Doc. AEWA/EGMIWG/5.20/Rev.1 Date: 11 June 2020

AEWA EUROPEAN GOOSE MANAGEMENT PLATFORM



AEWA European Goose Management Platform 5th MEETING OF THE AEWA EUROPEAN GOOSE MANAGEMENT INTERNATIONAL WORKING GROUP



15-18 June 2020, Online conference format

ADAPTIVE FLYWAY MANAGEMENT PROGRAMME FOR THE EAST GREENLAND/SCOTLAND & IRELAND POPULATION OF THE BARNACLE GOOSE *BRANTA LEUCOPSIS*

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The 5th Meeting of the AEWA European Goose Management International Working Group is taking place remotely in an online conference mode.

Content

Content
List of acronyms and abbreviations
Introduction
1. Definitions of Management Units (MUs) 4
2. Definitions of Favourable Reference Values (FRVs)
Favourable Reference Populations (FRPs)
Favourable Reference Range (FRR)
Favourable Reference Habitat (FRH)
3. Cumulative impact of derogation and legal hunting
4. Monitoring indicators and programmes
5. Protocols for the iterative phase
Annex 1. MU-specific workplans
Annex 2. Box 1 of the ISSMP for the East Greenland/Scotland & Ireland population of the Barnacle Goose
Annex 3. Population Models
Annex 4. Impact Models
Annex 5. Indicator factsheets
Annex 6. Protocols for the iterative phase

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	
EC	European Commission	
EGM IWG	European Goose Management International Working Group	
EGM IWG4	The 4 th meeting of the EGM IWG	
EGMP	(AEWA) European Goose Management Platform	
FRH	Favourable Reference Habitat (in sense of 'habitat for the species' DG Environment, 2017)	
FRP	Favourable Reference Population	
FRR	Favourable Reference Range	
FRV	Favourable Reference Value	
ISSMP	International Single Species Management Plan (Jensen et al., 2018)	
IWC	International Waterbird Census	
МОР	Meeting of the Parties	
MU	Management Unit	

List of acronyms and abbreviations

Introduction

The International Single Species Management Plan (ISSMP) for the Barnacle Goose *Branta leucopsis* (Jensen et al., 2018) was developed according to Paragraph 4.3.4 of the AEWA Text, Annex 3. This provides for developing ISSMPs for populations which cause significant damage, in particular, to crops and fisheries. In addition, it responds to AEWA Resolution 6.4, which requested the establishment of a multispecies goose management platform and process to address the sustainable use of goose populations and to provide for the resolution of human-goose conflicts, targeting as a matter of priority Barnacle and Greylag Geese.

The ISSMP for the Barnacle Goose was adopted at the 7th Session of the Meeting of the Parties to AEWA (MOP7), 4-8 December 2018 in Durban, South Africa. The ISSMP provides a mandate for developing a population-specific Adaptive Flyway Management Programmes (AFMP) for each population of the Barnacle Goose, recognising that there are regional differences in migratory behaviour and the human-wildlife conflicts involved in some population. This AFMP shall be formally adopted by the European Goose Management International Working Group (EGM IWG) and then reviewed periodically.

A document on the process and the outline for the development of the Adaptive Flyway Management Programme (AFMP) for the Russia/Germany & Netherlands population of the Barnacle Goose (Doc. AEWA/EGMIWG/4.13/CORR. 1) was presented and adopted at the 4th Meeting of the EGM IWG on 18-20 June 2019, Perth, Scotland, United Kingdom (EGM IWG4).

Based on this document, the Range States of the East Greenland/Scotland & Ireland population of the Barnacle Goose agreed on a similar process and AFMP outline at the Meeting on the Barnacle Goose Adaptive Flyway Management Development Process which took place in Reykjavik, Iceland on 1 October 2019.

This document follows the agreed outline of the AFMPs. The purpose of this AFMP is to establish an agreement amongst Range States of the East Greenland/Scotland & Ireland population of Barnacle Goose on the implementation of those activities in the Barnacle Goose ISSMP that require coordination at the population and/or Management Unit (MU) level. Specifically, this AFMP addresses the following issues:

- 1) Definition of MUs (Chapter 1);
- 2) Definition of Favourable Reference Values (FRVs) for the population and its MUs (Chapter 2);
- Provide a consolidated assessment of damages and risks caused by this population of Barnacle Goose (Annexes 2 and 4);
- 4) Establish protocols to assess the cumulative impact of all off-take including both derogations and legal hunting, where allowed (Chapter 3)
- 5) Establish indicators (Chapter 4 and Annex 5)

The implementation of further activities of the Barnacle Goose ISSMP is to be elaborated in the populationspecific workplans. Annex 1 provides guidance on developing such workplans.

It should be noted, however, that Range States remain responsible for national planning and implementation within the framework of the ISSMP including their derogation measures under the provisions of Articles 9 of the Birds Directive and the Bern Convention.

This AFMP covers the period of 2020 - 2026.

1. Definitions of Management Units (MUs)

The ISSMP has mandated the EGM IWG to define the Management Units (MUs) in the AFMP. The Range States of the East Greenland/Scotland & Ireland population agreed to manage this population as one Management Unit, following a Range State Meeting of the Barnacle Goose Adaptive Flyway Management Development Process which took place in Reykjavik, Iceland on 1 October 2019.

2. Definitions of Favourable Reference Values (FRVs)

The ISSMP has mandated the EGM IWG to set the Favourable Reference Values (FRVs) in the AFMP for the breeding and non-breeding seasons. Following EGM IWG4, a revised document setting out the principles of defining FRVs for the Barnacle Goose was circulated on 7 October 2019. This version was revised based on written feedback from Range States and a workshop held with the European Commission (EC) and EU Member States on 31 January 2020 in Brussels. A final version of the document was circulated to the EGM IWG on 24 March 2020 (AEWA/EGMIWG/Inf.5.11²).

Favourable Reference Populations (FRPs)

The FRP is proposed to be set at the Agreement Value (i.e. around the year 2000) of **54,000 wintering** individuals and distributed amongst the Range States as in Table 1.

Country	Breeding FRP (in pairs)	Non-breeding FRP (in individuals)	Notes
Greenland	17,400	44,000	Assuming 10,000 birds stay in Iceland.
Iceland	2,000	54,000	Breeding FRP is reported by the government Non-breeding FRP is estimated based on the wintering FRP assuming insignificant mortality after the spring census
Republic of Ireland	n.a.	8,500	Based on distribution of numbers around 2000
United Kingdom	n.a.	45,500	Based on distribution of numbers around 2000
Population total	19,400	54,000	Represents the total of the wintering population

Table 1. FRP values for the East Greenland/Scotland & Ireland population

Favourable Reference Range (FRR)

The FRRs for both the breeding and the non-breeding seasons were to be set by the Range States at the level of the 2013-2018 reporting period using the range method (DG Environment, 2017, pp. 125-128). This period is used to establish the FRR because of the CMS definition of the FRR³ and available EU guidance (DG Environment, 2013, p. 15, 2017, p. 48).

²https://egmp.aewa.info/sites/default/files/meeting_files/information_documents/AEWA_EGM_IWG5_Inf_5_11_FRVs _BG.pdf

³ "the range of the migratory species is neither currently being reduced, nor is likely to be reduced" (see Article I.c.(2) of the CMS Convention Text).

The available range information is summarised in Table 2.

Country	Breeding FRR (in km ²)	Non-breeding FRR (in km ²)	Notes
Greenland	100,000	100,000	Estimates based on Boertmann & Nielsen (2010)
Iceland	900	11,000	The FRRs are based on distribution area maps provided by the government
Republic of Ireland	n.a.	2,600	
United Kingdom	n.a.	7,900	The FRR is based on a distribution area map provided by the government
Population Total	c. 100,000	121,500	

Table 2. FRR values for the East Greenland/Scotland & Ireland population

Favourable Reference Habitat (FRH)

Assessment of FRH follows the same approach as the habitat for the species under the Article 17 reporting for the Habitats Directive (DG Environment, 2017, pp. 136-141), i.e. Range States were requested to qualitatively assess whether the extent and quality of the habitat is sufficient for the long-term survival of the population.

The UK and Iceland reported that there is sufficient habitat to support the population at the level of the FRP. The Republic of Ireland and Greenland did not report, but the document defining the FRVs for the Barnacle Goose (info doc number) concluded that based on the fact that the current population is larger than the FRP, there is sufficient habitat to support the population at the FRP level.

3. Cumulative impact of derogation and legal hunting

Actions 4.2 of the ISSMP requires to "asses periodically, and report to the AEWA EGM IWG, the cumulative impact of derogations (as well as hunting in Range States in which derogation is not required) on the development of the population, the likelihood of serious damage to agriculture and risk to air safety and to other flora and fauna (including the Arctic ecosystems), and the non-lethal measures taken to prevent damage/risk, as well as the effectiveness of these. If necessary, coordinate the derogation measures between Range States to avoid risk to the population and to enhance the effectiveness of the measures".

Consequently, the ISSMP does not define any target size for the population. It remains the sole responsibility of the individual Range States to take or not to take derogation measures in full compliance with the provisions of Articles 9 of the EU Birds Directive and of the Bern Convention.

Based on the above, the role of the Adaptive Flyway Management Programme for East Greenland/Scotland & Ireland population of the Barnacle Goose is not to maintain the population at a certain target level, but prevent that the population declines below the FRP. Thus, the FRP represents a lower limit of the legally acceptable population size but not a target for population reduction. Monitoring of the population size and offtake, predictive modelling of the cumulative impact of national derogation measures and hunting (where it is legally allowed) will be used to inform national decision-making to ensure this.

It follows from this logic that monitoring, assessment and, especially, coordination amongst the Range States is less important when the population size is well above the FRP. However, these activities become increasingly important when the actual population size is approaching the FRP. Therefore, a tiered system of coordination is recommended (Table 3). 200% of the FRP of the population is proposed to trigger a tighter coordination of offtake amongst the Range States⁴.

Actual size of the population and its MUs	Measures
> 200% of the FRP	 Monitoring of population size, offtake under derogation and hunting; Prediction of population development.
< 200% of the FRP	 Monitoring of population size, offtake under derogation and hunting; Prediction of population development; Coordination of offtake under derogation and hunting; Taking coordinated conservation measures, if necessary.

Table 3. Monitoring, assessment and offtake coordination depending on the status of the population

⁴ 200% of the FRP has been selected as a threshold to trigger coordination of offtake based on the precautionary principle as, everything else being equal, the closer the population is to the FRP the higher the risk that the population drops below the FRP if derogation and/or hunting is excessive or because of other reasons (such as increased predation). Such an ample buffer is also needed because total counts in this population can be carried out only once in every three years. Consequently, the population models need to make predicions for three years ahead, which increases their uncertainty. In addition, everything else being equal, the higher the actual population size is compared to the FRP, the more time is available to diagnose the causes of decline and to take conservation actions, if necessary, to maintain the population above the FRP.



Figure 1. Development of the population size in relation to the FRP (red line) and 200% of the FRP (dashed orange line).

As Figure 1 shows, the current population level is only 34% above the FRP. Therefore, it is recommended that Range States in a coordinated manner:

- Develop a predictive population model;
- Increase the frequency of full population censuses from 5 years to 3 years;
- Agree on the level of allowable offtake (either under derogation or hunting) in order to avoid that the population size drops below the FRP.

4. Monitoring indicators and programmes

Monitoring indicators are designed to measure the progress towards the fundamental objectives of the ISSMP (Jensen et al., 2018, pp. 17-18). 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 5.

Fundamental objective	Related indicators	Deadlines for reporting
I. Maintain the population at a	I.1 Population size compared to the	30 Apr. 2021
satisfactory level	Favourable Reference Population (FRP)	30 Apr. 2023
		30 Apr. 2026
	I.2 Range extent compared to Favourable	31 Dec. 2025
	Reference Range (FRR)	
II. Minimize agricultural	II.1 Relative change in damage payments	31 Dec. 2025
damage and conflicts		
III. Minimize the risk to	III.1 Risk of zoonotic influenza	No national reporting is
public health and air safety	transmission to the general public	required
	III.2 Number of bird strikes with aircrafts	31 Dec. 2025
	caused by Barnacle Goose	
	III.3 Number of Barnacle Geese passing	31 Dec. 2025
	over commercial airports	
IV. Minimize the risk to other	IV.1 Area of natural habitat or habitat of	31 Dec. 2025
flora and fauna	threatened species negatively affected by	
	Barnacle Goose	
V. Maximise ecosystem	V.1 Number of people enjoying watching	31 Dec. 2025
services	geese	
VI. Minimise costs of goose	VI.1 Relative change in cost of goose	31 Dec. 2025
management	management	

Table 4. Indicators for fundamental objectives of the ISSMP (Jensen et al., 2018)

5. Protocols for the iterative phase

Management evaluation and adaptation of the East Greenland/Scotland & Ireland population of the Barnacle Goose follows four iterative phases running in parallel (Figure 2):

- 1. A 10/12 year cycle of the ISSMP⁵;
- 2. Two 6-year cycles of the AFMP, and within the AFMP:
- 3. Two 3-year cycles of monitoring of the total population size and assessing if the actual size of the population and its MUs are below the 200% threshold and approaching the FRP;
- 4. 1-year cycles of monitoring in Scotland, Iceland and Greenland, as well as update of work plans.

⁵ The lifespan of the ISSMP is 10 years. However, it might be logical for the EGM IWG to recommend to the AEWA MOP to extend it to 12 years to include two 6-year-long AFMPs.

ISSMP

12 year cycle of evaluation and adaptation related to:

- Goals
 - Objectives (Fundamental, Means and Process)
- Alternative actions related to objectives

AFMP

6 year cycle of evaluation and adaptation related to:

- Management Units
- FRVs
- Box 1
- Population models
- Impact models
- Cumulative impact of derogation and legal hunting
- Protocol for the iterative phases
- The range of and methods for indicators and programs
- The state of indicators and evaluation towards achieving objectives

3-year cycle of assessment related to:

- Monitoring of the total population size
- Review the need for two Management Units;
- Assessing whether the population size is below the 200% threshold and approaching the FRP.
- Coordination of offtake under derogation and hunting if the population is below the 200% threshold and approaching the FRP.
- Taking coordinated conservation measures, if necessary.
- Increase understanding of population dynamics
- Refine models of population dynamics

1 year cycle of:

- Monitoring of indicators related to population models
- Update work plans for the Task Force, Data Centre and Range States

Figure 2. Flow chart of the four iterative phases of the AFMP

10/12 year cycle of the ISSMP

The 10/12 year cycle of the ISSMP encompasses evaluation and adaptation related to

- Goals;
- Fundamental, Means and Process Objectives;
- Alternative actions related to objectives.

6-year cycle of the AFMP

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

- Management Units (Chapter 1);
- FRVs (Chapter 2);

- Box 1 (Annex 2);
- Population models (Annex 3);
- Impact models (Annex 4);
- Cumulative impact of derogation and legal hunting (Chapter 3);
- Protocol for the iterative phases (Chapter 5);
- The range of and methods for indicators and programs (Chapter 4, Annex 5);
- The state of indicators and evaluation towards achieving objectives (Chapter 4, Annex 5).
- The AFMP is evaluated and adapted next time in 2026 by the EGM IWG.

Two 3-year cycle within the AFMP

The 3-year cycle within the AFMP encompasses assessment related to:

- Monitoring of the total population size;
- Monitoring of Icelandic breeding populaton (nest and bird numbers)
- Review the delineation of Management Units;
- Assessing whether the population size is below the 200% threshold and approaching the FRP;
- Coordination of offtake under derogation and hunting if the population is below the 200% threshold and approaching the FRP;
- Taking coordinated conservation measures, if necessary;
- Increase understanding of population dynamics;
- Refine models of population dynamics.

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 (Action 4.2 in the ISSMP);
- Update work plans for the Task Force, Data Centre and Range States (Annex 1).

Indicators/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, with the exception of the total population count which is performed every 3 years.

- 1. Total population counts in Ireland and Scotland (March 2020, 2023 and 2026, ongoing);
- 2. Population count at key sites in Scotland (ongoing);
- 3. Age counts on Islay and Tiree in Scotland (October-December, ongoing);
- 4. Offtake data (harvest and derogation) (ongoing);
- 5. Crippling rate for the same periods as offtake (season 2020/21-).

Monitoring data is to be submitted to the EGMP Data Centre on an annual basis (every 3-year for the total population count), and no later than 30 April each year.

References

Boertmann, D. & Nielsen, R.D. (2010). *Geese, seabirds and mammals in North and Northeast Greenland. Aerial surveys in summer 2009.* National Environmental Research Institute, Aarhus University. 66 pp. – NERI Technical Report No. 773. URL: <u>http://www.dmu.dk/Pub/FR773.pdf</u>

DG Environment. (2013). *Great cormorant: Applying derogations under Article 9 of the Birds Directive.* 2009/147/EC(pp. 22).

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

Jensen, G. H., Madsen, J., Nagy, S., & Lewis, M. (2018). *AEWA International Single Species Management Plan for the Barnacle Goose (Branta leucopsis): Russia/Germany & Netherlands population, East Greenland/Scotland & Ireland population, Svalbard/South-west Scotland population.* AEWA Technical Series No. 70. Bonn, Germany.

Annex 1. MU-specific workplans

According to the ISSMP for the East Greenland/Scotland & Ireland population of the Barnacle Goose, the AFMPs set out annual workplans for the ISSMP actions relevant for the population/management unit. At the current stage, due to the limited data available on the population size and offtake, its harvest cannot be managed at MU-level. In addition, most management actions will be overlapping. Therefore, it is proposed to establish one workplan for both management units. 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, *Rolling*: to be implemented perpetually. 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 3).

The timescale in combination with the priorities set in the ISSMP can be used to phase the implementation of actions. Thus, the most important would be to implement Essential actions that have an Immediate timing, followed by High priority with Immediate timing, etc.

Immediate				
Launched Shor within next Laur	Short Launched	Medium		
year, i.e. by 2019	within next 3 years, i.e. by 2021	Launched within next 5 years, i.e. by 2023	Long Launched within the next 5+ years	
	1		i.e. can be later than 2023	

Figure 3. Timescale for the implementation of the ISSMP for the East Greenland/Scotland & Ireland population of the Barnacle Goose.



Figure 4. Entities contributing the implementation of the implementation of the East Greenland /Scotland & Ireland population of Barnacle Goose ISSMP and would need to develop annual workplans.

Implementation of the ISSMP requires work by different entities (Figure 4). Some actions should be done at national level as part of national workplans. To facilitate coordination amongst Range States, it is proposed to establish population-specific Task Forces for the Barnacle Goose (AEWA/EGMIWG/5.23).

On the other hand, there are actions that are cross-cutting, affecting not only the population/management unit for which the work plan is developed but also some populations of other EGMP species such as the Greylag Goose and possibly also the Pink-footed Goose and the Taiga Bean Goose: e.g. B.3 Create a toolbox for decisions in relation to determining significant damage. The implementation of such tasks by population/-specific Task Forces would be inefficient and best taken up by a cross-cutting TF (e.g. the Agriculture TF) or by the EGMP Data Centre.

It is proposed that each EGM IWG entity contributing to the implementation of the ISSMP for the East Greenland/Scotland & Ireland population of the Barnacle Goose uses a common structure to produce its own workplan. This structure includes the ISSMP actions relevant for the time period (i.e. 2020/2021 between the 5th and 6th meeting 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 Goose Task Force, Data Centre and the relevant cross-cutting Task Forces). It is recommended that in the period of 2020/2021, 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.

An online form is available at:

https://docs.google.com/spreadsheets/d/1M64HWxzVagM9W0mG8iMMeVYS3_-M44W6QsHvvUonST8/edit#gid=1472654637

It is proposed that the Data Centre will develop its workplan before the EGM IWG5. The Range States, the Agriculture Task Force and the proposed East Greenland/Scotland & Ireland Barnacle Goose Task Force will develop their own workplans following the adoption of the AFMP at EGM IWG5, but before 30 September 2020. The workplans of the population-specific TF, the Agriculture TF and the EGMP Data Centre will be adopted by the EGM IWG in writing and revised at the next meeting of the EGM IWG in June 2021 (EGM IWG6).

Annex 2. Box 1 of the ISSMP for the East Greenland/Scotland & Ireland population of the Barnacle Goose

The ISSMP requires the use of a more detailed analysis concerning damage and site protection, as set out in Box 1 of the ISSMPs with the purpose to assist Range States in assessing the need for derogations from the provisions of Articles 5-8 of the EU Birds Directive and in coordinating the implementation of their derogation schemes. Each AFMP should therefore contain information that is relevant for assessing the need for derogations at Range State level.

A two-year project (2019-2021) is funded by the German Federal Ministry for the Environment and Nuclear Safety (BMU) and coordinated by the EGMP Data Centre. The project started in December 2019 and is expected to end in July 2021 with results ready for the 6th Meeting of the EGM IWG (EGM IWG6 in June 2021). In December 2019, a questionnaire for each species was sent to the Range States. The deadline for responses was set by 31 January 2020 and later postponed to 31 March 2020. Responses have been received from most countries (Table 1). However, the degree of information from the countries varies from very little information to almost full response to all questions. A questionnaire regarding air safety is treated separately by direct contact to the relevant national air safety organisations. The EGMP Agriculture Task Force will be consulted for matters regarding agricultural damage. All data will be synthesized and used for the final report at the end of the project period in 2021.

Country	Barn	acle Goose		
indicated by an X.				
Table 1. All countries	requested for data in relation	to Box 1. Responses	received by the deadli	ine 31 March 2020 are

Country	Barnacle Goose
Iceland	X
Ireland	X
Norway	X
UK	Х

Annex 3. Population Models

The modelling work has not yet started for this population. However, there is an agreement that an integrated population model (IPM) will be developed in the coming autumn by Exeter University in collaboration with the EGMP Data Centre with the financial support of SNH. It is expected that it will be available by for EGM IWG6 (June 2021), including predictions of the cumulative impact of derogation and harvest.

Annex 4. Impact Models

According to the ISSMPs for the Greylag Goose and the Barnacle Goose Range States are mandated to quantify the consequences of changes in population size on fundamental objectives, e.g., investigate if there is a relationship between goose abundances and the amount of damage caused by the species to agricultural crops, risks to air safety or other sensitive flora and fauna.

In order to scale up an assessment of the extent of damage or risks from local to regional, national or even flyway levels, it is necessary to apply either a retrospective time series, statistical analysis or a predictive simulation approach. With regard to agricultural damage, some first indicative examples of national time series analyses were provided in the respective ISSMPs based on compensation payments to farmers in relationship to annual abundances of geese. For Sweden this analysis has been extended and validated (Montràz-Janer et al. 2019). In case of Denmark, where compensation or subsidies are not used to support crop damage management, derogation has been used as a proxy of the intensity of crop loss. At national level, there was a relationship between Barnacle Goose numbers and licenses granted for derogation shooting (Clausen et al. 2020). In the Netherlands, retrospective analyses are also in progress (to be reported in 2021).

Predictive models to assess the relationship have so far been developed at regional levels in Norway (Baveco et al. 2017). Work is in progress in the Netherlands and Denmark (at regional level), using individual-based models and agent-based simulations, respectively (to be reported in 2021). The process of building, parameterisation and testing such models is resource demanding and cannot be rolled out easily to all Range States. Hence, at least for the foreseeable future, such models can realistically only be used for selected regions.

References

Baveco, H.M. et al. (2017). Combining modelling tools to evaluate a goose management scheme. *Ambio* 46(2): 210-223.

Clausen, K.C., Heldbjerg, H., Balsby, T., Clausen, P., Nielsen, R.D., Skov. F. & Madsen, J. (2020). Sammenhæng mellem forekomst af bramgæs og reguleringsindsats i Danmark. Scientific Report, Aarhus University, Denmark (in press).

Montràz-Janer, T., Knape, J., Nilsson, L., Tombre, I., Pärt, T. & Månsson, J. (2019). Relating national levels of crop damage to the abundance of large grazing birds: Implications for management. *Journal of Applied Ecology* 56: 2286-2297.

Annex 5. Indicator factsheets

I.1. Population size compared to the Favourable Reference Population (FRP)

Rationale

This indicator measures the progress towards the Fundamental Objective I. Maintain the population at a satisfactory level. The FRPs at national and flyway level are set in Chapter 2 of this AFMP. These FRPs corresponds to the ecological requirements part of Article 2 of the Birds Directive.

Indicator definition

The FRP will be monitored on the wintering grounds as the only feasible option to monitor the population size consistently.

Methodology

Data collection

The assessment of the FRP will be based on the 3-yearly coordinated total population counts (see Chapter 5).

Data flow

The dataflow is described in Chapter 5 of this AFMP.

Methodology for indicator calculation

Methodology is described in Chapter 5 of this AFMP.

Methodology for gap filling

Methodology for gap filling is to be agreed in 2020.

Methodology uncertainty

The pre-migration aerial surveys represent a snapshot and some flocks might be easily missed.

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

Rationale

This indicator measures the progress towards the Fundamental Objective I. Maintain the population at a satisfactory level. The population is considered to be maintained at a satisfactory level if the range is maintained at or above the level of the Favourable Reference Range, which is set (for most Range States) in Table 2 of this AFMP at the level of the 2003-2018 period.

Indicator definition

This indicator consists of two sub-indicators:

- Actual breeding range in proportion of the breeding FRR;
- Actual non-breeding (staging and wintering range) in proportion of the non-breeding FRR.

The breeding range includes the areas where nesting and brood rearing before fledging 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. Hence, the range is not restricted to key sites only, but includes all areas where the species regularly (although not necessarily) occurs annually.

Methodology

Data collection

The entire breeding range and most of the non-breeding range of this population is outside of the European Union. Consequently, there are no reporting obligations under Article 12 of the EU Birds Directive. The AEWA reporting on national population status reporting does not require Range States to report on distribution or range. Therefore, special reporting should be set up to monitor the changes in range extent.

Both the breeding and non-breeding ranges of the population should be monitored following the standards set for the reporting under Article 12 of the EU Birds Directive and use the range method described in DG Environment (2017, pp. 124-128).

Considering the high costs associated with monitoring of the breeding range in Greenland, it is proposed to update the range information only once during the lifespan of the ISSMP in 2027.

Data for the non-breeding range will be collected at the same time as for breeding range data is collected national population status reporting to AEWA (i.e. 2024). Range States are recommended to use the Range Tool⁶ developed for the reporting under Article 17 of the Habitats Directive to determine the range. The recommended gap distance for the Barnacle Goose is 140 km based on Box 3.2 in Bijlsma (2019, p. 40) using a body mass value of 1.765 kg. Information on non-breeding distribution can be obtained from the national IWC scheme, International Census of Greenland Barnacle Goose and online observation reporting portals (such as BirdTrack, eBird) active in the Range States.

Data flow

Range States should calculate the range based on their distribution mapping and report to the EGMP Data Centre by 31 December 2025.

Methodology for indicator calculation

For both sub-indicators the actual range will be compared to the national, MU and flyway level FRRs.

Methodology for gap filling

No need for gap filling is foreseen in the Range States.

Methodology uncertainty

The methodology is sensitive to changes on the edges of the range. Currently, the range method was not applied by all Range States.

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.

⁶<u>http://cdr.eionet.europa.eu/help/habitats_art17/Reporting2019/Guidelines_for_EEA_range_tool_README_.pdf</u>

II.1. Relative change in damage payments

Rationale

This indicator measures the progress towards the Fundamental Objective II. Minimize agricultural damage and conflicts. The most direct indicator would be the loss of yield of a given crop type caused by Barnacle Geese, aggregated from local to national and international levels. However, such measurements would be extremely costly and models for upscaling do not exist. Therefore, it is necessary to resort to measurable proxy indicators, such as (1) compensation payments or (2) subsidies, or management actions taken to prevent agricultural damage, such as (3) offtake under derogation.

Indicator definition

This indicator includes three sub-indicators (for definition and current use in the EGMP Range States, see Tombre et al. (2019)⁷:

- 1. Monetary compensation payments for crop damages cause by Barnacle Geese, under which farmers eligible for compensation receive public money to counterbalance for the lost crop.
- 2. Subsidy payments, i.e. farmers receiving public funds in order to allow goose grazing on their properties. Subsidies are usually paid in advance and may hence not directly reflect the level of damage.
- 3. Offtake under derogation, referring to the culling of flight-less geese (adults and young), removing of nests or eggs during summer, or geese shot outside the hunting season to protect crops.

Because the three sub-indicators are used slightly differently among Range States and do not all use a monetary currency, they will be used on a relative scale to evaluate trends in damage.

Methodology

Data collection

Data collected for the three sub-indicators at national level, species-specific and annually. Compensation payments, subsidies paid, and numbers of Barnacle Geese killed under derogation will be compiled from the national statutory authorities, who are also responsible for the quality check of the information provided. The authorities will also be asked to report any change in policies, regulations or management practices, which may influence payments or use of derogation.

Data flow

Data for each year from the period of 2020 - 2024 is to be reported to the EGMP Data Centre by 31 December 2025. Data collection shall continue also in 2025 - 2026.

Methodology for indicator calculation

The national payments and derogation information will be entered into a common database. Damage in 2020 will be set at an index of 100 for each country, and subsequent data will be indexed relatively to the starting year, taking into account the national inflation rate. An overview for all range states and the three relative sub-indicators will be updated annually.

Methodology for gap filling

No gap filling.

⁷https://egmp.aewa.info/sites/default/files/download/population_status_reports/EGMP_010_Management_measures_for_geese.pdf

Methodology uncertainty

The sub-indicators are sensitive to changes in management policies, regulations and practises. A metabase will document all the reported changes. Some countries do not have species-specific reporting of damage and can only give a rough estimate of the damage caused by Barnacle Geese. A system will have to be set up to assess the uncertainties in the reporting.

III.1 Risk of zoonotic influenza transmission to the general public

Rationale

This indicator measures the progress towards the public health component of Fundamental Objective III. Minimise the risk to public health and air safety.

Migratory geese can act as vectors of various diseases harmful to humans and poultry (Buij *et al.*, 2017) although the general risk was considered being low in the ISSMP. Risk of zoonotic influenza transmissions has been selected as an indicator because (i) its high relevance for human health, (ii) there is an ongoing surveillance programme in the EU/EEA with quarterly reports⁸. Hence, monitoring zoonotic influenza does not require additional resources from the EGM Range States. (iii) This indicator represents not only the prevalence of the virus, but also the preparedness to avoid transmissions.

Indicator definition

Number of human cases of zoonotic influenza per year in the flyway that can be attributed to Barnacle Goose.

Methodology

Data collection

No direct reporting is required by the Range States.

Data flow

Data will be obtained by the EGMP Data Centre from 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).

Methodology for indicator calculation

Number of cases per year.

Methodology for gap filling

No need for gap filling is foreseen in the Range States.

Methodology uncertainty

Attribution of the source of infection might be problematic in some cases.

References

Buij, R., Melman, T. C., Loonen, M. J., & Fox, A. D. (2017). Balancing ecosystem function, services and disservices resulting from expanding goose populations. *Ambio*, 46(2), 301-318.

⁸<u>https://www.ecdc.europa.eu/en/avian-influenza-humans/surveillance-and-disease-data/avian-influenza-overview</u>

III.2. Number of bird strikes with aircrafts caused by Barnacle Goose

Rationale

This indicator measures the progress towards the Fundamental Objective III. Minimize the risk to public health and air safety. The frequency of bird strikes with Barnacle Goose is the direct indicator for the development in incidents, cumulated from local airports to national and international levels. The risk is likely to increase with the number of Barnacle Geese passing over airports (see Indicator III.3).

Indicator definition

The indicator is the number of bird strikes caused by Barnacle Geese in commercial airports in the Range States.

Methodology

Data collection

Data collected at airport and national level, species-specific and annually. This indicator is reported as a standard in all commercial civil airports and the airport authorities attempt to make an identification of the species causing the bird strike. Airports will be asked to report:

- a) Date, time of bird strike,
- b) Species, flock size, number struck,
- c) Aircraft model,
- d) Phase of flight (takeoff, landing, descent, climb, en route).

Bird strike data will be compiled from the national statutory authorities. The authorities will also be asked to report any change in reporting practices, which may influence the indicator.

Data flow

Data for each year from the period of 2020 - 2024 is to be reported to the EGMP Data Centre by 31 December 2025. Data collection shall continue also in 2025 - 2026.

Methodology for indicator calculation

Range States will be asked to select at least three high-risk civil commercial airports within the national range of the Barnacle Goose for reporting. The frequency of bird strikes will be listed per airport and per country. An overview for all range states will be updated annually.

Methodology for gap filling

No gap filling is necessary.

Methodology uncertainty

The frequency of bird strikes with Barnacle Goose is low in most airports. Therefore, the indicator has to be combined with III.3 to give a more reliable indication of the risk.

III.3. Number of Barnacle Geese passing over commercial airports

Rationale

This indicator measures the progress towards the Fundamental Objective III. Minimize the risk to public health and air safety. The number of Barnacle Geese passing over an airport indicates the risk of bird strikes in a given airport (Indicator III.2) and can be related to the national and international levels.

Indicator definition

The indicator is the cumulative number of Barnacle Geese passing over civil commercial airports per year in the range of the Barnacle Goose, using the same airports as in III.2.

Methodology

Data collection

Data collected at airport and national level, species-specific and annually. This indicator is reported as a standard in commercial civil airports and the airport authorities attempt to make an identification of the species passing (or landing in the airport). Airports will be asked to report:

- a) Date, time of passage,
- b) Species, flock size.

Barnacle Goose passage data will be compiled from the national statutory authorities. The authorities will also be asked to report any change in reporting practices, which may influence the indicator.

Data flow

Data for each year from the period of 2020 - 2024 is to be reported to the EGMP Data Centre by 31 December 2025. Data collection shall continue also in 2025 - 2026.

Methodology for indicator calculation

Range States will be asked to select at least three high-risk civil commercial airports within the national range of the Barnacle Goose for reporting. The cumulative number of Barnacle Geese passing per year will be calculated per airport. A national trend index will be calculated. The starting year will be set at an index of 100, and subsequent data will be indexed relatively to the starting year. An overview for all range states (average national indexes and relative change) will be updated annually.

Methodology for gap filling

No gap filling.

Methodology uncertainty

The ability of species identification by bird control employees has to be checked. If some airports use radar for identification, standards for species identifications have to be defined.

IV.1 Area of natural habitat or habitat of threatened species negatively affected by Barnacle Goose

Rationale

This indicator measures the progress towards Fundamental Objective IV. Minimize the risk to other flora and fauna. The risk to other flora and fauna can be induced mainly via (1) grazing of plants, e.g. the Arctic tundra vegetation, with possible knock-on consequences for the whole ecosystem or (2) eutrophication of oligotrophic lake ecosystems by goose droppings transferred from foraging grounds to roosts. However, grazing and nutrient transport is amongst the ecological functions of geese and not necessarily a damage. Therefore, it should be assessed on a case-by-case basis and considered being a damage if it conflicts with the conservation objectives of a site.

Indicator definition

Area of natural habitat or habitat of threatened species negatively affected by Barnacle Goose. This indicator considers the natural habitats of conservation interest, which includes natural habitats listed on Annex I of the EU Habitats Directive or any other natural habitats that are of conservation interest at national level. It also includes the habitat for threatened species regardless whether the habitat is of natural origin or not. In case of

such habitats, the important factor is the presence and dependence of a threatened species on the habitat, and the structure and other characteristics of the habitat. In this context, threatened species include species that are listed on Annex I of the Birds Directive or on Annexes II or IV of the Habitat Directive or listed as threatened on a European or national Red List.

Methodology

Data collection

Range States will need to collect information from the organisations responsible for managing conservation areas on the damage caused by Barnacle Goose two times during the lifespan of this AFMP. As the damage can affect a wide range of species the extent of the habitat damaged will be used as the measurement of the damage. Site management organisations should be asked to report:

- a) the threatened species or habitats affected negatively by Barnacle Goose during the reporting period,
- b) the location, the nature of the damage and the extent of area affected.

Data flow

Data for each year from the period of 2020 - 2024 is to be reported to the EGMP Data Centre by 31 December 2025. Data collection shall continue also in 2025 - 2026.

Methodology for indicator calculation

The EGMP Data Centre will report the total area affected and also areas by habitat types or species.

Methodology for gap filling

No need for gap filling is foreseen.

Methodology uncertainty

This indicator is dependent on the judgement of the site management organisations.

V.1 Number of people enjoying watching geese

Rationale

This indicator measures the progress towards the cultural/recreational component of Fundamental Objective V. Maximise ecosystem services.

Watching geese represents an important cultural/recreational service for many people (Buij *et al.*, 2017) and the MCDA process (Johnson, 2020) has identified that several stakeholder groups valued this highly. Unfortunately, it is highly difficult to monitor the change in the recreational value of geese. Repeated socioeconomic surveys would be rather expensive. Therefore, it is suggested to use the number of people submitting Barnacle Goose observations to online observation recording portals. These portals target the general public and a very high proportion of people interested in watching birds keep records of their observations on these platforms. The main observation portals in the region all contribute to the EuroBirdPortal. This would allow obtaining data at a very low cost. Even if the indicator would probably underestimate the number of people enjoy watching geese, it is assumed it would correlate closely with the total number of people. It is proposed to focus on the number of people rather than the number of man-days because the latter would require a different level of engagement than simple enjoyment.

Indicator definition

Change in the annual number of people submitting Barnacle Goose observations to an online portal that contributes data to the EuroBirdPortal.

Methodology

Data collection

No direct reporting is required by the Range States.

Data flow

Data will be obtained by the EGMP Data Centre from EuroBirdPortal

Methodology for indicator calculation

An annual index of the number of people submitting goose observations to the online portals will be calculated for each country and aggregated at MU and flyway level.

Methodology for gap filling

No need for gap filling is foreseen in the Range States.

Methodology uncertainty

The index might also change if the number of users is changing and it should be tested whether this has any influence on the index.

References

Buij, R., Melman, T. C., Loonen, M. J., & Fox, A. D. (2017). Balancing ecosystem function, services and disservices resulting from expanding goose populations. *Ambio*, 46(2), 301-318.

VI.1 Relative change in cost of goose management

Rationale

This indicator measures the progress towards the Fundamental Objective VI. Minimize costs of goose management. An indicator for the successful fulfilment of this objective is that the measurable administrative costs for dealing with the many facets of goose related management and conflict are reduced with the progressive implementation of the ISSMP for the Barnacle Goose.

Indicator definition

This indicator is defined by the number of administrative man-years spent on the management of Barnacle Gooose in the Range States, including program management, communication with users, number of field assessments made, reporting (from local to international levels).

Methodology

Data collection

The EGMP Data Centre will send out a questionnaire to each Range State asking for administrative costs spent on goose management activities at various governance levels (local, regional, national).

Data flow

Data for each year from the period of 2020 - 2024 is to be reported to the EGMP Data Centre by 31 December 2025. Data collection shall continue also in 2025 - 2026.

Methodology for indicator calculation

The number of man-hours divided into different levels of governance and tasks will be amalgamated for each country and be presented in an international overview at 6- year intervals.

Methodology for gap filling

No gap filling.

Methodology uncertainty

It is important to standardize the questionnaires, but due to differences in national organisation of goose management, they will have to be tailored specifically. For some countries it may be difficult to make a quantitative assessment, and it may be necessary to resort to a qualitative assessment (increase, stable, decrease).

Annex 6. Protocols for the iterative phase

Monitoring, assessment and decision-making protocols will be developed by the EGMP Data Centre after the adoption of the AFMP.