GOOSE BULLETIN

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GOOSE BULLETIN is the official bulletin of the Goose Specialist Group
of Wetlands International and IUCN

Contents

GOOSE BULLETIN is the official bulletin of the Goose Specialist Group of Wetlands International and IUCN.

GOOSE BULLETIN appears as required, but at least once a year in electronic form.
The bulletin aims to improve communication and exchange information amongst goose researchers throughout the world. It publishes contributions covering goose research and monitoring projects, project proposals, status and progress reports, information about new literature concerning geese, as well as regular reports and information from the Goose Database.
Contributions for the **GOOSE BULLETIN** are welcomed from all members of the Goose Specialist Group and should be sent as a Word-file to the Editor-in-chief.
Authors of named contributions in the **GOOSE BULLETIN** are personally responsible for the contents of their contribution, which do not necessarily reflect the views of the Editorial Board or the Goose Specialist Group.

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Editorial

Goose Specialist Group – an editorial from the board

Dear members of the IUCN Goose Specialist Group!

With the publication of this newest issue number 28 of the Goose Bulletin we would like to share with you some news from the Goose Specialist Group. As you may have read in the newsletter sent around in May this year, we have a new logo (see above, designed under the supervision of Petr Glazov) and, as a board, are actively working on updating the global audit of goose population sizes and trends.

Changes in the board: With the war in Ukraine, it has become increasingly difficult for Petr Glazov to perform his task as chair of the Goose Specialist Group. It is therefore with great regret that he has decided to step down as chair of the group in the coming year, while he will remain in the board. We will organize an election for a new chair at the next Goose Specialist Group conference (hopefully in 2023, see below).
Until that time, Petr Glazov will remain chair and Thomas Lameris has agreed to act as co-chair of the group.

Conference 2023: We are currently planning to meet each other again at a GSG conference to be held in late summer/ early autumn 2023. Although we are still hoping to organize this conference in Mongolia, it has not yet proved possible to determine the exact details of the conference. We hope to send you an update on this before the end of 2022.

Updating the global audit on population trends: In May we reported that we are working on an update of the global audit of status and trends of goose populations in the Northern Hemisphere, as published by Tony Fox and James Leafloor in 2018 (as a CAFF report https://www.caff.is/assessment-series/all-assessment-documents/458-a-global-audit-of-the-status-and-trends-of-arctic-and-northern-hemisphere-goose).
As we are an IUCN specialist group, the GSG board feels that a regular update of the status and trends of goose populations should be one of the core tasks of the GSG. Tony Fox has updated the global audit over the summer, a process that is now partly finished, although unfortunately information on population sizes of some populations is still lacking.
We are working on a proposal to structure data collection for a regular update within the group, and we are trying to find an online location to host the data. We would like to discuss this proposal in more detail at the conference in 2023.

Registering as a GSG member at the IUCN portal: The IUCN uses an online portal to communicate with their members, and we as members can report our conservation activities related to the GSG on this website. To show our activity as a species specialist group, it would be great to have as many of you as possible as online IUCN SSC members. You can register by accessing the IUCN Commission System:
https://portals.iucn.org/commissions/.
Here you can create an account and profile, after which you can apply to the GSG by using the group code *1b1db8db-a0be-475d-b46a-fe5ce8797491*.

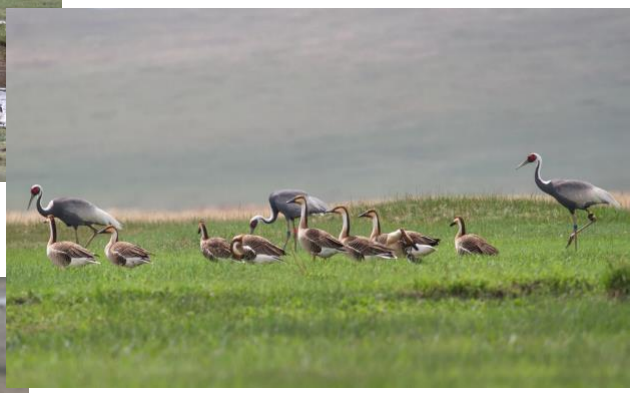
The next issue of the GOOSE BULLETIN is planned to appear in May 2023, which means that material for this issue should have reached the editor-in-chief no later than the 31st of March 2023.....but earlier submission is, of course, always permitted, if not actively encouraged!

Editor in chief

First announcement of the 20th Goose Specialist Group meeting

We are delighted to make an announcement about our next meeting. The 20th Meeting of Goose Specialist Group will be held in Mongolia between 16 and 18 August 2023.
During the conference we will visit the Ugii Lake in Arkhangai province.

It is an internationally important site for breeding, moulting, and migrating swan goose and bar-headed goose in west-central Mongolia.
It is a well-known Ramsar site, Important Bird Area, and East Asia-Australasian Flyway Site as well. The Wildlife science and conservation center of Mongolia agreed to host the meeting.



Environmental scandal on the River Ems:
Donald Duck kills his nephews

Helmut Kruckenberg

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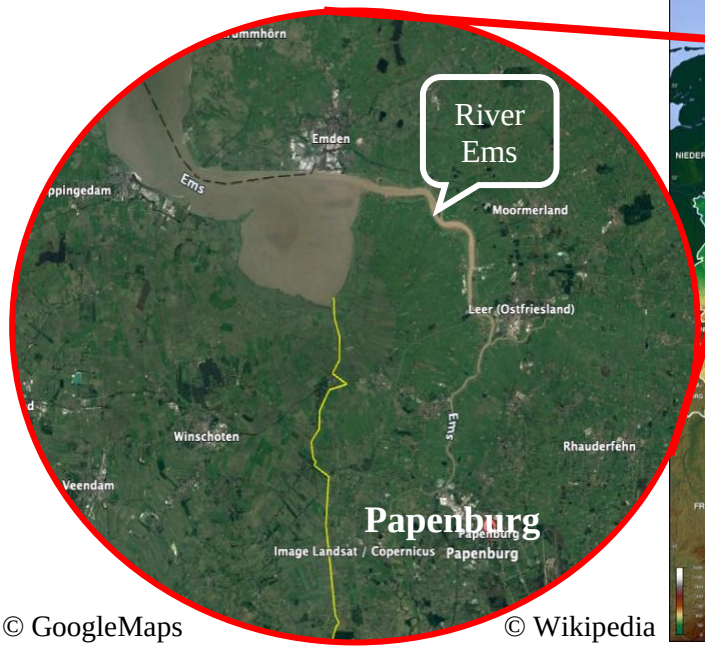
The Meyer shipyard builds cruise liners in Papenburg, 40km off from the coast. In order to bring the huge ships to open sea, the Ems has been deepened many times since the 1980s and in 1998 an additional barrage was built near Emden to dam up the river for the ship transfers.



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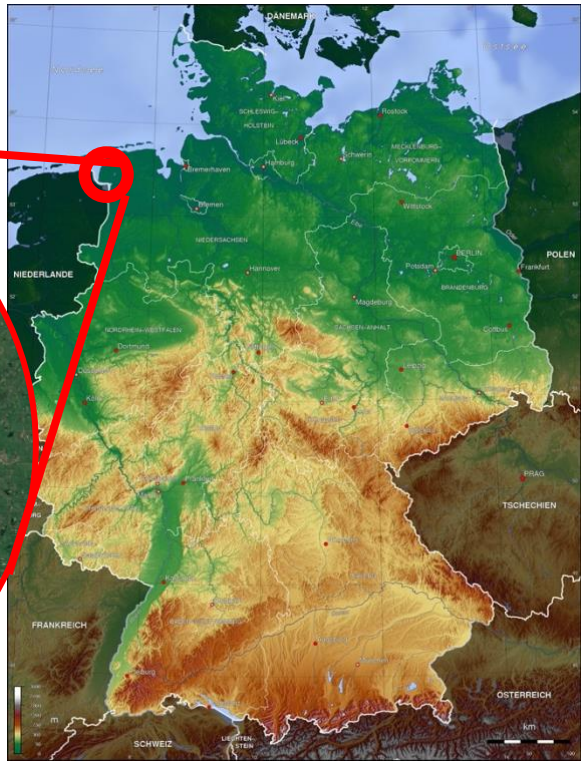

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What this means for the birdlife in the European bird sanctuary of the Ems could be observed again at the end of March 2022, when thousands of goslings died in the egg for the transfer of the cruise liner "Disney Wish".

Several times a year, the Ems, a small river in north-western Germany, is the scene of a great spectacle for tourists and small and large disasters for animals and vegetation. Along the Ems, the protected areas of the European Natura2000 network stretch like a string of pearls to the coast. These are protected areas under the EU Flora-Fauna-Habitat Directive as well as the Birds Directive: areas that represent the top areas of European nature conservation. In the lower reaches of the Ems, it is above all the guest birds in the winter months, including tens of thousands of geese, ducks and waders, and in spring the varied breeding birdlife of the wet meadows and reedbeds that make the area so valuable. Besides hundreds of families of geese, there are ducks, shelducks, waders of many species up to the white-tailed eagle, which regularly come by to forage. In the reeds, bluethroats, reed warblers, marsh harriers and water rails breed. In the middle of the breeding season, the Ems barrage at Gandersum was closed again at the end of March, 2022 and the river dammed up to bring the cruise liner "Disney Wish" towards the North Sea. In addition, powerful pumps brought water from the Dollard into the river to quickly raise the water level.

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On 30 March, the colossus set off from Papenburg and reached the Ems barrage in the evening. These cruise liner giants are so large that the normal water depth of the Ems would not be sufficient to tow the ship. As a result, almost the entire area between the two dikes is flooded.

The Ems barrage near Gandersum is primarily used to dam up the Ems for ship transfers.

Again and again: economy before bird protection

Cruise liner ships have been built at the Meyer shipyard in Papenburg since the 1980s. The River Ems has already been deepened four times between 1984 and 1995 to enable the shipyard to launch ever larger ships. According to conservationists, this was not only a huge environmental destruction, but at the same time an absurd subsidy for an inland shipyard, while in the 1990s the shipyards on the North Sea and Baltic Sea coasts were closing.

But at the beginning of the 1990s, the luxury liners could hardly be transported to the open sea through the River Ems, which had been deepened to a depth of 6.80 metres by then. It was the red-green state government under Gerhard Schröder - and not the owners of the Meyer shipyard - that proposed a deal to the environmental organisations: only one more deepening stage, but "comprehensive compensation for ecological damage". The River Ems was deepened to 7.30m, but by 1998 the promises were no longer valid. From today's perspective, at least some of the environmental and nature conservation organisations feel they have been taken to the cleaners.

In the meantime, huge dock halls were built far from the coast in Papenburg, where the ships were built. From the beginning, the bottleneck was the course of the River Ems, which is the connecting waterway to the North Sea. Further deepening was technically no longer possible, not least because of the motorway tunnel near Leer. Despite all the assurances given to the conservationists, a new plan was needed: if the river could not be deepened, the water level would have to be raised artificially. Again, it was the then prime minister of Lower Saxony, Gerhard Schröder, who, as one of the great advocates, laid the foundation stone for the construction of the River Ems barrage shortly before the federal election.

The dam's function was actually the main argument for its construction, but it occurred to the planners soon enough that a Natura2000 site could hardly be destroyed for such a structure. Thus, the function of flood protection for the River Ems was created almost incidentally. Since then, the rules for the impoundment laid down in the planning approval decision have been softened further and further to the detriment of nature. First, it was even made possible to impound the river during the summer months. Today, the River Ems can be dammed up to +2.7m NHN (=Height above sea level) until 31 March. At this level, there are almost no more dry areas between the River Ems dikes. This is what happened again on 30 March 2022: this time the River Ems was dammed for the "Disney Wish", a cruise liner of the Disney corporation.

Landfall in the bird sanctuary

For a long time now, the normal high tide in the River Ems has not been sufficient for the passage of the large cruise ships. For this reason, the river is closed off with the barrage and water is additionally brought in from the Outer Ems with powerful pumps. However, this not only increases the depth of the waterway, but also floods the adjacent foreshore areas. Areas that are designated as European bird sanctuaries of the Natura2000 network and as nature reserves, so that the birds of the wet grassland and the reed beds can safely breed here. Greylag and Barnacle Geese, Mallards or Lapwings - they are all firmly part of the breeding bird world. For them, the breeding season begins quite early. Greylag Geese often build their nests as early as the beginning of March in the reeds along the River Ems and especially on the two Ems islands. Lapwings also start laying their eggs

Hatzum Sand, the most important breeding island in the Lower Ems, was completely flooded

very early. In 2016, a complete survey of breeding Greylag Geese was last carried out with a photo aerial survey of the River Ems foreland between Papenburg and Emden. The count of the aerial photos revealed 1,079 Greylag and 110 Barnacle Geese nests in the Lower Ems. These are concentrated in a few riparian areas: the islands of Bingumer and Hatzum Sand as well as some foreshore areas near the motorway tunnel and the Weekeborger Bucht, an oxbow near Weener.

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According to the level measurements and also easily recognisable from the shore, these reed areas were completely flooded and at least 50 cm high for several hours. It can be assumed that none of the bird nests in these flooded areas survived. If we calculate an average of four to six eggs per goose nest, at least 4,800 to 7,200 goose eggs may have been killed by the man-made flooding. During a flushing line check on 15 April 2022, hundreds of washed-up eggs were found in just a few metres. This is a clear sign that the entire brood of Greylag and Barnacle Geese in the "Unterems" bird sanctuary fell victim to the Meyer shipyard this year. A winter damming of the River Ems for ship passage is permitted until the end of March, but in doing so the damage to nature must be kept as low as possible. "Here, a ship was quickly transferred at the last minute with the maximum possible damming height, in the truest sense of the word without regard for losses. We have to assume that several thousand chicks were lost. This mainly affects geese, ducks and Lapwings," explained Ihno Völker from German Birdlife Partner NABU in East Frisia. "We demand that in future species protection is taken into account and thus significantly more consideration is given to the animals." It is unclear whether the geese will start re-nesting a second time. Many of the pairs will certainly not do so. Of course, numerous Lapwings and Mallards were already breeding in the foreland meadows of the River Ems at this time.

When the media reported, the operator of the Ems Barrage, the Lower Saxony State Agency for Water Management, Coastal Protection and Nature Conservation (NLWKN), was initially unwilling to comment.

Later, however, they told Northern German Broadcast NDR that Greylag Geese had laid their eggs "unusually early" in 2022. This assessment contradicts the monitoring data from the River Ems during the last 20 years. In addition, there had been four natural storm surges at the beginning of April, so that the "eggs could not have been saved anyway". According to Dirk Post, head of the NLWKN in Aurich, the river levels were so high in the first week of April - well after the Ems overpass - that the island of Hatzumer Sand was completely flooded four more times. According to him, the eggs would have been washed away by then at the latest. Because of the good weather in March, the geese laid their eggs unusually early. The rather bad weather in the first week of April then caused the flooding. Post said that it is no longer possible to determine exactly when the eggs were washed away. However, publicly available data on the internet show that on 30 March - the day of the ship's transfer - water levels were the highest of the spring season.

A questionable justification for an unbelievable event is how Holger Buschmann, chairman of NABU (BirdLife) Lower Saxony, describes the flooding of the large goose colony. That would be "like justifying the murder of a human being because he would have had a heart attack in a few years anyway", says Buschmann.

Disturbance is part of the show

In addition to a few thousand spectators on the dikes, up to 1,400 people also travel on the ship itself during the transfer and subsequent test runs, in addition to staff and technicians, local politicians, employees from various authorities and ministries. Members of the shipyard project team, the shipping company and representatives of Disney Cruise Line were present to celebrate the manoeuvre in maritime tradition. The two project managers from Disney and Meyer Werft were also on hand. "Captain Minnie Mouse" even supported the captain and the tugs by attending the manoeuvre, according to Meyer Werft. A great spectacle. Repeatedly, conservationists have criticised the shipyard's behaviour in the past years: although it is a nature reserve where even nature lovers are confronted with numerous prohibitions, the cruise ships sail through the nocturnal River Ems with full lighting.

Constant use of the ship's big horn leads to massive disturbance of the roosting waterbirds along the River Ems. This was the case on 30 March 2022: to the great excitement of the waiting tourists, around 10,000 resting Barnacle Geese on the island of Bingum Sand flew up in wild panic when the giant ship sounded its horn right next to the birds. Even in the middle of the night at 0:30 a.m., the mighty horn sounded several times at the large roosting place of the geese in the Petkumer Vorland: the calls of startled geese filled the night a thousand times. Not only committed conservationists but also numerous visitors asked themselves whether this was really still a "bird sanctuary" in the true sense of the word.

How is the whole thing to be assessed legally?
The Federal Nature Conservation Act and the Birds Directive prohibit the destruction of nests. For such an intervention during the breeding season, which is likely to result in mass damage to or destruction of eggs of European bird species, an exceptional permit under species protection law is required. It must be checked beforehand whether there are alternatives and whether this damage could be avoided, e.g. by postponing the transfer to dates outside the breeding season. This is regulated by the Federal Nature Conservation Act and EU law. But even if such a postponement would not have been possible: the transfer of cruise ships is not one of the reasons for which the EU Birds Directive specifies such an exception under species protection law. Or to put it another way: death and destruction for the commissioning of a music steamer are not provided for.

As a result of the extensive press coverage, a working group consisting of Meyer Werft, nature conservation organisations and the coastal protection authority was hastily set up. However, the first round of talks remained inconclusive. In the view of the environmental organisations, there must not be a repetition, whereas the shipyard and the authorities initially see themselves as being in the right, because of the building permit for the barrage. Independently, the bird conservationists are now trying to get access to the files and a legal review. Whether they will later sue the state of Lower Saxony for a violation of EU law is currently left open by the associations.

Disney Wish - River Ems Conveyance on30 March 2022
© Shipspotting Channel

Flight altitudes of Arctic and Nordic geese in their wintering area – a radar study

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Abstract

In East Friesland, a favoured wintering area of Arctic and Nordic geese, feeding areas are protected and exempted from the installation of wind energy plants (WEPs). In their flights between their different staging areas, however, they remain vulnerable. Above a plain designated for a wind farm, we studied the behaviour of geese by radar (Furuno FR-2125) and field observations in winter 2014/15. We studied the distribution of the overflying geese visually and measured the flight altitudes by a radar rotating vertically. We identified the species visually or by their calls.

The most frequent geese were Greylag Goose *Anser anser*, Greater White-fronted Goose *Anser albifrons* and Barnacle Goose *Branta leucopsis*. Egyptian Geese *Alopochen egyptiaca* and Canada Geese *Branta canadensis* also regularly crossed the area.

Overflying Greylag Geese, Egyptian Geese and Canada Geese were concentrated mostly in the western half of the study area, which can be explained by the position of the water bodies frequented by the local resident geese. Greater White-fronted Geese flew mostly along a W-E axis. In the E their heading was to the SW and in the W between SW and SE. Barnacle Geese most frequently were recorded flying along the NE-SW axis.

According to the radar measurements median altitudes varied between 18 m and 163 m (18 m Canada Goose, 20 m Egyptian Goose, 56 m Greylag Goose, 85 m Greater White-fronted Goose, 163 m Barnacle Goose). Of the three most frequent species the Greylag Geese flew lowest and the Barnacle Geese highest. Seventy five percent of Greylag Geese flew below101 m, of Greater White-fronted Geese below 144 m and of Barnacle below 231 m above ground level. Canada Geese and Egyptian Geese flew very low. The middle 50% of Greylag Geese, Greater White-fronted Geese and Barnacle Geese flew between 31 m and 231 m.

The rotor sweep zone of modern WEPs, the risk zone for birds, has changed in recent years. With the greater hub heights and rotor lengths nowadays, it is much wider and at a greater height. Correspondingly, the percentage of birds at risk has also changed. In this study, Barnacle Geese and Greater White-fronted Geese were at highest risk, while Greylag Geese suffered the lowest risk from modern turbines. Barnacle Geese were more at risk by turbines whose rotor reached the greatest height (67%).

The Greylag Geese and Greater White-fronted Geese showed no preference for particular altitudes at specific sites. Barnacle Geese flew higher in the NE and SW sector than in the NW and SE sector. Most high flying geese (mainly Greater White-fronted Geese and Barnacle Geese) were in the NE sector.

This present research gives insight into the spatial and altitudinal use made by geese wintering in the study area with particular reference to the high-risk zone above a potential WEP. This gives policy-makers an instrument that allows them to assess possible barrier effects of planned turbines and to make decisions accordingly.

Key words: flight altitudes, radar, Arctic geese, Nordic geese, wind farm, sweep zone, East Friesland, *Branta leucopsis, Anser albifrons, Anser anser*

Introduction

Arctic and Nordic geese winter in the North German Lowlands bordering the North Sea (KRUCKENBERG et al. 2022). Whereas in earlier times the wintering area of the geese consisted of vast areas with wet meadows, today it is segmented by human structures and activities (streets, wind mills, power lines) and transformed by drainage. Conflicts between humans and geese are inevitable. As we are responsible for the conservation of these geese, we have to take care that they do not collide with human structures (KRUCKENBERG 2018).

There is extensive knowledge on avian mortality through collision with wind turbines (DREWITT & LANGSTON 2008, HÖTKER et al. 2004, GARTHE & HÜPPOP 2004, TELLERIA 2009, FIJN et al. 2012). According to an inland radar study close to the Ramsar site "Ismaning reservoir and (former) fish ponds" during moult migration (June/July), 45% of all birds and 40% of water birds flew below 200 m (the risk zone) within the potential WEP as well as outside (KÖHLER et al. 2014).
As birds are most at risk of collision in the sweep zone of a rotor, a three year radar study focused on flight intensities and flight heights at an offshore wind farm (FIJN et al. 2015). Fifty percent of birds (by day and by night) flew below the height of the WEP (115m) and 30% flew in the sweep zone between 25 m and 115 m. Today these zones are much higher–consonant with modern hub heights and blade lengths–so that the percentage of geese flying at risk height, has changed.

According to the mortality list of species in collision with wind turbines, the danger of being killed in this way is small in geese (LANGEMACH & DÜRR 2020). DESHOLM & KAHLERT (2005) found out that the number of geese and ducks (mainly Eider Ducks *Somateria mollissima*) entering the site of an offshore wind park on migration decreased by a factor of 4 to 5 from the pre-construction to the initial operation of a wind farm. In fact, less than 1% of the geese and ducks flew close enough to be at any risk. In migrating Pink-footed Geese *Anser brachyrhynchus* more than 90% avoided offshore wind farms (PLONCZKER & SIMMS 2012). Apparently, wind farms act as a barrier for migrating Pink-footed and other geese species and Eider Ducks.

The phasing out of fossil fuel use is increasing pressure to construct more wind farms. These wind farms, if placed in areas with high densities of flying geese, will force the geese to undertake flight detours, thus dramatically increasing their energy costs (LANGSTON & PULLAN 2003, HOETKER et al. 2004). Therefore areas, where wintering geese have over many years been observed to concentrate for feeding, roosting or comfort behaviour (GERDES 1994, KRUCKENBERG 2013), have been put under protection, and no wind turbines are permitted in these protected areas. However, geese regularly fly outside of these areas to reach and return from their roosts, to visit an external comfort zone, or to continue their migration route.

This study was promted by large numbers of geese flying from a roost in the north of the study area towards their feeding areas in the south, thereby regularly crossing an area designated as a WEP, were what prompted this study. The aim was to find out which parts of the study area were crossed by geese and by what species and whether they were flying in the sweep zone of modern WEPs that might act as a barrier for them (HÖTKER 2017). We used a vertical radar to measure flight altitudes of visually identified geese.

Material and Methods

The study area

The study area was situated south-east of Marienhafe (fig. 1). It was a grassless plain devoted mainly to the cultivation of maize. In winter, post-harvest, it was a stubble-field. Some freshwater lakes close to the study area were visited by the geese: 600m north (53°31'04.93''N 7°18'28.06''E), 700m west (53°30'32.40''N 7°16'38.61''E) and at the southwest border of the study area (53°29'41.22''N 7°18'08.14''E).

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Observation site

The observation site and position (53°30'16''N 007°18'51''E) of the radar (details given below) was chosen such that no spurious echoes from trees or man-made constructions would interfere with the measurements. For security reasons we chose a remote site at the end of a cul-de-sac dirt road, which we were allowed to shut temporarily. Additionally we installed a camera trap and made an arrangement with a local person to ensure the safety of the recording instruments. The recording site was 1 km from the western border and 2.4 km from the eastern border of the study area. The view to the east and west was open for several kilometres, but to the north and south, the study area was bordered by trees.

Fig.1. The study area is marked as a light area. The black point represents the observation site and radar site.

Observation period

During the first wave of arrivals of Arctic and Nordic geese in October, geese settled at the most attractive sites known from previous years (Großes Meer, Engerhafe). This, however, did not lead to recurrent overflights of the study area. Later, in the course of a cold snap in January, which was associated with further immigration of Arctic geese to East Friesland, flights of geese over the study area became frequent. The study started on 14 January 2015 and ended on 02 May 2015.

Field observations

The field work was done by a radar observer and a field observer, equipped with a binocular (10x40), a telescope (zoom 20-60x), a compass, a radio clock, a disc with the degrees of a circle, a forehead flashlight and a form sheet. The two observers had to work in close contact, in order to be sure that they were referring to the same flock of birds and radar echo. The field observations started one hour before sunrise and ended 2 hours after sunrise. In the evening, the observations started one hour before sunset and ended 2 hours after sunset. While in the morning most observations were made in daylight, in the evening most were made in darkness and numbers of geese could therefore be counted only at the beginning of the session. After dark, mostly neither the position nor the flight direction and the number of birds in each flock could be determined. In dark or foggy conditions the species were identified by their calls. We recorded observations on 50 days during the morning sessions and on 30 days during the evening sessions.

The field observer searched for geese in the entire study area, noting for each flock the species, the number of geese, the estimated distance and direction from the observer as well as the flight heading (bearing) and altitude of the geese. If a flock seemed likely to cross the radar beam, the observer informed the radar operator of its estimated distance to the W or E of the radar, its approximate height and the time. The radar operator verified the echo of the geese and noted the name of the file (date and time as file name), the position of the echo in the radar beam, the species and number of birds (determined by the field observer).

If the field observer missed geese flying through the beam, the radar operator described the position of the echo in the beam for further identification by the field observer. Flocks, which could not be assigned to a species, were recorded and will in this paper be referred to as "unspecified Anser/Branta geese". If a mixed flock with unknown proportions of different species passed, we classified it similarly. If time was too limited to document all overflights of geese, priority was given to those flocks that were likely to cross the radar beam, as of these we were able also to establish the altitude.

Radar observations

We used a ship radar of the type Furuno (Fr-2125) (fig. 2). The antenna was 2 m long and rotated at 24 r.p.m.. An image was made of every rotation and after every 10 revolutions of the beam an integrated image was made in order to show the track. The radar worked with a pulse length of 0.08 (HILGERLOH et al. 2010). We normally worked with a range of 750 m because of the better resolution and as most geese could be detected within this range. Very high flying geese might be underrepresented, as the border of the range corresponded to a semisphere. Geese passing directly over the radar site were detected up to a height of 750 m, but further east or west the ceiling became lower. When we heard calls of geese flying outside of the normal range, we switched to a range of 1500 m. During the change-over, it is possible that a flock may have been missed. Additionally, geese flying close to the ground will also have escaped detection.

Fig.2. The radar, in the position to rotate vertically, with view over the study area to the north.

The radar was mounted on a metal stand, which was fixed to the ground by pegs. A tilt mechanism allowed a manual change of the rotation plane. From field observations from the previous year we deduced that the main flight directions would lie between N and S. As the detection of birds by radar is best from a position perpendicular to the line of flight, we scanned the sky along a W-E axis. The radar beam rotated vertically from west to east to measure heights. As it turned out, the main flight direction of the previous year was not confirmed. This, however, caused no problem, as birds the size of geese can be detected head-on or tail-on even if we double the working range (FIJN et al.2015, appendices).In order to minimize ground clutter (=unwanted echoes), we suppressed the beam for the first 2 degrees from the ground. Of all the geese crossing the study area along a W-E-axis, only the height of those flying in the radar beam could be measured. For measurement of flight directions the beam rotated horizontally from 270° over North to 90°. The beam was suppressed when it was directed towards the ground during the vertical rotation and towards the south during the horizontal rotation. A 30 m cable connected the antenna rig with the monitor assembly, which was situated in our field office (a van). The radar was powered by a generator, positioned at a distance of 30 m to reduce noise. We rarely used the horizontal radar, as there was too much ground clutter and as the width of the operational beam allowed only detection of low flying geese (below 300 m) (HILGERLOH et al. 2010).

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The timing of the radar signal was calibrated according to the Furuno Installation and Operations Manual by a Furuno technician and further with the aid of a car at a known distance. This calibration ensured that the distance and height measurements of the radar were as accurate as possible. During the initial configuration of this radar a Sensitive Time Control (STC) was activated and remained in operation throughout the study. The purpose of this was to brighten the faint signals generated by objects (i.e. birds) detected at extreme range and to reduce glare from contiguous echoes (GÖBEL 2001). The computer program "Swarm" saved the images taken from the rotations of the radar beam. The integrated images containing ten revolutions of the beam showed the track of the flocks or of an individual goose.

Analyses

Height measurements of flying geese by radar: the files with the geese detected by the radar and identified by the field observer were checked after the field work. The position of the echoes of the geese was imported into a program that digitalized the echoes. Flight height and distance from the radar in metres was calculated by the program "radar calculations". These data were the basis for all further calculations. All graphs on the heights of the different species were created by the program R 3.1.0 (R DEVELOPMENT CORE TEAM 2014). Regional dispersion of overflying geese: The data on dispersion of overflying geese had been collected by the field observer. Some overflights at greater distances away from the observer might have been missed. Maps with trajectories of flocks of birds were created with the help of the program R 3.1.0 (R DEVELOPMENT CORE TEAM 2014). As they were based on estimations of distance and direction from the observer und flight direction of the birds, the values were rounded. Accordingly, several flight paths were exactly the same. In order to visualize all trajectories, we added a random spreading of ±4° (direction), and ±4% (distance).

Results

We registered 19,224 geese flying over the study area (tab. 1). The most frequent were the Greater White-fronted Goose *Anser albifrons*, followed by Barnacle Goose *Branta leucopsis*, Greylag Goose *Anser anser* and Tundra Bean Goose *Anser fabalis rossicus*. Egyptian Geese *Alopochon egyptiaca* and Canada Geese *Branta canadensis* were not migrants and were present throughout the year. A certain proportion of the Greylag Geese bred nearby and stayed through the winter.

Tab. 1. Number of overflying geese in the morning and in the evening. In darkness and in foggy weather the geese could not be counted.

species	number of individuals in counted flocks	flocks counted	flocks not counted	all flocks
Bean Goose	512	10	0	10
Greater White-fronted Goose	7335	217	52	269
Greylag Goose	959	123	17	140
Canada Goose	165	34	56	90
Barnacle Goose	5128	59	22	81
Egyptian Goose	97	41	2	43
Anser/Branta sp	4980	140	14	154

The highest number of flocks was observed in Greater White-fronted Goose, the second highest in Greylag Goose, followed by Barnacle Goose (tab. 1. and 2.).

Tab. 2. Flock sizes of the species (median, lower quartile, upper quartile), calculated on the basis of the morning flights

species	number of individuals in flocks counted	flocks counted	median indiv per flock	lower quartile	upper quartile
Bean Goose	222	7	2	1	61
Greater White-fronted Goose	6401	207	12	4	40
Greylag Goose	804	114	4	2	9
Canada Goose	156	28	3	1	6
Barnacle Goose	4659	49	35	10	110
Egyptian Goose	77	32	2	1	2
Anser/Branta sp	4904	131	7	3	19

The smallest numbers of geese were registered in the flocks of Greylag Geese and largest in those of the Barnacle Geese (tab. 3a).

Tab. 3a. Number of geese during the morning observations and % of all flocks in the morning and % of observation mornings with overflights of each species

species	number of individuals in morning	flocks counted in morning	flocks not counted in morning	flocks in total in morning	% of all flocks in morning	% of mornings present
Bean Goose	222	7	0	7	70	8
Greater White-fronted Goose	6401	207	8	215	80	54
Greylag Goose	804	114	13	127	91	7
Canada Goose	156	28	36	64	71	58
Barnacle Goose	4659	49	6	55	68	46
Egyptian Goose	77	32	1	33	77	48
Anser/Branta sp	4904	131	1	132	86	66

What was the temporal span of the overflights? While the local breeders such as some of the Greylag Geese, Canada Geese and Egyptian Geese stayed in the area all year, the Arctic geese were only present from mid-January to the end of March.
In their daily rhythm the geese started by flying from the nocturnal roost to their feeding area. During the day they moved between various feeding areas. At sunset they flew back to their roost. In the morning hours, more geese flew over the study area than at sunset. All in all, only 9 to 32% of flocks in each species flew over the study area in the evening hours (tab. 3b).

Tab. 3b. Number of geese during the evening observations and % of all flocks in the evening and percent of observation evenings with overflights of each species

species	number of individuals in evening	flocks counted in evening	flocks not counted in evening	flocks in total in evening	% of all flocks in evening	% of evenings present
Bean Goose	290	3	0	3	30	10
Greater White-fronted Goose	934	10	44	54	20	30
Greylag Goose	155	9	4	13	9	33
Canada Goose	10	6	20	26	29	50
Barnacle Goose	469	10	16	26	32	30
Egyptian Goose	20	9	1	10	23	33
Anser/Branta sp	76	9	13	22	14	30

Greater White-fronted Geese were present on 54% of the mornings, Barnacle Geese on 48% and Greylag Geese on 70% (tab. 3a). Some Greylag pairs bred nearby; these crossed the study area frequently. The same applies to Canada Goose and Egyptian Goose (tab. 3a).

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We appraised whether certain parts of the study area were frequented more than others by the different species in the morning hours. Overflying Greylag Geese were concentrated mostly in the western half of the study area, which can be attributed to the position of the water bodies frequented by the local birds (fig. 3).

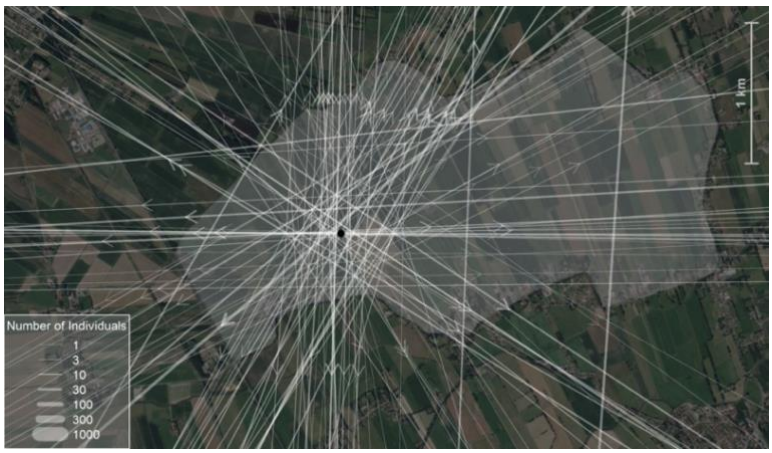

Fig.3. Dispersion of overflying flocks of Greylag Geese in the morning (n=105). The flight direction of the flocks was estimated visually.

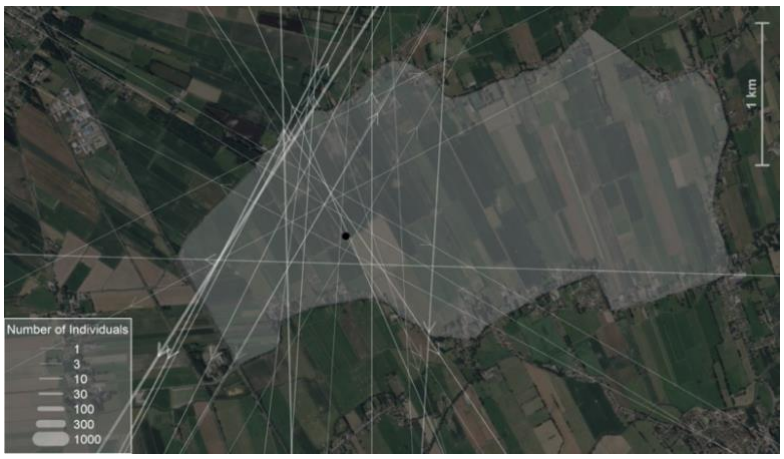

Fig.4. Dispersion of overflying flocks of Canada Geese in the morning (n=24). The flight direction of the flocks was estimated visually.

Canada Goose and Egyptian Goose, which visited the same water bodies, showed a similar distribution (fig.4, fig. 5). The Greater White-fronted Geese frequented the entire study area and were concentrated on a W-E axis along the radar beam (fig. 6). Barnacle Geese flew more frequently over the NE and SW sector than other parts of the study area (fig.7).

The few flocks of Bean Geese were seen crossing the entire study area mostly along the E-W axis (fig. 8). Unspecified Anser/Branta geese and flocks with unspecified proportions of different goose species were recorded in all parts of the study area, but most flocks were registered in the western part (fig. 9).

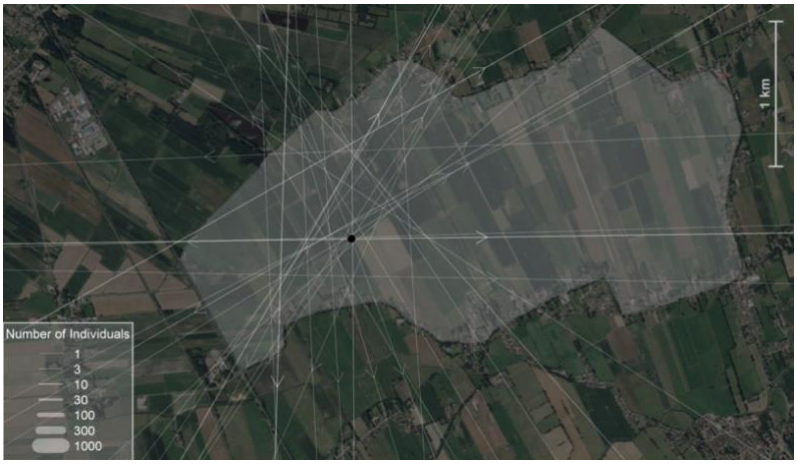

Fig. 5. Dispersion of overflying flocks of Egyptian Geese in the morning (n=29). The flight direction of the flocks was estimated visually.

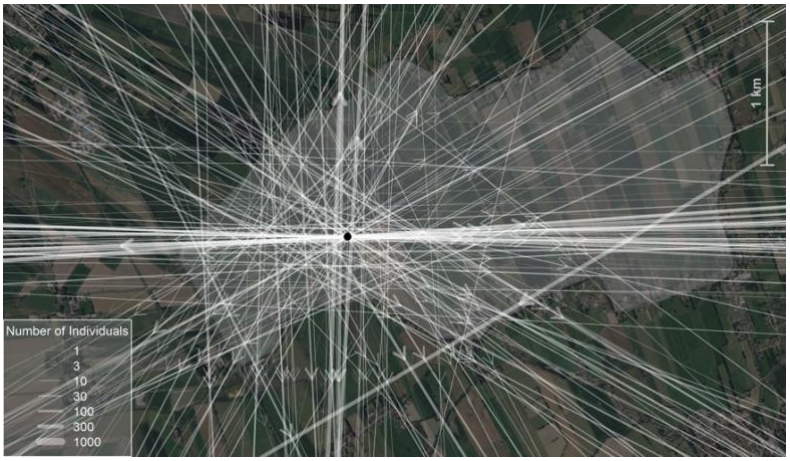

Fig. 6. Dispersion of overflying flocks of greater White-fronted Geese in the morning (n=193). The flight direction of the flocks was estimated visually.

Of the three most frequent species, Greylag Geese flew lowest, Barnacle Geese highest and Greater White-fronted Geese intermediate between them (fig. 10). In this graph the Greater White-fronted Goose is called simply White-fronted Goose. The five flocks of Bean Goose, measured by radar, flew on average lower than Greylag Geese (fig 11, tab. 4).

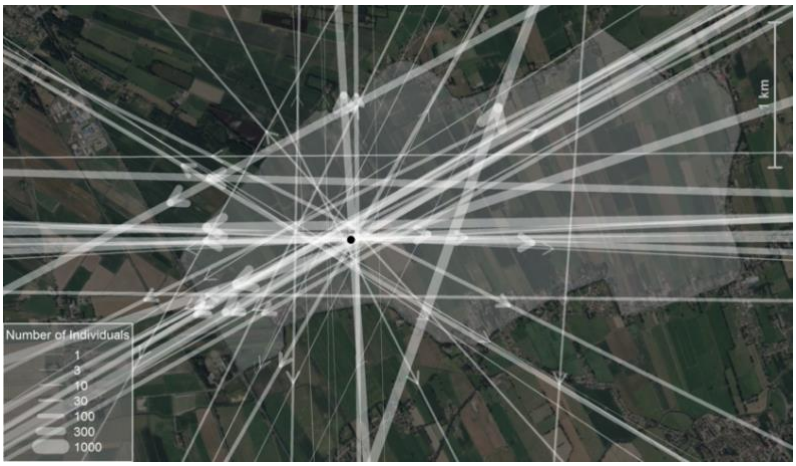

Fig.7. Dispersion of overflying flocks of Barnacle Geese in the morning (n=47). The flight direction of the flocks was estimated visually.

On average the unspecified Anser/Branta geese flew higher than Greater White-fronted Geese and lower than Barnacle Geese (fig. 10). The local Canada Geese (9 flocks measured) and Egyptian Geese (17 flocks measured) flew extremely low (fig. 11, tab. 4). The altitudinal layer of the middle 50% of the geese of the three most numerous species was between 31 m and 231 m (tab. 4). The flight height up to which 75% of the geese were recorded, was 101 m for Greylag Geese, 144 m for Greater White-fronted Geese and 231 m for Barnacle Geese (tab. 4).

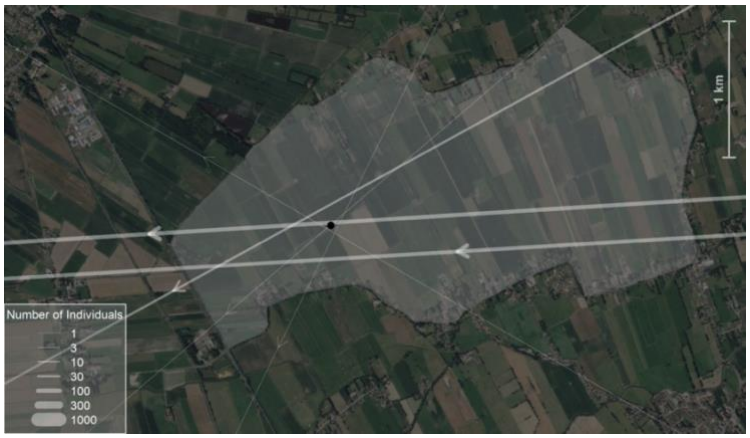

Fig 8. Dispersion of overflying flocks of bean geese in the morning (n=6).

We calculated the percentage of geese flying in the risk zone of a WEP having the dimensions of two modern types of turbine (E-160 EP5 and E-138 EP3, Enercon) with hub heights of 166m and 160 m and rotor lengths of 80 m and 69 m respectively. The rotor sweep zone extends from 86 m to 246 m height (160 m) and from 91 m to 229 m (138 m) (tab. 5).

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The sweep zone of turbine 1 was 22 m wider than of turbine 2 and the maximal height of turbine 1 was 17 m higher than that of turbine 2. The calculations demonstrated that the highest percentage of individuals counted in the sweep zone of turbine 1 occurred in Barnacle Geese (67%). Of the three most numerous species, the one with the smallest percentage flying in sweep zone 1 was the Greylag Goose (33%) and White-fronted Geese were present in the risk zone with an intermediate percentage of 54%. A comparable analysis of goose flocks resulted in the same placement. The percentage of individuals in the sweep zone of turbine 2 was lower in all three species, in this case with the highest percentage in White-fronted Geese (45%), followed by Barnacle Geese (38%) and Greylag Geese (27%). Also the percentage of flocks in sweep zone 2 was smaller in all three species, the percentage of Barnacle Geese being the highest.

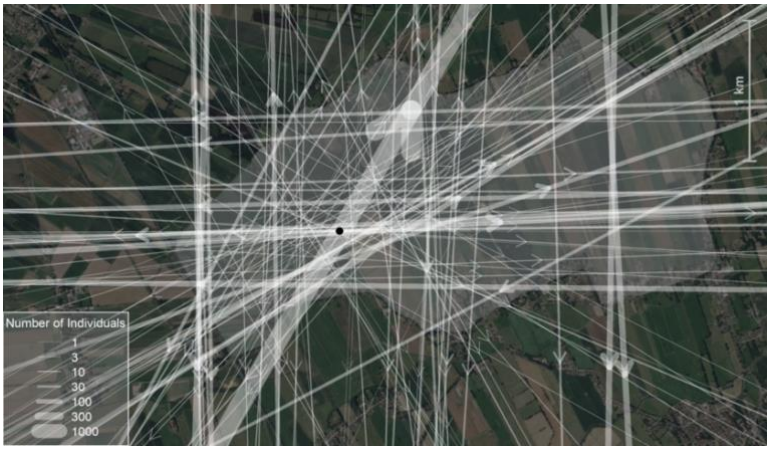

Fig. 9. Dispersion of overflying flocks of unspecified Anser/Branta geese in the morning (n=120).

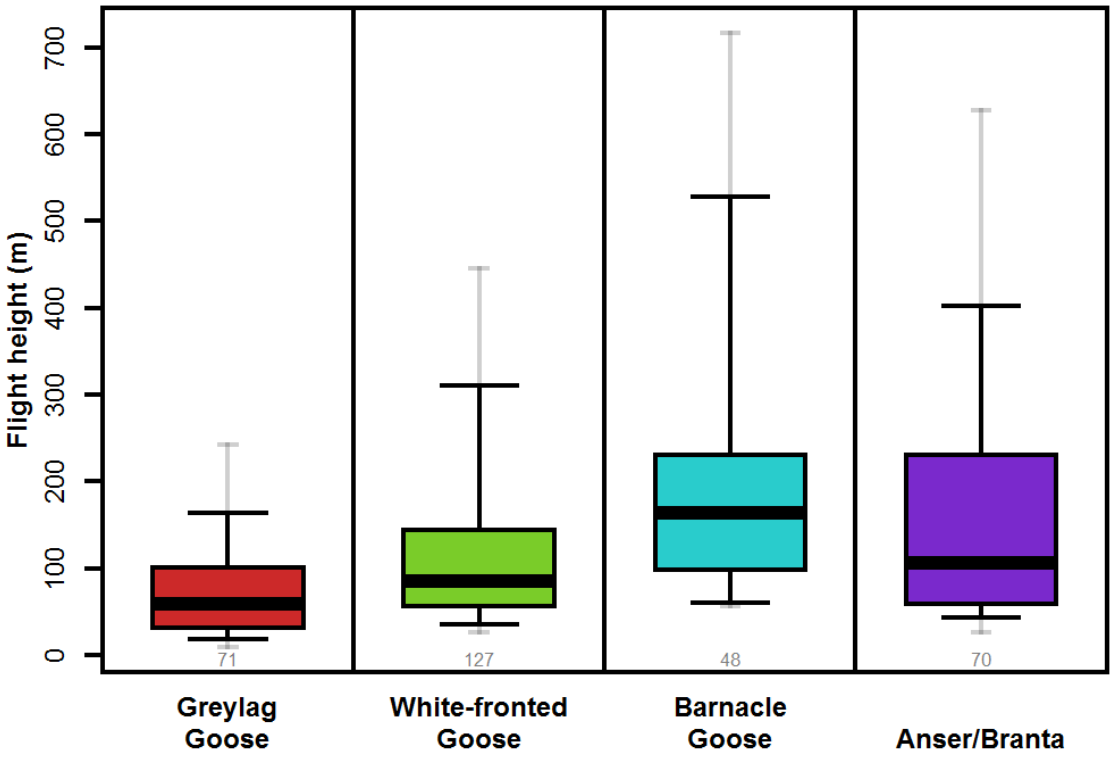

Fig. 10. Boxplot on flight altitude including median (thick black line), quartiles (box), 5% and 95%-quantile (black bars) and extreme values (grey bars). Number of flights in grey underneath each box-plot.

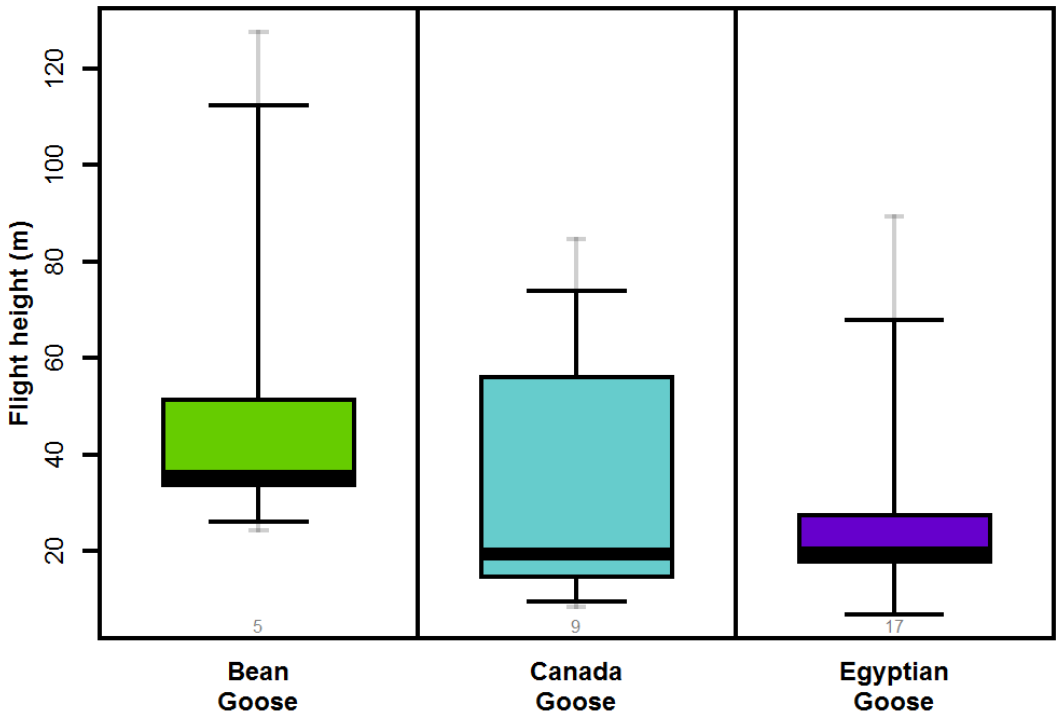

Fig. 11. Boxplot on flight altitude including median (thick black line), quartiles (box), 5% and 95%-quantile (black bars) and extreme values (grey bars). Number of flights in grey underneath each box-plot.

Tab. 4. Flight altitude of the flocks of the different geese species, measured by radar.

species	number of flocks	median (m)	middle 50% (m)	75% below (m)
Bean Goose	5	35	34 - 51	51
Greylag Goose	71	59	31 - 101	101
Greater White-fronted Goose	127	85	56 - 144	144
Barnacle Goose	48	163	99 - 231	231
Canada Goose	9	19	15 - 56	56
Egyptian Goose	17	20	18 - 27	27
Anser/Branta sp	70	106	60 - 227	227

In order to test whether regional patterns in respect to flight height could be detected, we considered only altitudes measured by radar, excluding evaluations made by the field observer, if the flight direction was estimated by the field observer.

Tab. 5. Percentage of geese in the sweep zone of two modern turbines:
Turbine 1 (E - 160 EP5) with a hub height of 166m and a rotor length of 80m. The sweep zone extends from 86 to 246m height (160m).
Turbine 2 (E - 138 EP3) with a hub height of 160m and a rotor length of 60m. The sweep zone extends from 91m to 229m height (138m).

species	sweep zone (1)		sweep zone (2)		individuals	counted	total of
	% of individuals in counted flocks	% of all flock	% of individu in counted flocks	% of all flocks	of counted flocks (n)	flocks (n)	flocks (n)
White-fronted Goose	54	42	45	36	3694	109	127
Barnacle Goose	67	67	38	52	3235	40	48
Greylag Goose	33	31	27	25	597	71	71
Anser/Branta sp	12	37	7	30	3117	65	70

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In fig. 12 to fig. 15 flight height is shown together with flight direction and number of geese per flock in the corresponding position of the overflight for the most frequent species and unspecified Anser/Branta geese. Greylag Geese, Greater White-fronted Geese and unspecified Anser/Branta geese displayed no preference for particular altitudes in particular parts of the study area. Barnacle Geese flew higher in the NE and the SW sectors.

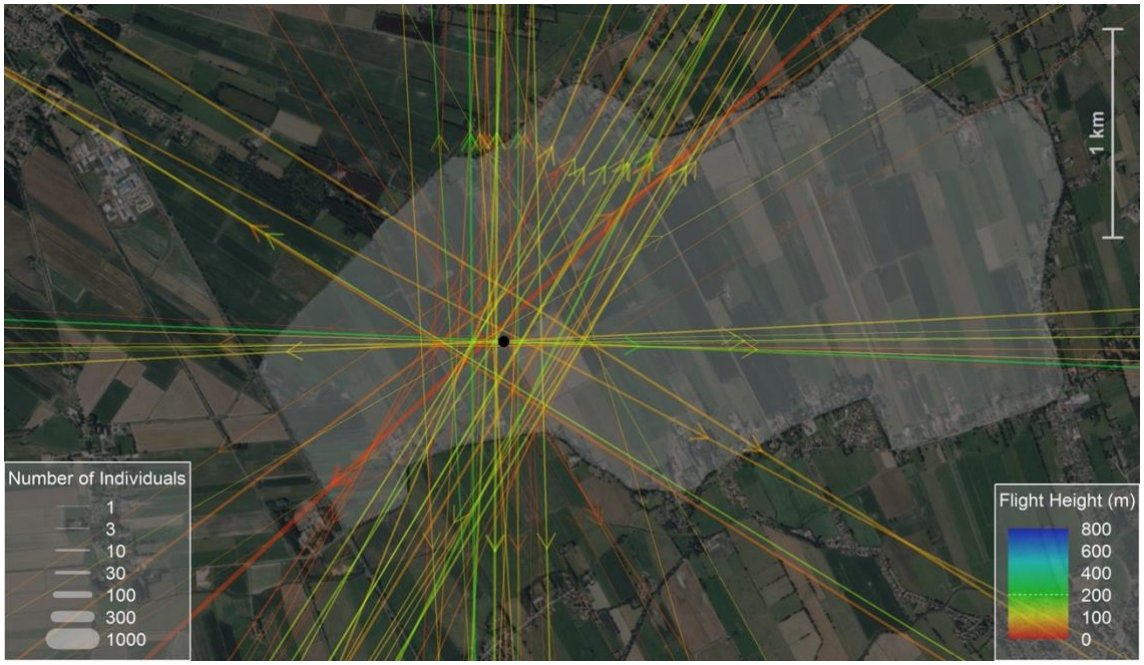

Fig. 12. Flight altitudes vs. area in Greylag Goose in the morning (n = 64). Flight directions were estimated visually, flight altitudes were measured by radar.

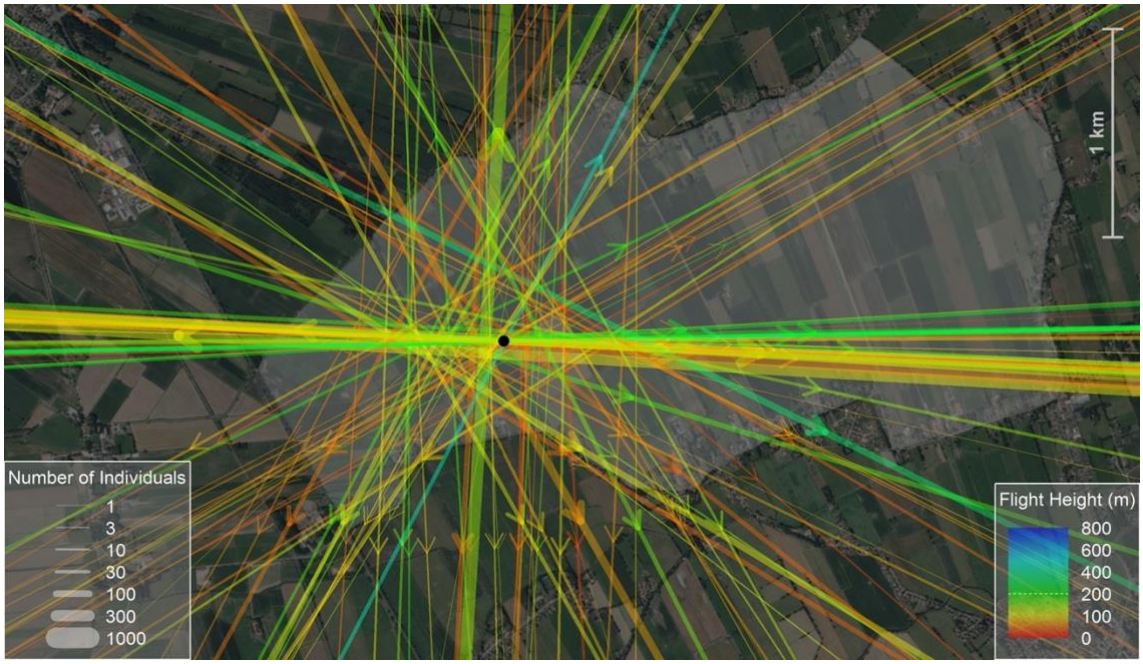

Fig.13. Flight altitudes vs. area in Greater White-fronted Goose in the morning n = 103). Flight directions were estimated visually, flight altitudes were measured by radar.

In order to examine any relationship between flight direction and flight altitude, the estimated flight headings of those flocks with altitudinal radar measurements were offset to our observation site and re-assessed. In Greylag Geese, no conspicuous correlation was demonstrable between flight height and direction (fig. 16).

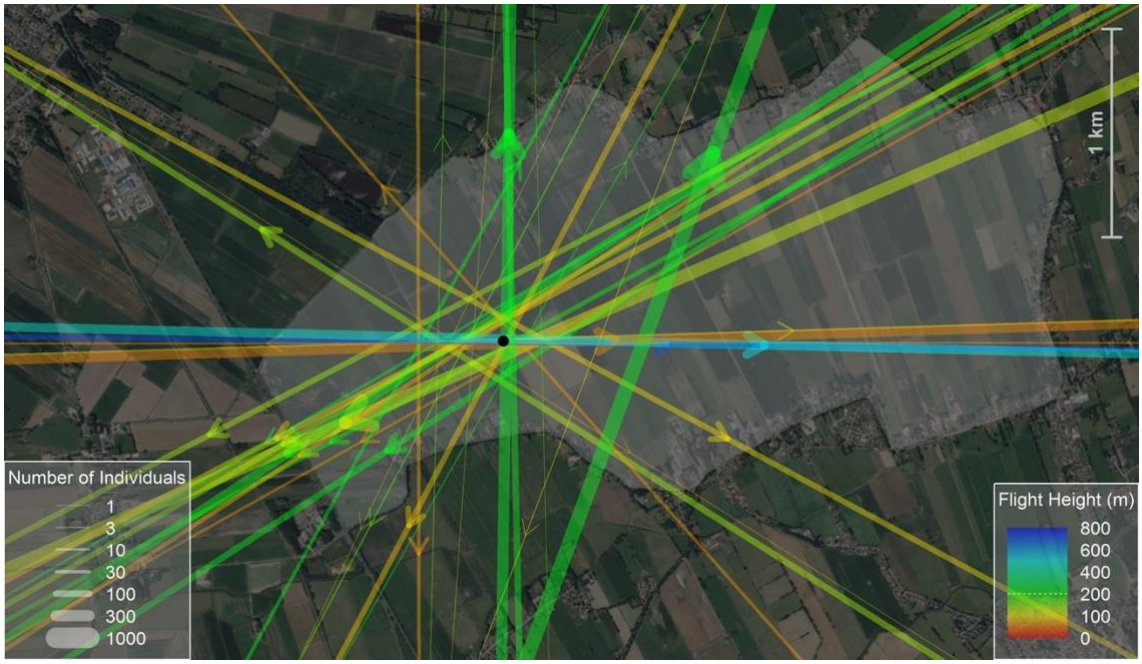

Fig.14. Flight altitudes vs. area in Barnacle Goose in the morning (n = 32). Flight directions were estimated visually, flight altitudes were measured by radar.

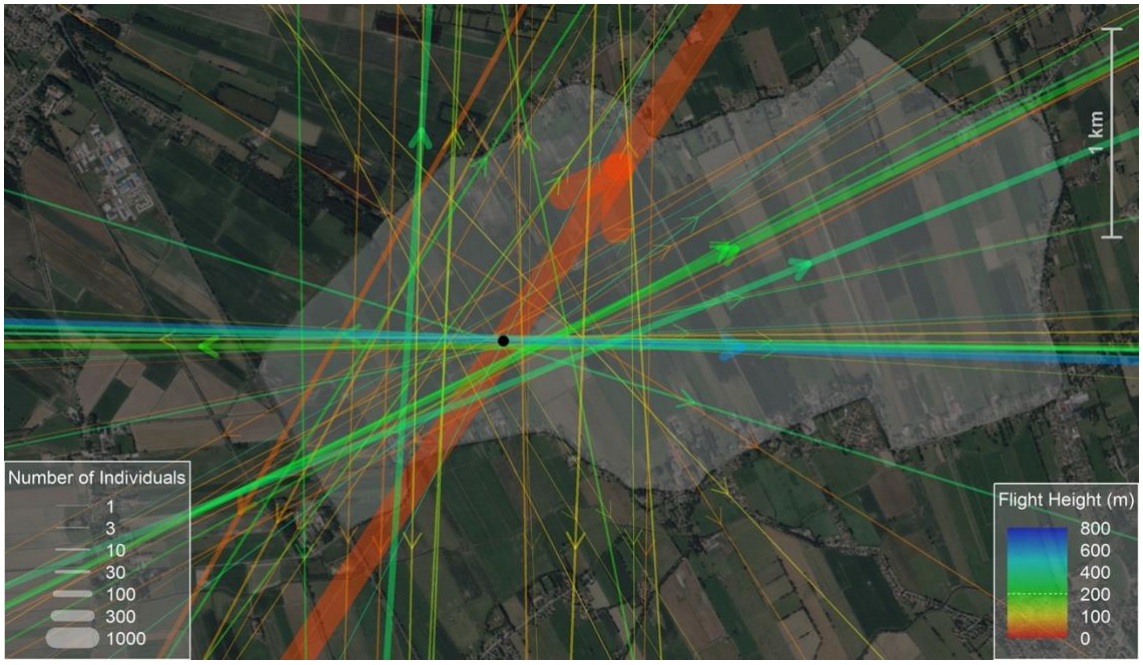

Fig.15. Flight altitudes vs. area in the group of unidentified geese in the morning (n = 57).

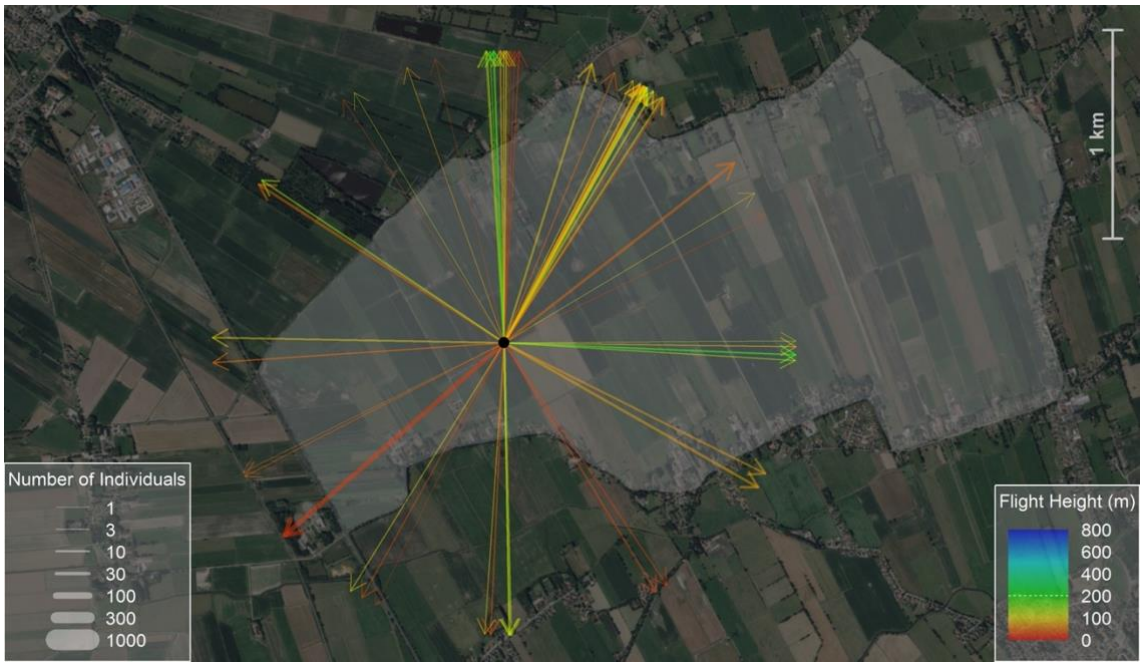

Fig.16. flight altitude vs flight direction in Greylag Goose in the morning (n= 64). Flight directions were estimated visually, flight altitudes were measured by radar.

Most low flying Greater White-fronted Geese were heading towards the sector extending from W to SE and the highest flying were heading towards the sector extending from N to ESE (fig. 17).

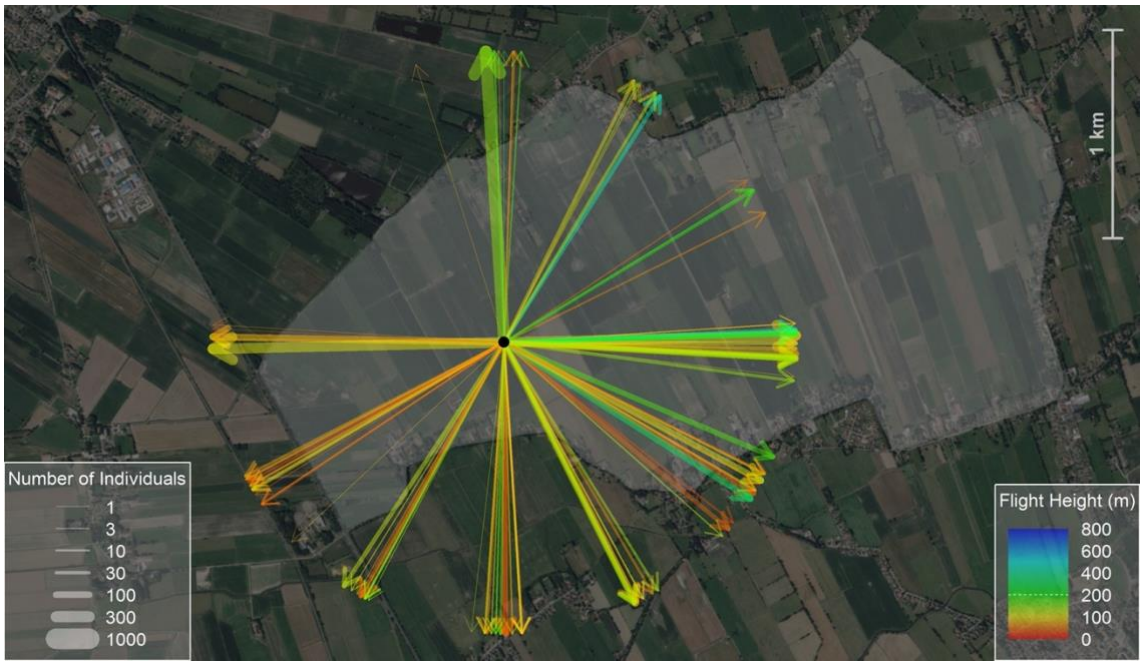

Fig.17. Flight altitude vs. flight direction in Greater White-fronted Goose in the morning (n = 103). Flight directions were estimated visually, flight altitudes were measured by radar.

The flight altitudes of Barnacle Geese heading in N to NE directions were all high, whereas in other directions lower altitudes were also registered (fig. 18).

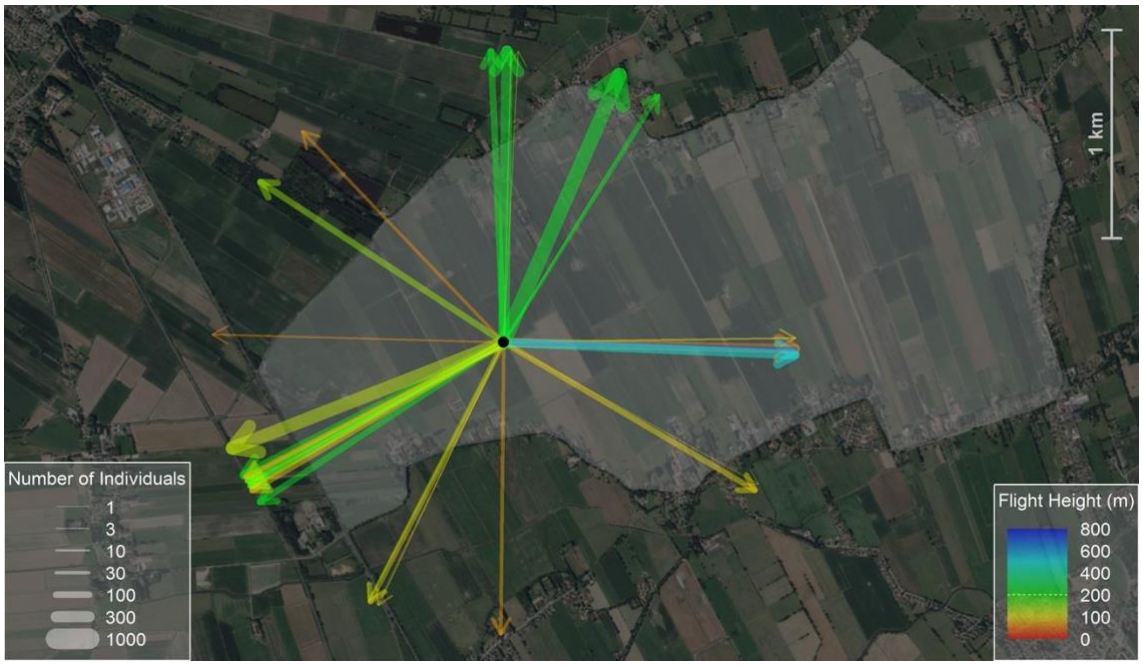

Fig. 18. Flight altitude vs. flight direction in Barnacle Goose in the morning (n = 32). Flight directions were estimated visually, flight altitudes were measured by radar.

In the consort of unspecified Anser/Branta geese, a high proportion of flocks flew very high with headings in the northern half of the compass (fig. 19).

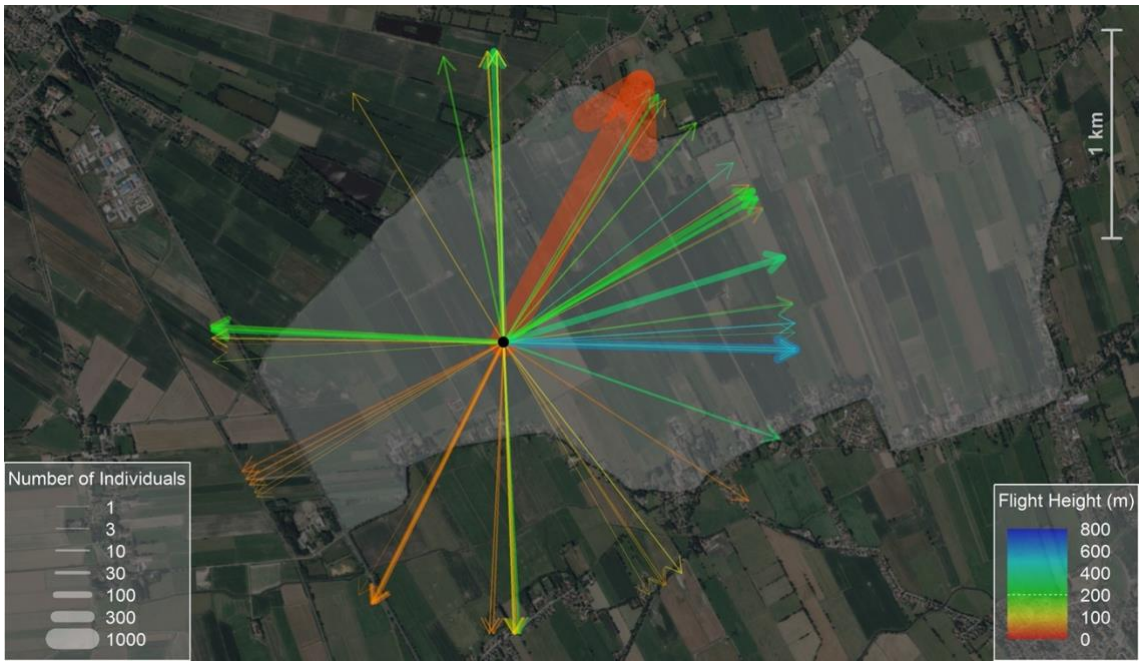

Fig 19. Flight altitude vs. flight direction in unspecified Anser/Branta geese in the morning (n = 57).

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Discussion

Discussion of the methods

Radar is an accepted tool in bird studies (EASTWOOD 1967, BRUDERER 1971, HILGERLOH 1981, PLONSZKIER & SIMMS 2012). With radar, observations can also be made at night and in poor visibility. It is also possible to measure the altitude and follow the flight path both of flocks and of individual birds. Nonetheless, the identification of species or taxa presents much more of a problem. To overcome this, recent studies have developed a number of new methods. Using an X-band tracking radar the wing-beat pattern of the birds was used to distinguish several groups of species: 1. waterbirds (such as ducks, coots and grebes), 2. songbirds, 3. swifts and 4. larger, unspecifiable birds (comprising geese, cormorants, herons and gulls) (KÖHLER et al. 2014). Other researchers have used an x-band surveillance radar rotating vertically. Two distinct groups emerge: a diurnal group and a nocturnal (FIJN et al. 2015).

An overview of the different species involved in day movements was established by independent field observations and consisted of gulls, terns, Cormorant, Gannet, ducks, geese and raptors. Passerines migrating during the night were identified by their calls (FIJN et al. 2015). Thus by the wing-beat method geese cannot be distinguished from cormorants, herons and gulls and by the second method geese are not distinguishable from gulls, terns, cormorants, gannets, ducks and raptors. Clearly, these methods would not answer the needs of the present study. It was decided, therefore, to adopt the method of PLONCZKER & SIMMS (2012) in their radar study on migrating Pink-footed Geese, where the species was identified by field observers. We used an x-band surveillance radar rotating vertically and identified the species visually or by their calls if possible. All studied birds belonged to the goose taxon.

The phenology of Arctic and Nordic geese wintering in East Friesland

As in previous years, the geese appeared over the study area in noteworthy numbers from mid-January (H. KRUCKENBERG, pers. com.), while the main feeding area at the "Großes Meer" and Leda-Jümme lowland had already filled up as usual by the end of November/beginning of December (KRUCKENBERG 2013, 2015).

As Greylag, Egyptian and Canada Geese bred and wintered nearby, they were seen crossing the study area throughout the entire observation period. By the 13th week of the year overflights of Greater White-fronted and Barnacle Geese ceased (23 March 2015 and 26 March 2015, respectively)

The pattern of geese movements differed greatly from that of the preceding winter, when a regular early morning movement of geese from a roost was observable within the study area (E. GIESE, pers. com.). On only a very few mornings did we register geese departing from the nearby roost. The pattern of flights may easily change enormously from one year to the next if, for instance, Greater White-fronted Geese, which normally prefer small lakes as nocturnal roosting sites, are no longer tolerated by a lake-owner.

Spatial distribution of the geese

Every evening, we saw large numbers of geese at a distance of about 5 km to the SW of the study area, flying towards the bay of the River Ley in the west and on the following morning back to the feeding areas at the Großes Meer, situated in the south of the study area.

Inside our study area, most flight activities were registered in the western part but there was no part of it entirely without flight activity.

Flight altitude

Radar-measured flight altitudes of geese migrating over the North Sea have been found to lie between 1000 and 3000m, most being between 1500 and 2100m (JELLMANN 1979a, 1979b). Similar altitudes of Greater White-fronted Geese (up to 1800m) were measured by satellite telemetry during spring migration (A. KÖLZSCH, pers. comm.). Conversely, most of the geese in our study area were wintering and only a small fraction was on migration (over land). Geese were flying either to feeding areas, their roost, their comfort zone or onwards towards their next wintering area or to their breeding grounds. In our study area, unless they were very close to their starting or destination point, the geese's flight altitudes varied according to their destination.

Thus, the altitudinal differences between the species was occasioned by the intentions of the geese: the relatively high altitude figures of the Barnacle Geese, for example, were due to the fact that several flocks observed were on active migration, The lower altitude figures of Greater White-fronted Geese may indicate a different flight motivation: they were relocating from one feeding area to another or to a comfort zone or to their roost. Very few will have been migrating. The highest flying Greater White-fronted Geese never reached the altitudes of the highest Barnacle Geese. These are known to make fewer breaks during migration than Greater White-fronted Geese (VAN WIJK et al. 2012). Barnacle Geese may have set off on their migration journey a fair distance away, for example in the Netherlands, whereas Greater White-fronted Geese most likely departed from East Friesland. In the even lower flying Greylag Geese two populations were involved: 1) the local population with short flights of small groups of geese between their local haunts (roost, comfort zone and feeding area), and 2) the wintering Nordic population. Canada Geese and Egyptian Geese flew even lower than Greylag Geese, explainable by the fact that they belonged to a purely local resident population. If a route to the roost of the geese had crossed over the study area we would have been better able to study the effect of the environment on flight altitude.

According to fig. 17 and 18 the highest flying geese, which involved Barnacle and Greater White-fronted Geese, were heading towards the NE sector. This corresponds with the expected migration directions towards Schleswig-Holstein, where they pause before migrating to their breeding area (JELLMANN 1979a). The highest concentrations of Greater White-fronted Geese in Schleswig-Holstein are recorded in March (HILGERLOH & BIERWISCH 1991), which is in line with the departure time from the study area. The highest flights to the W and SW, potentially involving migration flights towards the Netherlands, stayed below 250m.

Avoidance behaviour and risk zone

More action is required in the wintering areas of Arctic and Nordic geese than simply to protect their feeding areas. They fly out of these areas every evening to reach their roosts and fly back to their feeding area the following morning. Wind farms installed on these daily routes may have an adverse effect on the birds not principally as a direct cause of mortality but as a barrier around which they are constrained to detour (DESHOLM & KAHLERT 2005, PLONCZKER & SIMMS 2012, LANGGEMACH & DÜRR 2020). The energy costs of such circumnavigations can be significant (LANGSTON & PULLAN 2003, HÖTKER 2017).

However, if the geese did not change their route, in traversing a WEP they would incur the higher risk of fatal collision in the sweep zone of the turbines. The dimensions and height of this risk zone have altered in recent years owing to increasing hub heights and rotor length of the installations. According to an offshore wind farm study published seven years ago, 30% of migrating birds were at risk from a sweep zone of turbines

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between 25 m and 115 m height (FIJN et al. 2015). However, in our inland study, up to 67% of Barnacle Geese were at risk from the sweep zones of modern turbines between 86 m and 246 m height. Risk redefinition of this nature may be necessitated by changes either in the flight behaviour of the birds (on migration or on the wintering grounds as in our study) or of the width, height and number of turbines risk zones. Further studies in the wintering area of Arctic and Nordic geese are needed in order to elucidate in what situations and what percentage of geese are exposed to WEP risk zones.

The present research gives a first insight into the spatial and altitudinal use made by a number of geese species of the air space over an inland study area with characteristics similar to those suitable for the construction of WEPs. The percentage of birds flying in the risk zone of modern wind turbines was calculated for each geese species. It is hoped that this paper will help policy-makers to make informed assessments of the risks involved in the construction of WEPs in an important overwintering area of Arctic and Nordic geese.

Acknowledgements

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Was the (Lesser) Snow Goose (*Anser c. caerulescens*) once widespread in Eurasia?

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Introduction

It is common knowledge that the (Lesser) Snow Goose (*Anser c. caerulescens* Linnaeus, 1758) is mainly a species from Northern America, where they breed in the Arctic tundra and winter in more moderate southern parts of the continent. In Eurasia, snow geese only breed in northeastern Siberia on Wrangel Island, as well as sporadically on parts of the northern coast of Chukotka, and most of these birds migrate to the west coast of Northern America to winter. A small number of east-Siberian breeding birds winter in Japan and China.

But there is information from historical sources indicating that this geographical distribution might only be a rather recent phenomenon. It is only since the beginning of the internationally coordinated large-scale water bird censuses and bird marking programmes in the middle of the 20th century that we have gained more or less reliable information about the numbers and the range of the different goose species. Until then, there were only more or less flowery descriptions or rough estimates of the numbers of water birds ("countless" or "enormous masses") and there was only fragmentary knowledge about the breeding and wintering ranges of the different species.

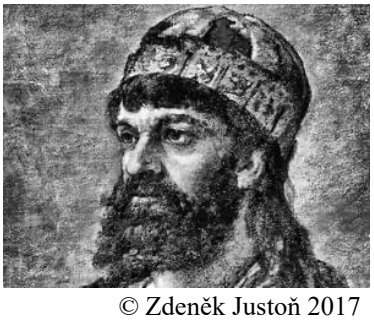
Besides, historic sources are sometimes difficult to interpret. For instance, historic authors frequently write about the "snow goose" that they "... saw them during their winter migration in Germany" and that they "covered entire regions". But it is still unclear whether it really was the white Snow Goose in all cases. It could also often have been a popular name for all kinds of migratory geese that came with the snow.

Keeping these caveats at the back of our mind, I here try to reconstruct the history of the (Lesser) Snow Goose in Eurasia.

Data from literature

The oldest literature sources about snow geese wintering in Western Europe originated from At-Tartûschi (10th century), Friedrich II of Hohenstaufen (1194-1250), Albertus Magnus (1200-1280) and Conrad Gesner (1516-1565) for the Middle Ages and Johann Matthäus Bechstein (1757-1822), who observed the species in swarms "of hundreds and more" over Thuringia in the 18th century. He described the white birds with their "black wing tips" as "a wonderful sight". Therefore, it seems that the snow goose, which winters mainly in North America today, also regularly occurred in western Europe until the 19th century.

Ibrahim ibn Ahmed at-Tartûschi (10th century) – an Islamic diplomat and merchant from Tortosa, (Spain) – travelled by order of Al-Hakam II. (915-976), Caliph of Córdoba, to the German emperor Otto I the Great (912-973) in 965 or 973. His journey led him through Spain, France, Belgium, the Netherlands, Germany and Denmark. He reported that, as he was crossing northern France, the winter was very cold and he saw white geese with red bills and legs wintering there (JACOB 1927).



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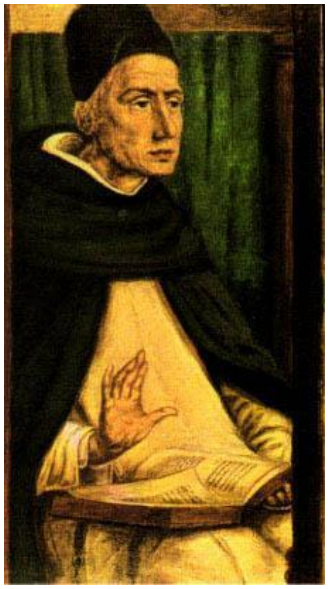
Hildegard von Bingen (1098 – 1179), was a German Benedictine, abbess, poet, composer, mystic, visionary and polymath of nature and medicine and a catholic saint since 1584 at the latest. She wrote books about theology, philosophy and natural sciences and was one of the most influential women of the Middle Ages. She travelled mainly through southwestern Germany, preaching in monasteries and churches and is internationally well known as the author of early publications about naturopathy . In her "Physica", she described minerals, plants and animals and their benefits for mankind. Here we find the description of two kinds of geese: "Anser – Die Gans" and "Halegans (Grandula A.A.)" or "Hagelgans" ("Anser - the goose" and the "hailgoose"). Based on the information given, the first species most likely is the greylag/domestic goose, whereas "hailgoose" might refer to any or all wintering geese or the Snow Goose in particular (LICHTENWAGNER 2019, REINPRECHT 2009, VAN BINGEN 1150-1160, 2010).

Friedrich II of Hohenstaufen, King of Sicily (1198-1250), King of Germany (1212-1250), Holy Roman Emperor (1220-1250) and King of Jerusalem (1225-1250), travelled during his life through Italy, Germany and Israel. He wrote a famous six volume book about falconry, "De arte venandi cum avibus" ("The Art of Hunting with Birds"), in which he showed that he was a good observer and a sceptical scientist. He did not just accept the knowledge of Aristotle or contemporary knowledge but mainly trusted his own observations and collected information. He was the first person who doubted the story that Branta-geese grew on trees. In his scientific "falcon book" the aristocratic author lists i.a. herons, waders, ducks, swans and geese as prey for his falcons. Coloured pictures of these birds are found in the margin of the pages around the text.

They show the following goose species: Greater White-fronted Goose *Anser albifrons*, followed by Greylag Goose *Anser anser*, Lesser White-fronted Goose *Anser erythropus*, Barnacle Goose *Branta leucopsis* and the Snow Goose *Anser caerulescens*. Probably two more species are included, the Bean Goose *Anser fabalis* as well as the Brent Goose *Branta bernicla*, but their identification is inconclusive (FRIEDERICH II 1756 & 1980, KINZELBACH 2008A & B, LAPPO et al. 2019).

GOOSE BULLETIN is the official bulletin of the Goose Specialist Group of Wetlands International and IUCN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Albertus Magnus or Albert von Lauingen (1200-1280) was a German polymath, philosopher, scientist, lawyer, Dominican monk, theologian, bishop, beatified in 1622 and since 1931 a catholic saint. He studied in Cologne, lectured i.a. in Cologne, Paris, Regensburg, Würzburg and Strasbourg and travelled through Italy, Germany and France, usually on foot. Albertus was the first Middle Age advocate of antique works of Aristotle and started the discussion about integrating the works of Aristotle and the Islamic academics into Christian science. He wrote books about theology, philosophy, law, logic, geography, astronomy and natural sciences. In one of these books, called the "Animalibus", he critically questioned contemporary knowledge and described the four goose species he knew to visit the territory nowadays called Germany. Besides the Greylag *Anser anser*, Bean *Anser fabalis* and Barnacle Goose *Branta bernicla* he definitely described the Snow Goose *Anser caerulescens* with following words: "*Et est tertius tetus albus praeter alarum extremas quatuor vel quinque pennas quae sunt nigerrimae: et hoc genus est parvum late et alte et longe volans*." ("And the third species is white except for the four or five outer wing primaries, which are very black: and this genus is small, flying wide, high, and far.") (STADLER 1920).

Painting of Tobias Stimmer 1564
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Conrad Gesner (1516-1565) was a Swiss physician, philologist and naturalist. He travelled through Switzerland, Germany and France. He wrote about geese: „*Im Anfang aber des Winters kommen sie wegen der Weyd / und wegen der gelinderen Lufft wiederumb zu uns / und fliegen alsdann mit grossen Schaaren also / daß ihrer zuweilen tausend / oder noch mehr beysammen gesehen werden*." ("But in the beginning of winter they come to us again because of the food / and because of the milder air / and then fly in large flocks / such that sometimes a thousand / or even more are seen together.") and states – with reference to Albertus Magnus – that in the 13th to 16th centuries four species of geese were found in Europe / Germany: the Greylag Goose, the (Taiga ?) Bean Goose, the Snow Goose ("*Das dritt Geschlecht ist gar weiß / außgenommen die vier oder fünff eussersten Schwingfedern / welche dann kolschwarz sind / welche gemeinlich Hagel oder Schneeganß genennt werden (Wiewol unsere erst und ander Gattung (als vorgesagt) also nennend) die sind auch klein / und fliegend hoch und weyt*." "The third species is white, except for the four or five outer wing primaries, which are very black, and commonly is called Hail or Snow Goose, although (as written before) the former species is called alike and this genus is small, flying high and far.") as well as the Barnacle Goose (GESNER 1600 & 1669).

Johann Leonhard Frisch (1666-1743) was a German schoolmaster, linguist, entomologist and ornithologist. He travelled through Germany, Switzerland, France, the Netherlands, Austria, Hungary and Italy. He wrote books about insects and birds.


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In 1733 he started to write a book about the birds of Germany, „Vorstellung der Vögel Deutschlandes und beyläufig auch einiger Fremden“ (“Presentation of the birds of Germany as well as passing mention of some foreign species”), which was finished by his sons and a grandson and appeared after his death in 1763. In this book, he wrote about „*Die Wilde Gans*“ („The wild goose“): „*In den Vögelbeschreibungen und Jagdbüchern, ist dies ein Hauptname vieler Arten. Indem unter diesem Tittel 2 Arten graubraune wilde Gänse, eine dunkelbraune Baumgans, und wie einige wollen, auch eine weisse mit schwarzen Flügelfedern, gezehlet werden. Eigentlich ist es die gemeine und überall häufige wilde Gans, die auch Graue Gans genennet wird.*“ (“In the descriptions of birds and books about hunting, this is a general name for most goose species. Under this designation 2 species of gray-brown wild geese, a dark brown tree goose and, as some may wish, also a white one with black wing feathers are counted. Actually it is the common wild goose that is common everywhere and is also called the Greylag Goose.”) (FRISCH 1763)


Painting of François-Hubert Drouais
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Georges-Louis Leclerc, Comte de Buffon (1707-1788) was a French aristocrat, naturalist, mathematician and encyclopedist He travelled through France, Italy and Switzerland and wrote a number of scientific books and papers, including a 44-volume “Histoire naturelle générale et particulière” (1749-1804) and, as a part of it, “Histoire Naturelle des Oiseaux” (1770-1783). In the last-mentioned, he also described the goose species he knew of. One of these species is the Snow Goose, of which he wrote: “*L’OIE DES ESQUIMAUX ... Outre l'espèce de nos Oies sauvages; qui vont en si grand nombre peupler notre Nord en été, il paroît qu’il y a aussi dans les contrées septentrionales du nouveau continent quelques espèces d'oies qui leur sont propres & particulières; celle dont il est ici question fréquente la baie d'Hudson & les pays des Esquimaux; elle est un peu moindre de taille que l’oie sauvage commune; elle a le bec & les pieds rouges, le croupion & le dessus des aîles d'un bleu-pâle, la queue de cette même couleur, mais plus obscure, le ventre blanc nué de brun, les grandes pennes des ailes & les plus près du dos sont noirâtres, le dessus du dos est brun; ainsi que le bas du cou; dont le dessous est moucheté de brun sur un fond blanc; le sommet de la tête est d'un roux-brûlé*.” (“The Eskimo Goose. … In addition to the species of our wild geese, which go to populate our North in summer in such great numbers, it seems that there are also some species of geese in the northern regions of the new continent, which are typical and characteristic there. The one in question here frequents the Hudson Bay as well as the land of the Eskimos. It is a little smaller in size than the common wild goose (*i.e. Greylag Goose*), has a red beak and feet, the rump and the top side of the wings are of a pale blue, the tail of the same colour, but darker. The belly is white streaked with brown, the flight feathers of the wings are blackish, the upper back and lower neck are brown, the underside is mottled with brown on a white background, the top of its head is a burnt fox-red.) (BUFFON 1785).


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Peter (Petrus, Pyotr) **Simon Pallas** (1741-1811) was a German (Prussian) zoologist, botanist and explorer. He studied at the German universities of Halle und Göttingen as well as at the Netherlands University of Leiden. During his lifetime, he travelled through Germany, the Netherlands, the United Kingdom and Russia. For most of his scientific life, he worked in Russia and between 1768 and 1794, sponsored by tsarina Catherine II of Russia, he undertook two expeditions, one through southern Russia, the other through Siberia. In his 1776 report about his Siberian expedition, he wrote: „*Die Schneegans ... ist an der Nordküste von Asien hauptsächlich nur von ohngefähr dem 130sten Grad der Länge an gen Osten, um die untere Gegend der Lena, Jana, und noch östlicher ins Eißmeer fallenden Flüsse gemein. ... Man soll sie auch auf den äussersten Landzungen, welche den Obischen Meerbusen einschliessen, dann auf Nowa Semlja an der ganzen Jurazkischen Küste des Eißmeers zwischen dem Ob und Jenisei, und sehr häufig auf der grossen taimurischen Landekke zwischen dem Jenisei und Chatanga antreffen. ... obgleich man sie am Ob zur Frühlingszeit ziehen sieht, so lassen sie sich doch niemals nieder. – Es scheint, daß auch in noch westlichern Gegenden, und selbst in Europa vorbeywandernde kleine Schwärme dieser Gänse gesehen zu werden pflegen.*“ („The Snow Goose ... is common on the north coast of Asia mainly east of the 130th meridian, around the lower region of the Lena, Jana, and rivers that enter the Arctic Sea even further east. ... They are also said to be found on the outermost peninsulas that enclose the Gulf of Ob, furthermore on Nova Zemlya, along the entire coast of the Arctic Sea between the mouth of the rivers Ob and Yenisei, and they are very common on the large Taimyr peninsula between the Yenisei and Khatanga. ... although you can see them moving along the Ob in springtime, they never settle down there. - It seems that small flocks of these geese also are observed wandering in more western regions and even in Europe.“) (PALLAS 1776).


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John Latham (1740-1837) was a British physician and naturalist, who worked as an ornithologist for most of his scientific life. He never left England and collected information by corresponding with colleagues and studying museum and private collections. In his Index Ornithologicus, published in 1790, he described most goose species. About the Snow Goose he wrote, “*hyperborea A. corpore niveo; fronte flavescento, remigibus decem primoribus nigris, rostro pedibusque rubris. ... Habitat in Europa, America boreali, ad sinum Hud sonis, gregatim migrans gregibus numerosissimis*.” (“*Anas hyperborea*. a snow-white body, a yellowish forehead, ten black primaries, beak and feet red. … She resides in Europe, north America, and at the Hudson Bay, with numerous migrating herds.”) Latham not only described the white, but also the blue morph, which lives in Canada: “*caerulescens A. grisea subtus alba, tectricibus alarum dorsoque postico caerulescentibus*.“ (“*caerulescens A.* greyish white on the underside, with the sides of the wings and the back blue.”)(LATHAM 1790).

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Johann Matthäus Bechstein (1757-1822) was a German theologian, naturalist, forester, entomologist, herpetologist and ornithologist. He wrote more than 130 publications, founded a forest academy and lectured about forestry, hunting and ornithology. He liked roaming through the forest and hunting, but never travelled far. In his „Gemeinnützige Naturgeschichte Deutschlands" (Public utility Natural History of Germany) Bechstein described the Snow Goose as follows: "*Der Schnabel ist orangegelb; die Stirn gelblich; die Füße sind roth; die Hauptfarbe weiß und die Schwungfedern von der Spitze an bis zur Mitte schwarz*." ("The beak is orange-yellow; the forehead yellowish; the feet are red; the main color [is] white and the primaries [are] black from the tip to the middle."). About the winter distribution during the late 18th century in Europe he stated: „*An der Preußischen Seeküste, ist sie auch im Winter, vermutlich also auch an der Deutschen. Den 13ten Jänner 1792. sah ich in Thüringen eine ungeheure Schaar von Osten nach Westen über den Thüringer Wald ziehen." … „Es wurde eine davon geschossen. Es zogen diesen Winter noch mehrere Schaaren, zuweilen von hunderten und mehrere, aber weit höher über den Thüringerwald*." ("In winter, the species is also found along the Prussian sea coast, so presumably it is also found along the German coast. On January 13th, 1792, I saw an immense crowd in Thuringia flying from east to west over the Thuringian Forest." … "One of them was shot. This winter several more flocks, sometimes of hundreds or more birds, migrated over the Thuringian Forest, but flew much higher.") (BECHSTEIN 1809).

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Coenraad Jacob Temminck (1778-1858) was a Dutch aristocrat, zoologist and the founding director of the Dutch "National Museum of Natural History" in Leiden. Temminck described a large number of species and a number of species are still named after him. About the Snow Goose (Oie hyperborée ou de neige *Anas hyperborea Gmel*.) he wrote: *"Front jaunâtre; tête, cou 'et corps d'un blanc pur; rémiges blanches jusqu'á la moitié de leur longueur, le reste noir; mandibule supérieure du bec d'un beau rouge, inférieure blanchâtre; iris d'un jaune brilliant; pieds d'un rouge trés foncé. …… Habite: les regions du cercle arctique; de passage régulier dans les contrées orientales de l'Europe; accidentellement en Prusse et en Autriche; jamais en Hollande*." ("Yellowish front; pure white head, neck and body; flight feathers white up to half of their length, the rest black; upper mandible of the bill of a beautiful red, lower mandible whitish; brilliant yellow irises; very dark red feet. …… Inhabits the regions of the Arctic Circle; regular passage in the eastern regions of Europe; accidentally in Prussia and Austria; never in Holland") (TEMMINCK 1820).

(Joseph) Karl Schmid (1788-1854) wrote in his book „Naturhistorische Beschreibung der Vögel“ (“Natural history description of birds”, published in 1818) about the Snow Goose in the late 18th century: „*Die Schneegans. A. hyperborea. (L‘ Oie de neige.) ist von Farbe weiß. Die Schwungfedern von der Spitze bis zur Mitte schwarz. Schnabel und Füße roth. Ist so groß wie die Hausgans, und bewohnt den Norden von Asien und Amerika. Man sieht sie auf ihren Wanderungen in Deutschland des Winters. In manchen Gegenden bedecken Heerden von mehreren Tausenden dieser Gänse das Land. Sie kann Ihrer ungemeinen Dummheit wegen leicht gefangen werden, und macht in den kalten Klimaten einen vorzüglichen Unterhalt der Einwohner aus. Ihre Federn sind ein Handelsartikel.*“ („The snow goose. *A. hyperborea*. (L’ Oie de neige.) is white of color. The primaries [are] black from the tip to the middle. Beak and feet [are] red. Has the size of a domestic goose and inhabits the north of Asia and America. You can see them on their migration in Germany in winter. In some areas, flocks of several thousands of these geese cover the land. Because of its immense stupidity, it is easily caught, and is an excellent means of subsistence for the inhabitants of cold climates. Their feathers are an article of commerce”) (SCHMID 1818).

John Gould (1804-1881) was a British ornithologist. He published a number of illustrated bird monographs. He was an expert in taxidermy and most of the pictures in his publications were developed by artists (including his wife Elisabeth Coxen Gould) from detailed sketches he made from killed and stuffed birds. He also produced a number of books about regional birdlife, e.g. about the birds of Australia, Asia, Great Britain and Europe. In the last-mentioned five volume “The Birds of Europe”, he wrote about the Snow Goose *Anser hyperboreus*, Pall.: “*This fine species of Goose inhabits all the regions of the Arctic circle, but more especially those portions appertaining to North America; it has also been said to inhabit the Antarctic circle, but this we find is not the case, its place being there supplied by another distinct species. From the northern portions of Russia and Lapland, where it is sparingly diffused, it regularly migrates to the eastern portions of Europe and is occasionally found in Prussia and Austria but never in Holland. The polar regions being its true and congenial habitat, it retires to those remote parts early in spring to perform the duties of incubating and rearing its young*.” (GOULD 1837).


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Johann Friedrich Naumann (1780-1857) was a German estate owner, farmer, naturalist and engraver. He published a 13 Volume „Naturgeschichte der Vögel Deutschlands“ (“Natural history of German birds”), which he dedicated to his father Johann Andreas Naumann (1744-1826), who was also an estate owner, farmer and naturalist. Neither his father nor Johann Friedrich travelled much, and both of them never left their home range. About the distribution of the Snow Goose in the early 19th century Naumann wrote: „*Wir sehen sie, nach den Angaben der Reisenden, von der Hudsonbai durch ganz Canada, bis zu den Aleuten und dem östlichen Sibirien, hier bis an die Lena, aber nicht viel weiter westlich, strichweise in großer Anzahl und ungeheuern Schaaren vorkommen*.“ (“According to the


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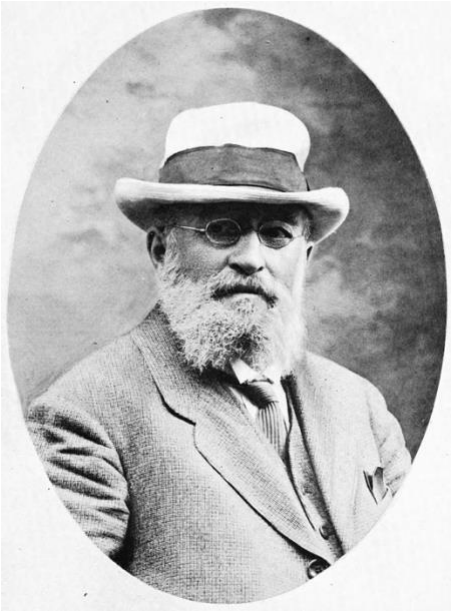
travellers' information, we see them from the Hudson Bay through all of Canada to the Aleutians and eastern Siberia, here as far as the Lena but not much further west, in large numbers and in immense flocks."). About the winter distribution in Germany Naumann reports: "*Schlesien ist von Schwenkfelds Zeiten her als das Land bezeichnet, in welchem sich sonst zuweilen Schneegänse gezeigt haben, über welches sie zuweilen sogar in großen Heerden hinzogen, und ein paar erst vor einigen Decennien dort wirklich erlegte Individuen gaben das sicherst Zeugniß hiervon. Auch in Preussen soll sie vorgekommen sein*." ("In Schwenkfeld's time (*i.e. 16th century*) Silesia was described as the country in which Snow Geese sometimes appeared, across which they sometimes even migrated in large flocks, and some individuals that were actually shot there only a few decades ago gave the most definite testimony of this. The Snow Goose is also said to have occurred in Prussia.") (MOOIJ 2018, NAUMANN 1842).

Sergei Nikolayevich Alphéraky (1850-1918) was a Russian ornithologist and entomologist. During his travels through Central Asia, from Kazakhstan to Western China, he collected data about Lepidoptera, geese and ducks and established a network of scientific contacts. The information he collected during his travels as well as from his network flew together in a number of books.



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In his book about the geese of Russia ("Gusi Rossii" or "The Geese of Europe and Asia"), he wrote about the distribution of the Snow Goose in the late 19th century in winter: „*As regards these geese visiting Western Europe, there is no lack of data, although of course they have been more often seen than cau ght, a usual circumstance in connection with wild geese of all species. If most or all have hitherto been noticed in Great Britain, this evidently is in consequence of the greater number of persons interested in zoology, and the greater number of wild-fowlers. Judging by the snow-geese - hitherto taken in England and Ireland, they all belonged to the lesser form, i.e. Chen hyperboreus, and not to the greater, Chen nivalis; from this it is clear that they could not have arrived from the eastern part of North America, where only the larger form is found, but from other regions, probably the northern part of the Palaearctic region, but the precise locality the future alone can make clear*." About the breeding area he wrote: „… *there is no doubt that, from the Lena on the east, along the shores of the Arctic Ocean and on the adjacent islands, the snow-goose is to be met with. According to Krasheninnikov, in Kamchatka "the snow-goose is especially rare. On the contrary, in the Northern Sea, about the Kolyma and other rivers there are so many that the hunters kill a vast number, on which account the very best down is brought to Irkutsk from those places*." "*Personally, I am of the opinion that snow-geese breed in Arctic Eastern Siberia and on the adjacent islands in considerable numbers, and that they migrate thence mainly to the Pacific shore to winter, and that only an insignificant proportion migrates westward ; the latter contingent being the source of those occasional snow-geese met with here and there in European Russia and farther west in various parts of Europe, and the birds regularly passing the winter on the Caspian*." (ALPHÉRAKY 1904, MOOIJ 2014).

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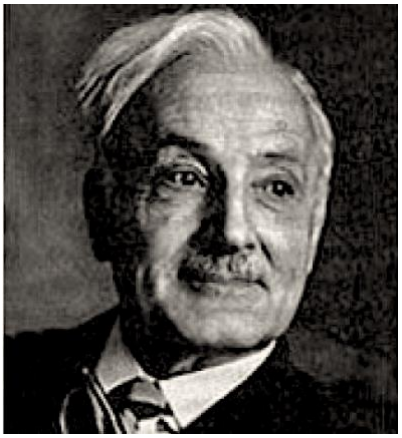
Sergej Alexandrowitsch Buturlin (1872-1938) was a Russian lawyer, naturalist and ornithologist. He spent most of his life time traveling through Russia, collecting specimens of species of the local fauna and describing them. He described a number of species for the first time.

About the Snow Goose he wrote: "*Within the limits of our country, the snow goose nests in the northerly coasts of Chukotka land; colonial breeding is also found on Wrangel Island. Several decades ago, it outnumbered ALL other goose species there. In the western part of the area of its distribution, it has now become a great rarity. The main breeding area of this goose species outside the USSR, it is necessary to consider, is the country of North America. It* (=the Eurasian breeding area) *runs along the Bering Sea and along the northeastern coast of the Asian mainland. Occasionally in winter, this species also occurs on the Caspian Sea. Most of the flocks winter in North America.*

Occasionally these geese enter the territory of Eastern and Western Europe. We saw them on the Volga near Astrakhan, near Orenburg, on Baikal, in the Minussinsk region, and in many other places." (BUTURLIN et al. 1940, MOOIJ 2016).



Georgi Petrovich Dementiev (1898-1969) and **Nikolai Alekseievich Gladkov** (1905-1975) were Russian ornithologists. Together they published a six volume work on the "Birds of the Soviet Union". About the Snow Goose they wrote:

"*Today persists at only one place in Soviet Union, i.e. Wrangel I.; there are no reliable data for nesting on Arctic coast of Chukot Peninsula. Earlier, in 17th and 18th centuries, was apparently widespread along east Siberian coasts of Arctic from mouth of Pyasina to extreme east of Chukot coast. Nested on lower reaches of large Siberian rivers Yana, Indigirka, Kolyma and its tributary Alazeya, as well as on Bolshoi Lyakhovskii I. In middle of last century still constituted quarry for special hunt in Russkoe Ustye. However in various spots became extremely rare in very early years of 19th century (Pallas 1811); by 1820-24 became extinct in delta of Kolyma (Vrangel') and disappeared completely by early 20th century. The prime reason for this extirpation in Soviet lands was incessant overshooting there and in America, at breeding territories, during molt, on migration flights, and finally at winter quarters. Most pernicious affects, of course, resulted from persecution of breeding and molting birds, as may be seen from the fact that the then unpopulated (before 20th century). Wrangel I., harbored enormous colonies of thousands of geese*." (DEMENTIEV & GLADKOV 1952).

Results

Historic winter distribution.
From the 10th century on, flocks of Snow Geese were reported to winter in Northern France (JACOB 1927), and from the 12th and 13th century on, the species was reported in Germany and maybe in Northern Italy (FRIEDERICH II 1756 & 1980, KINZELBACH 2008, STADLER 1920, VON BINGEN 1150-1160, 2010). In the 16th century, the Snow Goose was still known as a winter visitor in Germany (GESSNER 1600 & 1669), and in the 18th century it still wintered in northern and eastern Germany as well as in nowadays western Poland (BECHSTEIN 1809, NAUMANN 1842, SCHMID 1818). In the 18th century, Buffon did not know the species from France (BUFFON 1785, OTTO 1809), nor Nozeman (NOZEMAN & HOUTTUYN 1771-1829) from the Netherlands, which could mean that during the 17th century the species already abandoned the westernmost part of its winter range. In the 19th century, the species increasingly became a rare winter visitor in all of Europe (ALPHÉRAKY 1904, BAUER & GLUTZ VON BLOTZHEIM 1968, BUTURLIN et al. 1940, CRAMP & SIMMONS 1986, DEMENTIEV & GLADKOV 1952).

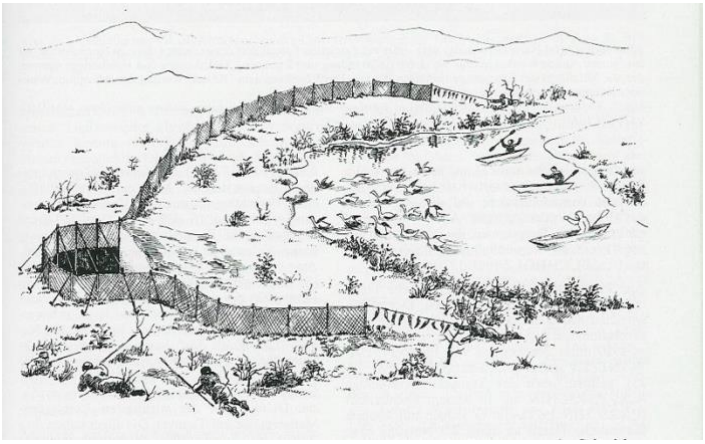
Historic breeding range.
The oldest information about the Eurasian breeding range of the Snow Goose is from the 17th and 18th century, when Pallas described the extended Eurasian breeding range that reached from the mouth of the Ob or Pyasina River in the west to the Bering Strait in the East in the 17th and 18th, and that by the late 18th century its western border had shifted to the Lena delta (ALPHÉRAKY 1904, NAUMANN 1842, PALLAS 1776, 1811). Since then, the breeding range has shrunk further. In the early 19th century, the species' breeding range was described to reach along the Arctic coast of the eastern Palearctic from the Kolyma river in the west to the Bering Strait in the east, the species being rare in Kamchatka (ALPHÉRAKY 1904). In the middle of the 19th century, the breeding colony of the Kolyma delta became extinct, and at the end of that century, Snow Geese were only breeding along the Arctic coast of Chukotka and Wrangel Island but had become increasingly rare on the mainland (BUTURLIN et al. 1940). In the early 20th century in Eurasia, the species was only breeding on Wrangel Island (DEMENTIEV & GLADKOV 1952), which means that between 1750 and 1950 the Snow Goose lost about 99% of its historic breeding range in the Palearctic.

Discussion

Based on the statements in historical literature (e.g. ALPHÉRAKY 1904, NAUMANN 1842, PALLAS 1776, 1811), it can be concluded that until the 19th century the Snow Goose still populated a continuous breeding area along the entire Arctic coast from the Ob estuary to the Bering Strait. Possibly, the breeding area was even larger in the Middle Ages. Since Snow Geese are distinct colony breeders, the breeding birds were most likely not more or less evenly distributed over the Arctic tundra, but in all probability formed large colonies in suitable places, as is still the case today on Wrangel Island. These colonies most likely were found around the lower reaches and mouths of the rivers Ob, Yenisei, Pyasina, Taimyr, Chatanga, Anabar, Olenjek, Lena, Yana, Indigirka, Kolyma, Chaun and Anadyr as well as on the Anzhu and Lyakhovsky Islands, Ayon and Wrangel Island.
Assuming eight to ten possible breeding colonies of around 24,500 nests (average size of the Tundrowaja River colony on Wrangel Island 1970-2010 according to BARANYUK 2019), the Eurasian snow goose population possibly reached a size of several million birds before the 19th century. In 1960, USPENSKI (1965) still counted 400,000-450,000 snow geese in the large colony on Wrangel Island and states that there were also a few

other smaller colonies on the island, on Ayon Island and on the mainland (for example in the estuaries of the Indigirka and Kolyma rivers), so that the entire Eurasian population at that time still has to be estimated at at least 450,000 - 500,000 and the original population probably by far exceeded the previously estimated 1.5-2 million birds.
According to BARANYUK (2019), the Eurasian population reached its smallest size of approx. 55,000 birds in 1975, then fluctuated between 50,000 and 100,000 birds. After 1995, a steady increase began, and in 2017 a population of approx. 350,000 birds was reached. The author states that the population has thus reached a size that enables it to expand again into new habitats in the former breeding and winter area (BARANYUK 2019).

The reasons for the sharp population decline since the 17th century have not yet been conclusively clarified. What is certain, however, is that the Snow Goose population has been under considerable pressure by human use for centuries.
The indigeous population collected eggs and down from the nests and caught moulting and breeding birds. The north of Siberia has a low population density, but the snow geese were easy prey, not only because they breed in large colonies, moult in large clusters and are temporarily unable to fly, but also because they are quite tame in the Arctic and therefore easy to catch and kill (BECHSTEIN 1809, DEMENTIEV & GLADKOV 1952, USPENSKI 1965). BECHSTEIN wrote: „*In jenem kalten Klima machen sie den vornehmsten Unterhalt der Einwohner aus und die Federn sind ein Handelsartikel, jede Familie tödtet jährlich an tausend. Sie werden gerupft, ausgenommen, dann in dazu gegrabene Löcher auf einander gelegt und dieß mit Erde bedeckt, welche zusammenfriert und ein Gewölbe über ihnen macht. Wenn nun eine Familie eins dieser Magazine öffnet, so findet sie eine wohlschmeckende und gute Speise*." ("In that cold climate, they are the main means of subsistence of the inhabitants, and the feathers are a commercial article. Every family kills a thousand each year. They are plucked, gutted, then piled up in a hole in the ground specially dug for this purpose and subsequently covered with earth, which freezes and makes a vault over them. If a family now opens one of these magazines, they will find tasty and good food."). AUBYN TREVOR-BATTYE (1895) wrote about the relationship between the indigenous people and Brent Geese: "*They hold the birds in almost superstitious regard because of its extreme importance to them as winter food*" and described how the indigenous people rounded up, caught and killed thousands of moulting geese at a single action. TREVOR-BATTYE also describes the storage of the killed geese in orderly soil-covered heaps. Despite the fact that his story refers to the Brent Goose this way of human use of colonial breeding birds certainly has a long tradition in the indigenous peoples of the North.



Dolgans rounding-up and catching moulting geese
(according to Popov 1937 in Nowak 1995)

This pressure on the Snow Goose population, caused by the indigenous people, was strongly enhanced as Russian settlers reached the palearctic region during the middle of the 16th century in the western and about 100 years later also in the eastern part. These settlers mainly lived on fishing and hunting as well as trade of fur and mammoth ivory.

They learned very early how to survive in this hostile Arctic climate by copying a part of the way of life of the indigenous people, which included using the resource "goose" by collecting eggs and down from the nests and catching moulting and breeding geese. The growing number of Russian settlers living in the Arctic since the 17th century, at first mainly in the western but from the 18th century also in the eastern part of the Palearctic, made the "predation"-level on the Arctic breeding and especially on the colonial breeding species increase considerably. The increasing number of settlers over time, the improved weapons and trapping techniques and the increasing sensitivity of the snow geese to predation, which forced them to breed in ever smaller colonies and moult in ever smaller groups, caused a further decline in their population.

An Artel in Northern Siberia successfully catching geese (according to Nasimovitsch 1934 in Nowak 1995)

This increasing pressure by overuse reached its peak between 1920 and 1955, when the fishing and hunting people in the Arctic were compulsorily united in hunting and fishing collectives ("Artels") with annual production targets, and chains of meteorological stations, military bases and prisoner camps (Gulag) were established in the Russian Arctic (KÄMPFER et al. 2007, NOWAK 1995, POPOV 1973, SEIFERT 1966, TORKE 1999).

Concurrently with this deterioration of the living conditions in the breeding area, the conditions in the staging and wintering areas changed for the worse.

After the waves of the plague leveled off in Europe and the subsequent peasant and religious wars ended, from the 16th century onwards economic and human population development began to evolve increase again. The demand for agricultural products rose, and the total area of agricultural land increased again. The simple three-field crop rotation system consisting of summer grain, winter grain and fallow land was no longer sufficient to feed a growing human population. New agricultural products, such as potatoes, vegetables, but also fruit and wine for the townspeople, made the cultivation program and the landscape more diverse. In addition to arable farming, livestock farming was also intensified as the demand for meat, leather and dairy products increased in the cities. As a result, forests were cleared, floodplains and brooks diked, lakes drained, coastal areas poldered and moors drained. Despite all the expansions in arable land, until the middle of the 19th century, agricultural production in Europe was only just sufficient to meet the needs of a growing human population, and bad weather events and periodical floodings led to food shortages and famines frequently. Until the middle of the 19th century, the limiting factor was the supply of the most important nutrients to the soil. This problem was solved by the onset of guano fertilization, which at the beginning of the 20th century was replaced by industrially produced fertilizers.

As a result of this development, the area that could be cultivated for agriculture could be more than doubled in a short period of time. Initially, these new areas for agriculture were undoubtedly still very close to nature. Grassland reclaimed from wetlands was wet grassland and arid sites were still dry despite irrigation. But not for long. The major changes in the landscape were accelerated by the increasing use of technology, especially between 1850 and 1950, when this enabled large-scale drainage of wetlands and large-scale irrigation of dry areas (ACHILLES 1993, KÜSTER 1995).

GOOSE BULLETIN is the official bulletin of the Goose Specialist Group of Wetlands International and IUCN

Hunter
17th century

Synchronously with these landscape changes, there were also considerable changes in hunting pressure on wintering geese. Until the 14th century, goose hunting was mainly performed by nobility and higher clergy with birds of prey, bow and arrow as well as crossbow. Ordinary people preyed on geese with bow and arrow, nets and slipknots. Until then hunting pressure was generally low, but subsequently increased. The number of hunters grew as the rich bourgeoisie also acquired shooting rights, the human population and the number of wealthy people increased, and weapons capable of killing at longer distances improved. In addition to hunting and poaching, ducks and geese have been caught legally in large numbers by professional bird trappers since the Middle Ages with nets, neck and foot snares and in duck decoys, to be sold on the urban markets as an important source of protein for the town people. During the apex of this profession in the 17th century, several thousand duck decoys and hundreds of (semi-)professional goose and wader catchers were active in Western Europe. It is hard to estimate how big the influence of these bird catchers was on the waterfowl stocks of that time, but it certainly was not negligible. Even in the late 19th and early 20th century, when the bloom of this profession was long gone, Dutch duck decoys caught more than 200,000, German decoys on the island Sylt up to 25,000 (in some years even 45,000), on the island Amrum 5,000-10,000 and those on the German island Föhr 60,000-70,000 ducks annually. In the same period several hundred of professional goose catchers annually caught thousands of geese for the local markets.
Because of the decline of waterfowl numbers, the commercial catching of waterbirds became increasingly unprofitable and gradually closed down (BÜRGER & REITER 2014, DEUTSCHE JÄGER-ZEITUNG 1916, DE RIJK 2015, DIEZEL 1849, DIRCKSEN 1953 & 1956, DOEBEL 1746, KRUCKENBERG et al. 2022, LUMEIJ et al. 2008).

Without trying to establish a ranking, it can be stated that all the described developments in the former breeding and wintering range most likely played an important role in the decline of the Palearctic population of the Snow Goose.
In 1990, after a detailed analysis of the available data, the Russian scientists Flint and Krivenko concluded that the breeding populations of waterfowl (ducks, geese and swans) on the territory of the former USSR around 1850 had been two to three times more numerous than the population level in the 1990s. The most important reasons for the decline of these populations were amelioration of wetlands, the loss of natural and semi-natural waterbird habitats, increasing land use and intensification of agriculture within the living range and possible overhunting of individual species (FLINT & KRIVENKO 1990, KRIVENKO 1996).
The fact that the Eurasian relict population of the Snow Goose was only able to survive on the largely uninhabited Arctic Wrangel Island seems to support the conclusion of FLINT and KRIVENKO. Since the entire island was placed under nature protection in 1976 and the last permanent residents left it in the 1990s, a steady recovery of the population has started, and the Snow Goose population there has grown from 70,000-80,000 to around 350,000 birds in 2017 (BARANYUK 2019 & BARANYUK et al. 2019).

Although all goose species had to cope with more or less the same problems, some species, like Snow Goose, Lesser White-fronted Goose, Brent Goose and Red-breasted Goose, showed themselves to be more vulnerable to these developments than others. All Eurasian goose species showed strong declines in population numbers during the past centuries, but most of them have shown increasing populations since the middle of the 20th century (KRUCKENBERG et al. 2022).

Conclusions

Based on an analysis of historic sources, it does not seem unrealistic to conclude that the (Lesser) Snow Goose *Anser caerulescens caerulescens* (Linnaeus, 1758)

- formerly was considerably more wide spread in Eurasia than it is nowadays.
- until the late 17th century was wintering in western Europe and had an Eurasian breeding range from the Ob or Pyasina River in the west to the Bering Strait in the east.
- from the 16th century on, suffered from increasing pursuit by a growing human population in the breeding area, both during migration and at its wintering sites.
- from the 16th century on, suffered from amelioration of wetlands, progressive changes in land use and intensification of agriculture along its migratory routes as well as in the wintering area.
- gradually abandoned the western part of its Eurasian breeding range and wintering sites in Europe during the 17th and 18th century.

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Obituary: Evgeny E. Syroechkovskiy jun. 1968-2022

Christoph Zöckler

When we first met in 1996 at the stairs of the Lomonosov University in Moscow I was not quite sure if the meeting point exit b was bh or the Russian B which is more like W and I was worried to be at the wrong place. There were many people on the stairs but after a while we were left alone and introduced ourselves. I was at the right exit of this huge building meeting this huge person in this huge country. Evgeny was not only physically huge but as I already learned that year during our first joined expedition to the Yano-Indigirko Tundra, he was also a great person and friend. Over the years he more and more accomplished a demeanour and charisma that made him popular and famous across the globe.

Evgeny („Zhenya“) Syroechkovskiy Jr. at the GSG-Meeting in Elista 2011. (Foto Melnikov).

His heart was really beating for large waterfowl like geese; birds that you can also eat in certain situations! It was at the 2nd International Goose Specialist Group meeting in Martin Mere in December, when organiser Carl Mitchell (WWT) asked me kindly to pick up Evgeny from Heathrow Airport and take him to Martin Mere in Northern England. Typically for him he was arriving late, although it was as usual not his fault and when we finally arrived in Martin Mere that night, Evgeny noticed that one vodka bottle was smashed inside his suitcase and I helped him to dry his clothes. The stench in his hotel room was almost overwhelming. Fortunately the second bottle survived, but only the first night.

He grew up in Moscow but at an early age as a boy travelled already regularly with his ornithologist parents to the Arctic region and developed early on an intimate knowledge of that region, its people and biodiversity. He graduated at the department of Geography at Moscow University and did his PhD on Brent Geese, published several papers on Brent, Red-breasted, Lesser White-fronted and Bean Geese. In 1997 we discovered mixed and overlapping pairs of both Dark-bellied and Black Brant in the Olenyok and Western Lena Delta, which we published in British Birds (Syroechkovskiy et al 1998). For many years he chaired the Goose Study Group of Eastern Europe and Northern Asia and founded and edited the journal Kasarka. He was also instrumental in mitigating many hunting related issues, such as spring hunting in Russia and along the flyway and initiated the new Red List of Russia and oversaw the process.

Many Goose meetings and I am afraid also drinking sessions followed, fortunately with fewer bottle casualties and Evgeny and I met in Bulgaria in 1998, Zeebrugge in 2000, Xanten in 2007 and many other occasions, where we both reported on results from our many joint expeditions to the Russian Arctic. More recently we also met in Asian countries when our joint conservation work turned more towards waders and in particular the Spoon-billed Sandpiper. When we met in 2017 in Singapore at the EAAFP MoP he asked me in how many different countries we have met already. To both our surprise Singapore was already country No 17.

His love for geese though never really faded and during several joint expeditions in Chukotka in the 2000s he managed to get first goose funded work financing Spoon-billed sandpiper work through Japanese funding and later when goose funding dried out he levered some surplus Spoon-billed funds to do goose work. Unforgettable will be the chasing and catching of 50 White-fronted and 5 Bean Geese in the Vaamochka Bay in Chukota to deploy green neck rings without applying the use of any engine, only canoes and nets.

In 2018 we finally agreed to meet again at a goose meeting after many years and that year we added Lithuania as country No 18 to our list where we met. I was hoping to add many more countries to our joint list and was never imagining that I would need to write this. But Evgeny's health deteriorated quickly. First lockdown and later Evgeny developed long Covid and more serious illnesses, which sadly this strong man succumbed to.

I lost a dear friend far too early. We will miss him sorely.

Evgeny Syrochkovskyi centre with Sasha Kondratiev left and the author during excursion in Lithuania Goose meeting Klaipeda 2018
Photo H. Kruckenberg

Outstanding ornithologist of the past: Cornelis Nozeman (1720-1786)

Johan H. Mooij

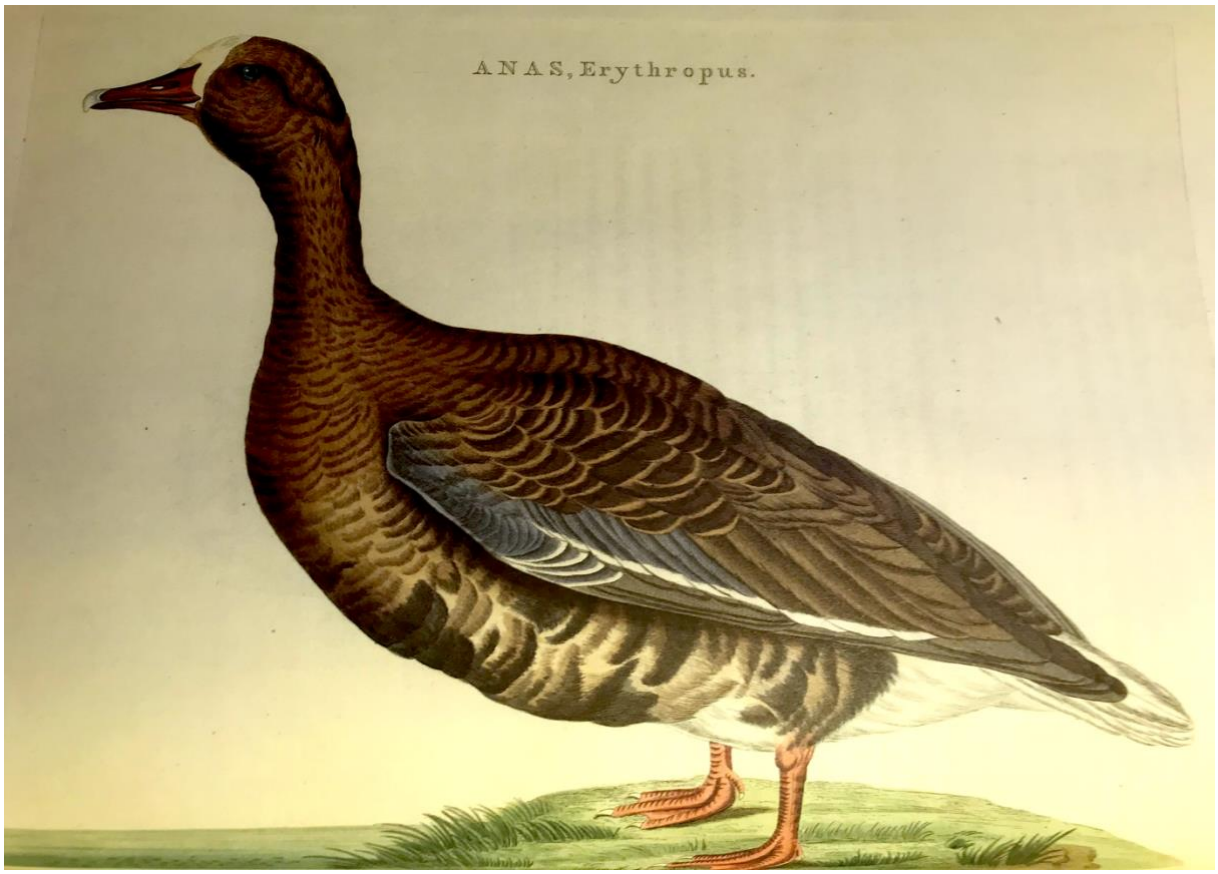
Posthumously painted picture of Cornelius Nozeman 1720-1786 (Remonstrant church, Rotterdam).

Cornelis (also Cornelius) Nozeman was born in Amsterdam as one of the two sons of the Netherlands composer Jacobus Nozeman (1693-1745) and his wife Geertruida Maria Corsterus. Like his younger brother Jan Willem (1733-1768), Cornelis was trained as a remonstrant preacher. After his theologic studies he was called to become preacher in Alkmaar (1744-1749), subsequently he was called to serve in Haarlem (1749-1759) and finally in Rotterdam 1759-1785). He tumbled down the stairs in 1780, and he never fully recovered. Subsequently he applied for medical leave in 1785, which was granted to him. One year later he died in Moordrecht, where he had moved over with his family after his retirement.

If Cornelis Nozeman only had been a remonstrant preacher he certainly had been forgotten by now.
But besides being a clergyman Nozeman wrote theologic and philosophic tracts, studied natural sciences, collected and dissected insects, fishes and birds, discussed his findings with colleagues and published his results, experimented with vaccination as an immunisation protection against cattle diseases.
During his studies Nozeman developed the idea to produce a big encyclopaedia about all the animals and plants found in the Netherlands. This book should not only include the name as well as a short description of each species, but also should imply behaviour and reproductive aspects, descriptions of the character and living environment as well their positive and negative aspects in relation to man of each species.

It is not known when Nozeman met nature lover, graphic artist and publisher Jan Christian Sepp (1739-1811) from Amsterdam, who together with his father, the graphic artist Christian Sepp (1710-1775), illustrated and published books about nature items. The three men started the book project named "Nederlandsche Vogelen" ("Dutch birds") in 1769. Nozeman wrote the text and father and son Sepp were responsible for the hand coloured pictures. In 1771 a first species description ("Garrulus, de Gaey.", Eurasian Jay *Garrulus glandarius*) was published and could be bought for two guilder (nowadays c. €16). Subsequently each year 5 or 6 of such species descriptions were published and until 1829 250 pictures and descriptions were published. These were assembled to five volumes of fifty plates and descriptions each. Nozeman died bevor the publication of the second volume was published. He was succeeded by the physician Martinus (or Maarten) Houttuyn from Amsterdam (1720-1798), who was supported by the zoologist Coenraad Jacob Temminck (1778-1858).

Nozeman and Sepp's "Nederlandsche Vogelen" was the first comprehensive avifauna of the Netherlands. The high quality hand coloured graphs, that as the publisher underlines "Alle near 't leven geheel nieuw en nauwkeurig getekend" zijn ("all pictures are newly an exactly drawn from living birds") were unique for their time.



Picture of the White-fronted Goose (*Anser albifrons*) from Nozeman and Sepp's "Nederlandsche Vogelen".

GOOSE BULLETIN is the official bulletin of the Goose Specialist Group of Wetlands International and IUCN

New Publications 2018 – 2022

BJERKE, J., I.M. TOMBRE, M. HANSEN & A.K.B. OLSEN (2021): Springtime grazing by Arctic-breeding geese reduces first- and second-harvest yields on sub-Arctic agricultural grasslands. - Science of the Total Environment 793, 148619. https://reader.elsevier.com/reader/sd/pii/S0048969721036913?token=D068E1C158F28E051952BB3B45C4C40D7DA39B23E3B826419E0C85624A3792D2DB4112EC50DC4AE13F6A8C1A64243379&originRegion=eu-west-1&originCreation=20210908073623

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KRUCKENBERG, H., A. KÖLSCH, J.H. MOOIJ & H.-H. BERGMANN (2022): Das große Buch der Gänse. Von Sozialen Wesen und rastlosen Wanderern. – Aula, Wiebelsheim, 256 pp.

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VAN DELLEN, A.W. & J.S. SEDINGER (2022): Predation risk and settlement decisions by colonially nesting black brant (*Branta bernicla nigricans*). - Wilson Journal of Ornithology 134:251-259.

WEEGMAN, M.D., R.T. ALISAUSKAS, D.K. KELLETT, Q. ZHAO, S. WILSON & T. TELENSKÝ (2022): Local population collapse of Ross's and lesser snow geese driven by failing recruitment and diminished philopatry. – Oikos 2022: e09184, doi: 10.1111/oik.09184

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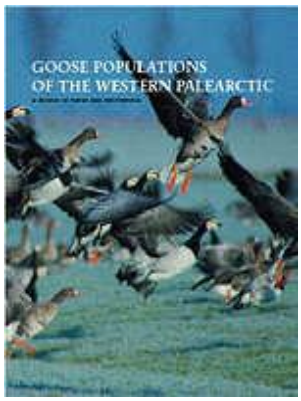
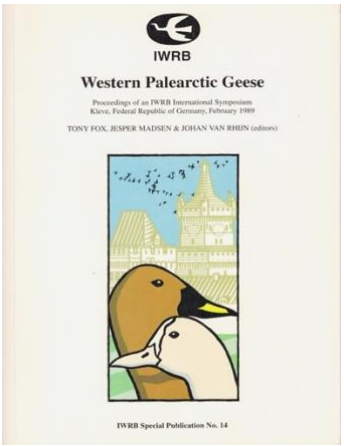


Goose populations of the Western Palearctic

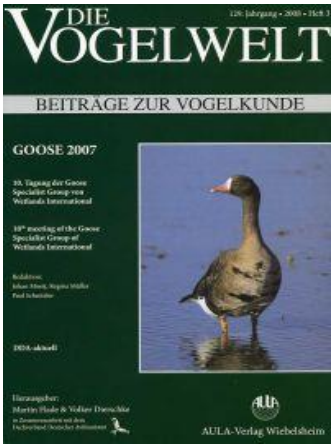
The Goose Specialist Group made an impressive compilation (edited by Jesper Madsen, Tony Fox & Gill Cracknell) of our knowledge on the status and distribution of the goose populations of the Western Palearctic. This book is not for sale anymore, but a digital copy can be downloaded for free from:
http://issuu.com/jesper_madsen/docs/goosepopulationswestpalearctic
or from
http://bios.au.dk/en/knowledge-exchange/about-our-research-topics/ animals-and-plants/mammals-and-birds/goose-populations-of-the-western-palearctic/

Proceedings of the Klever, the 10th and the 12th meeting of the GSG

Furthermore it is still possible to receive a printed copy of the official proceedings of earlier meetings of the Goose Specialist group, as there are:



Proceedings Goose Meeting 1989 (Kleve, Germany)
Interested? Please contact:
johan.mooij@bskw.de



Proceedings Goose 2007 (Xanten, Germany)
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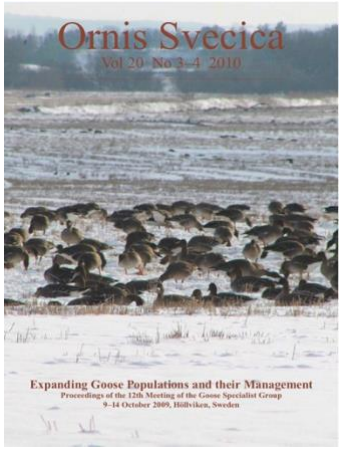


Proceedings Goose 2009 (Höllviken, Sweden)
Interested? Please contact:
leif.nilsson@zooekol.lu.se

Proceedings of the 14th meeting of the Goose Specialist Group

The proceedings of the 14th meeting of the Goose Specialist Group held in Steinkjer, Norway in April 2012 have been published in the online journal Ornis Norvegica, which is the scientific journal of the Norwegian Ornithological Society (Norsk Ornitologisk Forening – NOF). You can find articles from the 2012 meeting, as well as a number of other ornithological papers which are surely of interest on the journal website:
https://boap.uib.no/index.php/ornis/issue/view/62

Proceedings of the 15th meeting of the Goose Specialist Group

The proceedings of the 15th meeting of the Goose Specialist Group held in Arcachon, France in January 2013 have appeared as a special edition of the journal **Wildfowl.**

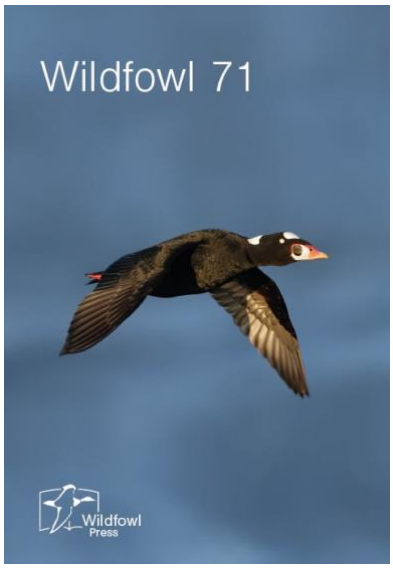
By sending an email to wildfowl@wwt.org.uk a printed copy of this Special Issue (nr.3) can be ordered at the cost of £17 plus an additional £3.50 for credit card transactions.

It also can be downloaded for free at:
http://wildfowl.wwt.org.uk/index.php/wildfowl/issue/view/285

The journal Wildfowl

Wildfowl is an international scientific journal, published annually by Wildfowl Press, and previously published by the Wildfowl & Wetlands Trust (from 1948–2020).
The journal appeared originally as the Annual Report of The Severn Wildfowl Trust at the end of the Trust's first working year in 1947. From the outset it presented the results of scientific research in order to improve knowledge and understanding of wildfowl populations. It disseminates original material on the ecology, biology and conservation of wildfowl (Anseriformes) and ecologically associated birds (such as waders, rails and flamingos), and on their wetland habitats. Research and review articles related to policy development and application are welcome. Material on habitat management is also sought, particularly where this is directed to the conservation of wildfowl and other wetland birds.

In 2020, the WWT took a decision that it would no longer publish the journal, as part of its plans to refocus as a wetland conservation charity.
The journal however continues to thrive with support from the waterbird research and conservation community, and is now being published by "Wildfowl Press", a newly-formed publisher dedicated to the journal, with pdfs also being made available online as usual.



Impact factor: 1.417 (2020)

The complete back catalogue of Wildfowl is available via the Open Journal System at https://wildfowl.wwt.org.uk/index.php/wildfowl

The current Issues are Wildfowl 72 (2022), which was published early November 2022 and Wildfowl 73 (2022), which is on schedule for publication in late November/early December 2022. In Wildfowl 72 you find a comprehensive paper about the history of IWRB, the predecessor of Wetlands International.

The IUCN-SSC waterbird specialist groups (Swan, Ducks, Geese, Threatened Waterbirds) support "their Wildfowl Journal" as well as its publisher the "Wildfowl Press".

Those interested in having access to or receiving future issues of the journal please send an email to Eileen Rees on her personal email, at <ReesEileenC@gmail.com>, including indicating whether they might be willing to subscribe to the journal. Either for online access to papers and/or for printed copy.

Instructions to authors

The Goose Bulletin accepts all manuscripts dealing with goose ecology, goose research and goose protection in the broadest sense as well as Goose Specialist Group items.
All manuscripts should be submitted in English language and in electronic form. Text files should be submitted in ".doc"-format, Font "Times New Roman 12 point", tables and graphs in ".xls"-format and pictures in good quality and ".jpg"-format.
Species names should be written with capitals as follows: Greylag Goose, Greenland White-fronted Goose etc. Follow an appropriate authority for common names (e.g. Checklist of Birds of the Western Palearctic). Give the (scientific) Latin name in full, in italics, at first mention in the main text, not separated by brackets.
Numbers- less than ten use words e.g. (one, two three etc) greater than 10, use numbers with blank for numbers over 1 000.
In case of doubt please look at the last issue of the Goose Bulletin.

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of Wetlands International and IUCN

GOOSE BULLETIN

ISSUE 28 – NOVEMBER 2022

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