Goose & Swan measure at key GWfG sites. At sites such as Wexford production of crops (*e.g.* fodder beet) to alleviate pressures on other lands.

Objective 8: Encourage support for policies and measures for Greenland White-fronted Goose conservation amongst all whose activities impinge on, or who otherwise share landscapes with the geese

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
Promotion of goose conservation by local communities	8.1. Inform the general public, and in particular farmers and hunters as relevant, of the objectives and provisions of this plan in order to ensure that it has broad support. Applicable to: **All Range States**	Other	Short-term	Government conservation agencies and NGOs	**Wales**: NRW work closely with hunting organisations to promote GWfG conservation. In **Ireland,** some engagement at key sites, primarily via NPWS farm plans. No actions yet in **Iceland**.

Result	Action	Priority	Time scale	Organisations responsible	Progress
	8.2. Publish and disseminate knowledge of important sites and their management requirements within local and central government, conservation and agricultural agencies, and other relevant land-use advisory bodies. Applicable to: **All Range States**	Other	Short-term	Government conservation agencies and NGOs	No actions known, although the SNH *Species Action Framework* (Urquhart *et al.* 2016) gave profile to the population in **Scotland** and funded the original development of the ISSAP and Small Sites Project (Francis *et al.* 2011). **Wales**: NRW with partner organisations such as RSPB, BASC and WWT tagged individuals in the Dyfi flock which initiated further research on the site, raised the profile of this flock and initiated management actions. The ECHOES project also received Interreg funding to collate knowledge on the two Welsh GWfG sites (see section 3).
					Ireland: NPWS and Department of Agriculture Food and the Marine direct engagement to target agri-environment measures at key GWfG wintering sites.

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
	8.3. Consider needs of Greenland White-fronted Geese when developing conservation and other land-use (*e.g.* agri-environment) policies away from protected areas. Applicable to: **All Range States**	Other	Continuous	Relevant government ministries and departments	In **Wales**, NRW are to collate and analyse GWfG records plus GPS tag locations to aid decision making and mitigate impacts of new woodland creation proposals outside the SPA network. In **Ireland**, NPWS input into land-use policies via inter-departmental consultation/ statutory consultation processes, with GWfG considered where relevant. No other actions known.
	8.4. Encourage and promote educational and public awareness programmes amongst communities (and especially in schools living in areas holding important concentrations of geese. Applicable to: **All Range States**	Other	Continuous	Government conservation agencies and NGOs	Refreshment/expansion of the Greenland White-fronted Goose Study's website https://greenlandwhitefront.org/ Educational programme including school visits at NPWS Wexford Wildfowl Reserve and other reserves ongoing. No other actions known.

Objective 9: Ensure full international co-operation between Range States in joint programmes of monitoring, conservation and liaison

Result	*Action*	*Priority*	*Time scale*	*Organisations responsible*	*Progress*
Effective international co-operation	9.1. Support the implementation, development and future review of this international plan. Applicable to: **All Range States**	Other	Short-term	Government conservation agencies and NGOs	No actions known since 2013.

Result	***Action***	***Priority***	***Time scale***	***Organisations responsible***	***Progress***
and liaison for the benefit of the population	9.2. Share knowledge relevant to the objectives of this plan between Range States. Applicable to: **All Range States**	Other	Short-term	Government conservation agencies and NGOs	Informal networking largely through the activities of NPWS, NatureScot, NRW, GWGS and other NGOs.
	9.3. Encourage both formal (*e.g.* governmental) and informal (*e.g.* via schools) twinning initiatives between internationally important sites or other areas with concentrations of geese. Applicable to: **All Range States**	Other	Long-term	Government conservation agencies and NGOs	No actions known.
	9.4. Co-operate in collaborative international research including population monitoring. Applicable to: **All Range States**	Critical	Short-term	Government conservation agencies, NGOs and research institutions	Annual monitoring maintained with inputs from networks in UK and IE and government funding; strong ongoing research links with international institutions.
	9.5. Train staff at key sites, and co-operate with international exchanges of staff and relevant training material so as to promote best practice in site and species management techniques. Applicable to: **All Range States**	Other	Short-term	Government conservation agencies and NGOs including NatureScot, NRW and NPWS	NRW with partners RSPB, BASC and WWT have collaborated on providing training to conservation managers at the Welsh sites which included visiting Wexford. No other actions known.
	9.6. Participate in emergency review meetings should 'alert' thresholds be reached. Applicable to: **All Range States**	As necessary	As necessary	Government conservation agencies and NGOs	NRW sent Welsh Government an evidence brief when the <20,000 threshold was met. No other actions known.

3. BIOLOGICAL ASSESSMENT

Changes and/or pertinent new evidence noted in relation to:

Greenland

- No new evidence known.

Iceland

- With an amendment to Regulation No. 456/1994 on June 12, 2006, the Greenland White-fronted Goose (*Anser albifrons flavirostris*) has been granted year-round protection.

- Designation as a Ramsar Site of the 3,086 ha Andakill Protected Habitat Area (Hvanneyri, west Iceland) on 18 February 2013). The most important single migratory staging area in Iceland.

- Bird counts at the Andakíll Ramsar Site are conducted in accordance with the area division and methodology established for the Andakíll Protected Habitat Area Bird Monitoring Project (Stroud & Tierney 2017). The survey is carried out four times annually and contributes to long-term monitoring and population assessment. All hunting statistics are publicly available on the Environmental Agency's website. Information on the status and trends in illegally shot birds (that are reported) is accessible, providing insight into compliance with hunting regulations.

Ireland

- **Wexford** – Largely the positive management of lands for GWfG in Wexford has continued, with primary land management at the Wexford Wildfowl Reserve of the Wexford Harbour and North Slobs SPA. Land management agreements under the NPWS Farm Plan Scheme have continued, with adaptation as required (e.g. relocation/rotation of fodder beet crop). Engagement with local landowners, hunters and other stakeholders continues and is largely positive. However, seemingly as a result of measures relating to the Covid-19 pandemic, there has been a significant increase in recreational activity at and penetrating into the site, leading to increased disturbance of geese. Engagement with the public and other stakeholders continues in order to seek to remove/minimise the issue. Pressures at other sites known to be used by the Wexford flock, including the South Slobs, Cahore Marshes, and Tacumshin Lake, are reducing the availability of these sites for the geese. These pressures include increased recreational disturbance, illegal activities (e.g. hare coursing, fishing), and changes in land management. Disturbance at the single known roost (Wexford Harbour) appears not to be a significant issue currently.

- **Rest of Ireland –** Further urgent actions are needed to sustain 'downcountry flocks' and maintain the species range and numbers outside Wexford. There is a crucial need to better understand landscape use and needs of flocks to a very detailed degree. Disturbance is still considered significant and there tangible measures that need to be taken in this regard. Most downcountry flocks utilise SPAs already, but there is a general lack of structured management for Irish SPAs (Olmeda *et al.* 2020) and the development of conservation objectives and conservation measures to implement these will be critical, led by the state.

  Effective conservation of these SPAs, and other important sites, will involve the need to review site use, better understand activities like shooting and resultant disturbance, and the creation of multiple disturbance-free refuges within the ranges of these downcountry flocks. These might involve the designation of new 'wildfowl sanctuaries' where shooting cannot take place, or with restrictions on when/where shooting can take place around down-country flocks, in a similar manner to Wexford. The shooting season could be shortened in these areas to give geese more time to feed prior to spring migration. Public support, from hunters in particular, would be crucial to the success of this though.

United Kingdom

- Review of UK Special Protection Area network *inter alia*, for Greenland Whitefronts reported to Ministers in 2016, finding that SPA provision is inadequate numerically, for range, and ecologically (inadequate habitat provision) (Stroud *et al.* 2016; here). The Review Phase 2 report that outlined advice and options to address the insufficiencies is still in draft and has been sent to UK and devolved governments for sign-off, and is due for publication in 2024.

England

- Greenland White-fronted Geese given legal protection through The Wildlife and Countryside Act 1981 (Variation of Schedule 2) (England) Order 2020 (Statutory Instrument 2020 No. 245) following AEWA Implementation Review case.

Wales

- Greenland White-fronted Geese given legal protection through The Wildlife and Countryside Act 1981 (Variation of Schedule 2) (Wales) Order 2020 (Statutory Instrument 2020 No. 272, W. 64) following AEWA Implementation Review case.

- ECHOES (Effect of climate change on bird habitats around the Irish Sea) was an Interreg-funded research project (2019-2023) that sought to address how climate change will impact coastal bird habitats of the Irish Sea (Wales and Ireland), with particular reference to two wetland species that are in rapid decline – Curlew *Numenius arquata* and Greenland White-fronted Goose. Modelling their distribution and behaviour was undertaken. Results are not yet available to inform management.

- The Welsh Greenland White-fronted Goose Partnership has run from 2017 to the present to deliver focussed evidence gathering and action for the Welsh sites. Partners include NRW, RSPB, WWT and BASC.

Scotland

- SNH funded research project into status of a sample of the smallest and most rapidly declining flocks (Francis *et al.* 2011) but, while it is used as an information resource, the recommendations not implemented.

- Survey of Caithness Lochs SPA roosts and flightlines commissioned by SNH in 2011/12 and 2012/13 to provide evidence base for assessment of local renewable energy developments (Patterson *et al.* 2013).

- NatureScot funded satellite tagging work, and research to understand potential disturbance impacts to Greenland Whitefronts from Barnacle Goose management work on Islay, reported by Griffin *et al.* (2015, 2020). NatureScot also contributed to funding a recent PhD on the decline of the population (Ozsanlav-Harris 2023a,b).

Research

- Major research projects from University of Exeter, UK, University of Aarhus (Denmark) and University of Saskatoon (Canada) have considerable enhanced knowledge of the demography and movements of the population since the ISSAP was adopted. Key findings of this, and other, research are summarised in Annex 1.

- Pan-arctic analysis of all White-fronted Goose populations shows Greenland Whitefronts to be highly genetically distinct (Wilson *et al.* 2022).

Table 3. Population size estimates for Greenland White-fronted Geese

Spring*	Wales	England	Islay	Rest of Scotland	*GB combined subtotal*	Wexford	Rest of Ireland	Global total	Count type	Source of assessment
1950s	550-650	100	2,500-3,000	2,250-2,870	*5,400-6,620*	4,000-6,000	6,500-8,500	17,500-23,000	Estimate based on international inventory of all known flocks (GE)	Ruttledge & Ogilvie (1979)
Late 1970s	45	0	3,700	2,800-3,600	*6,545-7,345*	5,000-6,000	2,800-3,300	14,300 – 16,600	Estimate based on international inventory of all known flocks (GE)	Ruttledge & Ogilvie (1979)
1983	73	0	3,441	3,768	*7,282*	6,363	2,896	16,541	International census of all known flocks in spring (GO)	Fox *et al.* (1994); Stroud (1984)
1984	78	4	4,198	3,646	*7,926*	6,267	3,344	17,537	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1985	88	13	4,715	4,181	*8,997*	7,590	3,361	19,948	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1986	98	0	5,669	4,255	*10,022*	7,940	3,928	21,890	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1987	95	0	6,486	4,814	*11,395*	7,780	4,106	23,281	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1988	127	1	7,314	4,095	*11,537*	8,781	4,249	24,567	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1989	124	0	6,816	4,933	*11,873*	9,799	4,315	25,987	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1990	133	1	7,209	5,623	*12,966*	9,331	3,793	26,090	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1991	150	0	8,857	6,181	*15,188*	9,598	4,610	29,396	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1992	143	0	9,196	6,678	*16,017*	9,452	4,485	29,954	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1993	124	14	10,836	4,247	*15,221*	8,091	4,030	27,342	International census of all known flocks in spring (GO)	Fox *et al.* (1994)
1994	144	2	9,495	5,375	*15,016*	10,356	4,211	29,583	International census of all known flocks in spring (GO)	Fox *et al.* (1994)

Spring*	Wales	England	Islay	Rest of Scotland	*GB combined subtotal*	Wexford	Rest of Ireland	Global total	Count type	Source of assessment
1995	155	0	9,652	6,828	*16,635*	9,347	4,477	30,459	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a,b)
1996	178	12	11,784	7,935	*19,909*	10,195	4,400	34,504	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a,b)
1997	125	1	11,210	8,231	*19,567*	8,751	4,788	33,106	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a,b)
1998	109	0	12,224	7,287	*19,620*	8,306	4,899	32,825	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a,b)
1999	119	1	13,560	8,437	*22,117*	8,958	4,617	35,692	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a,b)
2000*	109	0	11,201	7,707	*19,017*	8,330	*4,857*	*32,204*	Modelled estimate based on partial census in spring; 15% of Irish total was estimated (GE); see below	GWGS & NPWS; Fox *et al.* (2006a,b)
2001**								*30,500*	Foot & Mouth Disease access constraints; modelled estimate - see below (GE)	GWGS & NPWS; Fox *et al.* (2006a,b)
2002	93	10	9,161	6,899	*16,163*	7,133	3,158	26,454	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2006a)
2003*	126	9	10,677	7,460	*18,272*	7,915	*3,286*	*29,473*	Modelled estimate based on partial census in spring; 11% of Irish total was estimated (GE); see below	GWGS & NPWS; Fox *et al.* (2006a)
2004*	112	8	9,653	6,614	*16,387*	8,424	*3,885*	*28,696*	Modelled estimate based on partial census in spring; 14% of Irish total was estimated (GE); see below	GWGS & NPWS; Fox *et al.* (2006a)
2005*	92	7	7,152	6,779	*14,030*	7,707	*2,105*	*23,842*	Modelled estimate based on partial census in spring; 9% of Irish total was estimated (GE); see below	GWGS & NPWS; Fox *et al.* (2006a)
2006	84	7	7,111	7,085	*14,287*	7,892	2,716	24,895	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2008)
2007*	78	6	6,025	6,427	*12,536*	9,713	*2,919*	*25,168*	Modelled estimate based on partial census in spring; 12% of Irish total was estimated (GE); see below	GWGS & NPWS; Fox *et al.* (2008)

Spring*	Wales	England	Islay	Rest of Scotland	*GB combined subtotal*	Wexford	Rest of Ireland	Global total	Count type	Source of assessment
2008	77	13	7,086	5,937	*13,113*	7,536	2,559	23,208	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2008)
2009	59	10	6,429	6,008	*12,506*	8,034	2,623	23,163	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2009)
2010	75	14	5,744	6,097	*11,841*	8,381	2,622	22,844	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2010)
2011	63	7	6,911	6,265	*13,246*	9,733	2,777	25,756	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2011)
2012	48	29	4,309	5,775	10,161	9,567	2,675	22,403	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2012)
2013	55	12	5,449	5,424	10,940	8,751	2,465	22,156	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2013)
2014	33	5	5,093	5,044	10,175	10,622	2,512	20,797	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2014)
2015	25	32	3,995	4,536	8,531	7,984	2,282	18,854	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2015)
2016	36	6	5,183	5,061	10,286	6,421	2,172	18,879	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2016)
2017	36	0	6,141	5,420	*11,597*	7,047	1,912	20,556	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2017)
2018	24	6	5,319	5,579	*10,972*	7,637	1,950	20,285	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2019)
2019	24	6	6,771	5,349	*12,150*	7,436	1,899	21,466	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2019)
2020	28	21	5,910	5,132	*11,091*	8,312	2,106	21,509	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2020)
2021	40	2	6,878	4,856	*11,776*	6,262	2,148	20,186	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2021)
2022	47	4	5,297	4,390	*9,738*	5,361	2,928	18,027	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2022)
2023	31	3	5,168	5,033	*10,235*	5,531	2,261	18,027	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2023)

Spring*	Wales	England	Islay	Rest of Scotland	*GB combined subtotal*	Wexford	Rest of Ireland	Global total	Count type	Source of assessment
2024	30	2	4,926	4,462	*9,420*	4,283	1,294	14,997	International census of all known flocks in spring (GO)	GWGS & NPWS; Fox *et al.* (2024)

Data Quality:
GO = Good (Observed) based on reliable or representative quantitative data derived from complete counts or comprehensive measurements.
GE = Good (Estimated) based on reliable or representative quantitative data derived from sampling or interpolation.

Count data come from co-ordinated spring (late March/early April) counts undertaken at all known regular wintering localities since spring 1983.

* Missing values for 2003–2005 and 2007 (shown in italics) are estimated (because of uncollated counts from the rest of Ireland) on the basis of a regression model using total British and Wexford counts in other years (which explained 99% of the variance in the relationship between 1983 and 2000).

** Data are missing from 2001 (due to access restrictions during the foot-and-mouth epidemic) and the total count was estimated from a regression model predicting spring numbers from autumn counts (which explained 97% of the variance in the years 1982–2000).

Sources:

1950s- 2013 – see Annex 1 of full ISSAP

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4. PROBLEM ANALYSIS

Conduct rapid review of threats identified in original problem analysis based on possible new information and following the IUCN Red List Threat Classification Scheme[8], also noting threats no longer considered relevant for survival etc.

Table 4. Threat review: main actual or potential threats to the status of Greenland White-fronted Geese

Key to threat assessment ranks[9]:

- **Critical:** a factor causing or likely to cause very rapid declines (>30% over 10 years);
- **High:** a factor causing or likely to cause rapid declines (20-30% over 10 years);
- **Medium:** a factor causing or likely to cause relatively slow, but significant, declines (10-20% over 10 years);
- **Local:** a factor causing or likely to cause significant impacts at specific sites
- **Unknown:** a factor that is likely to affect the species but it is unknown to what extent

	Threat		Seriousness of actual or potential threat	Revised threat analysis since 2010[10]
A	**Inter-specific competition**	Interactions with Canada Geese *Branta canadensis* on spring arrival, and summer nesting, areas	Unknown/critical	Unchanged: possibly increased {Ex}
B	**Climatic impacts**	Change of habitats	Unknown	Unchanged {Ex}
		Constrained nesting due to high spring snowfall thus reducing productivity	Unknown/critical	Unchanged. Much stronger evidence of critical nature of threat {SE[11]}
		Changes in melt phenology and hence mismatch in timing of food availability through summer	Unknown/high	Unchanged {Ex}
C	**Human disturbance on the breeding grounds**	Disturbance at spring arrival areas	Unknown/local	Unchanged {Ex}

[8] https://www.iucnredlist.org/resources/threat-classification-scheme

[9] Note that the AEWA Species Action Plan format categorises threat ranks quantitatively. Knowledge of the population dynamics of Greenland White-fronted Geese does not allow the impacts of actual or potential threats to be addressed quantitatively, hence most are categorised as 'unknown', together with best expert (qualitative) judgement as to their relative importance.

[10] Strength of evidence for change assessed as Expert view (Ex) or SE (Scientific evidence)

[11] See recent research papers listed in Annex 1

	Threat		Seriousness of actual or potential threat	Revised threat analysis since 2010[10]
		Disturbance on moulting areas (including by vehicles, aircraft and helicopters)	Unknown/local	Unchanged {Ex}
D	**Human disturbance on the non-breeding grounds**	Planes/helicopters	Unknown/local	Unchanged {Ex}
		Disturbance of roost sites	Unknown/local	Unchanged {Ex}
		Deliberate and accidental disturbance from farmland feeding sites	Unknown/local	Unchanged {Ex}
		Habitat loss/modification	Unknown/local	Unchanged {Ex}
E	**Reducing mortality**	Illegal shooting	Unknown/medium	Unchanged {Ex}
		Legal hunting (Wales and England only)	Unknown/high in England & Wales only	Resolved: statutory protection provided in England and Wales (Section 3) from 2020/21[12]
		Collision risk with wind-turbines	Local	Unchanged (Potentially increased due to drive to enhance renewable energy production leading to more turbines) {Ex}
		Collision risk with power-lines	Local	Unchanged {Ex}
F	**Habitat loss or degradation**	Inappropriate management	Local	Unchanged {Ex}
		Cessation of established goose management schemes which promote co-existence with farmers	Unknown	Unchanged {Ex}
		Pollution	Unknown/local	Unchanged {Ex}
		Mining/mineral extraction	Local	Unchanged {Ex}
		Infrastructure development	Unknown/local	Unchanged {Ex}
		Land-use change	Unknown/medium	Unchanged {Ex}
G	**Inadequate monitoring and knowledge management**	Poor or inappropriate decision-making	Unknown	Unchanged {Ex}

[12] Bag documentation in UK of take of any race of White-fronted Geese would aid documentation of compliance

	Threat		Seriousness of actual or potential threat	Revised threat analysis since 2010[10]
		Conflicting policies in different Range States	Unknown	Unchanged {Ex}
		Inadequate knowledge to inform policy development	Unknown	Unchanged {Ex}
		Inadequate communication between research, monitoring and provision of advice to inform policy	Unknown	Unchanged {Ex}
H	**Contraction of range**	Extinction of smaller flocks at edge of range	Unknown/medium	Unchanged {Ex}
I	**Impacts on condition**	Disease	Unknown / potentially high	Spread of new genotype of Highly Pathogenic Avian Influenza in 2022 gives high mortality potential {SE}
		Pollution including poisoning from embedded or ingested lead shot	Unknown	Unchanged {SE[13]}

Possible new threats: short paragraph (2-3 sentences) highlighting any new threats to the species as a whole or to certain populations identified since the adoption of the Action Plan, if applicable.

- Potential impact on first winter mortality due to increased severity of winter storms consequent on changed weather patterns on the wintering areas.

[13] McIntosh *et al.* 2023

5. CONTACTS AND REFERENCES

5.1. Contacts

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BirdWatch Ireland – Brian Burke

United Kingdom

Department for Environment, Food and Rural Affairs – Simon Mackown
Scotland – NatureScot – Jessica Shaw, Simon Cohen
Wales – Natural Resource Wales – Patrick Lindley, Carol Fielding
England – Natural England – Bart Donato

Greenland

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Iceland

Ministry of the Environment , Energy and Climate
Natural Science Institute of Iceland
Environment Agency of Iceland (New agency starts operation 1 January 2025)

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Wilson, R.E., Sonsthagen, S.A., DaCosta, J.M., Sorenson, M.D., Fox, A.D., Weaver, M., Skalos, D., Kondratyev, A.V., Scribner, K.T., Walsh, A.J., Ely, C.R. & Talbot, S.L. 2022. As the goose flies: migration routes and timing of strategies influence genetic diversity patterns of a circumpolar migratory herbivore. *Diversity* 14: 01067.

Annex 1. Summary of research papers published since ISSAP drafting in 2010

Key conclusions	Source
Breeding deferral amongst adult females was associated with more time spent feeding during spring migration among tagged birds.	Cunningham, S.A., Schafer, T.L., Wikle, C.K., VonBank, J.A., Ballard, B.M., Cao, L., Bearhop, S., Fox, A.D., Hilton, G.M., Walsh, A.J., Griffin, L.R. & Weegman, M.D. 2023. Time-varying effects of local weather on behavior and probability of breeding deferral in two Arctic-nesting goose populations. *Oecologia* 201(2): 369-383.
Wexford wintering geese fattened up and departed to stage in Iceland 12-15 days earlier in 2011 than in 1973. Unchanged Iceland spring temperatures and their shift to artificial grasslands enabled geese to arrive earlier and acquire adequate fat stores there.	Fox, A.D., Boyd, H., Walsh, A.J., Stroud, D.A., Nyeland, J. & Cromie, R.L. 2012. Earlier spring staging in Iceland amongst Greenland White-fronted Geese *Anser albifrons flavirostris* achieved without cost to refuelling rates. *Hydrobiologia* 697: 103–110.
Ice formed on plastic neck-collars on geese under exception weather conditions in Iceland in spring without affecting fat accumulation or survival.	Fox, A.D., Walsh, A.J., Weegman, M.D., Bearhop, S. & Mitchell, C. 2014. Spring ice formation on goose neck collars: effects on body condition and survival in Greenland White-fronted Geese *Anser albifrons flavirostris*. *European Journal of Wildlife Research* 60: 831-834.
Wexford wintering geese departed with greater fat stores to stage in Iceland 15 days earlier in 2012 than in 1969. Staging geese in Iceland accumulated the same fat stores in 2012/13 but at a slower rate than the late 1990s, departing at the same date onwards to Greenland as in the 1880s.	Fox, A.D., Weegman, M.D., Bearhop, S., Hilton, G.M., Griffin, L., Stroud, D.A. & Walsh, A. 2014. Climate change and contrasting plasticity in timing of a two-step migration episode of an Arctic-nesting avian herbivore. *Current Zoology* 60: 233–242.
Five tagged geese were displaced from their roost by the Wexford Opera Festival firework display, 5 November 2017, flying more than 1 km for less than an hour before returning to their original roosting site in Wexford Harbour.	Fox, A.D., Walsh, A. & Weegman, M. 2019. Effects of the Wexford Opera Festival firework display on roosting Greenland White-fronted Geese *Anser albifrons flavirostris*. *Irish Birds* 11: 96-99.

Key conclusions	Source
Project investigated the changing distribution of the population on Islay. In addition, it examined potential causes of decline, first by investigating habitat selection by white-fronts and how this relates to that of Greenland Barnacle Geese, a potential indirect competitor. Secondly, by evaluating the impact of legal disturbance and shooting of Greenland Barnacle Geese on the movements and behaviour of wintering Whitefronts.	Griffin, L.R., Burrell, E.M., Harrison, A.L., Mitchell, C. & Hilton, G.M. 2020. *Conservation management of Greenland white-fronted geese* Anser albifrons flavirostris *on Islay, Scotland.* Scottish Natural Heritage Research Report No. 912. 101 pp.
Sampling Barnacle Geese and GWfG faeces on Islay found only four (faecal samples with elevated lead levels that may be indicative of lead shot ingestion. X-rays of live birds revealed similarly low levels of shot ingestion although 11% of GWfG had embedded lead shot. Accounting for limited shot retention time within individual GWfG, a maximum of 17% of the population ingested a single lead shot over a winter.	McIntosh, A.L., Ozsanlav-Harris, L., Taggart, M.A., Shaw, J.M., Hilton, G.M. & Bearhop, S. 2023. Incidence of lead ingestion in managed goose populations and the efficacy of imposed restrictions on the use of lead shot. *Ibis* 165(4): 1397-1413.
For Wexford, the most likely causes of low reproductive success are carry-over effects causing poor breeding condition, increases in predation or competition with the expanding Canada Geese population in western Greenland. For Islay, changes in other demographic rates, e.g. survival and emigration, are likely implicated in declines and warrant further research.	Ozsanlav-Harris, L. 2023a. *The decline of the Greenland White-fronted Goose: diagnosing causes, identifying solutions*. PhD thesis, University of Exeter. 268 pp.
Correlations between reproductive success and temperature/ precipitation on breeding grounds have weakened for both sub-populations resulting in lower reproductive success for the northerly, but not southerly breeding sub-population, which at the individual-level appears to be driven by lower nest survival. Earlier breeding ground arrival and less precipitation during incubation increased nest survival in the northerly breeding population, while no factors examined were important for the southerly breeding sub-population.	Ozsanlav-Harris, L., Hilton, G.M., Griffin, L.R., Walsh, A.J., Cao, L., Weegman, M.D. & Bearhop, S. 2023b. *Differing drivers of decline within a migratory metapopulation has implications for future conservation.* *Ecology and Evolution* 13(7), p.e10281.
Geese that expended less energy and fed longer during spring were more likely to reproduce successfully. Geese with offspring expended more energy and fed for less time that those without during autumn, potentially affecting fitness consequences for breeding.	Schindler, A.R., Fox, A.D., Wikle, C.K., Ballard, B.M., Walsh, A.J., Kelly, S.B., Cao, L., Griffin, L.R. & Weegman, M.D. 2024. Energetic trade-offs in migration decision-making, reproductive effort and subsequent parental care in a long-distance migratory bird. *Proceedings of the Royal Society B* 291: 20232016.
Contains the data supporting several of the published papers presented here.	Weegman, M.D. 2014. *The demography of the Greenland White-fronted Goose*. PhD thesis,

Key conclusions	Source
	University of Exeter, United Kingdom.
Multistate models to analyse movements of marked individuals caught at Wexford between other wintering subpopulations showed no sex-bias in emigration, immigration or survival rates.	Weegman, M.D., Fox, A.D., Bearhop, S., Hilton, G.M., Walsh, A.J., Cleasby, I.R. & Hodgson, D.J. 2015. No evidence for sex bias in winter inter-site movements in an Arctic-nesting goose population. *Ibis* 157(2): 401-405.
Integrated population modelling of geese 1983-2010 showed stable numbers wintering at Wexford could only be maintained by immigration, because of stable survival rates but falling reproductive success over the period. Hence a perceived "source" subpopulation turns out to be a cryptic "sink".	Weegman, M.D., Bearhop, S., Fox, A.D., Hilton, G.M., Walsh, A.J., McDonald, J.L. & Hodgson, D.J. 2016. Integrated population modelling reveals a perceived source to be a cryptic sink. *Journal of Animal Ecology* 85(2): 467-475.
Just 8% of all geese marked as 1st winter birds at Wexford reproduced successfully once and 2% twice/thrice. Birds bred earliest in years with prior good conditions, later after successive years with adverse conditions. Conditions in adulthood prior to successful breeding determine age of first breeding, but 90% never bred in their lifetime.	Weegman, M.D., Bearhop, S., Hilton, G.M., Walsh, A. & Fox, A.D. 2016. Conditions during adulthood affect cohort-specific reproductive success in an Arctic-nesting goose population. *PeerJ 4*: p.e2044.
Offspring associated with parents for 1-13 years (79% 2 or less years). Probability of birds associating with siblings breeding successfully was greater than independent birds at age 5, 6 and 7. Offspring survival was greater with parents than that of independent/non-breeders at all ages. Modelling showed staying with family members was favoured over leaving up to age 3 years, when leaving was favoured.	Weegman, M.D., Bearhop, S., Hilton, G.M., Walsh, A.J., Weegman, K.M., Hodgson, D.J. & Fox, A.D. 2016. Should I stay or should I go? Fitness costs and benefits of prolonged parent–offspring and sibling–sibling associations in an Arctic-nesting goose population. *Oecologia* 181: 809-817.
Summarising much of above and Mitch Weegman's thesis. Low productivity environmentally dependent on breeding ground conditions.	Weegman, M.D., Fox, A.D., Hilton, G.M., Hodgson, D.J., Walsh, A.J., Griffin, L.R. & Bearhop, S. 2017. Diagnosing the decline of the Greenland White-fronted Goose *Anser albifrons flavirostris* using population and individual level techniques. *Wildfowl* 67:3-18.
Despite 300 km longer migration flights, spring migratory flight duration, flight speed and energy expenditure did not differ in Wexford wintering geese compared to Loch Ken birds. Wexford birds also fed as much and expended the same amount of energy prior to migration as Loch Ken	Weegman, M.D., Bearhop, S., Hilton, G.M., Walsh, A.J., Griffin, L., Resheff, Y.S., Nathan, R. & Fox, A.D. 2017. Using accelerometry to compare costs of extended

Key conclusions	Source
individuals. Loch Ken birds will have arrived in Greenland with greater energy stores because of shorter migration, so may buffer food scarcity on arrival as a result.	migration in an arctic herbivore. *Current Zoology* 63(6): 667-674.
Production of young, with a contribution from annual adult survival rates, explained most variation in annual population growth rate in Greenland White-fronted Geese. There was no contribution from survival of birds marked as first winter birds to population growth rate.	Weegman, M.D., Walsh, A.J., Ogilvie, M.A., Bearhop, S., Hilton, G.M., Hodgson, D.J. & Fox, A.D. 2022. Adult survival and per-capita production of young explain dynamics of a long-lived goose population. *Ibis* 164(2): 574-580.
Based on ddRAD-seq and mitochondrial DNA, Greenland White-fronted Geese showed the highest level of divergence from all other sampled Greater White-fronted Geese from around the entire Arctic. The Greenland form is therefore the highest differentiated population, most isolated in time and space from other forms.	Wilson, R.E., Sonsthagen, S.A., DaCosta, J.M., Sorenson, M.D., Fox, A.D., Weaver, M., Skalos, D., Kondratyev, A.V., Scribner, K.T., Walsh, A.J., Ely, C.R. & Talbot, S.L. 2022. As the goose flies: migration routes and timing of strategies influence genetic diversity patterns of a circumpolar migratory herbivore. *Diversity* 14: 01067.