The 20th INTERNATIONAL GOOSE SPECIALIST GROUP MEETING

PROGRAM AND ABSTRACTS

20TH INTERNATIONAL
GOOSE SPECIALIST
GROUP MEETING
16-18 AUGUST, 2023
ULAANBAATAR, MONGOLIA

August 16-18, 2023
Ulaanbaatar, Mongolia

IUCN SSC GOOSE SPECIALIST GROUP
WILDLIFE SCIENCE AND CONSERVATION CENTER OF MONGOLIA

20TH MEETING OF THE IUCN SSC GOOSE SPECIALIST GROUP

SCIENCE. COOPERATION. CONSERVATION

For better understanding and protecting goose populations across the Northern Hemisphere

Program and Abstracts

August 16-18, 2023
Ulaanbaatar, Mongolia

20TH MEETING OF THE IUCN SSC GOOSE SPECIALIST GROUP

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IUCN SSC Goose Specialist Group
Wildlife Science and Conservation Center of Mongolia

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Ministry of Environment and Tourism of Mongolia
East Asia-Australasian Flyway Partnership
University of Oklahoma, USA
Institute of Biology, Mongolian Academy of Sciences

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20TH MEETING OF THE IUCN SSC
GOOSE SPECIALIST GROUP

IUCN SSC Goose Specialist Group

The IUCN SSC Goose Specialist Group (SGS) seeks to strengthen communications between all researchers on migratory goose populations in the northern hemisphere. Under the umbrella of the Group separate working groups deal with special topics. Many such groups are species oriented, e.g. the Greylag Goose Working Group, The Bean Goose Working Group, the Red-breasted Goose Working Group, etc.

Photo: Participants of the 13th meeting of the Goose Specialist Group that was held in Elista, Kalmykia, Russia in 2011

The GSG's annual meetings are held since 1995. At present over 400 people have joined the Goose Specialist Group. The last meeting, 19th GSG conference was held in Leeuwarden, The Netherlands, from 28-31 January 2020.

The Goose Specialist Group Bulletins are produced regularly. To access and download all the issues, click here. More extensive information about the Goose Specialist Group can be found on the special website www.geese.org/gsg.

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/.

20TH MEETING OF THE IUCN SSC
GOOSE SPECIALIST GROUP

PLENARY SPEAKERS

Dr. Lucy Hawkes, University of Exeter, UK

Dr. Lucy Hawkes is a physiological ecologist, whose work focuses on the costs and drivers of migration in animals (vertebrates and invertebrates) using emergent technologies such as satellite telemetry, heart rate logging, accelerometry and metabolic rate measurements in the Department of Biosciences at University of Exeter, UK. She is a well-known expert in biologging, spatial ecology, remote sensing and respirometry to make empirical measurements that help in the understanding of amazing migratory performances. Her work has also investigated the impact of external forcing factors, such as climate change and disease ecology on migration and breeding ecology. Some of her famous research works are amazing migrations by basking sharks and bar-headed geese.

Dr. Cao Lei, Chinese Academy of Sciences, China

Dr. Cao Lei is a Professor in the State Key Laboratory of Urban and Regional Ecology at the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. Professor Cao Lei focuses on wetland and waterbirds ecology and conservation, and movement ecology. Recent technology innovations in IT and micro-electronics have led to the rapid development of satellite tracking devices and techniques. By deploying cutting-edge transmitting devices, Professor Cao's group has initiated tracking programs in many sites in and outside China. Professor Cao is also coordinating a national monitoring and research network of bird-tracking in East Asia.

Dr. Diann Prosser, U.S. Geological Survey, USA

Dr. Diann Prosser is a research wildlife biologist at the U.S. Geological Survey (USGS) Eastern Ecological Science Center (formerly Patuxent Wildlife Research Center) in Maryland, USA. Diann's work focuses on movement ecology, spatial analyses, and modeling of wild birds and wildlife stressors such as climate change and disease. A large part of her research program is dedicated to understanding the role of waterfowl in the persistence, spread, and amplification of avian influenza viruses, as well as their interactions at the wild-agricultural interface where novel pathogens are most likely to emerge.

20th Goose Specialist Group Meeting Program
August 16-18, 2023, Ulaanbaatar, Mongolia

Day 1. August 16, 2023	
8:00-8:30	Registration
8:30-9:00	**Opening speeches** ***Uranchimeg Tserendorj***, General Director, Natural resources policy and coordination department, Ministry of Environment and Tourism of Mongolia ***Jennifer George***, Chief Executive, East Asia-Australasian Flyway Partnership ***Petr Glazov***, Chair, IUCN SSC Goose Specialist Group ***Nyambayar Batbayar***, Director, Wildlife science and conservation center of Mongolia
9:00-10:00	**Plenary talk by Dr. Lucy Hawkes, Exeter University, UK - *High altitude is for the birds!***
10:00-10:15	**Group photo**
Session 1.	**Ecology and Climate change**
10:15-10:30	**Natalia Lebedeva**, *Impact of climate change on the phenology and spatial distribution of the Greylag Goose in the south of European Russia*
10:30-10:45	**Julia Loshchagina**, *Interaction between Barnacle goose and White-fronted goose on the nesting sites of Kolguev Island*
10:45-11:00	**Iderbat Damba**, *Breeding ecology and age ratio of swan geese in Mongolia*
11:00-11:30	**Tea Break**
11:30-11:45	**Wenxin Liu,** *Extreme drought increases daily travel distance and energy expenditure, rather than affecting habitat use, wintering site or mortality, in a site-faithful wintering avian herbivore*
11:45-12:00	**Petr Glazov**, *Evaluation of the number of Barnacle Goose colonies in the Peschanka River Delta on Kolguev Island, Barents sea*
12:00-12:15	**Yuri Anisimov**, *World largest colony dynamics of Barnacle Goose: number and nesting density in Peschanka River Delta of Kolguev Island in in 2006-2019*
12:15-13:15	**Lunch**
Session 2.	**Migration, dispersal, population monitoring**
13:15-13:30	**Thomas Lameris,** *What limits earlier arrival and reproduction of Arctic migratory birds?*
13:30-13:45	**Zhang Junjian,** *Biogeographical variation in migratory patterns of Palearctic breeding Greater White-fronted Geese*
13:45-14:00	**Yusuke Sawa,** *Migratory routes and population status of brent goose in East Asia*
14:00-14:15	**Evgeny Shemyakin**, *New data on the autumn migration of the lesser white-fronted goose eastern population*
14:15-14:30	**Michal Podhrázský,** *The greylag goose ringing activities, GPS telemetry, genetic analysis of the populations and hunting small shots observation in the Czech Republic and the Slovak Republic*
14:45-15:15	**Tea Break**
15:15-16:00	Poster session
16:00-16:30	Vendor exhibitions: Druid, Global Messenger, KoEco
Workshop 1.	**Biologging (Meeting room 1)** Conveners: Thomas Lameris, Lucy Hawkes, John Takekawa
16:30-16:50	**Thomas Lameris,** *The use of tri-accelerometers to measure goose behaviour*
16:50-17:10	**Lucy Hawkes,** *Future trends in measuring physiology in free-living animals*
17:10-17:30	**John Takekawa,** *Interpreting behaviour from tracking devices in Snow Geese and Greater White-fronted Geese*
17:30-18:00	Q&A and Discussion
18:00-19:30	**Dinner**

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Day 2. August 17, 2023	
8:30-9:30	**Plenary Talk by Dr. Cao Lei, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, China - *Novel mapping of the flyway corridors of geese species in the East Asia-Australasian Flyway***
Session 3.	**East Asia and Australasian Flyway**
9:30-9:45	**Tetsuo Shimada,** Population trends and the potential background for greater white-fronted geese in Japan
9:45-10:00	**Hansoo Lee**, Current status of geese species in Korea
10:00-10:15	**Bernhard Seliger,** Some observations on the status and conservation of geese in DPRK
10:15-10:30	**Oleg Goroshko,** Status and conservation of the Swan Goose population in Russia
10:30-10:45	**Zhao Qingshan,** Levels of biogeographical subpopulation flyway exchange in East Asian goose species
10:45-11:15	**Tea Break**
Session 4.	**Central Asian Flyway**
11:15-11:30	**Blaise Humbert-Droz,** Impact of recent environmental changes on the bar-headed goose and other breeding waterbirds in the Trans-Himalayan Ladakh region of North-West India
11:30-11:45	**Vladimir Morozov,** Current state of lesser white-fronted goose local populations – the reasons of distribution and numbers decrease
11:45-12:00	**Altangerel Tsogtmagnai,** Variation and status of ducks (Anatidae) species during migration period: case study Chukh Lake
12:00-12:15	**Suresh Kumar**, The flagship species of the Central Asian Flyway – Bar-headed Geese *Anser indicus*, their status in India
12:15-13:15	**Lunch**
Session 4.	**Central Asian Flyway (cont-ed)**
13:15-13:30	**Zhang Junjian,** The importance of lakes in the eastern Qinghai-Tibet Plateau for Bar-headed Geese
13:30-13:45	**Tseveenmyadag Natsagdorj,** The importance of the Lakes in the Great Lakes Depression for geese migration in Central Asian Flyway
13:45-14:00	**Oleg Goroshko,** Population status of the bean goose in eastern Transbaikalia (Russia), including the key stopover site on the Russian-Chinese Argun river: distribution, abundance, dynamics, conservation
14:00-14:15	**Gitte Høj Jensen,** Monitoring in the context of the AEWA European goose management platform
14:15-14:45	**Tea Break**
Session 5.	**Population monitoring**
14:45-15:00	**Barwolt S. Ebbinge,** Population dynamics of Dark-bellied Brent Geese 1960-2020
15:00-15:15	**Meng Fanjuan,** Using aerial survey to study important geese species in East Asia
15:15-15:30	**Nyambayar Batbayar,** Monitoring of Bar-headed Geese at Terkhiin Tsagaan Lake using drone
15:30-15:45	**Tony Fox,** Monitoring of Arctic and northern hemisphere goose population: a common goal of the Goose Specialist Group
15:45-16:00	
Workshop 2.	**Monitoring of Arctic and northern hemisphere goose population (Main Hall)** Conveners: Tony Fox and Thomas Lameris
16:00-17:30	Discussions
18:00-19:30	**Dinner (not provided by the organizers)**

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Day 3. August 18, 2023	
8:30-9:30	**Plenary Talk by Dr. Diann Prosser, Eastern Ecological Science Center, US Geological Survey, USA - *Avian Influenza Virus: Understanding the role of wild birds***
Session 6.	**Infectious diseases and avian influenza**
9:30-9:45	**Herbert H.T. Prins,** Goose Conservation versus Human Health: Between the devil and the deep blue sea in China
9:45-10:00	**Sachiko Moriguchi,** Recent HPAI outbreak in Japan: The reality of surveillance and changes in highly pathogenic avian influenza infection status
10:00-10:15	**Kirill Sharshov,** Surveillance of avian influenza in wild birds in Russia: continuing story of puzzled HNx viruses
10:15-10:30	**Shenglai Yin,** *Linking biodiversity with disease risk: functional traits explains the HPAI risk in waterbird communities*
10:30-10:45	**Simba Chan**, *EAAFP Avian Disease Working Group*
10:45-11:15	**Tea Break**
Session 6.	**Infectious diseases and Avian influenza (cont.)**
11:15-11:30	**Shenglai Yin,** *Habitat loss exacerbates pathogen transmission: An Agent-based model of avian influenza infection in migratory waterfowl*
11:30-11:45	**John Takekawa,** *Perpetuation of avian influenza from molt to fall migration in wild Swan Geese: an agent-based modeling approach*
11:45-12:00	**Jeffery Sullivan,** *Potential Effects of Habitat Change on Migratory Bird Movements and Avian Influenza Transmission in the East Asian-Australasian Flyway*
12:00-12:15	**Henk van der Jeugd,** *From Vectors to Victims: The impact of Avian Influenza on wild birds*
12:15-12:30	**Nikita Dubovitskiy,** *Viral diversity of gut of Anseriformes species in Russia*
12:30-13:30	**Lunch**
Session 7.	**Behavioural ecology**
13:30-13:45	**Elmira Zaynagutdinova**, *Visual lateralisation in geese at individual and population levels*
13:45-14:00	**Diana Polikarpova,** *Are there differences in behaviour between males and females of white-fronted geese as a species with permanent monogamy?*
14:00-14:15	**Guozheng Li,** *Behaviour recognition facilitates the research of movement ecology through the combination of telemetry, AI and Citizen Sciences*
14:15-15:00	**Shenglai Yin,** *Functional traits explain waterbirds' host status, subtype richness, and community-level infection risk for avian influenza*
15:00-15:15	**Meng Fanjuan,** *First recorded wintering Brent Goose Branta bernicla on the east coast of China in last 20 years*
15:15-15:45	**Tea Break**
Workshop 3:	**Community inputs and collaboration in avian influenza pandemic prediction and prevention (Main Hall)** Conveners: Xiangming Xiao, John Takekawa, Diann Prosser, Jeff Sullivan, Shenglai Yin
15:45-16:00	Introduction about Pandemic Prediction and Prevention
16:00-16:30	Small Group Discussion
16:30-17:00	Wrap Up
17:00-17:30	**Award Ceremony** *Best oral and poster presentations* *British Ornithologists' Union Godman-Salvin Prize*
17:30-18:00	**Closing of the conference**
18:00-19:30	**Farwell dinner (19th floor, Meeting room 4)**

Contents

Session 1. Ecology and Climate change

IMPACT OF CLIMATE CHANGE ON THE PHENOLOGY AND SPATIAL DISTRIBUTION OF THE GREYLAG GOOSE IN THE SOUTH OF EUROPEAN RUSSIA

Natalia Lebedeva

Murmansk Marine Biological Institute, Russian Academy of Science, Russia

The breeding population of the greylag goose *Anser anser* in the reservoirs of the Kuma-Manych depression in Russia is relatively safe. Climate change, new agricultural technologies, anthropogenic transformation of breeding sites (decrease in the quality and area of reed habitats), disturbance, long periods of autumn hunting in breeding and wintering areas are factors that affect the local greylag goose population. Changes in climate and habitats are forcing this species to change its molting and wintering areas as well as migratory routes that existed in the 20th century. The studies were carried out in 2014–2022 in the Veselovsky reservoir, the western part of the Kumo-Manych depression. Wild geese as well as artificially bred and naturalized geese were tagged with GPS-GSM transmitters (ECOTONE, Poland). A total of 45 geese were tagged. Information about the geographical position of the same individuals over several years made it possible to clarify the timing and features of their movements during the breeding season, the area of molting and wintering. Data from young geese with transmitters show that in the first year of life they learn to know their living area, making trial movements in different directions during the pre-migration period, gradually covering the space along the entire Kuma-Manych depression between the Azov and Caspian Seas, the interfluve of the Don and Volga, Ciscaucasia. We found a shift towards later timing of autumn migration and earlier timing of spring migration, which is associated with climate warming. The wintering period has become shorter. The appearance of reverse migrations depending on weather conditions has been proven, their various features have been established in young and adult geese, a change in wintering and molting areas a high degree of philopatry to the place of "birth" has been established. It was found that greylag geese have shortened their migration routes in recent years and part of the population winters in the breeding area. Repeated complete migrations to the breeding area and return to wintering area during one season were recorded during the period of prolonged winter warming. This is explained by the proximity of the wintering area to the breeding area. It was possible to prove that a tagged female, who lost its brood early, molted outside the breeding area. A change in the area of molting in second-year geese was recorded for the first time in 2022, which suggests a deterioration in protective and feeding conditions in the area where geese have molted for many years. A molt migration to the wintering area was also observed.

The author is grateful for the support of Argamak-R LLC. The study was carried out according to the State assignment of the MMBI RAS.

THE WINTER POPULATION TREND OF THE GREATER WHITE-FRONTED GOOSE *ANSER ALBIFRONS* IN KOREA

Eun-Jeong Kim[1], Who-Seung Lee[2], Wee-Heang Hur[3], Hwa-Jung Kim[3], Yu Seong Choi[3], Dongwon Kim[3], Sejeong Han[1], Hyerin Joo[1] and Chang-Yong Choi[4]

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Recent anthropogenic effects, such as climate change, habitat loss, and hunting pressure, could have adversely influenced the population of various bird species, including long-distance migratory geese. Thus, understanding the population trend of specific avian species is crucial to develop appropriate management and conservation measures. The greater white-fronted goose (*Anser albifrons*; GWFG) is one of the long-distance migrants whose global population trend has not been clearly understood because of its extensive geographic range. To better comprehend the East Asian population of this species, we aimed to document the information on population trends in South Korea. We used the Nationwide Winter Waterbird Census (NWWC) data, prepared and compiled by the National Institute of Biological Resources (NIBR), to detect temporal (long-term and short-term) and spatial changes in the numbers of GWFG in wintering periods. For understanding a long-term population trend, winter census data collected every January from 1999 to 2023 were used, while the monthly count data from October to the next March were filtered out for analysing a recent short-term and spatial population change (between 2014 and 2023). Despite the fluctuations of counted GWFG numbers and the expanding monitoring efforts, the GWFG number in January gradually increased from 61,328 in 1999 to 127,843 in 2023, plus a peak number of 182,608 in 2020. Contrary to our initial prediction about the two peak numbers in October and March due to migratory groups, the highest number of geese was counted in November. Cheorwon Plain (38°16‘N 127°14‘E) in the northern region was identified as a key wintering and stopover site, while analysing more than half of GWFG at Ganwol Lake (36°39‘N 126°27’E) had disappeared since December. As known in other countries in East Asia (e.g., Japan), our data support the increasing trend of the East Asian population of GWFG. The high number detected near the Yellow Sea coast in the early autumn migration season suggested the occurrence of a passage group that may stop over Korea during their southward migration heading for wintering grounds (such as Poyang Lake, China). Interestingly, the short-term decreasing trend in each winter and the lack of a second peak in March provided a possible clue on a different spring migration route (detouring South Korea) of the passage group in the next spring. Collaborated with tracking data, Long-term monitoring efforts could provide more detailed information on population trends and migration strategies that contribute to the management and conservation of goose species in this region.

ARE THE TERMS OF GEESE SPRING ARRIVAL IN KYIV FOR 100 YEARS CHANGED?

Serebryakov V.V.[1], Kazannyk V.V.[2], Davydenko I.V.[3]

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[2]*Taras Shevchenko National University, Kyiv, Ukraine*
[3]*Institute of Zoology, Kyiv, Ukraine*

There are 9 species of geese in Ukraine. Among them Canad goose, Barnacle goose*, Brant goose, Snow goose* were observed very rarely with unknown origin. *Lesser white-fronted goose* is a rare migratory and wintering bird. *Red-breasted goose* is a more common wintering and migratory species but only along the Black and Azov Seas coast of the country. Bean goose, Greater white-fronted goose, *Greylag goose* are common wide-spread migratory and wintering birds, which are also hunted. *Greylag goose* is known to breed in some areas of Ukraine. The global changes of climate are well known. The question is whether it influences goose migration We collected 47 observations of Greylag geese during spring migration from different literature sources and ours at Kyiv city between 1910-2023. Statistical analysis of the migration phenology shows that there is a general trend that the spring migration starts earlier in the last decades.

INTERACTION BETWEEN BARNACLE GOOSE AND WHITE-FRONTED GOOSE ON THE NESTING SITES OF KOLGUEV ISLAND

Julia A. Loshchagina[1], Petr M. Glazov[1], Yury A. Anisimov[2], Olga B. Pokrovskaya[3], Elmira M. Zaynagutdinova[4], Alexander V. Kondratyev[5]

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Kolguev Island, located in the Pechora Sea, the southeastern part of the Barents Sea, is one of the main nesting sites for geese in the European part of the Russian Arctic. A relatively stable predation pressure due to the complete absence of rodents on the island resulted in the extremely high abundance of three goose species: White-fronted goose (*Anser albifrons*), Tundra Bean goose (*Anser fabalis rossicus*) and Barnacle goose (*Branta leucopsis*).

Russian Barnacle goose population has increased dramatically over the past 35 years. On Kolguev, the number of breeding Barnacle geese has also increased from single nests in the 1980s to the most numerous goose species nesting on the island. Barnacle geese first started nesting on the sandbars in the southern and eastern parts of the island, then expanded to the marshes in the river mouths including the Peschanka River delta, where the largest known colony of the species was settled. During recent decade, Barnacle geese have continued to expand inland occupying a variety of new nesting habitats, including swampy floodplains, dried lake basins and watershed bogs, lake margins with swampy basins, steep banks in creek valleys, palsa mires and hummocky tundra.

By dispersing throughout the island, Barnacle geese may compete with White-fronted geese, which used to be the most numerous goose species on the island, since they can use the same habitats for nesting, rearing goslings and moulting. To test whether there is a competition between the two species, we analyzed the breeding density and nesting success of the species in different parts of the island: in the area of the Peschanka Delta, where the huge colony of Barnacle geese is located, and in the central part of the island, where small colonies and single nests of Barnacle geese are more scattered.

The dynamics of the nesting density of Barnacle geese on the monitoring plots in the Peschanka River delta from 2006 to 2022 showed that it reached its maximum in the floodplain and a further increase in the number is possible only through expansion to new parts of the island and new habitats. At the same time, the nesting density of White-fronted goose decreased in the vicinity of the Peschanka Delta over this period, while in the central part of the island there is a tendency to an increase. A spatial analysis of the nest locations of the two species nesting on the same study plots showed that White-fronted geese preferred to nest more distant from Barnacle goose nests than randomly. This supports the hypothesis that the dispersal of Barnacle goose throughout the island can lead to a redistribution of White-fronted goose nests.

The collection and processing of field material was supported by the Russian Science Foundation grant No. 22-17-00168, https://rscf.ru/project/22-17-00168/.

BREEDING ECOLOGY AND AGE RATIO OF SWAN GEESE IN MONGOLIA

Iderbat Damba[1], Tseveenmyadag Natsagdorj[2], Nyambayar Batbayar[2] and Lei Cao[3]

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The swan goose *Anser cygnoides* is listed as a globally as ''Vulnerable'' species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) because of the population declining in breeding and wintering site. Swan geese breed predominantly in the wetlands of the Mongolian Plateau, a semi-arid region grassland dominated ecosystem. This study was conducted to study swan goose population, distribution and breeding ecology in eastern Mongolia. For this purpose, breeding monitoring survey in eastern Mongolia has been performed between 2015- 2017.

This species arrives at breeding sites by late April to early May. It nests in dense reed beds, and dry ground in tall grasses and small bushes near lakes and rivers. Females lay 5-8 eggs of creamy white eggs with fine granular textures. Incubation period is 28-30 days. The nests were on the ground, nest sites were near or in the lake, with an outer diameter of 38.21±3.28 cm (range 20-80 cm; N=19), an inner diameter of 23.84±3.17 cm (range 17-70 cm; N=19), and an inner depth of 13.64±1.97 cm (range 5-30 cm; N=14). Number of eggs in one nest were 4.19±0.33 cm (range 1-9; N=27). Totally, 110 eggs from 25 nests was measured. The average length of eggs was 82.26±0.44 mm (range 65.69-95.26 mm; N= 110) and the average breadth was 54.63±0.31 mm (range 40.46-58.90 mm). The mean egg weight was 132.84±1.00g (range 100.00-152.00 g; N=110). The mean volume of eggs was 126.02±1.61 cm^3 (range 55.44-154.81 cm^3; N=110).

The proportion of juveniles in flocks during the post-breeding period as measured in field surveys (during 17-23 June 2016) was 12%. In total data was collected from 350 adults and 46 juveniles at 23 lakes. Surveys during May 28 - June 15 2017 revealed a proportion of juveniles of 11%. In this year, data was collected from 1929 adults and 250 juveniles at 68 lakes. During the moulting period in the same year (06 - 26 July 2016) the proportion of juveniles was 1 %. In this period a total of 22259 adults and 276 juveniles were surveyed at 72 lakes. The juvenile proportion during the moulting period was particularly low compared to other geese species surveyed during autumn or winter. This suggests extremely low productivity of swan geese populations in eastern Mongolia.

The swan goose is very sensitive species, and its nest is mostly located among reeds in water. It is therefore also hard to approach. Too many nest inspections increases the risk of the nest being exposed to predators. So, continuous observation from the date of nest discovery until hatching and the disappearance of the family group from the nest area was not adopted. Correspondingly, exactly clutch size, clutch initiation date, hatching date, and incubation period were not successfully identified.

EXTREME DROUGHT INCREASES DAILY TRAVEL DISTANCE AND ENERGY EXPENDITURE, RATHER THAN AFFECTING HABITAT USE, WINTERING SITE OR MORTALITY, IN A SITE-FAITHFUL WINTERING AVIAN HERBIVORE

Wenxin Liu[1], Qingshan Zhao[2]*, Fang Ming[3], Lei Cao[2,4] and Anthony David Fox[5]

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The floodplain wetlands of the Yangtze River Basin in China are globally important wintering grounds for East Asian-Australasian Flyway migratory waterbirds. In 2022, the entire basin experienced the most severe summer, autumn and winter drought in 61 years, an event likely to fundamentally affect the ability of wintering waterbirds to find food and survive. At the largest and most important wetland, Poyang Lake, the area of inundated wetland was more than 90% reduced in winter 2022/23 compared with the same period in 2021/22. In this study, we used tracking data from both years from eight individual Greater White-fronted Geese (Anser albifrons), a relative specialist sedge-meadow grazing species, to contrast habitat use, behaviour and energy expenditure in these two radically different years, to determine their responses to extreme drought conditions. We predicted that the geese would show greater energy expenditure related to enhanced searching for suitable habitats and potentially movement to adjacent farmland habitat or other distant wetlands, which might ultimately result in elevated death rate. However, as was the cases in the “normal” 2021/22 winter, all tracked individuals remained within the natural wetland areas of Poyang Lake throughout the entire 2022/23 winter period, but based on paired tests in comparisons with 2021/22, the daily distance travelled and energy consumption increased. Although sample sizes were small, the tracked individuals did not die during the wintering period or within a month of their subsequent spring migration in both years. Although we are unable to determine the longer-term effects on body condition and fitness, these results suggest a plasticity in the behavioural responses of these birds that enabled them to survive the extreme conditions for an entire winter within Poyang Lake. For these individuals at this site, it appears that extreme drought had limited effects in the short-term, but studies on the effects on individual fitness (reproductive success, individual mortality) are necessary to determine the longer term effects. The results imply that Greater White-fronted Geese can still find the resources needed to at least survive at Poyang Lake in a year of extreme drought, confirming another aspect of the existing demonstrable outstanding importance of the site for wintering waterbirds.

BARNACLE GOOSE WORLD LARGEST COLONY DYNAMICS: NUMBER AND DENSITY OF NESTS IN PESCHANKA RIVER DELTA OF KOLGUEV ISLAND IN 2006-2019

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In late 80's – early 90's the barnacle goose population of Kolguev Island consisted of a few hundred pairs. By the 1995 the main colony appeared on the lowlands of Peschanka River (the largest river on the island) and its size was estimated as more than 6000 nests. In 2001, the assessment of nest number on Kolguev was 20000 nests.

We counted Barnacle geese at the largest colony of Kolguev Island in Peschanka River lowlands in 2006, 2012 and 2019. According to methodology as suggested by Litvin K.E., nests were counted within 10 meters wide transects, made in parallel on certain distance between each other all over the colony. Distance between transects varied from 50 m to 600 m in different parts of the colony, depending on size of the part and landscape types, with most common intervals 300 m and 600 m. Each year survey counts were repeated on the same transects. The total length of transects where counts were made during all 3 study years was 21.4 km. Total length of transects where counts were made only in 2006 and 2019 was 36.9 km. The area of the counted part of the colony is 22.4 km². In 2006 the known area of Peschanka River lowlands and surroundings colony was 26.3 km², and the counted and estimated nest number was 44000. In 2019 known area of this colony increased to 38,4 km² and the counted and estimated nest number was 70700. The colony is basically divided in 2 parts: the eastern part, which is closer to the salt marshes and to the shore of the bay, and the western part, which is more inland. The density of Barnacle Geese was growing during study period in both parts: 2006 – 1640 nests/km², N = 352 (here and below N – number of nests, which were counted within the transects), 2012 – 1850 nests/km², N=396, 2019 – 2030 nests/km², N = 436. In the eastern part, the yearly growth speed of the density was the same between 2006-2012 and 2012-2019, respectively 0.64% and 0.68% (here and below percentage for each year is taken from the first year in the counted period). In the western part, the yearly growth speed of the density was higher than in the eastern part and higher in the first period: 3.65% compared to 2.15% in the second one. We assume that the density in the eastern part was close to its maximum already in the beginning of the study period while in the western part there were still enough space for new breeding pairs. Therefore, this area was actively occupied after 2006, reducing places for new nests and slowing down the yearly growth. In total, for 13 years the density in the eastern part increased by 8.74% and in the western part by 40.2%. Together with increasing density on known nesting areas, barnacle geese nests continue to appear on new territories adjacent to the former colony. Hatching success was decreasing while colony was growing from 96% in 2006 to 94% in 2012 and 86% in 2019.

Session 2. Migration, dispersal, population monitoring

HIGH ALTITUDE IS FOR THE BIRDS!

Lucy A. Hawkes

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Many species of geese make seasonal migrations to breeding grounds in Mongolia in the summer, and face the formidable task of migrating across the 'Roof of the World' – the Tibetan Plateau, which rises to an average altitude of 4,500 metres (14,700 feet) with the world's eight highest points including Mount Everest at 8,848 m (29,030 feet). In doing so, they benefit from the seasonally favourable conditions here that make breeding more likely to be successful, but also must undertake one of the most challenging migrations in the world. In this talk, I will outline why birds are the migration champions of the world, including the unique features of their biology that make flight possible. I will also detail how the challenges of flight are greater for larger birds such as geese, which makes their migration all the more impressive. I will also outline more than a decade of work on the famous bar-headed goose, a species renowned for making the highest altitude flights in the world. Driven by research conducted here in Mongolia, I will describe the physiological and behavioural strategies that make this feat possible, and highlight why there may actually be many other species of goose that may join the bar-headed goose on the podium of the world's highest fliers.

WHAT LIMITS EARLIER ARRIVAL AND REPRODUCTION OF ARCTIC MIGRATORY BIRDS?

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In the current warming climate, migratory animals are under pressure to adjust their annual cycles. Animals need to start breeding earlier if they are to stay in synchrony with an earlier emergence of food in their breeding grounds, which ensures survival of their offspring. Advancements in reproduction timing may well be constrained by the time of arrival on the breeding grounds. Here we use a large dataset on migration and reproduction timing for 11 populations of Arctic-breeding migratory birds in the Atlantic flyway, including three species of geese, to study how timing relates to date of snowmelt at the breeding grounds. While earlier snowmelt did not affect egg-laying dates in four populations of skuas and birds of prey, all three shorebird and all four goose populations in our dataset advanced egg-laying dates in response to earlier snowmelt. At the same time, we found limited responses in migration timing, as only two goose populations advanced timing of arrival in the Arctic. These populations migrated following a coastal route to North-Western Russia, and in contrast to other waterfowl and shorebird populations did not undertake large ocean crossings. Together with recent findings of phenological advancements in a shorebird population following this same migratory route, this suggests that a lack of environmental cues may act as a more important constraint limiting earlier arrival on the breeding grounds compared to physiological constraints.

EVALUATION OF THE NUMBER OF BARNACLE GOOSE COLONIES IN THE PESCHANKA RIVER DELTA ON KOLGUYEV ISLAND, BARENTS SEA: METHODS AND PRELIMINARY RESULTS

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The Russian breeding population of the barnacle goose increased from 70 thousand in 1980 to 1.2 million individuals in 2015. The population growth coincided with the expansion of the breeding range to the southwest, as well as an increase in the diversity of nesting habitats used. New nesting colonies appeared on the Yugorsky Peninsula, Kolguev Island, Kanin Peninsula, Dolgiy and Golets Islands, as well as along the Barents Sea coast. Barnacle geese began to nest on coastal marshes and sandbars, later colonies began to appear on steep slopes under the protection of nesting peregrine falcons (*Falco peregrinus*) and rough-legged buzzards (*Buteo lagopus*), as well as in sedge-moss bogs further from the coast. This was accompanied by a rapid increase in the size of nesting colonies, as can be observed on Kolguev Island, where the colony in the Peschanka River delta had grown from a couple of hundred breeding pairs in 1994 to 70 thousand pairs in 2019. This is now the largest known barnacle goose colony in the world. Such a rapid growth of the colony size was facilitated by the unique conditions on the island, where, due to the absence of rodents and the relatively stable pressure of predators, the nesting success of barnacle geese is exceptionally high (more than 90% in some years).

Estimating the abundance of such a large colony is associated with both methodological and resource difficulties. The first attempts to estimate the abundance of the colony were made in 2006 by means of counting nests on transects and counting plots in different parts of the colony. Counts were repeated in 2012 and 2019, also by the method of transects and plots.

In 2022, in addition to calculating the nesting density of barnacle geese on the counting plots, we applied new methods for colony mapping using unmanned aerial vehicles (UAVs). A section of the Peschanka River delta with an area of about 10 km^2 was surveyed. The survey was conducted using DJI quadcopters from a height of 40 m above the ground.

Machine learning methods were used to process the survey materials. The YOLO (You only look once) algorithm version 5, which combines object classification and identification, was used for searching for barnacle goose nests in the images. More than 800 manually labelled examples of target objects were used to train the algorithm. When implementing the method, the PyTorch software platform in the Python programming language was used. To verify the recognition of barnacle goose nests in the images, the counting plots were surveyed, where all nests had been mapped. The results of this work made it possible to obtain data on the distribution of barnacle goose nests in different habitats, which will allow to extrapolate the obtained nesting densities to similar habitats in other parts of the island and estimate the total number of the breeding population of barnacle goose on Kolguev Island.

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BIOGEOGRAPHICAL VARIATION IN MIGRATORY PATTERNS OF PALEARCTIC BREEDING GREATER WHITE-FRONTED GEESE *ANSER ALBIFRONS*

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Continental comparisons within and between populations of single species can be insightful to understand key environmental factors shaping differences in migration systems, yet such studies are rare. We compiled a large telemetry dataset from three Eurasian Greater White-fronted Geese (GWFG) *Anser albifrons* populations, all of which breed at similar high Arctic latitudes, but face strikingly different topographic challenges along their migration routes, to investigate differences in stopover network and migration strategy between populations and seasons. Using 106 (autumn) and 65 (spring) tracks from tagged GWFG from three Eurasian populations (Baltic-North Sea [BNS] in the west; East Asia Continental [EAC] and West Pacific [WP] in the east), we generated stopover networks, calculated network metrics, quantified migration parameters and compared repeatability and variation within and between populations. BNS showed largest network size and shortest average geodesic distance in both seasons. BNS showed shortest migration distances, but most stopover sites, longest stopover duration and shortest step length. EAC had the longest migration distance and second maximal flight leg (> 1,600 km). WP had the shortest migration durations and longest maximal flight leg (> 2,500 km). Arrival dates to summering grounds did not differ between the three populations. Autumn migration duration was shorter and migration speed faster than in spring in all populations. We inferred that the lack of obvious ecological barriers to BNS geese shapes their frequent stopovers of short duration. In contrast, EAC geese face two major ecological barriers (3,100 km boreal forest, high mountains, dense human settlement and ocean) and WP geese must clear *c.* 2,400 km of forest, mountains and ocean along their migration corridors, necessitating longer staging and migration legs of greater duration. We conclude that, despite almost identical body plan, all populations respond to radically different physical impediments and habitat availability/connectivity along their migration routes by adopting contrasting movement strategies.

MIGRATORY ROUTES AND POPULATION STATUS OF BRENT GOOSE IN EAST ASIA

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Brent geese wintering in Asia is a small population estimated only 8,700 birds and little information is available for their migration and important habitat. A tracking study has been conducted to investigate the migratory route and important sites since 2017 in staging area in Notsuke Bay, and wintering area in Hakodate, Japan. A total of 96 geese were captured and of these, 67 birds were equiped with transmitters during 2017-2022. We obtained movement data from 22 geese and three of them completed autumn and spring migration. During spring migration, brent geese migrated across the Sea of Okhotsk directly from Hokkaido/Kunashiri Island to the north coast of the Sea of Okhotsk and arrived at Kotelny Island stopping over the middle of Kolyma river and Indigirka river mouth. In autumn migration, tagged geese migrated east from Kotelny Island and reached Chaun Bay, then moved along the east coast of Kamchatka Peninsula to Malamvayam Lagoon and returned to Hokkaido, Japan. Two of the geese captured in Notsuke Bay migrated further east to Korean Peninsula and mainland China.

The important habitats along the flyway of Brent Goose were extracted from recent literature and determined as potential sites with no/poor information on inhabitation status. Three areas, spring staging sites around the north coast of the Sea of Okhotsk, summering site in Kotelny Island, and wintering site in Shandon Peninsula, China were extracted and supplementary count surveys were conducted there. During spring migration in 2021 and 2022, the count survey was conducted in coastal area of the north coast of the Sea of the Okhotsk in cooperation with Institute for Biological Problem of North, Russian Academy of Science. We found that a flock of 20-300 geese were staging around Magadan and over 200 geese in Okhotsk city. An aerial survey was also conducted in Kotelny Island where the tagged geese stayed in summer under collaboration between Goose Swan and Ducks Study Group of Northern Eurasia and Head office of the "Foster a Goose Program". A boat survey was implemented in Sanggou Bay, China in collaboration with Chinese Academy of Science and over 100 wintering Brent Goose were found.

Population trends for recent 15 years was also analysed using the monitoring data in Japan and indicate that the East Asian population is increasing.

NEW DATA ON THE AUTUMN MIGRATION OF THE LESSER WHITE-FRONTED GOOSE EASTERN POPULATION

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The lesser white-fronted goose *Anser erythropus* is included in the Red Data Book of the Russian Federation as a vulnerable species. In the recent past in Yakutia these geese were distributed everywhere in northern taiga, tundra and forest tundra. Due to total number sharp decrease in 20th century second half, now only few reliably known scattered breeding areas remain in the region. The presence and distribution in vast watershed of Lena and Anabar Rivers remains unclear, where it has been found only in Vilyui and Muna River basins. Within the agreement on study and conservation of this species with ALROSA, surveys were conducted in the diamond mining industry area to determine the lesser white-fronted goose current status in Muna River valley, as compared to the records from 2005. According to expedition results, we did not reveal any significant negative impact of ALROSA's activities on the species well-being in Muna River valley. Moreover, in comparison with 2005 data, new breeding sites of the lesser white-fronted geese in Muna River lower reaches appeared. To study breeding distribution and reveal migration ways of the species eastern population for the first time in taiga zone, North-East Asia, six individuals were marked with Druid Technology transmitters on August, 26 and 27, 2022. According to data received from four transmitters, on August, 19-26, birds flew from the Muna River lower reaches northward for 250 km and stopped in Lena River valley, where they were staying for about one month. Geese started migrating southward on September, 22 and 24. The first bird made two stops, first for four days and the second for 13 days, and flew to their wintering ground at Poyang Lake on October, 18. The second bird flew to the Russian-Chinese border within four days and its transmitter stopped sending data on September, 26. The third bird made one stopover for 13 days and then flew to Poyang Lake on October, 17. The fourth individual, after a six-day flight, made long stopover from September, 30, to October, 25, at the border of Mongolia and China and flew to Poyang Lake on October, 28, and stayed there for four days before flying to Lake Dunting. The use of Druid Technology transmitters allowed us to reveal dates, migration ways, transit stops and wintering ground sites of lesser white-fronted goose eastern population breeding in the taiga zone. Currently, the study of lesser white-fronted geese in the Muna River valley with the support of ALROSA and work on the conservation of this rare species continues. Long-term annual scientific monitoring will allow to track possible changes in ecosystems and to apply the most correct and timely strategy of management for occurring processes.

EXAMINING NATAL DISPERSAL OF EMPEROR GEESE (*ANSER CANAGICUS*) ON THE YUKON DELTA NATIONAL WILDLIFE REFUGE, ALASKA

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In waterfowl, the time period between hatch and independence from adults is often difficult to study due to constraints in the ability to tag or observe young while they travel and learn from their parents. Understanding survival during this early time period is especially relevant for declining populations. The emperor goose (*Anser canagicus*) is a medium-sized goose that is endemic to the Bering Sea region that breeds primarily on the subarctic Yukon-Kuskokwim Delta in western Alaska. Given the reopening of a regular hunting season, it is imperative to examine juvenile recruitment and behaviour of emperor geese, given their previous population declines. Movements of emperor geese have been recorded using coarse collection technologies such as geolocators or internal satellite transmitters due to challenges of working in rural Alaska. Additionally, because the species overwinters in remote regions of Alaska, using more advanced data-collection technologies such as cellular or GSM transmitters are largely unrealistic. During summer 2022 six Argos equipped backpack transmitters were deployed on adult female emperor geese to examine fine-scale movements during the post-hatch. The data collected from these devices will be combined with data collected using internal transmitter devices deployed by both Alaska Department of Fish and Game and USFWS in order to assess appropriate technologies for studying gosling movements. Our objectives of this study are as follows: 1) to determine if an external transmitter technology is a useful tool for studying this species and 2) to examine home range size, gosling movements, and habitat use of broods on the Yukon Delta using data from both internal and external transmitter technologies. Here, we present the preliminary findings from the 2022/2023 field seasons.

THE GREYLAG GOOSE (ANSER ANSER) RINGING ACTIVITIES, GPS TELEMETRY, GENETIC ANALYSIS OF THE POPULATIONS AND HUNTING SMALL SHOTS OBSERVATION IN THE CZECH REPUBLIC AND THE SLOVAK REPUBLIC

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The greylag goose (*Anser anser*) population is divided into several nesting areas within the Czech Republic and the Slovak Republic. The first greylag goose was ringed in the Czech Republic in 1938. The Czech Republic/Czechoslovakia's first official bird ringing group started its activities in the 1950s in Southern Bohemia. The second official group started working in the 1970s in Southern Moravia, where were first used red neckbands in 1973 without code and in 1977 with code. A Czech - Slovak bird ringing group has started to use neckbands in the Slovak Republic since 2018. The group has an outstanding experience with GPS GSM neckband loggers. Since 2012 the ringing group has employed 26 GPS GSM loggers. They had bad experiences with GPS GSM backpack harness loggers, as harnesses were destroyed by the geese. Part of the ringing activities is the collection of goose feathers for genetic analyses of the populations. The study aimed to test the genetic variability and gene flow among the Czech and Slovak populations. We have analysed 14 microsatellite loci and mitochondrial DNA from 114 bird individuals' feathers, collected from nine different nesting areas in the Czech Republic and one nesting area in the Slovak Republic. The Bayesian clustering analysis did not detect any population differentiation. Therefore, we can assume that all the analysed populations share the gene pool and that the gene flow among the populations is not restricted. During the births ringing activities we x-rayed 74 greylag geese older than one year in 2019 - 2022. Twenty-five individuals had at least one small shot in the body, which is 34 % of the examined group. The highest number of shots in a goose was 15. The x-ray examinations helped, in a few cases, to recognise lead shots from still shots by their deformations.

PITFALLS WHEN ASSESSING THE PROPORTION OF JUVENILES USING AGE COUNTS

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Population size is regulated through basic demographic rates such as survival and productivity. Understanding drivers of change in these demographic parameters are critical for informing long-term conservation and management of wildlife populations. This applies to declining species as well as for increasing species. These analyses and related conservation and management recommendations rest, however, on the assumption that the methods for collection of the demographic parameters yield unbiased estimates, something which is not necessarily the case.

In migratory geese, productivity or breeding success is typically assessed at the autumn staging and wintering grounds by observing the number of young vs adults in flocks of geese – also called age counts. Such age counts are, however, likely to be affected by a number of factors as we are compelled to sample from an open population, in which the temporal and spatial age composition can vary due to differential migration, mortality, and flocking behaviour.

Using the long-term dataset for pink-footed geese, we investigated which factors might have an effect on the annual estimates of productivity, based on field collection of productivity data. Specifically, we investigated the effects of sampling in time and space, flock size and possible hunting influences. This allows us to identify which factors need to be considered when collecting data on breeding success in the population and, more widely, to provide guidance for the design of age counts in migratory birds. In the long term this will ensure that conservation and management of migratory birds rely on the best possible information. In this poster, we will present the results of this study.

Session 3. East Asia and Australasian Flyway

NOVEL MAPPING OF THE FLYWAY CORRIDORS OF LARGE-BODIED WATERBIRDS IN THE EAST ASIAN AUSTRALASIAN FLYWAY

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We combined recent tracking data from large-bodied waterbird species in the EAAF to define their flyway corridors, linking discrete breeding, moulting, staging and wintering distributions to define their biogeographical sub-populations. For the first time, this provides the foundation for generating population estimates and trends for these newly identified biogeographical units, especially those of unfavourable conservation status. Combined with remote sensing data, results have vastly improved our understanding of their geographical ranges and the key sites and habitats used by six waterbird groups (cranes, storks, pelicans, spoonbills, swans and geese) throughout their annual cycle. The results confirm the importance of relatively few major Asian river floodplains and their associated wetland habitats in China and Russia. With continuing development pressures in the region, it is vital that we use this information to support flyway initiatives to protect these floodplains, wetlands and waterbirds to safeguard them for the enjoyment of future generations.

POPULATION TRENDS AND THE POTENTIAL BACKGROUND FOR GREATER WHITE-FRONTED GEESE IN JAPAN

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Japan has the largest population of greater white-fronted geese *Anser albifrons* wintering in eastern Asia. The effective conservation of this East Asian goose population requires an understanding of their status and distribution in Japan. Long-term (15-year) trends in numbers were analysed from four main wintering areas – northern Miyagi, Kaetsu, Hokuriku and Sanin – in relation to nationwide trends recorded for greater white-fronted geese in Japan. Annual numbers determined from nationwide counts increased from 68,363 in 2004 to 280,316 in 2020. For northern Miyagi the numbers also increased from 55,961 in 2004 to 257,731 in 2020.

Annual trend indices over 5-year (2013/14–2017/18), 10-year (2008/09–2017/18) and 15-year (2003/04–2017/18) periods were calculated using TRIM software. These indices showed a significant increase both for Japan nationally and for northern Miyagi over the 15-year timescale, with moderate declines in Hokuriku and Sanin and uncertain trends for Kaetsu. The growth in numbers wintering in northern Miyagi may be at least partially attributable in the agricultural landscape, following the modernization of rice farming. Despite a significant positive correlation between trends recorded for the whole of Japan and those for northern Miyagi, there were no significant correlations with the other regions.

Data from satellite tracking geese suggested that difference in the trends recorded between geese in northern (northern Miyagi) and those in southwestern Japan (Sanin) could be explained by differences in migration routes taken by geese wintering in northern and southwestern Japan. Satellite tracking data showed that greater white-fronted geese left northern Miyagi by following a Pacific route along the northern Akita Prefecture and western Hokkaido. On the other hand, geese wintering on the Izumo plain in Sanin fly directly over the Sea of Japan.

In East Asia, major population increases have been reported for greater white-fronted geese in flyway including Japan and Korea. Although our data on migration routes are limited, geese wintering in Sanin appear to pass over the Sea of Japan to stage in east continental Eurasia in the spring. The decrease in the geese wintering in southwestern Japan (Sanin) may be linked to geese staying in continental Eurasia due to global warming.

CURRENT STATUS OF GEESE IN KOREA

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There are five species of geese, bean goose, greater white-fronted goose, lesser white-fronted goose, swan Goose and brent goose which regularly migrate to and winter in Korea. The major wintering habitats for geese are the coastal rice farming areas of the west and south coasts. Data from 2015 to 2020 in the national simultaneous waterbird census in winter conducted annually by the Ministry of Environment shows that the populations of the white-fronted goose and bean Goose, which are the dominant wintering species, are steadily increasing. The reason for the increase is that hunting and poaching have almost disappeared in Korea, and it is the result of active wild bird protection activities. In order to protect geese in Korea and East Asia and uncovering their migratory routes, and in a cooperative effort between Korea and East Asian, geese are captured and equipped with tracking devices (GPS- Mobile Transmitter). This enables us to find their migratory routes and provide detailed information on breeding and wintering habitats. As a result of this study, detailed migratory behaviour of geese has been uncovered. In addition, the characteristics of their habitat selection have been identified, and these tracking data are widely used in protection activities for geese in East Asia.

SOME OBSERVATIONS ON THE STATUS AND CONSERVATION OF GEESE IN DPRK

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Democratic People's Republic of Korea (DPRK, also known as North Korea) is probably one of the most under-research areas on the East Asian-Australasian Flyway (EAAF), due to difficulties to enter the country and to survey the country. However, in the early 2000s and then again from 2015, there were increasing possibilities to do some kind of research, related to the accession of DPRK to the Ramsar Convention on Wetlands and the EAAF Partnership. Important research on waders and Anatidae included a study on swan geese in Mundok, establishing Mundok wetland as a prime wintering area of the globally vulnerable species in 2018. This is related to the still largely intact tidal flats in the Korean West Sea (Yellow Sea). While DPRK like its neighbours People's Republic of China (PR China) and Republic of Korea (ROK) does some large reclamation projects, progress is slow due to the lack of machinery. Currently, when the damage done to the ecology and the very limited – if at all – economic benefit of reclamation becomes visible in ROK and PR China, there is still time to prevent larger damage to be done in DPRK. For this, work on the preservation of tidal flats is necessary, including capacity development of environmental decision makers and specialists in DPRK. This study shares observations on the status of geese and necessary conservation activities in DPRK in the last decade.

STATUS AND CONSERVATION OF THE SWAN GOOSE POPULATION IN RUSSIA

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The present population in Russia is estimated about 1800 birds (from 1450 to 2150), including about 180 nesting pairs (110–250). The western population, which uses inland flayway, has a summer range from the Uvs Nuur Lake basin in the west to the middle of the Amur River in the east; the key breeding area is located in the Daurian steppe in eastern Transbaikalia. The western population is estimated as 1000–1400 birds (including 55–100 breeding pairs), including 900–1150 birds (50–80 pairs) in Dauria. The eastern population, which uses coastal flayway, has a summer range in the lower Amur Basin in Khabarovsk Krai; this population is estimated at 400–700 birds, including 55–150 breeding pairs; current information on this population is very limited.

Climatic cycles of about 30 years with alternating wet and dry periods have a great impact on wetlands and swan goose populations in Dauria. Unfavorable perennial droughts significantly reduce wetlands, reproductive success and abundance of the population, causing the relocation of many birds from the arid Daurian steppe to more humid forest-steppe and forest zones. Therefore, in the dry years 2000-2020, the population significantly decreased in Daurian core of the breeding range, but slightly increased on the periphery of the range: in Buryatia (western Transbaikalia) and the middle Amur, some birds were also met in Altai, Krasnoyarsk Krai, Khakasia, Irkutsk Region and on Sakhalin. The wet climatic period in Dauria began in 2021. Therefore, now the reverse process of population increase in Dauria and decrease in the periphery has begun.

The main natural threats to the population are: disappearance of wetlands during dry climatic periods. The main anthropogenic threats (in order of importance) are: 1) poaching; 2) spring grassfires (more than 50% of habitat burns annually); 3) human disturbance during nesting (especially intense disturbance due to spring hunting); 4) changes in the natural hydrological regime of rivers; 5) disturbance and trampling of nests by cattle; 6) pesticide poisoning on agricultural fields; 7) predation by untethered herding dogs. The species is particularly vulnerable during the dry phases of climatic cycles. A major potential threat is the construction of a dam that began in 2020 in Mongolia on the Uldza River, which fills the Torey Lakes - the dam will significantly reduce water levels in the lakes and the goose population, especially during dry climate periods.

Conservation measures taken: Important nesting places of the western population are protected in the Daursky Nature Reserve and national Dolina Dzerena Refuge in Dauria, and of the eastern population in the national Udyl Reserve (Khabarovsk Krai). But unfortunately in dry climatic periods the wetlands in the Daursky Reserve almost completely dry out, so geese move beyond the reserve, where 90-98% of habitats are not protected. In general, the measures taken in Russia do not ensure the conservation of this species.

Necessary protective measures: 1) prohibition of spring hunting on breeding and migration sites; 2) creation of new protected areas in important habitats: on the Argun and Onon rivers in Dauria and in Nikolay and Ulbansky bays in Khabarovsk Krai; 3) prevention and effective extinguish steppe fires; 4) banning loose herding dogs; 5) stopping construction of the dam on the Uldza River.

LEVELS OF BIOGEOGRAPHICAL SUBPOPULATION FLYWAY EXCHANGE IN EAST ASIAN GOOSE SPECIES

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The recent use of tracking devices has successfully identified discreet biogeographical subpopulation flyways in East Asian large-bodied waterbirds, linking discrete breeding moulting, staging and wintering grounds within the same species. This information enables us to better monitor changes in their distribution and abundance and provides a deeper understanding of their population structure and population dynamics, based on the assumption of greater genetic flow within such subpopulations than between them, because of their observed temporal and spatial separation. However, the degree to which individuals shift temporarily or permanently between these subpopulations is difficult to determine. Previous studies in other species have used methods such as ring resightings, feather stable isotope assignments, and genetic analyses, but it remains difficult to calculate the probability of such exchange of individuals. Here, we analyse telemetry data from more than 1,300 individuals of 5 species of the Anser genus in Asia, to determine the probabilities of exchange of individuals between biogeographical subpopulations within species and populations. We contrast exchange rates between species and subpopulations and speculate on their potential cause and effects.

Session 4. Central Asian Flyway

IMPACT OF RECENT ENVIRONMENTAL CHANGES ON THE BAR-HEADED GOOSE AND OTHER BREEDING WATERBIRDS IN THE TRANS-HIMALAYAN LADAKH REGION OF NORTH-WEST INDIA

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In recent decades, the Western Trans-Himalayan Ladakh region has witnessed tremendous changes linked to its strategic importance, the rapid development of new means of communication and the effects of climate change. From melting glaciers and extreme weather events to the exponential growth of tourism, defence activities and infrastructure, these developments have an important environmental cost affecting Ladakh's high-altitude wetlands and their bar-headed goose population, for which they represent the sole breeding ground in the Indian Sub-Continent. Here I review the impact of these changes on the goose and other breeding waterbirds, based on yearly bird counts starting in the mid-1990s.

While the warming climate has some positive effects on the avifauna - new bird species have appeared or are able to breed in Ladakh – a higher frequency of droughts and floods, reportedly linked to it, have a negative impact on the goose and other waterbirds through habitat degradation and reduced breeding. Moreover, declining population trends are in evidence throughout the period, pointing to further triggers of environmental change. Overstocking – the wild ungulate population is now less than 5% that of their domestic relatives -, pollution, direct disturbance and encroachment on goose habitat appear to be the main causative factors.

The combination of rapidly-growing anthropogenic impacts and climate change threaten the very persistence of the goose and other waterbirds in the region, calling for urgent conservation measures. The first priority is to protect breeding grounds from further encroachment, which requires the active involvement of local communities, the tourism industry, the army and other stakeholders. New opportunities to lessen pressure on goose and other wildlife habitats have recently opened up, including recent declines in livestock numbers, de-escalation along the tense Indo-China borderlines, where the main wetlands are located, and concerted calls from the main political and non-governmental organisations to protect Ladakh ecosystems and promote controlled tourism.

CURRENT STATE OF LESSER WHITE-FRONTED GOOSE LOCAL POPULATIONS – THE REASONS OF DISTRIBUTION AND NUMBERS DECREASING

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Large-scale surveys of geese in Northern Kazakhstan staging areas carried out nearly annually since 1998 have shown that the total numbers of the main western population of lesser white-fronted goose (LWfG) has been restoring. In the middle of 1990's it was estimated at 8500-17000 ind., at the beginning of 2000's – 9000-12000 ind., but in autumn 2010-2014 the numbers varied between 17500 and 30800 ind. (Rozenfeld et al., 2016). The current estimation of total numbers of that population varies around 20000-50000 birds in different years. In contrast to these positive trends in the whole population, some local populations demonstrate negative trends in numbers. Thus, monitoring of local populations of LWfG in western marco-slope of the Polar Urals which was carried out in 1983-2021 (except 1991, 1995-1998 and 2003) has revealed the following situation. The total numbers of adult ind. in 1982-1988 in this area varied within 100-120 individuals, with the exception of 1987 when it counted for 50-60 individuals. In 1999-2015 we counted there from 18 to 36 adults and only 12 in 2016, 8 in 2017 and in 2018, 11 in 2019, 3 in 2020 and 0 in 2021.

In order to compare the above results, another local population of LWfG in lowland tundra of the Bolshaya Rogovaya river valley (400 sq.km) was surveyed. The numbers of LWfG in that study area was 21 adult birds in June 1999, 29 adult birds in July 2006, 14 in July 2007, 7 in July 2009, 4 in July 2011, 9 in July 2012 and only 1 pair in summer 2015. A similar situation has been observed in Southern Yamal. I guess that there are two reasons for the decrease of numbers in some local populations of LWfG. The main factor might be climate warming due to which birds from southern breeding areas move to northern areas where they formerly did not breed. For example, throughout recent years LWfG have been breeding in the middle and northern parts of the Yamal peninsula up to 72°N, while 20 years ago they did not breed further north than 69°N. The total numbers has been growing in the North. We do still not know in which way exactly climate change influences the population of LWfG. A second factor of local population of LWfG declines is an increase of human impact from local people on the population of LWfG. In 2018-2022 reindeer shepherds with their flocks stayed at the foothills of the Polar Urals for a long time and migrated to the shore pastures very late – only at the end of June. Disturbance made by people, reindeers and shepherd's dogs should be a serious disturbance for LWfG. As a result geese had a low nesting success or left their breeding area in search for quieter areas. They did fly to the moulting areas in the North like one of the goose (named Last) departed from the breeding area in the beginning of its unsuccessful breeding in 2015.

FAVOURABLE REFERENCE VALUES FOR GEESE IN THE NETHERLANDS

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The European Birds Directive requires regular assessment of the State of Conservation (SoC). This SoC is important within the practical implementation of Nature Legislation in the Netherlands (and other EU countries). The SoC is based on four subjects following the requirements of the Habitats Directive for species: distribution, population, habitat and future perspective. To allow transparent and objective assessment of the SoC for these subjects Favourable Reference Values (FRV) is called for to distinguish between favourable and unfavourable states. This presentation will show developed methodology for these FRV within the Netherlands exemplified for Geese. Points of extra attention will be the differences in assessment between breeding populations and populations spending the non-breeding period in the Netherlands. The difficulty in making these assessments nationally within a flyway framework in which most geese species (and other migratory populations) use several countries during their annual cycle and the choice of Favourable Reference Values for geese which represent in the Netherlands a situation with high population sizes partly related to agriculture intensification.

ANNUAL SURVIVAL OF DARK-BELLIED BRENT GEESE (BRANTA B. BERNICLA) IN WESTERN EUROPE FROM 1970-2016

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Annual survival was estimated from resightings of colour-ringed dark-bellied brent geese. The data-set contained 4.513 geese marked both in winter in England, France, the Netherlands, and in summer in northern Siberia (Taimyr peninsula) between 1973 and 2016 yielding 151.778 resightings and an estimated annual survival rate of 88.2 % for males and 87.9 % for females. These estimates are compared to those derived from annual population censuses in January in western Europe and estimates for annual reproductive success (proportion of first-winter birds) between 1956-2016. This yielded a slightly higher annual mean survival rate of 89.2 %. Because some of the marked birds have lost one ring, they cannot be identified any longer, but are still alive. Therefore, the estimates from ring-resighting information are slightly biased and underestimate the true survival somewhat.

MONITORING RESULTS OF ANSERIFORMES IN THE RUSSIAN PART BASIN OF LAKE BAIKAL IN 2020-2022

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In 2020-2022 monitoring of Anseriform birds in the basin of Lake Baikal (Russian part) was carried out. The main goal was to update data on the number of geese during spring migration, their concentrations, and to search for potential nests. In the spring-summer periods, searches and surveys were carried out in the reservoirs of the Barguzin basin (North-Eastern Baikal region), Orongoi basin, Borgoi basin, the valleys of the Selenga and Udunga rivers (South-Western Transbaikalia). There are 3 species of swans and 7 species of geese here.

The mute swan *Cygnus olor* in the Russian Baikal basin is a vagrant species. In the Russian part of the basin, we noted only a single occurrence on May 19-21, 2021 on Lake Beloe.

Whooper swan *Cygnus cygnus* is a migratory breeding bird occasionally wintering in the area. During the migration period, it can be common to uncommon, as their numbers differ markedly between years. On large lakes, flocks reach up to 300-500 individuals. During the breeding period it is rare throughout the territory of the Baikal basin.

The Bewick's swan *Cygnus bewickii* is a common migratory swan and numerous in certain places. The swan goose *Anser cygnoides* is a migratory breeding bird. While it is common on large lakes in Mongolia, it is rare in the Russian part of the Baikal basin. In spring, flocks of 5-20 individuals were observed in the Barguzin basin and the southern part of the Selenginsky Transbaikalia. In May 2022, on a lake near the village Selendum a flock of 103 individuals was observed. Swan geese mainly are found breeding in the Mongolian part of the basin. In the Russian part they were observed in 2022 with broods on the islands of the river Selenga for the first time in many years.

Bean goose *Anser fabalis* is a common migratory species, and flocks reach up to 500-1500 individuals. Greater white-fronted goose *Anser albifrons* is a rare migratory species, and only rarely large flocks are observed. Lesser white-fronted lesser *Anser erythropus* is a very rare migratory species. During migration they are found both singly and in small groups together with grey geese (*Anser spp.*) or swan geese. Greylag goose *Anser anser* is a migratory breeding bird. In the Russian part of the basin, they have not previously been recorded for more than half a century. Starting from 2021, we regularly mark them in small groups or singly on separate lakes in the Barguzin depression, and along the southern side of the lake. Goose, along the river. Selenga in 2022, broods were found in these places, which proves their return to their former nesting territories.

Bar-headed Goose *Anser indicus* is a nesting migratory species which is rare in the Russian part of the basin. In Mongolia it is common, in some places even numerous. A single case of nesting is known in Baikal - in 2007, a nest was found with 3 hatching eggs and one hatched chick.

The Snow Goose *Anser caerulescens* is a vagrant species.

VARIATION AND STATUS OF DUCKS (ANATIDAE) SPECIES DURING MIGRATION PERIOD: CASE STUDY CHUKH LAKE

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In Mongolia, there are more than 30 studies related to migration and disease of bird species belonging to the Anatidae family, and about 10 studies at the level of communities and covering several species, mostly related to the diseases. We determined the community structure of Anatidae passing through the Chukh lake in Mongolia during the spring and autumn migration of 2019-2022, including changes in community structure, species composition and numbers, and the dominant species based on the relative abundance. During the four-year research, about 187,000 birds of 31 species were recorded, of which 24 ± 2 species were recorded in the spring and 16 ± 3 species were recorded in the autumn. In terms of species diversity and richness, the spring season was higher than autumn, and in terms of abundance (n_i = 34855 ± 25187), the autumn season was higher than spring. During the spring and autumn migration in Chukh Lake, common pochard (*Aythya ferina*) (RA= 43.13 ± 14.08%), whooper swan (*Cygnus cygnus*) (RA=9.91 ± 3.60%), and common shelduck (*Tadorna tadorna*) (RA=8.25 ± 1.74%)), swan goose (*Anser cygnoides*) (RA=8.71 ± 14.08%), common goldeneye (*Bucephala clangula*) (RA=16.04 ± 8.37%), ruddy shelduck (*Tadorna ferrugeniea*) (RA=14.24 ± 9.24%), gadwall (*Anas strepera*) (RA=7.44 ± 1.91%) were the dominant species. In the course of our research, it was found that "Vulnerable" swan goose (*Anser cygnoides*), common pochard (*Aythye ferina*), and ferruginous duck (*Aythya nyroca*), which are classified as "Near Threatened" at the IUCN Red List category, breed in Chukh Lake. Long-tailed duck (*Clangula hymalis*), which has the status of "Vagrant" in Mongolia, has been observed to pass through Chukh Lake every year during spring migration. Also, in the spring of 2022, a pair of Baer's pochard, classified as “Critically Endangered” at the IUCN Red List category, was registered and summering near Chukh Lake. In the spring season, the migration takes place in a short period of time, and the activity is high in mid-May and early June. For autumn migration, activity varied over the four years.

POPULATION STATUS AND MOVEMENT OF BAR-HEADED GEESE *ANSER INDICUS* IN THE INDIAN WETLANDS MONITORED BY THE BOMBAY NATURAL HISTORY SOCIETY

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Among the wetlands monitored by the Bombay natural history society (BNHS), Pong Dam supported the largest population of bar-headed goose (30,000- 40,000) which are less migratory with restricted ranges. The increasing trend observed at Pong Dam and adjoining wetlands during 2000-2015 contradicts the global declining trend reported by BirdLife International. Koonthankulam Bird Sanctuary and its satellite wetlands located in the drought borne district of Tirunelveli in the southern Tamilnadu support the largest wintering population of bar-headed goose in southern India (c. 2000-3000). Several colour marked individuals (both neck collar and colour band) from China and Mongolia are regularly sighted from this sanctuary. The satellite tracking studies undertaken by the BNHS during 2008-09 also proved that the wintering bar-headed geese found in this wetland (located in the southernmost tip of India) are from breeding grounds in China and Mongolia. The movement pattern recorded through satellite tracking indicates that bar-headed geese spending the non-breeding season in Pong Dam (northwest India) and Uttar Pradesh are short distance migrants mostly from the breeding ground on the Tibetan plateau. However, the population recorded at Chilika (eastern India) belongs to both the breeding population in Tibetan plateau and China-Mongolia region. This was further supported by a sighting of a Pong neck-collared individual (generally migrating from the Tibetan Plateau) near Chilika. The neck collar studies undertaken at Pong and Chilika also proved that the population wintering here are of different populations as none of the neck collared geese from Pond Dam and Chilika were ever reported from Koonthankulam Bird Sanctuary. Earlier, Koonthankulam Bird Sanctuary was considered as the southernmost wintering ground for this species but a recent record in Kanyakumari suggests that birds extended their range to the southern tip of peninsular India. The significance of Koonthankulam Bird Sanctuary for the geese was also understood by occasional occurrence of another goose, the greylag goose *Anser anser*.

THE HOLLOW OF LAKE BAIKAL: THE MOST IMPORTANT KEY SITE FOR MIGRATIONS AND PROTECTION OF GEESE ALONG THE CENTRAL ASIAN FLYWAY

Yuriy Mel'nikov

Lake Baikal: Gees Migrations and Protection, Baikal museum of Siberian Branch Russian Academy Science/Irkutsk Oblast, setl. Listvyanka, Russia

Lake Baikal is the central link of the Baikal Rift zone, with a total length of more than 2000 km, dividing Eastern Siberia into two parts – Prebaikal and Transbaikalia. It occupies the most pronounced and deepest part of this zone, surrounded by mountain ranges. The modern period of climate warming is characterized by significant shifts in bird ranges to the north, east and west. They are associated with the transformation of the bird fauna in the interglacial period, which occurred after the last most powerful and prolonged Sartan glaciation of the territory.

Profound changes in the bird population have also affected the species composition of geese migrating through this region. It is represented here by 9 species (brent goose *Branta bernicla* and red-breasted goose *Branta ruficollis*, greylag goose *Anser anser* and white-fronted goose *Anser albifrons*, lesser white-fronted goose *Anser erythropus*, bean goose *Anser fabalis*, snow goose *Anser caerulescens*, bar-headed goose *Anser indicus* and swan goose *Anser cygnoides*). Until the middle of the 20th century, only swan goose was a common breeding species, greylag goose and bean Goose were much rarer, although they bred in large numbers on the mountain rivers of the Eastern Sayan and in the Prisayanye. Exceptionally rare, nesting sporadically, was the bar-headed goose. The lesser white-fronted goose was noted in small numbers on migration, and snow goose and red-breasted goose were noted only as vagrant migrants. In the second half of the 20th century, brent geese began to increase in numbers. During the same period, all species of geese stopped nesting here or were only rarely noted as breeding birds. At the same time, goose migration remained constant. Mass rest stops were very short – 3-4 days, although up to 1.5 thousand geese could linger on the territory of the Kabansky Republican Reserve (currently a branch of the Federal State Biosphere Reserve “Baikal”) for a longer time – up to 3-4 weeks. Short, but very massive rest stops of different species of geese have always occurred during periods of very strong and prolonged bad weather (prolonged rains with snow sometimes accompanied by snowfall) in late September – early October.

The most common migratory goose species, both in spring and autumn, is the West Siberian subspecies of bean Goose. The other subspecies, especially the Eastern taiga bean goose, have always been rare. White-fronted geese and greylag geese were more common during migration periods, and many were encountered on staging sites in the Bratsk reservoir. The total number of migratory geese in the south of Eastern Siberia in the autumn period by the end of the last century was estimated at 250-300 thousand birds, and at least 150 thousand of them flew through the Baikal Hollow. Currently, the abundance of geese is roughly the same. Their protection in the basin of Lake Baikal is carried out by 4 Nature Reserves and 3 National Parks, which protect the most important staging sites for geese by restricting access to humans. Very often, the process of reducing their numbers is associated with a sharply increased anthropogenic load on natural ecosystems. Its influence cannot be completely denied, but modern materials indicate that the influence of this factor, with the exception of some cases of complete restructuring of natural ecosystems, is clearly exaggerated. This is indicated by many cases of their mass migrations and rest stops, often in atypical places, during periods of severe weather. In such cases, the number of birds often exceeds their estimate within large geographical regions. Therefore, in order to correctly estimate their number, it is extremely necessary to improve the methods of their accounting and calculation of the number carried out on the basis of sample data.

THE IMPORTANCE OF LAKES IN THE EASTERN QINGHAI-TIBET PLATEAU FOR BAR-HEADED GEESE *ANSER INDICUS*

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The Bar-headed Goose (Anser indicus) breeds across the high plains and plateau of Central Asia and winters in the Qinghai-Tibet Plateau (QTP), the Yunnan-Guizhou Plateau and the Indian sub-continent, where it is currently increasing in abundance. Of the two recognized discrete flyways of the Bar-headed Goose, the Eastern Tibetan Flyway is the larger, comprising 70% of the total world population and at least six migration routes. However, we remain ignorant about their migratory connectivity, habitat use and effectiveness of site-safeguard mechanisms set in place for the species. We used data from GPS-GSM transmitters deployed on Eastern Flyway Bar-headed Geese and combined with the field survey, to determine their migration routes and staging patterns within the Qinghai-Tibet Plateau. In total, 14 tagged Bar-headed Geese provided information on their entire autumn migration and 4 geese on their entire spring migration. Qinghai Lake marked birds overwintered in the QTP (n = 2), geese tagged in Mongolia wintered either in the QTP (n = 3) or in India/Bangladesh (n = 9), representing three of the migration routes within the Eastern Tibetan Flyway. In total, tagged birds staged at 79 different stopover sites within QTP in autumn and 23 in spring, of which 65% (autumn) and 59% (spring) of all fixes fell within the boundaries of either National Nature Reserves or Important Birds Areas in the QTP. Bar-headed Geese predominantly occurred on four land-cover types: grassland (mostly by day), water bodies (at night), wetlands and bare substrates (salt flats, dry lake/river substrates and plough) with little change in proportion. Generalized linear mixed models comparing presence with pseudo-absence data suggested geese strongly selected for wetlands as staging habitat, avoiding bare substrates in spring. Besides, field survey in July 2022 suggested the Bar-headed Geese mostly occurred in the lakes for breeding, rather than river valleys and floodplains, which may be affected by the hydrological process. After hatching, the adults with their young, moved along channels to the river for feeding, suggesting the importance of channels linked lake and river. Based on our limited observations of these geese, this study shown that the importance of lakes in the eastern QTP for Bar-headed Geese. We recommend more telemetry studies to confirm these patterns and support improved site-safeguard networks, as well as more ground surveys of Bar-head Goose numbers, to establish threats to important areas used by the different sub-populations of Bar-headed Geese in Eastern Flyway with a view to securing their future.

THE IMPORTANCE OF THE LAKES IN THE GREAT LAKES DEPRESSION IN WESTERN MONGOLIA FOR GEESE MIGRATION IN CENTRAL ASIAN FLYWAY

Tseveenmyadag Natsagdorj, Batmunkh Davaasuren, Jigdernamjil Nergui, Otgonbayar Tsend, Khurelsukh Dulmaa, Nyambayar Batbayar

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Khar Us, Khar, Durgun, Airag, and Uvs Lakes are the largest lakes in the Great Lakes Depression in western Mongolia. They are known to support large number of migratory and breeding Bar-headed goose, Swan goose, and Greylag goose in the country. There is no record of Bean goose breeding in the western Mongolia, and they only pass through these lakes during migration. Greylag oose is most common breeder and can be found in most of the lakes. Bar-headed goose are also common breeder in the region but they tend to breed in colder water lakes. Swan goose has restricted breeding locations and they are on the decline. Major threats to the geese in this region are wetland degradation due to prolonged period of drought induced by climate change and hydropower dam projects. Water levels in all those lakes are decreasing at slow but consistent rates for the last ten years. A major dam construction project on the Kovd river going to bring major negative changes to the hydrology of Khar Us and Khar Lakes. Satellite tracking studies show that Greylag geese from western Mongolia winter in India and southeast China using both Central Asian and East Asian Flyways. Bar-headed goose fly to India, where is the Swan goose migrate to Yangze river basin in southeast China. Khar Us and Uvs Lakes are major stopover sites compared to other lakes because of their extensive reedbeds and shortgrass habitats along the shore. Khar Us, Khar, Airag, and Uvs Lakes also support large number of geese during the molting season.

WHITE-FRONTED GOOSE *ANSER ALBIFRONS* OF THE SOUTH-WESTERN PART OF WESTERN SIBERIA AND NORTHERN KAZAKHSTAN

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The White-fronted goose is a migratory bird in the southwestern part of Western Siberia and Northern Kazakhstan. We present historical data on White-fronted geese reports in this region. Hunters shot White-fronted geese during the migration of large flocks in the Tobolsk region on April 20 and September 28, 1892 (Slovtsov, 1892). 15 geese took off from the lake and flew north in the northern steppe near the Irtysh River on May 26, 2008. We saw three geese in this area on May 27, 2008. Also 1100 individuals were observed in the northern steppe on the shore of Lake Alabota in the region of the Irtysh River in the Omsk region on May 16, 2002. There are two records of ringed birds from Omsk region. White-fronted geese were shot in the Bolsherechensky district in the Omsk region on May 8, 1963, and May 15, 1970. These geese were ringed on February 1, 1961, and January 13, 1967 in the Netherlands, respectively.

White-fronted geese are the most numerous geese in the southern forest-steppe and northern steppe in the Ishim River in the North Kazakhstan region. Approximately 500,000-700,000 White-fronted geese fly through this area in spring. Up to 110,000-120,000 birds gathered on Lake Shagliteniz in the spring of 2011 and 2012. Transit autumn migration here is almost non-stop for the last 5–10 years (Vilkov and Zuban, 2013). We conducted a White-fronted geese census at Taldykol Lake in the Akmola region in Kazakhstan on November 13, 2022. According to our census, 25 000 individuals roosted on this lake and fed in the moved wheat fields around this lake.

MIGRATION AND CONSERVATION OF BEAN GOOSE *ANSER FABALIS ROSSICUS* (LATHAM, 1787) IN THE SOUTHWESTERN PART OF WESTERN SIBERIA AND NORTHERN KAZAKHSTAN

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The Bean goose is a migratory species in the southwest of Western Siberia and Northern Kazakhstan. We present historical data on Bean geese reports in this region. At the end of the 19th century, Bean goose migrated in a huge flocks in the south of the Tobolsk province [Slovtsov, 1892]. A.A. Morozov [1898a] suggested nesting of this species on the lakes of the Irtysh floodplain and large lakes of the forest-steppe and steppe south of Omsk Sity. V.S. Zhukov on May 27, 2008, observed about 50 Bean geese flying to the northwest at an altitude of 200 m near the salt lake Sylkino near the Irtysh River. Nowadays, Bean goose is a very rare migratory species in the southern forest-steppe and northern steppe near the Ishim River, North Kazakhstan region. V.I. Drobovtsev met 12 birds on Lake Gorkoe near the village of Matrosovo in the Zhambyl region on October 11, 1970. One goose was shot near the village of Kazanki in the Zhambyl region in early November 1971. Two birds were shot on Lake Chagly (Shagly-teniz) in the Akkainsky region on October 15 and 21, 1971. Two birds were shot on Chagly Lake (Shagly-teniz) in Akkainsky district on October 5, 1977. 11 individuals were found on the lake near Dubrovnoye village in Mamlyut district in October 2011. One individual was found in a flock of Graylag geese on a lake near the village of Yastrebinka in the Zhambyl region in October 2012. 12 birds were found in the Kamyshlov Log in the Kyzylzhar region in October 2013 [Vilkov, Zuban, 2013]. Ringed on December 30, 1969 in the Netherlands, a goose was shot on Lake Shishkino in the Sargatsky district in the Omsk region on September 21, 1971. Two birds were shot in the Kargatsky district of the Novosibirsk region on April 12, 2022, and eight birds were shot on April 14, 2022, in the same place. We have identified a subspecies of these birds at the Institute of Animal Systematics and Ecology. Petr Glazov and Alexander Kondratyev identified the *Anser fabalis rossicus* subspecies by photos of birds' heads. This subspecies is included in the Red Book of the Russian Federation (2020) with the status "subspecies declining in number and/or distribution" and in the Red Book of the Novosibirsk Region (2018) with the status "rare species, represented by small and (or) extremely limited in terms of range populations, a threat which can be real if habitat conditions continue degrading".

DYNAMICS OF THE NUMBER OF GEESE AND DUCKS OF LAKE CHANY IN WESTERN SIBERIA FROM THE XX TO THE XXI CENTURY

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Chany Lake is located in Novosibirsk Oblast in Western Siberia, Russia. The lake has an area of 3 200 km2 and an average depth of 2.5 m. This lake and the adjacent wetlands are the places of residence of 300 species of migrating and nesting birds.

The population of waterfowl and coots was at least one million individuals at Lake Chany and adjacent wetlands in the 30 – the 40s of the 20th century. State harvesting exceeded 500 000 ducks and geese annually in the middle of the 20th century. The geese population decreased to 220 000 – 350 000 individuals in 1969 – 1975. At the beginning of the 21st century, 30 000 – 80 000 geese were counted only. According to the bird counts database of the Laboratory of Zoological Monitoring, Institute of Systematics and Ecology of Animals, a steady decrease in the number of all species of ducks and geese with significant interannual fluctuations was revealed for the last 40 years. The most likely causes of interannual fluctuations in the number of waterfowl in the Southwest of Western Siberia are the cyclical flooding of the territory, anthropogenic influence (infrastructure development, conversion of the territory to agricultural land, hunting, and spring grass burning), and interannual fluctuations of breeding success due to the variability of climatic conditions in the current period.

POPULATION STATUS OF THE BEAN GOOSE IN EASTERN TRANSBAIKALIA (RUSSIA), INCLUDING THE KEY STOPOVER SITE ON THE RUSSIAN-CHINESE ARGUN RIVER: DISTRIBUTION, ABUNDANCE, DYNAMICS, CONSERVATION

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Eastern Tundra Bean Goose (*Anser fabalis serrirostris*) is a transit migrant in Transbaikalia, Eastern Taiga Bean Goose (*Answer fabalis middendorffii*) is a migratory and breeding (it nests in the taiga of central and northern Transbaikalia). The main migration route passes through the eastern part of the Zabaykalsky Krai (former Chita Region, Russia). All migration stopover sites are located in the steppe in the southeast of Transbaikalia. There are many wetlands here and it is an important area for growing wheat, which geese love to eat. The key spring migratory aggregations (both *serrirostris* and *middendorffii*) are located on the upper Argun River (approximately N 50.016; E 118.7601). In spring, *middendorffii* migrate earlier than *serrirostris*; therefore, subspecies composition at migration aggregations strongly depends on the stage of migration. But in general, *serrirostris* has been significantly dominant in Transbaikalia for the last 10 years (91.1% in 2019, 91.6% in 2022).

In eastern Transbaikalia, Bean Geese were very numerous everywhere during migration until the 1960s. Population declined rapidly from the late 1960s to the end of the 1990s. In the early 2000s, the species was rare everywhere except for the Argun River. The nesting population of *middendorffii* also almost disappeared. The population started slowly increasing since the early 2000s, but has been growing rapidly since 2011-2012. The number (of both subspecies) on the Argun was about 17,000 in 2004, 25,000 in 2010, 30,000 in 2011, 130,000 in 2019, 317,000 in 2022. Numbers geese are increasing not only on the Argun, but throughout the entire territory of Zabaykalsky Krai: aggregations 1,000-20,000 birds have also appeared in many other places, where the species was abundant until the 1960s. Therefore, the total current number in the region is much higher than the 317,000 counted on the upper Argun. Numbers of *middendorffii* nesting in Transbaikalia have increased approximately 2-3 times in the last 10 years.

The Argun spring stopover site has great importance to ensure breeding success of Bean Goose population on the EAAF. It is the last place where geese have the opportunity to feed well on the spring flyway. Geese eat here high-calorie wheat grains, which are left on the harvested fields. Geese acquire here the very important reserve of fat, which allows them to fly across the vast expanses of the taiga (there is little natural food and no crop fields in taiga) and to lay the necessary number of eggs. Therefore, geese feed on the fields along the Argun from the beginning of April to the end of May if there is no disturbance by hunters. But the birds left the stopover site prematurely, not being ready to breed if there is hunting here. A great many hunters came to Transbaikalia (especially to the Argun) for spring hunting. This significantly reduced breeding success and was one of the important reasons for the population decline.

Between 2004 and 2011, spring hunting in Zabaikalsky Krai and some other regions of Siberia and the Far East was restricted due to avian influenza. This caused some growth of Bean Goose population on the EAAF. In 2011, the Bean Goose (*serrirostris and middendorffii*) was included in the regional Red Data Book of Zabaikalsky Krai and since then migratory aggregations on the Argun River have been strictly protected. This is probably the main reason for the significant growth of Bean Geese population migrating in Transbaikalia and wintering in China. But, the rapid growth of the migratory population in Transbaikalia is probably also the result of shifting the intensive migration routes from the Amur Region to the Zabaikalsky Krai, as the Zabaikalsky Krai is the only region where the Bean Goose is protected in the vast territory of Eastern Siberia and the Russian Far East. Third probable reason for the rapid

growth in Transbaikalia: the movement of aggregations from neighboring areas of China due to mass cultivation there of rapeseed instead of cereals and legumes, which geese used to feed on. This is probably why the migratory population on the Argun increased 5.2-fold from 2010 to 2019, while the wintering population in China only increased 2.6-fold over the same time period (Chang Li et al. 2020). A. f. *middendorffii* was included in the Red Data Book of Russia in 2021. This is of great importance for protection of *middendorffii* in other regions and will also contribute to the protection of *serrirostris* because both subspecies often migrate and rest in the same places.

Session 5. Goose population monitoring

MONITORING IN THE CONTEXT OF THE AEWA EUROPEAN GOOSE MANAGEMENT PLATFORM

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Migratory geese increasingly pose a significant challenge for management. Their migration routes frequently span across national and even continental borders, thus requiring the coordination of management strategies at different levels, including the local, national, and international levels. Furthermore, the recent changes in environmental conditions, such as those caused by climate change, intensified agriculture, and wetland degradation, have resulted in some populations experiencing rapid growth while others are declining. This further complicates management efforts. One approach to managing natural resources in such uncertain and changing conditions is known as Adaptive Management (AM). AM engages stakeholders and employs an iterative process that includes problem framing, agreement of objectives and actions, assessing consequences and trade-offs, followed by implementing, monitoring, evaluating, and adjusting management strategies in order to continuously learn from the outcomes of management efforts. This approach has been applied for many years to managing waterbirds in North America, and in 2015, the European Goose Management Platform (EGMP) was established under the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) to provide a similar framework in Europe.

The EGMP is established to provide a mechanism for a coordinated and inclusive decision-making and implementation process for the sustainable management of goose populations in Europe, with the objective of maintaining them at a favourable conservation status, while taking into account concerns of relevant stakeholders and the pertinent legislative frameworks and regulations. Management and action plans developed under the EGMP are currently in place for the Svalbard population of the pink-footed goose *Anser brachyrhynchus*, the taiga bean goose *Anser fabalis fabalis*, the three populations of the barnacle goose *Branta leucopsis* and the NW/SW European population of the greylag goose *Anser anser*. In this presentation, we will give an introduction to the EGMP and the Adaptive Management process using examples from Adaptive Management plans in operation under the EGMP.

POPULATION DYNAMICS OF DARK-BELLIED BRENT GEESE 1960-2020

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The huge numbers of dark-bellied brent geese, that “darkened the sky” along the coasts of western Europe in the early 1900-s had declined to only 16,500 in 1958 because of excessive hunting. A hunting ban in France, England and the Netherlands, and finally in 1972 in Denmark, and in 1976 in Germany resulted in a spectacular recovery of the population to more than 300,000 individuals in 1992. Annual survival was estimated from counts and age ratio-censuses at 78 %: before 1972, and rose to 88 % after 1972 as estimated from colour-ring resightings. Breeding success usually shows a typical three-year cycle, in line with the lemming cycle on the key breeding grounds on the Taimyr peninsula in northern Siberia.

Small geese like brent can only nest successfully if they manage to avoid predation by arctic foxes. In order to do so brent nest on small islands in between large gull colonies, or in a lemming peak years also within the territories of nesting snowy owls. The latter is only possible because pomarine skuas (like snowy owls also only nesting in lemming peak years) attack these snowy owls so frequently that the owls can hardly prey on adult geese and their goslings, and keep arctic foxes away. The extra breeding possibility in lemming peak years results in a higher breeding success for brent in such years. However, the number of predators (arctic foxes and snowy owls) has increased so much in the following year, that brent goose breeding success in the year following a lemming peak year is often virtually nil.

The spectacular increase in numbers of brent from 1972 to 1992 is now levelling off at 200,000 to 300,000 individuals. Possibly this is because safe nesting sites that were readily available when the brent Goose population was extremely low due to excessive hunting on the wintering grounds, are now becoming a limiting factor, resulting in a marked reduction in breeding success.

Another interesting phenomenon is that with the increased population size, the sex ratio in adult geese has changed significantly. In the period 1970-80 the proportion of adult males in our catches was 48 %, but from 2000-2010 this had increased to 56 %. Another factor that could have an impact on breeding success is faltering lemming peaks because of earlier snow melt followed by refreezing that in some years has devastating effects on the number of lemmings.

USING AERIAL SURVEY TO STUDY IMPORTANT GEESE SPECIES IN EAST ASIA

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Compared with land survey, aerial survey has obvious advantages for mapping the abundance and distribution of arctic-breeding species, especially considering the vast areas of tundra inaccessible to terrestrial vehicles. Two aerial surveys were conducted from June to July in the 1990s (1993 to 1995) and the 2020s (2021, 2022), using amphibious aircraft (aircraft models Beaver-754 and Sterkh-1C), using identical methods, to better understand the habitat use, abundance, and distribution of these species during their breeding period. The aerial survey covered vast areas of breeding habitat in the Lena River, Yana Bay, Indigirka River, Kolyma River, Chaun Delta, and Anadyr River regions in the 1990s and 2020s, and the Ob River, Yamal Penisula, Pur River, Yenisey River, and Khatanga River regions in 2020s. In the 1990s, the main goal was to assess the status and distribution of populations of eiders and other waterfowl species. In the 2020s, we repeated the method used in the 1990s counts, to understand more about 30-year trends in waterbird abundance in the Northeastern part of Russia, from where the populations winter in China, Japan, Korea, Mexico and USA. In the 1990s surveys, a total of 44,000 birds of 48 species were counted, 85% of which were ducks, gulls, and terns, with the top ten species accounting for 80% of total bird numbers. In 2020s, about 400,000 birds of 83 species were recorded, 81% of which were geese and only 9% were ducks, with the top ten species accounting for 85% of the total bird numbers. We will present information demonstrating the extent and changes in abundance and distribution of the key species between the two period, as well as the distribution of hotspots within their overall range, is still under preparation and is expected to present at the meeting.

THE MONITORING OF BAR-HEADED GEESE AT TERKHIIN TSAGAAN LAKE USING DRONE

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The Bar-headed Goose (*Anser indicus*) is the most widespread goose species in central and western Mongolia. They are found in most mountain lakes in Altai, Khangai, and Khovsgol regions. There several locations that support significant numbers of bar-headed geese during molting season. One of them is the Terkhiin Tsagaan Lake, which is located in Tariat soum, Arkhangai province in westcentral Mongolia. Until recently we counted the bar-headed geese at Terkhiin Tsagaan Lake from the shore using spotting scopes and binoculars. In July 2023, we used a DJI Phantom 4 drone to count the geese at major locations to obtain population estimate. We counted Bar-headed geese at six different locations using the drone tallied them to get the final number. In addition, we used data from available ground survey data made in 2022 for two other locations. We estimate that there are around 6000-6300 bar-headed geese during molting period in July at Terkhiin Tsagaan Lake and nearby lakes. The estimate obtained using the drone was about 1.4-2.3 times higher than the count made from the shore by two experienced researchers. Distance between the counters and the geese flock and the visibility have the biggest influence in the low number obtained by ground-based counts.

Session 6. Infectious diseases and avian influenza

GOOSE CONSERVATION *VERSUS* HUMAN HEALTH: BETWEEN THE DEVIL AND THE DEEP BLUE SEA IN CHINA

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East Asian Geese and other waterfowl (including cranes) that breed in the tundra of the Arctic or in bogs and swamps in the Peri-Arctic have lost their wintering grounds in the southern parts of China but also in Indochina. This loss began in the early 20th C with the expansion of agriculture, and was exacerbated the last half century because of an enormous human population growth and intensification of agriculture. Now these waterfowl have generally as their southern wintering limit the Yangtse Kiang river flood plains. To the N of these floodplains good wintering grounds do not exist due to the prevalence of hardy and undigestible C_4-grasses combined with low winter temperatures and absence of drinking water. Because of its pursuit of economic development, the Government of China instructed the building of the Three Gorges Dam upstream in the Yangtse River. When the dam was commissioned, scientists warned for undesired effects of the dam including changes in the flooding regime of the floodplains downstream and the (re-)emergence bilharzia, which is a debilitating disease in humans. In the floodplains of the Yangtse where local and national government created safe havens for wintering waterfowl, wild wintering geese depend on heavy grazing by water buffalo owned by local people. In these protected areas, local people found extensive opportunities for grazing domestic ducks. Both water buffalo and domestic ducks made an important contribution to the local economy and lifted people out of poverty. The domestic duck did not compete with the wild geese, cranes or swans, and the wild geese were strongly facilitated by the buffalo thus enabling winter survival and fattening up before migration to the north. However, the Government of China instructed lower levels in government to urgently pay attention to people's health by (a) banning domestic ducks form close contact with wild waterfowl so as to prevent emergence of new outbreaks of Avian Influenza, and (b) banning domestic water buffalo from floodplain areas so as to prevent the very unhealthy cycle of bilharzia parasite – snail – buffalo – fluke. The banning of buffalo resulted in the development of tall sedge communities instead of very short lawn that we beneficial to wild geese. Hence, to safeguard local people's health government action result in quickly deteriorating living conditions for wild geese and other waterfowl, including cranes. Because it is the fashion of the day in conservation circles to plea for local communities, and to crow about 'nature based solutions', we believe that this case is a pertinent brain teaser for conservationists: clearly the present solution of local governments to ban water buffalo (to safeguard the health of people) is ethically commendable. The alternative (snail control) is proven to be only possible with environmentally disastrous chemicals. Indeed, to save children the future of the wild geese is sacrificed, which we as goose lovers lament. So: what to do? What to advice? We would love to receive your workable suggestions by e-mail in the in-box of the 1st author.

RECENT HPAI OUTBREAK IN JAPAN: THE REALITY OF SURVEILLANCE AND CHANGES IN HIGHLY PATHOGENIC AVIAN INFLUENZA INFECTION STATUS

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Japan has had intermittent outbreaks of highly pathogenic avian influenza (HPAI) in recent years, but from 2020-2021 to 2022-2023, three consecutive seasons of major outbreaks occurred, causing extensive damage to poultry, wild birds, and captive birds in zoos. In the 2022-2023 season, the number of cases in Japan exceeded that of previous seasons in domestic poultry (26 prefectures, 82 farms, 17,010,000 birds were culled), wild birds (27 prefectures, 223 events including environmental samples), and captive birds in zoos (6 prefectures, 10 events) (as of March 28, 2023).

National HPAI surveillance in wild birds is conducted through passive surveillance by dead birds and active surveillance by faecal samples, but most HPAI virus (HPAIV) have been detected in dead birds. In national surveillance, except for higher priority species, most of the wild birds are not tested unless their several carcases were found at the same place. Therefore, those species which are suspected as natural hosts of the avian influenza virus and also carriers of the HPAIV (e.g. waterfowls, gulls and shorebirds), have less chance to be tested HPAI. Even among dabbling ducks, which are target species in active surveillance in the United States and in several countries in Europe, some of them were not always tested in Japan. The abundance of dabbling ducks was positively associated with the risk of avian influenza outbreaks in wild birds, and was also associated with outbreak persistency of HPAI outbreaks in poultry farms.

In previous HPAI outbreak seasons, the species composition of ducks from which HPAIV had been detected has shifted from diving ducks to dabbling ducks, and the overall number of HPAIV positive ducks had decreased. On the other hand, HPAI cases in cranes, raptors, and crows have increased. In particular, in Izumi City, Kagoshima prefecture, the largest wintering ground for cranes, more than 1,400 cranes (included hooded cranes and white-naped cranes) died and HPAIV was detected in more than 160 cranes (as of March 28, 2023). The increase of HPAI infected crows should be watched, not only because they are scavengers, but also as they make visits to farmland with ducks as well as poultry farms, thereby being able to transmit HPAIV. In goose species there have been a few fatalities of greater white-fronted geese, bean geese in wild, and cackling geese in a zoo. In Europe, mass mortality caused by HPAIV occurred in barnacle geese in 2021-2022, and also occurred in canada geese, cackling geese and snow geese in North America in 2021-2023. Two goose species in the genus Branta (brent goose and cackling goose) as well as snow goose are wintering in Japan, and especially the reintroduced population of cackling geese and snow geese which share foraging area with dabbling ducks should be monitored with caution to HPAIV infection.

SURVEILLANCE OF AVIAN INFLUENZA IN WILD BIRDS IN RUSSIA: CONTINUING STORY OF PUZZLED H5NX VIRUSES

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Wild aquatic birds, especially Anseriformes, are considered as a natural reservoir for most of Avian Influenza virus (AIV) subtypes, and influenza pandemics are believed to result from a spill over of avian influenza virus subtypes from aquatic birds to other species. Severe outbreaks have affected wild bird population dramatically in last decade. In addition, recent outbreaks of an avian-origin H5N8, H6N1, H7N9, H10N8 influenza viruses raise concern of the emergence of novel reassortant viruses in Eurasia and the potential threat to the human population.

Wild Anseriformes migrate to and congregate in North Asian wetlands and lakes for breeding and moulting. Major wild aquatic bird migration routes overlap in Asian part of Russia, connecting this broad geographic area to the wintering grounds of Eurasia and Africa. The unique ecosystem of these territories has been implicated and plays a crucial role in the geographical dispersal of the virus as it was shown by HPAI H5N1 spreading in 2005–2010, in 2014-2015, and the current unprecedented spread in 2020-2023.

During AIV surveillance in wild bird population in Asian part of Russia in 2007-2023 more than 34800 avian samples were collected and screened according to the standard protocols. All samples were collected from the various sites located at the studied territory, such as Western Siberia, Eastern Siberia, Central Asia, Russian Far East region. In total, more than 500 LPAI viruses and 50 HPAI H5Nx were isolated. The LPAI viruses were further assigned for 44 subtypes mainly H1N1, H3N8, H4N6, H5N3, H6N6, H8N4, H11N8, H12N5.

In summer and autumn of 2016, several outbreaks were reported at Uvs-Nuur Lake on the border of Russia and Mongolia and in Novosibirsk region and then spread to the west to European countries. In winter 2017 the virus re-emerged to Central Russia and caused poultry outbreaks. All isolated viruses, which caused outbreaks, belong to novel highly pathogenic avian influenza viruses of subtype H5N8, clade 2.3.4.4. The H5N8 viruses were found to be reassortant with other avian influenza viruses in waterfowl and shorebirds of Northern Eurasia. In 2020 we detected a new H5N8 outbreak in Ubsu-Nur Lake. On the basis of our phylogenetic data, chronology of virus isolations, general birds' flyways, and previously described patterns of HPAIV spreading from Siberia in 2005–2006, 2014, and 2016–2017, we suggest that new "later 2020 Eurasian" H5N8 viral strain has possibly descended from the H5N8 virus circulating in Egypt during 2017–2019, followed by dissemination via Iraq into Western Siberia and North Kazakhstan during the spring migration.

In May 2022, a massive death of wild waterbirds was recorded on the northern Caspian Sea islands, Russia. The H5Nx influenza virus was detected in samples. The subtype of detected virus was determined to be H5N1. According to the analysis virus belongs to clade 2.3.4.4.b of HPAI. The report contains more detailed comparative virological, molecular, characteristics of viruses with emphases at HPAI. This study demonstrates the need for ongoing surveillance to detect new variants of influenza viruses and facilitate prevention of outbreaks.

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POTENTIAL EFFECTS OF HABITAT CHANGE ON MIGRATORY BIRD MOVEMENTS AND AVIAN INFLUENZA TRANSMISSION IN THE EAST ASIAN-AUSTRALASIAN FLYWAY

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Wild waterbirds and especially wild waterfowl are considered to be a reservoir for avian influenza viruses, with transmission likely occurring at the agricultural-wildlife interface. In the past few decades, avian influenza has repeatedly emerged in China along the East Asian-Australasian Flyway (EAAF), where extensive habitat conversion has occurred. Rapid environmental changes in the EAAF, especially distributional changes in rice paddy agriculture, have the potential to affect both the movements of wild migratory birds and the likelihood of spillover at the agricultural-wildlife interface. To begin to understand the potential implications such changes may have on waterfowl and disease transmission risk, we created dynamic Brownian Bridge Movement Models (dBBMM) based on waterfowl telemetry data. We used these dBBMM models to create hypothetical scenarios that would predict likely changes in waterfowl distribution relative to recent changes in rice distribution quantified through remote sensing. Our models examined a range of responses in which increased availability of rice paddies would drive increased use by waterfowl and decreased availability would result in decreased use, predicted from empirical data. Results from our scenarios suggested that in southeast China, relatively small decreases in rice agriculture could lead to dramatic loss of stopover habitat, and in northeast China, increases in rice paddies should provide new areas that can be used by waterfowl. Finally, we explored the implications of how such scenarios of changing waterfowl distribution may affect the potential for avian influenza transmission. Our results provide advance understanding of changing disease transmission threats by incorporating real-world data that predicts differences in habitat utilization by migratory birds over time. This presentation will explore these results and scenarios and provide discussion on potential implications and avenues for future research and collaboration.

ANALYSIS OF INFLUENCING FACTORS ON THE GLOBAL DISTRIBUTION PATTERN OF AVIAN HAEMOSPORIDIAN PARASITE

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Avian haemosporidians is a kind of common parasitic parasite, including three main genus: Plasmodium, Haemoproteus, and Leucocytozoon, which can cause serious harm to the health of infected birds. The life history of parasitic organisms is complex, and they have a strong dependence on hosts and vector insects, making the study of related biogeographic patterns challenging. There are various factors that affect the spatial distribution of haemosporidians, and as the vertebrate host of haemosporidians, the evolutionary relationships, distribution ranges, and migration types of different bird hosts all have significant impacts on haemosporidians. In order to explore the macroscopic ecological patterns of the distribution of avian haemosporidians, we constructed a hierarchical Bayesian model based on the classification of the distribution types of avian haemosporidians, and predicted the effects of climate, landscape, and biological factors, as well as animal geographical flora, on the distribution types of haemosporidians lineages.

The results showed that host phylogeny, zoogeographical flora flora and the genus of haemosporidians all affected its distribution pattern, that is, host specificity, flora characteristics and vector insect species played an important role in shaping the distribution pattern of haemosporidians in birds. Among non-biological factors, annual average temperature and altitude are the main factors affecting the distribution pattern of avian haemosporidians, which may indirectly affect the distribution of haemosporidians by affecting the distribution of vector insects. Among biological factors, the migration distance of birds is the main factor affecting the distribution pattern of haemosporidians, and birds with long migration distances are more likely to be infected with the widespread type of haemosporidians. Migratory birds (including goose) carrying haemosporidians may promote long-distance transmission of haemosporidians between different locations through migration, thus forming a widespread distribution pattern. On the basis of this study, future research can consider exploring the role of specific species or groups in the transmission of haemosporidians. The research results of this study are expected to be applied to evaluate and warn the risk of infectious diseases in bird distribution hotspots, and to take targeted protective measures for high-risk groups.

HABITAT LOSS EXACERBATES PATHOGEN TRANSMISSION: AN AGENT-BASED MODEL OF AVIAN INFLUENZA INFECTION IN MIGRATORY WATERFOWL

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The spatial distribution of waterfowl and their contact probability during migration are influenced by habitat availability, which further affects the spatiotemporal transmission of the avian influenza virus (AIV). However, the East Asian-Australasian Flyway (EAAF) has experienced extensive habitat loss, which may have altered the spatiotemporal transmission of AIV, but the consequences of this loss are not well understood. To address this gap, we predicted the presence probability of the Greater white-fronted goose (Anser albifrons) in the EAAF using environmental variables, landscape metrics, and species distribution map. We also calculated the area loss of predicted suitable habitats from 1992 to 2012. We constructed a base migration network that included all predicted suitable habitats and five additional scenarios that differed in their level of habitat loss by removing sites in order of their descending area of habitat loss in 10% intervals. As habitat loss increased, the resulting networks became smaller, with fewer vertices and edges. We integrated an agent-based model to simulate the migration of 10,000 waterfowl and a discrete-time susceptible-infected-recovered model (SIR) to simulate the spatiotemporal AIV transmission, considering environmental transmission factors. Our simulation results show that extensive habitat loss, i.e., the removal of 50% of area-shrinking sites in the EAAF, can lead to several consequences: (1) outbreaks of AIV can relocate northward in response to changes in the distribution of wintering waterfowl geese; (2) remaining sites can experience an increased outbreak risk due to larger waterfowl congregations; and (3) AIV transmission in the population may be facilitated. Our modeling output was also consistent with the predictions of the "migratory escape" concept, which posits that migration allows geese to escape from high-risk infection locations, thereby affecting the pattern of infection prevalence in the waterfowl population. Our modeling results provide insights into the potential consequences of habitat loss on spatiotemporal AIV transmission at the flyway scale, as well as the mechanisms driving these effects. These findings emphasize the importance of conservation efforts in maintaining suitable habitats and preventing changes in spatiotemporal patterns of AIV outbreaks.

PERPETUATION OF AVIAN INFLUENZA FROM MOLT TO FALL MIGRATION IN WILD SWAN GEESE (*ANSER CYGNOIDES*): AN AGENT-BASED MODELING APPROACH

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Wild waterfowl are considered to be the reservoir of avian influenza, but research on some of their distinct annual life cycle stages and their contribution to disease dynamics has been neglected. Studies of highly pathogenic avian influenza (HPAI) virus have primarily focused on the wintering grounds, where human and poultry densities are high year-round, compared with the breeding grounds, where migratory waterfowl are more isolated. Few if any studies of avian influenza have focused on the molting stage where wild waterfowl congregate in a few selected wetlands and undergo simultaneous molt of wing and tail feathers and replacement with new feathers during a vulnerable flightless period. The molting stage may be one of the most important periods for perpetuation of the disease in waterfowl, since during this stage, immunologically naïve young birds and adults freely intermix prior to the fall migration. Our study incorporated empirical data from virological field sampling and marking of Swan Geese (Anser cygnoides) on their breeding grounds in Mongolia in an agent-based model (ABM) that included susceptible-exposed-infectious-recovered (SEIR) states. Our ABM results provided unique insights and indicated that individual movements between different molting wetlands and the transmission rate were the key predictors of HPAI perpetuation. While wetland extent was not a significant predictor of HPAI perpetuation, it had a large effect on the number of infections and associated death toll. Our results indicate that there is a need to conserve undisturbed habitats for wild waterfowl during the molting stage of the breeding season in order to reduce the risk of HPAI transmission.

VIRAL DIVERSITY OF GUT OF ANSERIFORMES SPECIES IN RUSSIA

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Wild water birds are the reservoir of plural viral pathogens. The most known bird viruses associated with avian diseases are avian paramyxoviruses, avian influenza viruses, and avian coronaviruses. Infectious bronchitis virus (*Coronaviridae* family) is an acute disease of chicken, which can cause a variety of symptoms. Newcastle disease virus (*Paramyxoviridae* family) cause lethal infections in poultry all over the world. Highly pathogenic avian influenza (HPAI) viruses (*Orthomyxoviridae* family) of different subtypes are the reason for contagious infectious disease which causes outbreaks in poultry and wild bird with high mortality rate. Additionally, HPAI viruses can have the ability for interspecies transmission. Throughout history, flu pandemics in humans have been linked to avian influenza viruses and the reassortment of viral segments from avian-associated and swine-associated influenza viruses, leading to the emergence of novel variants capable of efficiently infecting and circulating within the human population. The devastating Spanish flu pandemics of 1918-1919, caused by an avian influenza virus, serve as a compelling example of interspecies transmission of viruses from birds to humans. Nowadays, the H5N1 subtype of HPAI viruses with zoonotic potential is detected in Eurasia, Africa, and North and South America. Importantly, a variety of avian influenza viruses circulates constantly in wild bird populations without causing disease and is disseminated through seasonal migrations.

New methods and technologies provide us with the opportunity to study the diversity of viruses as a part of the microbiome in different environments. Recent metagenomic studies reveal a high diversity of viruses among wild waterfowl. In the last ten years, three times more viruses in birds have been discovered than were previously known.

In our study, we have collected feces samples of bar-headed goose (*Anser indicus*), mallard (*Anas platyrhynchos*), and common teal (*Anas crecca*) from Novosibirsk region, Yakutiya and Altai republic. We performed metagenomic sequencing of virus-like particles-enriched (VLP-enriched) fecal samples. Virome analysis of the obtained metagenomic data showed the presence of DNA and RNA virus sequences; prokaryotic and eukaryotic viruses; bird's host viruses sequences and sequences of viruses associated with diet. We revealed *Adenoviridae*, *Parvoviridae* and *Picornaviridae* family viruses in bar-headed goose fecal samples. In metagenomic data of mallard pool we found viruses of *Reoviridae* and *Picornaviridae* families. We found *Reoviridae* family viruses in the common teal pool. Overall, we found a high diversity of viruses of families: *Adenoviridae, Astroviridae, Caliciviridae Parvoviridae, Reoviridae, Picronaviridae*, etc. Further investigation with *in vitro* and *in vivo* experiments is necessary to elucidate the diversity of viruses in wild birds, the role of viruses in virus-host and virus-microbiome interaction, and the potential risks for human and animal health.

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Session 7. Behavioural ecology

VISUAL LATERALISATION IN GEESE AT INDIVIDUAL AND POPULATION LEVELS

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The dominance of one brain hemisphere in the implementation of any function can be manifested in animal behaviour in the form of one-sided preferences, for example, preference to inspect a stimulus with one eye (visual lateralisation). Visual lateralisation was revealed in all animal classes. At the individual level, visual lateralisation increases brain efficiency. The one-side bias of the visual lateralisation at the population level allows animals to coordinate the behaviour of conspecifics in herd moving or in social interactions but individuals of such populations could be predicable to predators, prey or competitors. Therefore, the degree of lateralisation alignment on the population level is an evolutionary stable pattern that bases on the strategic factors arising from intraspecies and interspecies interactions. Geese are birds with a social hierarchy, a high level of intraspecific competition, and high predator and disturbance pressure. We investigated the visual lateralisation of greater white-fronted geese when feeding, alert on water, fleeing away and flying to reveal its manifestation at the individual and population levels. We also studied the factors affecting the manifestation of visual lateralisation.

Analysing the GPS tracks of goose families, we revealed individual lateral long-term preferences in the positions of juvenile birds relative to a parent in nearly half of the juveniles. However, one-side bias at the population level was not revealed. We also tested what factors affect the manifestation of visual lateralisation at the population level. A population-level preference to observe the mother with the right eye was shown in juveniles in long migration flights. We also studied population-level visual lateralisation of feeding birds. At the population level, the tendency to monitor the source of danger (the observer and the road) with the left eye increased with increasing flock size. In addition, the birds at shorter distances to the source of danger used the left eye to monitor it more often. No significant bias was found in a variety of goose behaviours associated with enhanced disturbance (when alert on water, flying or fleeing away when disturbed, feeding during the hunting period, in the urban area feeding and during moulting). Thus, at the individual level, geese manifest the preference to observe the partner in the either left or right eye but there is no bias at the population level in most cases. Some factors, such as migration, disturbance and flock size, affect the manifestation of visual lateralisation at the population level.

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ARE THERE DIFFERENCES IN BEHAVIOUR BETWEEN MALES AND FEMALES OF WHITE-FRONTED GEESE AS A SPECIES WITH PERMANENT MONOGAMY?

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Geese form long-term pair bonds due to the constant need for cooperation between males and females. For example, the male may drive away competitors from the female for her better feeding. This allows the female to accumulate more energy reserves and achieve greater reproductive success. Some researchers suggest that the leading role in the pair is assigned to the female and the following to the male. Long-term relationships contribute to the fine-tuning of the behavioural repertoire of the pair's members, which allows partners to coordinate behaviour better. Behavioural lateralization is an important aspect in their more consistent behaviour. It is a part of cerebral lateralization, which is expressed in the asymmetry of the hemisphere of the brain in structure and functions.

Little is known about the differences in behaviour and visual lateralization between sexes during migration in permanently monogamous birds. Since migratory stopovers are crucial for the accumulation of energy reserves for migration and future reproduction, we aimed to study behavioural differences of mates of greater white-fronted geese (*Anser albifrons*) during this period. We videotaped 11 pairs of geese with at least one of the partners having a neckband allowing us to detect the sex of the birds. The videos were recorded in 2022 in the Kologriv floodplain preserve in the Kostroma Region of Russia during spring migratory stopover. Videos from 20 to 40 minutes were analysed. We studied how much time both partners devote to different behavioural activities: feeding, resting, alert behaviour, aggressive behaviour, and walking. We compared the percentages of time spend on different activities and the average duration of each type of behaviour between males and females. No significant differences were revealed. Individuals of different sexes were compared by the percentages of time they followed their partner, the amount of the following positions per 10 mins and the average duration of the following positions during feeding. There were no significant differences in these parameters between males and females in the same pair. We also calculated the number of pecks per minute for each bird and compared males and females by this parameter. The number of pecks per minute may indicate the intensity of feeding. We found no significant differences in this parameter between geese of different sexes. Visual lateralization bias in males and females was examined by observing the partner while feeding. We calculated the lateralization index and lateralization strength for each bird and compared these parameters in males and females in the same pair. No significant differences were found.

Our findings contrast previously stated assumptions for wintering areas and revealed no differences in behaviour of males and females at migratory stopover, which could be explained by the synchronized behaviour of partners in species with permanent monogamous relationships. Probably, the absence of significant differences may also be the result of a small sample size. In the future, we plan to test these hypotheses on a larger sample.

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BEHAVIOUR RECOGNITION FACILITATES THE RESEARCH OF MOVEMENT ECOLOGY THROUGH THE COMBINATION OF TELEMETRY, AI AND CITIZEN SCIENCES

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Statistical results of behaviour recognition is one of the most important data clusters for the research of movement ecology. Data collecting by field observation of researchers or volunteers is time consuming, discontinuous, and lack of standards. For decades, the classic telemetry technology has been contributing to ornithological research by providing valuable information about locations and environment situations like temperature, humidity, or light intensity. As a comparatively new player in this industry, Druid would like to contribute by adding a new dimension of data: animal behaviours recognition along the way.

Our first step is to make full use of the accelerometer. Debut series telemetries have the accelerometer working non-stop to output continuous ODBA (overall dynamic body acceleration) data, which reveals the general activity rhyme and energy consumption, and can be used to roughly determine the behaviour categories if the sampling frequency is high enough and the thresholds can be determined.

Furthermore, we developed a series of tools that enable the researchers to do finer behaviour modelling based on the raw data. The tools include: (1) an App that can connects your mobile phone to the tracker to receive the raw data in real time, with an interface for the watcher to create/choose behaviour tags, and shoot videos along the way for demonstration of the tags; (2) a series of gateway products to lengthen the connection distance between the phone and the tracker; (3) a webpage platform for you to store and browse all the above-mentioned raw materials, and conveniently calibrate and analyse them; (4) compile the behaviour recognition modelling results into the device firmware by network or App, and enable the devices to compute on-board to output behaviour recognition results continuously, just like the GPS and other data.

By presenting the long term continuous behaviour monitoring results validated in our recent publications based on such tools and methodology, our work aims to share a package of tools we have designed to facilitate data collection, behaviour modelling, and furthermore, with the behaviour models in hand, how we enable the trackers to output continuous behaviour recognition results, which offers the new dimension of data with huge potential to bring considerable insight to diverse research projects.

VISUAL LATERALISATION IN GREATER WHITE-FRONTED GEESE (*ANSER ALBIFRONS*) IN THE PERIOD OF INCUBATION

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Behavioural lateralisation, based on the asymmetry of functions between the brain hemispheres, was revealed in many vertebrate and invertebrate species. One-side preferences can be found at the individual and population levels. While lateralisation at the individual level can increase the organism's efficiency, the alignment of the asymmetry direction at the population level may lead both to advantages and disadvantages. In recent studies, it was assumed that a high degree of similar one-side preferences in a population can be an “evolutionary stable strategy” when the fitness from better coordination of conspecifics outweighs the risks connected with the predictability of behaviour for predators or prey. Our study aimed to investigate whether visual lateralisation is present at individual and population levels during the period of incubation under the natural threat of predators and if there are any differences between males and females in lateralized behaviour.

The study was conducted in June-July 2018 and 2019 on Kolguev Island in the Barents Sea, which is a unique breeding habitat for greater white-fronted geese with exceptionally high nesting density. For observations we used cameras, taking pictures of geese pairs and nest surroundings. Around 75000 pictures from 16 nests were analysed. For each picture, it was recorded in which visual field (left or right) males and females keep their partners. Laterality and absolute laterality indexes, counted for each bird, were compared for males and females.

Most of the birds (24 of 32) showed a significant visual preference either to the left or to the right side. One-side bias at population level was not found. Five of the females and seven of the males preferred to use the right eye, seven of the females and five of the males – the left eye. We suggest that in the context of incubation there is no need for the alignment of the visual asymmetries at the population level as nests were not in colonies. The absence of the bias at population level helps geese to be unpredictable for predators. The interference between vigilant and social behaviour may explain the absence of the bias at the population level also. No difference between males and females was found neither in the side of asymmetry nor in the strength of lateralisation. It is known that different biases in males and females can be explained not only by the influence of sex hormones but also by the impact of individual experience, that in some cases differs in males and females. Our result can be explained by the similarity of mates’ experiences in interactions with each other during the incubation period. Our result stays in line with a number of recent studies and allows us to make further hypotheses on the manifestation of lateralisation in monogamous pairs in a different context.

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POMARINE SKUAS ENHANCE BRENT GOOSE BREEDING SUCCESS

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Why can Dark-bellied Brent Geese nest safely close to nesting Snowy owls?

This study is based on observations of brent geese, Snowy owls, lemmings, arctic foxes and Pomarine skuas on the Taimyr Peninsula in northern Siberia between 1990 and 2008 made during joint Russian-Dutch expeditions initiated by the late Prof. E.E. Syroechkovskiy, dr. G.C. Boere and dr. P. Prokosch and additional data from researchers of the International Snowy Owl Working Group (ISOWG). The lemming-driven ecosystem in Taimyr is characterized by a three-year lemming cycle, peaking in 1991, 1994, 1996, 1999, 2002, 2005 and 2008.

In the study period only one exception occurred in 1996, just two years after 1994, when in the late summer the lemming population already declined. Furthermore, meteorological conditions (rainfall and refreezing in early spring) strongly affected the build-up of a lemming peak in 2002 and 2008 and made the lemming population crash. Nomadic snowy owls only nested successfully in lemming peak years, and brent Geese were then found nesting within some of the 'safe havens' created by nesting snowy owls that kept arctic foxes at bay. It is known that Snowy owls are capable of killing even adult brent Geese.

Observations of non-nesting snowy owls in the year following a lemming peak year show that they have great difficulty in carrying such heavy prey, and usually eat a killed goose or eider on the spot where they killed it. Lemmings are the right size of prey to carry to the nest to feed young owlets. Carrying heavy prey to their nests is difficult because of the very frequent fierce attacks of pomarine skuas (that also only nest in Taimyr in lemming peak years) on snowy owls. We hypothesize that snowy owls keep foxes away, but are themselves restricted by pomarine skuas. The extra possibilities created by snowy owls also explain why breeding success of brent is also highest during lemming peak years. The other main option for brent geese is nesting on small islands within colonies of large gulls, but snowy owls, when confined by pomarine skuas, open up 'safe havens' in lemming peak years.

BLUE-WINGED GOOSE (CYANOCHEN CYANOPTERA) FIELD RESEARCH PROJECT IN ETIOPIA

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Blue-winged goose (*Cyanochen cyanoptera*) is an endemic bird species to the highlands of Ethiopia that inhabits grasslands, wetlands and inland waters. The IUCN Red List of Threatened Species classifies the species as near threatened. The population was estimated between 5,000-15,000 individuals in the 1990s. Recently the number of mature individuals has been estimated as between 3,000-7,000, which means approximately 4,500-10,500 birds. The decrease in the number of individuals is probably caused by habitat loss. The most important breeding areas in the Bale Mountains National Park and Guassa Community Conservation Area are protected. The field research project started in June 2023 and is focused on collecting data on population density, flights and migration in the selected areas across the natural population range. The research aims to determine population trends and discover additional important breeding and non-breeding sites. For the research we used personal observations and GPS telemetry methods. Part of the research is a genetic analysis of the population. The research result will be used to raise awareness of the species' conservancy activities and encourage the authorities to control hunting.

SOME DATA SUPPORTING THE TERRITORIAL DOMINANCE OF THE BEWICK'S SWAN OVER GEESE SPECIES IN TUNDRA BREEDING GROUNDS, NORTH-EASTERN YAKUTIA

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A population increase of Bewick's swan *Cygnus bewickii* in the subarctic tundra zone to east from Lena River Delta has been observed during the last decades. We studied territorial interrelation between breeding Bewick' swans and goose species which share the breeding range with them, the greater white-fronted goose *Anser albifrons* and bean goose *Anser fabalis,* in the basin of Indigirka River lower stream. Two areas were studied. In the first area, 1000 km^2, 70ºN, 14 pairs of Bewick's swan occupying permanent home ranges were registered, the breeding population density was 0.14 pairs /10 km^2 (2021-2022). The average distance between swan nests was 3.3 km. Also 11 non-breeding birds were observed within the territory. The area is optimal for swan nesting conditions, characterized by the presence of large lakes with a long shoreline (12.9-47.6 km) and length up to 10 km and more, rich with submerged and semi-submerged plants, especially *Arctophila fulva* which is the main food item in the diet of swans. The density of bean geese was 0.4 pairs/km^2 and of white-fronted goose was 0.03 pairs/km^2 (June, 2021-2022), occupying the low watered inter - lake habitats in the territory. Another study area of 200 km^2 was found in 100 km to the west, 71ºN, where nesting conditions are not appropriate for the Bewick's swans possible due to the lack of optimal lakes. Breeding white-fronted geese were present with a of 23 ind/km^2 on the steep stream banks and in polygonal tundra with high ridges (30 cm to 1 m). Only one non–breeding pair of Bewick's swan and 4 non-breeding whooper swans *Cygnus cygnus* were present in this area at one location, a lake with a plain shoreline. The relatively low density of geese in the first territory can be explained due to swan dominancy. A territorial pair defends its home range from individuals and pairs of their own species and geese. The aggressive behaviour including attacks of territorial swans to bean geese individuals were registered. In other studied areas, geese nested in habitats not used by swans, usually on the banks of rivers with an average channel width of 60 m. At least 4,000 adults of white-fronted geese (50%), bean geese (40%) and lesser white-fronted geese *Anser erythropus* (10%) were found on the boat route in July, 20, 2017, at 140, 8 km upstream from the mouth of the Malaya Kuropatochya River, 70ºN. Including the chicks, the total number was at least 5,000 birds. Geese were feeding on river bluffs in flocks of 200-300 birds. Common breeding aggregations of white-fronted and bean geese were also recorded in the lower reaches of the Alazeya, Bolshaya Chukochya and Malaya Chukochya rivers.

POPULATION SIZE AND BREEDING SUCCESS OF THE BAR-HEADED GOOSE IN MUNICH FROM 2009-2022

Silke Sorge, PhD

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A small population of bar-headed geese breeds in the English Garden in Munich, which presumably goes back to hand-reared geese for a television documentary. Poor breeding success keeps the population stably low at 20-30 individuals. The only breeding place is an island in the Kleinhesseloher See in the English Garden. From there the families hike to the Japanese tea house, which is almost 3 km to the south. Some of the bar-headed goose families migrate from the Japanese teahouse to other places along the river Isar, for instance to the Hellabrunn Zoo - a strategy that was last successful in 2011. All subsequent attempts by bar-headed goose pairs to lead their offspring along the Isar ended in the loss of the goslings. Only at the Japanese tea house goslings are raised successfully. In the years 2009-2014, 2-4 successful pairs together reared 3 (3.14) fledglings. Since 2015, 2 greylag goose families have also been migrating to the Japanese teahouse to raise their offspring there. Due to the competition for food between the greylag goslings and the bar-headed goslings, the breeding success of the bar-headed geese has declined. In the years 2015-2022, 1-3 successful bar-headed goose pairs together reared almost 2.5 (2.38) fledglings. The bar-headed geese are very popular with the people of Munich. They attract attention because of their friendly colouring and have aroused interest in birds in many people.

MOBILITY AND OVERNIGHT STAY OF PINK-FOOTED GEESE *(ANSER BRACHYRHYNCHUS)* WINTERING IN THE COASTAL AREA OF FLANDERS, BELGIUM

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Monthly counts of Arctic geese in Belgium started in the early 1960s. The Flemish Region represents the southernmost wintering area of pink-footed geese, with peak numbers around 27.500, occurring almost exclusively in the Oostkustpolders. During the recent decades pink-footed geese increasingly explored the adjacent coastal land, selecting new feeding grounds in polder areas to the west and in the Sand Region to the south. This poster presents the distribution and behaviour of pink-footed geese related to their overnight stay.

In most countries nocturnal roosts of geese are situated on vast lakes, fjords, rivers or intertidal areas. However, in the Flemish coastal area there is a lack of lakes and large water bodies, except a few artificial excavation ponds (5-10 ha). In this landscape the overnight stay of geese traditionally occurred on some of these ponds, but mainly at the feeding grounds themselves situated within larger core complexes of mainly wet grasslands. This phenomenon was enabled by the *absence of hunting disturbance* (due to the national goose shooting ban since 1982 and local regulations for 'bird rich sites'). More recently pink-footed geese developed a remarkable *behavioural change*. In the past 10-15 years this species increasingly stays on intensive farmland, with decreasing use of the preferred permanent grassland habitat. Especially during the first winter months they frequently forage on left-overs of maize, potatoes or sugar beet (until depletion). Due to the search of this new 'junk-food', geese expanded their original wintering area of the Oostkustpolders from ca 250 goose localities to almost 350 sites, up to 15-20 km from the North Sea coast.

In last decade the increasing use of sites outside the Oostkustpolders (often still temporary) also caused a -rather occasional- overnight stay at the feeding grounds in some of those new localities. Most flocks, however, maintain evening flights to their traditional grassland core sites. In some of the protected polder areas projects of *'nature restoration'* recently created inundated grassland depressions, that soon became new and very attractive habitats for waterbirds and function as nocturnal roosts for geese.

Thanks to the presence of some GPS-tagged pink-footed geese since 2018 (4 up to 14 each winter), we can compare the new land-use in the overall coastal region with the former distribution in the Oostkustpolders. In a sample of 5 tagged pink-footed geese that used 84 localities as nocturnal roosts, only 7 sites are situated outside the traditional wintering area (=8.3 %). Although the acreage of land use by geese considerably increased with 30%, most pink-footed geese still prefer the traditional sites for sleeping. In a sample of 1220 nights spend by tagged pink-footed geese , only 18 (=1.5%) were situated in 'new' localities. This trend seems to increase with the establishment of new traditions.