AEWA EUROPEAN GOOSE MANAGEMENT PLATFORM

WORKSHOP FOR THE REVISION OF THE INTERNATIONAL SINGLE SPECIES MANAGEMENT PLAN FOR THE SVALBARD POPULATION OF THE PINK-FOOTED GOOSE

8-9 October, Levanger, Norway

DRAFT ANNEX 1

BIOLOGICAL ASSESSMENT

1. Distribution throughout the annual cycle

The Svalbard population of the Pink-footed Goose[1] traditionally breeds in Svalbard, as well as on Bear Island in the Barents Sea south of Svalbard. The main breeding grounds in Svalbard are found along the west coast and in the western and northwestern fjords, and only smaller numbers are also found nesting on the east side of Svalbard (https://goosemap.nina.no/goosemap_eng/Startpage.aspx). Few scattered breeding records are reported from Finnmark in northern Norway (European Breeding Bird Atlas 2; https://ebba2.info/maps/species/Anser-brachyrhynchus/ebba2/breeding/). However, systematic surveys are lacking. Within the last one to two decades, the Pink-footed Goose started to breed on the western part of Severny Island, in Novaya Zemlya, north Russia (Madsen et al. 2023).

In Svalbard, immature and failed breeders of Pink-footed Geese undertake a moult migration to the eastern part of the archipelago, where flocks of flightless geese gather along coasts or on larger lakes (Glahder et al. 2007). Breeding pink-footed geese moult their flight feathers during the brood-rearing period and stay relatively close to the nesting grounds.

In autumn, the pink-footed geese from Svalbard migrate non-stop to staging areas in Trøndelag in mid-Norway and onwards to wintering grounds in western Denmark, The Netherlands and Flanders in Belgium. The vast majority of geese bypass Germany on migration; however, surveys and GPS-tagging has shown that in autumn flocks of pink-footed geese increasingly roost and forage in Schleswig-Holstein, Germany, night-time roosting in Rickelsbüller Koog just south of the border to Denmark, and foraging in southwest Jutland or in the north of Schleswig-Holstein (J. Madsen unpubl. data). Furthermore, small flocks of pink-footed geese are observed in Lower Saxony during autumn and winter.

In early spring, the pink-footed geese concentrate in west and northwest Jutland, Denmark, and migrate to spring-staging areas in Trøndelag in mid-Norway. From there, some of the geese migrate to stopover sites in Vesterålen in north Norway, from where they migrate to Svalbard; however, some geese make a non-stop migration from Trøndelag to Svalbard (Fig. 1).

Within the last two decades, flocks of pink-footed geese started to appear in the Örebro area in south Sweden in autumn and spring as well as in the Oulu area in western Finland in spring, i.e. far away from the tradition migratory path. Resightings of neckbanded individuals confirmed that the geese came from the traditional flyway. Numbers have rapidly increased, going from less than 100 birds around the year 2000 to close to 10,000 in the spring of 2024. GPS-tagging of geese caught in the Oulu area in the springs of 2018 and 2019 showed that around half of the tagged individuals migrated to Svalbard while the other half migrated to Novaya Zemlya (Fig. 1). The geese migrating to Novaya Zemlya were shown to breed there (Schreven et al. 2021). In autumn the Novaya Zemlya geese migrate back to south Sweden, with some individuals making stopover in the Oulu area as well in recent years. As winter sets in, the geese migrate further to southeast Denmark or northwest Denmark; some individuals also go to Belgium and The Netherlands. In spring, the Novaya Zemlya geese migrate from Denmark back to south Sweden and onwards to Oulu. However, some individuals also follow the Svalbard birds to Norway and cross over to Oulu from there.

[1] Throughout this document the population is termed as the Svalbard population regardless that the current population also breeds in Novaya Zemlya.

2. Habitat requirements

On the breeding grounds in Svalbard, the pink-footed geese exploit lowland wet, mesic and dry tundra vegetation, foraging on a variety of plants (graminoids, herbs, Equisetum, mosses) and plant parts (roots, rhizomes, leaves, seeds) in a spatial and temporal pattern dependent on snow melt and timing of availability, growth season and peaks in quality of food plants (e.g., Fox et al. 2009). At the time of snowmelt, pink-footed geese exert so-called 'grubbing', pulling out roots and rhizomes from the thawing moss carpet or soil (Fox, Francis & Bergersen 2006). As the pink-footed geese are able to defend themselves and their goslings against Arctic Foxes, they can forage inland during brood rearing when the adults are flightless; however, when non-breeders gather to shed their flight feathers, they are confined to foraging close to open water (coasts, rivers, larger lakes) where they can seek refuge. Pink-footed geese nest on south facing slopes, typically in *Dryas* vegetation, or on small hillocks in more flat terrain in lowland areas.

Outside the breeding areas, the pink-footed geese almost exclusively forage in agricultural habitats, ranging from extensively grazed grasslands (the traditional habitat) to cropland, utilizing green parts of pasture grass, clover or cereals, newly sown cereals, waste after harvest such as spilt grain, maize, potatoes, carrots or sugar beet (Fox et al. 2005; J. Madsen unpublished data). At night, the geese typically roost communally on sheltered coasts, lagoons, lakes or larger rivers and fly inland to feed in wide open fields in vicinity of the roosts, however, very dependent on the food resource. Within the last two decades, the increasing growth of maize in northwest Europe has provided pink-footed geese with a novel energy rich resource, and geese fly up to 45 km from the roosts to feed in maize stubble fields (Clausen et al. 2018a). This has increased the available range and habitat as well as the migratory behaviour of the population, the majority nowadays staying in Denmark throughout the winter (Clausen et al. 2018b).

3. Productivity and survival

The productivity of the Svalbard population of the Pink-footed Goose is strongly affected by the timing of the snow melt. The Pink-footed Goose is a 'capital breeder', building up body fat stores, mating and females starting the development of follicles in the spring staging areas in Norway as a prelude to breeding in Svalbard (Klaassen et al. 2017). In years with early snow melt, nest sites are readily available, and the females can start egg-laying shortly after arrival and their likelihood of hatching successfully is high because they have sufficient body reserves to stay on the nest thereby reducing the risk of predation by Glaucous Gulls and Arctic Skuas and, for males, to protect the nest and female against predation by Arctic foxes. In years with late snow melt, geese may have to wait for nest sites to become available for weeks. Many geese give up the breeding attempt, and the likelihood of hatching successfully is sharply reduced because females increasingly leave the nests to feed, exposing the nest to predation (Madsen et al. 2007).

The effect of the timing in snow melt on the nesting propensity and success is reflected in the overall productivity of the population. Age-ratio counts performed in goose flocks in the autumn has been carried out since 1980 and show highly fluctuating breeding success (Ganter & Madsen 2001), however with some biases due to the timing and spatial distribution of the age counts (Jensen, Johnson & Madsen 2023). Using an integrated population model (Johnson et al. 2020), it has been possible to estimate the post-breeding productivity of the population (i.e., prior to the departure from Svalbard and harvest on the autumn staging areas). During 1992-2024, the post-breeding proportion of young averaged 0.19 (se = 0.01). Productivity has generally increased over the period of record and is highly correlated with the

increasing number of days in which the mean air temperature is above freezing in May in Svalbard as a proxy for the timing of snow melt (Fig. 1) (Johnson et al. 2024).

Between 1990 and 2021, a capture-mark-recapture program based on neckbanding and metal ringing has provided estimates of the adult survival in the Pink-footed Goose (see Kéry, Madsen & Lebreton 2006). The program was recently stopped due to financial constraints. However, the integrated population model set up as part of the implementation of the adaptive harvest management program in 2013 continues to provide annual posterior estimates of survival. The model suggests a strong effect of harvest rate. Posterior estimates of annual harvest and survival rates of the flyway population are provided in Fig. 3. Harvests and harvest rates were increasing prior to 2013 but have been somewhat stable since. In recent years, harvest has decreased substantially in Denmark (Johnson et al. 2024). Estimates of annual survival have generally decreased during the entire period of record (from above 90% in the early 1990s to around 80% in the 2010s), although there is a high degree of uncertainty associated with the estimates in the last few years (due to the cessation of the capture-mark-recapture program).

4. Population size and trends (chapter extracted from FRP report)

Population census data for the Svalbard population of the Pink-footed Goose go back to the 1930s, when the wintering population was estimated at 5,000-8,000 individuals (Madsen 1982). Numbers increased to 8,000-12,000 in the 1940s and 1950s, and this increase continued in the 1960s and 1970s. By 1980, the population size had reached 27,000 individuals. The growth continued until the 2010s. Since then, the population size is estimated to have fluctuated between 72,000 and 90,000 in spring based on an integrated population model; Johnson et al. 2020) (Fig. 4). See Johnson et al. (2024) for adaptations in survey methodology and model. The causes behind the continued increase since the 1940s are mainly attributed to better protection from hunting, such as ban of spring shooting in Denmark since 1965, a national hunting ban in The Netherlands since 1976 and in Belgium since 1981 (with local bans instigated from 1958 onwards). The impact of hunting was corroborated by an analysis of ring recoveries showing an increase in adult survival from 1955-1974 to 1975-1983 (Ebbinge et al. 1984). Climate change giving rise to milder winters and land use changes (growth of winter cereals and maize) may also have contributed to better winter survival (Kéry, Madsen & Lebreton 2006). There are no signs of density-dependent regulation of the current population size (based on integrated population simulations; F. Johnson per. comm.). Hence the current stabilisation in population size is primarily an effect of the current adaptive harvest management program with the objective to stabilise the population at a target of 60,000 (±10,000) individuals and not a sign of density dependence regulation.

5. References

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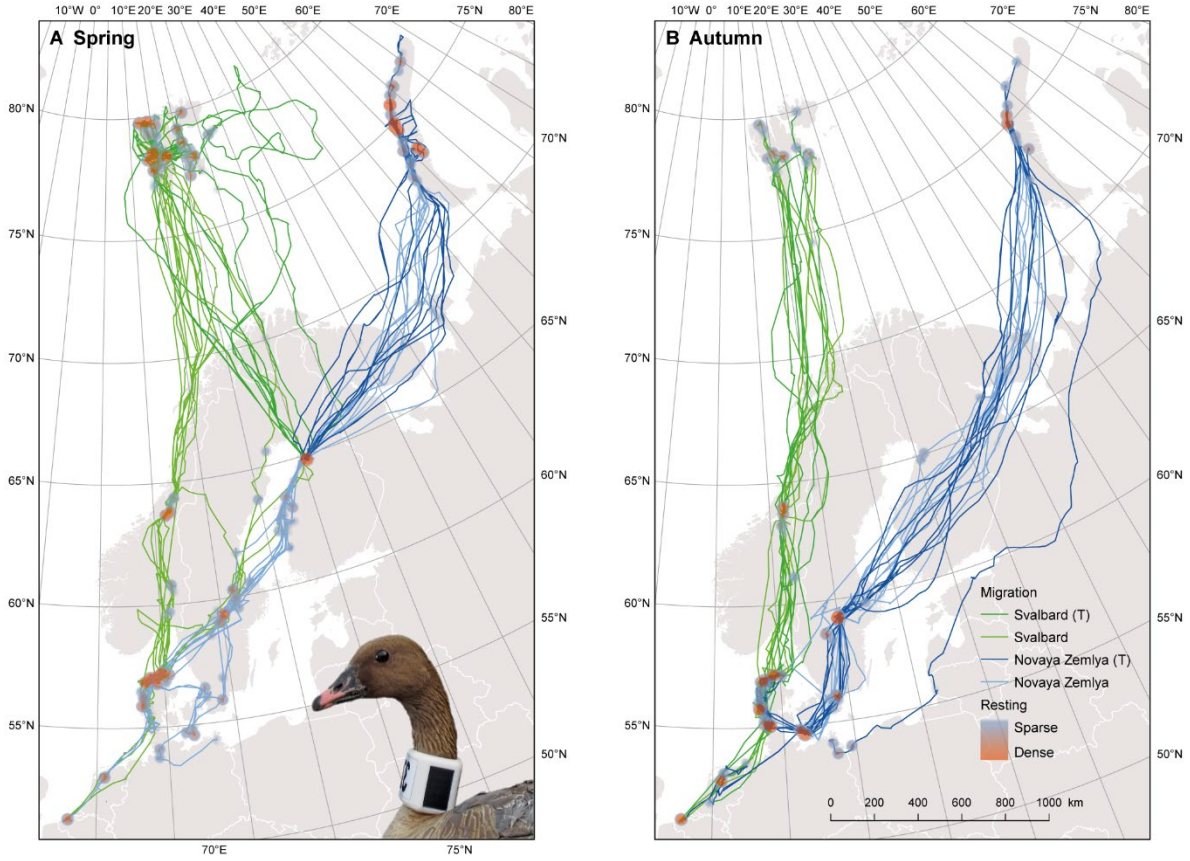

Figure 1. Migration routes taken by pink-footed geese marked and tagged with GPS-transmitters in Oulu, Finland, spring 2018 and 2019 and breeding records in Novaya Zemlya. (A) Spring migration routes (towards Svalbard versus Novaya Zemlya) in the year of tagging (T) and in the subsequent two years (January-August). Insert photo shows individual marked with neckband GPS-tag with solar panel. (B) Autumn migration routes in the autumn after tagging (T) and in the subsequent two years (September-December). A heat map is used to show areas where geese stopped (for resting, foraging, nesting). Source: Madsen et al. Current Biology (2023).

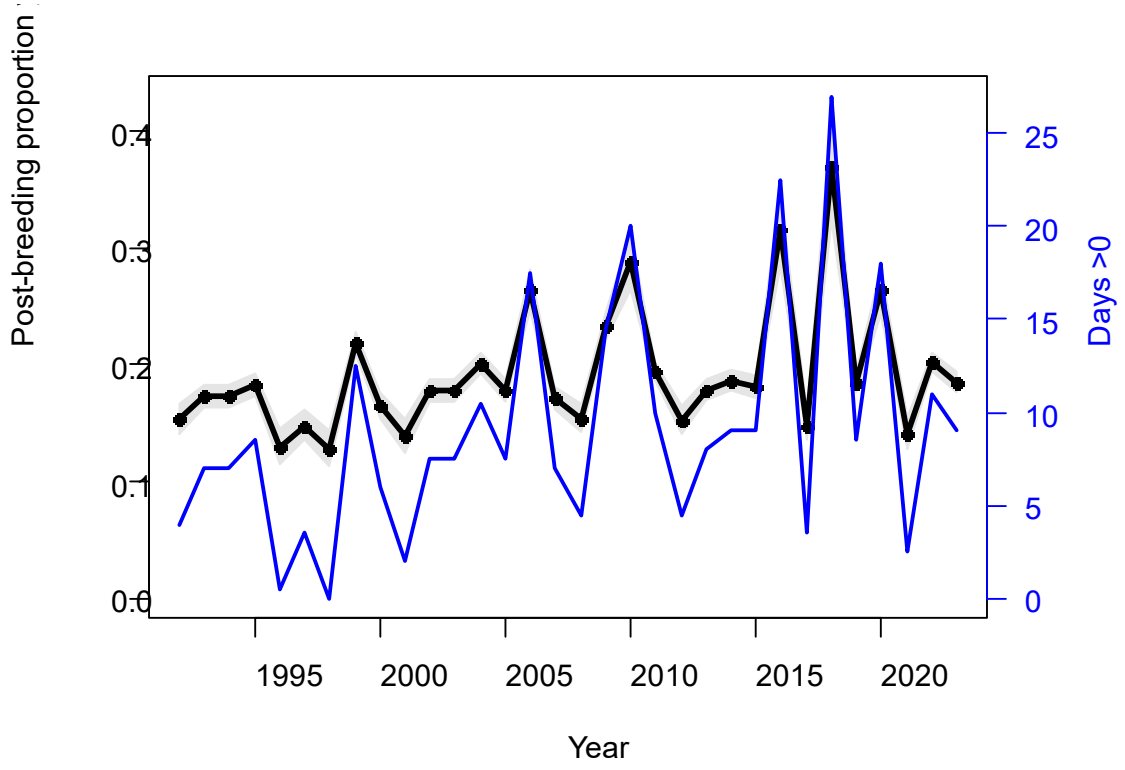

Figure 2. IPM-based estimates of the post-breeding proportion of young for Svalbard Pink-footed Geese (95% credible intervals are indicated by shaded polygon). In blue are the number of days above freezing in May in Svalbard. Source: Johnson et al. (2024).

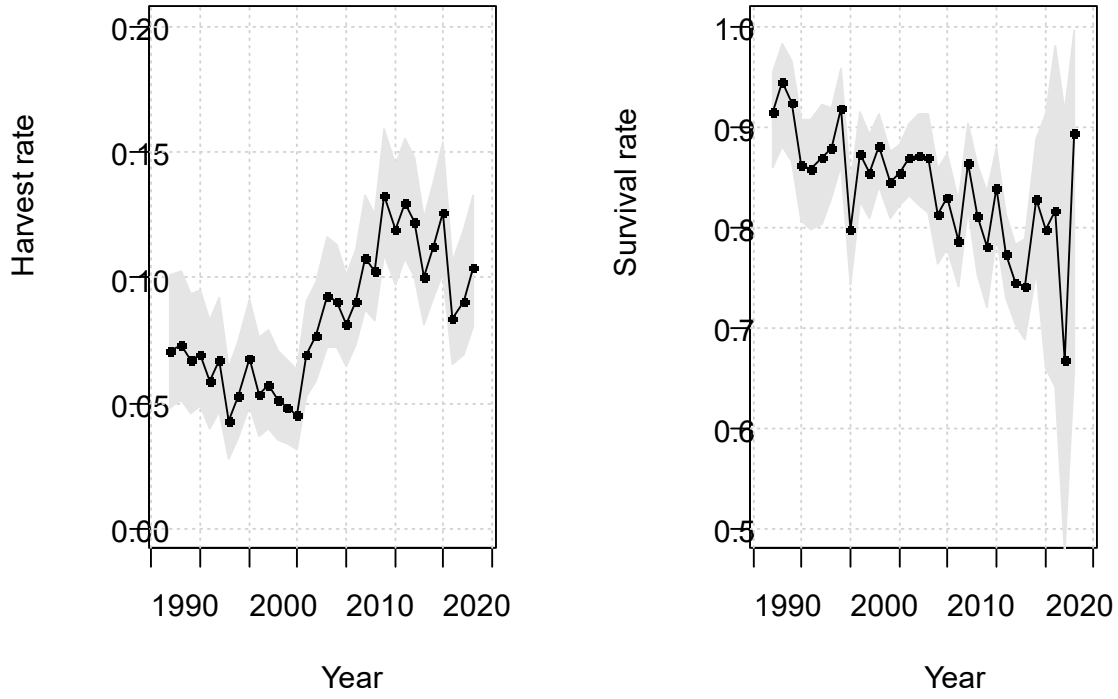

Figure 3. IPM-based estimates of harvest and annual survival rates of adult Svalbard pink-footed geese (95% credible intervals are indicated by the shaded polygons). The apparently large increase in annual survival in 2023 should be viewed with some skepticism. Source: Johnson et al. (2024).

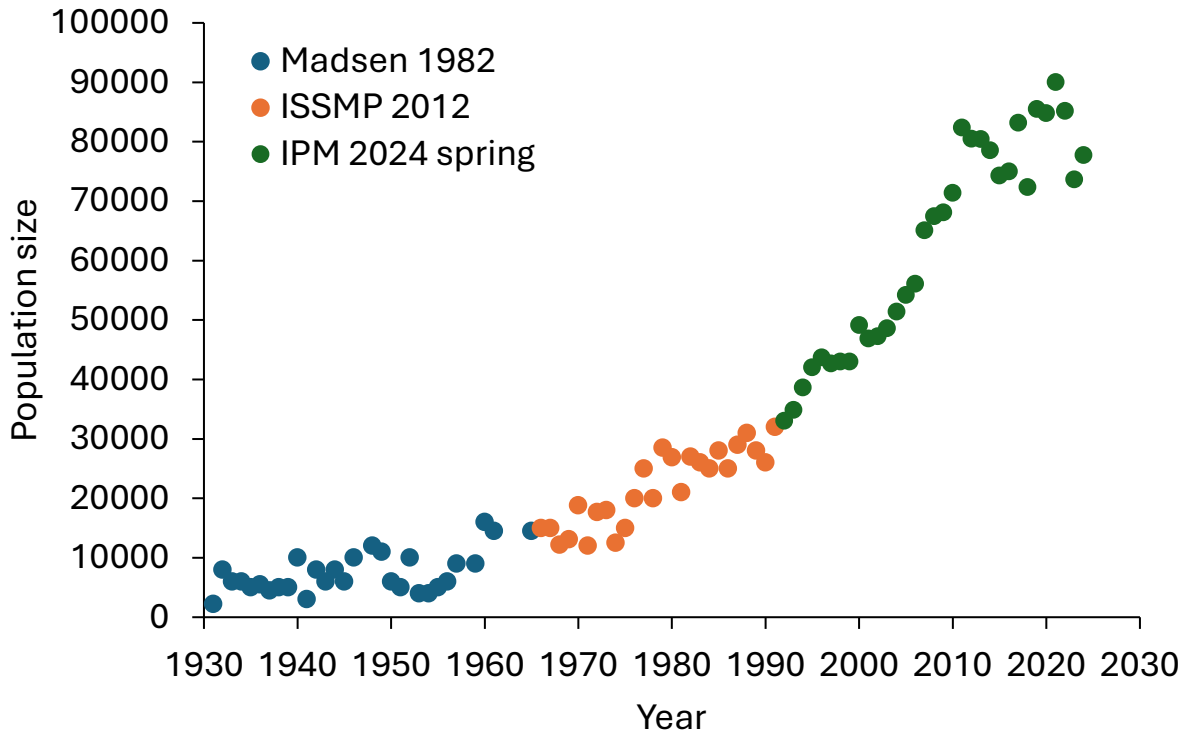

Figure 4. Trajectory of the Svalbard population of the Pink-footed Goose, 1931-2024, based on censuses (Madsen 1982; ISSMP 2012, referring to Madsen and Williams 2012) and outputs from the integrated population model used to estimate the spring population size under the EGMP (IPM 2024 spring; only median values shown).