Proceedings of the X International Crane Conference





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21–27 August 2023, Tartu, Estonia

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TARTU

Welcome to Tartu
X International Crane Conference

The main building of the Estonian University of Life Sciences,
Kreutzwaldi str. 1A Tartu Estonia:

21–27 August 2023

We warmly welcome you to Tartu for the X International Crane Conference, hosted by the Estonian University of Life Sciences and organised in cooperation with the European Crane Working Group and the International Crane Foundation. We would like to thank our sponsors very much for their support of the meeting.

Every few years, crane enthusiasts in Europe meet at international crane conferences. The conferences have now taken place in six different countries: Hungary, Germany, France, Spain, Sweden and Estonia, in many of these countries at least twice. It was 34 years ago, in 1989, the last crane conference was held in Estonia, just after the first meeting in Hungary in 1985. A lot has changed since then, both in the world and in our knowledge of the biology and ecology of cranes and the need for international cooperation to organise successful conservation. For many years now, our colleagues from practically all over the world have been attending the International Crane Conferences in Europe to share knowledge and experience. The last time we met in 2018 at the 9th International Crane Conference in Arjuzanx, France, we agreed that we would meet again in 2022 in Estonia. However, this plan has been changed due to the global pandemic, but it has taught us how to run events through various online platforms and, surprise, the work can be done successfully, and conferences can be attended without leaving home. We will have to see how it works in the next few days. Sadly, many of our colleagues are absent today due to war in Ukraine.

In 2023, the X International Crane conference will be held from 22–25 August in the main building of the Estonian University of Life Science in Tartu, Estonia. The symposium aims to share knowledge on cranes from across the globe, with information presented on their ecology, management and conservation. We have excellent speakers from Eurasia, Africa and America, with 36 oral presentations and 7 posters covering a variety of crane species. 78 delegates from 19 countries will attend the conference.

We hope you will discover Tartu town, the second largest city in Estonia with a population of nearly 100,000 people. It is a historical Hanseatic City and a central university town. Dating back to 1030, it is the oldest City in Estonia. We encourage you to visit the University of Tartu's main building, the Town Hall Square, Toome Hill, the Estonian National Museum and St John's Church, famous for its thousands of medieval terracotta figures.

We look forward to seeing our old friends and meeting new ones.

Welcome!

Ivar Ojaste, Estonian University of Life Sciences
on the name of the Organization Committee

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Programme
August 21-27, 2023 Tartu

Monday, August 21

12:00	19:00	Registration of participants at the main building of the Estonian University of Life Sciences, Kreutzwaldi tn. 1A Tartu

Tuesday, August 22

The main building of the Estonian University of Life Sciences, Kreutzwaldi str. 1A Tartu

8:00	8:30	Registration and coffee / posters to the wall
8:30	8:50	**Opening of the International Crane Conference** **Hanno Zingel,** Ministry of Climate **Ülle Jaakma**, Rector of the Estonian University of Life Sciences
8:50	9:05	**George Archibald** – In memory of our departed colleagues
9:05	9:15	**Ivar Ojaste** – Organisational notes of the conference
9:15	9:45	**Arne Ader** – Introducing Estonia
		PLENARY / KEYNOTE
9:45	10:30	**George Archibald** – Crane Workshops
10:30	11:30	**Richard Beilfuss** – 50 years of global crane conservation strategy and impact
11:30	12:30	**Ran Nathan** – Movement ecology of Common cranes: from soaring and migration, through gut microbiota to human-wildlife conflicts and major avian flu outbreak
12:30	15:00	**Lunch / poster session**
15:00	21:00	Cruise on river Emajõgi. Euro cocktail event with a local musician

Wednesday, August 23

8:30	9:00	**Arrival, coffee / posters session**
		SESSION: RARE SPECIES CONSERVATION
9:00	9:25	**Hillary Thompson** – Twenty years of reintroducing Whooping Cranes in North America
9:25	9:50	**Triet Tran** – The conservation of Eastern Sarus Cranes in Southeast Asia
9:50	10:15	**Wamiti Wanyoike** – An overview of applied research for the conservation of Endangered Grey Crowned cranes in East Africa
10:15	10:40	**Werner Schröder –** Crossborder Crane Conservation in East Africa
10:40	11:00	**Coffee / posters session**
11:00	11:25	**Hadis Tadele –** Breeding Population of Wattled Cranes (*Bugeranus carunculatus*) and Conservation Challenges in the Rift Valley wetlands, Ethiopia
11:25	11:50	**Abebayehu Aticho –** Effect of seasonality and environmental changes on crane population: A case of black-crowned crane population density in Gambella, Ethiopia
11:50	12:15	**Dessalegn Obsi** – Land Use Land Cover Change and Public Perceptions Differently Affect Black Crowned Crane (*Balearica pavonina*) Conservation: Evidence from Jimma Zone Southwestern Ethiopia
12:15	13:30	**Lunch / posters session**
		SESSION: MANAGEMENT OF CRANE POPULATIONS
13:30	13:55	**Karoline Hemminger** – Winners and losers of land use change: A systematic review of interactions between the world's crane species (*Gruidae*) and the agricultural sector
13:55	14:20	**Anne Lacy** – The right tool alone is not always the solution
14:20	14:45	**Lovisa Nilsson** – Diversionary feeding of common cranes and greylag geese to reduce damage risk to crops - does it work?

14:45	15:10	**Joseph Mwangi** – Promoting Climate Smart Agriculture as an intervention to reverse the current decline of Cranes in Western Kenya
15:10	15:35	**Gilbert Tayebwa** – The Status of Grey Crowned Crane Poisoning in Uganda and Current Mitigation Measures
15:35	16:00	**Coffee / poster session**
		SESSION: POPULATION AND MIGRATION ECOLOGY OF CRANES
16:00	16:25	**Tariku Mekonnen Gutema** – Seasonal Migration and Challenges, of Black Crowned Crane (*Balearica pavonina*) in Ethiopia-South Sudan Transboundary
16:25	16:50	**Shimelis Aynalem Zelelew** – Nest Ecology of Black Crowned Cranes in Lake Tana area Wetlands
16:50	17:15	**Günter Nowald** – Research and conservation of Black-necked cranes (*Grus nigricollis*) in Bhutan: Migration
17:15	17:40	**George Archibald, Alain Salvi –** International monitoring of the eastern migration route of the Siberian Crane in Yakutia
17:40	17:30	**Coffee / poster session**
		ART PROGRAMME
17:30		**Hermann Dirks** – Slide show with music „Fascination Cranes“ **Roger Book** – „Enjoying cranes” **Naturalistic Association “Le Gru”** Film „Where the wind takes you“ **Joosep Matjus** Film „The Wind Sculpted Land“

Thursday, August 24

8:30	9:00	**Arrival, coffee / posters session**
		SESSION: POPULATION AND MIGRATION ECOLOGY OF CRANES
9:00	9:25	**Kunikazu Momose** – Tracking of the red-crowned cranes banded in Hokkaido, Japan
9:25	9:50	**Morgane Gicquel** – Understanding the Demography of European Common Cranes: Insights from colour banding and resighting data
9:50	10:15	**Marketa Tichackova, Petr Lumpe –** The Common Crane (*Grus grus*) in the Czech Republic, the behaviour and changes in migration pattern of tagged cranes
10:15	10:40	**Angela Schmitz-Ornés** – Family behavior after hatching of young Eurasian Cranes (*Grus grus*) in their breeding grounds of Northern Germany
10:40	11:05	**Beate Blahy-Henne, Eberhard Henne** – Deeper Insights in Crane pairs' Life
11:05	11:30	**Coffee / poster session**
		SESSION: POPULATION AND MIGRATION ECOLOGY OF CRANES
11:30	11:55	**Magne Husby** – Predator and prey, cranes and other peatland birds
11:55	12:20	**Antti Karlin** – Common cranes (*Grus grus*) in Finland – nesting and migration
12:20	12:45	**Johan Månsson** – Flyways of Common Cranes (*Grus grus*) breeding in Fennoscandia
12:45	13:10	**Tatiana Kuzmenko** – Common Crane in Polesia, Ukraine
13:10	14:00	**Lunch / poster session**
14:00	16:00	Workshop „Colour-ringing of cranes and use of drones in crane research"
16:00	22:00	Official dinner at Kuremaa Castle and field trip to Kivijärve lake

Friday, August 25

8:30	9:00	**Arrival, coffee / posters session**
		SESSION: POPULATION AND MIGRATION ECOLOGY OF CRANES
9:00	9:25	**Ivar Ojaste –** Findings from the study of Eurasian crane population in Estonia
9:25	9:50	**Jozsef Katona, Zsolt Végvári** – The Eurasian Crane migration in Hungary
9:50	10:15	**Andreas Lehrmann, Günter Nowald** – The Crane population in Germany - new insights
10:15	10:40	**Alain Salvi** – Evolution of the status of the Common Crane *Grus grus* in France from the 1970s to the present day
10:40	11:05	**Sebastien Merle** – Development of the wintering of the Common crane (Grus grus) in central France
11:05	11:30	**Coffee / poster session**
11:30	11:55	**Sophie Dulau Laugareil**, **Patric Dulau** – Behaviour of the wintering Eurasian cranes in the area of the National Nature Reserve of Arjuzanx: 15 years monitoring
11:55	12:20	**Kees Woutersen** – Common Crane spring migration over the Pyrenees
12:20	12:45	**José Antonio Román Álvarez, Carlos Cruz** – Evolution of the Iberian population of crane, 2013/2023
12:45	13:10	**Ivar Ojaste, Günter Nowald, Alain Salvi –** Nature conservation, cranes and the role of the craniacs in it
13:10	15:00	**Closing ceremony of the conference (Professor Kalev Sepp), lunch**
15:00		**Post-conference excursion „Northern and western Estonia“.** Tartu-Toila-Valaste-Vihula Manor House; crane watching at Lahemaa National Park.

Saturday, August 26	Crane watching at Lahemaa National Park. Drive to Haapsalu via Tallinn. Crane watching in Matsalu National Park area.
Sunday, August 27	Drive to Tallinn.

POSTERS

Antti Karlin	Ringing and recoveries of the Common crane (*Grus grus*) in Finland
Sophie Dulau Laugareil	Public reception in the National Nature Reserve of Arjuzanx : key factor in a local acceptance and a better conservation of the Common cranes (*Grus grus*)
Isabel Barwisch, Wolfgang Mewes, Angela Schmitz Ornés, Sebastian Gunther	Heavy metal residues in eggshells of Common Cranes (*Grus grus*)
Igor Davydenko, Vitalii Kazannyk, Valentin Serebryakov	Are the terms of Common Cranes' spring arrival in Kyiv for 100 years changed?
Alessandro Ghiggi, Luca Baghino	Weather factors acting on the pre-breeding peak migration of Common Crane *Grus grus* along the mediterranean coast between the Gulf of Lion and the Gulf of Genoa
Isabel Barwisch, Wolfgang Mewes, Angela Schmitz Ornés	Shared responsibilities and sleepless nights - Threats to eggs of Common cranes
Alexander Abuladze	Monitoring of the Common Crane in Georgia: 1991-2022

SESSION: PLENARY

Tuesday, August 22



Crane Workshops

Dr. George Archibald
International Crane Foundation, Wisconsin, USA

Since the first International Crane Workshop (ICW) at the International Crane Foundation (ICF) in 1976, many encouraging things have transpired from such gatherings; friendships, collaborations, education, publications, plans for more gatherings and the creation of new working groups. From that first workshop, the North American Crane Working Group had its genesis and has met every 3-4 years at many locations where cranes gather. In 1983 in India and in 1987 in China, ICF collaborated with respective governments to co-host additional ICWs. The meeting in India gave birth to the European Working Group on Cranes, which subsequently met in Hungary in 1985 and then every few years in other European nations. Their meeting in Estonia 1989 gave rise to the Russian Crane Working Group. Today many working groups worldwide help crane and promote goodwill.

50 years of crane conservation: Reflecting back, flying forward

Dr. Richard Beilfuss
President & CEO, International Crane Foundation

Cranes, with their deep cultural connections, ecological sensitivity, and dramatic migrations, serve as flagships, indicators, and ambassadors for conservation on five continents. Cranes also are among the most endangered families of birds in the world, with long-term negative impacts associated with dams and water diversions, conversion of wetlands to agriculture and unsustainable land development, human interference and disturbance of nesting sites, drought, fires, and invasive species, all exacerbated by climate change, as well as illegal trade, disease, shootings, and other threats. We will share lessons from 50 years of strategic conservation action worldwide to ensure crane populations are viable, their vital habitats and surrounding catchments are sustainably managed, the flyways they traverse provide safe passage among breeding, staging, and wintering grounds, and knowledge important to their protection and management is continuously acquired and translated into conservation action. We'll also share inspiring, innovative ways forward to recover endangered crane populations and promote healthy wetlands, grasslands, and agricultural lands through the charisma of cranes. We'll explore how cranes can bring people together, from communities to countries, to support more sustainable lands, waters, and livelihoods in Asia, Africa, and North America. We'll also reflect on what it will take to reverse the decline of the most endangered crane populations and keep other crane species on their successful path of recovery.

Movement ecology of Eurasian cranes: from soaring and migration, through gut microbiota to human-wildlife conflicts and a major avian flu outbreak

Dr. Ran Nathan
Department of Ecology, Evolution and Behavior, Alexander Silberman Institute of Life Sciences, the Hebrew University of Jerusalem, Jerusalem, Israel

A large proportion of Eurasian cranes (*Grus grus* L.), breeding in Eastern Europe, migrate through the East-European Flyway and winter in or pass through Israel. The drastic rise in the wintering population in Israel since the 1990s, especially at the Hula Valley in north Israel, has made this species an iconic wildlife for Israel, drawing significant public attention but also raising growing concerns due to conflicts with agriculture and the increasing risk of epidemic outbreaks. Cranes are also excellent subjects for basic scientific research, leading the Movement Ecology Lab at the Hebrew University of Jerusalem to conduct a diverse series of studies on the movement ecology of the Eurasian crane over the past 15 years.

By using stable isotopes from cranes' feathers, soil water isotopic mapping, and probabilistic breeding distribution modelling, we found that most cranes wintering at the Hula Valley likely breed and moult their flight feathers in eastern Europe west of the Ural Mountains [1]. This confirms the expected patterns based on ring resights and GPS tracking. However, for two individuals, which might represent up to 1,000 wintering individuals, the assigned area was farther east, suggesting that some Eurasian cranes from central or north Asia migrate along the Central/North Asia - Middle East Flyway [1]. Most GPS-tracked cranes used the Russian-Pontic Flyway, and during fall and spring migrations, they crossed the Black Sea and the Mediterranean Sea, mostly through powered flight (flapping). Interestingly, high-resolution (1-10Hz) GPS and sensor data revealed a surprising discovery: migrating cranes routinely climb thermals while soaring across the sea far from the nearest land [2]. This finding is puzzling since wing-loading is much higher in Eurasian cranes than in any other bird species known to use thermal soaring over the sea. Furthermore, the climb rate over the sea and in northern latitudes over land was comparable. Sea-soaring occurred predominantly in the fall when large water-air temperature differences followed the passage of mid-latitude cyclones [2]. These findings highlight the behavioural plasticity of cranes as facultative soarers and challenge a fundamental paradigm in avian migration research, suggesting that large soaring migrants tend to avoid sea crossing

not due to the absence or weakness of thermals but due to their uncertainty and the costs of prolonged flapping [2].

Migrating Eurasian cranes heavily rely on agricultural food in their stopover and wintering sites and are attracted to homogenous food (corn) supplied in a diversionary feeding station at Hula Valley during winter to alleviate the damage to agricultural crops. In four complementary studies, we compared the effectiveness of this management practice to two other practices (intensive scaring and allocation of refuge areas) of this human-wildlife conflict [3], examined how it affects their gut microbiota [4, 5], and developed new, highly informative, disease management approach based on lessons from the mass mortality of cranes at this site during the 2021/2 Avian Influence Virus (AIV) outbreak [6]. In the human-wildlife conflict study, we found that diversionary feeding combined with active scaring reduced the cranes' core activity area and led to a significant shift in habitat preference [3]. However, intensive feeding was insufficient to prevent cranes from foraging on sensitive crops when refuge fields were highly limited. Furthermore, while most (~80%) cranes heavily relied on the feeding station, a smaller group (~20%) consistently avoided it and relied on refuge areas and sensitive crops despite scaring efforts. These findings illustrate the merits of using movement ecology methods in achieving a balanced and more effective management plan [3]. Microbiota diversity in cranes' faecal samples collected at the feeding station was, unexpectedly, not lower compared to samples collected in their Russian pre-migration aggregation sites or in Israel prior to intensive feeding onset in winter [4]. It was higher only in samples from non-supplemented wintering sites, presumably due to diet diversification caused by the degradation of residual crops at the agricultural fields. Samples from the feeding station were very distinct in their composition compared to samples from all other sites, with a high abundance of Firmicutes [4]. In another crane microbiota study, we compared microbiota in noninvasively collected faecal samples to those collected from trapped cranes at the same sites over the same periods [5]. Differences found in microbiota diversity and composition might result from the exposure of trapped birds to sedatives or stress, suggesting that noninvasive sampling may better represent host faecal microbiota [5].

The winter 2021/2 AIV outbreak at the Hula Valley, which resulted in ~8,000 of dead Eurasian cranes, is considered one of the major hotspots of the still ongoing global epidemic outbreak of the AIV H5N1 2.3.4.4b clade. Data from tracked cranes provided critical information for disease management in near-real-time during the outbreak, inspiring us to develop a general framework for using biologging data from wild animals as a highly informative management

tool during ongoing pathogenic outbreaks [6]. For example, biologging data allowed early assessment of outbreak magnitude, well before the mass mortality was observable, and also enabled assessing individual's health state and mortality (e.g., infected individuals that recovered, typical timescales of recovery and death), providing critical real-time information on outbreak dynamics that is difficult or impossible to obtain by other means. Moreover, past and ongoing biologging data can help assess patterns of potential spread at local to global scales and could provide early alerts on emerging outbreaks. We suggest further use of near-real-time biologging data for forecasting and managing disease outbreaks and other management and conservation purposes [6].

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SESSION: RARE SPECIES CONSERVATION

Wednesday, August 23



Twenty years of reintroducing Whooping Cranes in North America

Hillary Thompson
International Crane Foundation, Wisconsin, USA

The reintroduction of endangered Whooping Cranes (Grus americana) into the eastern flyway began in 2001 with the first cohort of captive-reared cranes migrating behind an ultralight aircraft from Wisconsin to Florida, USA. The first decade of the reintroduction focused on establishing a population and a migratory path, while the second decade focused on improving reproductive success and natural recruitment. During 2001-2022, 302 captive-reared Whooping Cranes were released. The population size grew to about 100 cranes during 2001-2010, remained at that size during 2010-2018, but then decreased to about 70 cranes during 2018-2022 due to a reduced number of releases of captive-reared cranes and low natural recruitment. Predation was the leading cause of death, followed by impact trauma (particularly powerline collisions), gunshot, and disease. Widespread nest abandonments were attributed to disturbance by avian-feeding blackflies during the first decade of the reintroduction. As a management response, the first clutch of eggs was removed from nests which increased renesting rates from 42% to 79% as well as overall nest success. However, recruitment remains low, and a total of 181 cranes were confirmed to have hatched in the wild, only 34 of which fledged. Current research is focused on management tools to increase chick survival and recruitment. This includes a better understanding of breeding season habitat use to inform management actions (e.g., drawing down wetlands and mowing woody vegetation) and choosing release sites with appropriate habitats and fewer black flies. As this reintroduction is an on-going process, we continue to use adaptive management to assess and modify our techniques to help ensure the successful down-listing of the species.

The conservation of the Eastern Sarus crane in Southeast Asia

Dr. Tran Triet
International Crane Foundation, Wisconsin, USA

Eastern Sarus Cranes (*Grus antigone sharpii*) have the smallest population among the three subspecies of Sarus Crane, estimated at 800 birds, and are rapidly declining. There are three disjunct populations of Eastern Sarus Cranes in Southeast Asia: Myanmar (approximately 500 birds), Cambodia and Vietnam (150 birds) and a reintroduced population in Thailand (150 birds). Ninety per cent of Myanmar's Sarus Cranes live in the Ayeyarwady River Delta. They use deeply flooded rice paddy fields, called "floating rice", as their habitats. This type of rice farming system risks converting to intensive, industrial rice farming. The conservation strategy in Myanmar focuses on preserving floating rice habitats. Thailand lost her Sarus Cranes around five decades ago. Thailand has been implementing a Sarus Crane reintroduction program for the last ten years. The reintroduced population has approximately 150 birds in the wild, which can now reproduce by itself. Also, during the past decade, the Cambodian-Vietnam population has rapidly declined, from around 850 birds in 2013 to 150 currently. Thailand and Vietnam just initiated a cooperation program to reintroduce a resident Sarus Crane population in the Mekong River Delta in Vietnam, building upon the success of the reintroduction program in Thailand.

An overview of applied research for the conservation of Endangered Grey Crowned Cranes in East Africa

Maurice Ogoma, Wamiti Wanyoike, Adalbert Aine-Omucunguzi, Joseph Mwangi, and Kerryn Morrison*
International Crane Foundation (ICF)/Endangered Wildlife Trust (EWT) Partnership – African Crane Conservation Programme (ACCP), Kenya

**Correspondence author, email: mauriceo@savingcranes.org*

East Africa (EA) region is a stronghold of the globally Endangered Grey Crowned Crane (GCC) whose population is the fastest declining among the crane species in the world. The species is threatened by encroachment into their breeding wetland habitats, illegal trade, emerging impacts of climate change, powerline collisions, and electrocutions. Besides, human-crane conflicts through poisoning because of suspected crop damage by GCC have escalated outside protected areas in western Kenya, southcentral and southwestern Uganda, and northern Rwanda. The African Crane Conservation Program (ACCP) is implementing a research and monitoring strategy to guide conservation interventions in the EA region. Key methodologies include crane ringing and fixed route surveys to understand crane movement patterns, distribution, and population trends. Others include crane censuses and mapping and incident reporting. Crane census and mapping have guided the identification of new sites for conservation intervention in Uganda and Kenya, while it has revealed increasing trends from our conservation efforts in Rwanda. Fixed route surveys provide population occurrence and trends across our intervention sites. Our crane custodianship, a citizen science initiative, enhanced reporting of crane incidents, local-level advocacy, and awareness creation across the region. Using research and monitoring as a strategy is critical for guiding conservation interventions, including where to focus efforts and measuring the impact of conservation at the local and regional scales.

An initiative for Crossborder Crane Conservation in East Africa

Werner Schröder
NABU - The Nature and Biodiversity Conservation Union - BirdLife Germany, Germany

Cranes know no boundaries and cross into suitable habitats in neighbouring countries. The state of protection might be very different in each country which puts the Cranes in danger and might counteract the efforts in the country of origin of the birds. Joint efforts of conservationists in Tanzania, Rwanda and Uganda show the first successes to harmonise the standards of Crane Conservation in the three neighbouring countries.

Breeding Population of Wattled Cranes (*Bugeranus carunculatus*) and Conservation Challenges in the Rift Valley wetlands, Ethiopia

Hadis Tadele
Madda Walabu University, Ethiopia

Wattled Cranes (*Bugeranus carunculatus*) are the largest, rarest, and most wetland-dependent of African cranes. Limited ecological information is available about them in Ethiopia, where this study was carried out in Central Rift Valley (Boyo Wetland) and Bale Mountains National Park from 2015 to 2017, to fill the information gap by investigating their breeding ecology, population, and distribution. A total population count was employed to collect data on population and distribution. Descriptive statistics and inferential (e.g. Chi-Square test and Pearson Correlation were used to investigate differences and relationships of parameters. The wattled crane's active breeding season was from September to October, with the majority (66.7%) of nests being built on islands of alpine lakes. Breeding behaviour was influenced by the density of alpine lakes (P = 0.000) and the availability of food density (P = 0.000) in their breeding territory. The mean clutch size was 1.78±0.15, n=9. The mean egg length, width and weight were 93.11±1.29 mm, 65.07±0.34 mm, and 250.69±4.73 g, respectively. Hatching and fledging successes were 37.5% and 100%, respectively, in which a strong association was noticed regarding nest-site fidelity. A population of 319 individuals was estimated in the Central Rift Valley area, with new population observations (169 individuals) in Melka Wakena hydroelectric dam indicating a potentially larger population than expected. In general, in the Central Rift Valley area, population fluctuations occur, rising from October to March, decreasing in April, slightly rebounding in May, and then declining from June onwards, with July and August having zero individuals. The wintering habitat faces greater human-related threats than the breeding area due to unsustainable resource use like overgrazing, deforestation leading to higher sedimentation, as well as unsustainable drainage development, farmer encroachment, and invasive species spread in wetlands. Therefore, besides the above threats, the species selectively occupies a unique feeding niche and breeding site demanding the urgent need to conserve its habitat, especially the Boyo wetland, the main wintering ground for the species.

Effect of seasonality and environmental changes on crane population: A case of black-crowned crane population density in Gambella, Ethiopia

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The eastern Black Crowned Crane subpopulation (*Balearica pavonia pavonina*) declined 21-44%, which requires conservation measures. Reliable population and threat information are required from representative ecological regions to develop a conservation plan. However, the available crane population data poorly represents the species size in all ecoregions, especially in Ethiopia. Hence, this study aimed to estimate cranes' population size in wetland habitats of the country's East Sudanian Savanna Ecological Region. We used the line transect sampling method to collect data during the dry and rainy seasons. The crane population density was estimated using distance software, whereas the effect of multiple variables on crane density was assessed using a mixed-effect model. We detected 172 cranes per sq. km of wetlands, with a cluster density of 2.77 and a population density of 61.98. Crane detection probability significantly ($r = 0.66$; $df = 164$, $p < .05$) declined as the perpendicular distance from the transect line increased. The

mixed-effect model components explain about 88% of the variation in crane density. The fixed effect model identified the dry season and intercept as significant ($p < .05$) density predictors. The mean crane cluster size was about 3.5 sq km when all model parameters were kept to zero, and this will increase by about 0.2 times when the seasons change from wet to dry. Subsistence livestock grazing and proximity to woodlands and rivers significantly ($p < .05$) benefit the cluster size, whereas wetland water depth and grass height have negative effects. Accordingly, the least live stocking rate required to create favourable habitat features for crane foraging was about 76 TLU per hectare. Also, wetlands require 2 and 3 km apart from rivers and woodlands, respectively, to support large crane flocks. When wetlands' grass height and water depth surpass 30 cm and 40 cm, respectively, the cluster size will decline by 0.02 units. Based on the black-crowned crane population size, the study area appears as one of the top crane conservation priority sites in Ethiopia.

Land use land cover change and public perceptions differently affect black crowned crane (Balearica pavonina) conservation: Evidences from Jimma zone southwestern Ethiopia

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Abstract

A study on land use land cover (LULC) conversion and rate of change can provide a scientific ground for conservation action. The present study aimed to analyze the effect of LULC change on Black Crowned Crane and public perception towards species conservation in southwestern parts of Ethiopia. A Landsat 7 ETM + 2000 and Landsat 8 OLI of 2020 were used to analyze the LULC change. The maximum likelihood supervised classification technique was employed to classify the LULC types. Image processing was performed using Earth Resources Data Analysis System, ERDAS Imagine 2015 software. Besides geospatial technologies, we sampled a total of 151 household heads, key informant interviews (n=6) and field observation were conducted in the study area. The results show that agricultural land increased from 74.24% in 2000 to 81.66% in the year 2020. Settlement and grazing land cover classes show a slight increase over the study period. Agricultural land expansions at the expense of forest, grassland and wetlands substantially affect the conservation of Black Crowned Crane. Water bodies, particularly wetland ecosystems, the key habitat of cranes, declined slightly from 0.69% in 2000 to 0.58%in 2020. The conversion of wetlands to agricultural land threat Black Crowned Crane as the species prefer wetlands for feeding, breeding, and roosting. The household survey results revealed that 93.4% perceived that environmental change significantly affects Crane. Concerning the population trend of the species, about 44.4% of the respondents perceived that the population of the species declined, while about 25.8%, 25.2%, and 4.6% perceived increasing, no change and didn't know, respectively. About 53.6% and 27.8% of the respondents think that the species is currently vulnerable

and endangered, respectively. We conclude that environmental modification and agricultural intensification are the key threats to Black Crowned Cranes conservation. This study provides baseline data on LULC change and the Black Crowned Crane conservation threat.

SESSION: MANAGEMENT OF CRANE POPULATIONS

Wednesday, August 23



Winners and losers of land use change: A systematic review of interactions between the world´s crane species (*Gruidae*) and the agricultural sector

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While agricultural intensification and expansion are major factors driving the loss and degradation of natural habitats and species decline, some wildlife species also benefit from agriculturally managed habitats. This may lead to high population densities impacting both human livelihoods and wildlife conservation. Cranes are a group of 15 species worldwide, affected negatively and positively by agricultural practices. While eleven species face critical population declines, the number of Common cranes (*Grus grus*) and Sandhill cranes (*Grus canadensis*) have increased drastically in the last 40 years. Their increase is associated with higher incidences of crane foraging on agricultural crops, causing financial losses to farmers. Our aim was to synthesize scientific knowledge on the bilateral effects of land use change and crane populations. We conducted a systematic literature review of peer-reviewed publications on agriculture-crane interactions (n=135) and the importance of agricultural crops in the diet of cranes (n=81). Agricultural crops constitute a considerable part of the diet of all crane species (average of 37%, most frequently maize (*Zea mays* L.) and wheat (*Triticum aestivum* L.)). Crop damage was identified in only 10% of all agriculture-crane interactions, although one-third of interactions included cranes foraging on cropland. Using a conceptual framework analysis, we identified two major pathways

in agriculture-crane interactions: 1) habitat loss with negative effects on crane species dependent on specific habitats, and 2) expanding agricultural habitats with superabundant food availability beneficial for opportunistic crane species. The degree to which crane species can adapt to agricultural land use changes may be an important factor explaining their population response. We conclude that multi-objective management needs to combine land-sparing and land-sharing strategies at the landscape scale. To support viable crane populations while guaranteeing sustainable agricultural production, it is necessary to include the perspectives of diverse stakeholders and streamline conservation initiatives and agricultural policy accordingly.

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The right tool alone is not always the solution

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When it comes to the issue of crop damage, providing an effective treatment to prevent cranes and other birds from pulling germinating grain seed from the ground is essential, but not the entire solution. It is only truly a solution when it works for the farmer as well. The International Crane Foundation (ICF) has been incrementally working toward a solution to this problem for decades. When field testing of Avipel (*Anthraquinone*) was completed and peer-reviewed research published, that was merely the beginning, not the resolution. As conservationists, we are often myopic about any problems that arise from our 'solutions'. In the decade since a seed treatment to prevent crane damage to sprouting corn was available on the open market, ICF has realized that farmers need a myriad of tools as well as institutional, financial, and expert support to truly mitigate the impacts of crop damage. ICF is in the process of developing regional cost reduction programs for Avipel, advocating for state policy changes, and testing additional viable alternatives. We also continue to investigate harm reduction to other crop types.

Diversionary feeding of common cranes and greylag geese to reduce damage risk to crops - does it work?

Lovisa Nilsson, Johan Månsson, Johan Elmberg, Niklas Liljebäck & Ingunn Tombre

Your notes:

Promoting Climate Smart Agriculture as an intervention to reverse the current decline of Cranes in Western Kenya

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Increasing demand for food from growing human populations coupled with poor farming practices increased droughts due to climate change, and declining yields on farmland have led communities to find new land for farming, which has led to encroachment into wetlands for agriculture. Agricultural encroachment into wetlands and the impact of upland farming practices on wetlands are the most serious long-term threats to Grey Crowned Cranes. Starting September 2021, International Crane Foundation (ICF), in partnership with Endangered Wildlife Trust (EWT) and Community Action for Nature Conservation CANCO) implemented a Climate Smart Agriculture for the adoption of crane and wetland-friendly agroecological practices on small-scale farms to reduce encroachment and sedimentation in wetlands. The aim of the project is to assist communities in building more resilient agriculture practices that reduce the impact of climate change and enhance optimal use of land for agriculture through increased yield leading to less need to encroach into wetlands which are key breeding habitats for the Grey Crowned Crane. The first year involved training model farmers and assisting them in setting up demonstration farms. The five main promoted practices were crop diversification, minimum tillage, Kitchen/vertical gardening, composting and food forests. Under the project, 70 model farmers were trained as trainers through an intensive two-week programme on adopting and practising climate-smart agricultural practices. Twenty-six model farmers were facilitated to set up demonstration plots in their villages for training and investigating the benefits of adopting the practices. In the second year, the project targeted increasing the number of trained farmers by facilitating the model farmers to train other farmers in their villages and track the adoption of the practices by the trained farmers. The model farmers held 26 trainings and trained 661 target community group farmers in 15 localities. To track the uptake of the practices, we visited and mapped 315 farmers out of the 661 farmers trained who were farming on 350 acres of wetlands. We have tracked uptake by 181 individuals, representing 28% of the

targeted individuals. A total of 70 farmers have taken up the best practices, of which 6 farmers have completely stopped utilizing the wetland. Thirty-three farmers have adopted compost manure production instead of using commercial fertilizers, 16 are practising crop rotation coupled with minimum tillage practises, 21 farmers have set up kitchen/vertical gardens, and two farmers are practising food forests. The results of this project suggest that adopting climate-smart agriculture is a potential solution for optimal use of small-scale farmers due to increased production compared to conventional agriculture and resonate well with farmers due to the high nutritional value, increased market value, and higher resilience of the practices during the shortage of rain. This negates the need to encroach into wetlands which are key crane habitats. The project has also led to increased support for other crane conservation interventions such as wetland restoration, reduced disturbance during the breeding season, and higher tolerance of cranes when they flock on farms.

The Status Of Grey Crowned Crane Poisoning In Uganda And Current Mitigation Measures

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The Grey Crowned Crane (*Balearica regulorum gibbericeps*) is the national bird of Uganda and is listed as endangered by the International Union for Conservation of Nature (IUCN). Despite this status, the species faces numerous threats, including poisoning. This paper provides an overview of the status of Grey Crowned Crane poisoning in Uganda and current mitigation measures. Poisoning incidents involving Grey Crowned Cranes have been reported in various parts of Uganda, with most cases occurring in the country's central region. The leading causes of poisoning are believed to be the inappropriate use of pesticides and herbicides in agriculture, illegal hunting, and intentional poisoning by farmers to protect their crops. Some communities are believed to use poison to kill Grey Crowned Cranes for their meat or body parts like feathers, which are highly valued in some Ugandan cultures. The effects of poisoning on Grey Crowned Cranes in not well documented but may include deaths, decreased breeding success, and reduced population sizes. Various measures have been put in place to mitigate Grey Crowned Crane poisoning in Uganda. These include community-based awareness campaigns on the dangers of using pesticides and herbicides in agriculture. Law enforcement efforts to curb illegal hunting and poisoning. Establishment of community-based conservation programs that promote sustainable agriculture practices, such as the promotion of alternative methods of pest control that are less harmful to wildlife. The establishment of rescue and rehabilitation centres for poisoned and injured cranes where poisoned grey crowned cranes can receive basic medical treatment before being released back into the wild once they recover. Additionally, community-based conservation groups are being established and tasked with monitoring crane populations and reporting any poisoning and other incidents to cranes.

Material and Methods: Data was collected through personal observations, phone interviews, and face-to-face interviews with farmers. Data was collected by field teams, crane custodians (community volunteers), and village wetland management committee teams. The data was collected using mobile smartphones with pre-installed *survey123* forms (a computer-based form for creating, sharing, and analyzing surveys). The data was then submitted to the online *survey123* database for real-time monitoring. During data collection,

parameters captured included; The number of grey-crowned crane chicks, adults, and juveniles reported or identified due to poisoning, GPS locations of where the incident occurred, the primary cause of poisoning, and symptoms the birds were observed to show. Data was analyzed using ArcGIS (Online and desktop versions 10.8.1) to identify the location of incidents; the Microsoft Excel database was used to analyze Descriptive statistics such as means and frequencies of occurrences.

Results: Results show that between 2019 and 2021, there were more than 233 adult crane incidents reported as compared to 72 adult cranes and four juvenile stage incidents in the 2022-2023 period

Discussion: While poisoning continues to have an impact on Grey Crowned Crane population distribution, there has been a significant decrease in the number of reported and identified Grey Crowned Crane incidents after the establishment of mitigation measures between 2022-2023

Acknowledgement: I am grateful to the International Crane Foundation/ Endangered

SESSION: POPULATION AND MIGRATION ECOLOGY OF CRANES

Wednesday, August 23



Ethiopia – South Sudan transboundary as hotspot area for Black crowned crane (*Balearica pavonina*) conservation

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Some of the world's most biologically intact ecosystems are found in locations with international borders. The Ethiopia-South Sudan Ecosystem is a transboundary biodiversity hotspot and is considered to contain the most significant population of Black Crowned Cranes (BCC) in the world. This could result from the numerous large rivers and Sudd Wetland, the region's largest and declared Ramsar site wetland. Except for a few studies in Gambella (Ethiopia), there is little knowledge of the BCC's distribution, population size, and threats on the South Sudan side of the transboundary. Between September 2021 and March 2023, we researched BCC's distribution and threats in this area using direct observation, FGD and questionnaire survey. In the investigation, 37 flocks of BCC were documented from the four South Sudanese sites (Boma, Uror, Nyiro, and Akobo), with an estimated range of 191 to 3500 individuals of BCC in one flock.

The number of BCC varies significantly from location to location, which might result from the habitat's different sizes, closeness to other wetlands, and degree of disturbance. The top three causes affecting BCC in the research area are habitat degradation (caused by agricultural development), retaliatory killing and chasing of BCC by farmers (because BCC causes crop damage), and fire. The study also revealed the existence of human-BCC conflict due to crop damage caused by crane flocks during seedling, which includes consuming the seeds and dinging the crops when the seedlings begin to grow, primarily maize. April, May, and June are the principal months for this. Due to this pressure, the majority of the communities oppose BCC conservation. Aerial surveys are required to determine the BCC population status in the area. We also suggest increasing community awareness and identifying conflict-mitigation techniques to improve human-crane coexistence in the area.

Nest Ecology of Black Crowned Cranes in Lake Tana area Wetlands

Shimelis Aynalem Zelelew
Bahir Dar University, Ethiopia

Your notes:

Research and conservation of Black-necked cranes (*Grus nigricollis*) in Bhutan: Migration

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NABU International - Foundation for Nature (NABU International), the Royal Society for the Protection of Nature (RSPN) and Crane Conservation Germany (CCG) implemented a research and conservation project about Black-necked Cranes (BNCs) in Bhutan, which runs from 2018 to 2023 and is founded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV).

Catching

We used snares (passive traps, Fig. 1) to catch three BNCs in 2019 and five in 2020. When the bird stepped through a snare, it tightened around the bird's foot while walking ahead. We used a nylon cord/fishing line (2-3 mm in diameter) with a loop (using a slip-knot) at one end for the single traps. The other end was attached to a 70 cm long flock, which was driven into the ground with a hammer. We hid the loop in (or with) the vegetation when possible.



Fig. 1: Snares (passive traps) to catch Black-necked cranes.

Tagging

BNCs tagged by the CCV team received the Bhutan national country code (Yellow-Red) above the left and the individual code above the right intertarsal leg joint. Each code consists of two colour rings, displaying a combination of white, yellow, red, blue, green, and black. Cranes are ringed with so-called ELSA rings (2.5 mm wide, 17/19 mm inner diameter) designed for cranes by the Fraunhofer Institute, Germany.

All GPS transmitters were designed and produced by E-obs (42g Solar GPS-GRSM tags, Fig. 2) and were fitted with a backpack harness of a 1.8 cm wide, flexible, black rubber band.

Six BNCs were tagged with GPS transmitters in Phobjikha Valley, three BNCs were tagged in Bumdeling Valley.



Fig. 2: The banding team 2020 with a GPSD tagged adult Black-necked crane (photo: David Hecht)

Results and discussion

From there, the tagged cranes migrated to the Qinghai-Tibet-Plateau in spring and vice versa in autumn. By doing so, they crossed the Greater Himalayas at one point and otherwise flew parallel to the mountain ridges. In general, BNCs tagged in Phobjikha used different migratory flyways as those tagged in Bumdeling with little signs of connection or variation (Fig. 3).

In general, the tagged cranes from Phobjikha have a shorter migratory route and have to gap lower flying altitudes compared to the cranes tagged in Bumdeling.

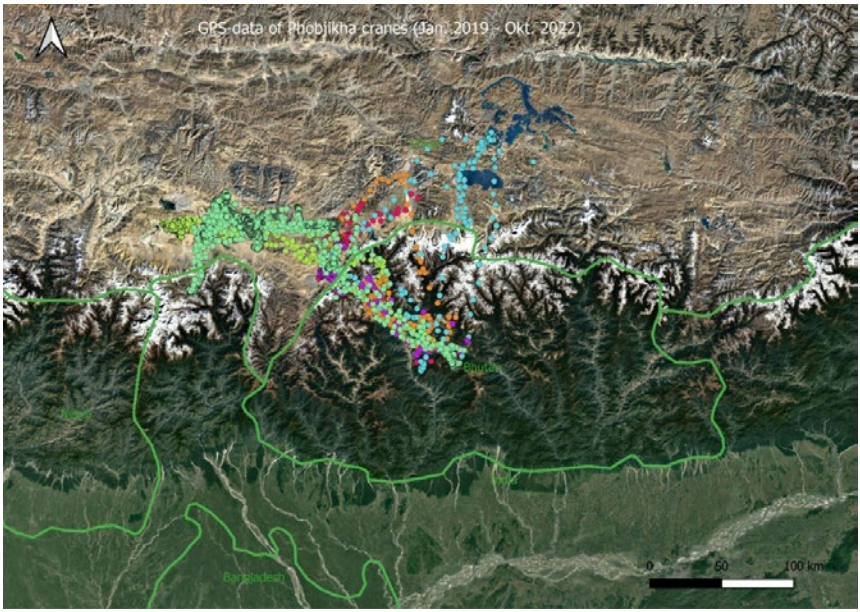

Fig. 3: Flyways/GPS-data of the six tagged Black-necked cranes from January 2019 to October 2022.

The maximum flying altitude over the mean sea level (MSL) per migration ranges from 4,572 to 7,441 metres for all cranes, with an average of 5,467 metres. Although the maximum altitude is similar for cranes from Phobjikha and Bumdeling, Bumdeling cranes have to gap larger altitude differences because their wintering area is located lower than Phobjikha Valley.

During the 17 migrations completed by the nine tagged cranes, 44 resting/stopover areas were identified. At 26 of these areas, the respective crane stayed only one night (stopover areas); at 18 of these areas, it stayed for more than one night (resting area). Of the 18 identified resting areas, ten were visited during more than one migration, and only two were visited by more than one crane (close to the border of Bhutan, which is important for conservation). No single resting area is located in Bhutan. Quite unexpectedly, the BNC (Id 7116), tagged on 20th Jan 2020 in Phobjikha Valley, made a short trip from the breeding area in China to India. He visited Khangchendzonga National Park in May 2020 and April 2021.

Of the 26 identified stopover areas, non were visited during more than one migration and only one by more than one crane. Six stopover areas are

located in Bhutan. Both migratory flyways cross China. Also, all important resting areas are located there. Therefore, international protection efforts are of the utmost importance.

Acknowledgement

We like to thank the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) for their generous financial support of the project as well as NABU International - Foundation for Nature (NABU International), the Royal Society for the Protection of Nature (RSPN), the Ugyen Wangchuk Institute for Conservation and Environment Research, Crane Conservation

International monitoring of the eastern migration route of the Siberian Crane *Grus leucogeranus* in Yakutia

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The Siberian Crane is one of the most endangered crane species today. Historically, from west to east of the vast Siberian area, 3 populations were known. However, only the most easterly of these are still truly active today, even though restoration efforts are ongoing to try and restore the other two.

The identification since 2008 of a regular passage corridor for the eastern population in the middle valley of the Aldan River in Yakutia has led to the launch of a series of monitoring programmes, in particular, to try to refine its numerical importance. In the autumn of 2019, an international team (Yakutia, USA, China, France) carried out the first complete monitoring of this migration in Okhotsky Perevoz village, led by colleagues from the Institute of Biological Problems of the Cryolithozone in Yakutsk.

The counts were carried out from several observation points located 1-4 km apart along the migration route, enabling the entire migration front to be covered within a 5-6 km radius and avoiding double counting.

The first flocks of migrating Siberian Cranes were registered on 15 September, and the last two birds were observed on 9 October. The migration lasted 25 days, with marked activity in the last days of September and the first week of October.

The visual count recorded 1998 cranes in 117 flocks. In addition, 13 flocks were recorded by voice, but the number of birds could not be counted due to poor visibility (n = 11) and night flight (n = 2). Considering that the average number in a flock is 10, we must consider that there was a minimum of 130 cranes in the flocks counted solely by voice. Thus, 2,128 Siberian Cranes in 130 flocks were counted, representing about half of the numbers counted on the wintering sites in China.

The counts showed high breeding success since 66 juveniles were observed out of 332 cranes in flocks where it was possible to count young birds (19.7%) (data from Guo Yumin). So, after two unfavourable seasons in 2017 and 2018 for Siberian crane breeding, 2019 was a successful year. This reproductive success is probably linked to the favourable weather conditions

in the wetlands of the tundra, as the water level was not critical for the start of incubation, due to the low amount of snow during the winter of 2018-2019 (data from Sergey Sleptsov).

Numerous observations of various species (n = 44) were made during the monitoring, including especially the migration of several species of geese.

Tracking of the red-crowned cranes banded in Hokkaido, Japan

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The banding project of the red-crowned cranes in Hokkaido was started in 1988 when 607 chicks 1.5 to 2 months old were released with rings up to 2022. We, RCC, have been monitoring the chicks for their survival and breeding status throughout the year, especially during winter count surveys, and here is what we have learned so far.

As of May 2023, the oldest survivor is a 32-year-old male. As of June 2021, the average age of the 172 survivors was 9.1 years. The annual mortality rate after age 1 ranges from 9 to 15%, with half of them disappearing at about age 4. Year-over-year mortality rates generally remain the same until age 13 and then tend to increase. After age 14, however, the year-to-year mortality rate for females is higher than that for males. When the age of successful breeding was determined by the presence of chicks at the time of the winter count, the age of first successful breeding ranged from 3 to 21 years. Comparing females and males on average, females were 6.3 years old (3-16 years old N: 103), and males were 7.5 years old (3-21 years old N: 81), with females being earlier. Of the individuals over 3 years old that reached breeding age, including current and deceased, 47% (103/218) of females and 40% (81/203) of males had ever successfully bred at least once as of 2021. Comparing the distance between natal and established sites for the 90 females and 91 males with known breeding sites, the average distance for males was 11.1 km and 44.7 km for females, indicating that males bred closer to their natal sites than females.

Understanding the Demography of European Common Cranes: Insights from colour banding and resighting data

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The Common crane (*Grus grus*) is an iconic species in Europe that has made a remarkable recovery since being granted the highest protection category under the Birds Directive in 1979. However, this success has also resulted in new conservation challenges, as cranes have been observed damaging agricultural crops and threatening other wetland bird species by preying on eggs and chicks. These conservation conflicts have raised the question of what can be expected in the future regarding the population numbers of common cranes. To better understand the future population trends of the common crane, it is essential to have accurate knowledge of demographic parameters such as survival and recruitment. Unfortunately, such information is still largely lacking for this species.

A collaborative effort involving 15 countries and an extensive team of ringers has been collecting data on thousands of banded common cranes in Europe to address this gap. This dataset includes 6 660 individuals ringed since 1985 in 13 countries and over 209 620 resightings registered in 30 countries through the internet-based Crane Observation Ring Archive (iCORA) and individual country databases. The European Cranes Demographic project aims to use this data to conduct a rigorous analysis of individual survival to determine the variation in survival among different age classes, the annual survival probabilities, and the longevity of individual cranes using Capture-Mark-Recapture methods.

This presentation will provide an overview of the data collected, the methods used, and the study results. Understanding the survival patterns of common cranes will not only enhance our knowledge of their ecology and demography. Still, it will also be critical for effectively conserving and managing the species. Ultimately, this research will help develop more accurate population models to inform future policy decisions.

The Common Crane (*Grus grus*) in the Czech Republic, the behaviour and changes in migration pattern of tagged cranes

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We have been monitoring the migration of Common Cranes (Grus grus) in the Czech Republic using colour rings (since 2002) and also GPS-GSM transmitters (since 2017). A total of 80 banded cranes (16 with transmitters) have been using the Western European migration flyway leading through Poland and Germany to France and Spain. Since 2017, the cranes have begun to overwinter in the Czech Republic regularly.

One young crane was marked with colour rings on July 17, 2010, at the Novozámecký pond in the Českolipsko region. During its first winter, this crane was repeatedly observed in the Arjuzanx reserve in southwestern France, which proves that it was taught by its parents to migrate to this wintering ground. It was also observed at the same place the following winter.

Its young was tagged with a transmitter on July 19, 2020. On August 21, the young and its family flew north to a gathering place in Saxony, Germany. After about two months, on November 4, they returned to the Czech Republic, where they spent the whole winter. This proves that the parent of the young has stopped migrating to France and has not taught their young the traditional route.

Cranes do not have an innate migration route: they learn it from their parents in their first year of life. When cranes stop migrating to traditional wintering grounds, it affects all subsequent generations. The number of cranes overwintering in gathering places or returning for winter to nesting areas in the Czech Republic is therefore expected to increase.

The Crane Life project, supported by Ostrava Zoo, Liberec Zoo and Kranichschutz Deutschland, is dedicated to crane research and protection in the Czech Republic.

Family behavior after hatching of young Eurasian Cranes (*Grus grus*) in their breeding grounds of Northern Germany

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The Eurasian crane (*Grus grus*) has experienced a positive population development in Germany for the last 50 years. These growing numbers have caused not only higher nesting densities in the already occupied areas but also an expansion of their distribution range and the occupation of unusual nesting habitats within intensively used agricultural areas. To understand the consequences of habitat changes and occupation densities on the behaviour of breeding pairs, we started a long-term project in 2016 to investigate, among others, parental investment, predation, and the effects of disturbances on their breeding biology. Here, we present a first insight into the behaviour of parents and their young after hatching. Knowing that cranes are very sensitive to disturbances at the nest, this information is based on pictures taken from hidden camera traps located close to the nests. To date, we have been studying the breeding behaviour of Eurasian cranes in the state of Mecklenburg-Western Pomerania using this methodology, and we present the results of observations collected from 2016 to 2019. Although there are some limitations, the behaviour of the family members could be recorded, and clear patterns could be identified. Generally, both parents seem to share in taking care of the young. In the evening, females tend to take over the nest and keep the chicks warm until the next morning. The behaviour of the family members changes in the course of the days after the first and then the second young have hatched. As the chicks grow older, the time they need to be kept warm by the parents decreases, while the time and range the young spend on foraging trips increases.

Deeper Insights in Crane pairs' Life

Beate Blahy-Henne, Dr. Eberhard Henne

Over more than 20 years, we followed the behaviour, the change of partners, the reasons for, and the many different "ways of life" of common cranes. We did – and are doing it still – in a monitoring area of approx. 25 km², observing the breeding pairs in this region.

We could make clear that the permanent pair bonding over many years is more the exception than a rule.

We could find out at what age crane males start to occupy their own territory and the reasons for leaving it. Who defends a territory? What kind of danger and threats exist in a crane's life?

What happens if one partner gets severely ill or gets lost?

Cranes can adopt the chick/s of another male or female – we report some examples.

Pairs can separate in some cases, and they can re-unite; we explain the reasons for this.

After 20 years of observation and research in these many aspects of cranes' life, we now can sum up: cranes are not holy animals; loving each other as long as life lasts. They always act in the superior interest of the survival of their species. That is the strongest and mightiest trigger of all that they do.

Predator and prey; cranes and other peatland birds

Dr. Magne Husby
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Introduction

Many publications are stating the positive effects of more food supply on predator abundance (Newton 1998, Pearson & Husby 2021). However, many factors affect population density, and the effects of predation on prey populations might be more complicated and challenging to reveal (Mönkkönen et al. 2007). The effects of predation on any prey population might be offset by compensatory reductions in other losses or improved reproduction (Newton 1998). Because the Common Crane *Grus grus* population has experienced an unprecedented increase across Europe during the last decades, many ornithologists have raised concerns that the cranes will reduce the populations of waders and other wetland birds. Although cranes feed primarily on invertebrates, amphibians and berries during the breeding season, they can also eat eggs and young of other birds.

Material and Methods

By using line-transect data from Finland from 1987 to 2014, we analyzed peatland bird densities as target variables and many possible explanatory variables like habitat and spatiotemporal trends and crane abundance, taking the first year the crane was observed in an area into consideration in GLMM analyses (Fraixedas et al. 2020).

Results

Among five common species, we found that the population densities of two small passerines (Meadow Pipit *Anthus pratensis* and Western Yellow Wagtail *Motacilla flava*) and one wader species (Wood Sandpiper *Tringa glareola*) were positively associated with crane numbers. We found no significant effect of crane abundance for the two other common species (Common Reed Bunting *Emberiza schoeniclus* and Common Snipe *Gallinago gallinago*). We also analyzed a set of seven less common waders whose observations were summed: Broad-billed Sandpiper *Calidris falcinellus*, Ruff *Calidris pugnax*, Whimbrel *Numenius phaeopus*, Jack Snipe *Lymnocryptes minimus*, Red-necked Phalarope *Phalaropus lobatus*, European Golden Plover *Pluvialis apricaria* and Spotted Redshank *Tringa erythropus*. We found no significant relationships

between their population trends and crane abundance. None of the species was influenced by the (lagged) effect of crane presence (i.e. years since the crane was first observed).

Peatland drainage was responsible for most species' negative densities. In addition, openness, wetness and area size were important peatland characteristics positively influencing most of the studied bird populations.

Discussion

We believe this positive relationship is probably related to a protective effect against nest predators. Other investigations have also stated this effect (Mönkkönen et al. 2007). The results indicate the need to protect and restore peatlands to mitigate the loss of peatland bird diversity in Finland. The development of cranes and other mire bird numbers in Europe should be monitored regularly to reveal any possible future predatory effects contributing to the shaping of the peatland bird community.

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Common cranes (Grus grus) in Finland – nesting and migration

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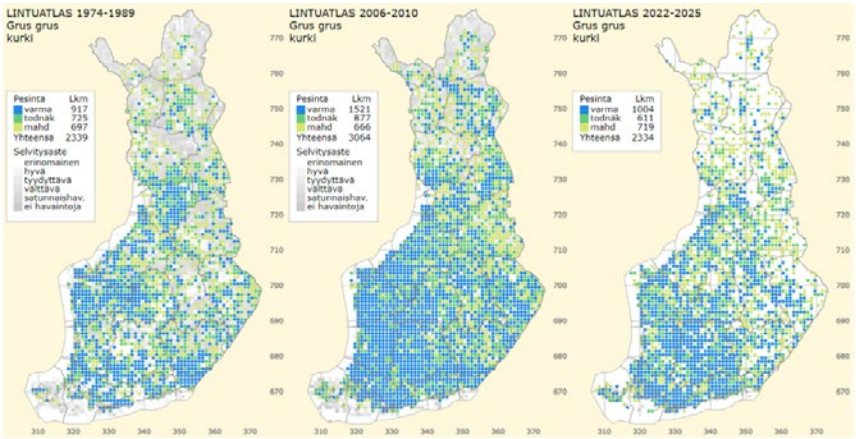
The crane was a project species for the year 1983 in Finland. The study aimed to get information from amateur ornithologists on migration, breeding biology and the size of the crane population in Finland. In addition, the most important resting areas, the number of non-breeding birds, and damage to agriculture caused by cranes were recorded. This study's results were published in 1985 in Hungary (Karlin & Raivio 1987).

In Finland, it has seen also Sandhill cranes (three birds: 2011, 2014 and 2022) and Demoiselle cranes (two times: 1972 and 2015).

The distribution and breeding habitat

The distribution of the crane in Finland is relatively well-known. The crane breeds occasionally as far as northern Lapland. The northernmost limit of the distribution follows the north boundary of the mixed birch-coniferous forests. Different kinds of mires (peatlands) are cranes' most common nesting sites. The cranes have therefore been forced to change their breeding habitats, shifting to large reed beds and damp meadows along the sea- and lakeshores.

In Finland, it has done three bird atlas, and 4th is now ongoing (2022–2025). The maps (the first map done together with two bird atlas information: 1974.1979 and 1986-1989) show the distribution of cranes in Finland:



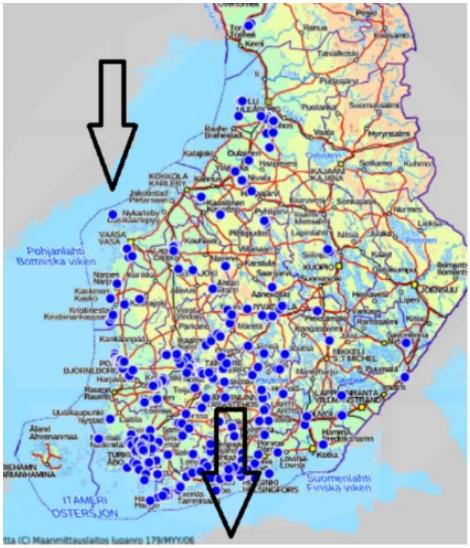
Egg-laying and clutch size

In southern Finland, egg-laying starts in the second half of April, in the Oulu district at the beginning of May (von Haartman et al., 1963—1972). In northern Finland, laying begins in June. The crane generally lays two eggs; one egg is rare, and clutches of three eggs are exceptional. So far, only three clutches with three eggs are known from Finland. In all cases, the third egg was a so-called dwarf egg.

Migration

The first cranes arrive in Finland at the turn of March and April, and they usually leave by the middle of October. Today it is possible to show the migration routes and the number of migrating cranes because Finland has created the www.tiira.fi database. A total of 132 553 observations for 16 907 622 migrating cranes were collected in this database between 1980 and 1.8.2023.

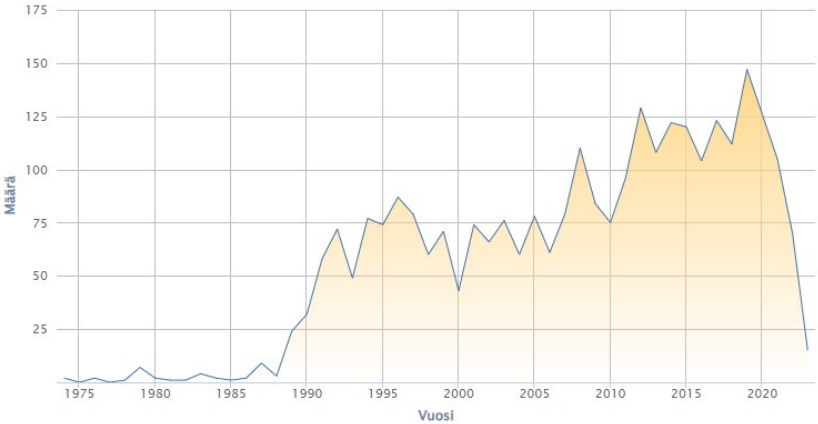
Autumn migration usually starts in August; the last cranes leave Finland at the end of October.



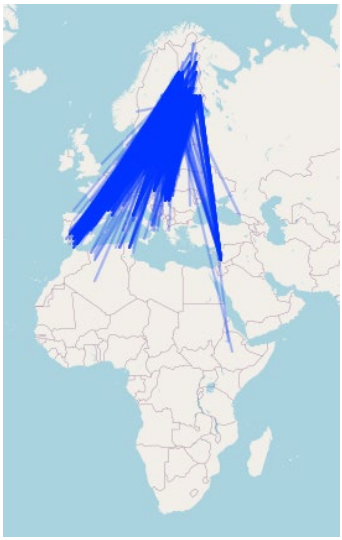
Autumn migration 2023: the observations of over 500 cranes in one place. Source: www.tiira.fi. The arrows show the main line to the south. Probably 400 – 800 cranes from Sweden migrate via Finland to Estonia and the South.

Ringing

The crane research started about 1987, and 2903 cranes have ringed during 1975 – 2023. Many cranes have also been ringed with colour rings in Finland, and the Finnish Ringing Centre database consists of 13 636 recoveries, of which 7492 are from abroad.



Number of ringed cranes in Finland during 1975–2023.
Source: https://rengastus.helsinki.fi/tuloksia/Rengastus/laji/GRUGRU



A map of the cranes ringed in Finland and seen abroad. Source: www.luomus.fi.

Satellite cranes

In the autumn of 1991, two cranes were mounted with a satellite transmitter first time to study the migration routes of the Finnish Cranes. Later many cranes got satellite transmitters, and a new migrations route was found from Hungary to Spain.

Satellite telemetry was also used to research Eastern Flyway: Of the 18 satellite-tracked cranes, seven (3 from Finland and 4 from Estonia) reached wintering grounds in either Turkey, Israel, or Ethiopia.

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Flyways of Common Cranes (*Grus grus*) breeding in Fennoscandia

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Knowledge of migration flyways plays an essential role in understanding bird spatiotemporal distribution patterns and is important for conservation and management. Here we used >15,000 sightings of 1,473 colour-ringed Common cranes (*Grus grus*) to study migration patterns of birds breeding in five regions along a longitudinal gradient of Fennoscandia. A large proportion of colour-ringed cranes were resighted (recovered) during migration, and an analysis of the data confirmed that Fennoscandian cranes follow two major and diverging flyways: the Western European flyway, to winter mainly in France and Spain, and the Central European flyway with a large proportion of cranes wintering in Hungary and Israel. Birds originating from Finland show larger diversity in migration patterns, both regarding migration distance and directions, while cranes originating from Norway and Sweden showed more similarities. For Finnish cranes using the Central European flyway, 13 of 21 birds, with several resightings during the same migration season, migrated to winter in Southwest Europe or Northwest Africa, interconnecting the two general flyways. The results show that the Baltic Sea is a migratory divider, Common cranes with an origin west of the Baltic Sea are very rarely observed along the Central European flyway. However, cranes with a more eastern origin to a greater extent use the Central European flyway. Our study confirms that a substantial part of the cranes originating in northeast Sweden crosses the northern part of the Baltic Sea (at Norra Kvarken) and migrate via Finland, more so during autumn than spring. Moreover, only cranes originating from Finland have been recovered in Africa. Our results lighten common cranes' migration patterns and can be used for management, conservation and land use planning. For example, the gained knowledge can be used to coordinate monitoring efforts or to plan wind farms to avoid sites important for migrating soaring birds for overseas crossings.

Common Crane in the region of Right-Banked Ukrainian Polissia

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Common Crane (*Grus grus*) is a rare breeding bird species listed in the Red Data Book of Ukraine (2009). The total abundance within the country at the beginning of 1960th was estimated as 450-510 breeding pairs (bp), in 1977 - 200 bp, in 1994 - 100-200 bp, and in 2009 - 500-850 bp (Red Data Book of Ukraine, 1980, 1994, 2009). Common Crane occurs in all the areas of the forest nature zone, partially also in the forest-steppe nature zone, and on the north of the steppe nature zone on the Left Bank of the Dnipro River. It is relatively evenly distributed throughout Ukrainian Polissia. Although, this species is less abundant on the Left Bank of the Dnipro River than on the Right Bank (Breeding Bird Atlas of Ukraine, 2021). In the Right-Banked Polissia region in 2009, the abundance was estimated at 80-100 bp (Red Data Book of Ukraine, 2009). The study area is 100,000 km², and its boundaries on the North and West are the state border; on the East - the Dnipro River, and on the South - approximately 50°E.

The Common Crane study in the region of Right-Banked Polissia was carried out in 2010-2022, but most data were collected within the implementation of the international transboundary Endangered Landscape Programme project «Polissia - wilderness without borders» in 2019-2020, as well as within the framework of the state program «Chronicles of Nature» in the institutions of the Nature Preservation Fund.

According to our field data and analysis of available materials in the region, the Common Crane abundance is 645-773 territorial pairs (tp), a significant

part of which are breeding pairs. The most registrations belong to the central part of the study area – they are from Rivne (210-260 tp) and Zhytomyr region (230-250 tp), fewer are from Volyn' region (120-160 tp) and the western part of Kyiv region (50-60 tp). The southern limit of the range in the study area passes through the north of Lviv (14-18 tp) and Khmelnytskyi (21-25 tp) regions and the South of Rivne and Zhytomyr regions. The Common Crane distribution is limited by breeding habitats in swampy forests, roosting places, forage capacity of mires, coastal forests, meadows, pastures, etc. Most Common Cranes inhabit eutrophic and mesotrophic mires. The species, mainly foraging and roosting, use the oligotrophic bogs in the study area's North-central part. In some separate individual model areas, the density in potential breeding habitats was as follows: in Cheremskyi Nature Reserve - 0.64-0.72 tp/100 ha (Khymyn, 2016b), in Rivnenskyi Nature Reserve: Bilske and Grabunske departments - 0.54-0.64 tp/100 ha (Khymyn, 2018) and Biloozerske department - 0.40-0.61 tp/100 ha (Khymyn, 2014), in Polisskyi Nature Reserve - 0.4-0.7 tp/100 ha, in Tsumanske Forestry of Kivertsivskyi National Nature Park «Tsumanska Pushcha» - 0.43-0.61 tp/100 ha, and in National Nature Park «Prypiat-Stokhid» - 0.36-0.43 tp/100 ha (Khymyn, 2016a).

It is important to emphasize that 44.0% of the Common Crane population in the study area is under protection within the territories of the Nature Preservation Fund: 78.8% - in Khmelnytskyi, 55.1% - in Rivne, 47.9% - Volyn', 44.0% - Kyiv, 26.0% - Zhytomyr and 15.0% - Lviv regions. Additionally, the important role in species conservation and breeding habitats preservation belongs to Wetlands of International Importance (Shatsk Lakes, Prypiat River Floodplains, Stokhid River Floodplains, Cheremske Bog, Perebrody Peatlands, Syra Pogonia Bog, Somyne Swamps, Byle Lake and Koza Berezyna Mire, Polissia Mires), Transboundary Ramsar Sites (Stokhid-Prypiat-Prostyr, Olmany Perebrody Mires), Emerald Sites and IBAs that fully or partially coincide with protected areas.

The increase in the abundance of Common Cranes over the last decades was influenced by the creation of protected areas, which covered the most important species breeding locations, and the trends of breeding population restoration in Male Polissia, starting from the early 2000s. Secondary successional processes in ecosystems that were under pressure in the past (drainage reclamation, peat extraction) contributed to the recovery and increase in species abundance. Restoration of the hydrological regime, increase in biodiversity and branching of the trophic network are observed on these territories. In some places (Lviv region), the creation of breeding

habitats for the Common Crane is facilitated by the increase in the European Beaver (*Castor fiber*) population, whose activity causes a local rise in the water level and the flooded areas formation. The current Common Crane study took place with the participation of a larger number of ornithologists and amateurs than in previous decades, which made it possible to do more objective abundance estimation.

The authors want to express their gratitude to O. Dobrynskyi, T. Kryvulskyi, V. Ilchuk, V. Karabashchynskyi, V. Gedziuk, V. Kot, Yu. Kuzmenko, P. Horlov, S. Vlasiuk, M. Khoptynets, O. Khoptynets, P. Pecheniuk, Yu. Korkh, and V. Mateichyk for the provided data on Common Crane observations.

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Findings from the study of Eurasian crane population in Estonia

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Timing of central migratory flow of cranes from Estonian population along West-European flyway

Many articles have been published on the visual migration of Eurasian cranes, but the birds' origin is generally still unknown. This is especially true as cranes arriving from the north mix with those nesting in the south during the autumn migration or in wintering grounds. The migration of individuals in a given population can only be described by resightings of colour-ringed individuals or birds tagged by satellite transmitters. However, these databases are different: the number of birds marked with colour rings and resighted is relatively large but randomly distributed; the number of birds tagged with satellite transmitters is generally small, but the data set is very dense, e.g. 5 min intervals over 5 years.

Most of the observations of Eurasian cranes marked with colour rings have been used to map migration routes but less to describe migration timing. The cranes of the Estonian population use three different migration routes. In this case, only observations (N=4,424) from the West-European migration route, i.e. Estonia, Germany, France and Spain, were used. The number of resightings from other regions is limited and does not allow a description of the temporal course of the migratory flow. As these are random observations, 25%-50%-75% quantiles were used to describe the timing of migration. The time period between the lower and upper quantiles is referred to as the central migratory flow. The 50% quantile difference in the timing of the central migratory flow for different age groups was tested using the Wilcoxon-Mann-Whitney test. The Kernel Density Estimation function was used to illustrate the migration waves. Statistical analysis was performed using the program R.

Summing up all observations of cranes colour-ringed in Estonia, the average flow length of autumn migration from Estonia to wintering grounds in Spain is 60 days (15.09–13.11), and even longer for spring migration, 65 days (27.02–02.05). However, dividing the observations between subadult birds (2nd and 3rd calendar year birds) and old birds (1st-year chicks migrating with their parents and 4th calendar year and older birds), we see that their

autumn migration periods are the same, 60 (10.09 – 09.11) and 59 days (16.09–14.11) respectively, but that for adult birds the migration peak is statistically significantly 4-6 days later than for subadult birds. However, the statistically significant earlier start of the spring migration of adults (26.02), which is 2, 7, 13 and 11 days earlier than the central migration of subadult birds in Spain (28.02), France, Germany and Estonia, respectively. The length of the spring migration of adult birds (26.02–25.04) is similar to the length of the autumn migration (i.e. 59 days), but the subadults migration peak (28.02 – 06.05) in Estonia is 10 days later. This means that the minimal difference in the median migration flow of two days in Spain increases to a week in France and almost two weeks in Germany, indicating an increasing stopover period of subadults. In Estonia, however, given the average hatching time of the chicks, the actual mean migration flow of adults should arrive at least 15-20 days earlier.

Shift of wintering sites

In general, the northward shift of wintering grounds has been associated with climate change. In Estonia, the colour marking of Eurasian cranes started in 1997. The first observations from wintering areas in Spain arrived in 1999 when 20 cranes were tagged in Estonia. The first observations of cranes wintering in France were received in 2002 when a total of 59 birds were tagged in Estonia. In Germany, the first Estonian Cranes were seen wintering in 2006, when the number of tagged birds had increased to 160. Until 2008, the number of wintering birds appeared to be decreasing in Spain and increasing in France-Germany, but it has remained relatively stable over the last 13 years (Fig. 1). Unlike in Spain, however, no birds can be confirmed to winter permanently in France or Germany. The most frequent shifts in the wintering range of the Eurasian cranes marked with colour rings have been the following:

Spain > France - 20 individuals
Spain > Germany - 11 ind.
Spain > Germany - Spain 6 ind.
France > Spain - 17 ind.
France > Germany - 5 ind.
Germany > Spain - 11 ind.
Germany > France - 5 ind.

However, there are also backward and forward movements over the years, for example:
France > Germany > France > Germany > France - 1 ind.
Spain > France > Spain > France > Spain > France > Spain - 1 ind.

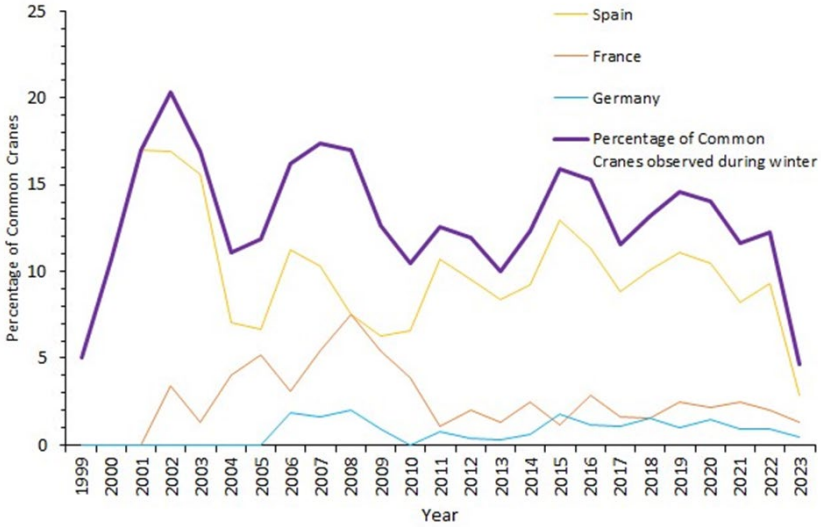

Fig. 1. Distribution of wintering Eurasian cranes among the three main wintering areas.

A partner is often found in the 2nd or 3rd year of life. It is also possible that the selection of wintering grounds and the establishment of a migration route occur together. Of the five pairs of tagged breeding adults, only one has changed wintering grounds between Hungary and Spain (from Camargue in France to Alessandria town area in Northern Italy). In the case of a pair that separated during the autumn migration, the male wintered in Poland and the female in Algeria against the Moroccan border. The development of a permanent wintering area in relation to age is illustrated by two cranes tagged with satellite transmitters as juveniles from the same territory:

Common crane "Uko" (hatched 2017)	Common crane "Soits 1" (hatched 2018, Fig. 2)
1cy – Tunisia	1cy – Tunisia
2cy – Hungary	2cy – Italy
3cy – Algeria	3cy – Poland
4cy – Hungary	4cy – Spain
5cy – Hungary	5cy – Spain

However, observations of one bird marked with coloured rings as an example of a perhaps extreme wintering area change can be cited.

1cy - Spain
4cy - Spain
10cy - Ethiopia
14cy – Spain.

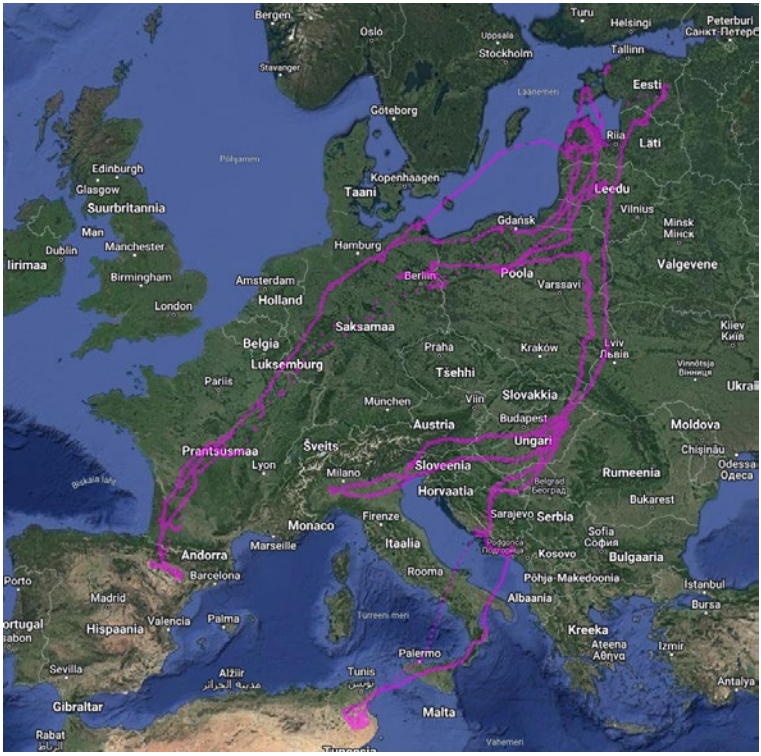

Fig. 2. Ageing and change of wintering sites of Eurasian crane „Soits 1“ (Movebank.org).

Acknowledgements:

The Estonian University of Life Sciences supported this work with the Research Development Project „Investigating strategy of the Common crane by satellite tracking.“ The authors are grateful to many colleagues and birdwatchers for their help in crane capturing in Estonia and to every birdwatcher looking for cranes in Europe, the Middle East or Africa.

The Eurasian Crane migration in Hungary

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The weekly counts of roosting cranes in autumn have been performed since 1994 in the Hortobágy National Park and since 2006 in other parts of Hungary. As we predicted earlier, the significant increase of the migrating flocks continued, and the number of individuals reached a peak of 160 000 birds in the Hortobágy region, and simultaneously we experienced record numbers of the other roost sites in the country. We thus conclude that during the autumn migration, Hungary has become the most important stop-over site for the species not just on the Baltic-Hungarian Flyway but also in the world.

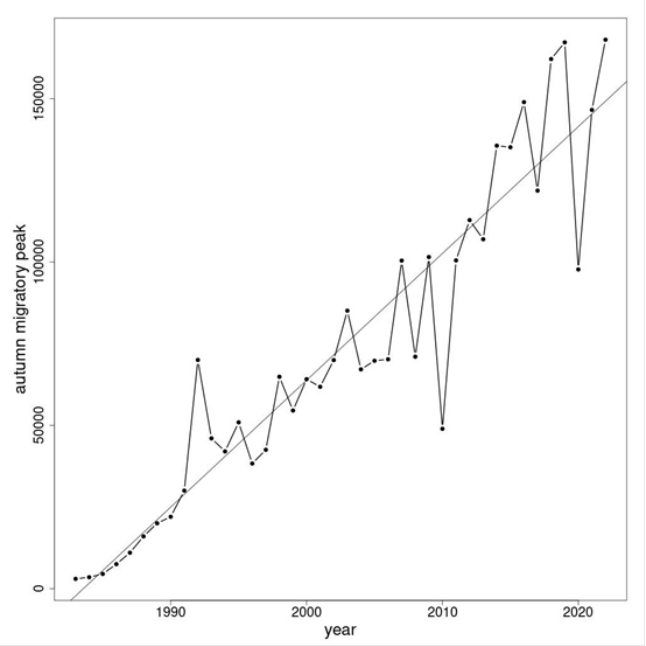

Figure. Annual peak numbers of migrating cranes as counted simultaneously in the region of Hortobágy

As the winters are getting milder in Central Europe, an increasingly large number of birds try to winter in the southern parts of Hungary and, recently, in the Hortobágy region, which is located in the middle part of Hungary. In autumn, the crane flocks usually forage on harvested agricultural fields but in winter, they can quickly adapt to feeding on cereal fields, causing serious crop damage. If this phenomenon will later become general, this can provoke a serious disagreement between farmers and nature conservationists.

Acknowledgements: Special thanks to the ranger services of Hortobágy National Park Directorate and the members of the following NGOs: Hortobágy Environmental Association, Birdlife Hungary and citizen birdwatchers for data collection.

The Crane population in Germany - new insights

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Introduction

During the last International Crane Meeting 2018 in Arjuzanx, France, the development of the dissemination of the Crane (Grus grus) in Germany since the 1970s was reported in detail (Lehrmann 2018). The population trend remains positive also with increasing numbers in the already colonised areas and further expansion to the west and south. The Crane population in Germany is currently not endangered. However, many federal states have reported declining reproductive numbers for several years, which is also evident during the ringing campaigns in June/July. If this trend continues, the population may shrink again. For this reason, we will briefly discuss the reasons for the decline in reproduction.

Material and methods

The first nationwide counting of crane pairs in Germany was made by W. Baer (1907). He determined a breeding population of at least 350 to 450 pairs for the beginning of the 20th century. This population continued to decline in the following decades. With the founding of the Arbeitskreis zum Schutz vom Aussterben bedrohter Tiere in der DDR (AKSAT) (Working Group for the Protection of Animals Threatened with Extinction in the GDR) in 1957, the establishment of an observer and caretaker network for the crane in East Germany began, which, in addition, to record the breeding sites also took over the protection. As a result, by the end of the 1970s, there was already a staff working almost nationwide in the territory of the GDR (Mewes 2014). In West Germany, the environmental foundation WWF Germany (World Wide Fund for Nature) and the Nature and Biodiversity Conservation Union Germany (NABU e.V.) carried out crane protection projects in Lower Saxony, Schleswig-Holstein and Hamburg from the 1970s onwards. In 1991, the working group «Crane Protection Germany» (AG KD) was founded. After that, state working groups were established in the federal states with crane occurrences, which have been recording and documenting the development of breeding populations. A. Lehrmann, as coordinator of the breeding population survey in Germany, regularly compiles the results and publishes them in the journal of the AG

Kranichschutz Deutschland. As a result of this, the population development all over Germany has been very well recorded and documented until today.

Breeding site monitoring usually records the presence of breeding pairs, clutch size or hatching success, the trapping and tagging campaign since 2012 has also provided information on reproductive success. Even though most of the young birds recorded can still not fly, their age and size mean they are already more likely to survive than small crane chicks.

Furthermore, there are various study areas to answer scientific questions; since 2009, there has been cooperation between Crane Protection Germany and the University of Greifswald and since 2022, also with the Swedish University of Agricultural Sciences and the Museo Nacional de Ciencias Naturales. Especially with the help of the data in iCORA, it is possible to make statements about population composition, breeding success and predation, among other things.

Results

Population, distribution, and density: As a breeding bird, the crane (Grus grus) continues to show a positive population trend in Germany. In 2021, the population in Germany has been estimated at 11,835 pairs, rounded to 12,000 pairs.

Due to the increase and densification of the population in the core areas (Mecklenburg-Western Pomerania with 21.6 pairs/100 km², Brandenburg with 9.7 pairs/100 km²), the crane has spread strongly to the northwest, west and south. Within Germany, the crane's contiguous range essentially extends across the North German Lowlands. Since the beginning of the 2000s, the German low mountain ranges have also been populated. The crane first settled in the federal state of Bavaria. Today, there are further settlements in the low mountain regions. It is worth mentioning that at altitudes of 800 to 900 m above sea level at the central and western Erzgebirge on both sides of the German-Czech border, three breeding records were found in 2021, and the breeding population in the Erzgebirge above 500 m is estimated at 10 to 15 pairs (Saemann et al. 2021). There is also evidence of the crane's resettlement in the Alpine foothills. In the meantime, the crane has been recorded as a breeding bird in 13 of 16 federal states. In comparison, in 1970, only 6 federal states had crane occurrences.

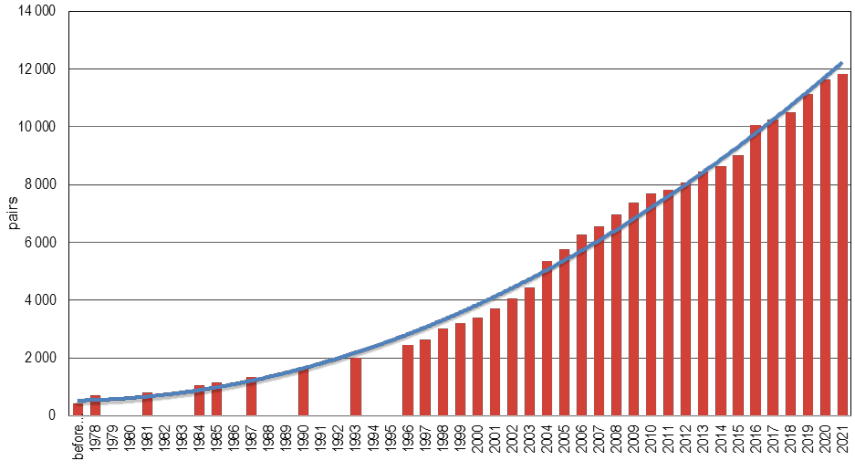

Figure 1: The breeding population development of the Common crane in Germany from 1977-2021.

An annual population survey is not possible in the northern federal states with large crane populations. To observe the trend of the population development in Mecklenburg-Western Pomerania, the federal state with the largest crane population has been recording crane pairs on 30 to 35 reference areas since 2015. The size of an area is approx. 30.5 km². However, this small sample is not suitable for extrapolating the total population. At least 10% of the country's area must be mapped. In 2023, the mapping will be carried out with a larger sample.

It is gratifying that the regional working groups of the federal states with lower crane occurrence try to record the increasing number of crane pairs every year, in particular, to continue documenting the development of expanding the distribution limit to the south and west. Only through this voluntary commitment is it possible to continue the unprecedentedly documented population development and spatial expansion of the crane in Germany over the last 50 years.

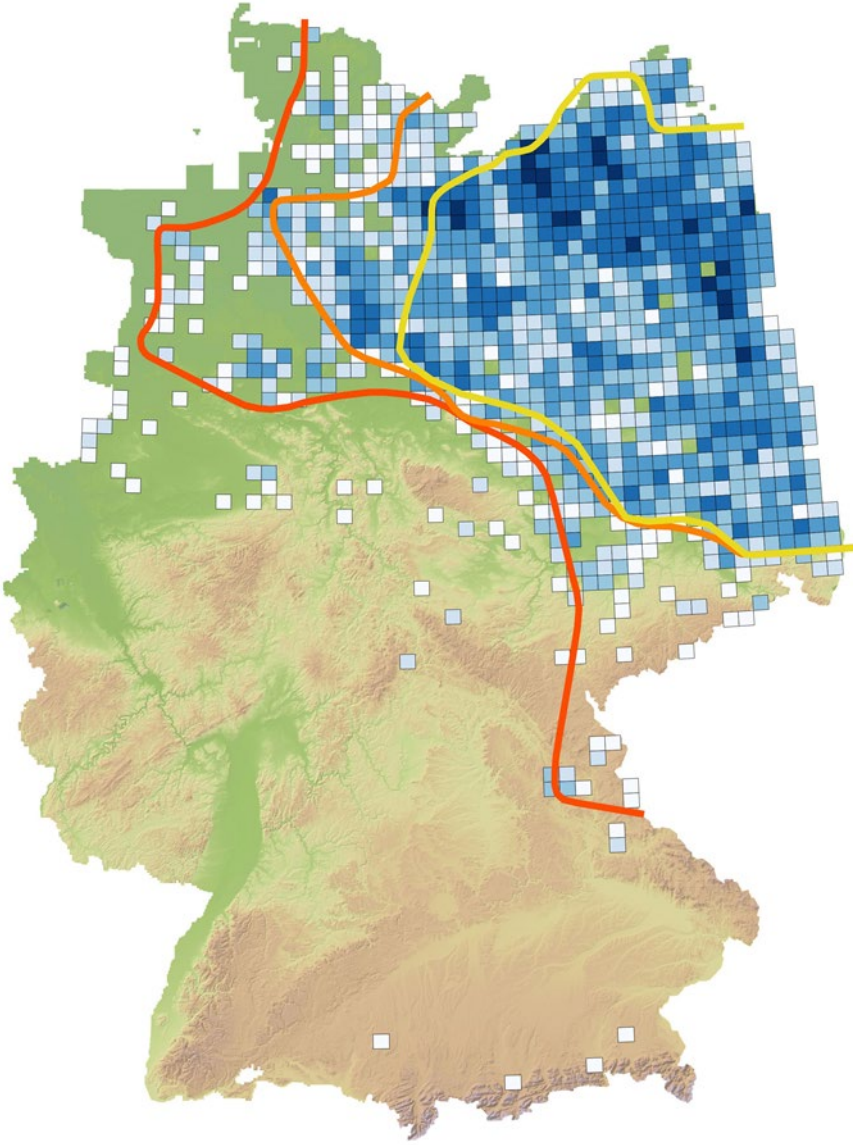

Figure 2: Current crane pair density in Germany (2021) based on MTB (1:25,000) and distribution borders of crane breeding pairs in Germany 1972 (yellow), 1993 (orange), and 2008 (red).

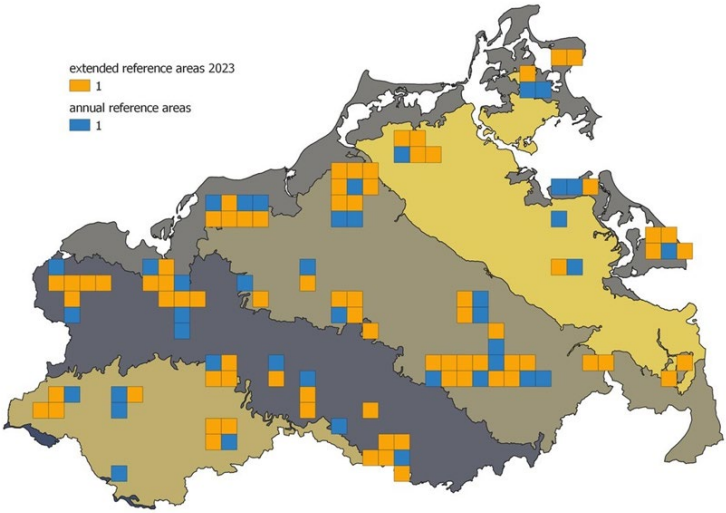

Figure 3: Overview of the reference areas surveyed in 2023 and their distribution in relation to the landscape zones in Mecklenburg-Western Pomerania.

Discussion

With a population of 12.000 pairs, the crane is currently not endangered in Germany. However, many federal states have been reporting declining reproductive numbers for years. If this trend continues, the population may quickly decline again.

Reproductive success: In the period from 10-30 June 2022, for example, 250 crane pairs were observed in Mecklenburg-Western Pomerania by the NABU Crane Centre team, from which 174 pairs had no young (70%), 40 pairs had one young and 36 pairs had two offspring. That reproductive success was better than the previous year (152 with no young, 33 one, 23 pairs two young, Fig. 4 (Nowald et al. in press). In 2019 (n=161 studied pairs) and 2020 (n=208 pairs), as many as 80% of pairs were found to be without offspring in June (fig. 5).

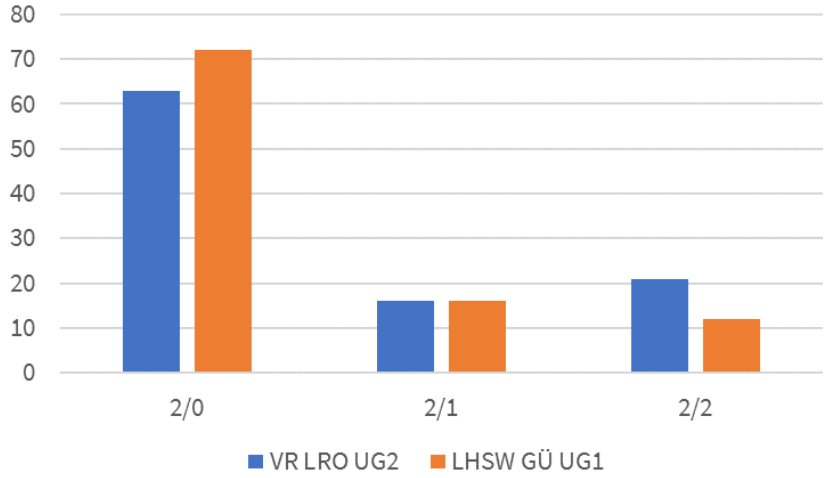

Fig. 4: Proportional family size of crane families during the ringing 10.-30.06.22 in MV (n=250 pairs, UG1 is situated at the crane gathering and resting site Langenhägener Seewiesen up to Güstrow; UG2 is the district Vorpommern-Rügen and border areas of district Rostock).

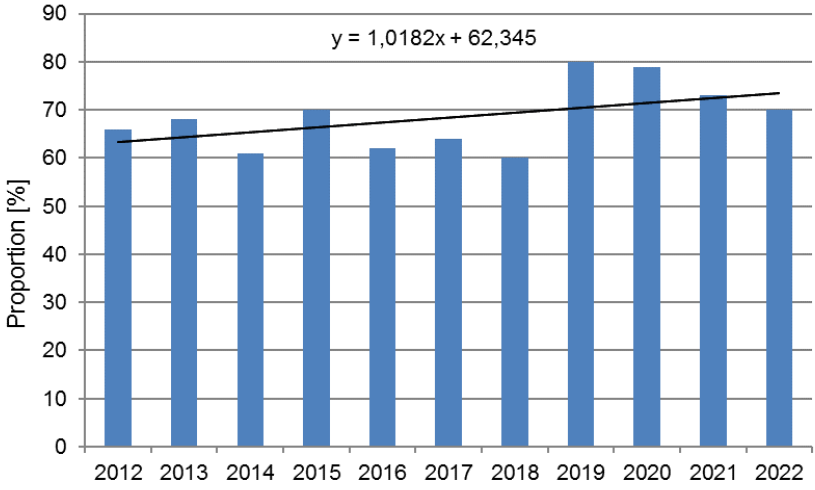

Fig. 5: Crane pairs without offspring during the ringing seasons 2012-2022.

The causes for the decline in reproduction are manifold and partly interdependent. One major factor is the extreme weather events of recent years. In addition to the significant warming trend in Germany, the third drought year in a row has been recorded in 2020. The east, west and north of Germany were particularly affected. The persistent lack of precipitation led to dried-up breeding sites and, therefore, to breeding failure. Mewes (2020) reports that in his study area in 2020, 47% of all breeding sites were completely dry and trough it unsuitable for breeding, 41% of the breeding sites had little water, and only 12% had normal water conditions. Evidence of breeding was found at only 20 % of the breeding sites investigated, and there was also a breeding failure of 50 % due to nests that had fallen dry.

Blahy & Henne (2020) report another effect of the lack of rainfall from their monitoring area. Numerous traditionally used breeding sites had also dried out here. This placed additional stress on the pairs that had occupied the few remaining suitable breeding habitats. They sometimes had to defend their breeding site against other pairs for weeks, which cost a lot of energy and weakened their condition.

The breeding cranes are also threatened by increased predation. With the help of new methods (e.g., wildlife cameras in the nest area), research on this was carried out at the University of Greifswald. The results show that the red fox seems to be the most effective predator because it can hardly be fended off by the breeding cranes. During the day and in the absence of the adults, the raven successfully destroys and carries away the eggs, the raccoon less so (Mewes et al. in press).

Another significant negative factor is the insufficient availability of food during the rearing period due to agro-industrial agriculture (Nowald 2003). A strong indication of this influence was provided by the body weights of the marked young birds, which, with a well-advanced plumage development, had a much lower mass than in all previous years (Mewes et al. in press).

The sum of all these influences has led to declining reproduction numbers for years, which has been proven, among other things, during ringing campaigns in Mecklenburg-Western Pomerania (Mewes et al. in press, Nowald et al. 2019, Nowald et al. 2020, Nowald et al. in press). The impact of this decline on population development will only become apparent with a time lag, as cranes can become old. Even in the wild, cranes can live for more than 25 years (Nowald et al. in press).

Acknowledgements

Crane conservation in Germany in its current structure with the extensive network of volunteer crane conservationists owes mainly to Dr Wolfgang Mewes, who passed away suddenly on 20.10.2022 after a short illness. He created the base for the breeding population survey in Germany, and without his work, we would not have these remarkable results today.

Further, thanks go to the many volunteers of crane breeding sites and the state coordinators of Crane Protection Germany.



Figure 6: Wolfgang Mewes in 2015 on the trip to the IV Eurasian Crane Meeting in the Daursky State Nature Biosphere Reserve - here in front of the Trans-Siberian Railway train at Irkutsk station before departure to Chita (photo A. Lehrmann).

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Evolution of the status of the Common Crane *Grus grus* in France from the 1970s to the present day

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Abstract

As observed in the whole continent, the long-term survey of the Common Crane in France reveals important changes in the last 4 decades. The demographic development of the species is caused by multiple factors, among them farming changes, landscape transformations, climatic changes and global protection-induced deep evolutions in its migratory behaviour. In France, the two main changes are the northward shift of the wintering area since the end of the 1970s and, more recently, the opening of new migratory flyways resulting in Cranes' colonization of the northern coast of the Mediterranean area. Some places became important staging areas for dozens of thousands of Cranes, and consequently, difficulties frequently occur in cohabitation with farming activities. However, demographic trends seem to be changing in recent years as a prelude to a settle-down in the overall numbers.

As a result of significant habitat protection and restoration programs and in the flourishing demographic context, some breeding pairs settled down to breed in the middle of the 1990s in the eastern part of the country, introducing the comeback of a French Crane population 160 years after it became extinct. These evolutions are strongly linked to similar changes in neighbouring but also more distant countries, as shown by the results of banding studies.

Résumé

Comme dans l'ensemble du continent, le suivi de la Grue cendrée sur les quatre dernières décennies en France révèle d'importants changements. Le développement démographique de l'espèce induit par de multiples facteurs, parmi lesquels l'évolution des pratiques agricoles, les transformations des paysages, les changements climatiques et la protection globale ont engendré de profondes modifications dans son comportement migratoire. En France, les deux changements majeurs sont le déplacement de l'aire d'hivernage vers le nord depuis la fin des années 1970 et, plus récemment, l'ouverture de nouvelles

voies migratoires entraînant la colonisation de la côte nord de la Méditerranée. Certains sites sont devenus des aires de rassemblement majeures pour des dizaines de milliers de grues générant souvent des difficultés dans la cohabitation avec les activités agricoles. Les tendances démographiques semblent toutefois se modifier dans les dernières années comme un prélude à un tassement des effectifs globaux.

À la suite d'importants programmes de protection et de restauration des habitats et dans le contexte démographique ambiant, certains couples nicheurs se sont établis au milieu des années 1990 dans l'est du pays, marquant le retour d'une population de Grues françaises 160 ans après sa disparition. Ces évolutions sont fortement liées à des changements similaires dans les pays proches mais aussi plus éloignés, comme le montrent les résultats des études sur le baguage.

Introduction

Crossing France represents a third of the Common Cranes' journey through Western Europe. Yet, despite some sporadic information, their specific study in France only began at the end of the 1970s following the discovery of the first wintering areas. At the same time, the now famous lake Der-Chantecoq was slowly flooded in 1974, quickly becoming an incredibly attractive place for migrating and wintering birds, especially for Cranes.

The French Working Group on Cranes (*Groupe Grues France*) was created in 1983 (the same year as the European one) and presented its preliminary results at the first European Crane Conference in Hungary in October 1985 (Riols 1987, Salvi 1987a). The following year, in cooperation with a famous nature journal and a national broadcasting radio, the Group succeeded in the first experiment of citizen science performed in France through a national public survey of migration during the autumn of 1986 (Salvi 1987b).

Then from 1990 to 1994, important programs for the protection of Crane places were developed in Lorraine, Champagne and Aquitaine with the financial support of the European Union and some national and regional institutions (Salvi et al. 1995). One of the results probably was the discovery of the first breeding pair in Lorraine in the spring of 1995 (Salvi 2017).

In November 2000, the 4th European Crane Conference was held in NE France, in Verdun and at the lake Der-Chantecoq with nice field discoveries around (Salvi 2003).

Ten years later, the total amount of wintering Cranes in France exceeded for the first time 100 000 birds and has almost never fallen below this level since

that date. Cranes always use the "traditional" places as well as some new important areas (Central France, Camargue) (Merle 2008, Kayser et al. 2018).

In December 2018, the 9th European Crane Conference held in Arjuzanx (France) was an excellent opportunity to present the evolutions observed in these last decades. During this time, large amounts of data have been collected at national and regional levels on the various phases of the annual cycle of the Common Cranes and are now regularly enhanced through online portals. Their analysis allows us to draw the long-term evolutions and to try to understand the reasons. For France, overall work has been presented recently (e.g., Salvi 2013, 2015a, 2016a, 2021, Salvi et al. 2021). A special focus deals with the situation in the French Grand Est region, which is the gateway to and from migratory flows in the country and, thus, a privileged place to study current developments (Salvi 2020).

Methods

Concerning the migration and stage areas, the data used for the study are mainly issued from intensive observation campaigns carried out since the early 1980s by many ornithologists' organisations and Crane watchers in France (see acknowledgements). The duration (more than 40 years in some areas), the regularity and the precision of the observations make it possible to highlight the populations' long-term evolutions and the Cranes' migratory behaviour. To characterise wintering, the values obtained during the simultaneous European counts in mid-January.

The special situation on the eastern facade of France is mainly studied for migration thanks to data collected via the Biolovision system, from Austria, southern Germany, Swiss and Italy, through the various French regions to Catalonia (Salvi 2016).

Monitoring breeding sites is conducted by a small local team in Lorraine (Salvi 2017).

Crane banding results have been analysed in some French regions thanks to data from the iCORA database and local observations (Ducout & Darblade 2008, Merle 2010, Kayser et al. 2018, Salvi 2018).

Results

Dramatic demographic change

At the end of the 1960s, the population of Common Cranes using the Western European migration route was estimated in France at a level of 17 to 18,000

individuals (Erard and Petit 1969), given probably below reality but overall cross-checked ten years later by the first winter counts in Spain (Fernandez-Cruz et al. 1981). Various assessments agreed in 1985 to raise this estimate to 30-35,000 birds, reflecting the beginning of a significant increase (and an improvement in the quality of counts?), which leads the current population to about 350 to 400,000 Cranes (Figure 1).

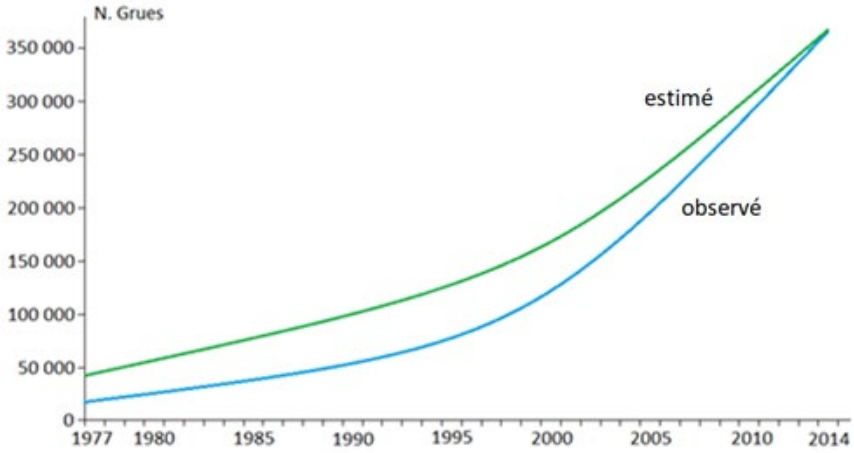

Figure 1: Changes in the population of Common Cranes transiting through the Western European migration route in recent decades. In blue: field data likely undervalued, in green is a hypothetical reconstruction of demographic evolution based on an overall annual mortality rate of 10% (according to Alonso et al. 2016).

The causes of this development have been discussed (Salvi 2013). It is illustrated, among other things, by the observed increase in breeding numbers in many European countries. This is manifested by the densification of pre-existing nuclei of nesting populations and an extension of the nesting area, particularly to the west, to the United Kingdom and eastern France (see review in Salvi 2017).

It also induces the formation of impressive concentrations at some staging sites and, especially for the French Grand Est region, on the lake Der-Chantecoq (more than 200,000 Cranes in November 2014, 260,000 in November 2019...), where the world records known for this species are pulverized. These trends are also observed in a lesser proportion at various sites in Lorraine, Central France, Aquitaine.

Finally, this dynamic demography has logically increased overwintering numbers at most sites concerned.

Migration modalities evolve spatially

The migration routes of the Common Cranes run along paths marked with traditional staging areas and thus are rather spatially stable except during specific meteorological situations. An extreme case is well documented in the autumn of 1982 with a massive western drift of the migratory flow to the shores of the English Channel and Western France (ONC 1983, Salvi 1995).

However, the development of new, particularly attractive sites can lead to significant changes in the migration route upstream and downstream. An obvious illustration is the Lake Der-Chantecoq, with a marked concentration effect of birds since its creation. More recently, the restoration of a large set of wetlands in Germany south of Bremen (Diepholzer Moorniederung) has led to a significant extension of the migration route to the north. Finally, regional demographic changes also contribute to these changes.

Thus, through the last century, the Lorraine region in the heart of North-Eastern France has seen the flows that fly over it change over time (Figure 2).

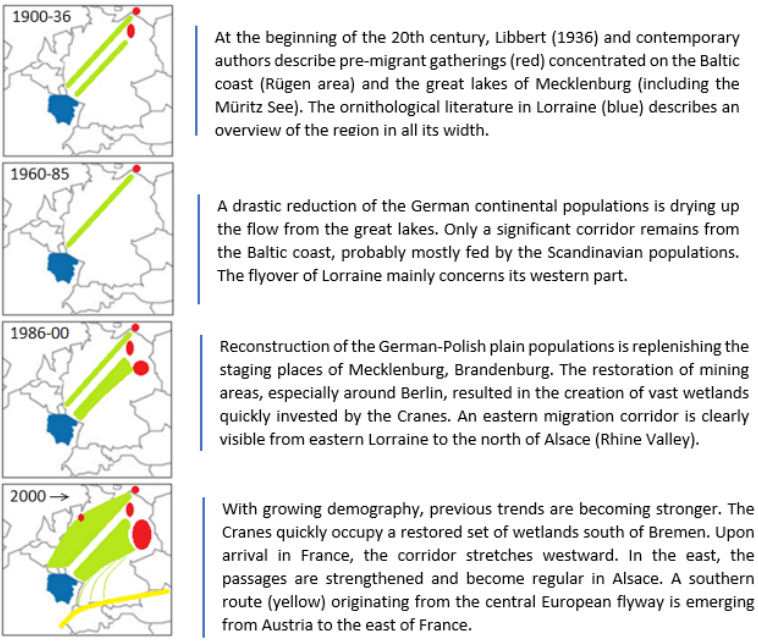

Figure 2: Schematic evolution of the migration routes of Common Cranes between North-East Germany and Lorraine (East France) during the 20th century according to available data.

The specific situation of the Camargue (Salvi 2016)

Until the end of the 1990s, the Common Crane was only exceptionally reported in very small numbers in the Camargue, far away from the traditional flyways. From 2004 increasing numbers of birds were observed from one winter to the following reaching more than 20 000 in the last years (see Fig. 6).

Looking at the recent data, the Cranes transiting the Camargue area in autumn are coming from two different pathways (Fig. 3):

- Cranes originating from the central European corridor flying west through Austria, North Italy, and South Bavaria along the Alps to reach Provence and the Camargue;
- Cranes from the western corridor fly southward along the Rhine and the Rhône valleys. As shown by the banding results (Kayser et al. 2018), the former probably spent the whole winter in the Camargue as the latter seemed to continue toward Spain.

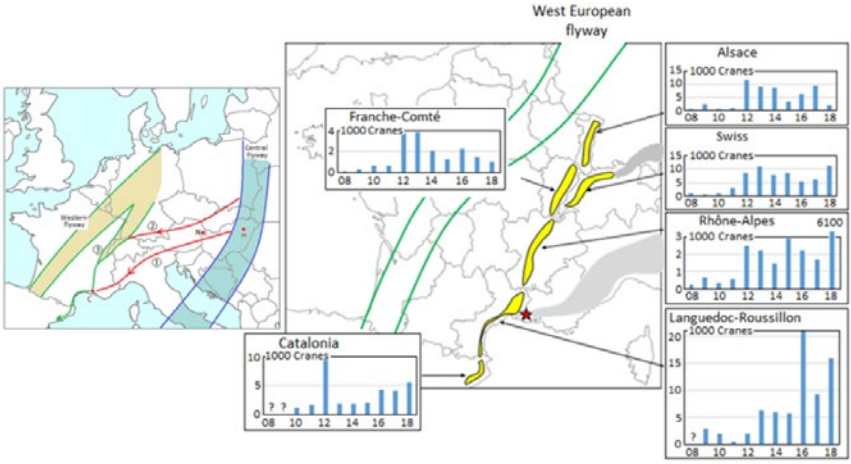

Figure 3: Autumn migration of Cranes in eastern and southern France and neighbouring regions toward the Camargue area since 2008 (yellow). Grey shapes: arrival corridors of Cranes from the central European route.

During the spring migration, the same separation in two flows is observed (Fig. 4):
- one coming from Spain along the Mediterranean coast and flying north along the Rhône valley, then joining the western flyway,
- the other leaving the Camargue and flying east to North Italy, Slovenia and joining the centre European flyway in west Hungary.

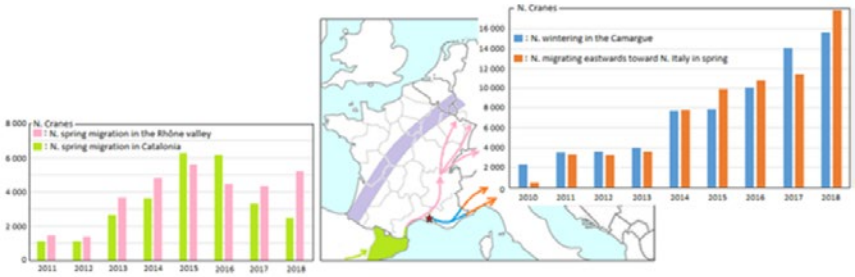

Figure 4: Different flyways of spring migration in the north Mediterranean area:
- left, number of Cranes observed from Catalonia (green) to the Rhône valley (pink)
- right, number of Cranes observed wintering in the Camargue (blue) and migrating to North Italy (orange)

The increasing numbers of wintering Cranes in the Camargue can reasonably be expected to result from transfers from North Africa, particularly Algeria, where drought and changes in farming activities considerably degrade overwintering conditions (Hafid et al. 2012).

Migration patterns change over time

In Eastern France, as in Europe, the temporal modalities of post-nuptial migration show good overall stability from year to year, with usually two significant waves in October and November. However, a third late influx of varying importance regularly occurs in December and sometimes even in January for birds clearly attempting a northernmost wintering (Nowald et al. 2012). More recently (2013, 2015, 2019, 2020), perhaps initiated by periods of severe summer drought, noticeable migratory movements, although limited, occur early in September.

On the other hand, the chronology of prenuptial migration has been deeply altered in recent decades. While it was mainly held in the first half of March until the early 1990s, a significant part is currently taking place in February, and a very recent trend shows the first prenuptial flights starting at the end of January (Figure 5).

This evolution is partly linked to the perception of the early departure of Cranes wintering in France. It also intersects with the trend previously mentioned for wintering near nesting areas, especially in Germany (Nowald et al. 2012). Among other causes, climatic changes, marked by warmer winters since the late 1980s, undoubtedly affect this phenology (Salvi 2012a).

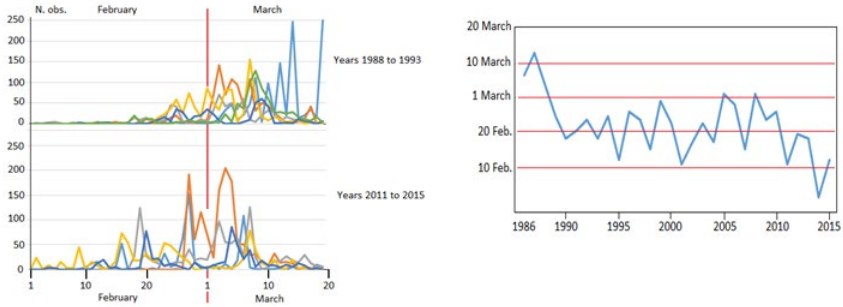

Figure 5: Phenology of the prenuptial migration of Common Cranes in Lorraine in recent decades. Left: chronology of the number of observations; right: changes in the date of the first observed migration movements (Salvi 2015b)

A stabilized number of wintering Cranes?

Except for a few isolated and sporadic cases, the first group of wintering Cranes in France was observed on Lake Der-Chantecoq during the winter of 1975-76. The observation was repeated the following year and extended to Lorraine and Aquitaine even if discrete previous presences may have escaped the observers (Salvi 1984, Petit 1986, Riols 1987).

After a slow growth until the early 1990s, the number of birds is growing rapidly. Thus, the French wintering total reached one-third of the European population in 1996 (Salvi et al. 1996) and exceeded 100,000 birds in 2010 (Réseau Grues France 2011) while new French regions have been invested (Central France, Camargue) (Merle 2008, Kayser et al. 2018) (Table 1).

Nowadays, every year about 35 places in France are used at various levels by Cranes to take some rest during the migrations (Fig. 6). Most of them are also wintering sites, sometimes for more than 40 years (Table 1).

On or near the main migration corridor, the evolution over time of the number of wintering Cranes is comparable at all sites, with a first phase of slow growth. Then a faster increase to a less or more asymptotic level in recent times (2014-15). However, from one year to the next important variations sometimes occur (Fig. 6). The overall situation suggests that the total number of Cranes on this route could begin to stabilize and perhaps decrease. It is also obviously observed at the national scale (Fig. 7).

Table 1: Historical wintering of Common Cranes in France up to 2022. * - about 10 sites from Limousin to Nivernais

Wintering area from N to S	First wintering		Maximum	
	Winter	N. Cranes	Winter	N. Cranes
Lorraine	1977-78	32	2021-22	36 000
Champagne-Ardenne	1976-77	34	2013-14	47 620
Central France*	1997-98	36	2018-19	25 000
Grand South West**	1977-78	25	2018-19	77 074
Camargue	1999-00	67	2021-22	27 426
Total France	**1976-77**	**34**	**2021-22**	**173 236**

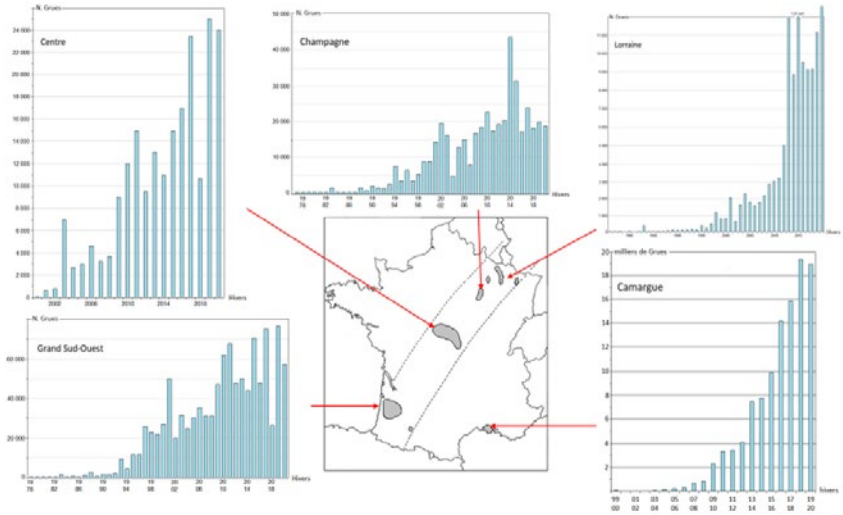

Figure 6: Evolution of the wintering of Common Cranes in different regions of France. NB: pictures are not at the same scale, see table 1.

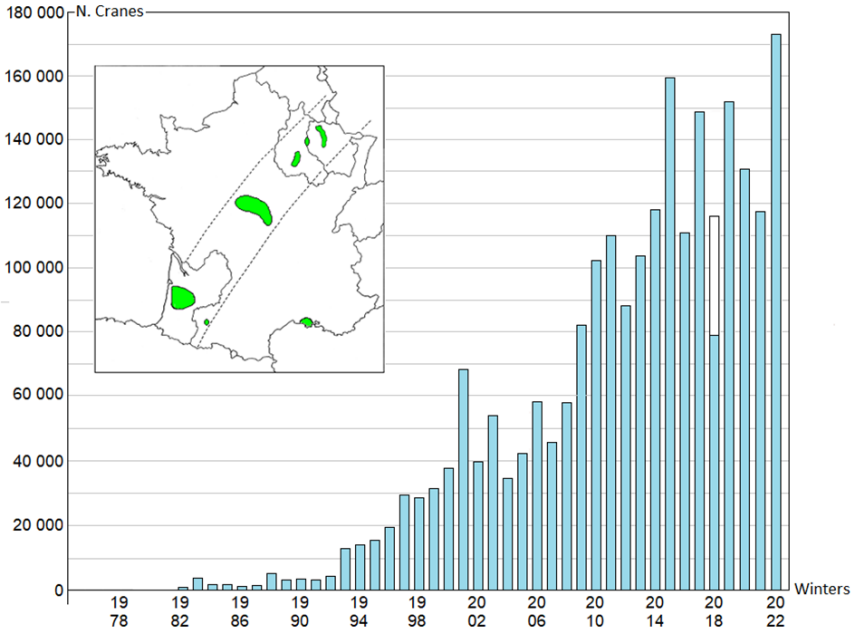

Figure 7: Yearly evolution of the total number of wintering Cranes in France.

Some years, wintering upstream of France (Germany) naturally leads to a sometimes-significant reduction in French numbers (2018, 2021) and *vice versa* (2022).

Finally, the Camargue, fuelled by flows from the Central European migration route previously wintering in North Africa (Algeria, Tunisia, Libya), shows a different trend with a steady growth of the numbers, perhaps slowed recently by the expansion of wintering sites in northern Italy but also in Serbia, Bosnia.

An increasing breeding population

In previous centuries, the Common Crane was probably nested in various regions of France, but very few data are available on this subject. The only verified data are issued from Aquitaine, in southwestern France. They attest that, in the first decades of the 19th century, Cranes used to breed there in wide, wet, sandy moors, now densely covered by pine trees. Some information was also found in the east of France but could not be really attested.

It was not until 1985 that breeding cranes were again discovered in France. This occurred in Normandy, a surprisingly far away from the usual Crane migration route. A pair bred here from 1985 to 1991 when one of the adults disappeared. Cranes were still sighted in this area during the following years but did not breed (Moreau 1990 and in litt.).

In Lorraine (eastern France), following various observations during previous summers, the first breeding pair was discovered 1995 near a usual resting and wintering place. Since then, nesting Cranes can be observed in 4 other areas of the region and at least 20 breeding pairs are currently known. Interestingly, these population nuclei can be quite far apart, sometimes more than 100 km (Fig. 8) (Salvi 2017).

This return occurs in a very positive demographic context in Europe, but compared to some other recently colonized countries, the evolution seems relatively slow despite many favourable and available habitats. It could be limited in Lorraine and elsewhere in France by predation, primarily due to large wild boar populations, but it could also be due to insufficient surveys. In fact, a few unsuccessful breeding attempts have been observed in other areas.

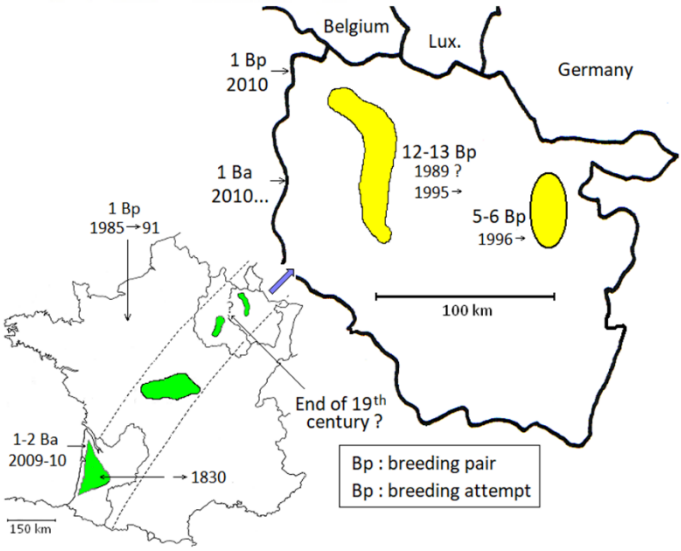

Figure 8: Breeding Cranes in Lorraine and national context (from Salvi in Prange 2016).

The migratory behaviour of these resident birds is unknown, but one can believe that they probably spend the winter in Lorraine within the large flocks of wintering Cranes. In any case, the breeding adults can usually be observed on the nesting sites as soon as in the early days of February. Accurate monitoring of these small populations is planned to study their eventual migrating and wintering habits.

Ringed/banded Cranes

In various parts of the country, some studies have attempted to analyse sightings of banded Cranes, particularly regarding the origin of the birds (Fig. 9). However, comparison between different regions should be cautious because of the number of data and the time span considered by the studies. Moreover, the locations observed do not prejudge the final wintering destination of the birds, and their interpretation must also be cautious.

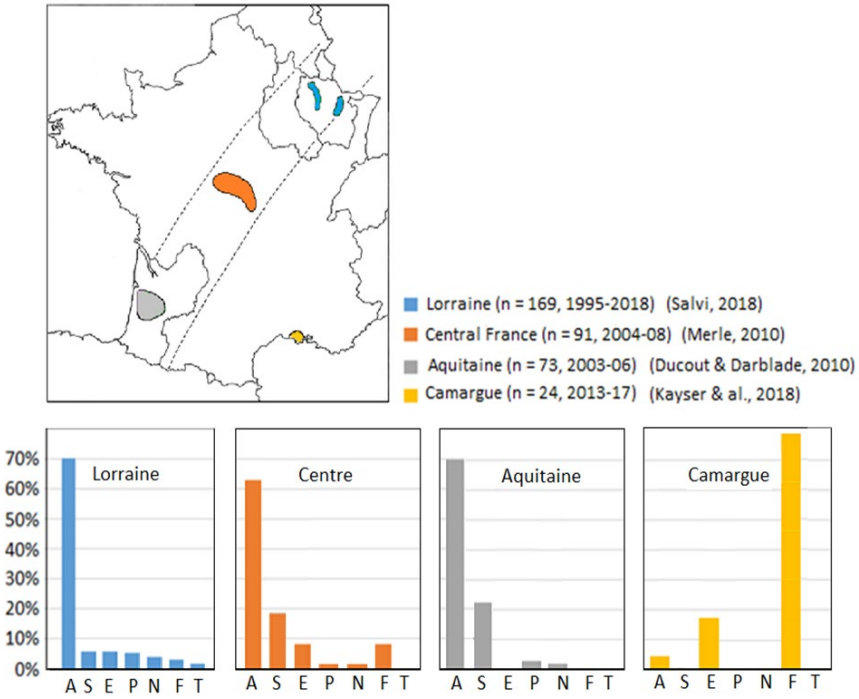

Figure 9: Origin of banded Cranes observed in different regions of France. A : Germany, S : Sweden, E : Estonia, P: Poland, N : Norway, F : Finland, T : Czech Republic

However, the results are clearly different between the regions along the western flyway on the one hand and the Camargue on the other.

In the first case, 60 to 70% of the observations concern Cranes banded in Germany. Sweden Cranes seem to migrate to areas further south than eastern France. On the other hand, Cranes from central European countries (Poland, Czech Republic, Latvia) seem to be more frequently observed in the eastern part of the country.

In the Camargue, about 80% of the banded Cranes come from Finland and 17% from Estonia, consistent with the origin of birds flying along the centre European flyway. These two Nordic countries are also represented in other regions but at much lower rates.

Discussion

In recent decades, despite the attractive effect of Lake Der-Chantecoq, the flyway used by the Cranes in Western Europe during the post-nuptial migration has widened significantly in the eastern borders of France. Furthermore, new roads have emerged from the Central European flyway across Austria, Swiss, South Germany and North Italy along the Alps and to join the Mediterranean coast (Salvi 2016b). These birds, previously wintering in North Africa (Algeria, Tunisia, Libya), are now spending the winter in the Camargue, probably for increasing numbers in North Italy and, to some extent, in former Yugoslavia (Serbia, Bosnia).

During the last 40 years, the number of Cranes wintering in France has steadily increased. Despite the sometimes-observed massive concentrations of staging birds, it recently reached a relative stabilization or even the beginning of a decrease. If this evolution characterizes Western Europe as a whole, it could be linked to a global slowdown in population growth using this route. The years to come will test this hypothesis of decline which could be linked to different environmental factors and especially to feeding conditions in relation to farming activities:

- harvesting techniques that produce less waste available for Cranes,
- rapid burying of crop residues after harvest,
- intermediate (and/or main) crops of no interest to Cranes.

The state of wetlands that are suitable for nesting appears less unfavourable with both effective protection measures at the European level and the ability of birds to adapt to tiny environments in areas with a high density of breeding pairs. Moreover, the potential for development in Western Europe seems

significant but subject to limiting factors (drought, predation, quiet) which can act in concert.

Although undoubtedly underestimated, the French breeding population (established only in Lorraine in the current state of knowledge) remains relatively modest, whereas its establishment began more than 25 years ago. However, unlike the situation in the Netherlands and the Czech Republic, this population is strongly discontinuous with the Polish-German area. This may be one of the reasons for this low growth rate. Colonization is not done by simple peripheral extension but only by swarming "random" establishment of pairs thanks to the production of their young birds.

The main roosting places are well-known and often protected along migratory routes. No significant threat exists, but any persistent droughts due to climate change could be a game-changer in the future. This is the case in North Africa, leading the Cranes to redirect their winter habits to North Italy and South France.

In this context, banding and telemetry techniques provide much additional information. They allow us to explore the individual strategies of some birds and understand some current developments (changes in wintering sites, choice of feeding places, colonization of new areas, etc.). Such a program could bring a lot of further information to France.

Conclusion

Monitoring the migratory cycles of Cranes over the past 40 years in France has made it possible to describe fundamental long-term changes. Thanks to international cooperation, their analysis was carried out with the information available in other European countries upstream and downstream. Consideration of environmental factors along the flyway, including the current status of wetlands, agricultural activities and climate change, helps to understand the phenomena observed and guides reflection on the environmental management measures to be implemented. Work for an effective strategy for the conservation of the species.

An impressive development of Common Crane populations has marked the last decades. During the winter seasons, they have taken full advantage of changes in agricultural practices, notably the expansion of maize on a European scale, a degradation of rural landscapes leading to better security of birds for migratory stopovers, and the development of vast artificial wetlands offering good conditions of tranquillity, widespread protection and favourable climate change (Salvi 2012a and b).

A recent evolution seems to draw a reversal of the situation, perhaps induced by a degraded feeding factor. If it is confirmed in the following years, this development risks generating, at least in the first period, increasing conflict situations with farming activities as already observed in Eastern France (Salvi 2012b, 2014).

However, the next few years will confirm (or not) the stabilization/decrease of the wintering population in France (correlated with a possible global stabilization of the population migrating along the western European flyway?). Furthermore, they will also provide new data about the evolution of wintering in North Africa and its possible entire transfer to the north of the Mediterranean Sea.

Acknowledgements

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Development of the wintering of the Common crane (*Grus grus*) in central France

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The wintering of the Common crane started at the end of the '90s in central France. Different steps appeared in the last 25 years: on average, 530 cranes were wintering between 1999 and 2008, 13,000 between 2008 and 2016, 21,000 between 2016 and 2022, and last the census in January 2023 gave a number of about 40,000 wintering cranes. During the past five winters, Central France was four times the second place in France for wintering cranes, while Aquitaine is always at the first rank; the Camargue is now at the 3rd rank and Lac du Der at the 4th rank.

Our 2022-2023 survey gave a good idea of the behaviour of the wintering common cranes in recent years. Our small team was composed of 10 regular observers, joined by about 20 other people for the significant countings. Half of the dozen of the site were regularly counted, and we organized two simultaneous countings, 26th November 2022 for the first one and 14th January 2023 for the second. As usual, we looked for ringed cranes, but during winter 2022-2023, we focused our searches on the eastern part of the wintering area, along the Loire and Allier rivers: our team made 798 observations of 251 different ringed cranes; it helped us to understand the wintering in our area, and the changes in the behaviour of the cranes. The first cranes arrive in central France during the first decade of October (2nd October 2022), but numbers remain relatively low until the end of October; most of the time, it is a stage on the way to Spain. From then on, there is a steady increase during the last days of October and the first days of November, leading to high numbers between mid-November and mid-December: usually between 35,000 (26th November 2022) and 50,000 (11th November 2019, the peak of season 2019-2020).

During the first week of December, some cranes leave central France to reach Aquitaine or Spain, and numbers usually decrease. New arrivals from Germany generally occur after mid-December; depending on the ratio of arrival/departure, the peak of presence is either in November or late December - early January. Numbers are relatively stable for about two months, although few southwest or northeast movements can be recorded. A dozen of sites hold cranes in central France. Excepted the Regional Natural Park of the

Brenne, located 110 km further southwest, which seems to be a separate entity, they are close together, at a distance of 20 km to 40 km.

Nowadays, many movements of cranes between sites are now recorded during these two months, attested by sightings of ringed cranes. It is a new behaviour: it was not the case before 2010, with cranes very faithful to just one site. It is probably due to agricultural changes and an adaptation of the cranes, which have to wander more for food resources. Twenty years ago, wintering cranes were leaving central France in early March. Still, winter after winter, we notice a shift in the departure, earlier and earlier, and now, most of the cranes leave our area between the 10th and the 12th of February. Depending on weather conditions (mainly strong winds from the northeast), some cranes arriving from wintering places of Spain stop for a few days, sometimes a week, in late February – early March, like in 2023. Very few cranes remained at the end of March; most were ill or disabled. The increase in the number of wintering cranes in recent years in central France can be explained by climate change.

Contrary to what happened before 2012, winters are now without periods of snow on the ground, very few days with temperatures below 0°C are now recorded, and we record a lack of rainfall in recent years. Thus, the level of our major rivers, Loire and Allier, is shallow, sometimes similar to the level of these rivers in August: it provides a lot of suitable sleeping places for cranes, often closer to their food resources. During the winter of 2022-2023, several temporary sleeping places have been occupied by cranes just for one to three weeks. For example, at the end of November 2022, we recorded six new sleeping places within 15 km of the Loire River that had never been used. It was the main difficulty for our team to find these temporary sleeping places, and we probably missed several of them.

We estimate that between 55 000 and 80 000 Common cranes made a stage in central France during the winter of 2022-2023, among which 40 000 spent the whole winter. Central France has become the 2nd most important place for wintering cranes in France, with 20% of the population in France and about 10% of the population in Western Europe counted in mid-January.

Behaviour of the Common cranes (*Grus grus*) in the area of the National Nature Reserve of Arjuzanx: 15 years of monitoring

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Abstract

Since the return of the first 70 birds in 1985, the Common crane (Grus grus) has become the emblematic species of the now National Nature Reserve of Arjuzanx, which is located in a vast territory, the Landes de Gascogne, offering favourable conditions for wintering and migrating cranes.

In the area of the Arjuzanx Reserve, 15 years of monitoring have allowed us to understand the behaviour of the cranes better using the study of several parameters: regular counts of wintering and/or migrating birds, monitoring of roosting places, search for birds equipped with rings or GPS, but also the analysis of agricultural practices in the foraging area.

The Arjuzanx Reserve is a leading site for the wintering of Common cranes. The population, using the Reserve, fluctuates according to the year and represents (Wetlands International counts):

- 38% to 60% of the total cranes counted in the Landes de Gascogne.
- 11% to 24% of the total cranes counted in France.

During periods of high-water deficit, the Arjuzanx Reserve retains a high potential for cranes due to the existence of lakes which preserve their capacity to be used as sleeping places. The number of cranes can then reach 40,000 birds. During episodes of heavy rainfall in autumn and winter, the cranes prefer to occupy other permanent or temporary roosting places closer to the foraging areas: the number of cranes using the Reserve then decreases significantly, but temporarily.

Since 2008, 818 banded cranes have been observed in the region of the Arjuzanx Reserve; banded cranes come from all countries located on the western migration route, with a preponderance of German cranes (52.69%). The Arjuzanx Reserve, the last primary site before crossing the Pyrenees,

plays an important role for young cranes: 23.59% of the banded cranes observed were on their first migration, and 62.22% were immature birds.

The other advantage of the Reserve is that it is located near an extensive agricultural area. During the study period, there has been a significant and continuous decline in maize cultivation (-53.78% compared to the early 2000s and -45.72% compared to 2009). This evolution can be explained by changes in cultivation practices but also by the rules of the CAP and environmental regulations. This negative trend has led to questions about the availability of food resources and their influence on the wintering of the Common cranes in the area, even though no decrease in wintering numbers has been observed.

The 2022 / 2023 wintering case, which occurred after a significant summer and autumn drought, illustrates this question. New crane behaviours appeared: birds dispersed over the entire foraging area from the beginning of November and used fields traditionally neglected by the cranes (winter cover). Is this a one-off strategy on the part of the cranes, or is it the beginning of an adaptation of the species to unavoidable climatic and agricultural changes?

Introduction

Since the return of the first 70 birds in 1985, the Common crane (Grus grus) has become the emblematic species of the now National Nature Reserve of Arjuzanx which is in a vast territory, the Landes de Gascogne, offering favourable conditions for wintering and migrating cranes.

In the Arjuzanx Reserve area, 15 years of monitoring have made it possible to understand the behaviour of the Common Cranes through the study of the numbers of wintering and/or migrating birds, the monitoring of roosts, the search for birds equipped with rings or GPS and the analysis of agricultural practices in the foraging area. The results obtained allow a better knowledge and understanding of the importance of the Common Cranes of the Arjuzanx Reserve in its territory but also on a national and European scale.

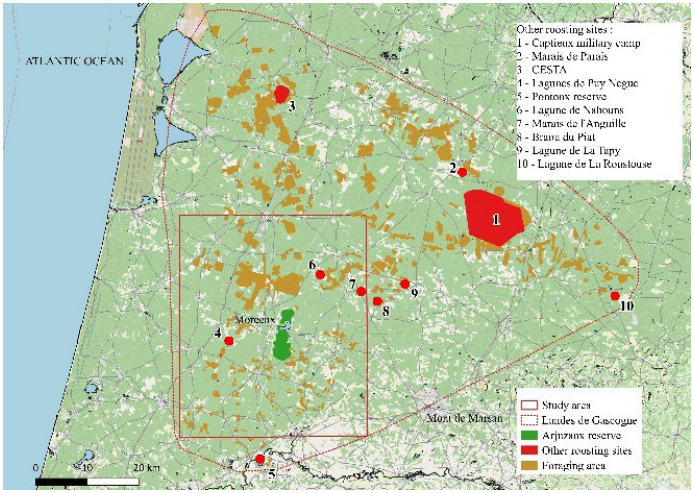
Material and methods

To improve knowledge of the wintering and migration of the Common Cranes in the Arjuzanx sector, the naturalists of the Arjuzanx Reserve have carried out data collection work based on a study program including the following themes: monitoring of wintering and migratory crane numbers, identification of the origin of the cranes, approach to the behaviour of the cranes, monitoring of changes in farming practices and monitoring in agricultural and environmental regulations.

1 – STUDY AREA AND PERIOD

The study area is about 20 km around the Arjuzanx Reserve and includes the main fields (10,300 hectares) used by the Common Cranes roosting in Reserve (Map 1).

The study period runs from winter 2008/2009 to winter 2022/2023, i.e.,15 years of monitoring.



Map 1: Study area, foraging fields and roosting places in Landes de Gascogne

2 – THE STUDY PROGRAM

- Monitoring the number of Common Cranes

Monitoring of staging and wintering numbers is carried out by two weekly counts (Mondays and Thursdays) from the arrival of the first birds (early October) to the departure of the last ones (late February/early March). They are carried out by 3 or 4 people from a 12-metre-high observation tower located in the southern part of the Reserve.

- Characterization of migrating and wintering Common cranes

The identification of cranes marked with rings and/or transmitters is carried out:

- in reserve on roosting sites from various bird hides. It occurs in the morning between daybreak and 2 to 3 hours after sunrise.

- from roads and forest paths open to traffic in the foraging area. It takes place during the day between 9 am and 4 pm.

The data are recorded in the European iCORA database. Their analysis allows us to know the origin of the cranes, their age, their distance from the ringing site, and to specify their status (wintering or migrating). The term «age» is used to designate the number of days between the bird's ringing date and the observation date.

Obtaining information on cranes equipped with GPS-GSM relies on the cooperation of the ringers so that they agree to communicate the data obtained in the wintering area. These data allow a detailed knowledge and understanding of the behaviour of the birds: migratory routes, exchanges between roosts, changes in foraging areas, disturbance, etc.

- Behavioural study

This study carried out ethological surveys during 4 wintering seasons from 2009/2010 to 2013/2014 using the Scan sampling method on groups of cranes occupying different areas (nature of the crop or intercropping...) and at different times. It was repeated for 2 wintering seasons in 2019/2020 and 2020/2021.

- Agricultural and environmental rules

To know the regulations of the farmers in the study area, a synthesis of agricultural (Common Agricultural Policy) and environmental rules was carried out.

- Monitoring of cultivation practices

Given the visible evolution of the crops in the fields used by the cranes, farming practices were monitored from the 2009/2010 wintering season until the 2020/2021 wintering season.

This monitoring was carried out on a control area representing 10,307.13 hectares, including plots around the Arjuzanx Reserve. On these plots, the nature of the crops was recorded after the harvest and before the start of the wintering period (October/November), distinguishing between grain maize, seed maize, other crops (including vegetables and sweet maize), meadows and various installations (solar panels). From the 2018/2019 wintering season onwards, two additional passes were made in December/January and February to record the cultural evolution of the stubble plots of maize grain.

Results

1 – Numbers of Common Cranes

1.1 – Numbers of Common Cranes using the Arjuzanx Reserve

During the 15 wintering seasons of the study period, 509 counts of Cranes at the roosts in the Arjuzanx Reserve were carried out, an average of 35 counts per wintering.

The 2020/2021 wintering period (Fig. 1) represents wintering periods with low numbers: a maximum of 17,705 cranes on 16/11/2020. From 15/11/2020 until 31/01/2021, the average is 8,553 cranes, with a minimum of 486 cranes on 27/12/2020.

The 2018/2019 wintering period (Fig. 2) is typical of high numbers with a maximum of 39,392 cranes on 10/12/18. From 15/11/2018 until 31/01/2019, the average is 29,763 cranes, with a minimum of 14,503 cranes on 15/11/2018.

The 2012/2013 and 2021/2022 wintering periods (Fig. 3) are typical of wintering periods when the Arjuzanx Reserve is used as a short stopover site: post-nuptial stopover in 2021/2022 with 80,000 cranes counted on 25/11/21 and in 2012/2013 with 38,200 cranes on 17/12/2012, pre-nuptial stopover in 2012/2013 with 58,739 cranes on 28/02/2013.

The 2022/2023 wintering period (Fig. 4) is considered to include all the changes in numbers usually observed during the wintering periods: a first migratory wave at the end of October (10,000 cranes on 31/10/2022), a second migratory wave in mid-November (19,488 cranes on 17/11/2022) The period from 15/11/22 to 31/01/23 is marked by a certain stabilisation of the numbers with an average of 21,752 cranes, a maximum of 35,153 cranes on 02/01/2023 and a minimum of 6,829 cranes on 19/01/2023.

For the 15 wintering of the study period, the median is 19,383 with 50% of the data between 13,938 and 24,478 (interquartile range 10,540).

The Wetlands International count on 15 January (Fig. 5) shows significant annual variations in the numbers present on this date in the Arjuzanx Reserve, with a minimum of 12,804 in 2018 and a maximum of 35,847 in 2017. The median equals 19,915, and 50% of the counts are between 17,791 and 23,798 (interquartile range 5,807).

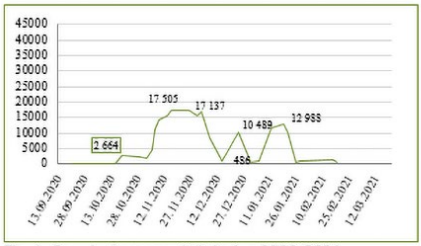


Fig. 1: Count of cranes - Wintering 2020/2021



Fig. 2: Count of cranes - Wintering 2018/2019

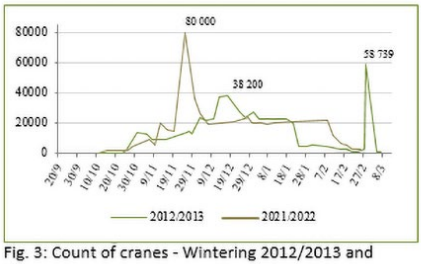


Fig. 3: Count of cranes - Wintering 2012/2013 and 2021/2022

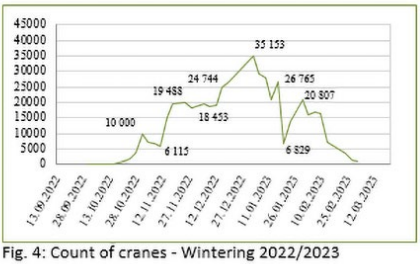


Fig. 4: Count of cranes - Wintering 2022/2023

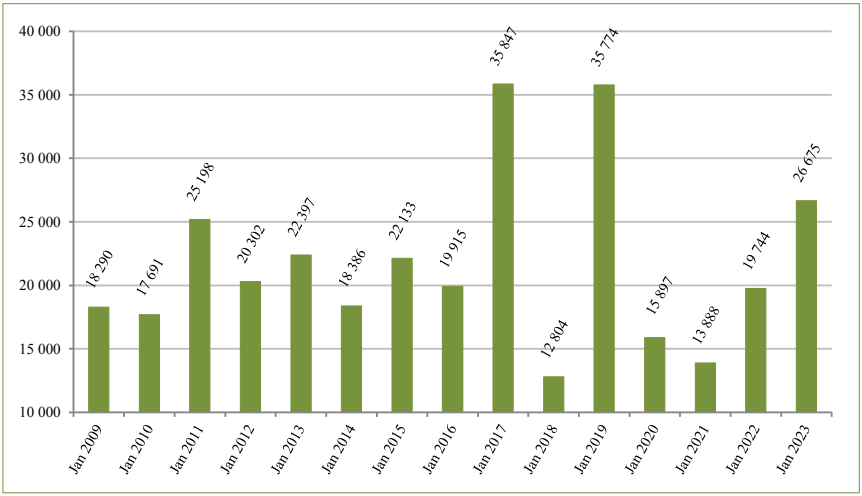


Fig. 5: Wetlands International – Number of Common cranes in the Arjuzanx Reserve from 2009 until 2023.

1.2 – The Arjuzanx Reserve in the Landes de Gascogne and in Aquitaine

The counts of the Common Cranes make it possible to specify the role of the Arjuzanx Reserve within its territory, the Landes de Gascogne, and, more widely, in Aquitaine. In the Landes de Gascogne, based on the results of the Wetlands International count (Table 1), the Arjuzanx Reserve is the main site for receiving Common Cranes, with numbers ranging from 13,888 in 2021 to 35,847 in 2017. These numbers represent between 38.49% and 60.26% of the cranes in the Landes de Gascogne sites. For the 12 years taken into account (in 2009, 2016 and 2018, the data for the Haute Lande sites are unknown), the median is 22,133 with an interquartile range of 6,718 (Q1 = 18,212 and Q3= 24,930).

Table 1: Wetlands International - Count of Common Cranes in the Landes de Gascogne

Year	Pontonx	Haute Lande	Pays d'Albret	CESTA	Captieux	Arjuzanx	Total LDG	% Arjuzanx
2010			2 529		25 741	17 691	45 961	38.49
2011		700	7 412		29 157	25 198	62 467	40.34
2012		1 500	5 936		16 220	20 302	43 958	46.18
2013		950	5 990		13 194	22 397	42 531	52.66
2014		1 260	11 044		15 608	18 386	46 298	39.71
2015		1 400	12 406		15 596	22 133	51 535	42.95
2017		625	12 425	188	10 399	35 847	59 484	60.26
2019		1 267	9 033	1 523	11 454	25 774	49 051	52,55
2020		901	6 293	1 121	13 065	15 897	37 277	42.65
2021		1 060	6 317	1 225	12 390	13 888	34 880	39.82
2022	527	1 600	7 592	1 204	9 022	19 744	39 689	49.75
2023	1 096	1 057	12 948	533	6 924	26 765	49 323	54.26

During the 2022/2023 wintering season (Table 2), 4 simultaneous counts were carried out in December and January at all the Aquitaine sites. The Arjuzanx Reserve hosts between 54.26% and 61.92% of the Common Cranes

present in the Landes de Gascogne and between 42.09% and 46.52% of the Common Cranes in Aquitaine. During the count on 15 January, the numbers present at Arjuzanx decreased significantly compared to the numbers present in mid-December and early January: -5.87% for the Landes de Gascogne and -4.43% for Aquitaine.

Table 2: Cranes count in Aquitaine - Wintering 2022/2023

	Sites	Early December 22	Mid-December 22	Early January 23	Mid-January 23
Landes de Gascogne	Arjuzanx	19 536	24 744	29 406	26 765
	Pontonx	361	580	488	1 096
	Haute Lande	400	37	587	1057
	Pays d'Albret	6 210	6 829	9 113	12 948
	CESTA	254	454	1 064	533
	Captieux	5 424	7 319	8 243	6 924
	Total Landes de Gascogne	*32 185*	*39 963*	*48 901*	*49 323*
	% Arjuzanx/Landes de Gascogne	*60.70%*	*61.92%*	*60.13%*	*54.26%*
Other sites	RNN Cousseau	8 653	11 733	12 072	12 541
	Sud Adour	3 474	4 115	2 234	1 726
	Total Aquitaine	*44 312*	*55 811*	*63 207*	*63 590*
	% Arjuzanx/Aquitaine	*44.09%*	*44.34%*	*46.52%*	*42.09%*

1.3 – The Arjuzanx Reserve in France

Based on the results of the Wetlands International count (Table 3), the numbers of Common Cranes at the Arjuzanx Reserve represent between 11.18% and 24.10% of the cranes wintering in France with a median number of 19 915 and an interquartile range of 5,807 (Q1 = 17,991, Q3 = 23,798).

Table 3: Wetlands International – Count of Common Cranes in France from 2009 until 2023

Winteri	Arjuzanx	Lorraine	Champagne Ardennes	Centre	Aquitaine (including Arjuzanx)	Camargue	Others areas	Total France	% Arjuzanx/ France
2009	18 290	2 900	21 500	9 070	46 000	825	1 290	81 585	22.42
2010	17 691	3 060	24 128	12 049	59 000	2 280	2 754	103 271	17.13
2011	25 198	3 200	20 199	15 024	65 900	3 550	2 175	110 048	22.90
2012	20 302	5 000	21 371	9 459	46 420	3 600	2 177	88 027	23.06
2013	22 397	11 754	24 500	13 400	47 225	4 030	2 692	103 601	21.62
2014	18 386	8 500	47 620	11 180	41 000	7 774	2 880	118 954	15.46
2015	22 133	26 000	39 130	16 000	67 000	7 860	3 474	159 464	13.88
2016	19 915	9 500	26 080	17 400	45 000	9 750	3 422	111 152	17.92
2017	35 847	9 100	26 135	23 450	68 800	14 175	7 052	148 712	24.10
2018	12 804	9 000	18 100	10 600	22 000	15 704	3 975	79 379	16.13
2019	25 774	11 000	19 821	25 000	70 954	19 409	6 148	152 332	16.92
2020	15 897	13 000	17 747	24 000	52 558	19 033	4 320	130 658	12.17
2021	13 888	6 500	10 150	25 000	50 917	22 303	4 000	118 870	11.68
2022	19 744	36 000	35 503	21 200	52 962	27 426	3 560	176 651	11.18
2023	26 675	8 000	22 500	39 890	63 590	26 800	10 968	171 748	15.53

2 – The characterization of cranes in migratory stopover and wintering

During the study period, 4,941 observations (Fig. 6) of banded cranes were made by the naturalists of the Arjuzanx Reserve. The average number of banded crane observations per wintering is 329. German cranes represent 74.62% of these observations.

The observations are located (Map 2) in the primary foraging area used by cranes roosting in the Arjuzanx Reserve. Observations of banded cranes were made outside this study area to consider changes in the behaviour (dispersion in particular) of the cranes during wintering.

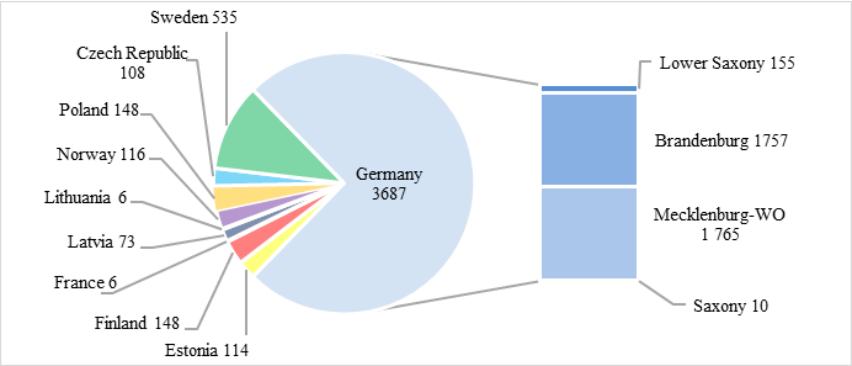
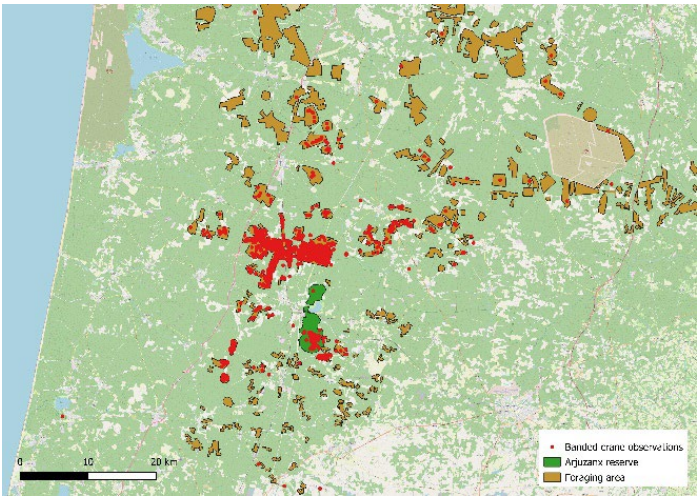


Fig. 6: Observations of banded Common Cranes from 2008/2009 until 2022/2023



Map 2: Location of banded crane observations – wintering 2009/2010 until 2022/2023

2.1 – Geographical and population data

During the study period, 818 different banded cranes were contacted (Table 4), of which 625 were adults (76.41%) and 193 juveniles (23.59%). 69.80% are German cranes (68.96% of adults, 72.54% of juveniles). In recent years observations of Polish cranes with a white ring with an alphanumeric code have increased. The identification of the bird is not systematic because of

the difficulty of reading this type of ring which does not respect the rules fixed by the European Working Crane Group.

Table 4: Origin of banded Common Cranes – Period 2008/2009 until 2022/2023

Age	Estonia	Finland	France	Latvia	Lithuania	Norway	Poland	Czech Republic	Sweden	Germany	Total
Adult	22	40	1	5	1	23	34	5	63	431	625
Juvenile	8	6	2	6	0	1	16	5	9	140	193
Total	50	46	3	11	1	24	50	10	72	571	818

The median age of the cranes contacted in the Arjuzanx Reserve area is 4 years 4 months, with a minimum age of 4 months 6 days and a maximum age of 22 years 5 months. The interquartile range is 5 years 11 months (Q1 = 1 year 6 months, Q3 = 7 years 6 months). 23.59% of the banded cranes contacted were less than one year old, and 62.22% were less than 4 years old (Table 5).

Furthermore, 334 of the 818 ringed cranes (40.83%) have not been observed for more than 1 year 5 months in the western migratory flyway of cranes in Europe. 20.42% have not been contacted for over 6 years and 1 month.

Table 5: Age of banded cranes - Wintering 2008/2009 until 2022/2023

	Age<1 year	1 year<=Age<4 years	4 years<=Age<6 years	6 years<=Age< 10 years	10 years<=Age<15 years	Age>15 years
Numbers of cranes	193	316	130	116	44	19
Percentage	23.59	38.63	15.89	14.18	5.37	2.32

The distance travelled by Common Cranes between their ringing site and the Arjuzanx Reserve area varies according to their country of origin (Table 6). The median is 1,478 km with an interquartile range of 77 km (Q1 = 1,439, Q3 = 1,516). Of 511 banded cranes that flew less than 1 500 km, 508 came from Germany and 8 from the Czech Republic. Of 35 cranes that have travelled more than 2 500 km, 31 came from Finland and 4 from Sweden. The crane that travelled the furthest distance (2 909 km) from its ringing site was a Finnish crane YYY-BkGR banded in Palovaara (Lapland) on 29/07/2012. The crane that travelled the shortest distance (1 159 km) was the German crane BuBuBu-BuRBu banded in Freistatt (Lower Saxony) on 15/06/2012.

Table 6: Distance travelled by Common Cranes – Wintering 2008/2009 until 2022/2023

	Distance <1,500 km	1,500 km <=Distance< 2,000 km	2,000 km <=Distance< 2,500 km	Distance >2,500 km
Numbers of crane	511	148	121	35
Percentage	62,70	18,16	14,85	4,29

2.2 – Behavioural data

2.2.1 – Wintering/migratory birds

Of 818 banded cranes contacted, 250 (30.56%) wintered at least once in the Arjuzanx Reserve area, and 568 never wintered there (Table 7).

Table 7: Wintering/migrating cranes status – Wintering 2008/2009 until 2022/2023

Activity	Estonia	Finland	France	Latvia	Lithuania	Norway	Poland	Czech Republic	Sweden	Germany	Total
Wintering	7	9	1	5	1	6	17	5	20	179	250
Migrating	23	37	2	6	0	18	33	5	52	392	568
Total	30	46	3	11	1	24	50	10	72	571	818

138 cranes (55.20%) were wintered (Table 8) only once in the Arjuzanx Reserve area, while one crane was wintered 14 times. In relation to the number of possible wintering according to the age of the cranes, 19 cranes (7.69%) were wintered in the Arjuzanx Reserve area each time it was possible. 77.20% of the cranes wintered less than half of the possible wintering.

Table 8: Relationship between the number of wintering cases and the number of wintering cranes

Numbers of wintering cases	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Numbers of cranes	138	58	23	12	6	4	2	1	2	2	1			1
Percentage	55.2	23.2	9.2	4.8	2.4	1.6	0.8	0.4	0.8	0.8	0.4			0.4

131 Common Cranes (55.40% of wintering cranes) wintered in the Arjuzanx Reserve area at least once during their first three years. 87 Common cranes wintered there in their first year (Table 9), 14 in years 2 and 3 and 20 in year 2 only. For 33 cranes, it was not possible to determine where they wintered in years 2 and 3.

Table 9: Location of the wintering area of cranes during their first 3 years

Year 1	Year 2	Year 3	Number	%
Arjuzanx	Arjuzanx	Arjuzanx	14	16.09
Arjuzanx	Arjuzanx	No data	20	22.99
Arjuzanx	Arjuzanx	Germany	2	2.30
Arjuzanx	Arjuzanx	Spain	2	2.30
Arjuzanx	France	Arjuzanx	1	1.15
Arjuzanx	France	No data	1	1.15
Arjuzanx	Germany	No data	1	1.15
Arjuzanx	Spain	Arjuzanx	1	1.15
Arjuzanx	No data	Arjuzanx	6	6.90
Arjuzanx	No data	Spain	3	3.45
Arjuzanx	No data	Germany	3	3.45
Arjuzanx	No data	No data	33	37.93

2.2.2 – Territory utilisation by the cranes

Roosting sites

In the study area extended to the Landes de Gascogne, 12 wetlands or groups of wetlands are used as roosting sites by cranes during the winter: Captieux military camp, Lagune de la Roustouse, Arjuzanx Reserve, Marais de l'Anguille, Lagune de La Tapy, Braou du Piat, Marais de Parias, Lagunes de Puy Nègue, Lagune de Nahouns, Lagune de Gouhuron lagoon, Lagune de Lasserre and the CESTA site (Map 1) This group represents at least 32 different roosts of unequal size (from a few hundred to several thousand cranes).

During wintering, during episodes of heavy rainfall, clear-cut areas in the forest and shallow depressions in the fields are also used as roosting sites. These roosts are ephemeral and disappear as soon as the rainy periods end.

Monitoring certain cranes has made it possible to characterise the behaviour of the cranes during the wintering period. Arcadio, a Polish crane, wintered in the area for 91 days in 2022/2023 and occupied 6 roosts with numerous exchanges between these roosts (Table 10). The roosts at the Arjuzanx Reserve and the Captieux Military Camp were occupied for 30 nights each, while the Lagune de La Tapy and the Marais de l'Anguille for 14 nights each.

Mütze, a German crane, wintered in 2015/2016 for 71 days and occupied 7 roosting sites, including the Arjuzanx Reserve for 56 nights and the Lagunes de Puy Nègue for 5 nights (Table 11). The other sites, including 5 fields, a clear cut and a wetland, were occupied for 8 nights at a rate of one or two nights per site.

Table 10: Dates and duration of occupation of the various roosts by Common crane named *Arcadio* - wintering 2022/2023

CaptieuX		Arjuzanx Reserve		Lagune de La Tapy		Marais de l'Anguille		Lagune de Nahouns		Field in Sabres	
31/10 - 02/11/22	3	02/11 - 03/12/22	30	03/12 - 04/12/22	1	22/12 - 25/12/22	3	25/12 - 26/12/22	1	17/01 - 18/01/23	1
4 - 19/12/22	15			19/12 - 21/12/22	2	26/12 - 27/12/22	1				
21 - 22/12/22	1			30/12 - 31/12/22	1	10/01 - 11/01/23	1				
27 - 30/12/22	3			07/01 - 10/01/23	3	16/01 - 17/01/23	1				
31/12 - 07/01/23	7			11/01 - 16/01/23	5	18/01 - 24/01/23	6				
28 - 29/01/23	1			24/01 - 25/01/23	1	25/01 - 27/01/23	2				
				27/01 - 28/01/23	1						

Changes in territory utilization

The utilization of the territory varies each winter depending on many parameters, including food availability, disturbance, and rainfall.

In the 2022/2023 wintering season, the vital area of the Polish Crane Arcadio is approximately 173,000 ha. This area represents a maximum distance of 42 km from north to south and 75.3 km from west to east. The fields used foraging vary according to the roosting site used by the crane at night (Table 12). When Arcadio uses one of the 4 main roosts, the fields it frequents are located at a maximum distance of 21 to 30 km.

The GPS data made it possible to define the 4 territories associated with each main roost (Map 3), highlighting the existence of two agricultural areas at the interface of these territories from which exchanges between the roosts occur. The first zone is located in Labrit and corresponds to the use by cranes of the roosts in the Arjuzanx Reserve, the Lagune de La Tapy, the Marais de l'Anguille or Captieux military camp. The second area is located in Luxey and corresponds to the use of the Lagune de La Tapy cranes, the Marais de l'Anguille or Captieux military camp.

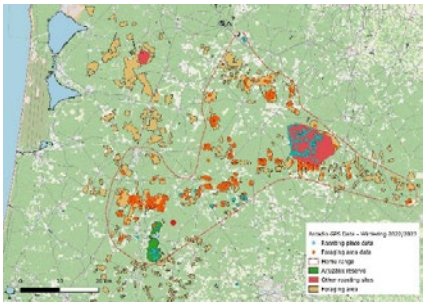
Table 11: Dates and duration of occupation of the various roosts by Common crane named *Mütze* – Wintering 2015/2016

Arjuzanx Reserve		Lagunes de Puy Nègue		CESTA		Field in Garrosse		Clear cut in Laluque		Field in Saugnac et Muret		Field in Commensacq		Field and clear cut in Sabres	
8/12/15 - 11/01/16	34	11 - 13/01/16	2	09 - 10/02/16	1	20 - 21/01/16	1	01 - 02/02/16	1	07 - 08/02/16	1	14 - 16/02/16	2	11 - 13/02/16	2
13 - 14/01/16	1	14 - 15/01/16	1											13 - 14/02/16	1
15 - 19/01/16	4	19 - 20/01/16	1												
21/01 - 01/02/16	11	03 - 04/02/16	1												
02 - 03/02/16	1														
04 - 07/02/16	3														
08 - 09/02/16	1														
10 - 11/02/16	1														

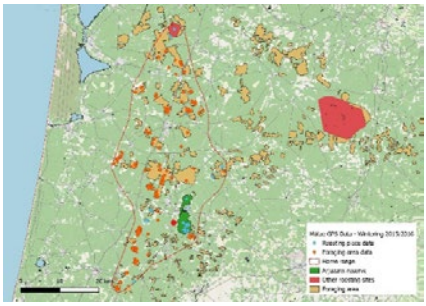
During the 2015/2016 wintering season, the home range (Map 4) of the German crane Mütze has an area of approximately 117,000 ha. This range represents a maximum distance of 57.3 km from north to south and 27.6 km from west to east. When Mütze uses the roost sites of the Arjuzanx Reserve, the fields it frequents are at most 44.3 km away (Table 12).

Table 12: Distance between roosting sites and foraging areas used by Common cranes named Arcadio and Mütze

	Arcadio (2022/2023)					Mütze (2015/2016)		
	Arjuzanx Reserve	Captieux military camp	Lagune de La Tapy	Marais de l'Anguille	Champ à Sabres	Arjuzanx Reserve	Lagunes de Puy Nègue	CESTA
Distance max, km	25,0	28,0	30,0	21,0	4,5	44,3	11,0	8,0
Distance min, km	3,8	5,9	4,0	2,5	4,5	19,8	2,5	8,0



Map 3: Arcadio – Home range and GPS data – Wintering 2022/2023



Map 4: Mütze - Home range and GPS data – Wintering 2015/2016

Since the 2019/2020 wintering season, there has been a pattern of crane dispersion across the whole foraging area from November onwards. The cranes, sometimes in small groups, occupy smaller plots they previously frequented only from January. This trend was particularly pronounced during the 2022/2023 wintering season: fields previously neglected by cranes were used throughout the season, and plots about 40 km from the roosts were occupied as early as November and December.

3 – Daily behaviour

The 2009 - 2013 study results were presented at the European Crane Conference 2014 in Gallocanta (Dulau & al., 2014). The 2019–2021 study gave the following main results:

- foraging activities (F1-Feeding and F2-Drinking) are dominant (41.66%) before comfort activities (34.84%). Foraging activity (F1-Feeding) increases to the detriment of comfort activities as the season progresses. Foraging activity was highest on plots with maise stubble and mulched or disked maise, whereas foraging activity was much lower on plots with winter cover. On the grass plots, no foraging activity was recorded.

- movement activity (L-Walking), with a value of 20.69%, is very high.

- the F2-Drinking activity in the wintering year 2020 / 2021 is at a high level with an adaptation of the cranes to the presence of water in the fields due to a relatively high autumn and winter rainfall.

4 – Agricultural and environmental regulations

The 2015–2022 Common Agricultural Policy has brought about a profound change by imposing crop diversification (3 crops for farms with more than 30 hectares of arable land with a main crop of less than 75% of the arable land). Under the CAP, farms specialising in maise can derogate from the diversification requirement but must establish a winter cover crop within 15 days of harvesting the last plot. (Gallocanta communication)

From an environmental point of view, the Nitrates Directive has been transposed locally in the National and Regional «Nitrates» Plans, which impose in part of the study area, the nitrate vulnerable zone, either a winter cover crop or the fine mulching and burying of maise stalks within 15 days of harvest.

5 - Evolution of the foraging area

5.1 - Agricultural practices

In the early 2000s, grain maise was grown on the entire area of the zone studied (10,307.13 ha). By 2009, the start of the study, the acreage of grain maise was down to 8,776.39 ha (-14.88%) with 912.16 ha of vegetables, 459.27 ha of grass fallow and 159.31 ha of seed maise.

The area planted to grain maise has decreased by 45.72% in 13 years to 4,773.39 ha in 2021 (Fig. 6). During this period, the acreage of vegetables (4,135.33 ha in 2021) increased by 353.36%, and the acreage of seed corn reached 678.18 ha, an increase of 9.99%. Since 2019, the acreage of grain maise plots has been smaller than the acreage of plots used for other crops.

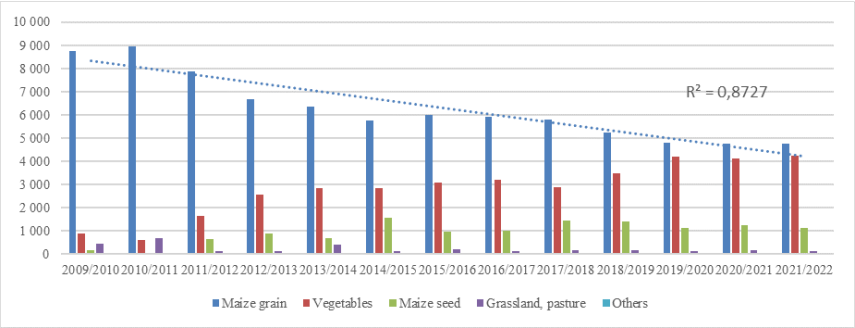


Fig. 6: Changes in agricultural crop types – Wintering 2009/2010–2021/2022

Since 2018, the acreage of grain maize stubble has decreased during the wintering period due to the development of winter cover (Table 13). In December, it represented only 28.55% to 51.74% of the acreage in grain maize, and in February, it 14.37% to 35.94%.

Table 13: Evolution of grain maize stubble areas during wintering

Wintering	October	December	February
2018/2019	5 241.06	1 496.18	753.18
2019/2020	4 789.36	2 478.10	1 721.30
2020/2021	4 763.75	1 973.94	1 258.77

5.2 - The development of agrivoltaics

Agrivoltaics combines agricultural production and electricity production by photovoltaic solar panels on the same site. The solar panels are installed to allow agricultural machines to work and follow the path of the sun. An agrivoltaics project, currently under study, aims to install 920 ha of solar panels in the most important agricultural area near the Arjuzanx Reserve (Le Platiet) and to cultivate lucerne on these plots. The project is phased in three stages: 90 ha in 2026, 495 ha in 2029 and 935 ha in 2032.

Discussion

The objectives of the 15-year study programme are to improve knowledge of the role of the Arjuzanx Reserve in the conservation of Common Cranes, to understand the utilization of the territory by cranes during wintering and

migration and to identify changes, particularly of anthropic origin, which are likely to have an impact on the Common Cranes.

The numbers counted in the Arjuzanx Reserve are, for half of the mid-January counts (Wetlands International), between 18,000 and 24,000 cranes. These values represent between 14.67% and 22.02% of the French numbers and 40.21% and 52.57% of the Landes de Gascogne numbers.

Furthermore, the results of the 4 simultaneous counts carried out since 2022/2023 on all the Aquitaine roosting sites show the primordial role of the Arjuzanx reserve, from mid-December to mid-January, with 61.92% of the numbers present for the Landes de Gascogne and 46.52% for Aquitaine.

However, these 4 counts over 2 months do not allow us to analyse the phenology of wintering on the Aquitaine scale, due to a need for more data, particularly for the period from mid-October to the end of November and from mid-January to mid-Feb Better knowledge of the numbers presents in the Landes de Gascogne and more widely in Aquitaine requires effective coordination of counts and monitoring of all the roosts at an ideal frequency of one weekly count from October to February.

Inter-annual variations in numbers are due to the fluctuation in the number of wintering birds in northern Europe and/or northern, central and south-eastern France. Indeed, the percentage of ringed cranes in December in Germany has approached or exceeded 60% of ringed wintering cranes in some years (iCORA.de). In France, the number of wintering birds reached 36,000 in Lorraine in 2022, and in the Centre is increasing each year significantly to reach 39,800 in 2023 (grusgrus.eu).

Rainfall also plays a major role in the variations in numbers. When there is a water deficit in the region, the Arjuzanx Reserve remains attractive for the Common Cranes because of the existence of large lakes which retain their capacity to be used as roosting sites. During episodes of heavy rainfall in autumn and winter, the cranes prefer to use other permanent or temporary roosts closer to the feeding areas: the numbers that use the Arjuzanx Reserve then fall significantly, but only temporarily.

Exchanges between the roosts also occur, to a lesser extent, during wintering, and the monitoring of cranes equipped with rings and/or GPS has made it possible to validate the existence of a real functional entity composed of around thirty permanent roosts and fields used for feeding by the Common Cranes. This entity, with an area of approximately 546 200 ha, extends beyond the study area and covers most of the Landes de Gascogne.

These exchanges take place from areas that are at the interface of the territories of each roost. Two zones have been identified in the foraging area. These are agricultural plots located in Labrit and Luxey, which the cranes use according to the roosts occupied. Their position at an equal distance from the main roosts determines a strategy of using the roosts based on better energy efficiency linked to travel. In Taller, an area that probably plays a similar role for the Arjuzanx reserve and the southern roosts was identified in the southwest of the study area. Further surveys on the function of these plots should be carried out during the next wintering season.

In order to satisfy their food needs, the spatiotemporal dispersion of cranes in the foraging area is a phenomenon characterized, in the Landes de Gascogne, by an increase in the territory prospected by the cranes as the wintering period progresses. From the 2018/2019 wintering season onwards, this dispersal phenomenon has increased with a search for food over almost the entire foraging area from December or even November. This development is related to the change in agricultural practices with:

- a significant decrease, linked notably to cultivation choices, of grain maize plots (-45.72% in 13 years) to the main advantage of vegetable crops.

- the greening of the CAP, which requires crop diversification in monoculture sectors.

- regulations linked to the fight against nitrates, such as installing a winter cover within 15 days after harvesting or fine grinding of maize stalks with landfilling, further accentuating the reduction of maize stubble areas.

In this context, the pressures on cranes have led to the empirical observation in 2022/2023 of significant use, from November onwards, of plots usually neglected at the beginning of the season and a search for food in fields with winter cover (rape, beans, mustard, etc.). This behavioural change could be due to the greater availability of food resources in winter cover at the beginning of the season.

These observations raise questions about the diet of wintering cranes in the Landes de Gascogne and the resource availability in the area.

The problem of agrivoltaics is also emerging, with the installation of solar panels in the fields, which is likely to accentuate the reduction in the number of plots of land available to cranes.

These disruptions threaten access to feeding areas and the availability of the previously priority food resource, accessible grain maize crop losses in maize stubble fields, without impacting crane numbers.

In addition, the ring readings clarified the structure of the population hosted and, consequently, the role of the Arjuzanx Reserve for this population.

The population hosted is rather young, with a median age of 4 years and 6 months. The proportion of juvenile and sub-adult cranes (62.22% under 4 years old) highlights the role of the Arjuzanx Reserve in hosting young cranes during their first migrations. This role is all the more important as the Arjuzanx Reserve, the last major site before crossing the Pyrenees, offers the conditions required for a post-nuptial migratory stopover or wintering.

More than two-thirds of the ringed birds are considered to be migratory. The low proportion of wintering cranes (30.56% of the ringed cranes contacted) raises questions about the regular use of the Arjuzanx reserve. Fidelity to the Arjuzanx Reserve as a wintering site is not demonstrated: 77.20% of wintering cranes were present there only one winter out of two, and only 7.69% of wintering cranes were observed there each time it was possible according to their age. Moreover, fidelity to the Arjuzanx Reserve alone does not necessarily seem relevant. Beyond the observation bias, it must be assessed on the scale of the Landes Gascogne, taking into account exchanges between the different roosts.

To do this, it is necessary to increase the pressure of ring reading in the areas far from the Arjuzanx Reserve, such as the Captieux camp, and to obtain the GPS-GSM data of the cranes using the area.

Conclusion

15 years of monitoring of Common Cranes in the area of the Arjuzanx Reserve have enabled us to improve our understanding of the wintering period and to acquire a better knowledge of the behaviour of Common Cranes.

Given the number of cranes wintering there and despite inter-annual variations, the Arjuzanx Reserve can be considered to be, to varying degrees, the major site for the wintering of Common Cranes both in France and in the Landes de Gascogne. The average is about 20 000 cranes. The role of the Arjuzanx Reserve is decisive for the reception of juveniles and sub-adults both in migratory stopovers and wintering.

Beyond its intrinsic interest, the Arjuzanx Reserve is a predominant element of interacting sites. This group of wetlands associated with a vast foraging area

constitutes a functional entity, the Landes de Gascogne, for the reception of Common Cranes.

Monitoring has also highlighted the relative fragility of crane wintering due to changes in farming practices, regulations and the emergence of projects impacting the cranes' territory (agrivoltaics). Changes in the occupation of the territory by Common Cranes have been observed, with greater dispersion in the foraging area, probably in connection with the search for food, and regular exchanges between the different roosts marked by an increase in the number of birds at small sites.

Is this a one-off strategy of the Common Cranes or the first sign of adapting the species to unavoidable climatic and agricultural changes?

Given this question, it is essential to continue acquiring knowledge on the territory extended to the Landes Gascogne. Two axes of work are to be prioritised. The first is to extend the scientific approach implemented in the Arjuzanx Reserve area to the Landes de Gascogne and to mobilise all local participants around this commitment. The second concerns the study of the cranes' diet and their adaptation to the resources of the agricultural environment.

Acknowledgements

We want to thank all the naturalists of the Arjuzanx Reserve for their work during these 15 years of monitoring and all the volunteer observers and actors working to protect the Common Cranes in the Landes de Gascogne. Special thanks to Günter Nowald, Micha Modrow, Lovisa Nilsson, Ivar Ojaste, and Arkadiusz Broniarek for their help.

Common Crane spring migration over the Pyrenees

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With this project, we want to find out how many Common cranes (Grus grus) migrate in spring over the Pyrenees, what routes they take and how they adapt to the weather.

During the spring of 2015, 2016 and 2020, we made daily counts of Common cranes starting their migration from the Sotonera reservoir at the foot of the Pyrenees of Huesca (Spain). We received (2015, 2016) forms with crane observations, including date, time, number of birds, direction of flight, behaviour and weather conditions of Huesca, Navarra and Cataluña, covering the whole Pyrenees. We calculated the number that effectively crossed the Pyrenean Mountain chain. We consider our numbers as a minimum.

The overall count was 303,357 birds in 2015 and 201,569 birds in 2016, respectively, showing two main routes over the western Ebro Valley and Pyrenees and a crossing at the Roncal-Ansó-Hecho valleys of Navarra and Huesca. The summits here are below 2,000 metres (the central Pyrenees are 3000+ m mountain tops). The January counts of Spain and Portugal by Ibergrus were 33% and 13% lower than our numbers respectively. The migration occurred in relatively few days; 58% of the birds migrated in two days in 2015, and 50% migrated in four days in 2016.

We found that cranes were driven to the east by strong WNW-NW winds, called Cierzo, that blow through the Ebro Valley 15 days a month when cranes commonly migrate (February/March). These are headwinds on the main migration route. Most Common cranes are forced to stay for 1-3 days in a roost Southeast of their main route, in the Ebro Valley or the Pyrenean Mountains. Numbers of cranes accumulate on roosts, especially the Sotonera reservoir, during unfavourable weather. In the high Pyrenees, birds can also be halted for several days by other weather conditions, e.g. storms from the Atlantic Ocean. However, these events are less common. A combination of both weather events (i.e. strong “Cierzo” headwinds, a prolonged cold front from the Atlantic) led cranes to accumulate at different roosts and to migration of 164,710 birds over the Ebro valley and Pyrenees on one single day, the 2nd of March 2015.

With favourable weather, all cranes cross the Pyrenees at the same point on the main route. With clearly unfavourable conditions, they stay on the

ground. With headwinds blowing between 3 and 5 Beaufort (1 –38 km/h), cranes at the Sotonera reservoir are doubtful for starting migration. Some groups fly up in circles, some return to the ground later, while others may decide to migrate. These migrating birds fly east, with tailwinds, along the exterior sierras, and many are found later at roosts in the Pyrenees. From there, most fly back through the mountains Westwards to the main route to cross the summits.

During very doubtful and clearly bad weather conditions, groups of cranes try to migrate, flying straight into strong headwinds with apparently no chance of success and losing a lot of energy. The reason they do this can be found in an improved weather situation further on their migration route. Two examples may confirm this.

On the 28th of February 2015, at least 5,400 birds tried to cross the Pyrenean summits against wind, rain and snow produced by a cold front from the Atlantic. They could not pass and ended up in a roost. Just behind this front, there was calm weather, and if they had passed the front, they would have gained one or two days on their migration to the north. The second example is a crane named Loode. Loode, a bird with a GPS-GSM tracker from Estonia (born in 2017), left the Sotonera reservoir under doubtful weather conditions on 26th February 2020. That morning, 1,012 Common cranes left while 4,550 individuals stayed on the ground. Loode first flew with strong and, therefore, tricky tailwinds to the East, later turned North, entered a windless area above the high Pyrenees, crossed at above 2,500 m altitude and gained two days on its migration to the North. This may be the best way to deal with difficult circumstances produced by these strong winds.

From our study, we can draw several conclusions. The 2015 census shows that the number of wintering birds in Spain and Portugal is at least 100,000 higher than it appears from the yearly counts of Ibergrus. Common cranes migrating during spring encounter two barriers when leaving the Iberian Peninsula. The most obvious one is the Pyrenean Mountain chain which, with favourable weather conditions, seems to be not a barrier at all. With adverse weather conditions, which irregularly occur, crossing may be impossible. The Ebro Valley is a more important barrier than the Pyrenees when the regular strong winds of the “Cierzo” are blowing. Different cranes react differently to difficult weather conditions. Some individuals try to overcome it, and some succeed, which results in gaining between one and three days on their route to the North.

We suspect that a substantial number of Common cranes migrate non-stop from Extremadura to France during favourable migration conditions at more than 1 km height, not being noticed by birdwatchers on the ground. The distance from Extremadura Centro to the French border is nearly 600 km. This behaviour could be confirmed by birds wearing a GPS tracker.

Acknowledgements

I like to thank all birders in the field, members of the GOO and rangers of Aragón for filling in the forms with detailed information. Special thanks to Rob Mooser for coordinating, editing and reviewing data and advice on texts and to Jesús María Lekuona and Institut Catalá de Ornithología for sending their data on Navarra and Catalonia.

Evolution of the Iberian population of crane, 2013/2023

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Abstract

We have followed the evolution of the Iberian population of cranes for ten years, undertaking two coordinated censuses in Spain and Portugal each season. Wintering cranes have been recorded regularly in 11 regions (1 Portuguese and 10 Spanish), and they have been seen in more than 409 localities (395 in Spain and 14 in Portugal) that have been censused over these years by 330 participants in Spain and 114 in Portugal.

The data enable us to confirm that the total of wintering cranes in the Iberian Peninsula stands at around 275,000 cranes, although fluctuations depend on the feeding resources and the meteorological conditions across the continent, as harsh winters in central Europe translate into more birds wintering in the peninsula, and mild winters may mean fewer birds.

In Spain, the region (Autonomous Community) with the largest population of cranes is Extremadura, which hosts more than 50% of the population, followed by Aragón and Castile-la-Mancha. 94% of the population is found in Spain, and the highest number recorded was 260,549 cranes in January 2017, and the lowest number recorded was 168,011 in January 2014.

In Portugal, with 6%, the largest population is found in Alentejo, with three sub-regions close to the border. The maximum number of birds recorded was 16,892 in January 2022 (with one family wintering in the Azores islands), and the minimum was 4,833 in December 2019 (when weather conditions were bad).

The significant agricultural changes that are happening rapidly in our countries, as well as climatic changes, could reduce the number of birds in the future.

Resumen/Resumo

Durante diez años hemos seguido la evolución de la población ibérica de grullas, realizando dos censos en cada temporada coordinados en España y Portugal. Se han registrado grullas invernantes de forma regular en 11 regiones (1 portuguesa y 10 españolas) y se han visitado 409 localidades (395 en España y 14 en Portugal) que han sido censadas, en estos años por 330 participantes en España y 114 en Portugal).

Los datos nos permiten confirmar que el total de grullas invernantes en la península ibérica se sitúa en torno a los 275.000 grullas, aunque hay oscilaciones dependiendo de los recursos tróficos y las condiciones meteorológicas del continente, ya que inviernos duros en centroeuropa se traducen en más invernantes en la península e inviernos suaves pueden significar menos aves.

En España la región (Comunidad Autónoma) con mayor población de aves es Extremadura que acoge a más del 50% de la población, seguida de Aragón y Castilla la Mancha. El 94 % de la población se encuentra en España y el número máximo registrado fue de 260.549 grullas en enero de 2017 y el mínimo registrado fue de 168.011 en enero de 2014. En Portugal, con el 6%, la mayor población de grullas se encuentra en Alentejo, con tres subregiones próximas a la frontera, el número máximo de aves registrado fue de 16.892 en enero de 2022 (con una familia invernada en las islas Azores)y el mínimo de 4.833 en diciembre de 2019 (cuando las condiciones meteorológicas fueron adversas).

Los importantes cambios agrícolas que están aconteciendo de forma rápida en nuestros países, así como el cambio climático pueden reducir el número de aves en el futuro

Durante dez anos seguimos a evolução da população ibérica de grous, realizando dois censos em cada temporada coordenados em Espanha e Portugal. Registamos os grous invernantes de forma regular em 11 regiões (1 portuguesa e 10 espanholas) e foram visitadas 409 localidades (395 em Espanha e 14 em Portugal) que foram censadas neste anos por 330 participantes em Espanha e 114 em Portugal.

Os dados permitem confirmar que o total de grous invernantes na península ibérica é de cerca de 275.000 com oscilações dependentes de recursos tróficos disponíveis e condições meteorológicas do continente europeu em que invernos rigorosos no centro da Europa traduzem maior número de aves invernantes na península e invernos menos rigorosos podem significar menos aves invernantes.

Em Espanha a região autónoma com maior população de aves é a Estremadura que acolhe mais de 50%, seguida de Aragão e Castela Machega.. 94% da população invernante ibérica encontra-se em Espanha e o número máximo registado foi de 260.549 grous em janeiro de 2017 e o mínimo registado foi de 168.011 em janeiro de 2014. Em Portugal, com 6% da população invernante na ibéria os animais ocorrem na região

Alentejo em 3 sub regiões próximas da fronteira. O número máximo de aves registado foi de 16.892 em janeiro de 2022 (dos quais 3 no arquipélago dos

Açores) e o mínimo de 4.833 em dezembro de 2019 (em que as condições meteorológicas registadas foram adversas à contagem de grous).

As importantes alterações agrícolas que estão a acontecer de forma rápida nos nossos países, assim como as alterações climáticas podem provocar a redução do número de aves no futuro breve.

Introduction

The Iberian Peninsula is the principal wintering area of the western population of European cranes, receiving up to 70% in some years. Until the 1980s and 90s, it hosted up to 95% of the wintering birds (Alonso & Alonso 1990, Fernández Cruz, Román & Boroviczeny 1987, Román 2014, Román & Cruz 2018).

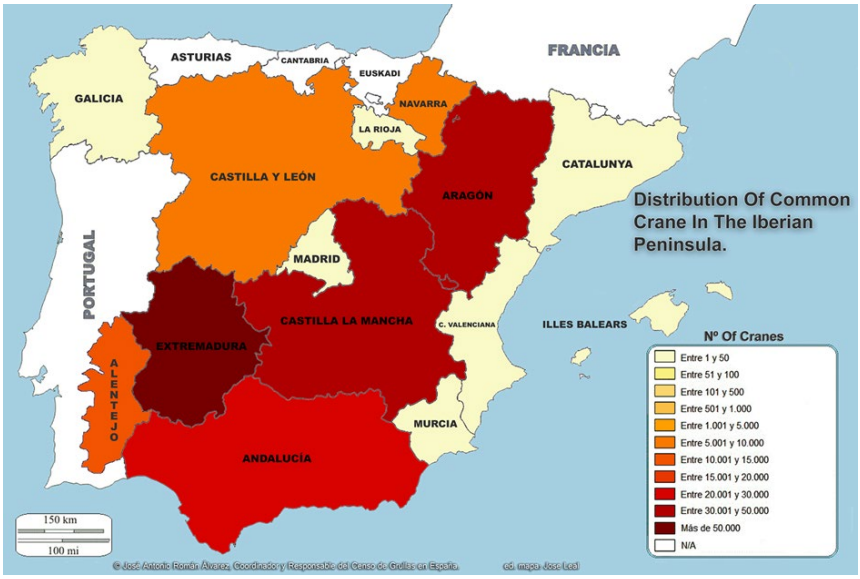
In the last 10 years, we have seen how the Iberian population has stabilised, with increases and decreases attributable to weather conditions and/or feeding resources, particularly in Spain, where the cranes are very closely linked to irrigated crops (maize and rice), while in Portugal the population generally uses the traditional dehesa habitat, although the number of wintering birds in this country can be influenced by the availability of resources in the Guadiana floodplain (Extremadura).

The ongoing increase in intensive tree crops (primarily olives, almonds and pistachios) is producing a considerable decrease in cereal crops such as rice and maize, which may influence the future of wintering cranes in the Iberian Peninsula.

Resources and methods

During these 10 years, we have monitored the Iberian population of cranes with two annual coordinated censuses (December and January), in which 409 localities have been visited in 11 regions or autonomous communities. 395 localities in 10 autonomous communities have been visited in Spain, and 14 localities in Portugal, in three sub-regions of the Alentejo region, all close to the border, in some cases using the feeding habitats or resting areas in both countries (Map 1).

The censuses are mostly done at roost sites, although in the central zone of Extremadura, which is in the Guadiana floodplain, they are done in feeding areas due to the high density of birds, multiple and changing roost sites, and geographical conditions. 450 people participated in the censuses (330 in Spain and 120 in Portugal).



Map 1: Distribution of the Common Crane in the Iberian Peninsula

Results

During this study period, we estimate at least 275,000 cranes have regularly wintered in the peninsula (Fig. 1). However, we don't rule out that in some years, they may have reached 300,000 birds, as Mooser & Woutersen showed in 2015, based on censuses in the pre-nuptial period (Román et al. 2016) and Román (2022).

Each season is different, and over the years, we have sometimes had problems counting in some areas or significant localities for diverse reasons, such as the weather making it impractical to use the tracks, in some cases, which prevented access to the roost sites, as well as these having been abandoned due to the lack of water, or disturbances. Also, because of the pandemic, some teams could not go out to do the censuses due to the restrictions. In the most recent season, the lack of water prevented thousands of hectares of maize and rice from being sown in Extremadura, affecting the distribution of cranes.

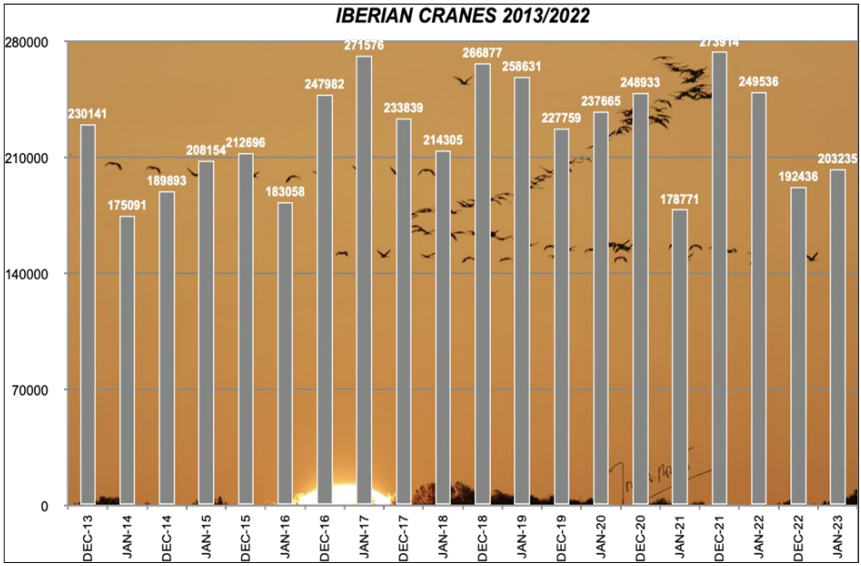


Fig. 1: Evolution of the Iberian population of Common Cranes 2013/2023

Spain

94% of the Iberian cranes are found in Spain (Fig. 2); the wintering population is around 250,000/260,000 birds, although there are fluctuations due to reasons already mentioned. In recent years, they have been closely linked to irrigated crops such as rice and maize. However, in the last few years, there has been a significant reduction in the area cultivated with these in favour of tree plantations, such as olives, almonds and others.

The population trend has been relatively stable over these years, with a minimum of 168,011 cranes in December 2014 and a maximum of 260,549 in January 2016. Generally, the censuses with high numbers take place in December, when some birds are still on migration, and others have not yet occupied their wintering areas. They are regularly spread through eight autonomous communities and occasionally in another four, involving birds on migration. There was just one record of a juvenile on the Canary Isles in 2022, undoubtedly from the Moroccan population.

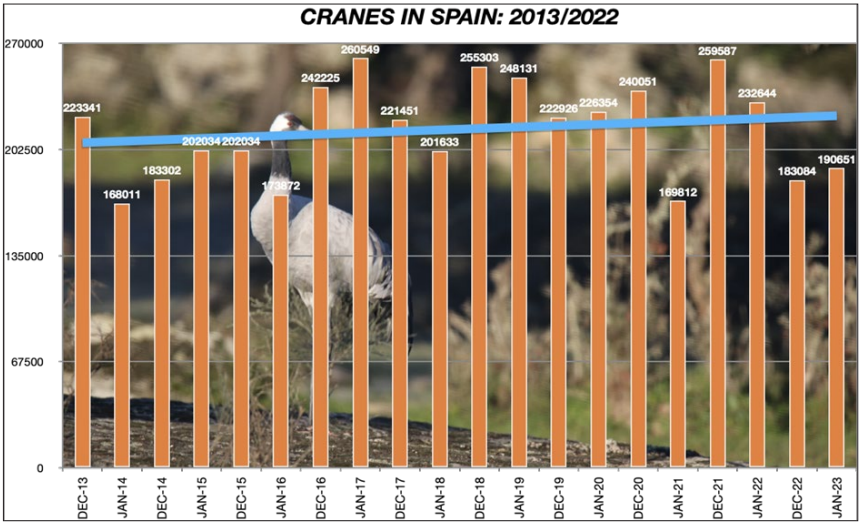


Fig. 2: Evolution of the Spanish population of cranes 2013/2023

During these years, there has been sporadic wintering (families in some cases) in some autonomous communities, such as Galicia, La Rioja, Madrid and Murcia. Still, they are only regular in the following ones:

Navarra

Wintering in this community (Fig. 3) can be influenced by the presence of migrants in both periods, having none recorded in January 2014 and a maximum of 14,731 in January 2020. We estimate that the wintering population is around 4,000 individuals.

Aragón

Aragón (Fig. 4) is the second most significant community for the number of cranes, for which we estimate the population is around 50,000 cranes. However, this is also subject to significant oscillations. Generally, the highest censuses were taken in December (58,788 in December 2013) due to the presence of migrants. In January, the figure reduced to as low as 15,650 birds registered in January 2018. The most important area is the Gallocanta Lagoon.

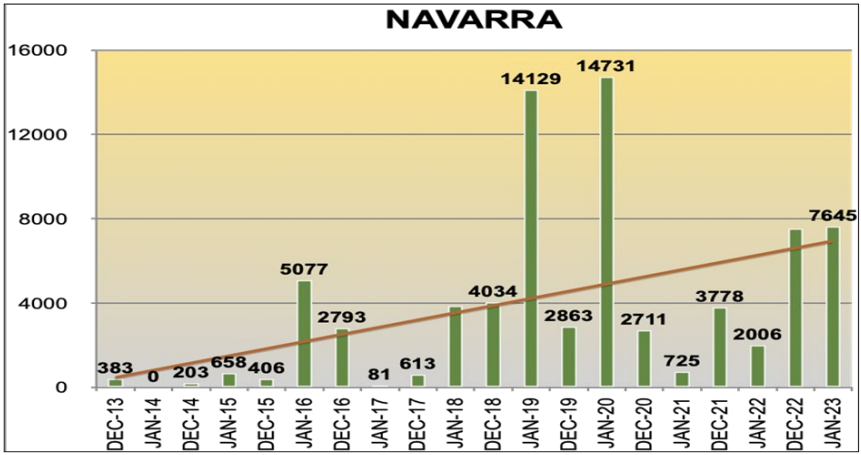


Fig. 3: Evolution of the Navarra population of cranes 2013/2023

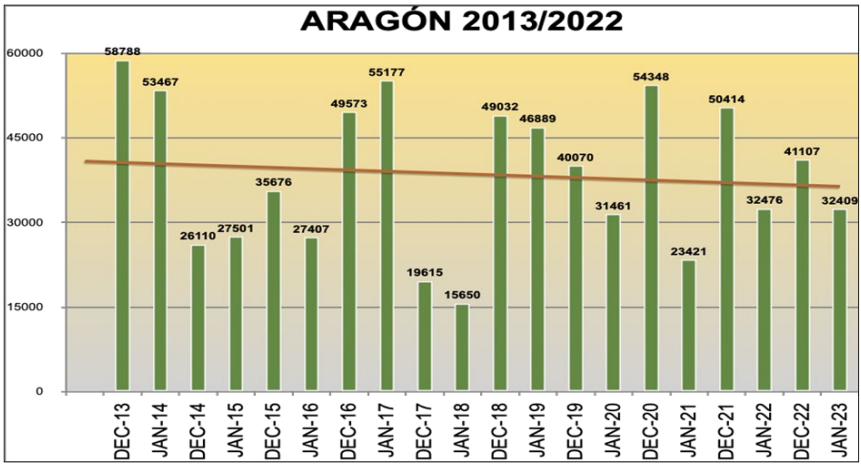


Fig. 4: Evolution of the Aragonese population of cranes 2013/2023

Catalonia

Wintering cranes are irregular in Catalonia (Fig. 5), and in some of the censuses, the recorded birds are migrants. The maximum recorded was 264 in December 2021, with a minimum of 5 in January 2015.

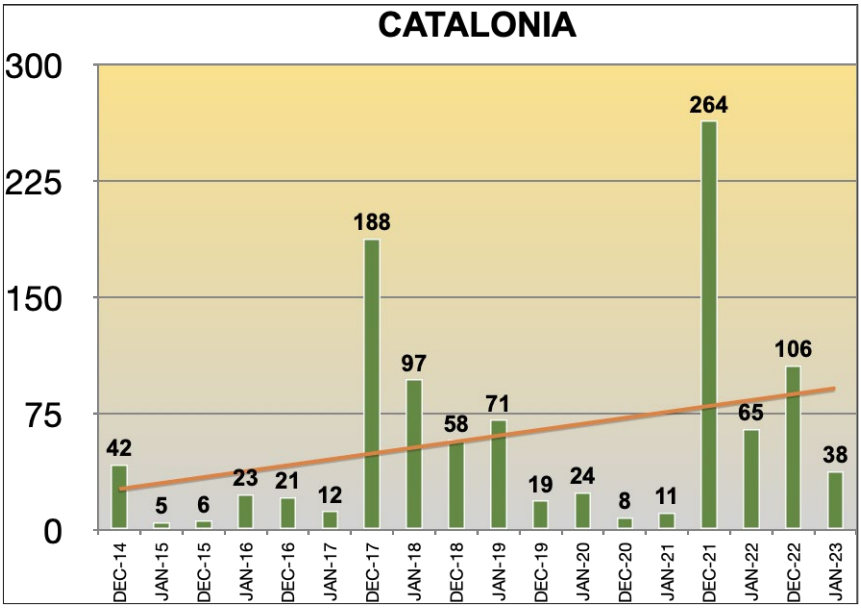


Fig. 5: Evolution of the Catalan population of cranes 2013/2023

Balearic Isles

The Balearic Isles (Fig. 6) also have an irregular wintering population, generally on the island of Mallorca. The majority of birds are usually migrants, particularly in December. The minimum recorded was 4 in January 2021, with a maximum of 108 in December 2018.

Community of Valencia

Wintering in Valencia (Fig. 7) is also irregular, and many of the registrations are birds on migration; only El Hondo reservoir (Alicante) regularly hosts wintering birds. The maximum recorded was 101 in January 2016, and the minimum was 9 in January 2017.

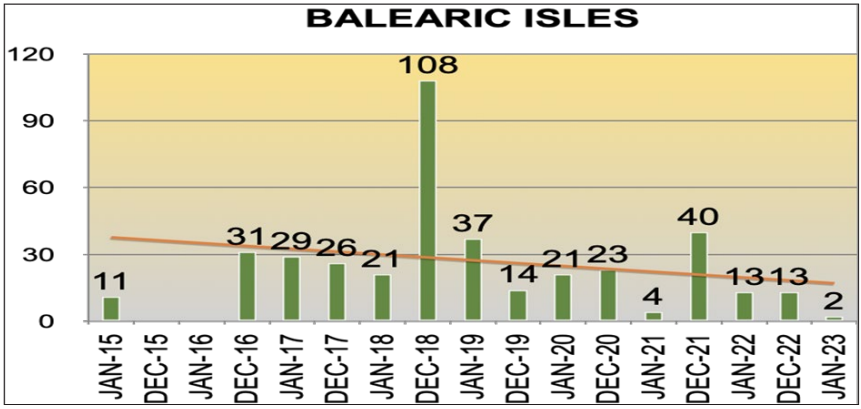


Fig. 6: Evolution of the Balearic population of cranes 2013/2023

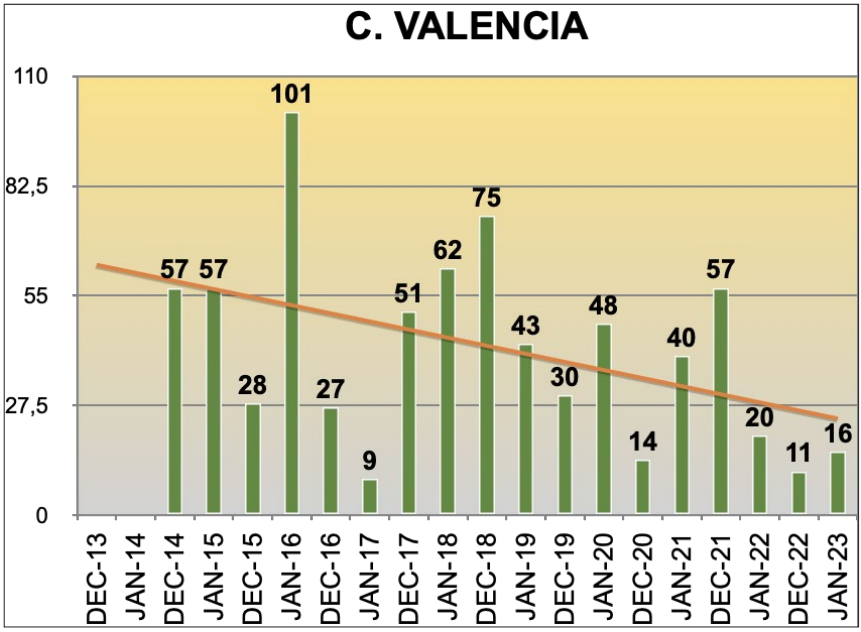


Fig. 7: Evolution of the Valencian population of cranes 2013/2023

Castile-y-León

The population in Castile-y-León (Fig. 8) is one of the most stable, at around 7,000 birds, generally associated with dehesas and areas without irrigation, with a minimum of 3,815 birds in January 2014 and a maximum of 9,359 in December 2020. There is concern over the population in Valladolid, which could disappear due to changing crops.

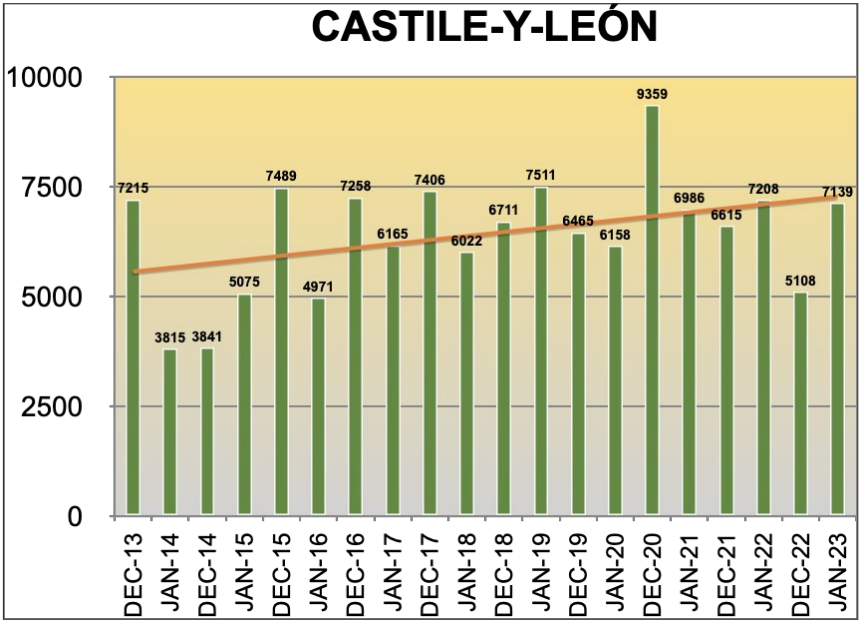


Fig. 8: Evolution of the Castile-y-León population of cranes 2013/2022

Castile-la-Mancha

Along with Aragón, this is the second most important community (graphic nº 9). The largest population is found in the dehesas of the River Tiétar, Toledo, which is shared with Extremadura. Another significant proportion of the population is located in the La Mancha wetlands. The population can exceed 50,000 birds. The highest registration was 56,202 in December 2017, and the lowest was 18,954 in January 2015 (incomplete census).

Extremadura

Extremadura (Fig. 10) hosts the largest wintering population of cranes (50%) and around 130,000 birds, with a maximum of 132,902 in January 2015 and

a low of 78,521 in December 2022. The principal area is the Central Zone, straddling both provinces, with 60% of the cranes. The area was intensely transformed with irrigated cereal crops, now being replaced by fruit and nut trees.

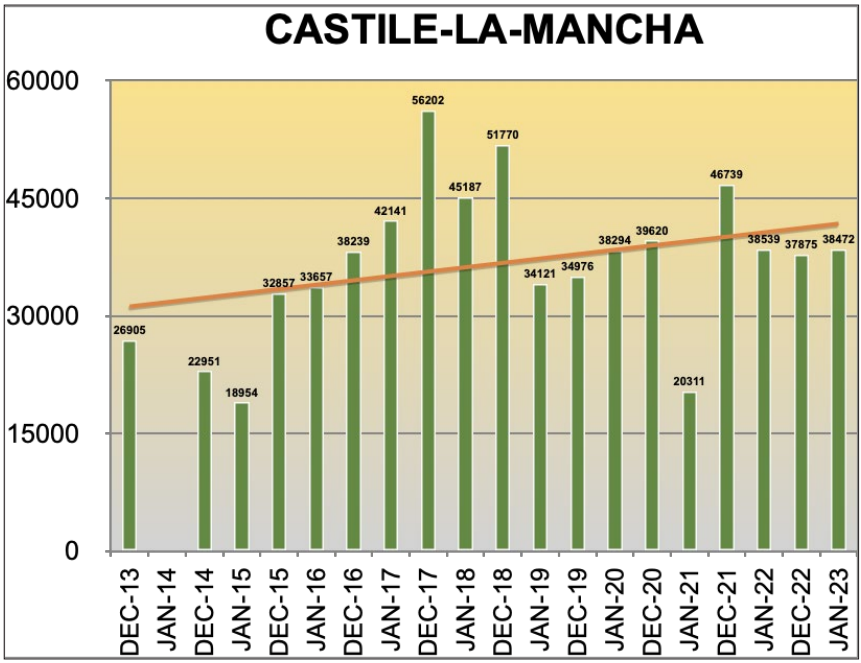


Fig. 9: Evolution of the Castile-la-Mancha population of cranes 2013/2023

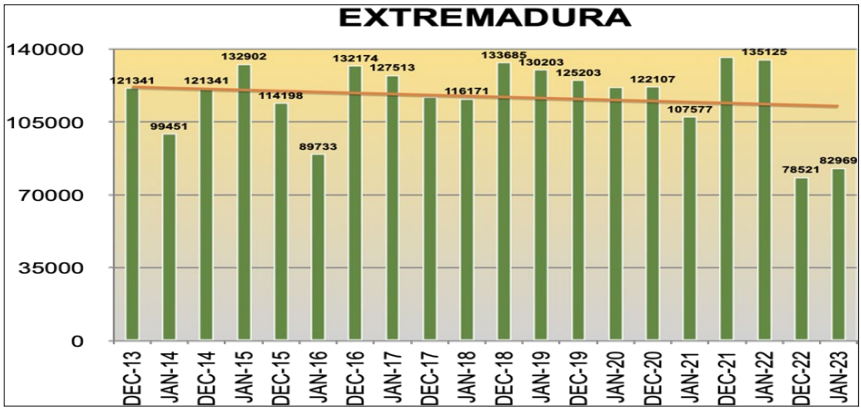


Fig. 10: Evolution of the Extremadura population of cranes 2013/2023

Andalucía

This is the fourth in importance, and the majority are found in the dehesas of northern Córdoba, with 52% of the Andalusian wintering birds. The highest figure recorded was 23,680 in January 2017; the lowest was 2,284 (incomplete census). The average is around 16,000 cranes (Fig. 11).

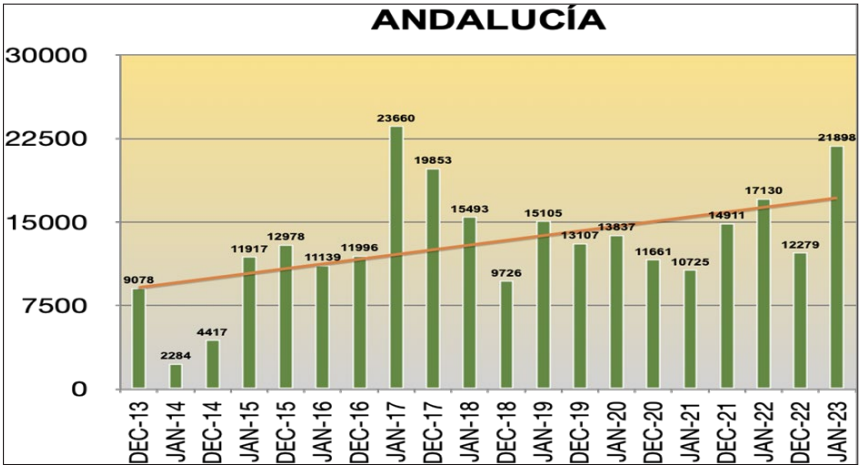


Fig. 11: Evolution of the Andalusian population of cranes 2013/2023

Portugal

The Portuguese population of cranes (Fig. 12) is usually relatively stable. It occupies the dehesas east of the country, some on the border with Extremadura, so they may routinely eat in one country and sleep in the other. In contrast with the Spanish cranes, they are less dependent on maise and rice and small groups or families are spread through the dehesas, feeding on acorns, bulbs and rain-fed cereal stubble. Generally, the dehesas are occupied quite slowly, so the highest census figures are usually those from January. The population is spread through the Alentejo region, divided into three sub-regions (Alto, Medio and Baixo).

In 2022 a family wintered on the Azores Islands (Terceira Island).

6% of the wintering population is found in these dehesas. We estimate this is around 12,000 cranes, with a maximum count of 16,892 in January 2022 and a minimum of 4,833 in December 2019 (influenced by bad weather conditions). Based on these data, the population trend is positive.

The transformation of dehesas to other crops, such as intensive olives, is reducing the suitable areas for Portuguese cranes within their traditional wintering areas, which could affect the future of this population. Due to its localised distribution, this species is classified as Vulnerable in the Red Data Book of Portuguese Vertebrates (Cabral et al., 2005).

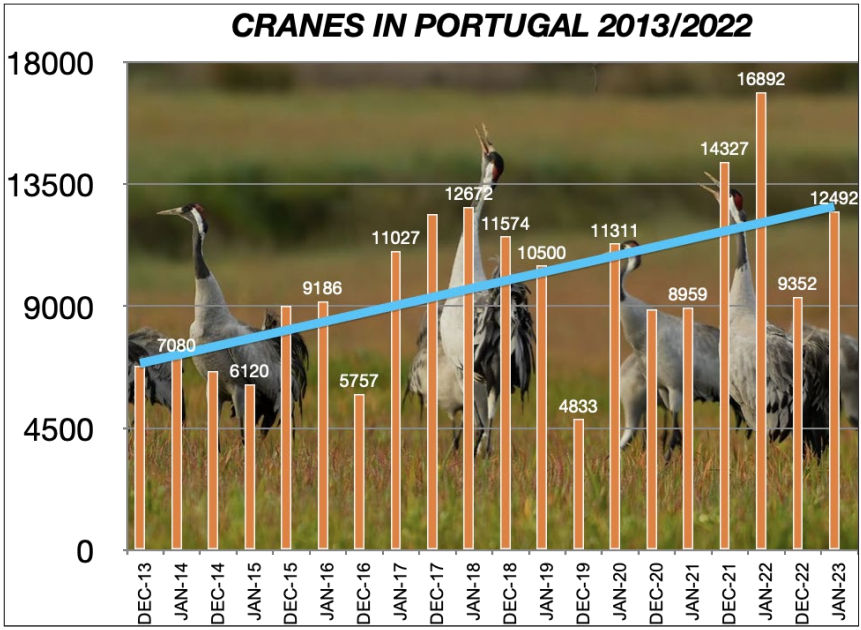


Fig. 12: Evolution of the Portuguese population of cranes 2013/2023

Conclusions

The Iberian population of wintering cranes is the largest of the European cranes, with some 275,000 birds. However, it is subject to fluctuations due to climatic conditions on the continent and the peninsula.

The availability of feeding resources has not been a problem so far. Still, we are witnessing a rapid process of agricultural transformation with significant reductions of areas for cereals such as maize and rice in favour of trees such as olives and almonds, which is significantly reducing the availability of food for cranes, and this is already affecting their distribution (Román, 2023).

Climatic conditions and reducing food resources may affect the species significantly in the coming years.

Acknowledgements

We want to express our most sincere thanks to all the people who have participated in the censuses during these years, as without them, we would not have been able to provide this information.

Also, to José Leal for the maps, Alfonso Pérez for some photos, Neil Renwick for the translation into English and Pedro Antonio García for reading the manuscript.

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Nature conservation, cranes and the role of the craniacs in it

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In Europe, the study of cranes has been carried out over decades in close cooperation between scientists, nature conservationists, and amateur ornithologists. In today's terms, scientists have worked closely with citizen scientists and have actively used citizen science data to discover new scientific findings to develop better management and protection of cranes.

Nature conservation, particularly species conservation, relies heavily on collaboration between local nature enthusiasts, conservation officials and scientists, farmers, and forest workers. In this context, a significant challenge for scientists is making the complex scientific language understandable to the public and, most importantly, conservation officials.

However, progress in nature conservation relies on the ability of conservation officers to link ecologically complex relationships with the law so that real conservation action can be taken. Unfortunately, it often takes 5-10 years from ecological knowledge to implementing a practical conservation measure. But this is only part; we also need to know whether the conservation measures implemented are sufficient, i.e. whether the species' population is beginning to stabilise or increase and whether reproductive successis improving. It is important to remember that conservation's primary task in a declining population is stabilising population abundance and achieving an age structure that supports further population improvement. Cranes are migratory birds – so action needs to be taken throughout the range, which means close international cooperation following conventions, directives, and agreements.

Practical species conservation is based on the 'three whales', which must be the output of monitoring – i) changes inpopulation abundance, ii) distribution and iii) reproductive capacity. However, from an ecological point of view, species longevity, habitat requirements, the onset of breeding age, clutch/brood size and migration patterns play a crucial role. For example, cranes are characterised by long life (around 20-25 years), late age of start the reproduction (third to fourth year of life), and slow reproduction (1-3 offspring

per year). If we only monitor the population size, we may not notice that reproductive success has decreased. The latter may also disappear «into» fluctuations in population abundance. If we do eventually detect in such a case population decline as a result of monitoring, this may already indicate a very long-term decline in reproductive success and, on the other hand, the age and sex structure of the remaining population may bealready skewed. However, the decline's cause still needs to be discovered, making it challenging to implement the proper conservation measures immediately after discovering the population decline. At this point, it is essential to look back in time – only 50-60 years ago, the Common crane population was relatively small, and the population recovering to today's abundance took some 30-40 years. To understand what factors influence the abundance of a long-lived species and how the species responds to changes in the landscape and climate, there is a need to turn attention to more numerous species and use them as model species. To illustrate how complex the reproduction of widespread and numerous Common cranes could be, please follow Fig. 1. It is important to note that nesting success can be considered positive if the offspring also start nesting - this means that the pair have contributed to the maintenance or increase of the population.

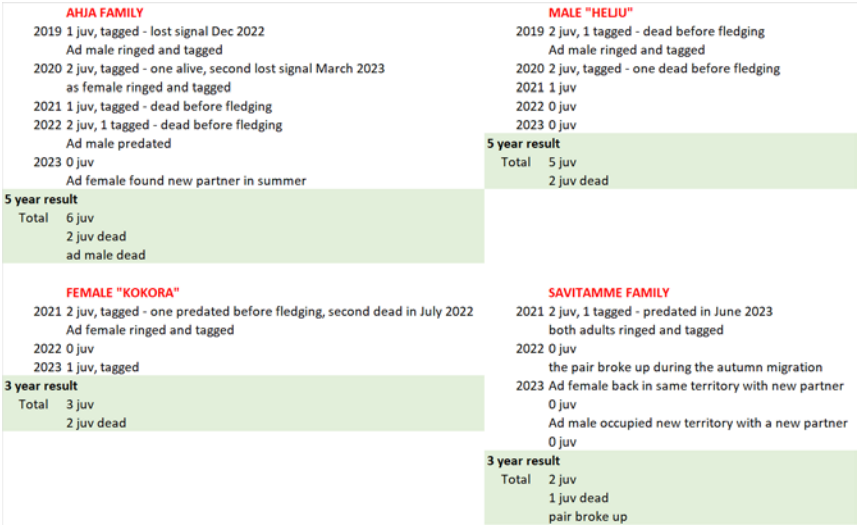

Fig. 1. Example of breeding results of four Common crane families in Estonia

Today, we live in a rapidly changing world with a growing need for operational ecological information concerning the size, distribution and reproductive success of animal populations. While conservation officials often look to scientists, the reality is that scientists also often need more data. However, close cooperation between researchers and amateur ornithologists is required to collect the necessary data. Fortunately, such collaboration between craniacs and many other bird groups (for example, geese, swans, birds of prey and waders) has been working for decades. One of our speech's objectives is to highlight the growing need for this cooperation both today and in the future. Scientists and official conservation workers will never be able to collect as much data as thousands of craniacs can. Dear crane enthusiasts, our knowledge about crane species' biology and ecology in future depends on the data you collect today!

It is already an old joke that migratory birds arrive on weekends – but the reality behind this is much more complex from the point of view of equal spatial distribution of data collected. Data collected by volunteers are often clustered in certain areas where observers live - which is normal. The practical meaning for nature conservationists is that there are many published papers about the species ecology, but this could not fit adequately to certain ecological regions. It means the data's heterogeneity must be considered to give it its actual value. Also, the pressure of observations, or more generally, the search for information, must not be come a nuisance (one-off or otherwise) for Crane populations, some of which are sometimes fragile.

The question always arises, what is important, what data to collect, and what is essential for nature conservation?

Nesting information – the locations of observed pairs; the coordinates of the nest found, the size of the clutch or the brood seen. During the incubation period, seeing a single bird often means that a crane nest is located in the area and another bird is incubating; during the chicks period, seeing a pair without brood means either a territorial non-nesting pair or a failed nesting. It would be good to define your own study area to monitor the change in abundance in a particular area.

Colour ringing – a relatively inexpensive method which produces a large number of resighting if cranes are intensively observed along the migratory route and/or in wintering areas of the cranes.

Observation/searching of ringed birds – it is very important to pay attentionto age, partner presence, and brood size. When seeing a single adult

crane, be sure whether he/she has a partner and offspring. If such a pair of cranes do not have offspring, it is as important to note this as when they have offspring. This is essential information that is needed to model population development. Colour-ringed birds also give important information about behaviour changing due to climate change, e.g., cranes ringed in Germany significantly reduced their migratory distance. So, some pairs start breeding earlier, and some cranes hatch so early in the year that the food availability of insects is unsatisfactory.

Counts of crane's summer flocks – in the summer, subadult cranes are scattered in smaller groups in a wide area. Occasional observations also provide an indication of the habitat need for the cranes. Finding colour-ringed cranes in such a flock helps to understand the extent and direction of the dispersal of young birds.

Autumn migration censuses – in monitoring the crane populations of different countries, it is essential to carry out censuses in the staging areas before the local birds begin to migrate or cranes from the North arrive. Estimating the proportion of young birds in these staging areas also provides clear information on reproduction. Counts of cranes on the migratory route give an idea of the location of the staging areas and the abundance and temporal dynamics of the staging cranes. Counts of young birds provide an idea of possible mortality during migration.

Counts in the winter area – the winter period's countings give an idea of the shift in the winter areas of cranes and the abundance and temporal dynamics of birds staying in different regions. Allows to estimate the number of crane populations in a given region, but as a rule, their breeding area is unknown. Again, it is very important to look at and search for cranes marked with coloured rings and collect the info about their family size or juveniles' rate in flocks, making it possible to assess the population dynamics.

All of the above aspects are common, and we all have done it for years, but all this is extremely important from the point of view of assessing the status of the crane population. Even if collecting information on only a few stages is possible, these data are invaluable.

We thank all active volunteers for their great support through their census and observations and for sharing the information. It's a great pleasure to be part of this crane community or, better, crane family!

Встречи гнездования даурский журавль на оз. Чингийн-цагаан в центральной Монголии

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Введение

Даурский журавль (*Antigone vipio*) – гнездящийся перелётный, летующий и пролетный вид. В настоящее время гнездовой ареал охватывает бассейн р. Улдзы, долину Керулена от срщднегорий до государственной границы, Керулено-Улдзинскую озерную степь, восточные отроги Хэнтэйского хребта, Буйрнуро-Хинганский район. Изолированный небольшой очаг гнездования расположен в 250 км западнее основного ареала – от устья р. Хар-Бух (приток Туула) и на запад до оз. Угий в районе слияния Тамира и Орхона (Звонов и др., 2016).

Азия – однин из крупнейших центров видового разнообразия журавлей, где обитает девять из 15 видов мировой фауны. В Монголии отмечено семь видов журавлей: на гнездовании – красавка, даурский и серый журавли, и на пролете или в летнее время – черный, японский журавли и стерх (Намсрайжав, 2015), и залётный черношейный журавль (один особь сново регистрииовано 2020 г. в Булган аймак). Из них четыре (стерх, даурский, серый и черный журавли) занесены в Красную книгу Монголии (Монгол улсын Улаан ном. 2013).

Озеро Чингийн-Цагаан заброшенное озеро на высота над у.м. 960 м, площадью 2,6 км^2, имеет длину 2,5 км и ширину 1,5 км, а длина береговой линии составляет 9 км. Берега озера богаты измельченным камышом, перед ними текут небольшие ручьи, уровень неустойчивый, минерализация воды 1466,52 мг/л, сульфатный тип магния относится к низшей категории. Температура воды в июле и августе 18,7°-21,5°C, дно покрыто сероводородным илом (рис. 1).

Исследуемая озера находится Среднегорья бассейна Селенга и Орхона на физико-географическое районирование Монголии. Это обширная горная

область, расположенная в низовьях Орхона и Селенги между Хангайским и Хэнтэйским хребтами. Здесь прщобладает рельеф сглаженных средневысотных гор в сочетании с широкими межгорными долинами. Максимальные высоты (до 2500 м над ур. м.) горы имеют на юге; в северной части (в низовьях Селенги) они не превышают 600 м; средня абсолютная высота долин – 800-1200 м. В долинах нередко встречаются заросли чия (Звонов и др., 2016).

Материалы и методы

С целью наблюдения распределения даурский журавль по территории Центральной части Монголии (Булганской аймак), в том числе в самом оз. Чингийн-Цагаан в сомоне Дашинчилэн. Маршрут протяжённостью более 2300 км. Материалы был собран 16.06.2013 г; 10.06.2015 г.; 14.06.2017 г.; 8.06.2018 г.; и 3.06.2023 г. Учет птиц проводили с помощью биноколя (ZESS CONQUEST HD 8*32) и дижитал аппарата SONY DSC-HX400, 20.4 MEGA PIXELS. Названия птиц в списке приведены по сводке С. Гомбобаатар (2019).



Рисунок 1. Юго-Восточный берег оз. Чингийн-Цагаан 16.06.2013 г.; перед ними текут небольшие ручьи

Результаты

В целом, миграционный период Центральной Монголии встречаются шесть вида журавли. Из них достоверно гнездится два вида-красавка и даурский журавли. В том числе даурский журавль (*Antigone vipio*) встречается как в гнездовой период на оз. Чингийн-Цагаан (рис. 1). В июня встречено 2013 и 2015 по один пар 2017 и 2018 гг. 2 пара даурский журавли (таб. 1). Так, 3.06.2023 г., 19:28 часов наблюдено 1 пар, где кормилась между их растояния было более 300 метров.

Таблица 1. Гнездового населения на оз. Чингийн-Цагаан даурский журавль в июня 2013–2018 гг.

№	Наблюдения срок	Кол-во особь	Экологические особенности
1	16.06.2013 г.	1 пар	Нормальное лето
2	10.06.2015 г.	1 пар	Засушливый лето
3	26.07.2015 г.	1 пар	Засушливый лето
4	15.06.2017 г.	2 пара	Засушливый лето
5	8.06.2018 г.	2 пара	Влажное лето
6	3.06.2023 г.	1 пар	Влажное лето

Нами в этого озера зарегистрирован встреча одна пара даурский журавль произошла 16.06.2013 года, по окраинам заросшим тростником озере Чингийн-Цагаан, в 2 км восточнее сомона Дашинчилэн. Вторая встреча этот же озера 10 июня 2015 г. одна пара видно что они здесь гнездятся и мы наблюдали 4 особи 26 июля 2015 г. из них были 2 молодые птенец. На оз. Чингийн-Цагаан 15.06.2017 г. встречена 2 пара все взрослые; 8.06.2018 г. отмечена 2 пара. Таким образом, оз. Чингийн-Цагаан, его заросли небольшой изолированный очаг гнездования. Последний два год озере Чингийн-Цагаан увлечивалась численность особь даурский журавль (рис. 2).



Засушливый лето. 15.06.2017 г.; фото Н.Цэгмид



Влажное лето. Дата съемки: 8.06.2018 г.; фото Е.А.Говорова

Рисунок 2. Озера Чингийн-Цагаан, его экологические особенности.

Обсуждение

В Центральной Монголии впервые отмечено в начале июня 2001 г. в том числе на оз. Угий нур. Н. Цэвээнмядаг и соавторов наблюдали 1 даурского журавля 3.06.2001 г. на оз. Угий-Нур (Намсрайжав, 2017). В работе Н. Цэвээнмядаг и соавторов (2005) «Население птиц озера Угий нур и его окрестностей» содержатся сведения появляется даурский журавль с обмелением озера стали (Цэвээнмядаг, 2005). На лугу, недалеко оз. Амин-нур 3.08.2006 г. была отмечена одиночная птица (Цэгмид, 2007; 2017). На Амин нур, его окрестности с 2008 г. началась интенсивно растил тростниковых зарослей. Так, появилась открытые тростниковых зарослей заболоченные поймы рек (рис. 3). 14.06.2017 г. отмечено гнездящийся одна пара даурский журавль с 1 птенецами на южной край на лугу оз. Амин-нур. Даурский журавль, его гнездование не мишаеть животноводства. В природе период гнездования они находится рядом. Этого условия можно видить только в Монголии.



16.06.2013 г. общий вид Амин нур



14.06.2017 г. гнездящийся пар, после спрятав птенец под тростников

Рисунок 3. Озера Амин нур. фото Н.Цэгмид

Один даурский журавль улетил на направлению северо-восток от наблюдателей (рис. 4).

Таким образом, гнездящихся даурский журавль отмечено на оз. Чингийн-Цагаан и Амин нур. Эти открытые тростниковых зарослей достоверно гнездящихся место даурский журавль и небольшой изолированный очаг гнездования в Центральной Монголии.



Рисунок 4. Озера Амин нур, гнедящихся даурский журавль. Фото Кестутис Чепенас. 14.06.2017 г.

Ссылки

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On weather, cranes, their nests, eggs and chicks

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The report presents the results of almost 50-year observations of five species of Palearctic cranes and the materials of more than 60 papers.

1) The social structure of the Common crane settlements was studied at three field stations in eastern Ukraine: territorial pairs that built nests but did not breed were found for the first time.

2) Adults constructed "nursery" nests close to the nests with small chicks; such nests could probably make the first days of life easier for chicks.

3) For the last 45 years, a new wave of spring arrival of Common cranes to the southernmost settlements in eastern Ukraine (about 17 % of the first birds in spring) has been revealed; it is timed to the second half of February – the first ten-day period of March.

4) The air temperatures in the pre-nesting period (March) in eastern Ukraine correlate with the egg-laying period: the higher the temperatures, the earlier cranes start egg-laying.

5) Nest constructions of seven species of Palearctic cranes are represented by three types: a) on the water; b) on the base of a tree; c) at the base of a tree; nests are most diverse in the Common crane that "builds" a nest throughout the entire period of incubation.

6) The Demoiselle, Common, and Sandhill cranes often build more than one nest; territorial pairs of Common cranes which did not breed built more nests than breeding ones;

7) The posture of a female Demoiselle crane in the process of egg-laying was observed in the wild;

8) A pygmy egg was found for the first time in the nest of the Common crane; two Demoiselle crane clutches and four Common crane clutches of three eggs were found on the territory of the former Soviet Union;

9) In nurseries, Demoiselle, Red-crowned, and probably, all other cranes lay smaller eggs than in the wild;

10) Data on the weight of fresh eggs of cranes (and all other birds) traditionally presented in scientific overview publications are redundant since they make no sense without real parameters of eggs; Common cranes lay two eggs

with the interval of two to three days, 2.11 days on average; the eggs in their replacement clutches are smaller than in the first ones; in cranes, the incubation stage could be determined by the specific gravity of eggs easier and faster than with the use of flotation test; for Common and Demoiselle cranes, tables of changes in specific gravity of eggs were compiled, which can help schedule a revisit to the nest, measurements of newly hatched chicks, and used to determine the probability of the laying of a second egg.

11) For Demoiselle and Common cranes, the correlation between the egg volume and the body weight of the chick hatched from it was revealed; up to 2–4 days of age, two chicks from a family are easily distinguished: the youngest is usually heavier and has a larger yolk sac.

12) If all duets of the Common crane in eastern Ukraine in March are taken as 100%, then they are less frequent by 4.8 times in April and by 15.6 times in May; the birds performed duet displays only in 27% of the nest shifts;

13) The majority of feathers of Common cranes on the nesting grounds in eastern Ukraine belonged to breeding birds, one of which moulted after hatching its chicks;

14) Incubaing Common cranes alternate between poikilothermy and homeothermy: in cold mornings, they rose on the nest to rotate eggs only 1.5 hours after dawn;

15) In Red-crowned, Common, Hooded, and Demoiselle cranes, the time of incubation is equally divided between the partners; Hooded and Common cranes shift on nests at night.

16) In rainy weather (drop in temperature), Red-crowned, Common, Hooded, and Demoiselle cranes rose from the clutch to rotate eggs and shifted on the nest two times less often than in fine weather.

17) The chicks of Demoiselle, Common, Sandhill, and White-naped cranes hatch with a split mandible tip that fuses in 3–8 days; a yolk apteria (*Apterium vittelinum*), previously unknown for precocial birds, encircles their yolk sac and is overgrown by 8–12 days of the chicks' life; in the chicks of the mentioned species as well as Red-crowned crane chicks, there are only a few rows of neoptile feathers on the upper surface of the hand leaving most of the hand free; it is a new apteria, *Apterium manuale embryonal*, represented on the hand of adult Common cranes only by a narrow strip.

18) Using "old-fashioned" methods, subspecies of the mainland (*Grus japonensis motignesia*) and island (*G. japonensis japonensis*) Red-crowned

cranes were identified according to the body size of individuals and peculiarities of their distribution and biology within the range.

19) Within the range of the Common crane, a northward gradient of decrease in the egg size was revealed; in the Demoiselle crane, only the egg length increases over 5600 km from west to east, while the volume of eggs remains constant.

POSTERS



A public reception in the National Nature Reserve of Arjuzanx: a key factor in a local acceptance and better conservation of the Common cranes (*Grus grus*)

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In all cultures, cranes have a high degree of symbolism: happiness, wisdom, longevity. In the Landes de Gascogne, the territory of the National Nature Reserve of Arjuzanx, the Common cranes are the inhabitants of winter: they announce their arrival but also their departure. They have an extraordinary capital of sympathy and are very attractive to the public.

To guarantee their preservation and avoid their disturbance while satisfying the expectations of the public, it was necessary to define a strategy for public reception based on the following:

- Appropriate regulations, now made concrete by the designation as a National Nature Reserve;
- the creation of infrastructures to prohibit access to the roosting places but also observatories in free access, located at the periphery of the site, and observatories, as close as possible to the roosting places, accessible for guided tours;
- a programme of activities that allows the general public to attend the spectacle of the Common cranes, but with a limit on the number of visitors that can be welcomed during each activity;
- environmental education work with schoolchildren;
- the search for local partnerships, such as the Landes de Gascogne Regional Nature Park and cottage owners, who make this strategy a tool for the development of sustainable tourism in the area.

Such a strategy, based on better knowledge of the cranes, is undeniably a factor in the local acceptance of their presence and thus contributes to better preservation of the species in the main roosting place of the Landes de Gascogne.

There is still a need for an appropriate approach to the public in the foraging area, where the cranes are still disturbed by people wanting to get as close as possible to them.

Heavy metal residues in eggshells of Common Cranes (*Grus grus*).

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Land use change, mainly in terms of intensification of agriculture, urbanisation, and industrialisation, has led to considerable pollution across the globe. Heavy metals are considered as major pollutants harming our ecosystems. Besides top-level predators, long-living, omnivorous species, like Common Cranes (Grus grus), are particularly vulnerable to heavy metal pollution's negative effects. So far, information on cranes' heavy metal contamination status in Europe and potential adverse effects on their reproduction have been missing. Using atomic absorption spectrometry, we studied concentrations of heavy metals arsenic (As), cadmium (Cd), copper (Cu), and lead (Pb) in eggshell residues of Common Cranes. 249 eggshell residues collected in nesting areas of north-eastern Germany between 2006 and 2021 have been analysed.

Neither As nor Cd was found, and levels of Cu and Pb found did not exceed concentrations considered potentially toxic in birds. The eggshells of unhatched eggs did not contain higher metal levels than those from hatched eggs. Other than expected, metal concentrations in eggshells did not increase with increasing female age, indicating that Cu and Pb do not accumulate in the circulatory systems of adult birds. Metal concentrations decreased significantly over time, most likely due to the ban on leaded gasoline in the early 21st century and strict limitations of heavy metal-based biocontrol products. However, we suggest that considerable amounts of Cu originating from agricultural practices are still being released into the environment. Cu levels found in eggshells gradually increase with increasing proportions of agricultural areas within the cranes' home ranges.

This study gives a first insight into the heavy metal contamination status of Common cranes in Germany, indicating the need for further investigations. Even though heavy metal concentrations found are not considered potentially toxic, metal concentrations of blood and soft tissues of egg-laying females are assumed to be several times higher than those found in eggshells. Additionally, our study suggests using eggshell residues of Common Cranes as bioindicators for monitoring environmental pollution.

Are the terms of Common Cranes' spring arrival at Kyiv for 100 years changed?

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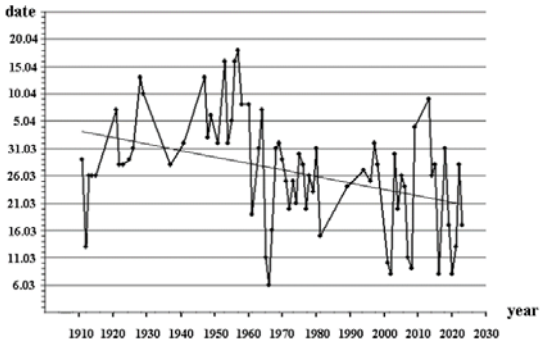
Common crane *Grus grus* is a migratory species in Ukraine, breeding in the country's northern part. The species is listed in the Red data book. The data for analysis were collected during 1911–2023 years at Kyiv town by different observers (literature sources) and ourselves on the spring migration of this bird. It is known that the climate is changed over the last decades. The question arises how can this influence bird migration? The statistical analysis of 69 dates of the first bird spring arrival shows that cranes start migrating on 27 March on average within limits from 6 March to 18 April. To answer the question, we compare the average data of the first arrival in the last years (2021–2023, n=19) with the corresponding dates of the whole part of the 20th century (1911–1998, n=69) and its last half (1951–1998, n=33). The results show that crane spring migration begins earlier in both cases. There is a difference between average dates in the first case – 20.03 (2001–2023) with limits 8.03–9.04 and 29.03 (1911–1998) with limits 6.03–18.04 and in the second case – 20.03 (2001–2023) with limits 8.03–9.04 and 28.03 (1951–1998) with limits 6.03–18.04. According to Student's t-test, the difference between average dates is significant in the first (p=0.001) and second (p=0.007) cases.The following figure shows the many-year dynamics of the Common Crane spring migration beginning and its trend.



Shared responsibilities and sleepless nights - Threats to eggs of Common cranes

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Facing climate and land use change, a species' ability to adapt successfully to changing circumstances is crucial for survival. Common cranes (Grus grus) have been shown to adapt to changing environments successfully. However, despite increasing population numbers, the reproductive success of Common cranes has been decreasing within certain regions over the last few years. Despite the negative effects of high population densities or late nest initiations in general, the actual causes of losses of clutches remained unclear. In general, predation is believed to be the main cause of reproductive failure in cranes and being exposed to anthropogenic disturbances may additionally increase the probability of reproductive failure significantly.

From 2016 to 2021, we installed camera traps at 161 nesting sites of Common cranes nesting in northeastern Germany. The collected photo material was used to identify major predators and investigate disturbances' effect on the breeding biology of Common cranes.

Throughout the study period, 50.9 % of clutches hatched successfully. Five eggs (equivalent to 1.6 % of clutches) were lost without external impact (e. g. rolling out of the nest). Only one of two eggs hatched in three cases (1.9 %), whereas the other was lost due to predation. 45.6 % of clutches have been predated, and anthropogenic disturbances, causing cranes to leave the nesting sites, were linked to 27 % of predation events. Within our study area, Red foxes (Vulpes vulpes) have been identified as major predators, successfully predating on cranes' nests in the presence of adult cranes. Northern ravens (Corvus corax) and North American raccoons (Procyon lotor) have been identified as the second most important predator species responsible for the loss of clutches. However, these species benefit from the absence of adult cranes, mainly caused by anthropogenic disturbances. Common cranes were found to be very successful in defending their clutches against North American raccoons, and avian predators have only been detected near the nests during the absence of the adults.

Predators or distinct defensive behaviour patterns of adult cranes have mainly been recorded during dawn and night periods, which resembles activity patterns of recorded mammalian predator species. Even though cranes show high individual variation in reactions to disturbances, in most cases, both

sexes protect eggs and offspring from predators. Nesting sites located within intensively used agricultural landscapes are more strongly affected by anthropogenic disturbances, but hatching success did not differ between different habitat types. Cranes are not only able to adapt to different nesting habitats but also adapt to frequently occurring disturbances throughout the nesting period.

Monitoring of the Common Crane in Georgia: 1991–2022

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The Eurasian Common Crane, which breeds in Georgia, belongs to an isolated Caucasian subspecies of *Grus grus archibaldi*, whose modern distribution and abundance and habitat changes are alarming. This report presents the collected and analyzed materials on the Common Crane population's status in Georgia during the last three decades. Data on territorial distribution, habitat selection, breeding biology, migrations, threats and limiting factors are also provided. Until the 1990s, very little was known about the status of this bird in Georgia. The fact is that during the times of the USSR, the border regime extended to this territory and the conduct of any field work was associated with significant difficulties.

The first three nests were only found here in 1978 and 1981. The first attempt to determine the total number of breeding pairs was made in the summer of 1991, and 18 pairs and 16 occupied nests were found. Due to the unstable socio-economic situation in Georgia in the 1990s - early 2000s, it was impossible to carry out fieldwork. Repeated surveys were organized only in 1997–1998, 2002 and 2008. The author and assistants began to conduct a more or less detailed study and regular monitoring of the local breeding population in 2011. From 2011 to 2022, it was possible to conduct annual censuses. During the yearly surveys in recent years, all known nesting sites of cranes are visited several times a year from the time of their arrival in spring until they depart for wintering in autumn; all formed pairs and non-breeding cranes were counted. Records of all individuals tagged in previous years were noted.

Data on the number of occupied nests, successfully breeding pairs, and hatched and fledged chicks were used to calculate the breeding success. Based on the collected materials, such breeding parameters were calculated as the number of hatched and fledged chicks per pair and an average number for all pairs. Breeding habitats are located in treeless mountain steppes on the South Georgian Upland of the Samtskhe-Javakheti region in the southern part of the country near the borders with Turkey and Armenia. For nesting, it prefers a variety of shallow wetlands with stagnant water located between hills and ridges, lake shores, temporary islands on lakes, seasonally flooded meadows around lakes, swamps, along river banks with numerous dense

sedge hummocks (*Carex spp.*), reed beds (*Phragmites spp.*), cattail (*Typha spp.*), some other plants associated with alpine wetlands - *Lemna trisulca*, *Eleocharis palustris*, *Myriophyllum spicatum*, *Potamogeton spp.*, *Beckmannia eruciforme*, *Calamagrostis ignorea*, *Digraphis arundinacea*, *Poa palustris*, etc. The highest nesting territories are located on the lakes Abuli (2184 m above sea level) and Avchalgel (2060 m) on the Samsari Range, and Madatapa (2112 m), and the "lowest" ones are in the eastern part of the Tsalka Hollow (1760 m), in the Sulda marsh (1853 m) and the Kartsakhi marsh (1847 m). One to five pairs nest within one wetland, usually one to three pairs. The minimum distances between occupied nests on different lakes and marshes ranged from 130 m to 325 m. Currently, the main limiting factors are the degradation and transformation of suitable breeding habitats due to drainage, overgrazing, and likely climate change. The sharply increased level of human disturbance due to the construction of roads, railway, and various agricultural facilities also has a negative effect. During the last two decades, all known breeding sites have been adjacent to areas with a relatively high level of economic activity of local inhabitants – cattle and sheep seasonal farms and pastures, potato and grain fields, hay meadows, villages, roads, railways, etc. Most pairs, except 1 - 2 in some years, nest within protected areas – in Javakheti National Park, Kartsakhi, Sulda, Khanchali, Bugdasheni, Madatapa and Ktsia-Tabatskuri managed reserves.

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