



**Flanders**  
State of the Art

# Goose Monitoring in Belgium

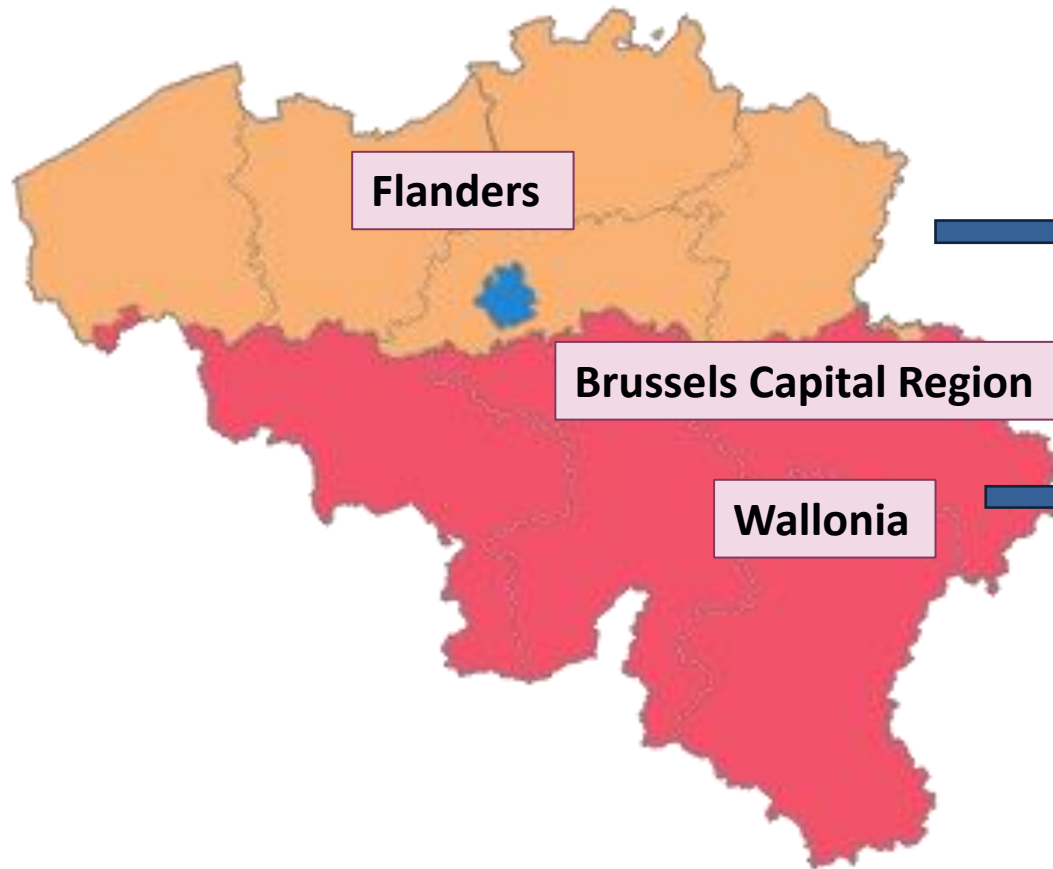


**Koen Devos** RESEARCH INSTITUTE  
NATURE AND FOREST

Goose Monitoring Workshop Copenhagen  
22-24 November 2023

# Context of monitoring

Belgium = federal state



## Coördination of waterbird monitoring

Research Institute for Nature and Forest (INBO)  
in coöperation with Natuurpunt (NGO)

Aves/Natagora (NGO)

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# Regional differences in occurrence of geese

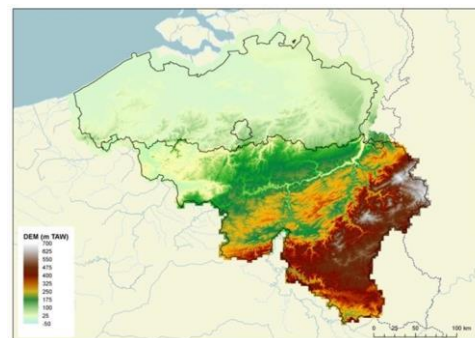
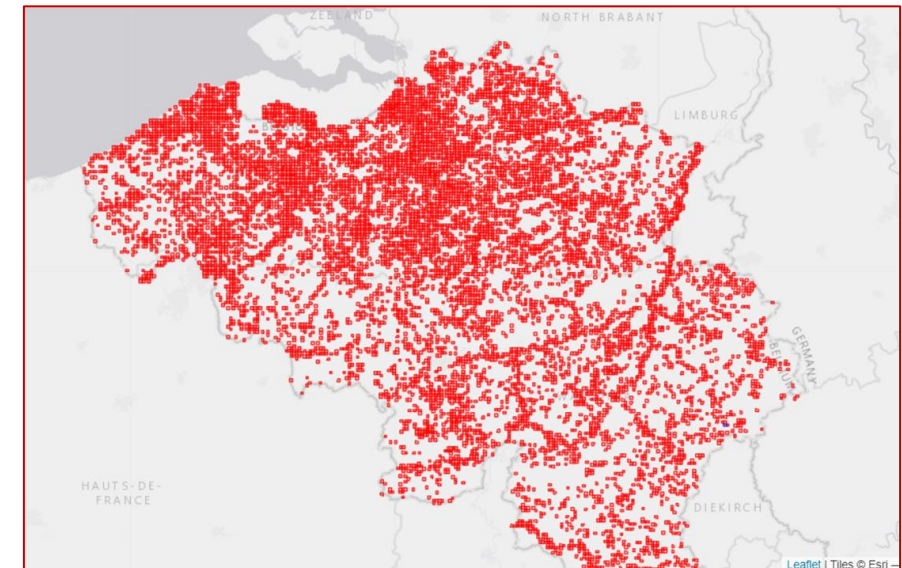
## Total count January 2023

January 2023	Flanders	Wallonia/ Brussels
Tundra Bean Goose	2143	0
Pink-footed Goose	23202	1
White-fronted Goose	77235	2
Greylag Goose	18736	143
Canada Goose	8171	5188
Barnacle Goose	11321	310
Egyptian Goose	2117	681

## White-fronted Goose 2000-2023



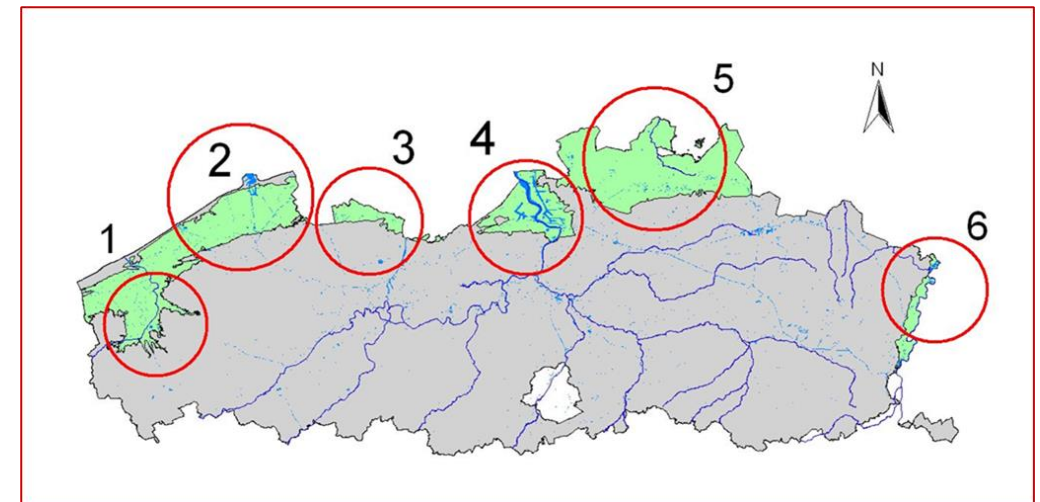
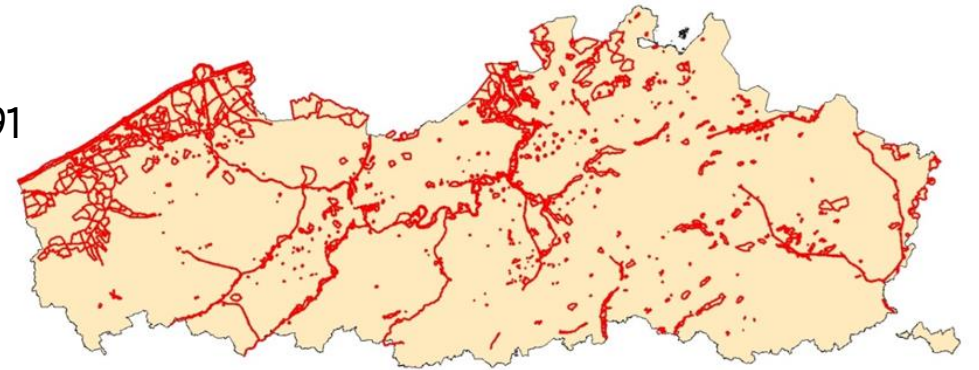
## Greater Canada Goose 2000-2023



# Census scheme wintering geese

Part of broader monitoring programme for wintering waterbirds

- ▶ Flanders: mid-monthly waterbird counts October-March
  - First counts in 1967, standardised monthly counts since 1991
  - Coastal Polders: extra goose count end of December
- ▶ 750-800 sites (or count units) counted
- ▶ Counts by +300 volunteers (and some professionals from INBO)
  - Local organisation by regional coordinators
- ▶ Daytime counts
  - Roost site counts for some species (but not for geese)



## Other data

- ▶ Reading of neck bands: long tradition en quite popular
- ▶ Counts of age-ratios: occasional, mainly for White-fronted Goose



## Data analysis

- ▶ Coverage wintering areas (wild) geese is quite complete
- ▶ Total counted numbers are close to actual numbers present
- ▶ Imputing for sites that were not counted

# Data handling: imputation of missing values

J Ormthol  
DOI 10.1007/s10336-016-1404-9



ORIGINAL ARTICLE

## Working with population totals in the presence of missing data comparing imputation methods in terms of bias and precision

Thierry Onkelinx<sup>1</sup> · Koen Devos<sup>1</sup> · Paul Quataert<sup>1</sup>

Received: 9 December 2015 / Revised: 30 August 2016 / Accepted: 10 October 2016  
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**Abstract** Missing observations in water bird censuses are commonly handled using the Underhill index or the bird-STATs tool which enables the use of TRIM under the hood. Multiple imputation is a standard technique for handling missing data that is rarely used in the field of ecology, but is a well known statistical technique in the fields of medical and social sciences. The purpose of this paper is to compare these three methods in terms of bias and variance. The bias in the Underhill method depends on the algorithm and starting values. birdSTATs and multiple imputation are unbiased in the case of missing values that are missing completely at random; more missing values implies less information, and so wider confidence intervals are expected as the missingness increases. The Underhill method and birdSTATs tool underestimate the variance; omitting data from a complete dataset and applying the Underhill index or birdSTATs tool

**Keywords** Missing data · Multiple imputation · Monitoring of biodiversity · Survey design and analysis

### Zusammenfassung

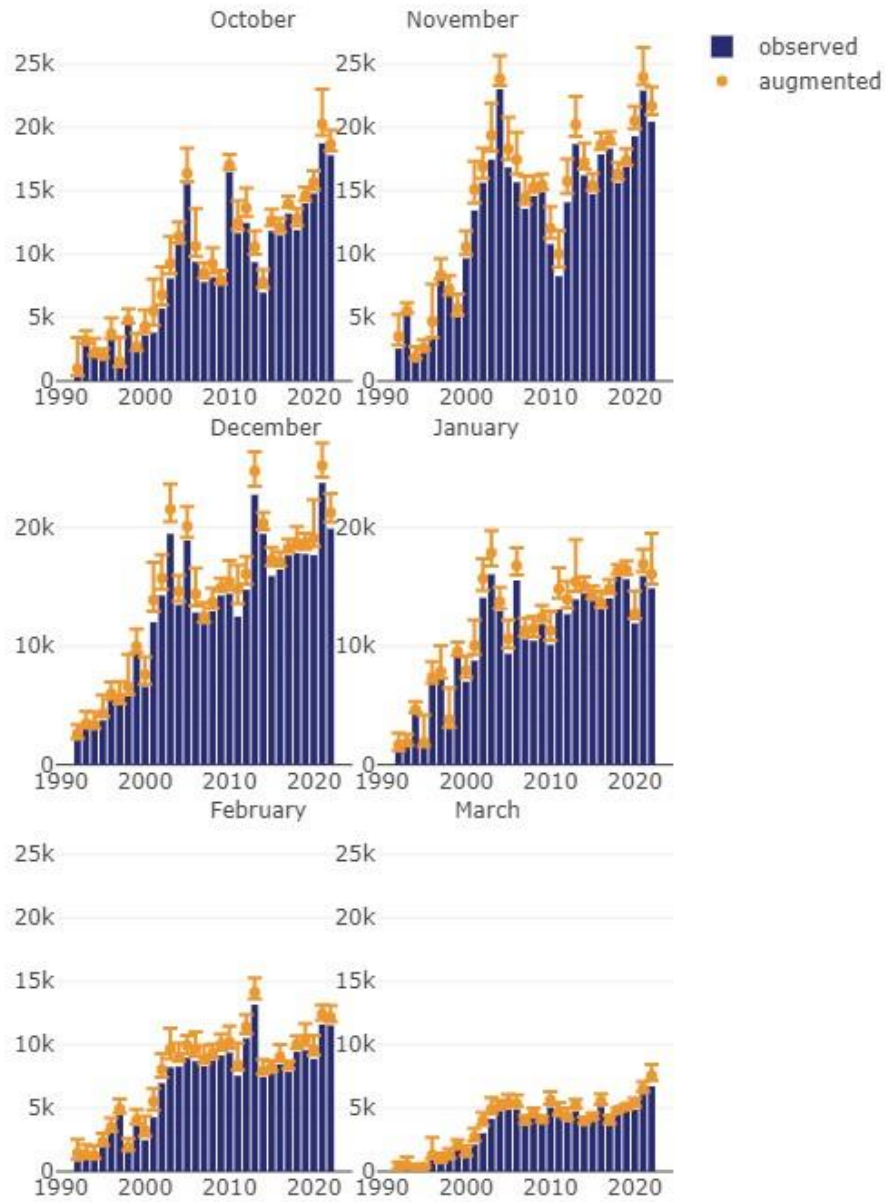
**Gesamtbestandszahlen trotz fehlender Daten – ein Vergleich von Imputationsmethoden hinsichtlich systematischer Abweichungen und Genauigkeit**

Fehlende Beobachtungen bei Wasservogelzählungen werden üblicherweise gehandhabt, indem der Underhill-Index oder birdSTATs angewendet werden. Letzteres nutzt TRIM. Multiple Imputation ist eine Standardmethode für die Handhabung fehlender Daten, die in der Medizin und in den Sozialwissenschaften wohlbekannt ist, in der Ökologie jedoch kaum angewendet wird. Das Ziel dieses Artikels ist

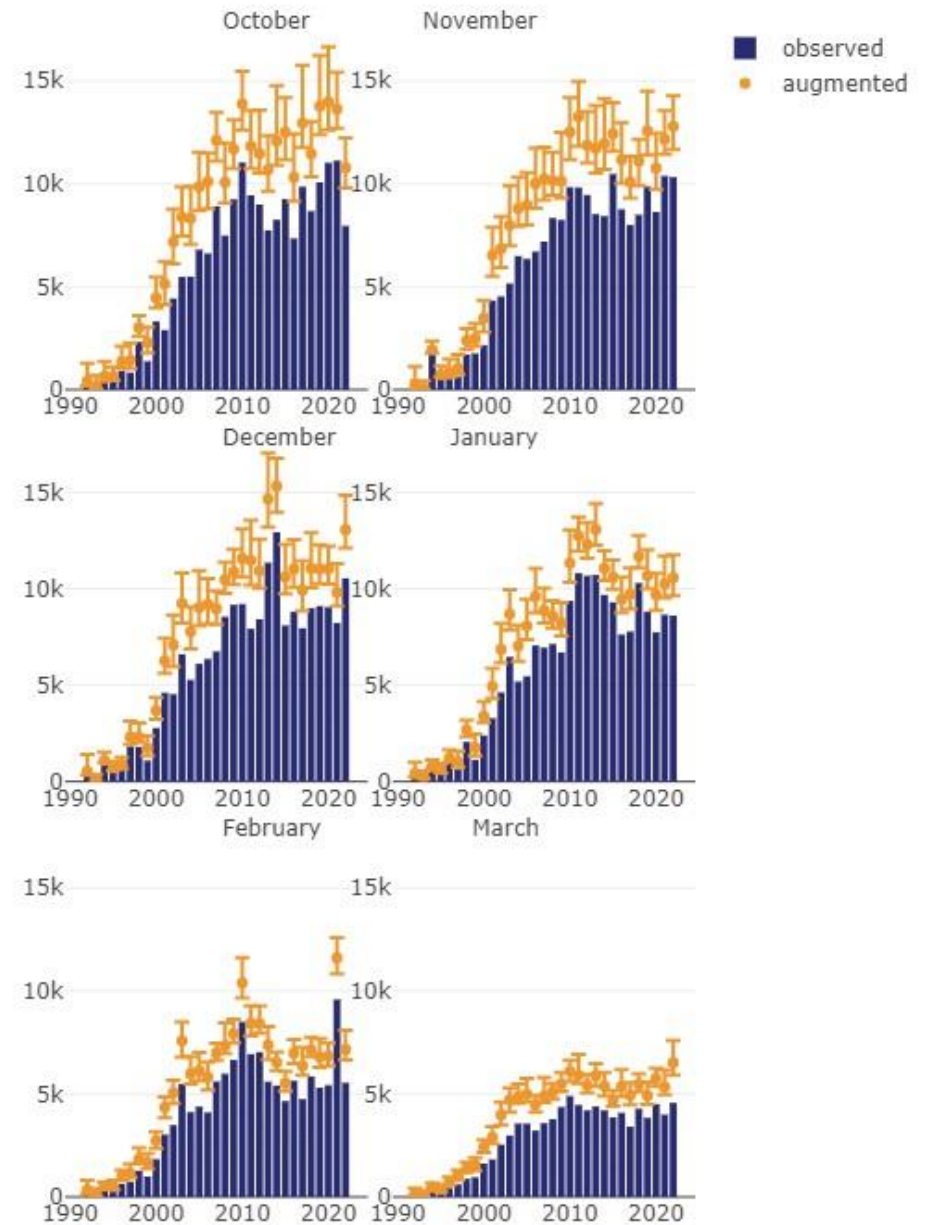


Downloads available on [www.inbo.be](http://www.inbo.be)

## Greylag Goose



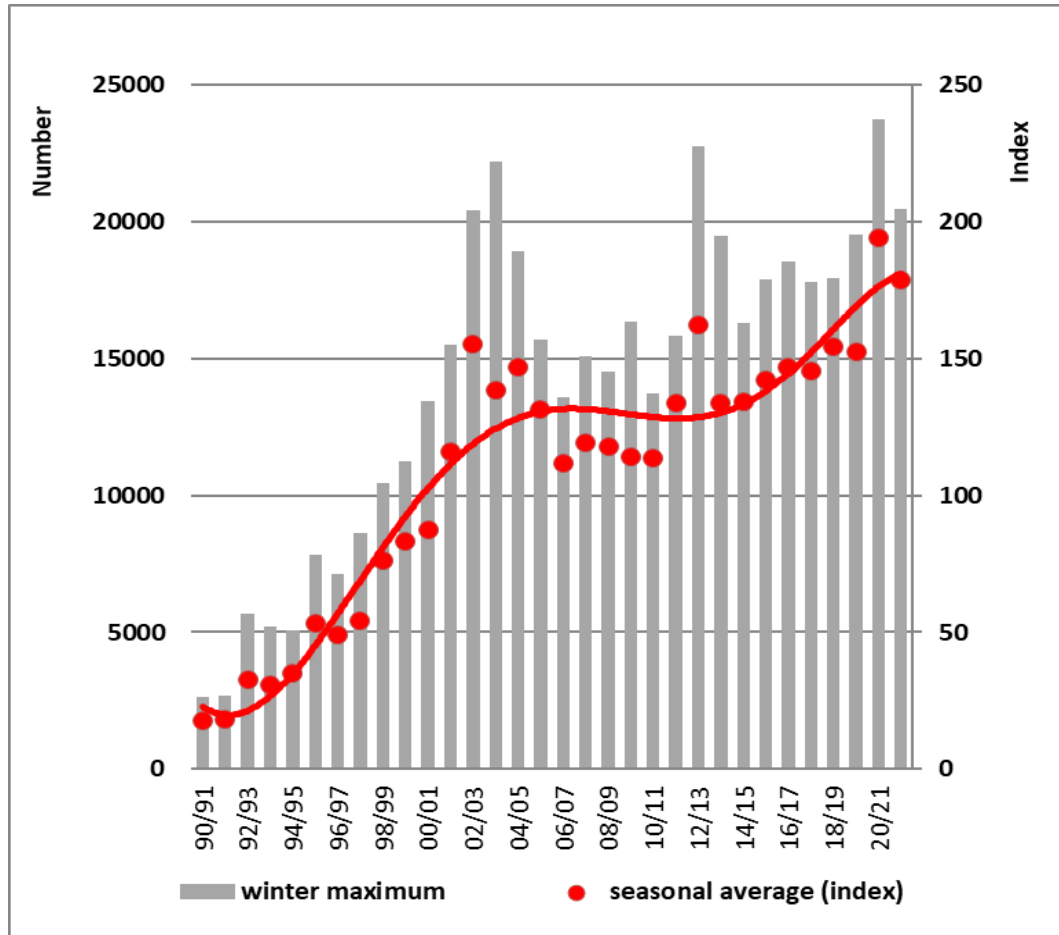
## Greater Canada Goose



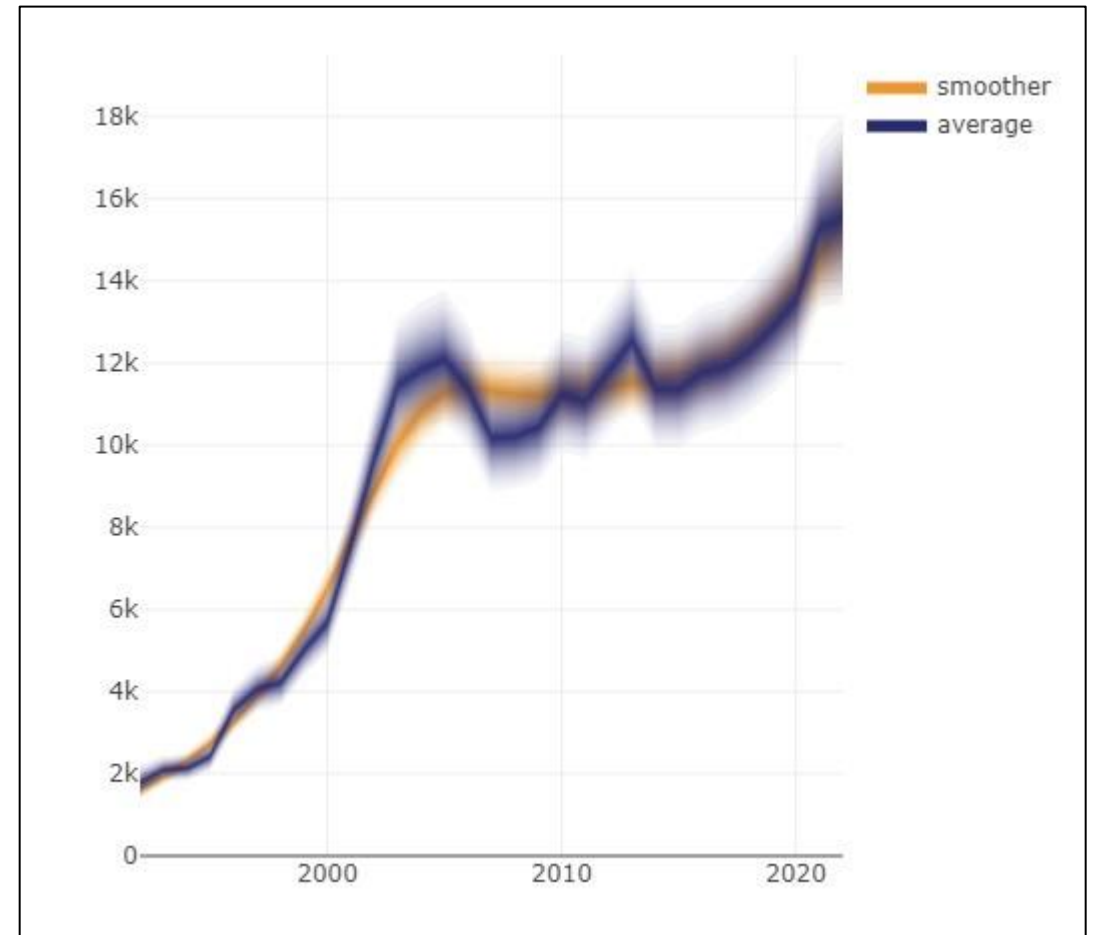


# Trend Greylag Goose

Based on counted numbers alone



With imputation of missing values



# Data flow

► Online data portal (Flanders)



Database INBO

► Observation.org (Wallonia/Brussels)



Database Aves-Natagora

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Watervogels

INSTITUUT  
NATUUR- EN BOSONDERZOEK

Telprojecten Telling invoeren Telgebieden Tellers Regio's en gebieden Soorten Rapporten Analysesets Mijn Watervogels

Teldata

Project	Seizoen	Telling	Startdatum	Einddatum
Midmaandelijkse Watervogeltellingen	2023/24	Oktober	14/10/2023	15/10/2023
Midmaandelijkse Watervogeltellingen	2023/24	November	18/11/2023	19/11/2023
Midmaandelijkse Watervogeltellingen	2023/24	December	16/12/2023	17/12/2023
Midmaandelijkse Watervogeltellingen	2023/24	Januari	13/01/2024	14/01/2024
Midmaandelijkse Watervogeltellingen	2023/24	Februari	17/02/2024	18/02/2024
Midmaandelijkse Watervogeltellingen	2023/24	Maart	16/03/2024	17/03/2024
HVP-tellingen steltlopers Vlaamse kust	2023/24	Oktober	16/10/2023	16/10/2023
HVP-tellingen steltlopers Vlaamse kust	2023/24	November	13/11/2023	13/11/2023
HVP-tellingen steltlopers Vlaamse kust	2023/24	December	11/12/2023	11/12/2023
HVP-tellingen steltlopers Vlaamse kust	2023/24	Januari	22/01/2024	22/01/2024

Voor vragen contacteer [watervogels@inbo.be](mailto:watervogels@inbo.be).

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natuurpunt

LIFE

NATURA 2000

AGENTSCHAP  
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Deze applicatie is ontwikkeld met financiële ondersteuning van de EU in het kader van het LIFE programma (LIFE14 IPE BE 002 Belgian Nature Integrated Project)

deel van [Observation.org](#)

Observations.be

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Projecten » DHOE Wallonie Bruxelles Meld u aan bij dit project

Details Locaties Bezoeken Waarnemingen

**Naam** DHOE Wallonie Bruxelles

**Beschrijving** Les dénombrements hivernaux d'oiseaux d'eau (DHOE) se déroulent chaque année depuis 1966 en Wallonie et à Bruxelles. Ce projet permet de saisir les observations réalisées dans le cadre des DHOE. Il est coordonné par le Département Études de Natagora et les coordinateurs régionaux d'Aves, pôle ornithologique de Natagora. Manuel pour la saisie de vos observations : <https://drive.google.com/file/d/1en3DpKyO-HqQyLjcUH0FyJau-BKct7t-view?usp=sharing> Vidéo tutorial pour la saisie des données : [https://www.youtube.com/watch?v=RdoG\\_os1M5g](https://www.youtube.com/watch?v=RdoG_os1M5g) Vidéo tutorial pour coupler un transect au projet : <https://www.youtube.com/watch?v=KiNying-texE> Liste des sites avec leurs codes : <https://docs.google.com/spreadsheets/d/1gBQFOSNag5wriRFj3OfUNV7sOoFKYwqA8XqcXohZ3U/edit#gid=0>

**Periode** vanaf 2020-10-06

**Land** Belgium

**Domeinen** observations.be

# Data flow

Every six years: Flemish and Wallon data are put together to allow trend analysis and population estimates at a Belgian level for the EU Bird Directive reporting

Transfer to database Wetlands International: on a yearly basis, only midwinter count, target for delivery is the beginning of the upcoming season (October)

Flemish data: open access on GBIF

The screenshot shows a web browser displaying the GBIF dataset page for 'Watervogels - Wintering waterbirds in Flanders, Belgium'. The page includes a navigation bar with 'Get data', 'How-to', 'Tools', 'Community', and 'About'. The main content area features the dataset title, publication information (Research Institute for Nature and Forest (INBO)), and authors (Devos K, T Jollyn F, Brosens D, Desmet P). A summary box provides details about the dataset, including the number of occurrences (837,932) and citations (100). The page also displays a progress bar for data quality metrics: 100% with taxon match, 100% with coordinates, and 100% with year. The URL in the browser is https://www.gbif.org/dataset/7f9eb622-c036-44c6-8be9-5793eaa1fa1e.

← → ↻ https://www.gbif.org/dataset/7f9eb622-c036-44c6-8be9-5793eaa1fa1e

Get data How-to Tools Community About

SAMPLING EVENT | REGISTERED NOVEMBER 27, 2014

## Watervogels - Wintering waterbirds in Flanders, Belgium

Published by [Research Institute for Nature and Forest \(INBO\)](#)  
Devos K • T Jollyn F • Brosens D • Desmet P

DATASET METRICS ACTIVITY DOWNLOAD HOME PAGE

837,932 OCCURRENCES 100 CITATIONS

Watervogels - Wintering waterbirds in Flanders, Belgium is a sampling event dataset published by the Research Institute for Nature and Forest (INBO). It contains information on more than 94,000 sampling events (bird counts) with over 720,000 observations (and zero counts when there is no associated occurrence) for the period 1991-2016, covering 167 species in over 1,100 wetland sites. The aim of these bird counts is to gather information on the size, distribution and long term trends of winterin... [More](#)

**RESEARCH INSTITUTE NATURE AND FOREST**  
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[How to cite](#) [DOI](#) 10.15468/lj0udq

837,932 Occurrences 100% With taxon match 100% With coordinates 100% With year

837,932 GEOREFERENCED RECORDS

# Census scheme breeding population (Flanders)

- ▶ Common Bird Monitoring (point counts)
  - OK for widespread species as Greater Canada Goose
  - Problems with localised and/or semicolonial species as Greylag Goose
- ▶ Rare Bird Monitoring (complete covering)
  - Most goose species too abundant for yearly covering in whole of Flanders
- ▶ Breeding bird atlas
  - Population estimates / distribution 2000-2002 versus 2020-2024

## Summer count

- ▶ One count around mid July
- ▶ Count data available for 2010-2018 and 2021-2023.



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