Adaptive Flyway Management Programme for Svalbard Breeding Population of the Pink-footed Goose (*Anser brachyrhynchus*)

AEWA European Goose Management Platform

AEWA EGMP Programme No. 4

AEWA European Goose Management Platform

AEWA

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Adaptive Flyway Management Programme for the Pink-Footed Goose

Svalbard Breeding Population

Anser brachyrhynchus

AEWA EGMP Programme No. 4

June 2026

Lifespan of Plan
6 years (2026– 2032)

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Lifespan and review of the AFMP: The lifespan of this AFMP is 6 years (2026-2032). Before the end of the AFMP's lifespan, it should be reviewed to inform the EGM IWG's decision regarding whether the AFMP is to be extended or revised. The EGM IWG has the mandate to amend the AFMP earlier than the next scheduled review, if necessary, including in response to the conclusions of an emergency evaluation of the International Single Species Management Plan for the Pink-footed Goose.

Milestones in the preparation of the AFMP:

- The first draft of this document was presented to the Pink-footed Goose Task Force for initial comments and technical input on the indicators on 17 March 2026.
- A second draft was sent to Range States on 13 April 2026 for consultation until 4 May 2026.
- The final version was submitted for adoption during EGM IWG11 held in Skövde, Sweden in June 2026.

AEWA European Goose Management Platform (EGMP): Please send any additional information or comments regarding this document to the AEWA European Goose Management Platform Coordinator, Mr Bruno Leles (bruno.leles@un.org).

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List of Acronyms and Abbreviations

AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
AFMP	Adaptive Flyway Management Programme
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COAT	Climate-ecological Observatory Arctic Tundra
EGM IWG	European Goose Management International Working Group
EGMP	AEWA European Goose Management Platform
EU	European Union
FO	Fundamental Objective
FCS	Favourable Conservation Status
FRH	Favourable Reference Habitat
FRP	Favourable Reference Population
FRR	Favourable Reference Range
FRV	Favourable Reference Value
IPM	Integrated Population Model
PfG ISSMP	International Single Species Management Plan for the Svalbard Breeding Population of the Pink-footed Goose
MU	Management Unit
SDP	Stochastic Dynamic Programming

1. Introduction

An International Single Species Management Plan for the Svalbard Breeding Population of the Pink-footed Goose *Anser brachyrhynchus* (PfG ISSMP) (Madsen & Williams 2012) was developed in response to paragraph 4.3.4 of the Action Plan in Annex 3 to the African-Eurasian Migratory Waterbird Agreement (AEWA), which provides for the development of ISSMPs for populations that cause significant damage, in particular to crops and fisheries. The PfG ISSMP was adopted by the 5th session of the Meeting of the Parties to AEWA (MOP5) in 2012 with a 10-year lifespan. In 2022, MOP8 extended the ISSMP's validity until 2025 to enable its revision (Resolution 8.4). The revised PfG ISSMP (Madsen et al. 2025b) responds to Resolution 8.4 and to a subsequent evaluation of the first ISSMP's results and implementation performance, which concluded that implementation of management actions is still necessary, but that the ISSMP should undergo a full revision, including to its goal, objectives and framework for action (Madsen et al. 2024).

The revised ISSMP for the Pink-footed Goose, adopted by MOP9 in November 2025, has a lifespan of 12 years (2025-2037) and provides a mandate for developing a population-specific Adaptive Flyway Management Programme (AFMP) for the Svalbard breeding population of the Pink-footed Goose, recognising that there are regional differences in migratory behaviour and the human-wildlife conflicts involved. The proposed process for developing this AFMP was approved by relevant Range States of the European Goose Management International Working Group (EGM IWG) via written correspondence in October 2025.

A first draft of the AFMP was presented to the Pink-footed Goose Task Force for technical input in March 2026, and a revised version was circulated for consultation with the National Government Representatives of relevant Range States in April 2026. The final draft was presented in May 2026 and submitted to the 11th meeting of the EGM IWG for adoption in June 2026.

The aim of this AFMP is to establish an agreement amongst Range States on the implementation and monitoring of those activities in the PfG ISSMP that require coordination at population level. This AFMP summarises those decisions already reflected in the ISSMP regarding Management Units (Chapter 2), Favourable Reference Values (Chapter 3) and Population Target (Chapter 4). It also outlines the applicable monitoring programme (Chapters 5 – 7), defines a set of indicators for assessing the progress toward the Fundamental Objectives (FOs) and guide the implementation of further activities of the Pink-footed Goose ISSMP (Chapter 6 and Annex V).

The AFMP thus provides a framework for joint management of the Svalbard population of Pink-footed Goose to ensure that the FOs agreed in the ISSMP are achieved. However, each Range State remains responsible for national planning and implementation within the framework of the ISSMP.

This AFMP covers the period of 2026 – 2032. It was adopted in June 2026 by the 11th Meeting of the AEWA EGM IWG and will be reviewed before the end of its lifespan.

2. Definition of Management Units (MUs)

During the revision process for the PfG ISSMP, the Range States agreed to manage the population as one Management Unit since all agreed management objectives pertain to the entire population. The Range States acknowledged the distance between the traditional breeding range on Svalbard and the newly established breeding area on Novaya Zemlya, and the difference in number of breeding pairs at the two sites, yet no imminent threat to the Novaya Zemlya breeding group, calling for targeted conservation actions, is currently identified. Furthermore, the exchange between the two groups is ongoing.

3. Definition of Favourable Reference Values (FRVs)

During the revision process for the ISSMP, the Range States agreed to set the Favourable Reference Values (FRVs) for the breeding and non-breeding seasons. The Favourable Reference Range values are shown in Table 1, and all FRVs are presented in the revised ISSMP (Madsen et al. 2025b). A full discussion of the approach through which these FRVs were defined is available in Madsen et al. 2025a.

3.1. Favourable Reference Population (FRP)

The ISSMP set the FRP at the Agreement Value (i.e. the closest available value after the date that AEWA entered into force on 1 November 1999) of 49,000 individuals in spring. The most recent estimate of the spring population size is 78,749 (63,873 – 96,605) (Sørensen et al. 2025).

3.2. Favourable Reference Range (FRR)

The ISSMP set the FRR at a total of 41,400 km^2 for the breeding range (Svalbard), 374,600 km^2 for the non-breeding land range, and 835,100 km^2 including seas crossed on migration. These FRR values are based on the population's range around year 2000, corresponding to the FRP set at the Agreement Value (see above). The range used at this time was sufficient to maintain the population and its ecosystem services throughout the annual cycle. Several sources of information were included, of which only a summary is provided here. Details are presented in Madsen et al. 2025a.

For breeding range, spatial data from GOOSEMAP (2012) on pre-nesting, nesting and brood-rearing distribution on Svalbard up until around 2011 were used. For non-breeding range, moulting and post-breeding distributions on Svalbard were obtained from GOOSEMAP (2012) and combined with other data sources to cover the flyway. These include observations, resightings of neck-banded individuals, and GPS-tracks of individuals marked and tagged in Svalbard. GPS-data constitute the only source of information on the post-breeding range in Svalbard and the range of migration routes crossing remote areas at land or sea without visual records. Geese using the Swedish-Finnish migration route, which was not yet established in year 2000, were excluded.

The FRR for Pink-footed Goose in each Range State is summarised in Table 1.

Table 1. *FRR values for the Svalbard population (in km^2) (values from Madsen et al. 2025b).*

Country	Breeding FRR	Non-breeding FRR (land area)	Non-breeding FRR (land and sea)
Norway	41,400	266,100	682,600
Denmark	n.a.	33,200	51,700
Sweden*	n.a.	40,800	45,300
Germany**	n.a.	10,000	24,900
The Netherlands	n.a.	22,200	28,200
Belgium	n.a.	2,300	2,400
Population Total	**41,400**	**374,600**	**835,100**

** Most of the Swedish land range consists of the migratory path. Around year 2000 Sweden was not regarded as a principal range state (however, has become more important since then).*
*** Most of the German land range consists of the migratory path. Germany is not regarded as a principal Range State.*

3.3. Favourable Reference Habitat (FRH)

According to the European Union (EU) and the Convention on Migratory Species (CMS) definitions, the FRH means that sufficient extent and quality of habitat is available to sustain the FRP. Within the breeding range, the geese continue to expand their range in Svalbard (and Novaya Zemlya), indicating that there is sufficient habitat for even further increase in the overall population size. The shift from seminatural habitats to intensive farmland seen in parts of the non-breeding range does not appear to be caused by lack of seminatural grassland habitat (Lorenzen& Madsen 1985), but rather that the geese prefer farmland habitats because these are more favourable in energetic terms (Madsen 1985; Therkildsen & Madsen 2000; Clausen et al. 2018). Sufficient habitat for even further increase in population size appears to be available both in the wintering and spring staging areas.

To conclude, as the current population size exceeds the FRP and there is no sign of density dependence, it can be logically deduced that there is sufficient habitat to sustain a larger population than the FRP.

4. Population Target above the FRP

The former population target of 60,000 Svalbard Pink-footed Geese in spring was reviewed during the revision of the PfG ISSMP, and a population target of 72,000 birds in spring was agreed on by the Range States (Madsen et al. 2025b). This target is above the FRP and slightly below the estimated population size in spring 2025 (see Sørensen et al. 2025). A description of how the target was agreed is provided in Annex 3 of the ISSMP (Madsen et al. 2025b).

5. Cumulative Impact of Derogation and Hunting

The cumulative impact of offtake (mainly hunting, but some Range States may also issue derogation permits for shooting Pink-footed Goose (currently only applicable to Denmark)) is reported by Range States and assessed annually by the EGMP Data Centre. Management decisions are based on the output of the population-specific Integrated Population Model (IPM) incorporating all available demographic data (see Annex II and Johnson et al. 2020). Based on the IPM, country-specific hunting quotas are agreed on by the EGM IWG. If necessary, changes to national hunting seasons are introduced for the coming season(s) to ensure that the population size remains as close as possible to the target population size and well above the FRP (see Table 2).

Table 2. *Monitoring, assessment and offtake coordination depending on the status of the population.*

Status of the population	Measures
> the FRP **> the target**	● Monitoring of population size ● Prediction of population development ● Annual offtake quota determined based on IPM
> the FRP **< the target**	● Monitoring of population size ● Prediction of population development ● Reduced offtake quota/hunting season based on IPM ● Taking coordinated conservation measures, if necessary
< the FRP	● Introducing hunting moratorium ● Taking coordinated conservation measures

To inform discussions regarding harvest capacity and target population size during the revision of the ISSMP, it was investigated how the capacity to achieve varying harvest quotas may affect the ability to reach the population target over a 12-year period (the expected lifespan of the ISSMP). It was shown that a declining capacity to exert

harvest pressure will increase the variation in population size and decrease the variation in the annual harvests (see Table 3). A constrained maximum harvest capacity will thus increase the risk of failing to achieve the target. In the case of unconstrained maximum harvest, optimal harvests are apparently able to successfully achieve a mean population size close to the desired target after 12 years but will also result in a (potentially very large) variation in annual harvest quotas. Managers should attempt to increase the maximum attainable harvest to a level above the mean of the last three years (10,000), as otherwise control over population growth may be lost. The target of 72,000, once achieved, provides more hunting opportunity (larger quotas) than those available with a target of 60,000. However, higher harvests must be maintained on a more regular basis with higher population targets than with lower targets.

Table 3. *Projection of Pink-footed Goose population size (N) and harvest (H) 12 years into the future, beginning with the 2024 system state (N ≈ 78k, thaw days ≈ 10), assuming a target population in spring of 72,000. Mean N and H are the means over the 13-year timeframe (and 1,000 simulations). Last N and H are the ending (in 2037, the end of the ISSMP's lifespan) population size and harvest averaged over the 1,000 simulations. Adapted from Madsen et al. 2025b.*

Maximum attainable harvest	Mean N (sd)	Mean H (sd)	Last N (sd)	Last H (sd)
50k (unconstrained harvest capacity)	74.2k (4.1)	10.2k (7.5)	74.1k (4.1)	10.3k (7.9)
17k (maximum offtake reached during 1992-2023)	69.5k (6.3)	10.1k (6.0)	68.7k (6.8)	9.0k (6.0)
15k (mean offtake during 2016-2020)	69.9k (8.3)	10.1k (5.2)	69.2k (10.0)	9.5k (5.2)
10k (mean offtake during 2021-2023)	82.5k (21.4)	9.2k (2.1)	91.0k (31.0)	8.9k (2.5)

As shown in Figure 1, the current population level is above the FRP, and the target agreed in the revised ISSMP. Therefore, it is recommended that Range States continue the established protocol for monitoring population size and that the EGMP Data Centre continues predicting the population development and provide guidance on the annual offtake quota based on the IPM described by Johnson et al. (2020).

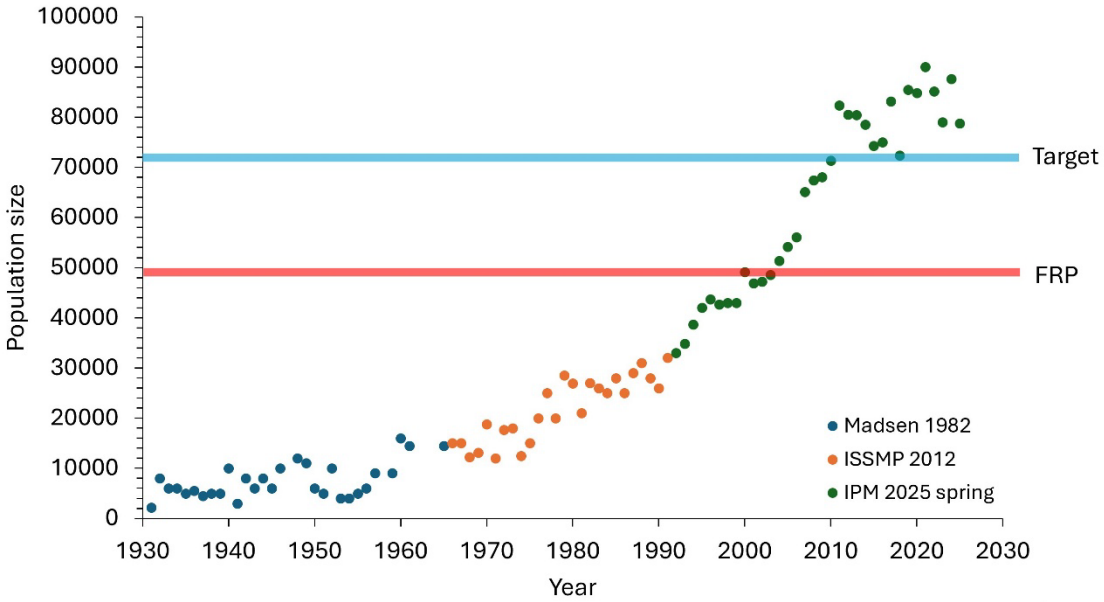

Figure 1*. Development of the population size in relation to the FRP (red line) and the target of the revised ISSMP (blue line).*

6. Monitoring Indicators and Programmes

Monitoring indicators are designed to measure the progress towards the fundamental objectives of the ISSMP (Madsen et al. 2025b). Indicators are presented in Table 4 for each Fundamental Objective. For each indicator, the rationale, the definition of the indicator and the indicator protocol is presented in Annex V.

Table 4. Indicators for fundamental objectives of the ISSMP (Madsen et al. 2025b).

Fundamental objectives	Related indicators	Deadlines for reporting
I. Maintain a stable Pink-footed Goose population and its range and habitat at a satisfactory level above the FRVs.	I.1 Population size and trend relative to the population target	Annually to the EGM IWG
	I.2 Range extent compared to Favourable Reference Range (FRR)	31 Dec. 2031
	I.3 Proportion of key sites legally protected and managed	31 Dec. 2031
II. Keep agricultural conflicts at an acceptable level.	II.1 Relative change in costs related to goose management	31 Dec. 2031
III. Minimise the long-term degradation of tundra vegetation in the breeding range.	III.1 Frequency of bare tundra patches created by goose-grubbing on Svalbard	31 Dec. 2031
IV. Minimise the risk to human health and safety.	IV.1 Risk of avian influenza transmission to the general public	31 Dec. 2031
	IV.2 Number of bird strikes with aircraft caused by Pink-footed Goose	31 Dec. 2031
V. Minimise the risk to animal health and the risk of other ecological impacts.	V.1 Proportion of geese breeding or moulting on Novaya Zemlya contaminated with radioactivity	31 Dec. 2031
	V.2 Area of natural habitat or habitat of threatened species negatively affected by Pink-footed Geese	31 Dec. 2031
VI. Maintain the socio-cultural value of Pink-footed Geese in a manner that does not jeopardize the population status or aggravate conflicts and risks.	VI.1 Annual offtake compared to the annual quota	Annually to the IWG
	VI.2 Social and cultural events and activities related to the annual cycle of the Pink-footed Goose	Annually to the EGM IWG
	VI.3 Crippling rate	31 Dec. 2031

7. Protocols for the Iterative Phase

Management evaluation and adaptation of the Svalbard Population of the Pink-footed Goose follow three iterative phases running in parallel:

1. A 12-year cycle of the ISSMP,
2. Two 6-year cycles of the AFMP, and
3. Annual cycles of monitoring, as well as update of work plans for all Range States.

12-year cycle of the ISSMP (unless the need for an emergency evaluation arises)

The 12-year cycle of the ISSMP encompasses evaluation and adaptation related to:

- Goals
- Objectives (Fundamental, Means and Process), and

- Actions related to objectives.

6-year cycles of the AFMP

The 6-year cycles of the AFMP encompasses evaluation and adaptation related to:

- Population model (Annex II),
- Impact model (Annex III),
- Protocol for the iterative phases (Annex IV),
- The range of and methods for indicators and monitoring programs (Chapter 4; Annex V), and
- Evaluation towards achieving objectives (Chapter 4; Annex V).

The AFMP is evaluated and, if necessary, revised in 2032 by the EGM IWG.

1-year cycles within the AFMP of data collection and update of work plans

The annual cycle within the AFMP encompasses:

- Monitoring of indicators related to population models,
- Updating and reporting on work plans for the Task Force, Data Centre, UNEP/AEWA Secretariat and Range States (Annex I),
- Updating models of population dynamics (IPM),
- Predicting the optimal harvest quota for the forthcoming hunting season, and
- Taking coordinated conservation measures, if necessary.

7.1. Monitoring Related to Objectives and Used in Population Models

The monitoring program and the specific activities are listed below. Monitoring activities take place every year, except monitoring of crippling rate.

1. Total population counts organised in May (mainly Norway and Finland) and November (mainly Norway, Sweden, Denmark, the Netherlands and Belgium).
2. Age ratio estimates based on sampled flocks in Norway, Denmark, Sweden and Belgium (October-November).
3. Total offtake in Denmark and Norway (harvest and derogation).
4. Temporal distribution of harvest in Denmark (based on the Danish wing survey).
5. Number of thaw days (average temperature above 0 °C) on Svalbard in May, as a proxy of the productivity during the forthcoming breeding season.
6. Crippling rate (when available, ideally available at least every 6 years for the assessment of indicators).

Monitoring data is submitted to the EGMP Data Centre on an annual basis, no later than 15 May each year. May temperature data are available on 1 June each year. Progress on monitoring activities are reported along with the estimated population size, optimal hunting quota and, if necessary, proposals for revisions of the monitoring programme in the annual EGMP population status and assessment report (most recently in Sørensen et al. 2025).

8. References

Clausen, K. K., Madsen, J., Nolet, B. A., & Haugaard, L. 2018. Maize stubble as foraging habitat for wintering geese and swans in northern Europe. *Agriculture, Ecosystems & Environment* 259: 72–76. https://doi.org/10.1016/j.agee.2018.03.002

Johnson, F.A., Zimmerman, G.S., Jensen, G.H., Clausen, K.K., Frederiksen, M., & Madsen, J. 2020. Using integrated population models for insights into monitoring programs: An application using pink-footed geese. *Ecological Modelling* 415, 108869. https://doi.org/10.1016/j.ecolmodel.2019.108869.

Lorenzen, B., & Madsen, J. 1985. Gåsebestandene på Tipperhalvøen: II: Græsningsøkologi i relation til områdets bærekapacitet. *Dansk Ornitologisk Forenings Tidsskrift* 79: 113-132.

Madsen, J. 1985. Relations between change in spring habitat selection and daily energetics of Pink footed Geese *Anser brachyrhynchus*. *Journal of Avian Biology* 16: 222-228.

Madsen, J. & Williams, J.H. 2012. International Species Management Plan for the Svalbard Population of the Pink-footed Goose *Anser brachyrhynchus*. AEWA Technical Series No. 48. Bonn, Germany.

Madsen, J., Pedersen, C.L., Tombre, I., Nienhuis, J., Koffijberg, K., & Schreven, K.H.T. 2025a. Defining Favourable Reference Values for the Svalbard Population of the Pink-footed Goose (*Anser brachyrhynchus*). EGMP Technical Report No. 27. Bonn, Germany.

Madsen, J., Sørensen, I.H., Johnson, F.A., Germain, R.R., Lewis, M., Leles, B.P. (Compilers) 2025b. AEWA International Single Species Management Plan for the Pink-footed Goose (*Anser brachyrhynchus*) – Svalbard breeding population. AEWA Technical Series No. 79. Bonn, Germany.

Madsen, J., Tombre, I., Gundersen, O.M., Verhaeghe, F., Kuijken, E., Verscheure, C., Mensink, G., Koffijberg, K., Ravolainen, V. & Lewis, M. 2024. Evaluation of the AEWA International Single Species Management Plan for the Svalbard Population of the Pink-footed Goose (*Anser brachyrhynchus*). Results achieved and implementation performance. EGMP Technical Report No. 24, Bonn, Germany.

Sørensen, I.H., Germain, R.R., Johnson, F.A., Baveco, H., Koffijberg, K., & Madsen, J. 2025. Population Status and Assessment Report 2025. EGMP Technical Report No. 26. Bonn, Germany

Therkildsen, O. R., & Madsen, J. 2000. Energetics of Feeding on Winter Wheat Versus Pasture Grasses: a Window of Opportunity for Winter Range Expansion in the Pink-Footed Goose *Anser brachyrhynchus*. *Wildlife Biology* 6(2): 65-74.

Annex I: Workplan

According to the PfG ISSMP, the Svalbard population of the Pink-footed Goose will be managed as one Management Unit (MU). Thus, there is no need for MU-specific workplans.

As the role of the workplan is to guide the implementation of the ISSMP, the prioritisation and timescale agreed in the ISSMP provides a framework for the work planning process. The ISSMP prioritises actions as Essential, High and Medium priority and assigns time-scales to actions as follows: *Immediate:* launched within the next year; *Short:* launched within the next 3 years; *Medium:* launched within the next 5 years; *Long:* launched within the next >5 years; *Ongoing:* currently being implemented and should continue, and *Rolling:* to be implemented perpetually (see Figure 2).

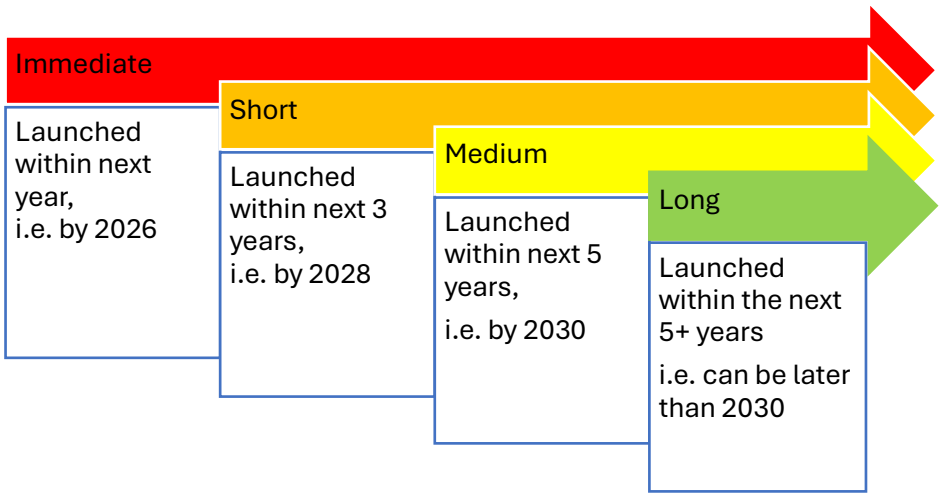

***Figure 2**. Timescale for the implementation of the ISSMP for the Svalbard population of Pink-footed Goose.*

In essence, this timescale system can be seen as a mechanism to stagger the implementation of actions taking into account both their dependencies and urgencies (Figure 2). In other words, the timescale in combination with the priorities set in the PfG ISSMP can be used to phase the implementation of actions. Thus, the most important is to implement Essential actions that have an Immediate timing, followed by High priority with Immediate timing, etc.

Implementation of the PfG ISSMP requires work by different entities (Figure 3). Some actions should be carried out at national level as part of national workplans. To facilitate coordination amongst Range States, a population-specific Task Force for the Pink-footed Goose was established in 2017 following the Generic Terms of Reference[1] that were adopted by the 2nd meeting of the EGM IWG and in accordance with the *Modus Operandi* of the EGMP[2].

[1] See Appendix 2 of the *Report of the 2nd Meeting of the European Goose Management International Working Group*, available at: https://egmp.aewa.info/sites/default/files/meeting_files/reports/aewa_egm_iwg_2_report.pdf.
[2] See Appendix 1 of the *Report of the 1st Meeting of the AEWA European Goose Management International Working Group*, available at: https://egmp.aewa.info/sites/default/files/meeting_files/reports/aewa_egm_iwg_1_meeting_report.pdf.

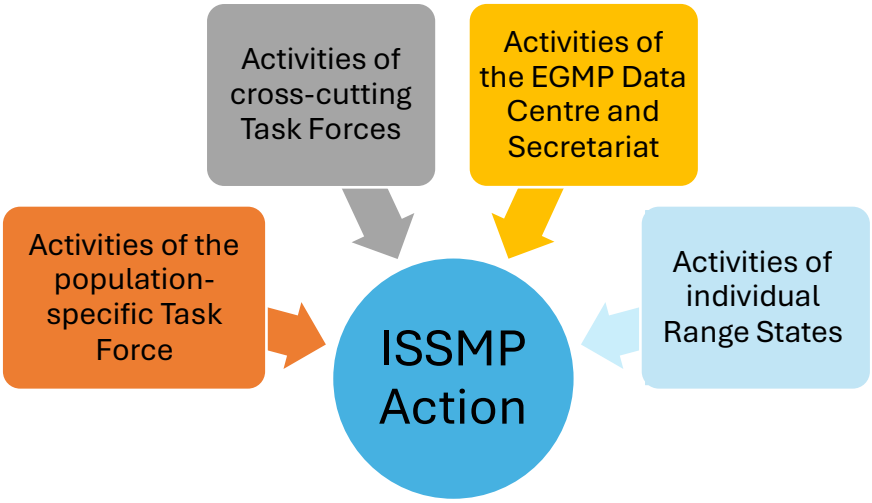

Figure 3. *EGM IWG entities contributing to the implementation of the ISSMP for the Svalbard population of the Pink-footed Goose.*

Each EGM IWG entity contributing to the implementation of the ISSMP for the Svalbard population of the Pink-footed Goose uses a common structure to produce its own workplan. This structure includes the ISSMP actions relevant for the time period (i.e. 2026/2027 between the 11th and 12th meetings of the EGM IWG), their priority and timescale as defined in the ISSMP, list of activities to be implemented by the entity (e.g. a Range State, the Pink-footed Goose Task Force, the Data Centre, or the relevant cross-cutting Task Forces). It is recommended that in the period 2026/2027, the EGM IWG entities focus on implementing the activities that have a timescale of Immediate or Short and focus first on the Essential ones followed by High and then by the Medium priorities as capacity allows.

Annex II: Population Model

An Integrated Population Model (IPM) is currently used to derive estimates of abundance and demographic rates for the Svalbard Pink-Footed Goose (see Johnson et al. 2020; Figure 4). Annual changes in population size in May are described by a difference equation:

$$N_{t+1}^{M} = N_t^{M}\left[s_t + r_t\theta_t\left(1 - \upsilon h_t^{n} - \upsilon h_t^{d}\right)\right]$$

where N_t^M is May population size in year t, s_t is the annual survival rate, r_t is the ratio of young of the year to older birds at the start of the hunting season, θ_t is survival from natural causes, h_t^n and h_t^d are per capita harvest rates of birds aged >1 year in Norway and Denmark, respectively, and υ is the differential vulnerability of young relative to older birds in the harvest.

Population size in November is a function of population size in May, six months of natural mortality, and the portion of harvest in Denmark occurring prior to November:

$$N_t^{N} = N_t^{M}\theta_t^{6/12}\left[\left(1 - h_t^{n} - h_t^{d}\right) + r_t\left(1 - \upsilon h_t^{n} - \upsilon h_t^{d}\right)\right]$$

where N_t^N is November population size and $h_t^{\dot{d}}$ is the harvest rate of older birds in Denmark prior to November.

Within the IPM, we specified a generalized linear model for reproductive rate (r) using the number of thaw days (D) in May in Svalbard as a covariate: $r_t = \frac{\gamma_t}{(1-\gamma_t)}$, where γ_t is the binomial probability of young, and:

$$log\left(\frac{\gamma_t}{(1-\gamma_t)}\right) = \beta_0 + \beta_1 D_t$$

Posterior estimates of natural mortality, differential vulnerability of young to harvest, and the regression coefficients expressing the relationship between thaw days and reproductive success were used to derive an optimal harvest policy. We used stochastic dynamic programming (SDP), which can explicitly account for various sources of uncertainty in modelled systems (Marescot et al. 2013).

***Figure 4**. IPM-based estimates of abundance of Svalbard Pink-footed Geese in May and November (95% credible intervals are indicated by the dashed lines).*

For computational purposes, the optimal value (V^*) of a management strategy (A) at time t is the maximum (max) of the expectation (E) of the temporal sum of discounted population utilities:

$$V^*(A_t|x_t) = \max_{(A_t|x_t)} E\left[\sum_{\tau=t}^{\infty} \lambda^{\tau} u(a_\tau|x_\tau)|x_t\right]$$

where $\lambda = 0.99999$ is the discount factor for an infinite time horizon. This particular discount factor means that population utility 100 years hence will still retain 99.9% of its current value, in keeping with the desire to protect exploited resources for use by future generations (Sumaila & Walters 2005). Population utility is defined as:

$$utility = \begin{cases} 0 & \text{if N} \leq 53.7 \text{ or N} \geq 90.1 \\ f(N) & \text{otherwise} \end{cases}$$

where $f(N) = -14.257 + 0.424N - 0.003N^2$ and N is the expected population size (in thousands) the subsequent spring. Thus, the objective function devalues harvest quotas that are expected to result in a population size which differs from the population target of 72,000, with the degree of devaluation increasing as the difference between population size and the target increases. As described in Madsen et al. 2025, this utility function utilizes consensus-convergence values from the formal balloting of stakeholder satisfaction at a range of population sizes around the target. Thus, we fit a quadratic curve reflecting how satisfaction reaches a peak at the target population size and declines as the population size either falls below or grows above the target, rather than remaining at its peak across a range of values deemed 'satisfactory' close to the former target of 60,000. The current utility function is compared to the former function in Figure 5.

The optimal harvest strategy is computed using the publicly available software MDPSolve (© 2010 – 2011 Paul L. Fackler, https://github.com/PaulFackler/MDPSolve), which is a set of SDP tools written in the proprietary MATLAB® programming language.

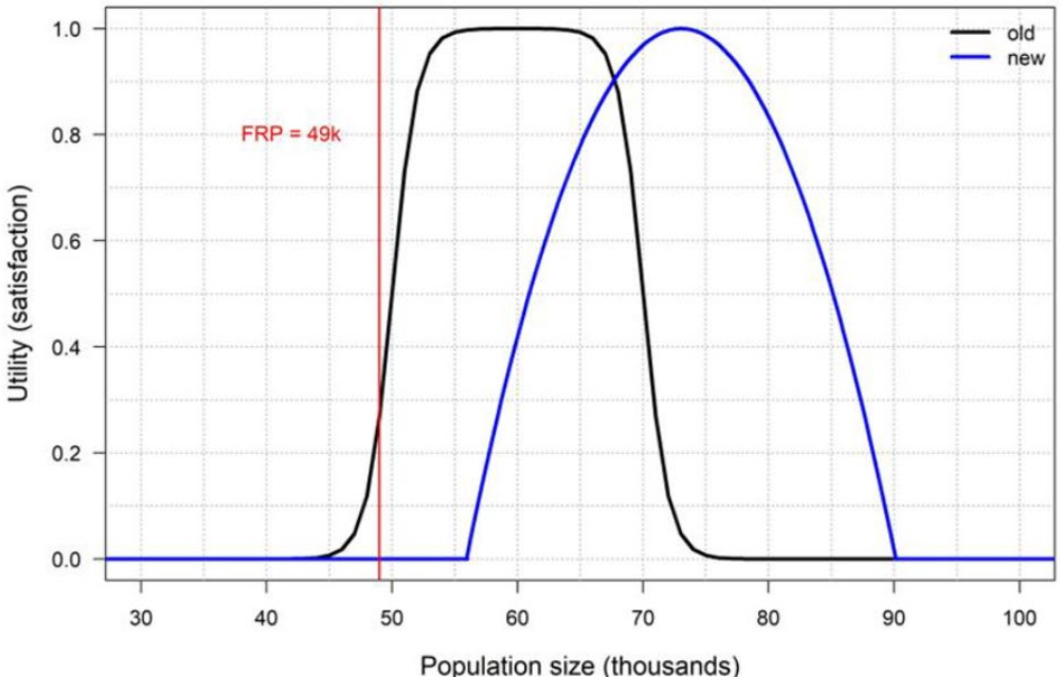

***Figure 5.** Utility functions used to derive optimal harvest strategies for Pink-footed Goose, each expressing the relative satisfaction with varying population sizes and both normalized to values from 0 to 1. The "old" function relates to the former*

spring population target of 60,000 geese, whereas the "new" function relates to the agreed spring population target of 72,000 geese (see Madsen et al. 2025 for details). The vertical red line represents the proposed Favourable Reference Population (FRP) size which has been set at 49,000 individuals.

The most recent version of the IPM for the Svalbard Pink-footed Goose is available on Gitlab (https://gitlab.com/aewa-egmp) along with data files (input and output) from 2021 onwards. Raw data is available on the EGMP data page: https://projects.au.dk/can/international-data-centre-for-geese/pink-footed-goose.

References

Johnson, F.A., Zimmerman, G.S., Jensen, G.H., Clausen, K.K., Frederiksen, M., & Madsen, J. 2020. Using integrated population models for insights into monitoring programs: An application using pink-footed geese. *Ecological Modelling* 415, 108869. https://doi.org/10.1016/j.ecolmodel.2019.108869.

Madsen, J., Sørensen, I.H., Johnson, F.A., Germain, R.R., Lewis, M., Leles, B.P. (Compilers). 2025. AEWA International Single Species Management Plan for the Pink-footed Goose (Anser brachyrhynchus) – Svalbard breeding population. AEWA Technical Series No. 79. Bonn, Germany.

Marescot, L., G. Chapron, I. Chads, P. L. Fackler, C. Duchamp, E. Marboutin, and O. Gimenez. 2013. 'Complex decisions made simple: a primer on stochastic dynamic programming', *Methods in Ecology and Evolution*, 4: 872-84, https://doi.org/10.1111/2041-210X.12082

Sumaila, U. R., & C. Walters. 2005. 'Intergenerational discounting: a new intuitive approach'. *Ecological Economics*, 52(2):135-42, https://doi.org/10.1016/j.ecolecon.2003.11.012

Annex III: Tundra Impact Assessment

Fundamental objective III of the International Single Species Management Plan for the Svalbard Population of Pink-footed Goose is to minimise the long-term degradation of tundra vegetation in the breeding range. As options for surveying the vegetation on Novaya Zemlya are limited, this objective focuses mostly on the breeding range on Svalbard where long-term monitoring programmes are in place.

The main impact of an increasing population of Pink-footed Goose on Svalbard is anticipated to be a potential degradation of the vulnerable tundra vegetation, and conservation of this habitat type was taken into consideration during the decision-making process leading to the adopted population target of 72,000 birds in spring. The relationship between the abundance of Pink-footed Geese and their effect on the Arctic tundra on Svalbard was described in Madsen et al. 2024. As expected, an increase in the extent of grubbing with increasing population size was demonstrated by Ravolainen et al. (in prep.), yet no signs of complete tundra degradation were found. These findings are included in the assessment of indicator III.1 measuring the progress towards minimising the long-term degradation of tundra vegetation in the breeding range (Fundamental objective III, see Annex V).

References

Madsen, J., Tombre, I., Gundersen, O.M., Verhaeghe, F., Kuijken, E., Verscheure, C., Mensink, G., Koffijberg, K., Ravolainen, V. & Lewis, M. 2024. Evaluation of the AEWA International Single Species Management Plan for the Svalbard Population of the Pink-footed Goose (*Anser brachyrhynchus*). Results achieved and implementation performance. EGMP Technical Report No. 24, Bonn, Germany.

Annex IV: Protocols for the Iterative Phase

Monitoring protocols for the Svalbard population of Pink-footed Goose are well established, and annual reporting to the EGMP Data Centre is coordinated with national authorities (Range States), research institutions (data providers), the Pink-footed Goose Task Force and the EGM IWG. The monitoring program is adjusted as necessary to accommodate changes to the population-specific IPM (Integrated Population Model).

For the 6-year cycle of the AFMP, reporting on specific monitoring activities related to the indicators described in chapter 6 and Annex V of this document is required. For most indicators, data should be collected annually and compiled and reported on at 6-year intervals. For others, providing a status update accompanied by an indication of trend/development will be the most appropriate way to assess the indicator.

For the 12-year cycle of the PfG ISSMP, an evaluation based on all data compiled during the interim cycles will be carried out, following an Evaluation Report Template approved by the AEWA Technical Committee. The Evaluation Report will conclude with a recommendation regarding whether the ISSMP should be retired, extended, updated or revised. This recommendation is subject to approval by the AEWA MOP or Standing Committee (with advice from the Technical Committee). For further information, see section 1.3 of the *Revised Format and Guidelines for AEWA International Single and Multi-Species Management Plans* (as adopted by MOP9).

In the case of developments that deviate from the objectives of the PfG ISSMP, an emergency evaluation of the ISSMP should be carried out. This may result in a process to update or revise the ISSMP before the end of the plan's envisioned lifespan if a recommendation to do so is approved by the AEWA MOP or Standing Committee. Such developments include, but are not restricted to, substantial changes in migration routes (potentially affecting the designation of Management Units), distribution of breeding pairs (potentially affecting the population target) and other factors that were given significant weight during the revision process and thus formed the basis of the management decisions agreed on in the ISSMP.

Annex V: Indicator Factsheets

This annex describes a set of indicators for each of the fundamental objectives of the PfG ISSMP, including the rationale, definition, and methodology for each indicator. These indicators can be used to assess the progress towards achieving the Fundamental Objectives of the plan, and they also take into account the associated Means and Process Objectives.

Fundamental Objectives are indicated **in bold** (I-VI), related indicators are numbered I.1, I.2, […], VI.3 with the Roman numerals of each indicator referring to the relevant Fundamental Objective.

I. Maintain a stable Pink-footed Goose population and its range and habitat at a satisfactory level above the FRVs.

I.1 Population size and trend relative to the population target

Rationale

This indicator measures the progress towards Fundamental Objective I: Maintain a stable Pink-footed Goose population and its range and habitat at a satisfactory level above the FRVs.

As the target (72,000 individuals in spring) is set above the FRP (49,000 individuals in spring with corresponding values for FRR and FRH), and agreed on by all Range States, the target value is assumed to currently represent a satisfactory population size. Comparing the population size to the population target and evaluating the current stability (trend) of the population will provide a direct indicator of the progress made towards achieving Fundamental Objective I. While most management decisions regarding actions pertaining to Fundamental Objective I are taken on an annual basis, an in-depth assessment of this indicator after 6 years is important and may lead to adaptations of the AFMP.

Indicator definition

Annual monitoring efforts include flyway-wide counts during spring and autumn, an overview of offtake, and measures of productivity and survival, all combined in the population-specific IPM described in Annex II (see Johnson et al. 2020). The output of the IPM, both in terms of population size and trend, provides the direct measure of this indicator and is presented annually during the EGM IWG meeting in June. In addition to the IPM-based population estimate, the number of geese in each of the two breeding groups, on Svalbard and Novaya Zemlya, respectively, will be assessed and reported to the EGM IWG in the annual population status and assessment report. Only the current distribution was considered during the revision of the ISSMP, and major changes in distribution may have significant impacts on conflict levels and tundra degradation, even at population levels below the agreed target.

Methodology

The estimated population size and trend is given by the population-specific IPM (Johnson et al. 2020; Annex II). The existing internationally coordinated programme encompassing monitoring, assessment and decision-making protocols must be maintained and adapted as necessary, and national harvest levels must be adjusted in response to the annual decisions of the EGM IWG. To increase the likelihood of achieving the annual hunting quotas, hunters' engagement must be maintained and further increased.

References

Johnson, F.A., Zimmerman, G.S., Jensen, G.H., Clausen, K.K., Frederiksen, M., & Madsen, J. 2020. Using integrated population models for insights into monitoring programs: An application using pink-footed geese. *Ecological Modelling* 415, https://doi.org/10.1016/j.ecolmodel.2019.108869.

I.2 Range extent compared to Favourable Reference Range (FRR)

Rationale

This indicator measures the progress towards Fundamental Objective I: Maintain a stable Pink-footed Goose population and its range and habitat at a satisfactory level above the FRVs.

The population's range is considered satisfactory if the range is maintained at or above the level of the Favourable Reference Range, which is equal to the range used by the population in year 2000 (see Table 1). This range was sufficient to maintain the population (at FRP) and its ecosystem services throughout the annual cycle (Madsen et al. 2025). As the population was only breeding on Svalbard in year 2000, Novaya Zemlya is not included in the FRR for the breeding season.

Indicator definition

This indicator consists of two sub-indicators:

A. Current breeding range on Svalbard in proportion to the breeding FRR, and
B. Current non-breeding (staging and wintering) range in proportion to the non-breeding FRR.

The breeding range includes the areas on Svalbard where nesting and brood-rearing takes place. According to the CMS definition, the non-breeding range includes any areas the migratory species stays in temporarily, crosses or overflies during its normal migration, or conduct moult. Hence, the range is not restricted to key sites but includes all areas where the species occurs regularly (although not necessarily annually).

Methodology

The entire breeding range and parts of the non-breeding range of the Svalbard population of Pink-footed Goose is outside of the European Union. Consequently, there are no reporting obligations under Article 12 of the EU Birds Directive that will include all Range States, and the AEWA reporting on national population status does not require Range States to report on distribution or range. Therefore, the current range should be determined as described by Madsen et al. (2025).

Range States should report to the EGMP Data Centre by 31 December 2031. For both sub-indicators the extent of the current range will be compared to the national and flyway-level FRRs.

References

Bijlsma, R., Agrillo, E., Attorre, F., Boitani, L., Brunner, A., Evans, P., . . . van Kleunen, A. 2019. Defining and applying the concept of Favourable Reference Values for species and habitats under the EU Birds and Habitats Directives. Retrieved from https://edepot.wur.nl/469035

.

DG Environment. 2017. Reporting under Article 17 of the Habitats Directive: Explanatory notes and guidelines for the period 2013-2018. In (pp. 188). Brussels: European Commission.

Madsen, J., Pedersen, C.L., Tombre, I., Nienhuis, J., Koffijberg, K., & Schreven, K.H.T. 2025. Defining Favourable Reference Values for the Svalbard Population of the Pink-footed Goose (*Anser brachyrhynchus*). EGMP Technical Report No. 27. Bonn, Germany.

I.3 Proportion of key sites legally protected and managed

Rationale

This indicator measures the progress towards Fundamental Objective I: Maintain a stable Pink-footed Goose population and its range and habitat at a satisfactory level above the FRVs, focusing specifically on the availability of sufficient and suitable habitat for sustaining the population at or above the FRP.

Geese often rely on the same breeding, roosting and foraging sites year after year, and they depend on key sites remaining available for them throughout the annual cycle. Although protection and management do not necessarily guarantee high quality foraging areas, protection and management of key sites is likely to improve site conditions through increasing the availability of natural habitat, thus also minimizing agricultural damage and disturbance. Protection will also ensure that key sites are taken into account during land use planning processes and infrastructure development.

Indicator definition

This indicator is defined as the proportion of key breeding, foraging and roosting sites for Pink-footed Geese that are legally protected, for example as part of the existing Natura 2000 network (EU Member States) or similar instruments throughout the flyway, and managed specifically for (Pink-footed) geese.

Methodology

Assuming that key sites have been identified, data should be readily available from all Range States. Foraging and roosting sites should be reported separately, and additional information on site management should be provided for all sites. The existing monitoring programme will ensure that newly established roost sites are discovered and monitored to ensure their addition to the list of key sites, if applicable.

II. Keep agricultural conflicts at an acceptable level.

II.1 Relative change in costs related to goose management

Rationale

This indicator measures the progress towards Fundamental Objective II: Keep agricultural conflicts at an acceptable level.

During the evaluation of the first ISSMP for the Svalbard Population of the Pink-footed Goose (Madsen & Willams 2012), agricultural conflicts were reported as having subdued and reached an acceptable level based on the stabilization of the number of geese foraging on agricultural fields, particularly in Norway (Madsen et al. 2024). If Fundamental Objective I of the current ISSMP is achieved, and the population stabilises at the

adopted target, the damages leading to conflicts may also stabilise. However, if the costs related to goose management continue increasing, conflict levels may rise again regardless of the number of geese potentially causing damage. Thus, the relative change in costs related to goose management (including expenses related to annual compensation, subsidies, and/or man-years spent) is a useful additional indicator for the progress towards keeping conflicts at an acceptable level. It must be noted, however, that the level of subsidies is often negotiated on an annual basis, which may affect the overall costs incurred. Furthermore, conflict levels are not necessarily directly proportional to the costs incurred, which calls for caution when analysing the data submitted for this indicator.

Indicator definition

The indicator is defined as the relative change in annual costs of compensation and subsidy payments (e.g. for accommodating geese), number of derogation permits issued (Denmark only), as well as man-years spent to manage conflicts related to Pink-footed Geese during the period 2026-2030.

Methodology

Range States will report the total annual costs related to goose management to the EGMP Data Centre, including as separate amounts.

A. The annual amount of compensation paid for goose damages caused by Pink-footed Geese,
B. The annual amount of subsidies paid, e.g for accommodating geese (species-specific, if available),
C. The number of derogation permits issued for Pink-footed Geese, and
D. The number of man-years spent annually on goose management (species-specific, if available).

References

Madsen, J. & Williams, J.H. 2012. International Species Management Plan for the Svalbard Population of the Pink-footed Goose *Anser brachyrhynchus*. AEWA Technical Series No. 48. Bonn, Germany.

Madsen, J., Tombre, I., Gundersen, O.M., Verhaeghe, F., Kuijken, E., Verscheure, C., Mensink, G., Koffijberg, K., Ravolainen, V. & Lewis, M. 2024. Evaluation of the AEWA International Single Species Management Plan for the Svalbard Population of the Pink-footed Goose (*Anser brachyrhynchus*). Results achieved and implementation performance. EGMP Technical Report No. 24, Bonn, Germany.

III. Minimise the long-term degradation of tundra vegetation in the breeding range.

III.1 Frequency of bare tundra patches created by goose-grubbing on Svalbard

Rationale

It is anticipated that an increasing breeding population of Pink-footed Geese will increase the number of individuals foraging on the vulnerable tundra vegetation in the breeding areas, and concerns have been raised that a growing population will thus increase the risk of the geese causing long-term degradation of the tundra moss layer in Svalbard (and elsewhere). The agreed population target is assumed to ensure that vulnerable habitats are not further jeopardised. However, since the extent of damages caused by geese are not always directly proportional to the population size, this indicator is included as a separate and complementary measure of the progress towards Fundamental Objective III: Minimise the long-term degradation of tundra vegetation

in the breeding range. Furthermore, this indicator also relates to Fundamental Objective V: Minimise the risk to animal health and the risk of other ecological impacts and is directly linked to Actions 7.1 and B.5 in the ISSMP: Determine and agree on acceptable levels of tundra degradation, and Investigate the impact of goose grubbing of tundra moss layers on habitat quality for high Arctic waders. The agreement resulting from Action 7.1 was envisaged to be included in the AFMP, yet it seems premature to discuss such an agreement until information based on the existing tundra monitoring programme has been compiled and made available to the IWG. It is therefore proposed that the EGMP Data Centre and the Pink-footed Goose Task Force be tasked with compiling information to support a decision regarding acceptable levels of tundra degradation prior to EGM IWG12 in June 2027, thus allowing the EGM IWG to agree on the format, content and timing of an addition on this topic to the AFMP. The investigation related to Action B.5 is dependent on additional funding as it is not included in current monitoring programmes (see below).

It is important to note that the term "long-term degradation" implies a (semi-)permanent change of the habitat which is rarely caused by goose-grubbing alone. Climate change is increasing the risk of irreversible changes to the vulnerable arctic ecosystems through rising temperatures, deeper thaw of the active layer and changes in hydrology (Artsdatabanken 2025), thus particularly threatening the mesic and wet arctic tundra habitats that are important foraging habitats for both geese and reindeer (Ravolainen et al. 2024). Arctic permafrost wetlands were recently listed as near threatened in the national red list of ecosystem types in Norway, and the assessment recognizes grubbing as one of the potential future impacts (Artsdatabanken 2025). Goose-grubbing may create patches with barren soil, yet, dependent on the size, open patches in the moss layer created by geese alone are likely to be revegetated again within 5-10 years if the moss layer is allowed to regrow – and should therefore not necessarily be termed degradation.

To estimate the likelihood of any observed changes being caused by geese, and for this indicator to be meaningful in terms of goose management and for evaluating the relationship between population size and extent of damages, monitoring must include two factors for each monitoring site:

A. An indication of whether geese have been present and foraging (grubbing), and
B. A measure and documentation of the occurrence of bare patches which can be ascribed to goose grubbing.

In case that geese have been grubbing and there is an increasing trend in sub-indicator B (measure of extent of bare patches) over time, it indicates that the goose grubbing has a degradation effect on the moss habitat.

Indicator definition

Data will be obtained through the existing COAT (Climate-ecological Observatory Arctic Tundra) monitoring programme (see https://www.coat.no/en/) where a number of transects and plots are monitored on an annual basis (COAT 2026). Data for sub-indicator III.1A will measure the proportion of transects and/or plots where geese have exerted grubbing within the same year. Data for sub-indicator III.1B will measure the proportion of transects and/or plots where geese have removed the tundra moss layer through grubbing to create bare patches.

Methodology

The annual tundra surveys carried out through the COAT program in Svalbard will allow us to benefit from a well-established and standardized monitoring program with a long time-series of tundra vegetations records.

Transects and plots are investigated through annual visits, revealing through recording of freshly grubbed moss pulled out of the moss carpet whether geese have been present at each site or not. Patches of bare soil in the plots and along the transects are registered and reported to the EGMP Data Centre along with the proportion of bare patches on transects or plots likely caused by goose-grubbing.

More spatially comprehensive surveys were conducted in 2007 and 2012 if more detailed background knowledge is needed. These surveys may be repeated in the future if funding allows.

References

Artsdatabanken (2025). Norsk rødliste for naturtyper 2025 [Norwegian Red List for habitat types 2025]. https://lister.artsdatabanken.no/naturtyper/2025. Direct link to page on arctic permafrost wetlands: https://lister.artsdatabanken.no/naturtyper/2025/1225. Accessed 10 March 2026.

COAT 2026: Moss Tundra Module of the Climate-ecological Observatory Arctic Tundra. https://www.coat.no/en/Mosstundra. Accessed 10 March 2026.

Ravolainen, V., Paulsen, I. M.G., Eischeid, I., Forbey, J. S., Fuglei, E., Hájek, T., Hansen, B.B., Loe, L.E., Macek, P., Madsen, J., Soininen, E. M., Speed, J. D. M., Stien, A., Tømmervik, H., Pedersen, Å. Ø. P. 2024. Low spatial habitat overlap of herbivores in the High Arctic tundra, Global Ecology and Conservation, Volume 49, 2024,e02797, https://doi.org/10.1016/j.gecco.2024.e02797.

IV. Minimise the risk to human health and safety

IV.1 Risk of avian influenza transmission to the general public

Rationale

This indicator measures the progress towards the human health component of Fundamental Objective IV: Minimise the risk to human health and safety and the animal health component of Fundamental Objective V. Minimise the risk to animal health and the risk of other ecological impacts.

Although the risk of Pink-footed Geese transmitting avian influenza to humans was considered low in the ISSMP (Madsen et al. 2025b), the potential threat of a global pandemic calls for continued monitoring. The risk of avian influenza transmission to the general public is thus considered an appropriate and timely indicator, even for low-risk species like Pink-footed Goose.

Monitoring of this indicator includes different levels of specificity, ranging from direct infection of humans following contact with Pink-footed Geese to the level of infection risk at a societal level, expressed by the number of cases registered among captive birds (poultry farms). As species identification is not always correct, and source of infection may be impossible to detect, it is considered important to monitor the exposure risk at all levels.

Since this indicator relates mainly to the general public, passive surveillance may be of particular importance. Testing of live animals is usually carried out by wildlife professionals, whereas anyone can come into contact with dead or sick birds and thus expose themselves to infection. However, it is important to keep in mind that species identification may be less reliable if not carried out by professionals, so species-specific results should be interpreted with caution. It must also be noted that the occurrence of avian influenza among wild or captive

birds does not necessarily translate directly into the risk of transmission to the general public, which calls for caution when analysing the data submitted for this indicator.

Indicator definition

This indicator consists of three sub-indicators:

A. Annual number of human cases of avian influenza recorded following exposure to wild Pink-footed Geese, including dead geese, or their droppings (note that attribution of the actual source of infection may be impossible in some cases).
B. The number of tested and number of infected Pink-footed Geese recorded annually, ideally combined with a description of the national monitoring programme, at least specifying whether testing is active (on-going, background testing of live birds) or passive (testing of dead birds only).
C. Annual number of outbreaks of avian influenza registered in poultry farms.

Sub-indicators B and C will also serve as measures of progress towards achieving the animal health component of Fundamental Objective V. Minimise the risk to animal health and the risk of other ecological impacts.

Methodology

Reporting on all sub-indicators shall be done at national level. Data will be compiled by the EGMP Highly Pathogenic Avian Influenza (HPAI) Contact Group in collaboration with the Range States and the EGMP Data Centre. Sources include, but are not limited to, the Avian Influenza overview reports published quarterly by the European Food Safety Authority (EFSA), the European Centre for Disease Prevention and Control (ECDC) and the European Union Reference Laboratory for Avian influenza (EURL). Hence, monitoring zoonotic influenza does not require additional resources from the EGMP Range States. However, the outcome of the assessment of this indicator may lead to recommendations regarding future monitoring efforts which, if adopted, may require additional funding.

Data covering the period 2026 – 2030 is to be reported to the EGMP Data Centre by 31 December 2031. Data collection shall continue in 2031 – 2032.

References

Madsen, J., Sørensen, I.H., Johnson, F.A., Germain, R.R., Lewis, M., & Leles, B.P. 2025. AEWA International Single Species Management Plan for the Pink-footed Goose (*Anser brachyrhynchus*) – Svalbard breeding population. AEWA Technical Series No. 79. Bonn, Germany.

IV.2 Number of bird strikes with aircraft caused by Pink-footed Goose

Rationale

This indicator measures the progress towards the human safety component of Fundamental Objective IV: Minimise the risk to human health and safety.

The frequency of bird strikes with Pink-footed Goose is the direct indicator for the development in incidents, accumulated from local airports to national and international levels. The risk is likely to increase with the overall population size.

Indicator definition

Annual number of bird strikes caused by Pink-footed Geese at commercial airports in the Range States. Data is collected annually at airport and national level.

Methodology

Bird strikes are routinely reported by all commercial civil airports, and airport authorities attempt to identify the bird species involved (causing the strike). Airports will be asked to report date and time of each bird strike along with the flock size and number of birds struck.

Bird strike data will be compiled by the Flight Safety Task Force based on reports from national statutory authorities. The authorities will also be asked to report any change in reporting practices, which may influence the indicator.

Data covering the period 2026 – 2030 is to be reported to the EGMP Data Centre by 31 December 2031. Data collection shall continue in 2031 – 2032.

As the frequency of bird strikes with Pink-footed Goose is low, the indicator could be combined with GPS tracks of tagged birds to provide an indication of the frequency and timing of major migration paths crossing civil commercial airports, thus providing further information on the level of risk to human safety.

V. Minimise the risk to animal health and the risk of other ecological impacts.

V.1 Proportion of geese breeding or moulting on Novaya Zemlya contaminated with radioactivity

Rationale

This indicator measures the progress towards the animal health component of Fundamental Objective V: Minimise the risk to animal health and the risk of other ecological impacts and the human health component of Fundamental Objective IV. Minimise the risk to human health and safety.

Geese breeding and moulting on Novaya Zemlya may be contaminated by radioactive emissions causing a concern for the birds affected as well as for the radiation safety to the public, in this case particularly relevant to people consuming Pink-footed Geese shot on the staging or wintering grounds. Measuring the level of contamination with radioactivity in contaminated geese from Novaya Zemlya will provide information on the level of threat posed to birds as well as to humans.

Indicator definition

To be defined. A pilot study by Aarhus University and the Danish Technical University is currently in progress, with initial results expected to be available by the end of the year 2026. As the severity of the problem has not yet been examined, it is premature to decide on relevant indicators, such as types of emitters (gamma, alpha or beta), yet the pilot study is expected to provide further guidance on this.

Methodology

To ensure that sampling of geese shot by hunters and retrieved for analysis includes only birds that have potentially been exposed to radioactivity, sampling should be based on either GPS-tagged individuals known to migrate to Novaya Zemlya, or individuals shot in southeast Denmark, which is a confirmed wintering ground of the Novaya Zemlya breeding group.

V.2 Area of natural habitat or habitat of threatened species negatively affected by Pink-footed Geese

Rationale

This indicator measures the progress towards the ecological impact component of Fundamental Objective V: Minimise the risk to animal health and the risk of other ecological impacts. While knowledge on this topic is limited, it is acknowledged that geese may affect natural habitats negatively, for example through grubbing (see indicator III.1), and negative impacts on habitat quality for threatened species is of particular concern. Impacts of goose grazing on the breeding habitat of high Arctic waders should be specifically investigated as described in Action B.5.

Indicator definition

This indicator consists of three sub-indicators:

A. The percentage of habitat of threatened species (birds, plants, or others) negatively affected by Pink-footed Goose, including a description of how the geese affect the habitat.
B. Habitat types negatively affected by Pink-footed Goose (e.g., the percentage of nutrient-poor lakes in Denmark negatively affected by goose droppings). Please describe how the geese affect the habitat.
C. Conservation or management objectives (e.g., in Important Bird and Biodiversity Areas (IBAs) or Special Protection Areas) hindered or affected negatively by the presence of Pink-footed Geese. Please describe how the geese interfere with the defined objectives.

Methodology

If data is not available at an annual basis, Range States will be asked to provide information on the situation at the time of reporting along with an indication of the trend (growing, stable, or diminishing) for the period 2026-2030.

VI. Maintain the socio-cultural value of Pink-footed Geese in a manner that does not jeopardize the population status or aggravate conflicts and risks.

VI.1 Annual offtake compared to annual quota

Rationale

This indicator measures the progress towards Fundamental Objective VI: Maintain the socio-cultural value of Pink-footed Geese in a manner that does not jeopardize the population status or aggravate conflicts and risks. Providing an annual recommendation for the optimal hunting quota in terms of reaching the agreed population target of 72,000 individuals in spring allows for recreational use in accordance with Fundamental Objective VI.

Recreational hunting of Pink-footed Goose is legal in Norway and Denmark, and the number of geese shot in the two Range States provides an indicator of the socio-cultural value provided to the hunting community while maintaining a stable population of Pink-footed Goose as described in Fundamental Objective I. Evaluating the difference between the annual hunting quota and the annual offtake will provide an indication of how successful the implementation of the PfG ISSMP is by measuring whether hunters are able to achieve the annual quota (thus avoiding aggravation of conflicts) and whether Range States are able to take actions to prevent surpassing the annual quota (national legislation, follow-up etc.).

Indicator definition

Annual offtake reported to the EGMP Data Centre is compared to the optimal hunting quotas provided annually by the EGMP Data Centre based on the population-specific IPM.

Methodology

Hunters in Norway and Denmark are obliged to report the annual harvest of game species at species level. The data is retrieved by the EGMP Data Centre in May each year, providing input to the annual update of the IPM to derive the optimal harvest quota for the forthcoming hunting season. Annual hunting quotas are compared to annual offtake based on data compiled by the EGMP Data Centre. No additional reporting is required.

VI.2 Social and cultural events and activities related to the annual cycle of the Pink-footed Goose

Rationale

This indicator measures the progress towards Fundamental Objective VI: Maintain the socio-cultural value of Pink-footed Geese in a manner that does not jeopardize the population status or aggravate conflicts and risks. The annual cycle of the Pink-footed Goose and other goose species breeding in the high Arctic and wintering in northwest Europe means that the arrival and departure of the first individuals each year signal the beginning of new seasons along the flyway. As a result, the geese hold great sociocultural value for human communities, beyond their ecological role, including their cultural, spiritual, recreational, educational and aesthetic importance. Maintaining such sociocultural importance rests on opportunities for observing Pink-footed Geese, sharing values and bringing people and birds together. This can be accomplished through social and cultural events and activities related to the annual cycle of Pink-footed Goose.

Indicator definition

This indicator is defined as the number of social or cultural events arranged and the number of people observing Pink-footed Geese.

Methodology

Range States shall report on an annual basis the number of social or cultural events arranged, including (but not restricted to) national Goose Days, celebrations of World Migratory Bird Day and similar recurring or stand-alone global, international, national or local events, related to the annual cycle of Pink-footed Goose.

Furthermore, Range States shall share on an annual basis the number of individual observers submitting observations of Pink-footed Goose on national citizen-science platforms

VI.3 Crippling rate

Rationale

This indicator measures the progress towards Fundamental Objective VI: Maintain the socio-cultural value of Pink-footed Geese in a manner that does not jeopardize the population status or aggravate conflicts and risks. Reaching the population target for the Svalbard Population of Pink-footed Geese relies on an adaptive approach, including an adjustable hunting pressure exerted by hunters in Denmark and Norway. Regardless of the current population size, hunting must be sustainable and follow wise use principles. This implies, among other criteria, that continuous efforts are made to minimise the crippling rate through awareness campaigns and education of hunters. Developing and promoting the use of guidance and training on best practices for goose hunting has proven effective for reducing crippling as well as minimizing disturbance and were identified as priorities in the PfG ISSMP. The crippling rate is reported as the percentage of the population carrying embedded shotgun pellets resulting from shotgun shooting.

Indicator definition

The crippling rate is measured as the percentage of adult and juvenile Pink-footed Geese carrying shotgun pellets in their tissue.

Methodology

Crippling rate is monitored by x-ray examination of wild geese captured during spring (i.e. after the hunting season) at one or several sites along the flyway. Captures are carried out regularly, at least every 3-5 years, and birds are caught using cannon- or clap-nets. The age of each individual is determined as “juvenile” or “older/adult” based on plumage characteristics. Taking the harvest rate into account, as this may influence the crippling rate, the crippling ratio can be calculated by dividing the crippling rate by the age-specific harvest rate (Clausen et al. 2017). The harvest rate is derived from the annual update of the IPM for the Svalbard Population of the Pink-footed Goose.

References

Clausen, K.K., Holm, T.E., Haugaard, L., Madsen, J. 2017.Crippling ratio: a novel approach to assess hunting-induced wounding of wild animals. *Ecological Indicators* 80:242-246. https://doi.org/10.1016/j.ecolind.2017.05.044

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