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DEFINING FAVOURABLE REFERENCE VALUES FOR THE BARNACLE GOOSE *(Branta leucopsis)*

(Russia/Germany & Netherlands Population

East Greenland/Scotland & Ireland Population

Svalbard/South-west Scotland Population)

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The 4th Meeting of the AEWA European Goose Management International Working Group is being hosted by Scottish Natural Heritage.

DEFINING FAVOURABLE REFERENCE VALUES FOR THE BARNACLE GOOSE *(Branta leucopsis)*

Background

The International Single Species Management Plan (ISSMP) for the Barnacle Goose (*Branta leucopsis*) (Jensen et al. 2018) aims to maintain the populations in a Favourable Conservation Status (FCS) and states that Favourable Reference Values (FRVs) for population size, habitat and range are to be established in the Adaptive Flyway Management Plans (AFMPs) by the European Goose Management International Working Group (EGM IWG). Although the Barnacle Goose ISSMP does not foresee setting any population targets, defining FRVs is necessary to provide agreed benchmarks to assess the cumulative impact of derogation measures and hunting[1] against the goal of maintaining the populations in an FCS.

The 2nd AEWA International Management Planning Workshop for the Barnacle Goose and the Greylag Goose (NW/SW population) held in Leeuwarden, the Netherlands on 19 June 2018 has agreed that the process of setting the FRVs will follow the principles set out in the EU guidance documents (Bijlsma et al. 2019)[2].

This document presents the results of the assessment process following the stepwise process outlined in Bijlsma et al. (2019)[3] and presents some options to define FRVs for the three Barnacle Goose populations.

Action requested from the EGM IWG

The EGM IWG is requested to review the assessment and agree on the preferred options and ways forward to define the FRVs for all three populations of the Barnacle Goose. Only one of the options ('aggregated SPA-level FRPs') would require further modelling or expert input.

[1] Hunting in countries and territories where hunting is allowed such as Russia, Iceland and Greenland.

[2] The Netherlands made a disclaimer with regard to the use of this approach for other Birds Directive related subjects, in order to avoid setting a precedent in using this approach.

[3] The document on defining and applying the concept of Favourable Reference Values for species and habitats under the EU Birds and Habitats Directives (Bijlsma et al., 2019) is a technical report that presents a common methodology for setting FRVs under both directives in agreement with the Explanatory Notes and Guidelines for reporting under Article 17 of the Habitats Directive for the period 2013–2018 (http://cdr.eionet.europa.eu/help/habitats_art17). The disclaimer of the document states that in case of conflicting definitions, approaches or examples, the above mentioned official guidelines takes precedence.

Step 1.1 Biology of the Species

The biology of the species is described in Annex 1 of the ISSMP for the Barnacle Goose and is not repeated here. Only information relevant for the application of the FRV guidance not mentioned in the ISSMP is added here.

Average body mass: 1.8 kg[4].

Step 1.2 Spatial Scale of Functioning

Breeding Population

The species home range size is estimated at 37x1.8 = 67 kilometres, using the allometric relationship with body mass[5]. The species dispersal capacity is estimated at $12x67^{0.5}$ = 98 kilometres. This means that populations more than 5*98 = 490 kilometres apart can be considered as isolated.

The three Arctic breeding ranges (East Greenland, Svalbard, Russia) are separated from each other by larger distances than 490 kilometres and there is only very limited exchange between these populations (Black et al. 2014). Although both the Baltic and the North Sea Management Units (MUs) are also further than 490 kilometres from the MU breeding in the Russian Arctic, there is substantial interaction between these MUs (van der Jeugd & Litvin 2006). This is consistent with the treatment of the populations adopted in the ISSMP.

Therefore, we propose to treat the flyway breeding populations as category MR3[6] and set the FRVs at supranational level[7].

Wintering Population

The three flyway populations have separate wintering areas:

- East Greenland breeding birds winter in Scotland & Ireland;
- Svalbard breeders in Southwest Scotland;
- Russian and Baltic breeders in the Netherlands and Germany together with resident birds from the North Sea areas.

These populations correspond to category MNR3: Species with one or a few isolated non-reproductive populations for which FRVs are to be set at supranational level. This treatment is also justified by the fact that an increasing number of birds winter further north in response to climatic changes and further range shifts are to be expected. Hence, the total population size is more relevant than national population sizes to judge the conservation status of the population in the non-breeding season.

[4] This information will be required for allometric calculations in subsequent steps

[5] For further details on the allometric relationship between home range and dispersal distance with body mass see Box 3.2 in Bijlsma et al. (2019).

[6] See Table 3.1 in Bijlsma et al. (2019)

[7] The proposed treatment would be consistent with the treatment of the Dunlin (*Calidris alpina*) in Bijlsma et al. (2019).

Step 1.3 Historical Perspective: What Happened to the Species?

It is not possible to quantify the species' historical numbers and distribution other than stating that historical numbers were larger than in the 1950s and it was an exclusively Arctic breeding species. The population sizes have been estimated for all three populations since the 1950s based on winter or spring counts. Since the end of the 1950s, all three populations have increased substantially (see Section 4 in the ISSMP).

At the time the EU Birds Directive came into force, in 1979, all three populations had already started recovering, but the wintering population concentrated on a few sites. This has led to listing the species on Annex I of the Birds Directive. According to Tucker & Heath (1994) over 90% of the species' population has concentrated on ten sites (eight in the Netherlands and two in the UK). Therefore, the species was also listed as Species of European Conservation Concern Category 4. However, the species has not qualified anymore under the criterion "Localised" a decade later as a consequence of the population growth, and its conservation status was considered "Secure" by BirdLife International (2004). Of the three populations, currently only the Svalbard/South-west Scotland population is considered qualifying under criterion (a)[8] for Category 3 of Column A or Category 2 of Column B of AEWA Table 1.

Degradation of feeding conditions due to reduction in grazing livestock on island feeding grounds in Ireland/Scotland and Norway were considered as a threat to both the Greenland and the Svalbard population. However, the populations switched to more intensively managed fields and continued increasing (Black et al. 2014).

Step 1.4 Analysis of Distribution and Trends

Breeding Population

Distribution and breeding population data is available in BirdLife International (2015) and in Table 4 of the ISSMP. All Arctic breeding populations are increasing. Traditionally, the Russian population was confined to Novaya Zemlya and Vaygach islands, but it has expanded its breeding range to the Kola and Kanin Peninsulas to the west, both on the islands and on the mainland. It has established itself in the temperate zone in the early 1970s. It is increasing in all temperate zone breeding range states in the long-term but decreasing locally in Gotland and Öland in Sweden and in Estonia in the short-term.

The size of the total breeding range of the species is 5,700,000 km^2 (BirdLife International 2019), of which 155,000 km^2 is in the EU27 (EEA 2015) where the species did not occur historically. As the maps in EEA (2015) and, on finer details, the Dutch bird atlas[9] show, colonies are spreading increasingly inlands from coastal areas.

The potential range of the breeding population is difficult to model because it is discontinuous in climatic space reflecting recent colonisation of the Baltic and North Sea regions and no good models are available (Huntley et al. 2007). Consequently, the impact of climate change on the breeding range also cannot be reliably predicted.

Although BirdLife International / European Bird Census Council (2000), BirdLife International (2004, 2015) and the ISSMP all provide breeding population size estimates at different point in time, these are typically derived by back-calculation from counts, age-ratio and brood-size assessments at the wintering ground (see the formulas e.g. in Black et al. 2014). However, it is important to note that it is only possible to estimate the number of potential breeders (representing the potential maximum) and the successful breeders (representing the absolute minimum) from such counts on the wintering areas. It is not possible to estimate the real number

[8] Concentration onto a small number of sites at any stage of their annual cycle.
[9] https://www.vogelatlas.nl/atlas/soorten/soort/1670

of breeding pairs (i.e. the number of pairs attempted to breed) on the Arctic breeding grounds with high degree of certainty. Figure 1 shows that published estimates of breeding numbers are sometimes inconsistent with the back-calculated figures.

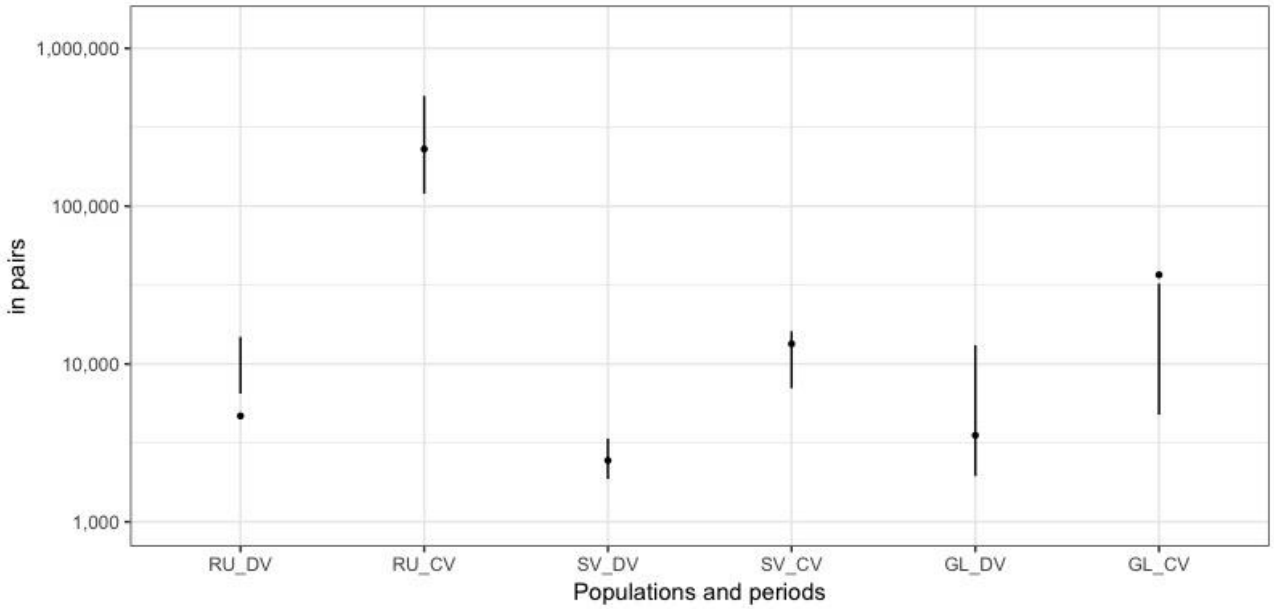

Figure 1. *Comparison of geometric mean of published size estimates in pairs (dots) with the range defined by the number of successful breeding pairs (lower end of the vertical lines) and number of potential breeding pairs (upper end of the vertical lines) back-calculated from winter or spring censuses. The first two letters indicate the populations: GL = East Greenland/Scotland & Ireland, RU = Russia/Germany & Netherlands, SV = Svalbard/South-west Scotland. DV and CV represent Directive and Current Values respectively.*

Wintering Population

According to the ISSMP, the total wintering population of the Russia/Germany & Netherlands population was estimated around 1.2 million individuals in 2014. The Russian MU has increased by 7.8% per year, while the Baltic/North Sea MUs around 25% annually. The Svalbard/South-west Scotland population has grown at an annual rate of 6.6%, increasing from 1,350 birds in 1958 to 41,700 in 2016/2017. The East Greenland/Scotland & Ireland population has grown at an annual rate of 3.6% up to 80,670 birds in 2013, while the latest estimates from the March 2018 international census gives a total population size estimate of 72,162 individuals.

Conclusions

None of the populations of the Barnacle Goose show a negative trend since when the EU Birds Directive entered into force and even since the 1960s. This Arctic breeding species has established itself and is expanding rapidly in the temperate zone.

The wintering numbers also do not show a negative trend over the same period. It is not restricted to a small number of sites anymore. The growth of the populations is driven by a combination of protection and improved feeding conditions on agricultural areas.

Step 2.1 Favourable Reference Population (FRP) Assessment

Breeding Population

As noted under Step 1.4, the status of the population is traditionally monitored based on counts at the wintering grounds and published breeding population estimates represent a mixture of estimates based on surveys in the breeding areas and back-calculation from counts at the wintering grounds. However, all three populations are highly separated. Therefore, it is sufficient to estimate the FRPs based on wintering populations[10].

Wintering Population

The wintering population trends are presented in Figures 6-8 of the ISSMP. All three populations show (almost constant) increase since the beginning of counts. Historically, these trends can be regarded as a recovery from a historical low point in the 1950s, but it is unclear whether Current Values (CVs) are larger than at any time in history considering that release from limited carrying capacity in the wintering areas might have contributed to the population growth.

DVs for wintering populations are:

- Russia/Germany & Netherlands: 47,919 individuals in 1979 (van der Jeugd et al. 2009);
- Svalbard/South-west Scotland: nearly 9,050 individuals in 1980/81 (Ogilvie 1981);
- East Greenland/Scotland & Ireland: 33,815 individuals in 1978 (Ogilvie 1983).

Although, only application of reference-based approaches is recommended for wintering populations by Bijslma et al. (2019), we argue that using a population-based approach should also be applicable in the case of populations showing such a small degree of mixing as the Barnacle Goose ones do. Although there are various PVAs available for the Svalbard/South-west Scotland and East Greenland/Scotland & Ireland populations (the latest ones in Trinder et al. 2005, Trinder et al. 2014), these do not estimate MVP, but only extinction risk under various off-take scenarios. Therefore, we approximate the upscaled allometric MVP threshold using the standard conversion factor of 3 (i.e. 2,500 pairs x 3 = 7,500 individuals)[11].

Options for Setting FRVs

All three Barnacle Goose populations have increased since population size estimates are available and there are no suitable historical reference points for any of the populations before the EU Birds Directive came into force. In this respect, the situation is comparable to the Greylag Goose.

Setting FRVs for the Barnacle Goose populations however, is more challenging than for Greylag Goose, because it is listed on Annex I of the EU Birds Directive and not on Annex II. This means that it would be inconsistent with the species Annex I status, to apply Option 3 in Step 2 in Section 4.3.2 in Bijlsma et al. (2019)[12], that makes it possible to define the FRP at DV or at the upscaled MVP[13]. This is because the Annex I listing indicates that the DVs represent an unfavourable conservation status. Although the DVs were around or exceeded the upscaled allometric MVP, the species concentrated on a small number of sites.

[10] This suggestion is analougus with the Gannet example in Bijlsma et al. (2019), only the role of the seasons is reversed.
[11] This might be inaccurate in case of Barnacle Goose, but it has little practical consequence as it is explained in the next section.
[12] "*A species' population size can have increased after the BD came into force not as a consequence of restoration/improvement of natural conditions but due to unnatural human influences. In this case, we suggest to set FRP equal to DV (if DV exceeds upscaled MVP), despite a higher current value*".
[13] Whichever one is the higher.

An alternative approach could be to set the FRP at CV as suggested in Box 3.3 in Bijlsma et al. (2019). This choice would preserve the status quo, but it would preclude adapting population levels, taking into account economic requirements once the ecological requirements enshrined in the FCS concept[14] are satisfied. This option would also neglect that this Arctic breeding species has not only recolonised its former range, but it has expanded into the temperate zone. The overall population growth has already led to increased human-wildlife conflicts and the range expansion has also changed the temporal patterns of such conflicts because the seasonal pattern of damages and risks have changed. Therefore, some Range States have already found it necessary to reduce the size of the population. However, a population reduction equivalent to c. 10% in three generations would lead to a classification of the population as declining and consequently to an unfavourable conservation status (see criteria in EEA 2014). This might trigger the European Commission to conclude that derogations that cause relatively small but statistically significant declines (>3% in 10 years[15]) would be already incompatible with the provisions of the Birds Directive.

The 'wait-and-see' approach is also advocated in Bijlsma et al. (2019) for formerly threatened species that are naturally expanding. This means to wait until population size and distribution has stabilised. This approach might work well in the case of species that do not cause damage or represent risk to other interests[16], but would not be a logical choice in the context of management planning, as it would not provide any benchmark to assess the cumulative impact of derogations and hunting on the conservation status of the populations.

The solution to the above dilemma might be to recognise that Special Protection Areas (SPAs) under the EU Birds Directive were designated for the species across its wintering range and that EU Member States shall maintain Barnacle Goose also in FCS at the level of these sites. These obligations under the EU Birds Directive are also consistent with Means Objective 1 of the ISSMP. This means that the population-level FRPs could be derived by aggregating the site-level FRPs. As (i) designation of SPAs has happened over an extended period and (ii) the populations have concentrated on a small number of sites when the Birds Directive came into force as well as (iii) the site-level FRPs might be higher than the population level was at the time of the site designation, the population-level FRPs derived by summing up the SPA-level FRPs would be certainly higher than the DV but lower than the CV. Being consistent with the site management objectives, they would provide a more appropriate benchmark for management under derogation than the CV or the 'wait-and-see' approaches. Wintering Range States are requested to provide the SPA-level FRPs to the EGM Data Centre as part of their contribution of data to compile Box 1 for the AFMPs. If no site-level FRP has been set yet, the FRP should be set as a minimum at the population size at the time of designating the site.

In the case of the Svalbard/South-west Scotland population an alternative option could be to accept the FRP of 25,000 individuals defined in the flyway plan developed in the mid-1990s with the participation of the statutory agencies of Norway and the UK (Black 1998) taking into account available suitable habitats along the flyway and policy requirements such as the AEWA Table 1 criteria. Range States of that population might consider elaborating further on the FRVs established in that plan.

The numerical consequences of the various options are summarised in Table 1.

[14] I.e. Habitats Committee (2004) defines the FRP as the „*Population in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species"*

[15] Taking into account of the 10.5 years generation length for the species.

[16] E.g. it was proposed for Great White Egret (*Ardea alba*) in Bijlsma et al. (2019).

Table 1. *Summary of the possible FRPs under different options*

Population Season	DV	CV[17]	'wait-and-see'	Aggregated SPA-level FRPs
Russia/Germany & Netherlands				
Wintering	c. 50,000 ind.	c. 1,200,000 ind.	Not set	To be defined
Svalbard				
Wintering	c. 9,000 ind.	c. 42,000 ind.	Not set	25,000 ind. based on Black (1998) or to be defined
Greenland				
Wintering	c. 34,000 ind.	c. 80,000 ind.	Not set	To be defined

Step 2.2 – Favourable Reference Range (FRR) Assessment

The FRRs depend on the options selected to set the FRP. However, Range States would have an obligation, both under AEWA and the Birds Directive, to maintain the range of the species, also including the naturally colonised breeding areas. Therefore, it is suggested to define the FRR as the CV.

[17] Taken from Section 4 of the ISSMP

Abbreviations

CV	Current Value (population level reported in Powolny et al. 2018)
DV	Directive Value (population level at the time the EU Birds Directive has entered into force)
EU	European Union
FRP	Favourable Reference Population
FRR	Favourable Reference Range
FRV	Favourable Reference Value
MR1	Reproductive population of a widespread migratory species with more or less continuous distribution (often crossing national boundaries) and populations (assessment units) with more or less exchange at or below national level, for further explanation see Bijlsma et al. 2019
MNR3	Non-reproductive population of a migratory species with one or a few isolated populations, for further explanation see Bijlsma et al. 2019
MVP	Minimum Viable Population
NW/SW	Northwest/Southwest
PVA	Population Viability Analysis

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