The Swedish Wing Survey

Status evaluation of the Swedish Wing Survey in 2023 and 2024

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Content

1 Introduction

Aarhus University, Department of Ecoscience/DCE (National Center for Environment and Energy) was contracted by the Swedish Association for Hunting and Wildlife Management to provide an evaluation of the Swedish Wing Survey.

The Swedish Wing Survey is based on voluntary contributions by hunters, sending in wings from shot ducks and geese, and is managed by the Swedish Association for Hunting and Wildlife Management. The survey was launched in 2023 and has been running in the hunting seasons 2023/24 and 2024/25.

The aim of the survey has been to improve the knowledge of the hunting bag of waterfowl, specifically with respect to sex and age composition and seasonal timing of the annual bag, enabling more detailed and informed assessments of the implication of hunting on the population dynamics of huntable species, and to enable improved hunting management if needed.

Following the first years of running the wing survey, the scheduled evaluation was planned to focus on the following bullets:

- How a Swedish wing survey can contribute to an improved Swedish management of huntable bird species.
- How wing survey data may fit in an international context.
- Identify operational deficiencies and suggest improvements.
- Suggest how the wing survey can be integrated in the Swedish game management for optimal deliveries to national and international bodies.

The present report provides an assessment of these bullets. It also includes a brief overview of the data collected by the Swedish Wing Survey up to the hunting season 2024/25, which is authored by the Swedish Association for Hunting and Management. Data collected by the Swedish Wing Survey has previously been published on a national level, but also in collaboration with the international Waterfowlers Network (Midtgaard *et al.* 2025), an initiative launched by seven Northwest European countries with the aim of enhancing populations of migratory birds through international projects and collaboration on data collection, sustainable harvest and improvement of habitats for migratory water birds.

2 The Swedish Wing Survey

Information and data presented in this section is authored by the Swedish Association for Hunting and Management to provide an overview and current status of the Wing Survey.

2.1 History and description of the Wing Survey

Since 1938, through the voluntary efforts of hunters, the Swedish Association for Hunting and Management have collected data on the number of birds harvested in Sweden. To supplement the national bag collections, wing collection have been used periodically to determine the age and sex of the harvested birds during smaller periods, most recently in 2007. Historical data has provided knowledge, which has been crucial in discussions on matters such as the length of hunting seasons. In 2023 a new wing survey program was launched, and data so far exists for this pilot year covering the hunting season 2023/24, where focus was on building up methodology and logistics. Collection of wings has then continued in the hunting season 2024/25 and 2025/26. A hunting season (Swedish: jaktår) is defined as the period of July 1th until June 30th the following year.

To contribute to the Swedish Wing Survey, hunters are asked to cut one wing from each harvested water bird, which can be geese or ducks, but not released mallards, as far as it is possible to determine. The wings are cut at the shoulder joint, ensuring that the surrounding feathers, known as scapular feathers, are included. After removing the wing, it is placed in a plastic bag and put into a freezer. The hunters include a note in a separate bag, specifying the species, the date of harvest, and the location where the harvest took place. In agreement with the Wing Survey manager, hunters forward the wings to the Wing Survey by various methods, adapted to individual hunters' preferences and possibilities. This flexible service is implemented to engage and optimize hunters' willingness to send in wings. If only few wings are collected, typically the hunter will use ordinary post handling (PostNord) where the wings are placed into predelivery packings (plastic bags, envelopes, paper boxes). When larger numbers (volume) of wings need to be transported the practical challenges are handled individually to minimize costs and the burden for the hunters.

Experiences indicate that a high degree of local information and engagement from the Wing Survey manager is needed to engage Swedish hunters to contribute with wings from shot birds continuously throughout the hunting season. A specific challenge seems to relate to coastal hunting where several waterfowl species are shot by many hunters but in relatively low numbers, especially diving ducks, and ducks that are shot over a long period but few individuals on each hunting occasion along the Swedish coasts. To improve the collection of wings in coastal regions, freezers have been set up locally, where hunters can deposit wings throughout the season. However, the availability and use of freezers have presently not been sufficiently adapted to the needs of individual hunting teams or in some cases individual dedicated waterfowl hunters. The need for future use of freezers will be assessed and evaluated with respect to specific demands, and for use in both coastal and inland hunting areas, based on the experiences obtained through the present network.

Continued outreaching activities will take place as far as possible to encourage hunters to contribute with wings and to solve any logistical limitations in dialogue.

Incoming wings to the Wing Survey are stored in freezers centrally. When appropriate, a large number of wings are processed (sexed and aged) by the manager and scientific leader, using available references and manuals (Mouronval 2016, Ottenby Bird Observatory (https://ringersguide.ottenby.se/), U.S. Fish and wildlife service 1992).

The data collected contains two different parts of information. Hunter specific information such as contacts details and exact position where the bird was shot is kept for internal use. Data regarding the wing, shooting date and the county (län in Swedish) is used for external use.

All data has so far been entered into a dedicated module of the large database "Viltdata.se". In this database, bag statistics from Sweden is collected and stored. Also, other biological data from game as well as monitoring data from ungulates are collected and stored. Swedish bag statistics are built around hunting teams and game management precincts (Swedish: jaktvårdskrets) as reporting units. Sweden is an elongated country and much geographical variation in the distribution of shot birds is expected. This variation can only be covered if the wing collection data is given a geographical and species-specific resolution similar to that of the bag statistics i.e. county level.

Swedish bag data was for long collected as point estimation i.e. harvest per area unit for each game species. Within one game management precinct bag data was calculated based on the harvest and areas of the reporting hunting teams. In cases where an individual hunting management precinct lacked shooting reports, it was assigned the average value for the county. Shooting per area unit was then calculated using the hunting management precinct's total huntable area and summed up for the county and nationally.

Point estimation, however, proved over time to be sensitive to deviating values in individual reports, mainly in game management precincts with a low reporting rate. This meant that local deviating values, which were correct in themselves but not representative of surrounding land, could have too much power in the estimate for the district as a whole. Point estimation also did not allow for a calculation of the uncertainty of the estimates. However, recent developments in both statistical methods and increasing computational capacity have created new opportunities. In order to achieve a new method for estimation that better met the requirements of the Swedish program, the Swedish Association for Hunting and Management began a collaboration with researcher Tom Lindström at Linköping University in 2018. The developed method is based on Bayesian inference and is presented in its basic form by Lindström and Bergqvist (2020).

One of the characteristics of the Bayesian model is the ability to "borrow strength" from nearby areas when estimating the harvest in precincts with a low reporting rate. At a later stage, the model was supplemented with an autoregressive component, which means that the estimate can also "borrow strength" in time (i.e. from the same area in previous years). This contributes to reduced uncertainty in the estimates. The autoregressive component is presented by Lindström and Bergqvist (2022).

In this Bayesian model, hunting is described by five parameters at precinct level. Two parameters describe the distribution of hunting ground area in the form of mean and variability between hunting teams. This needs to be taken into account because the analyses show that hunting teams with small areas often shoot more per area than large hunting teams. The three remaining parameters describe the hunting intensity per area: mean and variation and how non-linear the effect of hunting area is on shooting. In a linear relationship, shooting increases in relation to the area, hence a doubling of the area corresponds to a doubling of shooting in the case where the ratio is 1:1.

An attempt to explore integration of wing survey data into the models developed for bag statistics have started. If these modelling exercises becomes fruitful this may take geographical variation in age structure from wing survey data into account and produce data on more detailed spatial scale than just a national estimate. Further, such modelling would also produce measures of uncertainty in relation to age structure, corresponding to the values now being produced for annual harvest.

2.2 Overview of data collected in 2023 and 2024

The total number of wings collected in Sweden during the past two hunting seasons were 1.539 wings received from 8 counties in 2023 and 3.766 wings from 15 counties in 2024.

The exact number of hunters contributing cannot be retrieved, as in many cases one person collected the wings from all birds shot collectively during a day. Consequently, one contribution of wings sent to the Wing Survey may represent many hunters. The number of persons coordinating and facilitating transport of wings increased from 26 in 2023 to 51 in 2024 (Figure 1), also showing an increasing geographical coverage between years.

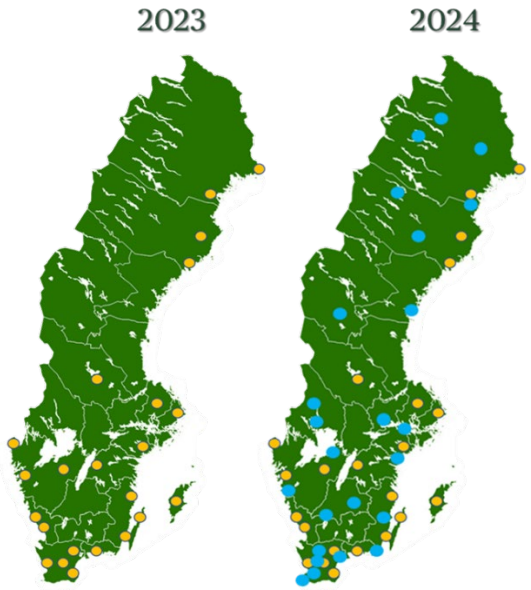


Figure 1. Map of Sweden showing the locations where wings were collected in the hunting seasons 2023/24 (2023) and 2024/25 (2024). Blue dots represent locations that were new in 2024.

In both seasons, most wings were received from Skåne county, representing 44.6% (N=687) of the annual totals in 2023 and 59.6% (N=2245) in 2024. Excluding Skåne, the average number of wings from separate counties was 121.7 in 2023 and 108.6 in 2024.

The number of wings received on 12 individual species during 2023 and 2024 is shown in Figure 2. Wings from Tufted Duck (N=8) and Woodcock (N=1) were only received in 2024. Geese constituted the most numerous group, representing 91.1% and 64.4% in 2023 and 2024, respectively. In both seasons, about half of the geese were shot during derogation, 49.5% in 2023 and 53.4% in 2024 (Figure 3). All Barnacle Geese were shot under derogation, as there is no hunting season on this species. Also, all the Bean Geese and most (55%) of the Greylag Geese were shot under derogation.

The most numerous duck species in the survey were Mallard, Teal and Wigeon, while there were only small numbers of wings (less than 50/year) for other species.

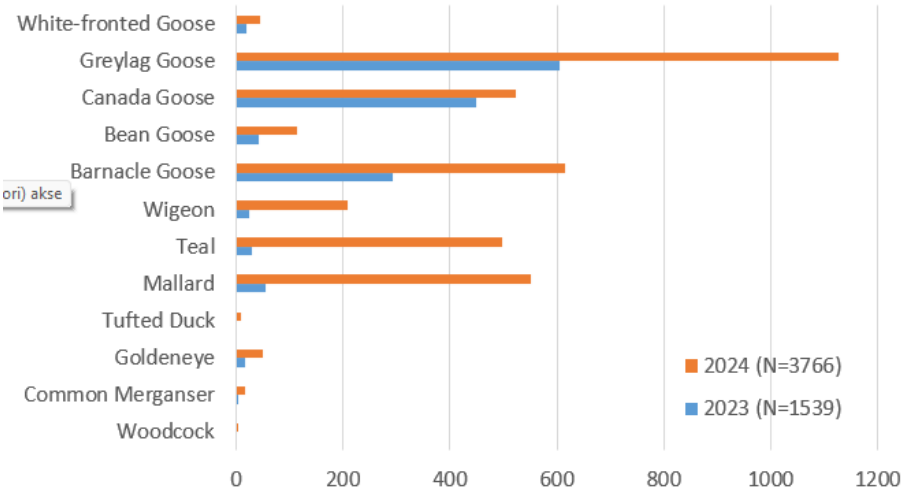
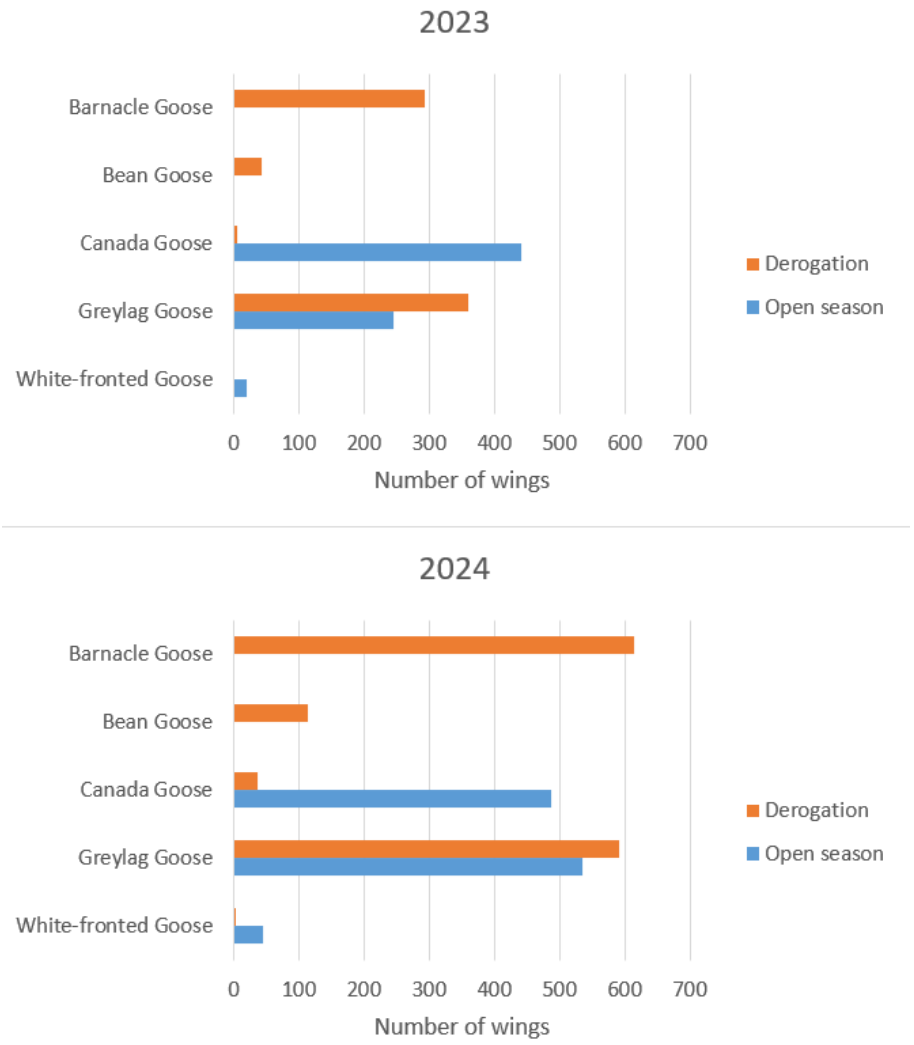


Figure 2. Number of wings received for each species in the Swedish Wing Survey from 2023 and 2024.

Figure 3. Number of wings from geese received for each species in the Swedish Wing Survey from 2023 and 2024 separated into wings from birds shot during the open hunting season and shot under derogation.



3 Assessment of the key questions

3.1 Contribution to Improved Swedish Management of Huntable Bird Species

Effective management of huntable species primarily depends on accurately assessing or estimating the total harvest by hunters and aligning this with population size. This requires consideration of population dynamics, including reproductive potential and longevity.

Game bird populations naturally fluctuate over both short and long time frames due to environmental factors affecting reproductive success, survival rates, and demographic composition. If hunting pressure is not properly regulated, these fluctuations can lead to overexploitation affecting population growth rate negatively. Therefore, gaining detailed insights into the impact of hunting on bird populations is essential for sustainable management.

The Swedish Wing Survey offers valuable support in optimising the management of huntable bird species. By providing seasonal data on the age and sex distribution of harvested birds, it enables more informed decisions. For example, an excessive harvest of females can negatively affect population development and sustainability. Wing survey data helps visualise the proportion of females and other sex/age groups taken throughout the hunting season, which makes it possible to adjust hunting season timing, quotas, or restrictions on specific groups as needed.

As a supplement to national bag reports submitted by hunters, systematically collected wing survey data can reflect broader trends in game bird populations. With sufficient sample sizes across multiple seasons, this data can provide reliable indices of breeding success—such as juvenile-to-adult ratios—and reveal long-term changes in demographic structure and seasonal presence. Such insights allow managers to anticipate population bottlenecks and adjust hunting practices accordingly.

To ensure the wing survey accurately represents wild populations, it is crucial to exclude wings from released birds, e.g. Mallards. Since nearly all harvested released birds are juveniles, their inclusion would skew the data. Hunters should therefore be clearly instructed not to submit wings from released birds.

A national wing survey also has the potential to raise hunters' awareness of the relationship between hunting practices and the biology of game bird populations. Increased understanding may lead to more responsible behavior and contribute to more balanced and sustainable hunting practices within local and regional hunting communities. As an example, the role and understanding of Danish goose hunters as 'active managers' has improved greatly through both theoretical and practical education of goose hunters, relating to the impact of hunting in the frame of the adaptive harvest management plan for Pink-footed Goose.

3.2 Fit in an International Context

Most waterfowl species are migratory birds that cross several political borders on their annual migration between breeding and wintering grounds. These cross-border movements present challenges for management, as migrating bird populations depend on the preservation and sustainable management of habitats as well as hunting exploitation along their entire flyways rather than within any single country.

Sweden's participation in the wing survey under the Waterfowlers' Network, alongside Denmark, the UK and Ireland, aims at harmonizing data collection and to compare the demographic profiles of the hunted species along the geographical (migratory) gradient. By engaging in this network, Sweden contributes with data that increase the general understanding of hunting internationally and improve management of migratory species throughout Europe. This collaborative work also puts focus on the challenges of harmonization of data collection among countries and of the differences in hunting intensity, species focus, and sampling methods across countries.

Internationally the need for more detailed demographic information on huntable species has increased over the past decades. Such data are presently included in the assessment of hunting (un)sustainability in Europe (Task Force on the Recovery of Birds under the EU Birds Directive; Cruz-Flores et al. 2024a, 2024b), in AEWA reports (management plans) and can be expected to be part of future national reporting on bird hunting bags to EU (reporting under Article 12 of the Birds Directive). Hence, establishing a running wing survey scheme in Sweden, will leave Sweden prepared for such future requests.

3.3 Operational Challenges and Future Considerations for the Swedish Wing Survey

Following a successful launch in 2023 and 2024, the Swedish Wing Survey now faces several operational challenges that must be addressed to ensure continued progress in the coming years.

3.3.1 Increasing Sample Size for Reliable Analysis

A key priority is to increase the number of collected wings—particularly from ducks. Current sample sizes are insufficient to support reliable analyses of sex and age when data is segmented by geographic region and time (e.g., monthly intervals). Lumping data from different counties may help if larger regions are relevant units. Nevertheless, data collection at the county level should continue, as future increases in sample size may enable county-based analyses.

3.3.2 Engaging and Retaining Hunters

Since the volume of wings received depends on hunter participation, expanding the number of contributors is essential. While recruiting a large number of hunters may be a gradual process, targeted outreach—through hunting magazines, websites, newspapers, and local/national radio—could prompt immediate engagement. The greater challenge lies in retaining hunters across multiple seasons. To foster long-term involvement, it is important to establish effective feedback mechanisms that help contributors feel actively involved and valued in the survey. In this context engagement from hunters NGO's may play a crucial role.

3.3.3 Streamlining Wing Collection Logistics

The current system—using envelopes and locally placed freezers—has proven effective. However, as hunter participation grows, this flexible (individual) setup may become increasingly time-consuming and require simplification. Additionally, each local freezer must be managed by a designated key person who coordinates with the central survey manager. Ensuring that this structure remains scalable and efficient will be critical as the survey expands.

3.4 Strategic Integration of Wing Survey Data

Swedish hunting is governed by the Swedish Environmental Protection Agency, County Game Committees, and Swedish Association for Hunting and Wildlife Management. To maximize its impact, wing survey data should be used to adjust regional hunting plans/seasons.

Hunters are increasingly recognized as environmental stewards, as exemplified by their role in moose management. This stewardship model can be extended to bird species by training hunters in citizen science and promoting monitoring as a core responsibility. Empowering hunters in this way strengthens their role in sustainable wildlife management.

To meet both national and international conservation objectives, wing survey results should be made publicly accessible and available if data is needed by relevant bodies such as AEWA, the EU, and Wetlands International. Ensuring the long-term viability of the survey will require securing stable funding from government or from other sources, as well as building strong partnerships with academic institutions and NGOs—such as the Waterfowlers Network.

4 Conclusion

Wing survey schemes like the Swedish Wing Survey are strategically valuable tools for both national and international waterfowl management. By aligning it with Sweden's regulated, ethical hunting practices and embedding it within national and international frameworks, the survey can evolve into a cornerstone of adaptive, ecosystem-based game management.

Apart from securing stable funding, the Swedish Wing Survey faces two key challenges in the near future:

1. Scaling up wing collection to ensure that the data gathered is sufficient and accurately reflects county-level hunting activity.
2. Recruiting and retaining contributing hunters to maintain continuity and long-term reliability.

Denmark offers an example of how to address these challenges. Immediate feedback through a monthly updated website displaying current results, a monthly lottery for contributors, and an annual email summarizing seasonal outcomes have proven highly effective in both recruitment and retention. Implementing similar systems in Sweden would likely strengthen and expand the value of the Swedish Wing Survey.

The current set-up of the Swedish Wing Survey is promising. Combined with the potential use of modelling approaches to compensate for data gaps – similar to those applied in Swedish bag statistics – the wing survey data can become a valuable resource for sustainable waterfowl management, both within Sweden and internationally.

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