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Abstracts: Oral Presentations

Session 1: Population Ecology

Talk 1: Evaluating the Role of Ecological Focus Areas for Farmland Birds Conservation in the Grosses Moos Region

Elia Sartoris

ETH Zürich/Swiss Ornithological Institute, Switzerland

Co-authors: Urs Kormann, Franziska Korner-Nievergelt, Nica Huber and Simon Hohl

Farmland bird populations have declined sharply across Europe due to agricultural intensification. In Switzerland, ecological focus areas (EFAs) were introduced to mitigate these losses, yet their effectiveness relative to other land-use options and the role of vegetation structure remain insufficiently understood. This study investigates habitat preferences and territory distribution of eight conservation-relevant farmland bird species across four breeding seasons in the intensively cultivated Grosses Moos region. Breeding bird monitoring data were combined with high-resolution LiDAR-based land-use information and detailed vegetation surveys to assess species-specific responses to EFAs, with a focus on extensively managed meadows (EMM), the most common EFA type in Switzerland.

Although EFAs covered only 7.8% of the landscape, approximately 75% of recorded bird territories were associated with them, highlighting their disproportionate importance for farmland bird conservation. However, only half of the EFAs were occupied, indicating that habitat quality within and around EFAs is critical. Territory numbers increased with both shrub quantity and quality on EMM, with the strongest positive effects linked to small (<3 m) Hawthorn (*Crataegus spp.*) and Blackthorn (*Prunus spinosa*) shrubs, while larger shrubs had negative effects. Higher EFA density at the landscape scale further enhanced territory numbers. Model predictions showed that improving EMM quality had a substantially stronger effect than increasing EFA area alone.

These results emphasize the key role of EFAs in intensively managed farmland and demonstrate that small-scale improvements of EMM through small thorny shrubs can provide high conservation benefits.

Talk 2: Changes in subarctic bird community composition in an era of climate change

Johanne Burmeister

University of Potsdam, Germany

Co-authors: Martin Green¹, Sören Svensson¹, Göran Paulson², Thomas Andersson³ and Åke Lindström¹

¹Department of Biology, Lund University, Ecology Building, SE-223 62 Lund, Sweden

²Allégatan 36, SE-263 33 Höganäs, Sweden

³Önneköp folk high school, Department of natural sciences, Bygatan 30, SE-29173 Önneköp, Sweden

Climate change is known to impact species' distribution ranges and abundances, but the effects on the composition of local species assemblages remain relatively unknown. Especially communities in colder ecosystems, with species well adapted to the cold temperatures, are likely particularly sensitive to climate warming and yet among the least-studied. In this study, we investigate how temperature niches of the subarctic breeding bird communities in Swedish Lapland developed in 1963-2023. To do so, we applied the community temperature index (CTI), that reflects the balance of more southerly distributed ("warm-dwelling") and more northerly distributed ("cold-dwelling") species in a community, to the bird communities, and used an additional jackknifing approach to identify the species mainly driving the observed patterns. The breeding bird communities showed a tendency towards warmer temperature niches but responses varied between habitats, sampling schemes and taxonomic groups. In the subalpine birch forest, the increase in the CTI was mainly caused by shifting species compositions through the immigration of warm-dwelling and the disappearance of cold-dwelling species. In the alpine communities, however, warming temperature niches resulted from decreasing relative abundances of cold-dwelling species. When considered individually, the passerine and duck communities in the study region exhibited positive trends, whereas local waders showed a surprisingly contrasting pattern.

The varying patterns are likely caused by relative weak temperature increases during the summer months for the sampled area. This study emphasizes the complex impact climate warming has on ecosystems and therefore the urgency for more research and attention.

Talk 3: Mangrove Specialisation Drove the Rapid Evolution of Strong Reproductive Isolation in a Phenotypically Cryptic Avian Species Complex

David Tan

German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany
Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, USA

Co-authors: Paisin Lekcharoen¹, Jacky S.M. Soh², Robert Teo², Yip Jen Wei³, Ariel Wee⁴, Constance Liew³, Frank E. Rheindt⁴, Philip D. Round⁵, Michael J. Andersen⁶

¹Faculty of Veterinary Science, Chulalongkorn University, Bangkok, Thailand

²National Parks Board, Singapore

³School of Biological Sciences, Nanyang Technological University, Singapore

⁴Department of Biological Sciences, National University of Singapore, Singapore

⁵Department of Biology, Mahidol University, Bangkok, Thailand

⁶Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, USA

Mangroves are physiologically stressful environments that experience daily fluctuations in salinity and inundation. While these dynamic conditions have been associated with various morphological adaptations in mangrove-dwelling fauna, few studies have examined if faunal specialisation in mangroves drives the evolution of reproductive isolation. To investigate this question, we combined phylogeographic and phylogenomic analyses with palaeogeographic models to reconstruct the biogeography of the Mangrove and Blue-winged Pittas (*Pitta megarhyncha* and *P. moluccensis*), a phenotypically cryptic species complex that exhibits divergent ecological preferences. Our results revealed a surprisingly recent three-way diversification event during the middle-to-late Pleistocene that coincided with a climatically-driven retreat of forest habitats into small refugia, resulting in the speciation of the Mangrove Pitta in the mangroves fringing the Andaman Sea, and the intraspecific subdivision of the Blue-winged Pitta within two refugial forest fragments in mainland Indochina and the Thai-Malay Peninsula. Our models showed that the rapid onset of secondary contact allowed for the resumption of gene flow between the Blue-winged Pitta populations, but not with the Mangrove Pitta, suggesting that mangrove specialisation drove the evolution of strong reproductive isolation in this species complex. Our results highlight how adaptation to mangrove habitats may be a strong driver of genetic divergence and speciation, and indicate that Pleistocene refugial dynamics may have played a major role in the diversification of faunal communities in Sundaland and Indo-Burma.

Talk 4: The role of vernal pools and aquatic invertebrates in supporting waterfowl breeding success

Basile Marteau
University of Helsinki, Finland

Co-authors: Janne Sundell, Céline Arzel, Petri Nummi

The decline of invertivorous waterbirds in Fennoscandia over the recent decades has raised concerns. Decrease in food resource availability and quality are suggested as one of the potential drivers behind this decline. Fewer wetlands are suitable for dabbling ducks as many shallow wetlands have been drained for agriculture or forestry, and existing ones are overgrown. Temporary wetlands may be particularly important for rearing ducklings as they might host a high abundance of aquatic invertebrates due to the absence of fish predators. Hence, Vernal pools are small temporary wetlands, usually filled with precipitation in autumn and winter. The impact of temporary wetland productivity (in terms of available aquatic invertebrates) and ducklings body condition and survival is poorly understood.

In this research, we used imprinted mallard ducklings to study the effects of habitat type (lake, and vernal pools) and their aquatic invertebrate availability on duckling growth in 2023 and 2024. Ducklings were divided into two groups to forage in either lakes or vernal pools. Ducklings foraged at the study sites for 4 hours daily and were weighed before and after. Aquatic invertebrates were sampled with emergence and activity traps. Ducklings gained as much or more weight when feeding in vernal pools compared to lakes in 2023 and 2024 respectively. Ducklings' daily weight gain was linked to macroinvertebrate availability. Temporary ponds were richer in aquatic macroinvertebrates than lakes, and more ducklings survived in temporary ponds due to the absence of fish predation. We highlight the crucial role of aquatic

invertebrates in ducklings' mass gain and the underinvestigated potential importance of temporary wetlands for duckling survival and overall waterbird breeding success.

Session 2: Human—Wildlife Interactions

Talk 5: Foraging behavior of breeding Great Tits (*Parus major*) and nestlings food composition in a gradient of urbanization

Patrycja Piotrowska
University of Warsaw, Poland

Co-authors: Marta Szulkin¹, Michela Corsini²

¹Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw

²Institute for Alpine Environment, Eurac Research, Italy

Great Tits are a valuable model species in urban ecology studies, as they can rear their offspring in a mosaic of different urban and suburban habitats. At the same time, they have reduced reproductive success in cities, which can be linked to increased levels of impervious surface (ISA - impervious surface area) in the environment. Associated with ISA is a change in the biotic environment, and little is known about the diet composition of nestlings reared in the urban mosaic.

I investigated the diet of urban Great Tits nestlings in relation to changes in ISA and tree cover around the nest, as well as the influence of parental sex and time of day on the prey composition delivered. My data were collected through the analysis of a total of 130 hours of parental feeding recorded in 2018 and 2019 inside 26 Great Tit nestboxes distributed along an urbanization gradient in Warsaw. In accordance with findings from forested sites, caterpillars were the main component of the nestling diet. However, their proportion in the diet was negatively correlated with ISA percentage around the nest. An increasing amount of impervious surfaces also influenced the proportion of spiders and adult Lepidoptera in the diet, decreasing the former and increasing the latter. Furthermore, the proportion of spiders was positively affected by tree cover percentage. I did not observe any sex- or time-dependent differences in prey composition.

Although further studies are necessary, my results suggest that the urban diet may contribute to impaired breeding parameters of Great Tits, as it is poorer in nutritious invertebrate taxa. Information on feeding frequency, prey abundance in the urban environment, and the dietary requirements of nestlings are vital to obtain a comprehensive understanding.

Talk 6: Dietary Strategies Drive Ingestion of Anthropogenic Particles: A Finch–Tit Comparison

Marta Nartowicz
University of Białystok, Poland

Co-authors: Weronika Mierzejewska¹, Anna Winiewicz¹, Alina T. Dubis², Krzysztof Deoniziak³;

¹The Włodzimierz Chętnicki Biological Science Club, Faculty of Biology, University of Białystok, Konstantego Ciołkowskiego 1J, 15-245, Białystok, Poland

²Faculty of Chemistry, University of Białystok, Konstantego Ciołkowskiego 1K, 15-245 Białystok, Poland

³Division of Biodiversity and Behavioural Ecology, Faculty of Biology, University of Białystok, Konstantego Ciołkowskiego 1J, 15-245, Białystok, Poland

Microscopic anthropogenic waste (MAW) is an emerging pollutant in terrestrial ecosystems, yet its ingestion by small terrestrial birds remains poorly studied. We investigated MAW ingestion in nine common European passerine species from the finch (Fringillidae) and tit (Paridae) families to assess exposure levels and their potential as bioindicators of environmental contamination. Gastrointestinal tracts of 149 individuals collected in north-eastern Poland were analyzed using visual inspection and Raman microspectroscopy.

MAW was detected in 31 individuals (20.8%), with a total of 57 particles identified. The vast majority (96.5%) were microfibers, predominantly artificial cellulosic fibers (cotton, rayon, viscose), while confirmed microplastics were rare and consisted mainly of polyethylene, polyethylene terephthalate, and polystyrene. One carbon nanotube was also detected.

Generalized linear mixed models revealed bird family and season as significant predictors of MAW ingestion. According to this analysis, ingestion rates were higher during the non-breeding season and finches ingested more MAW than tits. No significant effects were found for sex, age, gastrointestinal tract section, or sampling site. Overall MAW ingestion rates were low compared to other terrestrial birds, likely reflecting diet and foraging behavior.

Although finches and tits may facilitate trophic transfer of MAW, our results suggest they are not reliable indicator species for terrestrial MAW pollution. The study demonstrates the feasibility of using birds killed by collisions for monitoring MAW exposure in terrestrial environments.

Talk 7: From reflection to protection: UV films and the ecology of bird collisions

Aleksandra Syguła

The Włodzimierz Chętnicki Biological Science Club, University of Białystok, Poland

Co-authors: Syguła A¹, Mierzejewska W¹, Nartowicz M¹, Winiewicz A¹, Kiewlicz M¹, Hryszko A¹, Kościelniak J¹, Zyśk-Gorczyńska E², Skelton J³, Swaddle JP⁴, Deoniziak K⁵

¹The Włodzimierz Chętnicki Biological Science Club, Faculty of Biology, University of Białystok, Ciołkowskiego 1J, 15-245, Białystok, Poland

²Glass Traps Foundation, Murarska 25/27/6, 54-135 Wrocław, Poland

³Department of Plant Pathology, University of Florida, Gainesville, FL, USA

⁴Institute for Integrative Conservation, William & Mary, Williamsburg, VA, USA

⁵Division of Biodiversity and Behavioural Ecology, Faculty of Biology, University of Białystok, Poland

Bird-glass collisions are a major source of avian mortality worldwide, often caused by birds mistaking reflections for habitat. While visible deterrents exist, aesthetic concerns have driven interest in UV-reflective solutions invisible to humans. BirdShades is an invisible, UV-reflective

window film that prevents bird-glass collisions by leveraging birds' ability to see ultraviolet light while remaining transparent to humans. We tested the effectiveness of BirdShades UV film and examined ecological factors influencing carcass detection.

We monitored glass façades of campus buildings at the University of Białystok, Poland. From 2019 to 2025, we conducted 645 inspections, during which we recorded 473 bird carcasses representing 48 species. In July 2023, BirdShades UV film was installed on a 330 m² highly reflective façade (35% reflectance). Using a Before-After-Control-Impact design, we applied a Poisson GLMM with site as a random effect and predictors including study phase, survey effort, temperature, month, habitat type, and reflective glass area.

BirdShades installation reduced predicted carcass counts by 77%, independent of other predictors. Collisions peaked during autumn migration and were more frequent at façades with greater reflective glass area. Longer intervals between surveys increased detection probability. BirdShades UV film offers strong mitigation potential while remaining invisible to humans. Its effectiveness is comparable to leading visible marker products (64–86% reduction) and may be particularly beneficial during early morning when UV light is relatively strong. Our findings highlight BirdShades UV film as a promising conservation tool and underscore the importance of accounting for ecological context and survey bias when assessing collision risk.

Talk 8: Why Cities Work: Understanding Urban Nesting Preferences in Heronry Birds of Kerala, India

Roshnath Ramesh

Kannur University, Kerala, India

Urbanization is reshaping biodiversity, yet many waterbirds show remarkable adaptability to city environments. Long-term monitoring of heronry birds in Kerala (2013–2025) reveals a strong shift from natural wetlands and mangroves to urban nesting sites. To understand this transition, we examined nesting-tree characteristics, predator presence, behavioural responses to humans, and parasite prevalence across urban and semi-rural/mangrove colonies. Most nests occurred on avenue trees along roadsides, followed by non-residential and residential areas. Tree height, canopy spread, girth, and overall tree quality strongly influenced nest-tree selection. Rain Trees (*Albizia saman*) and Copperpods (*Peltophorum pterocarpum*) were preferred for their large, dense canopies that support colonial nesting. Predator surveys showed markedly lower predator abundance and predation attempts in urban heronries. Although Brahminy Kites (*Haliastur indus*), Black Kites (*Milvus migrans*) and House Crows (*Corvus splendens*) occurred in both habitats, they acted largely as scavengers in cities. Behavioural assessments based on flight-initiation distance indicated that urban birds were bolder and more tolerant of human activity, suggesting that urban areas function as safer foraging spaces. Parasite screening revealed reduced gastrointestinal parasite prevalence among birds in urban colonies. Lower parasite loads may relate to fewer intermediate hosts, altered foraging behaviour, or degraded waterbodies that suppress parasite survival. Overall, these advantages explain the growing preference of heronry birds for urban habitats; however, these short-term benefits may mask potential long-term conservation challenges.

Session 3: Bioacoustics

Talk 9: Dominant and competitor species affect calling rate and diel vocal activity patterns in a forest owl guild

S. Sangeeth Sailas

Department of Zoology, Faculty of Science, University of South Bohemia, Czech Republic

Co-authors: Bohuslav Kloubec, Pavel Linhart, & Martin Šálek

Within guilds of co-occurring predatory species, resource competition and interference from larger, dominant species often restrict the activity of smaller, subordinate predators and result in their temporal segregation. Using long-term passive acoustic recordings from the Šumava mountains, Czech Republic, we assessed the effect of dominant and competitor species on vocal activity of owls. We quantified calling rates, bout durations and the diel vocal activity pattern in a predator guild consisting of 4 species: Tawny Owl *Strix aluco* (TO), Ural Owl *Strix uralensis* (UO), Boreal Owl *Aegolius funereus* (BO) and Pygmy Owl *Glaucidium passerinum* (PO). Using Generalised Linear Mixed Models, we found that BOs significantly reduced calling rate in the presence of TOs, probably to reduce predation risk. Also, larger UOs produced longer bouts, likely as an aggressive response, when TOs, their closely-related competitor, had called 30 minutes before. Generalised Additive Mixed Models suggested that all 4 species shifted their diel vocal activity pattern in the presence of dominant or competitor species. BOs reduced calling activity in the presence of the TO, especially in the second half of the night, and increased calling activity in the presence of the UO, during both halves of the night, suggesting a mutualistic relationship with the latter. The typically crepuscular PO increased calling activity during sunset and during the second half of the night in the presence of the TO. The TO reduced and the UO increased their calling activity in the second half of the night, respectively, in each other's presence. Our results shed light on mutualistic, inhibitory and agonistic interactions that occur between members of a predator guild, which may act as mechanisms favouring their coexistence.

Talk 10: Mates and rivals under moonlight shadow: Factors shaping signalling patterns in European Nightjars

Richard Schnürmacher

University of Antwerp, Belgium & Comenius University Bratislava, Slovakia

Talk 11: Long-term changes in the acoustic space use by birds across habitats in Central Europe

Marcin Winiarek

Department of Behavioural Ecology Adam Mickiewicz University, Poland

Co-authors: Michał Budka¹, Tomasz Chodkiewicz²

¹Adam Mickiewicz University, Faculty of Biology, Department of Behavioural Ecology

²Research Assistant at Museum and Institute of Zoology, Polish Academy of Sciences

Over the past two decades, Europe has experienced substantial changes in bird abundance, distribution, and species composition. These transformations vary geographically and across habitats, influencing interspecific competition for resources, including acoustic space. Bird vocalizations play a crucial role in communication, and the arrival or expansion of new species may disrupt acoustic stability, potentially serving as an indicator of ecological change. In this study, changes in the use of acoustic space by bird communities in Poland between 2000 and 2023 were examined. The data from the Common Breeding Bird Survey was used to assess species composition along randomly selected transects. Based on recordings obtained from Xeno-canto, the acoustic profiles of 226 bird species were created and to quantify acoustic space use at the community level for each transect several indices were proposed. These indices describe the extent to which species occupy particular frequency bands and how evenly acoustic space is distributed among them. To investigate temporal trends in acoustic space use, as well as differences across habitat types and protection status Generalized Linear Mixed Models were applied. The results indicate that the use of acoustic space by birds has changed significantly over time, with the most pronounced shifts observed in urban environments. Furthermore, protection status had no effect on acoustic evenness. This finding is particularly concerning for protected areas, suggesting that current conservation frameworks may not effectively buffer rare or threatened species against broader, ecological changes in the acoustic structure of bird communities.

Talk 12: Singing in a changing world: effects of Ecological, Social and Anthropogenic Factors on complex duet vocalisation of non-passerine Sarus Crane

Suhridam Roy
Independent Researcher

Co-authors: K.S. Gopi Sundar
Editor-in-Chief, Waterbird Society

Vocal communication in birds is shaped by complex selective pressures, yet our understanding of these drivers is largely restricted to the songs of oscine passerines. Complex vocalisations such as duets, which require precise temporal coordination between partners, remain understudied, particularly in non-passerine lineages. We investigated how ecological, social, and anthropogenic factors influence the duetting behaviour of Sarus Cranes (*Antigone antigone*) across a gradient of wetlands and agricultural landscapes in India.

Using the Acoustic Adaptation Hypothesis (AAH), we tested if duet properties, including bandwidth, tone, duration, minimum frequency, and coordination, reflect adaptations to habitat structure, infrastructure proximity, noise, and social variables like neighbor density and parental status. Data from three regions show that bandwidth and tone are specialized for open habitats, supporting the AAH. Conversely, duration and minimum frequency deviated from AAH predictions, suggesting plastic adaptations to anthropogenic noise and disturbance. Duets near high-traffic highways exhibited wider bandwidths, likely due to increased amplitude and

frequency modulation to maintain signal efficacy. Socially, higher neighbor density correlated with improved coordination, reinforcing the role of duets in territorial defense.

Our findings highlight the interplay between environmental structure, human activity, and social dynamics in avian communication. We advocate for holistic conservation strategies safeguarding both wetlands and traditional agriculture to ensure Sarus Crane persistence in anthropized landscapes.

Plenary 1: “Sentinels of the marine environment: seabirds under multiple pressures” — Jérôme Fort

Session 4: Ecotoxicology

Talk 13: Are marine heatwaves affecting mercury contamination in seabirds? A case study of two Procellariiformes species in Bass Strait, southeastern Australia

Margot Serrurier-Arabadjieva

Littoral Environnement et Sociétés (LIENSs), UMR 7266 CNRS - La Rochelle Université, 17000 La Rochelle, France

Co-authors: Aymeric Fromant¹, John P.Y. Arnould², Paco Bustamante^{3,4}

¹Biosis Pty Ltd, 38 Bertie Street, VIC 3207, Australia

²School of Life and Environmental Sciences, Faculty of Science, Engineering and Built Environment, Deakin University, Burwood, Victoria, Australia;

³Littoral Environnement et Sociétés (LIENSs), UMR 7266 CNRS - La Rochelle Université, 17000 La Rochelle, France

⁴Institut Universitaire de France (IUF), 1 rue Descartes 75005 Paris, France

Mercury (Hg) is a toxic contaminant that biomagnifies along marine food chains, exposing top predators such as seabirds through their diet. Bass Strait, in southeastern Australia, is one of the fastest warming oceanic regions on the planet and is influenced by several currents that create a highly variable physical and biological environment. Here, we studied the blood Hg concentration and stable isotope values ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) in two seabird species, the common diving petrel (*Pelecanoides urinatrix*) and the fairy prion (*Pachyptila turtur*). The survey was carried out during incubation and chick-rearing periods over four breeding seasons with different environmental conditions on site. We hypothesized that years marked by marine heatwaves would show different blood Hg concentrations than colder years, due to differences in prey availability. Both species exhibited significantly higher blood Hg concentrations during incubation than during chick-rearing, suggesting a carry-over effect from pre-breeding period. Inter-annual variation in blood Hg concentrations was observed in both species, and common diving petrels showed significant differences in Hg and stable isotope values between the two

colder years of the study. These results suggest that factors other than the increase of sea surface temperature associated with marine heatwaves caused inter-annual variation in Hg contamination. In particular, changes in the relative dominance of water masses may have altered the prey composition in Bass Strait, subsequently causing fluctuations in Hg contamination. As the East Australian Current is expected to intensify, our results highlight that environmental variability associated with climate change could cause further variation in Hg contamination in seabirds in the future.

Talk 14: Pollutant exposure shapes Mitochondrial Bioenergetics in a Wild Seabird

Guadalupe Lopez Nava

Evolutionary Physiology Research Group, Max Planck Institute for Biological Intelligence, Germany

Co-authors: Lucie Michel¹, Giacomo Dell’Omo², Petra Quillfeldt¹, Paco Bustamante³, and Stefania Casagrande⁴

¹Animal Ecology and Systematics, Justus-Liebig University, Giessen, Germany

²Ornis italica, Rome, Italy

³Littoral Environnement et Sociétés (LIENSs), La Rochelle, France

⁴Evolutionary Physiology Research Group, Max Planck Institute for Biological Intelligence, Seewiesen, Germany

Laboratory studies indicate that Mercury (Hg) and per- and polyfluoroalkyl substances (PFAS) can disrupt mitochondria energy metabolism, but such effects may not reflect pollutant concentrations currently present in ecosystems and wildlife. In free-living animals, pollutant exposure is shaped by multiple ecological factors and differs among pollutants due to distinct bioaccumulation processes across trophic levels. Consequently, the subcellular effects of environmentally relevant pollutant exposure in wildlife remains unknown. To address this, we collected blood samples from 52 breeding adult Scopoli’s shearwaters (*Calonectris diomedea*), long-lived apex predators, during two consecutive breeding seasons on Linosa, a remote volcanic island in the Sicilian Channel. In red blood cells we measured mitochondria bioenergetic traits, stable isotope ratios ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) as indicators trophic ecology, and concentrations of Hg and PFAS. Concentrations of Hg, but not of total PFAS, were higher in older individuals and in males compared to females. Our results also indicate dietary pollutant exposure: Hg, but not total PFAS, was higher in birds with a higher trophic position and foraging closer to shores. Additionally, higher Hg concentration was linked to higher mitochondrial proton leakage (LEAK), reflecting reduced efficiency to couple oxygen consumption to energy production. In contrast, specific PFAS were negatively associated with LEAK, suggesting a potential impairment in the regulation of mitochondrial membrane potential through proton conductance, a key mechanism protecting cells from oxidative stress. Our study shows how foraging ecology shapes pollutant exposure and its consequences for subcellular energy production in a species of conservation concern.

Talk 15: Plumage colour of scops owls exposed to varying levels of anthropogenic pressure

Leonie Pries

Georg-August University Göttingen, Germany

Anthropogenic environmental change is a major driver of global biodiversity loss, but its effects vary among species depending on their biological traits. Birds are particularly affected by human activities such as land-use change, urbanisation, and pollution. Urban environments impose novel pressures on wildlife, making it essential to understand how species respond to human-associated factors like urbanisation and artificial light at night. Species traits and adaptive capacity may influence success in urban habitats. In my Bachelor's thesis, I investigated the effects of urbanisation and artificial light at night on the plumage colouration of the Eurasian scops owl (*Otus scops*), a small nocturnal predator showing high variability in feather colour. Using data from Spain and southern France across an urban gradient, I examined whether owl colouration varies with urban intensity, artificial light, and climate variables. Colouration was quantified using feathers and photographic analyses. The study assessed the influence of impervious surface cover, artificial light at night, temperature, and precipitation on plumage colouration. Results show that neither urbanisation nor artificial light significantly affects scops owl colouration. Instead, colouration is correlated with climate: individuals are redder in warmer and wetter conditions. The lack of an urban effect may be due to gene flow among populations and weak selective pressure on colouration in cities. The observed climate-related patterns support Gloger's rule, which predicts darker individuals in hot, humid environments. Ongoing climate change may therefore lead to redder scops owls in the future.

Talk 16: Urban alchemy: does darker plumage reflect a detox advantage in feral pigeons?

Valentin Adrian Kiss

Behavioural Ecology and Ecophysiology group, University of Antwerp, Belgium

Feral pigeons are among the most widespread urban birds and are chronically exposed to anthropogenic heavy metal pollution. As melanin can bind metals, it has been hypothesized that darker individuals may be favored in urban environments if increased melanisation aids in metal sequestration and excretion through feathers. To investigate this, we collected blood and feather samples from 91 pigeons across Antwerp and measured concentrations of arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn). Environmental samples were also collected at corresponding sites to assess local contamination. Plumage phenotypes were categorized based on literature, and melanin content was estimated using standardized image analysis, with feather brightness serving as a proxy (darker feathers indicating higher melanisation). Blood reflecting short-term exposure, closely mirrored environmental contamination, including a positive correlation between blood Cd and environmental Cd. In contrast, feather metal concentrations showed weak and inconsistent associations with environmental levels, likely due to exposure integration over the moult period and across multiple locations. Melanisation showed no consistent relationship with metal concentrations in feathers, except for Zn, which increased with darker plumage. Overall, while feral pigeons offload heavy metals into feathers, this process does not appear to

be influenced by plumage melanisation. Thus, we found no evidence supporting the hypothesis that darker plumage in urban pigeons has evolved to facilitate heavy metal detoxification

Session 5: Dispersal & Reproductive Success

Talk 17: Weather effects on age-specific chick mass and mortality in common terns

Thomas Cansse

Institute of Avian Research "Vogelwarte Helgoland", Germany

Co-authors: Thomas Cansse, Matteo Beccardi, Oscar Vedder, Sandra Bouwhuis

Weather conditions may affect food abundance and accessibility, as well as foraging and thermoregulatory costs for birds. These effects can be especially important during the reproductive period, when energy expenditure is elevated and parents need to acquire resources for both themselves and their chicks. In long-lived species that prioritise adult survival, adverse conditions are likely to negatively affect the body condition of offspring, as well as increase their mortality hazard. Such effects may vary with offspring age due to changes in parental investment, as well as offspring frailty. Here, we analyse 19 years of detailed data on age-specific chick mass and survival in common terns and test for effects of temperature, wind and precipitation across the developmental phase, while accounting for effects of phenology, brood size and hatching order. We find chick body condition to be negatively affected by increasing wind speeds, with similar effects on their mortality hazard being supplemented by negative effects of increasing rain, and decreasing temperature. Vulnerability to adverse conditions was higher for younger than for older chicks, potentially because their lower reserves or thermoregulatory capacities were not compensated for by their parents. Overall, our study supports the concept of the 'prudent parent' and shows that common tern chicks are vulnerable to adverse weather conditions, with the consequences of such stochastic events for reproductive success being highly dependent on their timing within the chick-rearing stage.

Talk 18: Does nest cover matter for incubation? A study on biparental shorebird nesting in mild environment

Hela Boughdiri

University of Debrecen, Hungary

Co-authors: Grant C. McDonald², Tamás Székely^{1, 3}, András Kosztolányi²;

¹ University of Debrecen – Department of Evolutionary Zoology and Human Biology – Debrecen – Hungary

² University of Veterinary Medicine Budapest – Hungary

³ University of Bath – United Kingdom

Nest cover selection is a key reproductive decision in ground nesting birds given its direct consequences for breeding success and survival. Studies in extreme hot environments show that nest cover strongly shapes parental incubation behaviour yet in different climates, its role in shaping parental cooperation in biparental species remains less documented. In this study we investigated how nest cover influences parental incubation effort and sex-specific investment in a wild biparental population of Kentish Plovers (*Anarhynchus alexandrinus*) breeding in a Mediterranean environment. We used 24-hour video recordings from 24 nests (12 high-cover and 12 low-cover), we computed the total proportion of nest attendance, diurnal off-bout mean duration and frequency, and male versus female contribution in open vs concealed nests. Contrary to our predictions and previous work from hot environments, the total incubation duration did not differ between nest types, nor did the mean off-bout duration or frequency. However, we showed that males contributed more to overall incubation than females, nevertheless this share was unaffected by nest cover. The absence of difference between concealed vs open nests could suggest the incubation may be constrained by factors like consistent predation risk. Alternatively, parents may use specific thermoregulatory behaviours (e.g., panting, shading) that do not alter how long they incubate. Our results highlight that incubation strategies are population and context-dependent. Thus, we encourage future research to integrate direct microclimate and specific heat stress behavioural data to disentangle the drivers of parental investment.

Talk 19: Impact of incubation temperature on avian developmental patterns and fitness: An experimental study on collared flycatchers

Karolina Skorb

Doctoral School of Natural and Agricultural Sciences PAS, National Research Institute of Animal Production, Cracow, Poland

Co-authors: Rafał Martyka¹, Lars Gustavsson², Aneta Arct³

¹Institute of Nature Conservation, Polish Academy of Sciences, Kraków, Poland

²Animal Ecology, Department of Animal Ecology/Ecology and Genetics, Evolutionary Biology Centre, Uppsala University, Sweden

³Institute of Environmental Sciences, Jagiellonian University in Kraków, Poland

Temperature is a key environmental factor shaping avian reproductive success, yet its effects within the nesting environment remain poorly understood. Here, we investigated how experimentally induced variation in nest temperature influences incubation behaviour, embryo development and offspring fitness-related traits in a population of collared flycatchers (*Ficedula albicollis*) on Gotland Island. Over four breeding seasons, we manipulated nest temperature across two stages (incubation and nestling period), resulting in four treatments: stage-specific heating (incubation or nestling only), continuous heating (both stages), and a control. This approach allowed us to disentangle the thermal effects of each developmental stage on offspring performance.

We found that only heating during the incubation period influenced reproductive parameters, whereas heating during the nestling stage or throughout the entire nesting cycle had no detectable effects. Nests exposed to elevated temperatures during incubation had shorter incubation periods, a pattern consistent with long-term data linking warmer environmental

conditions to shortened incubation stages. Heating during incubation also increased embryo heart rate, which is linked to the pace of embryonic development. Despite these physiological adjustments, nestlings from heated nests at the incubation period showed reduced early mass gain, suggesting potential developmental constraints following elevated ambient temperature during incubation stage.

By examining temperature variation at the scale of individual nests, our study provides new insights into how nest thermal conditions may shape early development in birds. The observed effects, however, may reflect population-specific responses shaped by the local ecological context.

Talk 20: Flycatcher real estate: nest-site selection and dispersal in the collared flycatcher (*Ficedula albicollis*)

Adéla Kelnerová

Department of Zoology, Faculty of Science, Palacký University, Olomouc, Czech Republic

Co-authors: Vojtěch Lyko¹, Michaela Tajovská¹, Valerie Zdražilová & Miloš Krist^{1,2}

¹Department of Zoology, Faculty of Science, Palacký University, Olomouc, Czech Republic

²Museum of Natural History, Olomouc, *Czech Republic*

Nest-site selection and dispersal represent key ecological processes influencing animal population dynamics. Although these processes are currently relatively well described in many species, knowledge concerning nest-site selection remains still incomplete due to the demanding methodology. However, technology allows us to uncover previously unknown trends. In this study, we investigated nest-site selection and dispersal in the collared flycatcher (*Ficedula albicollis*), a small passerine that readily nests in nest boxes, using RFID readers in combination with more traditional field methods. We analysed detailed data on movements between 95 nest boxes as well as information on the characteristics of individual birds. The results we obtained are consistent with previous findings of other authors, but also bring new insights into flycatcher population dynamics. For instance, the data show that only 39% of individuals present in the study area each year used nest boxes for breeding. Further, the average number of nest boxes visited by an individual per year was 2.92, and this number varied depending, for example, on sex or breeding status. It was also apparent that flycatchers no longer visited nest boxes after their fledglings had left. In addition to these results, the simultaneous mapping of natural cavities in the area allowed us to compare nesting data from both natural and modified conditions. Overall, our results demonstrate, among other findings, that data collected using RFID readers provide valuable insights into the population dynamics and behaviour of this species.

Plenary 2: “Host-parasite interactions through the lens of avian immunogenetics: from ecology to macroevolution” — Piotr Minias

Session 6: Ecophysiology

Talk 21: Microbiota shows major difference in case of two shorebird species with different feeding strategy

Ákos Őrsi

University of Debrecen, Hungary

Co-authors: Levente Laczkó, Renáta Bókéyné Tóth, Csongor Freytag, Pál Tóth, Gábor Simay, Dániel Popovics, Míra Júlia Radnai, Lili Sztrehárszki, Nándor Szabó, Gábor Kardos, Ádám Lovas-Kiss

Migratory birds aid the dispersal of many organisms, including the bacteria which colonises their gastrointestinal tracts. It is well-known that these have a great effect on mammalian hosts, however birds had only started to receive attention recently. These studies are focused mostly on poultry; thus, wild birds' microbiome remain understudied, despite their capability to aid the dispersal of human pathogens.

We described the cloacal microbiome of the Common snipe (*Gallinago gallinago*) and the Wood sandpiper (*Tringa glareola*) using 16S rRNA metabarcoding. The main objective was to understand how the differences in their foraging habits may affect the microbiome, and to get a basic insight into what pathogens they might carry.

The alpha diversity indices did not show significant differences, however there was a tendency towards *T. glareola* having higher values. SIMPER analysis revealed that the observed differences were caused by several different taxa, however the biggest contributor was *Catellibacterium marimammalinum*, with a mean contribution of 2.76% ($p = 0.003$). We also found great differences in Fusobacteria abundances, as this phylum had a 29.4% relative abundance in *G. Gallinago*, as opposed to the 8.8% in *T. glareola*.

Our findings showed substantial differences in the microbiomes of the two host, which may be due to the differences in chitin consumption and feeding techniques. We also identified multiple human-and animal pathogens, some of which are associated with the growing issue of antimicrobial resistance. We need to understand the dispersal of these microbes, to ensure human and environmental health in the long term.

Talk 22: Variable temperature promotes vertical take-off flight in zebra finches: birds from less predictable environment fly faster

Faina Bikmurzina

Jagiellonian University, Kraków, Poland

Co-authors: Natalia Boroń, Rutkowska Joanna

Some species may be at risk of extinction because they cannot evolve quickly enough to adapt to the growing unpredictability of their environment. Therefore, it is important to understand how unpredictability generally affects the physiology and behavior of organisms. For birds, any impairment to the ability to fly can have a dramatic effect on fitness.

This study examined the differences in motivation and speed of vertical flight between zebra finches kept in Stable and Variable temperature conditions. For several months, birds were kept in climatic chambers: 42 individuals experienced stable temperature conditions (21°C), while 44 individuals experienced daily fluctuations between 11°C and 31°C (mean 21°C). Then, their flight in a vertical plastic tube was recorded and analysed. Each bird flew 3 times with 1 hour break between attempts.

We found no initial difference in motivation to fly between the treatment groups, and birds generally became less self-motivated with repeated attempts. However, birds in the Variable group maintained their motivation better across subsequent flight attempts than birds in the Stable group. Birds from the Variable group flew significantly faster - the difference reached 47% in the third attempt. In addition, Variable conditions reversed the relationship between body mass and flight speed: contrary to Stable conditions, heavier birds from Variable conditions flew slower.

Our findings may suggest that moderate temperature variability enhances sustained motivation and vertical flight performance. Therefore, when it occurs in an otherwise stable environment, it may act as enrichment rather than a harmful stressor.

Talk 23: Energetic demands of winter murmurations in Starlings

Ance Priedniece

University of Latvia, Latvia

Co-authors: Viesturs Vīgants, Oskars Keišs, Ivo Dinsbergs, Māris Jaunzemis, Valts Jaunzemis, Elza Marija Zacmane, Martins Briedis

The purpose of murmurations — the collective, prolonged, highly coordinated, and often erratic movements of Starlings and other species — has been widely debated. Proposed explanations range from reduced predation risk and roosting site advertisement to more recent hypotheses of competition for relatively safer positions within a roost. Regardless of their function, these movements are energetically costly for all participants. Here, we characterize their prevalence across and within individual birds, estimate the energy expenditure of individual murmurations, and quantify their cumulative energetic cost across the wintering period. We used multi-sensor geolocator data to reconstruct migratory tracks of more than 30 short-distance migrating Common Starlings and derive winter murmurations from them. Further, we estimated energetic costs of murmuration flights from accelerometer-derived activity data, using average Starling morphological traits. Most tracked Starlings participated in murmurations at their wintering grounds almost daily at dusk before roosting. The average energy expenditure of a single murmuration was 11 kJ, corresponding to >5% of daily winter energy expenditure. Our results suggest that the total energy costs of murmurations during the wintering period are comparable in magnitude to the costs of migration, with preliminary results indicating that murmurations correspond to 73%–128% of migratory flight costs in one migration season. These findings highlight that despite our limited understanding of the function of Starling murmurations, they represent a substantial proportion of the Starlings' winter and annual energy budget.

Talk 24: Modulating hypothermia across the lifespan: age-related trade-offs between energy and oxidative balance in zebra finches during energetic challenge

Jakub Płachta

Institute of Environmental Sciences, Faculty of Biology, Jagiellonian University, Kraków, Poland
& Doctoral School of Exact and Natural Sciences, Jagiellonian University, Kraków, Poland

Co-authors: Edyta T. Sadowska¹, Małgorzata M. Lipowska¹, Ulf Bauchinger^{1,2}

¹Institute of Environmental Sciences, Faculty of Biology, Jagiellonian University, Kraków, Poland

²Nature Conservation Station Unterelbe, State Agency for Bird Conservation, Freiburg/Elbe, Germany

Rest-phase hypothermia is a widespread energy-management strategy in birds, allowing temporary reductions in nocturnal body temperature (T_b) under unfavourable conditions. Although this strategy is highly flexible and well documented, its energetic and oxidative consequences across the lifespan remain poorly understood. Here, we examined age-related modulation of T_b in 79 zebra finches exposed to fasting and low ambient temperature, and resulting changes in oxidative stress.

Hypothermia was strongly deepened by both challenges, with synergistic effects on mean and minimum T_b. Age did not alter body temperature but markedly affected hypothermic dynamics: older birds cooled down slower yet maintained higher minimum T_b than younger individuals. Surprisingly, this shallower hypothermia did not result in greater body mass loss or elevated oxidative stress. Instead, deeper hypothermia in younger birds was associated with increased body mass loss and elevated antioxidant capacity. Generally, antioxidant capacity increased as hypothermia deepened, whereas oxidative damage did not, suggesting effective (but potentially costly) mobilisation of antioxidant defences. Uric acid levels were not generally affected by age but increased in individuals reaching exceptionally low T_b, consistent with enhanced protein catabolism contributing to antioxidant protection.

Our results demonstrate that deeper rest-phase hypothermia does not necessarily maximise energetic benefits and may entail hidden costs. Ageing in zebra finches might be characterised not by impaired thermoregulation, but by more measured use of hypothermia. We suggest this physiological moderation as a key feature of thermoregulatory ageing in birds, allowing them to survive and retain adequate fitness as they grow old.

Talk 25: Physical activity improves long-term memory in juvenile zebra finches *Taeniopygia castanotis*

Natalia Boroń

Jagiellonian University, Kraków, Poland

Co-authors: Bikmurzina Faina, Rutkowska Joanna

It is generally believed that physical activity enhances cognitive performance. However, the impact of physical activity on the cognitive abilities of juvenile animals has rarely been studied experimentally. This study tested whether physical training improves associative learning and memory in juvenile zebra finches (*Taeniopygia castanotis*).

Juveniles from 63 families were assigned to four experimental groups. For three weeks two groups of birds experienced physical training, flying 1.2 km per day, while the remaining two groups only observed the training. Simultaneously within each training regime one group of the birds learnt to associate food with blue and the other group with purple feeder. The learning performance test was conducted immediately after training, and a memory test was performed four months later.

We found that birds that experienced training had significantly lower body mass. Physical activity did not affect initial learning performance significantly. However, trained finches demonstrated significantly better long-term memory of rewarded color than non-trained birds, with 65% versus 48% choosing the correct feeder.

Overall, these findings suggest that physical training during early life may enhance cognitive performance in zebra finches, particularly their memory retention. Further research is needed to determine the mechanisms responsible for the observed effect and whether the enhanced memory of trained birds translates into higher fitness later in life.

Session 7: Movement ecology & Morphology

Talk 26: Keeping Up with the Weather? 51 Years of Spring Arrivals in Euro-African Migratory Birds

Jakub Zając

University of Wrocław/Polish Society for the Protection of Birds (OTOP), Poland

Co-authors: Tomasz Chodkiewicz^{1,2}, Lucyna Hałupka³ & Grzegorz Neubauer⁴

¹Laboratory of Ornithology, Museum and Institute of Zoology, Polish Academy of Sciences, Poland

²Polish Society for the Protection of Birds (OTOP), Poland

³Department of Avian Ecology, University of Wrocław, Poland

⁴Laboratory of Ornithology, Museum and Institute of Zoology, Polish Academy of Sciences, Poland

The phenology of avian migration has been affected by climate change, but the importance of environmental conditions influencing birds at different stages of migration requires further investigation, particularly in long-distance migrants. Using long-term data collected in the Białowieża Primeval Forest (eastern Poland) between 1975 and 2025, we examined the climatic factors influencing the timing of spring arrival in 27 Euro-African migratory bird species. We investigated the effects of three variables: temperature and rainfall at the wintering quarters in Africa, and temperature at the breeding grounds, which are most likely to affect spring

migration. By analysing multiple species simultaneously, we aimed to identify both general patterns and interspecific differences in responses to climatic variability. Our results show that first arrival dates have changed and that spring migration is shaped by climatic conditions at both wintering areas and breeding grounds, although the strength and direction of these effects differ among species. Despite generally lower phenological plasticity, long-distance migrants also exhibited detectable shifts in arrival timing, suggesting a greater capacity for adjustment than traditionally assumed. These findings highlight the complex, multi-stage nature of climatic influences on migration phenology and underscore the importance of long-term, multi-species approaches for understanding avian responses to ongoing climate change.

Talk 27: Connecting the knots: the timing, scale and individual drivers of the overwintering season in the islandica red knot

Isla Botting

Liverpool John Moores University, United Kingdom

Co-authors: Bijleveld, Allert¹; Mariani, Stefano²; Franks, Samantha³; Bowgen, Katharine³; Beardsworth, Christine²

¹Department of Coastal Systems, NIOZ Royal Netherlands Institute for Sea Research, Texel, the Netherlands

²School of Biological and Environmental Sciences, Liverpool John Moores University, Liverpool, UK

³British Trust for Ornithology, The Nunnery, Thetford, United Kingdom

Arctic-breeding migratory shorebirds are at high risk from climate change and habitat degradation. But while their breeding behaviours and long-distance migrations receive much attention, the non-breeding or ‘overwintering’ season, which encompasses most of the annual cycle, remains largely overlooked. Understanding when, where and why individuals move within their overwintering season is of crucial importance for determining conservation priorities. The islandica red knot (*Calidris canutus islandica*) is a small shorebird which breeds in the high Arctic, subsequently migrating to the overwintering grounds in Western Europe from late summer - spring. Using a spatial network analysis, we integrated more than two decades of individual resighting (n=3989) and ringing (n=1077) data to investigate the spatiotemporal patterns and scale of overwintering movements in red knot. We identify some of the key connections between overwintering sites and temporal segregation to movements. In addition to this, we preliminarily examine the individual-level drivers of red knot movements between intertidal areas using a combination of automated radio-tracking (ATLAS) stations at key habitats along the UK and the Dutch Wadden Sea, explorative personality tests, and dietary DNA metabarcoding (n=59), discussing the potential interplay between diet and behaviour within the broader context of movement strategies. Our findings highlight the complex behaviours which occur in the non-breeding season and emphasise the need to study migratory species throughout their entire annual cycle.

Talk 28: Using stable isotopes to reveal moult migration in a short-distance migratory passerine

Elza Zacmane
University of Latvia, Latvia

Co-authors: Ivo Dinsbergs¹, Steffen Hahn^{1,3}, Māris Jaunzemis¹, Valts Jaunzemis¹, Oskars Keišs¹, Ance Priedniece¹, Viesturs Vīgants¹, Martins Briedis^{1,2}

¹Laboratory of Ornithology, Institute of Biology, Faculty of Medicine and Life Sciences, University of Latvia, Riga, Latvia

²Unit of Bird Migration, Swiss Ornithological Institute, Sempach, Switzerland

³Department of research, conservation & monitoring, National Park Harz, Wernigerode, Germany

Moult strategies, including the timing and location of feather replacement, vary considerably within bird species, yet the factors driving this variation remain poorly understood. One such strategy, moult migration, involves individuals stopping at a secondary site during migration to complete feather moult before continuing to their wintering grounds. We used stable hydrogen ($\delta^2\text{H}$) and sulphur ($\delta^{34}\text{S}$) isotope analyses of feathers from 291 Common Starlings (*Sturnus vulgaris*) to estimate the prevalence of moult migration among birds breeding in the Baltics. Isotopic baselines were established using reference samples from individuals moulting near breeding sites in Latvia ($n = 24$) and at expected moulting sites in north-eastern Germany ($n = 53$). In addition, we tracked a subset of birds with multi-sensor geolocators to integrate isotopic and movement data and validate isotope-based assignments. Feather isotope values differed significantly between Baltic and north-central European starlings. Assignments indicated that 86.2% of Latvian starlings moulted near breeding sites, while 4.5% undertook moult migration (9.3% unassigned). Combined $\delta^2\text{H}$ and $\delta^{34}\text{S}$ analyses provided the highest discrimination between moulting regions. The isotope-based approach correctly classified five of seven geocator-tracked individuals, with no misclassifications. Moult strategies did not differ between adults and juveniles and were consistent across years. Our findings show that combining $\delta^2\text{H}$ and $\delta^{34}\text{S}$, particularly with reference samples, reliably identifies moult strategies at small spatial scales and highlights the value of $\delta^{34}\text{S}$ as an emerging tracer in avian movement ecology.

Talk 29: Migrating songbirds, changing morphology - a museum study

Martina Darwich
Natural History Museum Vienna; Department of Evolutionary Biology, University of Vienna, Austria

Co-authors: Swen Renner¹, Mihaela Pavlicev¹

¹ Natural History Museum Vienna; Department of Evolutionary Biology, University of Vienna, Austria

Climate change has various effects on birds. Recent studies show that with rising temperatures, migratory behavior has changed over time. Additionally, morphology has changed with migratory behavior. Evidence suggests that morphological traits such as tarsus and wing length have changed over time with changing migration strategies. Study results suggest that with shorter migration routes, shorter wing lengths are to be

expected. For this master's project, we investigate four songbird species with different migration strategies in Europe over the past 150 years: blackbird *Turdus merula*, chaffinch *Fringilla coelebs*, blackcap *Sylvia atricapilla* and robin *Erithacus rubecula*. Due to their abundance across Europe, they are available in large numbers in museum collections. A total of approximately 1.000 specimens from various bird collections (Vienna, Berlin, Leiden and Tring) have been measured (bill length, wing length, Kipp's distance). Initial results indicate a significant change in wing shape in Central Europe over the last 150 years.

Talk 30: Mallards as key vectors of propagule dispersal in Hungary

Dániel Popovics

HUN-REN Centre for Ecological Research, Hungary

Co-authors: Nándor Szabó^{1,2}, Pál Dr. Tóth^{1,3}, Gábor Simay^{1,3}, Balázs Dr. Koleszár^{1,4}, Gábor Papp¹, Júlia Míra Radnai¹, Lili Sztrehárszki^{1,4}, Ákos Őrsi¹, Péter Óvári¹, Ádám Lovas-Kiss^{1,4}

¹Momentum Dispersal Ecology Research Group, Centre for Ecological, Research, Institute of Aquatic Ecology, Debrecen, Hungary

²Juhász-Nagy Pál Doctorate School, University of Debrecen, Hungary

³Hortobágy National Park Directorate; ⁴Institute of One Health, University of Debrecen, Hungary

As a result of anthropogenic effects, such as urbanization, floodplain regulations, draining marshlands for agricultural purposes and road constructions most of the wetlands are just a fraction of their original size. Wetlands are essential breeding, feeding and resting sites for numerous different organisms. Due to the fragmentation of these habitats, dispersal is difficult for stationary species. Vector organisms play an intrinsic role by dispersing propagules, which leads to higher biodiversity, connecting isolated habitats and populating newly formed wetlands. Migratory waterfowl can carry out long-distance dispersal (LDD), which is far more effective compared to local dispersals via other vector organisms, such as fish or mammals. During our research we collected 1284 excrement samples from one of the most common waterfowl, mallards (*Anas platyrhynchos*), then we processed the samples in search for propagules. The samples were collected for a 4-year period, all year round. We identified 110 species (98 plant and 12 invertebrate) of 65 genus (57 plant and 8 invertebrate). Out of the 15075 propagules 1401 germinated (9,29%). The highest number of propagules in a single sample was 385. These results highlight the importance of mallards as wetland connectors in the fragmented landscape. By far the mallard is the most studied species in the topic of propagule dispersal, however we still found species that were never showed before as a dispersed species. To understand their role as a disperser and to do improved predictions on species distribution further research is required.

Plenary 3: “Blackcap migration — adaptation in time and space” — Miriam Liedvogel

Session 8: Biologging

Talk 31: Long North Sea crossings of approximately 500 km are the norm, rather than the exception, for many passerine migrants.

Thiemo Karwinkel

University of Oldenburg, Germany

Co-authors: Leo Körner, Georg Rüppel, Aida Lopez, Jan Erik Roer, Peter Sjolte Ranke, Morten Elmeros, Heiko Schmaljohann

Over the North Sea, the most abundant and most diverse avian group are surprisingly not seabirds, but migratory songbirds. Probably millions of them cross marine areas during their annual journey between breeding and wintering grounds. To date, we know little about their distribution and route choice, mainly due to methodological limitations in observing and tracking small birds at night over the sea. Yet, such data are urgently needed to assess potential conflicts with increasing industrialisation, particularly the rapidly expanding offshore windfarms. To fill parts of this knowledge gap, we tracked four songbird species using Motus radiotelemetry from southern Norway southwards over the North Sea towards Denmark, Germany, the Netherlands, and Great Britain. Our results provide the first direct evidence of regular, non-stop flights approximately 500 km over the North Sea. This indicates that such route choices are the norm, not the exception. This becomes even more remarkable given that songbirds cannot land on water, unlike geese, ducks, and seabirds, making these water crossings even more dangerous than the crossing of other ecological barriers, such as the Sahara Desert. We evaluated the species-specific proportion of these long sea crossings compared to shorter routes over water and analysed the associated weather conditions. While this description of flight frequency and weather conditions allow us to infer a potential conflict with offshore development, we are still lacking data on the actual conflict. Therefore, future studies should quantify the interactions with human-made structures at sea to gain true insights into ecological consequences for migrant songbirds.

Talk 32: The vertical dimension of bird migration: spatial and temporal variation in flight altitude of migrating Eurasian woodcocks (*Scolopax rusticola*)

Susan Ellen McKinlay

Università degli Studi di Milano, Italy

Co-authors: Alessandro Tedeschi¹, Michele Sorrenti², Vincenzo Cavaliere³, Lorenzo Serra⁴, Federico De Pascalis⁴, Pierfrancesco Micheloni⁴, Diego Rubolini⁵

¹Associazione “Amici di Scolopax”, Via Roma 57, Mugnano del Cardinale, AV, I-83027, Italy

²Ufficio Studi e Ricerche Faunistiche e Agro-ambientali, Federazione Italiana della Caccia, Via Garigliano 57, I-00198, Rome, Italy

³Dipartimento di medicina Veterinaria e Produzioni Animali, Università degli Studi di Napoli Federico II, via F. del Pino n. 1, I-80137, Napoli, Italy

⁴Area Avifauna Migratrice, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Ozzano dell'Emilia, Italy

⁵Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, Via Celoria 26, Milano, I-20133, Italy

While bird migration has been extensively studied in two dimensions, fine-scale individual behavioural patterns in the vertical dimension remain poorly understood. We used satellite telemetry to investigate spatial and temporal patterns of flight altitude of migrating Eurasian woodcocks (*Scolopax rusticola*), a nocturnal, forest-specialist species that undertakes long-distance migrations of up to 6000 km largely across Eurasia. We deployed GPS-GSM transmitters on individuals wintering or migrating along the Italian Peninsula and Mediterranean islands and tracked their migratory movements to and from their breeding grounds. Based on the distribution of ground speeds, we identified 566 night-time locations with active migration (ground speed >18 km/h) and reliable altitudinal data (>4 satellites), 527 during pre-breeding and 39 during post-breeding migration, from 67 individuals. The median flight speed was 61 km/h, while the median flight altitude was 370 m a.g.l., confirming that woodcocks tend to migrate at relatively low altitudes. Flight altitudes were considerably higher during pre-breeding (median 388 m a.g.l.) than post-breeding migration (199 m a.g.l.), while no meaningful differences emerged in flight speed. Despite generally low flight altitudes, we observed large variability, with some individuals exceeding 1500 m a.g.l. (3% of locations) and one reaching 2429 m a.g.l. (2565 m a.s.l.). These findings indicate that Eurasian woodcocks migrate at relatively lower altitudes than other migratory landbirds, yet can perform high-altitude flights when required. Seasonal variation in flight altitude suggests that migrating woodcocks adaptively tune flight altitudes to maximize exploitation of prevailing westerlies (tailwinds) at higher altitudes during spring.

Talk 33: No significant effect of radio-tagging on the apparent survival of a small migratory songbird

Giovanna Sandretti da Silva

Carl von Ossietzky Universität Oldenburg, Germany

Co-authors: Hannah Reich, Zephyr Züst, Annika Peter, Jan Ulber, Lisa Kirsten, Wieland Heim, Heiko Schmaljohann

The miniaturization of tracking devices has allowed researchers to follow the migratory routes of small songbirds, enhancing our understanding of their movement ecology, including stopover sites and activity patterns. Despite the importance of these findings, there is not a general consensus about the unintended effect of the tracking devices on the fitness of the birds, and studies report mixed reproduction and survival responses. Understanding these consequences is of fundamental ethical, conservation, and methodological importance. In this study, we investigated the effect of radio-tracking tags on the apparent survival of Northern Wheatears

(*Oenanthe oenanthe*), a long-distance migratory songbird, on the island of Norderney, Germany. Between 2021 and 2024, we ringed and tagged 358 individuals using different tag loads (<3.1% and <1.5%). In addition, 638 individuals were only ringed with coded colour-rings and served as controls. Based on resightings on the island from 2022 to 2025, we constructed capture histories and fitted Cormack-Jolly-Seber models, including age, tag, and year as predictor variables. We found no difference in the apparent survival between tagged and control individuals for both adults (tagged $\Phi=0.34$ [0.22–0.50]; control $\Phi=0.50$ [0.34–0.66]) and juveniles (tagged $\Phi=0.10$ [0.05–0.20]; control $\Phi=0.17$ [0.11–0.27]) indicating no significant effect of tags on survival. Our results indicate a strong effect of age on apparent survival, with juveniles exhibiting less than half of the apparent survival of adults. These findings suggest that our tagging does not strongly impact the survival, regardless the age and the weight load. Still, we suggest to use smallest and lightest tag available to reduce any potential negative effects not assessed in our study.

Talk 34: Satellite telemetry helps understand a cryptic and endangered bird species: the corncrake (*Crex crex*)

Ryan Boswarthick
CNRS - LPO Anjou, France

Co-authors: Tiphanie HERCE, Frederic JIGUET, Aurelien BESNARD

Corncrake (*Crex crex*) is among the bird species most severely affected by recent changes in agricultural practices. In France, its population has declined dramatically, from an estimated 2 450 singing males in 1982–1984 to only 82 in 2024. This decline results from multiple interacting factors, including habitat loss, agricultural intensification and climate change. Despite the implementation of several conservation programmes (LIFE programmes and National Action Plans) since the early 1990s, the decline has continued, and Corncrake is now on the brink of extinction in France.

As a species with a fast-paced life-history strategy, Corncrake population dynamics are strongly dependent on fecundity, and conservation measures enhancing breeding success could potentially reverse the decline over relatively short timescales. However, current knowledge of Corncrake breeding ecology and the determinants of breeding success remains fragmented and incomplete. A better understanding of behaviour and habitat selection during the breeding season is therefore essential to identify the mechanisms driving this population collapse.

Since 2024, fourteen males have been equipped with Ornitela GPS tags in France. The first results already provide key insights on the species breeding ecology, and reveal overlooked behaviours including important daytime movements, responses to disturbances such as flooding and mowing events, detection of breeding events and more.

Talk 35: Sublethal tag effects on European Storm Petrels

Trevor MacLaurin
Aarhus University, Denmark

Co-authors: Feliksa Żurawska, Ben Porter, Jón Aldará, Jens-Kjeld Jensen, Ib Krag Petersen, and Anne NMA Ausems

Biotelemetry (e.g., GPS, GLS, and accelerometer tags) has advanced our understanding of how birds move, behave, and interact with their environment. However, attaching tracking devices can impose costs, including impaired locomotion, increased aerodynamic drag, and altered behaviour. Quantifying these impacts is both an ethical responsibility and a prerequisite for ecological inference, as unaccounted tag effects can bias home range estimates, misidentify key foraging areas, or distort activity budgets. These risks are greatest for small-bodied species, which frequently approach or exceed recommended tag-burden guidelines (e.g., <3% of body mass). European Storm-Petrels *Hydrobates pelagicus*, the smallest breeding seabird in the North Atlantic, are therefore especially vulnerable to tag-related impacts. Previous tracking studies focused largely on adult and juvenile mortality, leaving potential sublethal effects unresolved. We studied European Storm-Petrels in the Faroe Islands from 2022–2025 to test whether tail-mounted GPS tags (3–4% body mass) altered successive foraging trip metrics (duration, distance, and direction), juvenile growth rates, or in-nest behaviour. Preliminary analyses detected no changes in foraging trip characteristics across successive trips and no effects on juvenile growth. Our findings indicate that, despite their small size, European Storm-Petrels tolerate tail-mounted GPS tags without detectable short-term behavioural or developmental consequences.

Session 9: Interspecific relationships & predation

Talk 36: Identifying knowledge gaps and future research directions: a synthesis of mammalian and avian predation on Procellariiformes

Rowan Kuminski
University of Aberdeen, United Kingdom

Predation is a potential pressure acting on all seabirds, and can have a range of effects on a population. In addition to predation from naturally-occurring species, many species now also experience predation from introduced animals, against which they have not evolved proper defenses. Procellariiformes are the most threatened order of seabirds, and include 146 species including albatrosses, petrels, etc. While there are numerous studies on predation of Procellariiformes, most only focus on one predator species or functional group, preventing a “big picture” understanding of predation. We conducted an evidence synthesis of all mammalian and avian predation on Procellariiformes globally, with no temporal limit, to identify knowledge gaps and future research directions for this area of study. We also categorised extractions by method type used, and compared predation type and impact by Procellariiform species, nesting type, and body size. Our study included 269 studies, and we divided studies into two categories: those that have not experienced predator management (Category 1) and those that have

(Category 2). We found that there was a clear bias towards IUCN “Least Concern” species, with fewer studies devoted to species of conservation concern. There were clear patterns of mammalian and avian predators preying on specific nesting types and body sizes. Methodologically, even studies that utilised the same method often reported metrics that were non-comparable, thus precluding comparison with other studies. We present our results to highlight the research gaps regarding predation on this order, as well as the value of largescale syntheses. We also discuss how we also incorporated studies published in non-English, to make our study more linguistically inclusive and robust.

Talk 37: Methodology for inducing anti-predator behaviour in reintroduced little owls (*Athene noctua*)

Eliška Kučerová

Czech University of Life Sciences Prague, Czech Republic

Co-authors: Markéta Lukavská¹, Jiří Vlček², Petr Jandík³, Marek Kouba¹, Tomáš Bušina¹

¹Department of Ethology and Companion Animal Science, Faculty of Agrobiological Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 16500, Czech Republic

²Department of Nature Conservation, Regional Authority of the Pilsen Region, Škroupova 1760/18, Pilsen, 30100, Czech Republic

³ZO ČSOP Spálené Poříčí, Plzeňská 55, Spálené Poříčí, 33561, Czech Republic

The little owl (*Athene noctua*) is an endangered species experiencing a rapid population decline across Central Europe. To prevent local extinction in western Bohemia, a reintroduction programme was initiated in 2017, with intensive radio-telemetry monitoring implemented from 2020 onward. The programme applies a soft-release method, whereby adults originating from captivity are placed in aviaries within a suitable habitat in early spring and released with their fledged offspring. To date, 118 individuals (52 adults and 66 juveniles) have been released. Post-release monitoring confirmed a mortality rate of 27.1% (n = 32), with predation proving to be the most common cause of death (37.5%, n = 12). To mitigate the effect of long-term breeding in captivity on natural behaviour, i.e., suppressed anti-predator response, and thus predation-related mortality, anti-predation training was designed and introduced in 2025. Selected breeding pairs and their offspring were conditioned to domestic cat (*Felis catus*) and beech marten (*Martes foina*), whose display was paired to the little owl's alarm call. The anti-predation training was conducted during two periods, before egg laying and after hatching. Each period contains four training sessions, one control and one test. Predator models moving along the aviary were employed in random order. The behaviour of the little owls was recorded during all sessions. One-year preliminary results showed that none of the trained individuals (n = 14) were predated during the six-week post-release period, whereas 18.2% of the untrained individuals (n = 11) were. These results underscore the need for continuing with anti-predator training and monitoring to enhance reintroduction success and ensure the little owl population persistence.

Talk 38: Red-backed Shrike vs. Common Cuckoo: Could egg recognition reduce parasitism?

Johanka Bláhová

University of South Bohemia in České Budějovice, Czech Republic

Co-authors: Krausová L¹, Syrová M¹, Mari L², Veselý P¹, Troscianko J³, Šulc M²

¹University of South Bohemia in České Budějovice, Faculty of Science, České Budějovice, Czech Republic

²University of Jyväskylä, Department of Biological and Environmental Science, Finland

³University of Exeter, Centre for Ecology and Conservation, Penryn, UK

⁴Czech Academy of Sciences, Institute of Vertebrate Biology, Brno, Czech Republic

Historically, the Red-backed shrike was a frequent host of the Common cuckoo, but cuckoos have virtually ceased to parasitize this species in the Czech Republic over the past 100 years. Several factors may have contributed to this decline, such as the evolution of strong antiparasitic defences in shrikes, including egg rejection, and high interclutch but low intraclutch variability in egg appearance, making difficult for cuckoos to achieve good mimicry. Our aim was to test the responses of shrikes to four types of foreign eggs: artificial cuckoo eggs, artificial shrike eggs, and both dead and live conspecific shrike eggs, to compare their rejection rates and identify key egg characteristics involved in recognition.

We conducted experiments by placing these eggs into shrike nests (one per nest; n=101). Rejection rates were calculated for each egg type, and all eggs and clutches were photographed. Egg volume and pattern and colour traits were measured from standardized photographs using ImageJ. Logistic regression and Wilcoxon tests were used to identify the key features influencing conspecific egg rejection.

Artificial shrike eggs had the highest rejection rate (100%), followed by artificial cuckoo eggs (95%), dead shrike eggs (73%), and live shrike eggs (46%). Chromatic and achromatic contrasts of the spotting and background, along with spotting percentage, were the strongest predictors of conspecific egg rejection (all p-values < 0.05). Our results show that shrikes possess strong recognition and rejection abilities towards multiple types of foreign eggs. This ability, combined with high interclutch and low intraclutch variability, may represent an effective adaptation against brood parasitism and could have contributed to the disappearance of cuckoo parasitism.

Talk 39: Assessing the effects of *Amorpha fruticosa* invasion on avian assemblages: insights for management in riparian ecosystems

Leonardo Siddi

University of Eastern Piedmont, Italy

Co-authors: Giulia Cenzi, Giacomo Assandri

Riparian ecosystems are globally threatened by the invasion of non-native plants, with *Amorpha fruticosa* representing one of the most critical cases in Europe. However, its impact on bird communities outside its native range remains largely unknown. We addressed this knowledge gap by examining the effect of *A. fruticosa* invasion on riparian breeding bird assemblages within the floodplain habitats of the Po River (Italy). Bird communities were surveyed by means of 86 point counts, while environmental variables were collected within a 100-m buffer. We derived species richness, community conservation index, and community specialization index, testing their association with *A. fruticosa* cover, landscape composition, and proxies of habitat degradation. Our results indicate that *A. fruticosa* invasion positively affected species richness and the community conservation index, suggesting this non-native plant may act as a surrogate habitat for shrubland specialists (e.g. Common Whitethroat). While forest cover and compositional heterogeneity promoted species richness, heterogeneous and degraded habitats – both wooded and herbaceous – reduced the degree of specialization of avian communities. Anthropogenic alterations of riparian ecosystems are reshaping breeding bird assemblages, with invasive plant species such as *A. fruticosa* acting as key drivers. Consequently, management strategies should prioritize the restoration of native vegetation and the mitigation of environmental degradation caused by direct and indirect human activities. At the same time, the eradication of *A. fruticosa* – a common conservation measure in such ecosystems – should be performed with caution, as it may negatively impact the residual populations of avian species of conservation concern in Northern Italy.

Abstracts: Poster Presentations

1. The Role of Linear Habitat Heterogeneity in Shaping Avian Assemblages in Agricultural Landscapes

Aleksandra Gawrońska

Faculty of Biology, Adam Mickiewicz University, Poznań, Poland

Co-authors: Paweł Szymański

Faculty of Biology, Department of Behavioural Ecology, Adam Mickiewicz University, Poznań, Poland

In the context of the continuously intensifying agricultural economy and the ongoing biodiversity crisis in agricultural landscapes, the conservation of natural landscape elements has become increasingly important. Such elements play a key role in mitigating biodiversity loss and providing refugia for wild animal species. Linear habitats, including hedgerows, field margins, and drainage ditches, constitute an integral component of agricultural landscapes and may significantly contribute to the maintenance of ecological connectivity and habitat availability for avian communities. The aim of this study was to assess the relationship between the spatial structure of linear habitats in agricultural landscapes and the diversity and composition of bird assemblages, with particular emphasis on habitat spatial heterogeneity as a key ecological factor. The study focused on selected linear landscape elements and evaluated their structural characteristics in relation to observed patterns of avian species richness. The preliminary results indicate a positive relationship between bird species diversity and the degree of heterogeneity of linear habitats within agricultural landscapes, suggesting that structurally diverse linear elements may enhance habitat suitability for a wider range of bird species. These findings highlight the importance of maintaining and restoring heterogeneous linear habitats as part of sustainable agricultural landscape management and biodiversity conservation strategies. Detailed statistical analyses of the collected data are still ongoing.

2. Where do barn swallows from Central Europe winter? Outlining non-breeding grounds using feather stable isotopes

Barbora Počtová Vodičková

Charles University, Czech Republic

Co-authors: David X. Soto², Jaroslav Cepák^{1,4}, Petr Klvaňa⁴, Ondřej Kauzál^{1,3}, Josefína Záleská¹, Václav Jelínek³, Oldřich Tomášek³, Tomáš Albrecht^{1,3}

¹Charles University, Faculty of Science, Department of Zoology, Prague, Czech Republic

²Leibniz Institute for Zoo and Wildlife Research (IZW), Department of Evolutionary Ecology, Berlin, Germany

³Institute of Vertebrate Biology of the Czech Academy of Sciences, Department of Evolutionary Ecology, Brno, Czech Republic

⁴National Museum – Czech Ringing Centre, Prague, Czech Republic

Understanding the ecology of migratory birds is dependent on knowledge of their non-breeding grounds, as conditions during this season can strongly influence population dynamics and reproductive performance. Identification of non-breeding grounds is essential for understanding carry-over effects and for effective species conservation.

The barn swallow is an ideal model species because it is widespread, easily observable across Europe, and has well-known migratory strategies. The populations of southwestern Europe mainly winter in the Equatorial Afrotropical region, while the populations of northeastern Europe winter in the eastern and southern African savannah. The contact zone in Central Europe between these strategies crosses the Czechia and Slovakia, making this area an ideal place to study the carry-over effects of different wintering grounds. We use stable isotope measurements of H ($\delta^2\text{H}$), C ($\delta^{13}\text{C}$), and N ($\delta^{15}\text{N}$) in barn swallow feathers that molt during winter, reflecting the isotopic composition of the wintering ground. We also tested the usability of different feather types for identifying wintering grounds using stable isotope methods, due to limited knowledge about the timing of feather molting in barn swallows. At least, by using stable isotopes from feathers, we define the distribution of wintering grounds and associated carry-over effects in barn swallow populations in the Czechia and Slovakia.

3. Scale-dependent habitat use of birds in alpine grasslands at the upper elevational limit

Codruț Helerea

Independent Researcher / Bachelor's Graduate (Awaiting MSc Admission)

Co-authors: Dan Chamberlain¹

¹Department of Life Sciences and System Biology, University of Turin, Italy

Alpine birds occupy the upper elevational limit and have restricted possibilities to shift their distribution upslope, making them vulnerable to climate and land-use change. Where alpine grasslands form this limit, rising temperatures and the abandonment of traditional pastoral practices accelerate vegetation advancement to higher elevations. Although upslope range shifts have been documented, species-specific habitat use remains poorly understood, limiting our ability to identify which alpine species are most at risk of habitat loss. As shrubs encroach into alpine grasslands, open-landscape, ground-dwelling species are expected to be disproportionately affected. We conducted point-count surveys during the breeding season in an alpine grassland in the Southern Carpathians and analysed habitat use of common species at landscape and fine spatial scales in relation to topography, vegetation, and bare ground. At the landscape scale, Horned Larks *Eremophila alpestris* and Skylarks *Alauda arvensis* avoided shrub cover, indicating high vulnerability to vegetation encroachment, whereas Water Pipits *Anthus spinoletta* and Black Redstarts *Phoenicurus ochruros* occurred more frequently in shrub-rich environments. At the fine scale, Horned Larks, Black Redstarts, and Northern Wheatears *Oenanthe oenanthe* selected bare ground and rocky patches, while Dunnocks *Prunella modularis* selected shrubs. These findings suggest that larks are most threatened by vegetation encroachment, while Northern Wheatears and Black

Redstarts may be affected by the loss of open microhabitats. Conversely, Dunnocks and Water Pipits may benefit from shrub expansion. Maintaining open alpine grasslands through sustainable livestock grazing is therefore crucial for preserving alpine biodiversity.

4. The role of key feature arrangement in predator recognition by the red-backed shrike (*Lanius collurio*)

Daniela Svojanovska
University of South Bohemia, Czech Republic

Co-Authors: Ondřej Fišer¹, Cara-Marie Denney¹, Kateřina Motýlová², Alena Fišerová¹, Michaela Syrová¹, Petr Veselý¹, Roman Fuchs^{1,2}

¹Department of Zoology, Faculty of Science, University of South Bohemia

²Charles University, Faculty of Science, Prague, Czech Republic

Holistic perception refers to a recognition process in which individual features and their spatial configuration are evaluated simultaneously. It was originally described in humans in the context of face recognition, but evidence suggests it is also applied to other object categories. According to this framework, objects suitable for holistic processing must fulfil three requirements: individual distinctiveness, high structural similarity with differences primarily in detail, and a canonical orientation. Although holistic perception has been widely studied in primates, its function in birds remains poorly understood. The typical body shape of a perched diurnal avian bird predator meets the criteria for holistic recognition and thereby offers a suitable model for testing this mechanism in untrained birds. We examined nest-defence behaviour of untrained red-backed shrikes (*Lanius collurio*) in their natural habitat using dummies of the common kestrel (*Falco tinnunculus*). Two types of modifications were tested: altered body proportions and adjusted body orientation. A European turtle dove dummy (*Streptopelia turtur*) and an unmodified kestrel dummy served as controls. The experiment involved 18 breeding pairs, which were observed over 2 seasons. Aggressive responses, including attacks and alarm calls, were recorded and analysed using principal component analysis and linear mixed models. Aggression towards modified kestrel models was significantly lower than towards the unmodified model (LMM for both modifications, Tukey HSD, $Z > 4.5$, $P < 0.01$). These findings indicate that correct body proportions and orientation are crucial for predator recognition, even when key visual features and colouration are maintained.

5. Age-related changes in avian thermoregulatory performance: experimental design for analysing the Scholander–Irving curve in the zebra finch (*Taeniopygia guttata castanotis*)

Dawid Pszczoła
Institute of Environmental Sciences, Faculty of Biology, Jagiellonian University, Kraków, Poland

Co-authors: Jakub P. Płachta^{1,2}, Małgorzata M. Lipowska¹, Ulf Bauchinger^{1,3}, Edyta T. Sadowska¹

¹Institute of Environmental Sciences, Faculty of Biology, Jagiellonian University, Kraków, Poland

²Doctoral School of Exact and Natural Sciences, Jagiellonian University, Kraków, Poland

³Nature Conservation Station Unterelbe, State Agency for Bird Conservation, Freiburg/Elbe, Germany

Active thermoregulation is a key evolutionary innovation in birds, enabling activity across a wide range of environmental conditions. While ageing in mammals is known to impair body temperature regulation and thermoregulatory performance, comparable age-resolved data for birds are largely lacking. Here we present the experimental design of an ongoing project aimed at quantifying how ageing affects the fundamental parameters of avian thermoregulation.

The study will focus on the thermoregulatory (Scholander–Irving) curve in 90 captive zebra finches (*Taeniopygia guttata castanotis*) spanning a broad age range (1–6 years), implanted with temperature-sensitive transponders. Birds will be exposed to a series of controlled ambient temperatures spanning values within, below, and above the thermoneutral zone, while body temperature and metabolic rate will be measured using open-flow respirometry.

We will estimate parameters of thermoregulatory performance such as – body temperature, lower and upper critical temperature, basal metabolic rate and minimal thermal conductance. Age will be treated as a continuous predictor to test the hypothesis that ageing progression is associated with systematic shifts in these parameters, reflecting a gradual decline in the ability to maintain homeothermy in older individuals. The results of the project will provide the first age-resolved characterization of the Scholander–Irving curve in a passerine and will contribute to understanding how physiological ageing constrains the performance of avian endothermy and its ecological consequences.

6. Follow the locals: Do environmental conditions predict heterospecific attraction between migratory and resident songbirds?

Dorota Kudělková

Palacký University Olomouc, Czech Republic

Co-authors: Vladimír Remeš¹

¹Department of Zoology, Palacký University Olomouc, Czech Republic

Birds evolved various strategies to cope with unfavorable conditions, long-distance migration being the most notable. However, since not all species migrate, migratory and resident birds often share the same space and dietary niches, leading to interspecific competition for resources. While one solution is local spatial avoidance, spatial co-occurrence with a potential competitor might actually benefit migratory species; since residents have more time to locate optimal microhabitats, migrants might benefit from

seeking out areas where these residents are present—a hypothesis supported by several studies of European birds.

The aim of this study is to determine whether migratory and resident species with overlapping niches avoid or attract one another on a local scale and how this relationship shifts along an environmental gradient. Our hypothesis is that in areas with high seasonality and thus lower resident densities, migrants will tend to seek their company to exploit public information about good habitat patches, whereas in areas with lower seasonality and thus higher resident densities, migrants will tend to avoid competing with them. Our analysis focuses on North American species using data from the Breeding Bird Survey (BBS), which offers high-resolution spatial data on a large spatial extent. Explaining these dynamics is essential for understanding community assembly, a fundamental question in ecology with direct relevance to biodiversity dynamics.

7. Sex differences of bill morphology in a highly dimorphic seabird species

Feliksa Żurawska
University of Gdańsk, Poland

Co-authors: Lucas Krüger¹

¹Instituto Antártico Chileno, Chile

Intra-specific variation in morphological traits can reflect ecological differences between sexes and provide insights into niche partitioning and sexual dimorphism. Bill morphology is a multifunctional trait involved in feeding, competitive interactions, and mating behavior, making it particularly relevant for understanding ecological and evolutionary divergence in birds. In two sibling species of giant petrels (*Macronectes halli* and *Macronectes giganteus*), intersexual differences in diet exceed inter-specific differences, suggesting that sexual dimorphism may have evolved prior to species divergence.

Based on this evidence, we expect that dietary divergence between sexes in the Southern Giant Petrel (*Macronectes giganteus*) relates to sexual dimorphism in bill morphology. We predicted that males and females would differ in bill shape in ways consistent with sex-specific dietary and feeding. To test these predictions, we analyzed bill morphology of nesting partners using geometric morphometrics, which enables precise quantification of shape variation and detection of subtle intersexual differences not captured by traditional linear measurements. Our results provide a morphological framework for understanding sex-specific ecological strategies of sexual dimorphism in giant petrels.

8. Do Songbirds Fall Silent in Africa? Vocal Activity of Palearctic Passerines on Their Wintering Grounds.

Gabriela Szczeblowska
Witaszczyk, Uniwersytet Im. Adama Mickiewicza, ul. Uniwersytetu Poznańskiego 6, 61 614 Poznań, Poland

Co-authors: Gabriela Szczelbłowska, Zuzanna Trzebuniak, Paweł Szymański, Hanna Witaszczyk

During the breeding season, songbirds use songs to defend territories and attract mates. However, vocal activity outside this period remains poorly understood, particularly across the annual cycle. We investigated vocal activity of long-distance migratory birds on their African winter grounds. European passerines wintering in the montane forests of Cameroon were studied: Willow Warbler (*Phylloscopus trochilus*), European Pied Flycatcher (*Ficedula hypoleuca*), Garden Warbler (*Sylvia borin*), and Wood Warbler (*Phylloscopus sibilatrix*). Acoustic recordings were collected using passive acoustic monitoring (PAM) from 07.11.2015 to 24.12.2016 using autonomous recording units (ARUs). Recordings were analyzed using BirdNET algorithms, and all automatic detections were manually verified.

Three of the four studied species were vocally active on the winter grounds. Vocal activity varies among species. The Willow Warbler was recorded singing and calling, with vocal activity increasing over the course of the winter and peaking in February, just before spiring migration. The structure of songs showed variation, suggesting improvement of vocal performance. Peak daily activity occurred during the morning, within four hours after sunrise. Garden Warbler was recorded singing 347 songs but no contact calls, the European Pied Flycatcher was detected only calling (n = 247), while the Wood Warbler showed no vocal activity. These results suggest a puzzling alternative function for winter song, as long-distance migratory birds may practice and improve their songs during non-breeding season. However, the role of winter singing in annual song development remains poorly understood and requires further study. Winter vocal activity provides insights into migratory passerine behavior and conservation.

9. Higher nest predation risk close to forest patches is compensated by specific bird responses towards predator guilds in an agricultural mosaic landscape

Guillaume Dillenseger

University of South Bohemia, Czech Republic

Co-authors: Justine Delautre^{1,2}, Ankitha Jayanth^{1,3}, Zora Marchal^{1,4}, Petr Veselý¹, Vojtěch Kubelka^{1,5}

¹Department of Zoology, Faculty of Science, University of South Bohemia, Branišovská 1760, České Budějovice, 37005, Czech Republic

²Département Biologie Écologie, Université de Montpellier, Bâtiment 13, CC 13003, Montpellier 5, 34095, France

³Biological and Life Sciences Department, Ahmedabad University, Gujarat, 380009, India

⁴Faculté des Sciences de la Vie, Université de Strasbourg, 28 rue Goethe, Strasbourg, 67000, France

⁵Centre for Polar Ecology, Faculty of Science, University of South Bohemia, Branišovská 1760, České Budějovice, 37005, Czech Republic

The risk of nest predation differs across habitats and increases with the proximity to habitat edges. In agricultural mosaic landscapes, the breeding success of ground-nesting birds can be negatively impacted by the presence of adjacent forest patches, which act as a source of predation. However, we still have limited knowledge on how birds nesting in such habitats are coping with variable predation risk. In this study, we investigated predation rates of experimental ground nests and Northern Lapwing nests (*Vanellus vanellus*), in relation to the closest forest patch. Furthermore, we tested the aggressive responses displayed by nesting pairs towards stuffed nest predators of different guilds, at different distances from the forest. Predation rate on experimental nests increased with proximity and area of the closest forest patch. In contrast, predation rate on lapwing nests were not affected by the presence of forest, suggesting efficient nest defence performed by parents to protect their clutch. Pairs displayed more aggressive behaviours against predators compared to a control. Additionally, responses to specific predators varied with regards to forest distance. Lapwings were more aggressive towards a bird at close distance from forests, but more aggressive towards a mammal further from forests. This study highlighted the importance of fine-scale differences in anti-predatory behaviours to compensate for local variations in predation risk, in heterogenous agricultural landscapes.

10. Diet composition and fledging success in birds exposed to heavy metal pollution: A DNA metabarcoding approach

H.A.S.S. Alwis

University of Turku, Finland

Co-authors: Lydia I. Leino, Eero J. Vesterinen, Miia J. Rainio, Tapio Eeva

Air pollution may affect birds directly and indirectly and point sources of heavy metal emissions, such as smelters, are well suited for investigating avian ecological responses along a pollution gradient. In highly polluted areas, insectivorous passerines may be impacted directly by toxic pollutants and/or indirectly through changes in their invertebrate diet. As an anthropogenic stressor, heavy metal point sources can alter the invertebrate abundance and species composition, which may in turn modify the diet of breeding birds and potentially influence their fledging success. This study investigates the relationship between anthropogenic changes in invertebrate prey and the reproductive success of three hole-nesting bird species - great tit (*Parus major*), blue tit (*Cyanistes caeruleus*), and pied flycatcher (*Ficedula hypoleuca*)- breeding around a copper-nickel smelter in Harjavalta, Finland. We used fecal DNA metabarcoding to characterize the dietary composition in polluted and control zones. In addition, we measured heavy metal concentrations in nestling feces and examined the associations between diet composition and fledging success. We identified 14 arthropod orders in total, but only six orders were consumed by all three bird species. Generalized linear models with binomial error structures revealed that fledging success was influenced by nestling body mass in all species. A PERMANOVA indicated that the dietary arthropod communities differed significantly among species and between zones, and were also significantly associated with nestling body mass. Overall, our findings highlight the

potential impacts of pollution-driven dietary shifts on avian development, contributing to broader research on environmental stressors in common model bird species in Finland.

11. Natal Dispersal and Habitat Selection in the White-tailed Eagle: Causes and Consequences of First Breeding Site Choice

Ida Penttinen
University Of Turku, Finland

Co-authors: Carina Nebel¹, Toni Laaksonen¹
¹*University Of Turku, Finland*

Movements and habitat selection of individual organisms is responsible for the gene flow, range dynamics and population dynamics, and individual fitness. Common form of movement is natal dispersal, the movement of an individual from the site of birth to the site of first breeding. The last phase of natal dispersal is the choice of first breeding site. Individuals choosing their first breeding site lack information about fitness prospects of different habitat types, so the choice must be made based on cues, such as resemblance to the natal habitat and presence of conspecifics. If a species exhibits very high breeding site fidelity, the consequences of the first breeding habitat choice are potentially life-long. For such species, it is especially important to understand which cues are used when choosing breeding sites, and whether these are coupled with subsequent reproductive success.

In my thesis I study natal dispersal and habitat selection patterns the white-tailed eagle (*Haliaeetus albicilla*), a long-lived species with delayed maturity and high breeding sites fidelity, using genetic and visual identification of breeding individuals. I examine, how conspecific density and habitat imprinting affect the choice of the first breeding site and are they related to the subsequent breeding success. The results show that factors affecting the settlement decisions do not necessarily reflect in breeding success. Density affects natal dispersal distance and settlement patterns and white-tailed eagles prefer breeding habitats resembling their natal habitat despite the natal dispersal distance and habitat availability. However, the habitat similarity is not associated with breeding success, which seems to be determined by conspecific density, breeding habitat type and parental age.

12. Effects of temperature in Europe on autumn migration phenology of Wren *Troglodytes troglodytes* at the southern Baltic coast over 1965-2024

Ignacy Gołębiewski
University of Gdańsk, Poland

Co-authors: Magdalena Remisiewicz

In the last decades, temperatures in Europe have increased, but the magnitude of these changes varies longitudinally throughout the year, so their effects on birds may differ,

depending on the geographical range of the examined population. We investigated the effects of temperature in four regions of Europe on the timing of autumn migration of Eurasian Wren at the coastal bird ringing station Mierzeja-Wiśłana (MW) located in northern Poland over 1965–2024. We used the passage dates of 10% (start), 50% (median) and 90% (end) of the wren's mist-netted at MW during autumn migration (20 August–1 November). We examined the effects of temperature on the passage dates using quantile regression modelling. The dates of start, median and end of wren's passage at MW shifted later by, respectively, 5.8, 7.3 and 6.3 days over 1965–2024. During this period, the start, median and end dates of autumn migration at MW were late after warm winters in southern or central Europe, but the start of passage was early after warm springs in south-western Europe. Warm summer and autumn in northern Europe were correlated only with the delayed end of passage at MW. We suggest that the timing of autumn migration was influenced by the effect of temperatures in these regions on the survival and fitness of wren's during the non-breeding period, and on the breeding success and number of juveniles on their breeding grounds. These effects of temperature likely explain long-term shifts in all stages of autumn passage. Our findings suggest that the phenology of wren's autumn migration is shaped by the carry-over effects of temperatures on their breeding grounds and non-breeding grounds, where they stay about 5–10 months before their actual autumn migration through the southern Baltic coast.

13. Influence of age and foraging ecology on mercury concentrations in Whiskered Terns (*Chlidonias hybrida*) from southern Poland

Izabela Wiśniowska

University of the National Education Commission, Kraków, Poland

Co-authors: Łukasz J. Binkowski¹, Paco Bustamante^{2,3}, Adam Flis⁵, Bartłomiej Kusal⁴, Halszka Łożyńska⁴, Paulina Smużyńska¹, Mateusz Ledwoń⁴

¹Institute of Biology and Earth Sciences, University of the National Education Commission, Poland

²Littoral ENvironnement et Sociétés (LIENSs), CNRS-La Rochelle Université, France

³Institut Universitaire de France (IUF), 1 rue Descartes 75005 Paris, France

⁴Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Poland

⁵Institute of Nature Conservation, Polish Academy of Sciences, Kraków, Poland

Anthropogenic activities have significantly altered mercury (Hg) cycling in the environment, making it more bioavailable to biota. Due to methylation, Hg forms an organic compound which is more easily bioaccumulated and biomagnified along the food chain. As a result, animals from higher trophic levels, including predatory piscivorous birds, are significantly influenced. Since diet is the main exposure pathway, foraging ecology, including trophic position (proxied by $\delta^{15}\text{N}$) and feeding habitat (proxied by $\delta^{13}\text{C}$), is a major driver for its variation. In that context, the study aimed to determine whether Hg is present in the blood of Whiskered Tern individuals and whether its presence is influenced by age and foraging ecology. Blood samples were collected from the wing vein from 50 adults and 45 chicks in 2024 and 2025 from the fishpond

complexes (Upper Vistula Valley, Lesser Poland) and stored frozen at -18°C until further analysis. In all samples, total Hg concentrations (CV-AAS) were measured. After that, samples were freeze-dried and relative abundance of stable isotopes $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ (IR-MS) were determined. General linear models were built to explain Hg variability. Age, $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values were used as explanatory variables with model selection based on AICc. We found that Hg was quantifiable in all specimens. Model selection indicated that Hg concentrations were best explained by the model, including all variables. Hg concentrations were significantly higher in adults and showed a negative relationship with both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. We conclude that higher Hg concentrations in adults results from bioaccumulation over time, while isotopic relationships suggest that specific feeding habitats drive differential exposure risks in this population.

14. An evidence for relaxed selection in predator-prey interactions: Isolated population of Arctic terns shows diminished ability of predator recognition

Jan Špička

University of South Bohemia, Czech Republic

Co-authors: Tereza Hromádková¹, Johanka Bláhová¹, Roman Fuchs¹, David Milesi Gaches¹, Michaela Syrová¹, Renata Szarvas², Lucie Špičková¹, Jose Valdebenito^{2,3,4}, Petr Veselý¹

¹Department of Zoology, Faculty of Science, University of South Bohemia, Branišovská 31a, České Budějovice 370 05, Czech Republic

²Department of Evolutionary Zoology and Human Biology, University of Debrecen, Egyetem tér 1, H-4032 Debrecen, Hungary

³Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad

de Concepción, Casilla 160-C, 4070386 Concepción, Chile

⁴Instituto Milenio Biodiversidad de Ecosistemas Antárticos y Subantárticos (BASE), Las Palmeras 3425, 8320000 Santiago, Chile

Isolated populations often lose their ability to respond appropriately to predation threat, despite this ability being believed to be evolutionarily conserved. Only predator-free populations are supposed to lose their antipredator behaviour and recognition ability. We studied the ability of an isolated Svalbard populations of Arctic terns facing very limited spectrum of predators to recognize and respond appropriately to various avian predators. Their nest defence behaviour was compared to populations from Iceland and European mainland, where more predators occur. We presented the following predator dummies: peregrine falcon occurring only on the mainland; common raven occurring in Iceland and mainland, and great black-backed gull and common eider both present on all three localities. Terns on all localities showed strong aggression toward the gull threatening their eggs and also some aggression to eider, which may also obviously act as a threat to the tern nest content. Terns at Svalbard were willing to regularly incubate their nests in the presence of raven and falcon, which is likely a result of very low experience with these two species as predators. On the contrary, mainland and Icelandic terns showed quite fearful responses towards these two stimuli. Our results suggest that unfamiliarity with a predator may result in a significant decrease in antipredator

behaviour, despite other predators still being present. The isolated tern population has lost the ability to recognize some predators based on general characteristics, which is particularly surprising in comparison with theoretical models presuming that if the population faces some predators their ability to recognize them persists.

15. Inter- and intra-annual variation in the foraging ecology of chick-rearing Brünnich's guillemots (*Uria lomvia*) breeding in the High Arctic colony

Karolina Cieślińska
University of Gdansk, Poland

Co-authors: Lech Marek Iliszko, Michał Goc, Lech Stempniewicz, and Dariusz Jakubas

Seabird foraging ecology is shaped by a combination of external environmental conditions and internal energetic demands. In response to fluctuations in prey availability, seabirds can adjust their feeding strategies to maintain adequate energy delivery to their offspring. In this study, we investigated inter and intra annual variation in the foraging ecology of Brünnich's guillemots (*Uria lomvia*) breeding in the High Arctic colony on Spitsbergen (Svalbard), using a combination of GPS-tracking and remote sensing data. Despite contrasting environmental conditions between the two studied years, both the distances travelled and the duration of foraging trips remained broadly consistent. Individuals typically foraged in cold waters along shelf and shelf break zones located up to 100 km from the colony (median 51 km). They foraged at colder waters with lower primary productivity in colder 2015 compared with warmer 2016 but still used areas of similar depth. In 2016, guillemots exploited a narrower foraging habitat foraging niche (characterised by specific ranges of sea surface temperature, chlorophyll a concentration, sea depth, and seabed slope) compared to 2015. This pattern suggests a reduced diversity of microhabitats offering suitable prey. As the chick rearing period progressed, adults in both years travelled progressively farther from the colony. This pattern is consistent with a temporal prey depletion halo effect. Overall, our findings highlight the spatio temporal variability of foraging behaviour in a key Arctic seabird species and underscore the sensitivity of predator-prey dynamics to rapid environmental change in the High Arctic.

16. Occurrence of phenolic compounds in *Pygoscelis* penguins as an indicator of human impact in the South Shetland Islands region

Kinga Hoszek-Mandera
University of Gdańsk, Poland

Co-authors: Marta Staniszewska¹, Magdalena Bełdowska¹, Katarzyna Fudala², Robert Bialik², Jefferson Hinke³, Anna Panasiuk⁴

¹University of Gdańsk, Faculty of Oceanography and Geography, Department of Chemical Oceanography and Marine Geology, Al. M. Piłsudskiego 46, 81-378 Gdynia, Poland

²Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Department of Antarctic Biology, Pawinskiego 5a, 02-106 Warsaw, Poland

³U.S. Antarctic Marine Living Resources Program, Ecosystem Science Division, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, La Jolla, California

⁴University of Gdańsk, Faculty of Oceanography and Geography, Department of Marine Biology and Biotechnology, Al. M. Piłsudskiego 46, 81-378 Gdynia, Poland

Phenolic compounds such as bisphenol A (BPA), 4-tert-octylphenol (4-tOP), and 4-nonylphenol (4-NP) belong to the group of endocrine-disrupting chemicals (EDCs). As xenoestrogens, they exhibit structural similarity to endogenous hormones, enabling them to bind to hormone receptors and modulate endocrine responses. These compounds are toxic even at low concentrations, showing genotoxic, mutagenic, and teratogenic effects, including oxidative stress induction, DNA damage, metabolic disorders, developmental abnormalities, and reduced fertility. Moreover, they can bioaccumulate within trophic chains, posing significant threat to top predators.

In Antarctic ecosystems, penguins of the genus *Pygoscelis* (*P. adeliae*, *P. antarctica*, and *P. papua*) represent a significant component of biomass and act as biovectors of contaminants. By foraging in the marine environment and nesting on land, penguins can transfer toxic compounds from the ocean to terrestrial ecosystems via guano, feathers, and eggshells. The aim of this study was to determine the concentrations of BPA, 4-tOP, and 4-NP in these matrices to assess the level of phenolic compounds concentration in Antarctic wildlife. Samples of feathers, guano, and eggshells were collected from six breeding colonies on King George Island during the austral summer of 2021/2022 at the Henryk Arctowski Polish Antarctic Station. Concentrations of phenolic compounds were analyzed using HPLC-FLD. BPA was detected in 82% of samples, followed by 4-NP (76%) and 4-tOP (41%), with the highest concentrations observed in chicks. These results indicate the presence of anthropogenic contaminants in the Antarctic environment and highlight the need for continued non-invasive monitoring to support conservation efforts.

17. Slow vision in owls: behavioural evidence from two species

Kotryna Jakuba

University of Vilnius, Lithuania

Co-authors: Simon Potier¹, Almut Kelber², Mindaugas Mitkus³;

¹Les Ailes de l'Urga, France

²Department of Biology, Lund University, Sweden

³Institute of Biosciences, Life Sciences Center, Vilnius University, Lithuania

To interact with the visual environment, animals must detect and track moving objects in space and time, a requirement that is particularly critical for flying predators. Owls possess visual systems adapted for low-light conditions, prioritizing visual sensitivity over high spatial and temporal resolution. To date, owl temporal resolution has not been assessed using behavioural methods.

In this study, temporal resolution was assessed using a two-choice discrimination task. A Bengal owl (*Bubo bengalensis*) and a Barn owl (*Tyto alba*) were trained to discriminate a flickering light stimulus from a steady light stimulus. After learning the task, flicker frequency was increased stepwise from 10 Hz until the owl could no longer reliably discriminate flicker from constant light. Due to experimental constraints, *Tyto alba* was tested under one luminance condition only, allowing estimation of flicker fusion frequency (FFF).

For *Bubo bengalensis*, the highest discriminable flicker frequency at 30,000 cd/m² was 43.33 ± 0.47 Hz (mean ± s.d.; n = 3), identified as its critical flicker fusion frequency (CFF). At 55,500 cd/m², discrimination was possible up to 33.66 ± 0.82 Hz, while at 3,200 cd/m² it declined to 17.00 ± 0.01 Hz (n = 3). The Barn owl showed an FFF of 27.6 ± 0.6 Hz at 55,500 cd/m², though further testing is required to determine its CFF.

These results show that owls exhibit lower temporal resolution than diurnal raptors, reflecting an adaptation favoring sensitivity under dim light over the perception of rapid motion. The Bengal owl lies at the lower extreme of temporal resolution among birds, indicating that high temporal acuity is not essential for effective predation in low-light environments. Whether this applies broadly across owl species remains unresolved.

18. The impact of tourist pressure on parental care in the Ringed Plover *Charadrius hiaticula* – preliminary results

Kuba Kasprzycki
University of Gdańsk, Poland

Co-authors: Agnieszka Ożarowska
1Ecophysiology and Behavioral Ecology Research Unit, Department of Vertebrate Ecology and Zoology, Faculty of Biology, University of Gdańsk

Coastal regions are currently subject to intense tourist pressure. However, beaches constitute major breeding habitats for rare bird species sensitive to human pressure. The persistence of these populations depends strongly on adults' ability to provide offspring with high-quality parental care. In this study, we examined how tourist pressure, defined as the presence of people on beaches, may influence parental care during the egg incubation period in the Ringed Plover *Charadrius hiaticula*, a small shorebird breeding on coastal beaches in northern Poland. Following the weekend effect hypothesis, we assumed that parental incubation patterns would vary across the week in response to fluctuating human presence. Incubation behaviour of ringed plovers was continuously monitored with camera traps from April to July 2025. The weekend effect hypothesis was tested using the generalized additive mixed models (GAMMs) that included mean air temperature, sunshine duration, incubation stage, nest as a random effect and day of the week. We found that during weekends, ringed plovers spent significantly less time incubating their eggs compared to the other days of the week. Moreover, birds modified their incubation routine over the weekends: (1) the number of incubation recesses was significantly higher, with average recess duration being significantly longer compared to

other days; (2) incubation bouts were both significantly shorter and more variable. These findings demonstrate that increased tourist presence during weekends results in significant alterations in the incubation patterns and routines of the ringed plover. This may consequently lead to a decline in egg incubation quality.

19. Acrosin Gene Family Expansion in Passerine Birds

Laima Bagdonaitė

Natural History Museum, University of Oslo, Norway

Co-authors: Arild Johnsen¹, Jan T. Lifjeld¹, Erica H. Leder^{1,2,3}

¹Natural History Museum, University of Oslo, Norway

²Tjärnö Marine Laboratory, Department of Marine Sciences, University of Gothenburg, Strömstad, Sweden

³Section of Ecology and Evolution, Department of Biology, University of Turku, Turku, Finland

Acrosin is an enzyme important for successful fertilization and sperm-egg interaction across a broad range of organisms. Acrosins belong to the serine protease family and are present in the anterior part of the spermatozoa – the acrosome. In birds, acrosins are released during the acrosome reaction when spermatozoa fuse with the inner perivitelline membrane of the ovum. Previous studies have shown that the chicken has two acrosin (ACR) gene copies, whereas the zebra finch has seven. It is not known whether this gene expansion is restricted to the zebra finch or encompasses a broader range of bird lineages. Here, we examined and compared ACR copy number across non-passerine and passerine species utilizing high-quality chromosome-level genomes and their annotations. We show that the ACR has undergone a large expansion (from four to twelve copies) at the base of the passerine radiation. The ancestral ACR has duplicated and translocated to new genomic regions. We identified eight syntenic loci across passerine birds: six on autosomes and two on the Z-chromosome. We also analysed testis transcriptomes of eight passerine species and verified that all ARC copies were significantly expressed in the testis. In addition to ACRs, we investigated four other acrosome-associated genes—HYAL3, HYAL6, SPAM1, and LYZ—and found that all were present as single-copy genes across the species examined, suggesting that the expansion observed in ACR is not mirrored across other acrosomal gene families. We discuss the possible implications of these findings in light of the passerine radiation and their high levels of sperm competition.

20. Dispersal of plants by shorebirds in Hungarian wetlands

Lili Sztrehárszki

HUN-REN Centre for Ecological Research, Institute of Aquatic Ecology, Momentum Dispersal Ecology Research Group, Hungary

Co-authors: Balázs Koleszár^{1,3}, Péter Óvári¹, Ákos Őrsi¹, Gábor Papp^{1,2}, Dániel Popovics^{1,2}, Míra Júlia Radnai¹, Gábor Simay^{1,2,4}, Nándor Szabó^{1,2}, Pál Tóth^{1,4}, Ádám Lovas-Kiss^{1,3}

¹HUN-REN Centre for Ecological Research, Institute of Aquatic Ecology, Momentum Dispersal Ecology Research Group, Debrecen, Hungary

²Pál Juhász-Nagy Doctoral School, University of Debrecen, Debrecen, Hungary

³One Health Institute, Faculty of Health Sciences, University of Debrecen, Debrecen, Hungary

⁴Hortobágy National Park Directorate, Debrecen, Hungary

Endozoochorous seed dispersal by birds is an important mechanism for maintaining and connecting plant communities in wetland habitats, yet the vector role of shorebirds remains relatively poorly quantified. In this study, we analysed a dataset of plant propagules recovered from faecal samples of 15 shorebird species, excluding non-plant organisms (Cladocera, Daphnia, Bryozoa, etc.). Our aim was to characterise the species richness of dispersed plant taxa, describe their quantitative patterns and compare bird-plant interactions.

The dataset comprised 43 plant species/species groups assigned to 32 genera; these were represented by a total of 232 propagules, 19 of which germinated successfully. Shorebird species differed in various amount: Northern Lapwing (*Vanellus vanellus*) carried propagules of 17 and Pied Avocet (*Recurvirostra avosetta*) of 12 plant species/species groups, while samples of Ruff (*Calidris pugnax*) yielded the highest propagule count in a single plant taxon (*Eleocharis palustris*, 93 propagules). Most plant taxa were dispersed by a single vector species (31/43) and only two taxa were associated with at least three shorebird species.

The connectance of the species-level bipartite bird-plant interaction network was 0.09, meaning that propagules were detected in only 58 of the 645 theoretically possible bird-plant combinations, indicating a sparse system with few generalist and many specialist vector species. These results suggest that a limited subset of shorebirds may play a key role in propagule flow among wetland patches and in the regional-scale connectivity of the flora.

21. Breeding Season Foraging Ecology of the Mediterranean Shag in the Adriatic Sea

Louie Taylor

Croatian Academy of Sciences and Arts, Institute of Ornithology, Croatia

Co-authors: Biljana Ječmenica¹, Jelena Kralj², Luka Jurinović¹

¹Croatian Veterinary Institute, Poultry Centre, Heinzelova 55, Zagreb, Croatia

²Croatian Academy of Sciences and Arts, Institute of Ornithology, Gundulićeva 24, Zagreb, Croatia

Shags, like other seabirds, are central-place foragers during the breeding season and are widely used as indicators of marine ecosystem health; understanding their foraging distribution and habitat preferences is therefore essential. The Mediterranean subspecies of the European Shag (*Gulosus aristotelis desmarestii*), which breeds in the

Adriatic Sea is the only population of the species that is migratory and remains understudied, particularly with respect to foraging movements during breeding and habitat use. To address this knowledge gap, we conducted a GPS-tracking study on 22 breeding individuals from a colony in the Adriatic Sea, Croatia. Foraging metrics were comparable to those reported for Atlantic populations of the nominate subspecies, with a median maximum distance from the colony of 4.81 km and a maximum recorded distance of 24.45 km; no significant differences were detected between sexes in movement metrics or spatial distribution. Shags predominantly foraged in seagrass meadows and, to a lesser extent, in infralittoral algal communities on rocky substrates, typically at depths of 10–20 m. Further studies across additional colonies are needed to assess foraging ranges and habitat preferences throughout the Adriatic Sea and to provide a robust scientific basis for the designation of Marine Special Protection Areas (SPAs) and the effective conservation of the Mediterranean Shag in Croatia.

22. Wings and trains: bird interactions with railway traffic

Lucie Parolková

University of Ostrava, Czech Republic

Co-authors: Lukáš Choleva

Birds play a crucial role in ecosystems, and their behaviour often reflects the quality of the environment they inhabit. While research on avian diversity typically focuses on forest, aquatic, and agricultural ecosystems, railway corridors remain an understudied environment. These linear structures combine natural and anthropogenic elements that can have positive or negative impacts on birds.

Our research analyses bird behaviour along a specific 20-km section of the Studénka–Ostrava railway corridor, paying particular attention to the stretch running alongside the Poodří Protected Landscape Area, where a new High-speed rail line is planned. We focus on bird reactions to passing trains and the characteristics of their flight patterns over railway infrastructure.

The results will contribute to the optimal integration of biodiversity conservation into the planning of new railway infrastructure and the management of existing lines. A better understanding of bird interactions with these structures can help design effective mitigation measures. This ensures the use of modern construction elements while avoiding costly and ineffective measures that merely disrupt the aesthetic value of the landscape.

23. Usefulness of a non-invasive method for measuring marsh bird eggs

Maria Gawęł

Zakład Ekologii Ptaków Wydziału Nauk Biologicznych Uniwersytetu Wrocławskiego, Poland

Co-authors: Beata Czyż

The development of technology worldwide enables scientists to access increasingly advanced methods useful in research. However, the key challenge lies not only in improving measurement precision but also in reducing environmental interference, including minimizing the impact on animals. We compared two methods for measuring bird eggs: a non-invasive method based on photography analysis, and the traditional caliper measurement method. The eggs of birds nesting in the reed beds of the nature reserve “Stawy Milickie” (Milicz fishponds), including the Eurasian Coot *Fulica atra* and three species of grebes *Podiceps* sp., were measured for length and width using both methods. Photographs were analysed with ImageJ software and EggTools plugin. The results obtained by both methods were then compared, taking into account the egg's position in the image (left side, center, right side). The highest compatibility between the two methods was obtained for the grebe family, likely due to the more regular shape of their eggs. In this group, differences between the results obtained by both methods were minimal, although the highest standard error was recorded due to the high variability of egg sizes within the three grebe species and a smaller sample size. In the case of the Eurasian Coot, the photographic method systematically overestimated both the length and width of the eggs compared to caliper measurements. These discrepancies were particularly evident for eggs positioned at the edges of the measurement box, most likely resulting from perspective effects and optical distortions. The results suggest that the photographic method can be a useful alternative for measuring bird egg dimensions, provided that egg positioning and image calibration are standardized.

24. You are what you eat – reconstructing the winter diet and mercury exposure of six tern species using feather samples

María Jesús García Bianco
Institute of Avian Research, Germany

Co-authors: Sandra Bouwhuis

Mercury has increased in the environment due to anthropogenic activities. Once released, it can accumulate within individuals and biomagnify across the food chain. Seabirds' longevity and their tendency to occupy high trophic levels may result in elevated exposure to mercury, although the precise exposure levels will depend on the individual diet and foraging areas. Feathers have been shown to be a useful tissue for measuring mercury levels, as well as inferring foraging behaviour. We therefore used feathers collected from 225 individuals of known sex of six species of tern: arctic tern (*Sterna paradisaea*), black tern (*Chlidonias niger*), common tern (*Sterna hirundo*), little tern (*Sternula albifrons*), roseate tern (*Sterna dougallii*), and sandwich tern (*Thalasseus sandvicensis*), to study their pollution levels, while also performing stable isotope analyses to infer their diet. We found that mercury levels differ among species, and that, across species, male terns exhibit higher pollutant levels than female terns. The stable isotope analyses revealed a positive association between mercury levels and both nitrogen and sulphur isotopes in all but the common terns. These findings indicate that

terns foraging on higher trophic level prey (indicated by higher nitrogen isotope values) and with a more marine-based diet (indicated by higher sulphur isotope values) are especially vulnerable to mercury pollution, and proves feathers to be a useful relatively non-invasively collectable tissue to pick up these patterns.

25. Changes in wing length of selected passerine marsh birds over a 50-year period

Mariusz Mastosz

Department of Avian Ecology, University of Wrocław

Co-authors: Beata Czyż, Lucyna Hatupka

Responses of animals to environmental changes may be manifested in many ways, among other, by changes in body size. Climate warming is expected to reduce body size of endotherms, although data collected so far produced equivocal results. We analysed temporal changes in wing length of three bird species differing in migration strategy: a long-distance migrant the Eurasian reed warbler (*Acrocephalus scirpaceus*), a short-distance migrant the penduline tit (*Remiz pendulinus*) and a resident or nomadic species, the bearded reedling (*Panurus biarmicus*). Data were collected over the period spanning from 1974 to 2025. We predicted that penduline tits and bearded reedlings, that spend the whole year in Europe – the fastest-warming continent, would shorten their wings in response to climate change. Furthermore, we anticipated that reed warblers would not change their wing length (or the trend would be less pronounced) because they spend most of the year in Africa, where warming has been much weaker compared to Europe. We found support for our hypothesis in case of bearded reedlings. However, contrary to our expectations, we found that the wing length increased over the study period in reed warblers and did not change in penduline tits. Further research is needed to interpret these findings.

26. Range size, spread and migratory connectivity as drivers of migratory bird population trends

Martina Frýbová

Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic

Co-authors: Aurélien Besnard¹, Carole Doucerain¹, Petr Procházka², Jiří Reif^{3,4}, Odin Rumianowski³, Vojtěch Brlík^{5,6}

¹CEFE, Univ Montpellier, CNRS, EPHE-PSL University, IRD, Montpellier, France ²Institute of Vertebrate Biology, Czech Academy of Sciences, Brno, Czech Republic

³Institute for Environmental Studies, Faculty of Science, Charles University, Prague, Czech Republic

⁴Department of Zoology, Faculty of Science, Palacký University, Olomouc, Czech Republic

⁵Department of Ecology, Faculty of Science, Charles University, Czech Republic

⁶Department of Integrative Biology, University of Guelph, Ontario, Canada

Migratory species are declining worldwide due to climate change and habitat loss. Although they represent a critical conservation challenge, the mechanisms underpinning these trends are still not fully understood. These changes may be mediated by the size of the non-breeding area (range) over which a population spreads (migratory spread). Species with more diverse migratory strategies, higher spread and larger non-breeding ranges tend to exhibit more positive or stable trends by allowing individuals to occupy diverse environments, buffering populations against negative environmental change. However, the impact of the interaction between spread and non-breeding range size on population trends remains poorly understood. The role of migratory connectivity - the intermixing of individuals from different breeding sites within non-breeding sites - is also largely unexplored.

We examined these interactions using tracking data (GPS, geolocators and satellite tags) of 3059 individuals across 121 species for spread, and 2491 individuals across 53 species

for migratory connectivity, while controlling for phylogeny and life-history traits. Furthermore, we aimed to determine the relative importance of range size versus spread in predicting trends. We assume that range size is a primary driver of stability, representing the total area and habitat availability to species. In contrast, spread reflects the capacity of a population to use diverse geographic areas, thereby hedging against localized environmental risks through low migratory connectivity. Our preliminary results reveal a significant positive correlation between range size and spread, while range size is the only trait with significant phylogenetic signal; ongoing analyses will test their effects on population trends.

27. Endocrine drivers of incubation performance in a High Arctic seabird, the little auk (*Alle alle*)

Maureen Hocquet

University of Gdańsk, Poland

Co-authors: Marion Devogel¹, Antoine Grissot¹, Dariusz Jakubas¹, Olivier Chastel², Charline Parenteau², Katarzyna Wojczulanis-Jakubas¹

¹Department of Vertebrate Ecology and Zoology, Faculty of Biology, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland

²Centre d'Etudes Biologiques de Chizé (CEBC), UMR 7372 CNRS - La Rochelle Université, 79360 Villiers-en-bois, France

Parental care in long-lived seabirds is mediated by complex hormonal and behavioural mechanisms, yet the links between endocrine profiles and incubation performance remain poorly understood. We investigated how baseline and stress-induced levels of prolactin (PRL) and corticosterone (CORT) relate to incubation behaviour in the little auk (*Alle alle*), a High Arctic seabird with biparental care. Using a standardised capture-restraint protocol, we measured hormonal responses to acute stress in males and females as well as their subsequent nest attendance. As expected, acute stress elicited

a decrease in PRL and an increase in CORT, consistent with patterns reported for other long-lived polar seabirds. Sex differences were non-significant: females only tended to have higher circulating PRL and a stronger CORT stress response, potentially reflecting that females spend less time at the colony outside incubation, whereas males also invest in territorial defence and social activities. Baseline CORT was positively associated with time spent outside the colony in parents that maintained incubation (attentive individuals), suggesting a role in supporting foraging activity, while no such relationship was observed in birds that subsequently abandoned incubation (neglectful individuals). No differences in stress-induced hormone levels were found between attentive and neglectful individuals, raising the possibility that relevant endocrine changes occurred outside the sampling window. These findings highlight the subtle interplay between hormones, sex-specific roles, and parental behaviour in a long-lived seabird, and suggest that both proximate endocrine mechanisms and individual life-history strategies shape incubation decisions.

28. Parental hormone disruption by mercury exposure: a mechanism driving the emergence of infectious disease outbreaks in magnificent frigatebirds (*Fregata magnificens*)?

Miguel Hernández-González
University of Antwerp, Belgium

Co-authors: Marcel Eens¹, Olivier Chastel², Charline Parenteau², Geoffrey Monchaux-Lefèvre³, Paco Bustamante^{4,5}, David Costantini⁶, Manrico Sebastiano¹

¹Behavioural Ecology and Ecophysiology group, Department of Biology, University of Antwerp, Universiteitsplein 1, 2610 Wilrijk, Belgium

²Centre d'Etudes Biologiques de Chizé (CEBC), UMR7372- CNRS / La Rochelle Université, F-79360, France

³Groupe d'Étude et de Protection des Oiseaux en Guyane (GÉPOG), 431 route d'Attila Cabassou, Remire-Montjoly, 97354, French Guiana, France

⁴Littoral Environnement et Sociétés (LIENSs), UMR 7266 CNRS - La Rochelle Université, La Rochelle, 17000, France

⁵Institut Universitaire de France (IUF), 1 rue Descartes 75005 Paris, France

⁶Department of Ecological and Biological Sciences, University of Tuscia, 01100 Viterbo, Italy

Infectious disease outbreaks represent one of the major threats to avian conservation, yet the mechanisms underlying such outbreaks remain poorly understood. The magnificent frigatebird (*Fregata magnificens*) colony of Grand Connétable (French Guiana) has been suffering from recurring herpesvirus outbreaks affecting the majority of the nestlings every reproductive season and causing massive mortality events. Amongst the different hypothesised mechanisms driving these outbreaks, endocrine disruption caused by mercury (Hg) exposure has been highlighted as one of the main potential candidates. A Hg-induced reduction in the circulating concentrations of the pituitary hormone prolactin, which plays a major role in the expression of avian parental

care, might cause adult frigatebirds to reduce their parental investment, indirectly worsening the physiological condition of their nestlings and rendering them more susceptible to the infectious disease pathogen. In this research, we will use a correlational approach to investigate the association between blood Hg contamination and prolactin concentrations in magnificent frigatebirds (n = 123). We will first evaluate whether prolactin secretion experiences a seasonal pattern throughout the different stages of the breeding cycle in frigatebirds, an important factor to be accounted for in ecotoxicology studies. Subsequently, we will assess whether Hg disrupts prolactin secretion at any of these breeding stages. Our results will provide guidelines for studies assessing the endocrine-disrupting properties of Hg exposure on wild birds. We will discuss why further research is needed to understand how concomitant exposure to Hg and other environmental stressors might contribute to the emergence of infectious disease outbreaks in frigatebirds.

29. The role of waterbirds and shorebirds in the endozoochorous dispersal of propagules of the non-native *Pectinatella magnifica*

Míra Júlia Radnai

HUN-REN Centre for Ecological Research, Aquatic Ecology, Department of Tisza Research, Momentum Dispersal Ecology Research Group, Hungary

Co-authors: Balázs Koleszár^{1,3}, Péter Óvári¹, Ákos Órsi¹, Gábor Papp^{1,2}, Dániel Popovics^{1,2}, Lili Sztrehárszki¹, Gábor Simay^{1,2,4}, Nándor Szabó^{1,2}, Pál Tóth^{1,4}, Ádám Lovas-Kiss^{1,3}

¹HUN-REN Centre for Ecological Research, Institute of Aquatic Ecology, Momentum Dispersal Ecology Research Group, Debrecen, Hungary

²Pál Juhász-Nagy Doctoral School, University of Debrecen, Debrecen, Hungary

³One Health Institute, Faculty of Health Sciences, University of Debrecen, Debrecen, Hungary

⁴Hortobágy National Park Directorate, Debrecen, Hungary

The role of waterbirds and shorebirds in the spread of non-native invasive species is often underestimated, particularly with respect to endozoochorous dispersal. This study aimed to quantify bird-mediated transport of propagules in Hungarian wetland systems and to test whether statoblasts of the invasive bryozoan *Pectinatella magnifica* remain viable after passage through the avian gastrointestinal tract. Between 2022 and 2025, 107 samples were collected from six wild bird species captured at Andaháza, the Szarvas backwater of the Körös River, and multiple sites at Lake Tisza, complemented by fresh field droppings. Samples were washed through a 100 µm sieve and examined under a stereomicroscope; propagules were isolated and identified based on morphological characters, and viability was assessed using germination/hatching assays. In total, 2,234 propagules representing 23 families were recovered (60.48% plant seeds/spores; 39.52% animal resting stages). The highest abundance and taxonomic richness occurred in Mallard (*Anas platyrhynchos*). Two non-native bryozoans were detected: *P. magnifica* and *Plumatella casmiana*. Several *P. magnifica* statoblasts successfully hatched,

providing direct empirical evidence for endozoochorous dispersal. Statoblasts were present in both spring and autumn samples, suggesting that dispersal is likely in both migratory directions and can occur over long distances. Plant taxa with water-demand values (WB) ranging from 3 to 12 indicate that birds connect habitats across a broad hydrological gradient, including comparatively drier environments. Overall, the results identify waterbirds as plausible vectors and potential drivers of regional spread of *P. magnifica*, supporting the need for targeted monitoring and updated risk assessment.

30. Seasonal Prevalence and Diversity of Haemosporidian Parasites in Tree Sparrows (*Passer montanus*) at Lake Eymir, Ankara

Mustafa Esad Gökgöz
Ankara University, Turkey

Co-authors: Havva Yalaz¹, Furkan Efe Gürgen², Ayşenur Akgün¹, Arzu Gürsoy Ergen³, Cemal Can Bilgin⁴

¹Ankara University, Graduate School of Natural and Applied Sciences, Department of Biology, Turkey

²Ankara University, Faculty of Science, Department of Biology, Turkey

³Ankara University, Faculty of Science, Department of Biology, Department of Zoology, Turkey

⁴Middle East Technical University, Faculty of Arts and Science, Department of Biological Sciences, Turkey

Haemosporidians are widespread intracellular pathogens that infect avian blood cells. Beyond clarifying parasite-vector-host dynamics, they serve as vital research models because their infections impose severe, long-term detrimental effects on bird health, significantly influencing the ecological and evolutionary trajectories of wild populations. Conducted at the Eymir Ornithology Research Center (2021–2025), this study analyzed 30 blood samples from Tree Sparrows (*Passer montanus*), divided equally between spring and autumn. Results indicated that the total infection load was significantly higher in autumn than in spring ($p < 0.05$). While seasonal variations in *Haemoproteus* and *Leucocytozoon* counts were not statistically significant, *Plasmodium* levels showed a substantial increase during the autumn season ($p < 0.05$). These findings highlight the critical role of seasonality in driving the dynamics of specific avian blood parasite genera. These findings confirm that the increased autumn infection load is primarily driven by *Plasmodium*. Interaction analyses between age and season reveal that this surge is not population-wide but stems specifically from high infection rates in juveniles during autumn. This significant increase in the 'Autumn-Juvenile' group supports the theory that immunologically naive young birds are more sensitive to infection when vector populations peak. Conversely, infections detected in adults during spring suggest these individuals act as reservoirs, reinitiating the annual transmission cycle. Consequently, the interplay between host age and seasonal vector abundance appears critical in shaping haemosporidian prevalence.

31. Daily and seasonal patterns of vocal activity in temperate forest birds – do current assumptions in breeding bird monitoring need revision?

Natalia Goździewska

Adam Mickiewicz University in Poznań, Poland

Co-authors: Michał Budka

Adam Mickiewicz University in Poznań, Department of Behavioural Ecology, Poland

The Monitoring of the Common Breeding Birds (Monitoring Pospolitych Ptaków Lęgowych – MPPL) is a program aimed towards collecting abundance data of the most common breeding birds in Poland. It is based on acoustic and visual detections carried out by qualified observers. Data collected this way help estimate the state of certain species' populations and their habitats. Because of the global climate change and anthropogenic alterations of the environment, diel and seasonal patterns of birds' vocal activity may experience change. The aim of this study is to compare the diel and seasonal bird vocal activity with the MPPL's guidelines referring to the time of the surveys, and determining their relevance. 5 species of temperate forest birds were taken under consideration. The data was collected within the Forestry Management of Białowieża using autonomous sound recorders. 10 400 1-minute samples of recordings were analysed both manually and automatically, using the BirdNet software, to establish the presence of the species in consideration. Manual detections served to create statistical models of the diel and seasonal vocal activity of the birds and the probability of their detection over the day and the breeding season, which were then compared to the survey's guidelines. It was revealed that the time frame dedicated for the counts covers the peaks of the vocal activity of the studied species, despite the differences between them. Additionally, the study revealed the diel and seasonal variations of the precision and recall parameters of the BirdNet analysis.

32. Age-independent non-breeding isotopic niche in a migratory bird: An indirect test of the serial residency hypothesis

Nataša Gemzová

Masaryk University, Brno, Czech Republic

Co-authors: Petr Procházka, Milica Požgayová, David X. Soto and Vojtěch Brlík

Age-related differences in migratory behaviour and non-breeding habitat use are central to the serial residency hypothesis. This hypothesis predicts that stochastic settlement by young and naïve birds during their first migration may lead to the use of novel environments and, consequently, to broader realised non-breeding niches than in older individuals. We tested this prediction by comparing non-breeding isotopic niches of young and adult Eurasian Reed Warblers (*Acrocephalus scirpaceus*) using stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope measurements from feathers grown during their first and subsequent non-breeding periods, respectively. We quantified isotopic niche breadth and overlap between age classes using kernel utilisation density methods in

bivariate isotope space. Isotopic niche breadths were similar for young and adult birds and showed extensive overlap across 50, 75, and 95% kernel utilisation density contours. In a subset of individuals sampled in two consecutive years, isotopic values indicated no systematic changes between years. Our results do not support a key prediction of the serial residency hypothesis and instead suggest that high inter-individual variability and survivorship bias may obscure age-related differences in realised isotopic niches. Our study illustrates the potential and the limitations of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios for testing age-dependent predictions of the serial residency hypothesis and points to the value of integrating additional intrinsic tracers, such as stable hydrogen isotopes ($\delta^2\text{H}$), to link niche dynamics with large-scale non-breeding distributions and their implications for population resilience under environmental change.

33. Born into Risk: Behaviour of Lapwing Chicks under Different Environmental Conditions

Nela Tesařová

Czech University of Life Sciences Prague, Czech Republic

Co-authors: Janatová V.¹, Burešová Pešková L.¹, Trejbalová K.¹, Zámečník V.², Šálek M.¹

¹Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Prague – Suchbát, 165 00, Czech Republic

²Czech Society for Ornithology, Na Belidle 252/34, 150 00 Prague, Czech Republic.

Bird species differ in how they respond to danger, stress and challenging environmental conditions, but it remains unclear whether these differences already appear early in life. Lapwings are well suited to address this question because their precocial chicks must make behavioural decisions shortly after hatching. We compared chick behaviour in two closely related species breeding under contrasting conditions: the temperate Northern Lapwing (NL) and the subtropical Red-wattled Lapwing (RWL).

We analysed three behaviours representing different phases of a stressful encounter: reaction to capture, resistance during handling and vocalisation intensity. These behaviours did not form a single stress response but reflected distinct biological mechanisms. The probability of reacting to capture increased with age and was highly consistent within individuals, indicating early behavioural fixation. Resistance during handling was more flexible, decreased with age, increased with better body condition and was consistently lower in RWL. Vocalisation showed contrasting developmental patterns: NL chicks vocalised strongly when young but rapidly reduced calling with age, whereas RWL chicks showed lower but more stable vocal responses. Ambient temperature had no immediate effect on any behaviour.

Overall, our results show that species differences in stress-related behaviour are already expressed at the chick stage. The observed patterns are consistent with contrasting life-history strategies and support the idea that early-life conditions shape behavioural pathways linked to pace of life.

34. Quill mites (*Syringophilidae*) from the European robin *Erithacus rubecula*: prevalence and a new species of the genus *Rafapicobia*

Olaf Gwiazdowski

Department of Animal Morphology, Adam Mickiewicz University in Poznań, Poland

Co-authors: Izabella Łaniecka, Eliza Głowska-Patyniak

Quill mites (Acariformes: *Syringophilidae*) are obligate parasites inhabiting feather quills. We examined feather samples from European robins (*Erithacus rubecula*) captured at the Baltic Operation ringing station Hel during spring migration in 2024–2025. In 2024, two innermost secondary remiges were collected from 296 birds, while in 2025 body feathers from three microniches (flanks, belly, back) were sampled from 231 birds.

Torotroglia rubeculi was found in 13.9% of birds, with higher prevalence in adults (2cy+; 23.1%) than in immature birds (2cy; 6.6%). Symmetrical remige infestation was more frequent in adults (76.7%) than in immature birds (63.6%). An undescribed species of *Rafapicobia* was detected in body feathers. Morphologically, it is most similar to *R. copsychnus*, but clearly distinct from all described species. Overall prevalence of this species was 10.4%, again higher in adults (13.5%) than in immature birds (9.5%). The back was the most frequently infested microniche.

Higher prevalence in older birds probably results from the extended period available for parasite colonization and persistence, which is further supported by the higher proportion of symmetrical remige infestations in adults. To date, only a few studies have reported quill mite prevalence in relation to host age. The discovery of a new *Rafapicobia* species in a well-studied host underscores the still incomplete understanding of quill mite diversity.

35. Effects of weather conditions and land use on diet and foraging strategies in a highly aerial insectivorous bird, the Alpine swift (*Tachymarptis melba*).

Pascal Pini

University of Bern and Swiss Ornithological Institute, Switzerland & University of Aberdeen, United Kingdom

Co-authors: Alexandra Brighten^{2,3}, Raphaël Arlettaz¹ and Pierre Bize²

¹Division of Conservation Biology, Institute of Ecology and Evolution, University of Bern, Switzerland;

²Swiss Ornithological Institute, Sempach, Switzerland;

³School of Biological Sciences, University of Aberdeen, UK

Access to sufficient food quantity and quality is a key determinant of species success. Aerial insectivorous birds are currently threatened by changing in prey availability due to human-induced habitat alteration and climate change. Indeed, changes to intensive agriculture practices (land use and pesticides) have led to a rapid decline in prey species

diversity and abundance. Moreover, the timing and abundance of flying insects is highly dependent on weather conditions. We therefore aimed to understand how weather conditions and land use influence their diet and foraging behaviour of a highly aerial insectivorous bird, the Alpine Swift (*Tachymarptis melba*).

We addressed these questions by collecting food boluses provided by adults to their offspring and by conducting morphological prey identification. Additionally, we deployed GPS loggers to analyse the habitat use by breeding adults during foraging trips. Thereby, we collected 98 food boluses to be analysed and obtained GPS data from 162 deployments. The first results on food bolus composition indicate that Diptera, Hemiptera and Hymenoptera are the three main prey orders fed by Alpine swifts to their nestlings. Preliminary analyses support the idea that weather conditions have a strong influence on the quantity of food provided by the parents.

These results will provide insights into changes in the environment on the diet of this highly aerial insectivore species and will serve as the basis for informing policymakers about key requirements needed for the conservation of insectivorous birds.

36. Trait-based responses and co-occurrence patterns of waterbirds at urban ponds in a tropical megacity

Prakhar Rawal

University of Turku, Finland

Disentangling the relative roles of biotic and abiotic processes in shaping ecological communities remains a central challenge in ecology, particularly because species often respond differently to the same drivers across regions. Urban ecological research has been disproportionately focused on temperate systems, despite some of the world's most rapidly urbanizing landscapes occurring in the tropics. Here, we present one of the first applications of joint species distribution modelling (JSDM) to investigate the processes structuring waterbird assemblages in a tropical megacity, Delhi, India. At the site-level scale, variables describing shoreline structure and vegetation explained most of the variation in species abundances for most bird species (54 %), potentially influencing access to foraging substrates and nesting sites. At broader scales, wetland connectivity and built-up cover shaped the occurrence of both resident and migratory species, highlighting the role of landscape heterogeneity in shaping avian diversity across cities. These variables also filtered out species based on traits relating to body mass, feeding strategy, and habitat guilds. High number of positive residual species associations (85 %) indicated that biotic interactions also contribute to community assembly, even in highly human-dominated systems. Together, by integrating species traits and co-occurrence patterns with local and landscape-scale environmental predictors, we demonstrate that urban ponds act as strong environmental filters, with habitat structure and surrounding land use jointly determining which species, guilds, and traits persist.

37. What Winter Ringing Reveals About Local Bird Populations: Results from the IWM Programme in Salzburg, Austria

Sarah Wagner
University of Salzburg, Austria

Co-authors: Hemma Gressel¹, Eva Neuböck², Jakob Pöhacker³, Wolfgang Vogl⁴, Beate A. Apfelbeck²

¹Birdlife Salzburg, Austria

²University of Salzburg, Austria

³Museum Haus der Natur Salzburg, Austria

⁴AOC Austrian Ornithological Institute, University of Veterinary Medicine Vienna, Austria

Bird ringing is one of the most important methods for studying migratory patterns and population trends. Ringing programmes pursue three main objectives: monitoring, research, and management. The focus on migration during spring and autumn and on the breeding season in summer has greatly improved our understanding of bird populations and their survival strategies. However, comparatively little is known about birds' whereabouts and migratory behaviour during winter.

To investigate the composition and origin of wintering birds, we participate in the Austria-wide Integrated Winter Visitor Monitoring (IWM) programme coordinated by the Austrian Bird Observatory. Since 2023, birds have been attracted to two feeding stations in the Botanical Garden of the University of Salzburg from November to March. Birds are captured monthly, ringed, and biometrically measured. All data are submitted to the national ringing database, enabling long-term analyses of winter origins and the influence of climatic and ecological factors on winter movements.

Many bird species observed at winter feeding stations are commonly assumed to be resident; however, ringing data and our preliminary results indicate that a substantial proportion consists of winter visitors originating from north-eastern Europe, as well as species that occur exclusively during the cold season, such as the Brambling (*Fringilla montifringilla*). Continuous long-term winter monitoring helps disentangle the complex ecological relationships and dynamics within local bird populations during the nonbreeding season.

38. Reversal of Local and Regional Bird Diversity Across Temperate Forests of North America and Europe

Tereza Hladka
Department of Zoology, Faculty of Science, Palacký University in Olomouc, Czech Republic

Co-authors: Vladimír Remeš^{1,2}

¹Department of Zoology, Faculty of Science, Palacký University in Olomouc, Czech Republic

²Department of Ecology, Faculty of Science, Charles University, Prague, Czech Republic

Species diversity varies among continents due to both historical factors and current environmental conditions. Although temperate forest blocks in the Northern hemisphere cover areas of similar sizes and are ecologically alike, previous work has shown that they

differ significantly in their regional bird diversity. We reassessed this biodiversity anomaly by collating a dataset of 200 territory mapping studies conducted in broadleaved, coniferous and mixed forests within the temperate forest biome in North America and Europe. While we confirmed that regional (gamma) diversity was higher in North America, we found that local (alpha) diversity as well as overall bird density irrespective of species was higher in Europe. Correspondingly, the proportion of the regional species pool represented in European communities was higher. Given this reversal of diversity pattern from small to large spatial scales, we expected differences in change of species across locations (beta diversity) to emerge. Therefore, we also analyzed turnover (replacement of species) and nestedness (species-poor sites being a subset of species-rich areas) patterns of forest birds across these two continents. Turnover was more prominent in North America, while in European communities the nestedness was the dominating component and rare species were present only in more abundant and species-rich ecosystems. Together, these findings highlight the importance of spatial scale when comparing continental biodiversity patterns and provide a foundation for disentangling historical versus environmental drivers of species assembly.

39. Do you know who I am? Recognition of an aerial avian predator in non-canonical positions – preliminary results

Tereza Sommerová

University of South Bohemia, Faculty of Science, Czech Republic

Co-authors: Helebrant Václav¹, Motýlová Kateřina², Fišer Ondřej¹, Veselý Petr¹, Fuchs Roman^{1,2}

¹University of South Bohemia, Faculty of Science, Czech Republic

²Charles University, Faculty of Science, Prague, Czech Republic

Humans and some animals recognise particular objects, such as faces or bodies, better in their canonical, typical position than in their inverted form. This phenomenon is associated with holistic perception, in which these specific objects are recognised as a whole rather than by their individual parts, unlike most common objects. This method of recognition is swift and could be used to quickly identify predators. One characteristic that holistically perceived objects share is their uniformity across individuals. The bodies of sitting bird predators also meet this condition.

In previous experiments with the Great Tits (*Parus major*, Linnaeus, 1758), I have shown that they have a harder time recognising a predator, in my case the Sparrowhawk (*Accipiter nisus*, Linnaeus, 1758), when rotated 180° from its canonical position. If the predator was rotated only at an angle of 90°, the tits were better at recognising a predator lying on its stomach than on its back. In the subsequent experiment, I investigated the behavioural response to further rotations at an angle of 45° from these original positions. The Tits were placed into the outdoor aviary, where their behaviour was monitored, including the number of flights, alarm calls, and the time spent in the shelter and in the free space of the aviary, in relation to the individual positions of the stuffed dummies. This paper thus summarises the preliminary results of this experiment, which so far

indicate that a predator on the abdomen, rotated by 45° from the inverted position, and a predator on the back, rotated by 45° from the canonical position, are recognised, as well as a predator in its canonical position.

40. By Hearing or by Sight? The Role of Acoustic and Visual Cues in the Recognition of Owls by Passerines – Preliminary Results

Václav Helebrant

University of South Bohemia, Czech Republic

Co-authors: Veselý Petr¹, Tereza Sommerová¹, Fuchs Roman^{1,2}

¹University of South Bohemia, Faculty of Science, Czech Republic

²Charles University, Faculty of Science, Prague, Czech Republic

Previous research has shown that birds are capable of recognizing diurnal aerial predators down to the species level using both visual and acoustic cues, and that they adjust their responses according to the predators' potential threat. In contrast, for nocturnal predators, acoustic cues are assumed to play a more important role due to their crepuscular and nocturnal activity, but empirical evidence remains limited. In this study, we examined the responses of birds visiting a feeder to four European owl species differing in dietary specialization: the pygmy owl (*Glaucidium passerinum*), the little owl (*Athene noctua*), the long-eared owl (*Asio otus*), and the tawny owl (*Strix aluco*). Each owl was presented under three conditions: (1) visual stimulus – mounted specimen, (2) acoustic stimulus – playback of vocalizations, and (3) combined visual and acoustic stimuli.

Preliminary results indicate that acoustic stimuli alone were not crucial for owl recognition. Adding vocalizations to the visual presentation did not significantly lower the number of feeder visits for any of the owl species. Across treatments, acoustic cues alone had less impact than visual cues, regardless of the owl species. When exposed to visual stimuli only, birds were significantly more likely to approach the feeder in the presence of a pygmy owl, a small-sized predator of small passerines, compared to a tawny owl, a medium-sized generalist predator. These preliminary findings suggest that, in the context of visual owl recognition, birds are guided more by perceived predator size than by its genuine dangerousness.

41. Occurrence and characteristics of natural cavities in an old oak coppice forest

Valerie Zdražilová

Palacký University Olomouc, Olomouc, Czech Republic

Co-authors: David Tomáš¹ & Miloš Krist^{1,2}

¹Palacký University Olomouc, Olomouc, Czech Republic

²Museum of Natural History, Olomouc, Czech Republic

Natural tree cavities are important microhabitats for many animal species. Their occurrence depends on forest age, species composition, and stand structure. This study aimed to map the occurrence and characteristics of cavities in a 160+ year-old oak coppice forest at Velký Kosíř. Covering about 16 ha, the research involved a systematic inspection of all trees in 2024–2025. We recorded 237 cavity-bearing trees with 432 cavities, corresponding to densities of 14.7 trees/ha and 26.8 cavities/ha. Cavities were more common in oaks than in other species such as black locust and pine. The most frequent type was woodpecker/nesting cavities (55.8%), typically located higher in trees and oriented south or southwest. In contrast, cavities formed by decay and cracks showed greater dimensional variability. Cavity-bearing trees had larger girths and were in poorer condition than those without cavities. Preliminary data suggest an occupancy rate (nest material inside) of 10–20%, with the common starling as the most frequent breeder, followed by the great-spotted woodpecker, great tit, and collared flycatcher. Trail cameras installed at 20 natural cavities in 2025 documented frequent prospecting by local cavity breeders and nest predators.

42. Effect of size and key features on predator recognition by Arctic tern (*Sterna paradisaea*)

Veronika Boháčová

University of South Bohemia, Czech Republic

Co-authors: Jan Špička¹, Václav Helebrant¹, Michaela Syrová¹, Petr Veselý¹, Roman Fuchs¹

¹Department of Zoology, Faculty of Science, University of South Bohemia, Czech Republic

Arctic tern (*Sterna paradisaea*) shows a very active nest defence against predators that approach it. Although our previous study shows that terns do differentiate between predators, they hesitate to attack some dangerous species, whilst chasing away a presumably harmless one. In this study, we tested whether body size affects the intensity of antipredation behaviour and/or the ability of terns to correctly recognise the given species. As stimuli, we selected the peregrine falcon (*Falco peregrinus*), a dangerous predator of adult birds and the common eider (*Somateria mollissima*), which is a marine duck similar in size to the falcon. For both species, textile dummies altering the body size were prepared: one in natural size (50 cm in body length) and two dummies scaled down, corresponding to 75 % (37 cm) and 33 % (16 cm) of the original size. The dummies were placed near the nests where terns were incubating eggs. Subsequently, we observed several behaviours that indicated the terns' attempts to drive away the intruder (attacks, flyovers) or their lack of interest (incubation, absence). These behaviours were evaluated using multivariate principal component analysis (PCA). Post hoc Tukey HSD tests showed that in the presence of both small dummies, the terns rather incubate, unlike in the presence of naturally sized dummies. The large falcon can securely trigger a strong antipredator behaviour, while the reaction to both large and medium eider dummies, as well as the medium falcon, varies from pair to pair. The smallest falcon does not elicit an anti-predation response, despite possessing the salient predator features (hooked beak,

talons). Thus, it can be summarised that size is an important trait that affects the response of terns and their ability to recognise a predator.

43. Beyond melody: Amplitude variation in the songs of common passerine birds

Weronika Mierzejewska

The Włodzimierz Chętnicki Biological Science Club, Faculty of Biology, University of Białystok, Poland

Co-authors: Marta Nartowicz¹, Krzysztof Deoniziak²

¹The Włodzimierz Chętnicki Biological Science Club, Faculty of Biology, University of Białystok, Ciołkowskiego 1J, 15-245, Białystok, Poland

²Division of Biodiversity and Behavioural Ecology, Faculty of Biology, University of Białystok, Poland

The effectiveness of acoustic communication depends not only on the spectral and temporal structure of signals, but also on their amplitude, which determines the range and detectability of vocalizations in the environment. Animals can dynamically adjust the amplitude of emitted sounds in response to changing acoustic conditions, such as background noise or habitat structure. Nevertheless, the role of amplitude as an adaptive component of acoustic signals remains poorly understood. Therefore, we examined this issue in more detail. In this study, we measured song amplitude of six common passerine bird species using a calibrated sound pressure level meter. Simultaneously, data on air temperature, humidity, and ambient noise level were collected. From recordings obtained with a directional microphone, we determined mean song duration and peak frequency. The mean song amplitude, recalculated to a distance of 1 m from the singing individual, was: 81 ± 2 dB(A) (75–86) in the chaffinch (*Fringilla coelebs*), 82 ± 3 dB(A) (74–89) in the yellowhammer (*Emberiza citrinella*), 81 ± 1 dB(A) (75–87) in the chiffchaff (*Phylloscopus collybita*), 82 ± 1 dB(A) (77–87) in the willow warbler (*Phylloscopus trochilus*), 81 ± 2 dB(A) (74–88) in the whitethroat (*Curruca communis*), and 88 ± 2 dB(A) (83–95) in the great reed warbler (*Acrocephalus arundinaceus*). Generalized linear mixed models showed that song amplitude was significantly influenced by background noise level, ambient temperature, and song duration. These results indicate that environmental conditions and song structure play a key role in shaping vocal amplitude in birds. This suggests that amplitude modulation is an adaptive vocal response. The study was funded by the National Science Centre (Poland), project no. 2022/47/D/NZ8/00565.

44. Reproductive timing in female great tits is driven by spring temperatures and density but not personality

Zalihe Kourtoural

Wageningen University and Research, Netherlands

Co-authors: Joseph Burant¹, Kees van Oers^{1,2}

¹Department of Animal Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, the Netherlands

²Behavioural Ecology Group, Wageningen University & Research, Wageningen, the Netherlands

Understanding the mechanisms that drive changes in breeding timing is important, since fluctuating environmental conditions, such as climate change, have large fitness consequences. It is known that individuals decide to initiate egg laying depending on environmental cue such as temperature and local density, however the role of personality remains unclear. Therefore, we here investigated how exploration behaviour associates with laying date decisions in the great tit in relation to temperature and density fluctuations. For this, we used breeding information from the long-term population of Westerheide from 2003 until 2023. Our results show that one of the major factors that affected egg laying dates for great tits in Westerheide, were temperature fluctuations. Individuals laid their eggs earlier in warmer years, while breeding timing was delayed with cold spring temperatures. Additionally, individuals in higher- density locations tended to lay their eggs earlier. On the contrary, exploratory behaviour was not associated with laying date variation in great tits. Our results highlight that environmental cues, both within and between years, are main drivers for the timing of breeding, and not individual characteristics. This suggests external factors are major drivers for lay date decisions, while personality traits might be more important for plastic changes to these laying data decisions. Further research should distinguish between these within- and between-individual level processes.

45. Covering the Hits or Creating Your Own Songs? Song Repertoire Sharing in Male Aquatic Warblers (*Acrocephalus paludicola*)

Zuzanna Trzebuniak

Adam Mickiewicz University, Poland

Co-authors: Tomasz S. Osiejuk¹, Justyna Kubacka²

¹Zakład Ekologii Behawioralnej, Wydział Biologii, Uniwersytet im. Adama Mickiewicza w Poznaniu, ul. Uniwersytetu Poznańskiego 6, 61-614 Poznań, Poland

²Muzeum i Instytut Zoologii Polskiej Akademii Nauk, ul. Twarda 51, 00-818 Warszawa, Poland

Song repertoire sharing is a relatively common phenomenon among songbirds and may play a significant role in social communication, particularly in male–male interactions, as well as serve as an indicator of individual male quality. This phenomenon has been widely documented across numerous species, including members of the genus *Acrocephalus*, which are known for their complex vocalizations and diverse mating systems. A particularly intriguing representative of this genus is the Aquatic Warbler (*Acrocephalus paludicola*) – a globally threatened species exhibiting an uncommon, promiscuous mating system for temperate Europe and in Poland, breeding predominantly in fen mires of the Biebrza Valley.

Although previous studies have provided detailed insights into the structure and function of Aquatic Warbler's song, the occurrence and role of song repertoire sharing in this species have not yet been investigated. The aim of this study was to fill this gap by analyzing the extent of repertoire sharing among male Aquatic Warblers and exploring its potential functional implications.

Our results indicate that the most frequently shared whistle phrases belong to song type C, which is directed toward females, suggesting a role of repertoire sharing in intersexual selection. Furthermore, we observed a positive correlation between the degree of repertoire sharing and reproductive success – males whose songs were more similar to those of other individuals in the population achieved higher reproductive success. These findings highlight a potentially adaptive function of song sharing in a promiscuous species. However, further research is needed to clarify the specific roles of different shared phrase types and to better understand the mechanisms of sexual selection in the Aquatic Warbler.