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Estimating flight heights of migratory birds in the Gulf of Lion: an integrated approach

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Offshore wind turbines are being developed on a large scale worldwide. For instance, annual offshore wind installations are expected to triple in the next three years compared to 2023. While this energy system provides benefits such as affordable energy production and few conflicts with stakeholders, little is known about the impact of these structures on ecosystems. In France, three offshore wind farm projects have been initiated in the Gulf of Lion.
Migratory species travel across a wide range of habitats throughout their journeys, exposing them to multiple threats along the way. As they move between different ecosystems, they encounter various challenges such as habitat loss, climate change, hunting, pollution, route deviations, and collisions with human-made structures. These threats accumulate over time, increasing the pressure on migratory populations and making their conservation particularly complex. In this context, the potential impact of wind turbine installations on migratory birds and bats crossing the Gulf of Lion remains unknown.

In this project, we estimated the flight height of migratory birds by integrating data from various technologies to evaluate the risks posed by future wind turbine installations. To provide a comprehensive overview of flight heights in the Gulf of Lion, data were collected using a wide range of technologies, including GPS, GLS, on-land radar, and offshore radar. Since each technology introduces specific biases in measuring flight heights, we assessed the feasibility of integrating these data into a unified framework. Finally, we developed an integrated state-space model within a Bayesian framework to estimate flight heights over the sea.
Our work provides a novel methodology for integrating data from different technologies to generate a comprehensive overview of space use by birds. Our results suggest that flight height behaviors vary widely among bird species, with small birds, such as passerines, flying higher than larger birds, such as raptors or waders. Our approach also reveals different crossing strategies among bird species and between seasons (northward or southward migration). We found that flight heights were higher near the coast than further out at sea. Finally, our findings indicate that the flight heights of migrating birds mostly fall within the range of offshore wind

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*Speaker

turbines, emphasizing the need for further research to precisely evaluate the potential impact of future wind farms on migrating birds and guide stakeholders in infrastructure planning.

Prospecting under pressure: social information gathering strategies in immature Golden eagles

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In heterogeneous environments, individuals must assess the quality of different breeding sites to optimise their dispersal decisions and maximise future reproductive success. Prospecting-the behavior of visiting several breeding sites-allows individuals to gather social information, such as local reproductive success of conspecifics, to assess breeding site quality. However, this behaviour can lead to agonistic interactions with territory owners resulting in energy expenditure, injuries, or even death for prospectors, referred to as "altercation costs". In species where these costs are high, it might, in some situations, outweigh the benefits of social information gathering, making such behaviour rare. Investigating prospecting strategies in such species may allow to characterise when and for whom social information gathering is most beneficial.

We investigated social information gathering behaviour in 75 GPS-tracked immature Golden eagles (Aquila chrysaetos), where prospectors are often chased, injured, or even killed by adults when intruding into breeding territories. Despite these potential high altercation costs, immature eagles visited nesting sites of breeding adults, highlighting the potential strong benefits of social information for their future reproductive success. However, they mainly visited previously occupied nesting sites outside the breeding season, where the quality of social information was low, but altercation costs reduced. As they aged, individuals increased their prospecting activity, demonstrating the critical importance of social information for sexually mature individuals. Furthermore, males, who likely experienced more territorial aggressions than females, reduced their prospecting efforts, suggesting that altercation costs shape sex-specific prospecting strategies.

Our study provides key insights into how birds balance acquiring reliable social information while avoiding territorial aggression, refining our understanding of prospecting and dispersal in heterogeneous landscapes.

Keywords: Prospecting, Social information, Territorial aggression, Golden eagles, GPS data

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*Speaker

Early post-breeding dispersal of Australasian gannets

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Animals typically reproduce when environmental conditions and food availability are optimal. These might decline after the reproductive period and, consequently, individuals no longer constrained by central-place foraging may leave the breeding area. Knowledge of the post-breeding period in marine species is lacking despite its importance to survival and future reproductive success, as obtaining direct information about at-sea movements and distribution during the non-breeding period can be challenging. In Australasian gannets (*Morus serrator*) in particular, current studies are limited to banding records and geolocation. As south-eastern Australia is one of the fastest warming areas in the world, obtaining more precise information on this critical part of the annual cycle is essential to understand how this species might react to a changing environment. As such, the present research is the first to use satellite-transmitted GPS data to track the early post-breeding movements of adult Australasian gannets from two colonies in northern Bass Strait. In contract to previous findings, most individuals appeared to be resident, especially males and individuals breeding in an enclosed bay. Individuals that left their breeding foraging range headed west, making use of the cold coastal areas of the Great South Australian Coastal Upwelling System, or south-east towards Tasmania in coastal waters with higher sea surface temperature and chlorophyll-a concentration. Resident individuals shifted high-use areas to preferentially select cooler waters in a globally warmer environment. This species appears to rely on upwelling systems and temperature cues which will likely be affected by the changing climate, highlighting the need for fine-scale data covering the entire non-breeding period and long-term monitoring.

Keywords: Australasian gannet, post breeding, movement, seabird, Bass Strait, satellite tracking

*Speaker

Dispersal on islands: the case of an endangered vulture

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Natal dispersal is the movement of individuals, and therefore genes, between the natal and first breeding sites. This is a complex process based on individual decisions that are constrained by the interaction of intrinsic and extrinsic factors. The dispersal strategy adopted by each individual will determine its lifetime fitness, but it will also play a key role at larger ecological and evolutionary scales, shaping the dynamics and genetic structure of populations, and ultimately the global distribution and persistence of species. Despite its importance, the functioning of dispersal is still poorly understood, particularly on islands where populations face different selective pressures to those on the mainland. Insular species adapt their dispersal strategies to island dwelling thought morphological or behavioural changes, a common adaptation is the reduction of dispersal extent, even in vagile species such as birds.

We have studied the natal dispersal patterns of the insular and sedentary population of Egyptian vultures from Canary Islands. This population is recovering from the critical conservation status it experienced at the end of the 20th century, but it remains restricted to the two eastern islands of the archipelago. Using long-term monitoring data from 208 vultures we have analysed how the phenotype and natal socio-environmental conditions shape the dispersal distance of these long-lived and territorial birds.

Canarian Egyptian vultures showed a highly reduced dispersal extent and a preference to settle on their natal island, no recruitment was registered in the non-inhabited islands of the archipelago. We found sex-biased dispersal pattern but also different sensitivities of each sex to dispersal drivers. Males were more philopatric than females and their dispersal strategy was influenced by competition-related drivers such as population density and dominance status. Females were more sensitive to territorial quality factors, such as the food availability, the local pair density and productivity. This population showed a tendency towards philopatry, conspecific attraction and reduced dispersal propensity, which may explain the slow recolonisation pattern across the archipelago. Understanding the key drivers of dispersal can be a powerful tool for conservation and management, particularly in fragile and isolated environments such as islands.

Keywords: Natal dispersal, Island ecology, Raptors

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*Speaker

Ontogeny and variability of take-off flight performance

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Studying bird flight in a laboratory has laid the foundation for flight models in a stable, defined state. These models translate flight speed as a function of power, helping to interpret real-life flight speed measurements in the terms of the trade-off between power reserves and distance. However, birds are rarely in a stable state, always accelerating or decelerating, and switching between stable and unstable modes. Especially for small birds exposed to sudden attacks by predators, unstable, burst flight such as take-off can determine survival in the natural environment.

Take-off flight performance, given its high energy demand, is expected be closely linked to morphology. To investigate the correlation between morphology and take-off flight performance, we recorded take-off behaviour with 22 motion-capture cameras and a 1k-Hz sampling force sensor, alongside bodyweight and wing area measurements of captive zebra finches at 20, 24, 28, 32, 40-, 60-, 80-, and 100-days post-hatching. As expected, bodyweight increased until reaching a plateau around 36-40 days post-hatching. Kinematically, on the legs, the relative impact force to bodyweight increased, accompanied by an increase in horizontal force and a decrease in angle of impact. On the wings, wingbeat frequency increased while wingbeat amplitude decreased with age. These results highlight the nuanced behavioural changes accompanying the physiological changes inevitable in developing fledglings.

In the natural environment, take-off flight performance, already energetically costly, may be further maximized in a critical situation such as predator escape. To understand the variability of take-off flight performance in the context of predator escape, we simulated a predator attack at a frequently visited feeder (66 individuals logged) using a video of an approaching goshawk in Wytham Woods. The force sensor at the perch collected leg force and angle of impact, while infrared sensors along the flyway recorded flight speed at each take-off. Additionally, three synchronised Raspberry cameras, combined with custom machine learning algorithms, enabled analysis on head angle and posture as proxies for vigilance.

On the experimental day, RFID-tagged blue tits and great tits were randomly assigned to either a control group or treatment group at their first visit of the day. The control group individuals only saw a stationary, first frame of the video on their first and subsequent visits. The treatment group individuals were subject to the video display of an approaching goshawk at their first visit and were exposed to further replay at their subsequent visits at 50% chance. This experimental setup provides an unparalleled opportunity to understand within- and between-individual responses in take-off flight performance pre-, during-, and post-predator attack in wild birds.

At this talk, I will present the latest findings from the abovementioned project, aiming to high-

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[*]Speaker

light the ecological significance of take-off flight performance at the intersection of morphology, behaviour, and the environment.

Modelling the distribution and abundance of Culex pipiens in Scotland: Implications for West Nile Virus risk in a changing climate

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Climate change is driving vector-borne diseases (VBDs), such as West Nile Virus (WNV), to higher latitudes. Understanding the current spatial distribution, habitat preferences, and abundance of *Culex pipiens,* a key WNV vector, is essential for predicting future spread and mitigating disease risks. However, most research efforts in the UK focus on England and Wales, leaving Scotland largely overlooked. To address this gap, we are developing a species distribution model to predict *Culex pipiens* distribution in Scotland, identifying key habitat types, locations, and transmission hotspots. Using a hierarchical Bayesian framework that accounts for detection probability, observation biases, and spatial autocorrelation, we model associations between mosquito abundance and climatic and environmental variables. This study integrates abundance data from adult mosquito surveillance at 25 wetland sites, collected in 2023 and 2024, with citizen science reports to assess current distributions and VBD risks. To date, 554 adult *Culex pipiens* observations have been recorded across surveyed wetlands in Scotland, with the highest densities found in ponds and reedbeds. Preliminary analyses indicate that vegetation quality and elevation influence *Culex pipiens* abundance, while trap type affects capture success. Future analysis will employ a joint species distribution model from the Hierarchical Modelling of Species Communities framework to simultaneously predict common and rare mosquito species' distribution. We will also incorporate climate change scenarios and habitat restoration plans to enhance the model's utility for policy and risk assessments. By broadening the geographical scope of mosquito surveillance, this research aims to contribute to a more comprehensive understanding of UK mosquito ecology and to support a stronger national response to emerging VBD threats in a changing climate.

Keywords: species distribution model, spatial distribution, spatial ecology, bayesian modelling, mosquito, climate change, vector ecology, vector borne disease

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*Speaker

Unveiling bird migration routes using pathfinding optimization algorithms

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Billions of organisms, ranging from bacteria to humans, migrate annually to efficiently exploit large-scale (even global) spatiotemporal productivity patterns. Birds serve as a paradigmatic example of migratory organisms, with some species undertaking some of the longest, most challenging, and most fascinating migratory journeys between relatively constant breeding areas and wintering grounds. These migrations require significant energy investment from individuals and may incur both immediate and long-term fitness costs (e.g., carry-over effects).
To mitigate these costs, it is widely accepted that organisms must adopt various strategies to optimize the migratory process, by minimizing travel distances, while reducing the energetic demands of migration. In this context, birds are known to rely on specific environmental "facilitators," such as wind currents and highly productive stopover (i.e., refueling) areas, to decrease the costs associated with migration. However, the precise role of these facilitators in shaping individual decision-making and migratory routes remains insufficiently quantified, partly due to methodological challenges.

As a result, several open questions persist regarding the migratory process, including: How do individuals select specific routes to reach their migration destinations? What is the precise role of different facilitators in guiding them through multiple decision-making processes? Addressing these questions is crucial for advancing our understanding of migratory behavior and the ecological factors influencing it.

To address these questions, we propose the implementation of optimization methods and mathematical modeling, such as A* and Yen's algorithms, to simulate the flight process and identify not only the optimal routes but also suboptimal alternatives available to migratory seabirds. By artificially simulating oceanic environmental conditions and assigning corresponding energetic costs, we approach this process as a min-max optimization problem. Indeed, both algorithms are commonly employed in graph-based data structures, making them well-suited for modeling migratory pathways.

Following the implementation of the A* algorithm, the least-cost path (mathematically representing the most efficient route from the starting point to the destination) can be identified.

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*Speaker

However, seabirds do not follow a single deterministic path; instead, they navigate multiple viable, potentially suboptimal routes influenced by variable environmental conditions that shape migratory facilitators or by historically established strategies passed down through generations. To account for these alternative pathways, we implemented Yen's algorithm, which identifies efficient suboptimal routes while considering environmental constraints.

The proposal is a web-tool, which integrates an optimization solver, using short path algorithms, visualization of the modeled pathways, and high level of personalization of input parameters to offer. The aim is to give the movement ecology community an optimization model that can assist them to make better decisions and identify possible new bird migration pathways.

By approximating real-world migratory routes based on these optimization methods, we can gain a more accurate understanding of the factors influencing seabird movement. Additionally, this approach highlights the critical importance of protecting natural migration corridors, which are frequently used during these journeys. Safeguarding these pathways is essential to prevent disruptions in the life cycle of migratory birds.

Evaluating the impact of thinning thresholds in tracking data for habitat suitability models

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Recent advances in obtaining animal tracking data have allowed scientists to better understand species, from their behaviour, foraging and migratory strategies to ecological and evolutionary processes. Furthermore, this data allow us to link species occurrences with environmental variables to determine their suitable habitat and distribution over time. Species Distribution Models (SDMs) are often used to this end, however, tracking data do not commonly fulfil the independence assumption for the SDMs. Tracking data exhibit high spatiotemporal autocorrelation, so to use them as input for SDM it is necessary to mitigate this bias. A common approach to reduce autocorrelation in tracking data is to apply thinning thresholds, which requires discarding data to obtain quasi-independent records. However, these thresholds are often chosen arbitrarily, and the impact of different filtering strategies on model outcomes remains poorly understood. The main goal of this study is to evaluate the importance of the choice of filtering thresholds for tracking data in SDMs. Using tracking data from penguin species during the non-breeding season, we calculated temporal and spatial semivariograms for individual tracks to estimate autocorrelation ranges, which were then used to define multiple thinning scenarios. Each filtered dataset, along with the most relevant environmental variables that influence penguin distribution, was modeled using GLOSSA (Global Species Spatiotemporal Analysis) R Shiny app, which uses Bayesian Additive Regression Trees (BART) for SDM. The resulting models for each filtering strategy were compared through differences in predicted probability, potential habitat area estimates, comparisons of the most important environmental variables influencing habitat suitability, and overall model performance by comparing the AUC and cross-validation of each model. With these results, we aim to highlight the importance of properly filtering tracking data for use in SDMs to avoid autocorrelation biases. All these models and their respective comparisons should be tested on a wider range of ecologically different species, across additional seasons (e.g., the breeding season), and with data obtained from other commonly used tracking devices, such as GPS and PTTs.

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*Speaker

A Remote Sensing-based Toolbox to disentangle the ecological drivers of insect migration

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Insect migration is a major ecological phenomenon involving the mass movement of species across diverse taxa. Many insect species perform long-distance, even intercontinental, movements that seasonally connect distant regions on Earth and provide fundamental ecosystem services. Yet, for most insect migrants, the spatio-temporal dynamics of their migratory ranges, habitat selection strategies, and population-level impacts remain poorly understood. Unlike migratory vertebrates, insects pose unique challenges for migratory studies due to their short life cycles, high reproductive rates, and vast population sizes.

To overcome these constrains, we present a remote sensing-based integrative framework to disentangle the ecological drivers of long-distance insect migration. First, we use field sampling and citizen science observations combined with remote sensing data vegetation indices to develop temporally explicit Species Distribution Models. These models identify key environmental drivers of reproduction and habitat turnover, allowing inference of obligate population movement and demographic fluctuations. By projecting SDMs across time, we test for the greenwave-surfing hypothesis, extensively studied in larger migratory animals but less explored in insects. We later use wind trajectory models to explore seasonal dispersal corridors that link shifting reproductive habitats with necessary migratory movements. Furthermore, we incorporate instances of ecological radar data to track aerial biomass flows, and stable isotope-based inferences of insect tissues to geolocate natal origins.

We test this integrative approach with the cosmopolitan and long-distance migratory Painted Lady butterfly (*Vanessa cardui*). Across its Afro-Palearctic range, the species continuously tracks suitable reproductive habitats in an annual cycle encompassing up to 10 generations, ranging from equatorial latitudes in the Afrotropical region to Northern Europe.

Our findings revealed latitudinal differences in phenological tracking: in northern latitudes, low temperatures constrain migratory expansion despite favorable vegetation productivity, whereas in tropical regions, peak vegetation productivity defines a narrow temporal reproductive window, which is surprisingly optimal at the senescence stages of vegetation communities. This suggests local environmental constraints shape reproductive timing and behavior across generations. Indeed, the analysis of anomalies of the Normalized Difference Vegetation Index

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*Speaker

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time-series detected exceptional vegetation growth surplus in North-west Africa in 2009, and in Arabian Peninsula in early 2019, suggesting these regions likely served as independent breeding sources of well-documented Painted Lady population outbreaks occurring in two corners of Europe during the respective springs. Seasonal wind patterns across ecological barriers identifying potential migratory corridors align with observed butterfly arrivals.

Altogether, our findings frame Painted Lady migration as a highly adaptable strategy that exploits ephemeral, seasonal and both predictable and unpredictable resources across broad geographic regions. This adaptability is driven by a plastic response to habitat phenology, allowing the species adjust movements in response to environmental variability.

This work highlights the dynamic interaction between climate variability and resource availability in shaping migratory outcomes-sometimes facilitating successful expansions, while other times limiting movement or triggering collapse. The proposed integrative framework - linking remote sensing with biological and atmospheric data- advances the study of insect migration and offers a scalable toolkit to enhance ecological forecasting and biodiversity conservation.

Mapping the menu: Understanding seabird-prey interactions to inform conservation strategies

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Seabirds are among the most threatened group of birds globally, with nearly half of all species experiencing population declines. Their conservation poses significant challenges due to their reliance on marine ecosystems, and highly mobile nature. Key threats to many declining seabird populations include shifts in prey availability driven by fisheries and climate change. Therefore, understanding the relationship between seabirds and their prey is crucial for developing effective spatial protection strategies and exploring the role of food availability in observed population trends.

In this study, we aim to investigate the fine-scale responses of a seabird species of conservation concern: the European shag (Phalacrocorax aristotlelis) to prey distribution in the Isles of Scilly, an archipelago off the southwest coast of the UK. We will utilise GPS tracking data collected from 29 adult European shags across four colonies over two years to identify and map their foraging grounds during breeding. In addition, we will map the distribution, abundance and biomass of prey fish using data collected from Baited Remote Underwater Video Systems (BRUVS) and hydroacoustic surveys. To establish the crucial mechanistic link between foraging seabirds and the distribution of their prey, we will analyse seabird guano samples collected from tracked individuals and study colonies using DNA metabarcoding. Lastly, we will use this novel combination of datasets to compare seabird foraging hotspots with prey fish distributions to assess priority zones for conservation across the archipelago as well as explore the potential role of changes in food availability on seabird foraging.

The Isles of Scilly hosts an internationally important assemblage of 13 seabird species. However, in line with global trends, eight of these species have experienced significant population declines over the last two decades. Given the ongoing local declines in seabird abundance and productivity, this research will improve our understanding of marine ecosystem functioning in the Isles of Scilly, and therefore, enhance our ability to mitigate human impacts on seabird populations and inform future conservation efforts.

Keywords: Biologging, Movement Ecology, Seabirds

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[*]Speaker

Too few, too many, or just right? Optimizing sample sizes in animal tracking projects

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Successful animal tracking projects rely on well-informed sampling strategies to produce biologically meaningful insights. However, financial and logistical constraints often limit study design, making key decisions (such as tracking duration, sampling frequency, and the number of individuals tracked) critical for reliable inferences. Misinterpreting ecological processes due to suboptimal sampling can lead to wasted resources and misguided management decisions.

To address these challenges, I created a workflow for determining optimal sample sizes in movement ecology, explicitly considering the trade-offs between tracking duration, sampling interval, and population sample size. This flexible approach can be applied before deployment, during data collection, or post hoc to assess the adequacy of study design. By prioritizing methods that account for uncertainty and remain robust to sampling variation, researchers can evaluate whether sample sizes are sufficient to estimate key population-level metrics, such as home range size or movement speed. The workflow also integrates additional constraints, including fix success rate, location error, device malfunctions, and individual variation.

We demonstrate the application of this workflow through case studies and simulation-based evaluations. To enhance accessibility, we have added this workflow into "movedesign", a user-friendly R Shiny application that allows researchers to explore sampling designs, now across varying population sample sizes. By improving the rigor and reliability of tracking studies, this framework supports robust ecological inferences even under limited financial resources.

Keywords: experimental design, biologgers, GPS, simulations, home range, space use, speed

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*Speaker

Assessing the determinants of migratory connectivity for Alpine ibex (Capra ibex) at different spatial scales using movement data

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The impacts of climate change are exacerbated in mountainous ecosystems whereas they host rich and mostly endemic species communities. This intensifies landscape fragmentation induced by human activities that jeopardize species habitat and displacement. Thus, a deeper understanding of connectivity (*i.e.* the effect of landscape structure on the movement of individuals) is pivotal to inform conservation actions on these biodiversity hotspots.

After decades of reintroductions, the Alpine ibex (*Capra ibex*), an endemic and emblematic Alpine species, is currently experiencing dramatic levels of inbreeding. Its current distribution does not increase anymore and remains highly fragmented, despite suitable habitats being uncolonized. This raises questions about the adaptive potential and the long-term viability of the species in the context of global changes in alpine environments. The dispersal abilities of ibex remain unknown but it has been showed that seasonal migrations allow for connections between populations and relates with individual and gene flows. Thus, understanding the environmental drivers of effective migratory connectivity is cornerstone for the species preservation.

Taking advantage of a unique dataset from the Euroibex initiative on more than 500 individuals distributed across 17 populations over the whole Alpine arc, we first predicted habitat suitability for the species along its distributional range during both winter and summer. Then, we combined this work with a previous analysis of fine-scale and movement-informed migratory connectivity performed on the same data. It allowed us to expand it on a larger spatial scale and inspect unused corridors to identify potential large-scale barriers that would not have been detected in the fine-scale connectivity evaluation.

This work is the first of its kind on the species and on a large spatial extent, raising methodological and computational issues. It also set the stage for subsequent applied research to determine key areas for corridor restoration and functional habitat (*i.e.* suitable and connected) preservation. Finally, it provides a methodological basis to investigate connectivity drivers in other alpine species which may open possibilities for future multi-species connectivity assessments.

Keywords: Capra ibex, movement ecology, connectivity, migration conservation, habitat selection

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*Speaker

Blessing or curse? The effects of Artificial Light at Night (ALAN) on the nocturnal space use of urban shorebirds.

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The ever-growing human population and resulting expansion of urban areas worldwide is not only causing widespread habitat loss and degradation, but also altering the wider landscape with spillover effects such as light and noise. The area of the Earth's surface that is artificially lit is continually increasing as a result of urban expansion. While this artificial lighting has been shown to cause a suite of negative impacts on the movement and foraging behaviour of many taxa, for some species it may represent opportunities, for example aggregating prey or eliminating sensory constraints on foraging.

Coastal areas are among the most severely impacted by expanding urbanisation, as a majority of the world's population, and hence a large proportion of the world's major cities, are located on or near the coast. Because of this, coastal species such as shorebirds are finding their natural habitats increasingly encroached upon by urban infrastructure, forcing them to make use of alternative terrestrial foraging sites and habitat patches such as urban green spaces. As a result, they are also brought into direct contact with Artificial Light at Night (ALAN) from urban infrastructure such as street lighting, flood lighting, and industry. Several shorebird species, such as redshanks and godwits, have been found to make use of this, foraging more efficiently under ALAN by switching from tactile to visual foraging and hence increasing prey intake rates. While this apparently indicates a benefit afforded by artificial lighting, allowing birds to supplement their daytime feeding by continuing to forage at night, it may also represent a challenge of living in an urbanised landscape: Lower habitat quality and hence lower prey availability or quality in urbanised coastal areas may mean birds are forced to forage nocturnally in order to meet their energetic requirements, and this may be facilitated by ALAN. There have so far been no landscape-scale studies on the effects of ALAN on the movement behaviour and habitat use of shorebirds in urbanised coastal habitats, and the drivers of artificial light use for foraging are as yet not well understood.

This study uses GPS tracking data from four species of shorebird (redshank, curlew, oyster-catcher, and black-tailed godwit) wintering in Dublin Bay Biosphere reserve, across three estuaries of varying levels of urbanisation. The aim is to quantify the population-level effects of ALAN on movement and habitat use in these species, determine the scale of nocturnal foraging under artificial lighting, and also to assess the drivers of this nocturnal foraging at an individual level. An understanding of the effects of ALAN on movement, the potential benefits for foraging, and the drivers of its use by shorebirds will be key in predicting the potential fitness implications and downstream consequences of an increasingly bright nocturnal landscape, and therefore help inform conservation management strategies for this threatened group of birds.

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*Speaker

Evolutionary Ecology

Positive effects of heatwaves on male reproductive behaviour: evidence from a cricket population in Madagascar

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Climate change threatens the persistence of populations, not solely through the rise in global average temperatures, but also due to increased frequency and intensity of extreme climatic events, such as heatwaves. Insects, being ectothermic, are particularly vulnerable to thermal stress. Those living in the tropics have been found to be at even greater risks as these are adapted to a narrower range of temperatures. Yet, the effects of heatwaves on animal behaviour remain largely unexplored, especially in the context of reproduction. Temperature is an important factor that modulates behavioural interactions among mating partners, as it can positively increase courtship performance up to a threshold, after which courtship activity declines. Examining the impact of nonlethal heat stress on reproductive traits can provide valuable insights into the long-term effects of heatwaves on insect population decline and biodiversity loss related to climate change. In order to understand to which extent a thermal stress can affect mating we tested whether an ecologically relevant heat stress affects the mating and courtship behaviour of a population of the field cricket Gryllus bimaculatus from Madagascar. We simulated a three-day heatwave of 30 degrees and 60% relative humidity on experimental males (n=75) and maintained a group of control males (n=78) at outdoor temperatures. We then paired males to females that were not thermally stressed. Males exposed to heatwaves had more attractive courtship traits and had higher mating success than control males. Although we cannot exclude trade-offs with other life history traits (e.g., survival), our results suggest that a mild heatwave can have beneficial effects on male reproduction, most likely by affecting male acoustic signalling. Using different thermal ranges, future studies on sex-specific behavioural responses and associated fitness outcomes will be able to fully assess the impact of heatwaves on tropical populations.

Keywords: Tropical insects, reproductive behaviour, climate change, heatwaves, female choice

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*Speaker

Effects of parasitoid venom on the parasitism success of aphids protected by the symbiont Hamiltonella defensa

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Facultative endosymbionts such as *Hamiltonella defensa* provide aphids with effective protection against parasitoid wasps, thereby significantly affecting host–parasitoid dynamics. It is well-documented that *H. defensa* provids strong protection against some genotypes of different parasitoids, with varying efficacy. This symbiont-conferred resistance poses a major challenge to biological control strategies and may drive adaptive responses in parasitoids. Among these, the injection of venom during oviposition could play a key role in overcoming symbiont-conferred resistance. However, the role of parasitoid venom in successfully parasitizing symbiont-defended hosts has never been studied.

This study investigated whether venom of the parasitoid wasp *Lysiphlebus fabarum* can increase parasitism success on *Aphis fabae* individuals carrying different strains of *H. defensa*. Using venom extracted from different genotypes of *L. fabarum*, we performed microinjections into aphids from genetically uniform lines carrying different strains of *H. defensa*. Injected aphids were then exposed to parasitoids, and we monitored survival, mummification, and adult emergence rates.

Our results suggest that venom-injected aphids exhibit increased susceptibility to parasitism, particularly in certain symbiont backgrounds. These findings point toward a possible role of venom to overcome aphid *H.defensa*-conferred defence . This study provides a promising framework to explore the mechanisms by which parasitoids may adapt to symbiont-conferred resistance. By identifying potential venom-mediated effects on the host-symbiont interaction, this work could ultimately contribute to understanding coevolutionary dynamics and improving biological control approaches in agroecosystems.

Keywords: symbiotic bacterium, parasitism, physiology, microinjection, tritrophic interaction, coevolution

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[*]Speaker

Birds in the Grey Zone: High-Resolution Satellite Imagery Reveals Continental Patterns in Plumage Colouration of Urban Great Tits (Parus major)

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Urbanization reshapes ecosystems and influences wildlife traits, yet fine-scale impacts on traits such as plumage coloration remain understudied. Here, I demonstrate a continuous negative relationship between urbanization intensity and carotenoid-based plumage coloration in great tits (Parus major), using an innovative approach based on high-resolution (0.1 m) satellite imagery from Google Earth to quantify urbanization as the proportion of impervious surfaces within individual bird territories.
Long-term data from a Parisian great tit population reveal that higher urbanization correlates with lower feather carotenoid chroma-a spectrophotometric proxy for carotenoid pigment concentration in plumage. Carotenoid-based coloration directly reflects dietary quality and has crucial physiological roles, including antioxidant defences, immune responses, and reproductive success. Paler coloration in more urbanized environments likely results from reduced availability of carotenoid-rich resources, highlighting nutritional constraints imposed by urban habitats.

To test the generality of this relationship, we expanded the analysis to feather samples collected from multiple urban populations across Europe (Montpellier, Warsaw, Turku, Malmö, Antwerp). Preliminary analyses consistently replicate the Parisian pattern, indicating a widespread ecological response to urbanization. The use of high-resolution satellite imagery and a semi-automated GIS protocol significantly enhances accuracy in distinguishing vegetation from impervious surfaces at sub-metric resolution, addressing critical limitations of previous land-cover datasets. This standardized and fine-scale urbanization measure provides a powerful tool for comparative urban ecological studies.
To our knowledge, this is the first continent-wide study linking continuous urban parameters directly to continuous phenotypical traits at such fine resolution, and may spotlight parallel evolutionary trajectories across Europe. These results suggest that carotenoid-based plumage coloration could also serve as a reliable bio-marker of urbanization intensity, and may offer practical applications for monitoring urban environmental health.

*Speaker

Sensing, Spectrophotometry, Bioindicator, Europe

Unraveling size-dependent demographic processes in Atlantic salmon using a structured population model

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Understanding the ecological mechanisms driving wild population dynamics is essential to support science-based management of ecosystems, populations and natural resources. Structured population models are fundamental tools for understanding and predicting how populations respond to global change. However, these models often overlook the variability in demographic structure and phenotypic traits. In particular, variations in individual growth trajectories are critical to population dynamics, influencing both survival and sexual maturation decision, ultimately shaping a population's response to changes in environmental conditions. Yet, quantifying these effects remains challenging due to the imperfect detection of life stages and demographic transitions in wild populations.

We developed an integrated population model for Atlantic salmon, focusing on the marine phase of its migratory life cycle. The model is structured by age, stage, sex, and size. The model is fitted to multiple sources of observations from a 30-year survey of the wild population in the Scorff river (Brittany, France). By integrating population-level data (abundance, sex ratio) with individual-level data (size structure derived from the analysis of growth trajectories on the scales of adults), this approach allows us to infer size-dependent survival and sexual maturation during the unobserved marine phase.

Our results indicate that the survival rates during the first months at sea is highly variable over time and that size at migration explains only a small fraction of this variability, with larger individuals having higher survival probabilities. After the first months at sea, some fish become sexually mature and return to their homewaters to spawn after only one year spent at sea. Our findings demonstrate that probability to mature after one year at sea is higher in males than in females and increases with size at decision stage. In addition, we show that recent decline in growth rates at sea led to lower maturation rates over time. These results highlight the importance of incorporating size-dependent demographic processes in population models to better predict population responses and inform conservation strategies.

Keywords: Population dynamics, Phenotypic traits, Size, structured population model, Growth, Integrated population model, Hierarchical Bayesian model, Atlantic salmon, Climate change

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*Speaker

Male reproductive senescence in mammals is pervasive and aligned with the slow-fast continuum

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Reproductive senescence, the decline in reproductive performance with increasing age, has been well documented in mammalian females. Male reproductive senescence, on the other hand, is much less understood, partly due to the past complexities of getting reliable paternity assignment in the wild. Through a standardized literature search, we compiled age-specific reproductive data on both mating and reproductive success on 57 species encompassing 73 populations. We then explored the occurrence of male reproductive senescence and sought to identify key ecological and evolutionary drivers modulating its intensity. We found evidence of reproductive senescence in 60% of the studied species, with a detection probability increasing with larger sample sizes and longer lifespan coverage (measured as the age range studied relative to longevity). As expected, both the onset and the rate of male reproductive senescence were aligned with the species position along the slow-fast continuum, with fast-living species exhibiting earlier and stronger reproductive senescence than slow-living species. Moreover, the rate of reproductive senescence also increased with the level of sexual size dimorphism, highlighting that males from species displaying a high level of sexual selection suffer from a steeper rate of reproductive senescence.

Keywords: reproductive ageing, mating success, reproductive success, senescence, sexual selection

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[*]Speaker

Transition from monogamy to polygamy in human-modified environments: the case of free-ranging dogs

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Reproductive systems are known to experience major changes during transitions from a wild to a human-modified environment. Notably due to their high plasticity, mating systems can thus impact or promote the ability of organisms to adapt to the new environment. Domestic dog (*Canis lupus familiaris*) is a notable example, which involved a transition from a monogamous mating system (observed in grey wolves *Canis lupus*) to a polygynandrous mating system. While this transition is usually considered a consequence of selective breeding, an alternative hypothesis is that the mating system transition occurred at early domestication stages due to a change in dietary niche in human-modified environments, thus preceding selective breeding practices. This hypothesis requires precise data about the altered mating system of domestic dogs, however detailed studies on genetic mating systems are lacking. Here, we focused on free-ranging dogs from three populations in Italy, Morocco, and Ukraine combining high density genome-wide SNP data (> 120,000 SNPs, for respectively 44, 196, and 286 individuals) with behavioral observations, to characterize their mating systems in detail. We reconstructed the genealogies of these three populations, and for one of them compared it with a social network based on behavioral data. A polygynandrous mating system was confirmed in the three populations, characterized by non-random mate choice, as supported by differences in the distribution of reproductive partners compared with simulated random mating scenarios. The non-random mate choice was also supported by a positive correlation between reproductive success and the strength of social interactions, as well as the number of connections with individuals of the opposite sex. We found multiple paternity within the litters and cases of incest in each population. The identified characteristics of the free-ranging dog mating system, such as retention of kin and flexibility in social groups, incest tolerance, and preference for familiar mating partners, may facilitate the natural spread of domestication-related traits among dog social groups and

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*Speaker

limit the introgression from wolves. The shift in mating system could have thus facilitated the domestication process.

Influence of urbanization on phenotypical traits in great tits: a common garden study

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Despite widespread evidence of phenotypic divergence in urban populations across taxa, the relative roles of genetic and environmental factors driving these changes remain unclear in most urban/forest systems. To disentangle these influences, we conducted two common garden experiments using eggs from great tits (*Parus major*) collected along urbanization gradients in Montpellier and Paris. Previous studies have shown that in these cities, great tits were smaller, more aggressive, and exhibited more exploratory behaviours, compared to forest individuals. Our study aimed to: 1) determine genetic and environmental contributions to morphological and behavioural trait variations by testing if urban–forest differences in great tits persist under identical rearing conditions 2) analyse patterns of divergence between the Montpellier and Paris urban/forest systems, which have distinct urban gradients, in birds reared in a common garden setting. While the first common garden showed persistent differences in traits related to morphology and physiology, the second experiment failed to reveal such genetic divergences between forest and city, either in Montpellier or Paris. Instead, we found strong annual variation related to contrasting early spring conditions. Annual variation in environmental conditions can therefore substantially influence our ability to decipher between genetic and environmental origins of phenotypic differences, even in a common garden setting.

Keywords: urbanization, great tits, genetic adaptation, plasticity, common garden experiment, urban/forest systems

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*Speaker

Snails don't forget... Or do they? A transgenerational experiment on predator-induced plasticity

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Transgenerational plasticity (TGP) allows organisms to adjust their phenotype in response to environmental changes experienced by previous generations. However, the persistence of TGP across multiple generations remains poorly understood, limiting our ability to assess its evolutionary significance (Tariel *et al.*, 2020; MacLeod *et al.*, 2022). While some studies report TGP effects lasting only a single generation, others suggest longer-lasting influences, raising the question of how long past environmental experiences shape offspring phenotypes on multiple generations to best match future conditions. Indeed, key challenge is to determine how long TGP persists and how cumulative exposure in previous generations may impact plastic responses in subsequent ones. Using the well-established *Physa acuta - Orconectes limosus* predator-prey system, we experimentally assessed TGP persistence or decline by exposing snail lineages to different treatments of predator cues for several consecutive generations. We measured morphological, and anti-predator defence traits and reproductive traits. Our experimental design allowed us to unravel elements of predator-induced TGP across time, to test how repeated ancestral exposure influences trait response (cumulative effect), and to discuss potential sensitive windows for signal transmission and expression of TGP. Preliminary results suggest persistence of TGP across generations, with variable plastic responses depending on studied trait, and some cumulative effects induced by the persistence of predation. This work provides novel insights into the temporal dynamics of TGP and its potential evolutionary implications in fluctuating environments.
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Keywords: Plasticity, Transgenerational plasticity, Physa acuta, Predation, Anticipatory effects, Eco, evolutionary dynamics

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[*]Speaker

Light Pollution alters wild biological clocks: Four years of evidence on clock gene expression in a migrant bird, the Collared flycatcher (F. albicollis)

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Life on Earth has evolved under predictable light-dark cycles via the circadian rhythms that govern individual performance. The rapid expansion of artificial light at night (ALAN) disrupts such circadian rhythms, driving biological repercussions for species like birds, which misregulate their physiology and can shift their activity timing. Hence, exploring the molecular mechanisms regulating avian circadian clocks in response to ALAN will enhance our understanding of its broader biological implications, including ecological and evolutionary aspects. In this study we experimentally introduced ALAN in nestboxes occupied by collared flycatchers (*F. albicollis*), a migrant bird breeding in Gotland, Sweden. Nestlings were exposed to ALAN or dim-ALAN from two days post-hatching until fledging. We collected morphometrics and blood samples at the experiment's start and again on day 12, including a "Day" and a "Night" sample. Breeding data and activity patterns were recorded to account for potential effects on reproductive success and timing. Furthermore, we quantified the expression of four key circadian genes (*Clock, Bmal1, Per2,* and *Cry1*) from reverse-transcribed cDNA. Data from four different breeding seasons (2021–2024) revealed subtle but consistent effects of ALAN on circadian gene expression, particularly at night. Negative clock regulators (*Per2* and *Cry1*) showed higher expression in ALAN-exposed birds, with distinct day-night differences. I will present and disentangle these results, as well as the life-history and behavioural responses to ALAN. This study highlights the impact of light pollution in natural populations, especially in long-distance migrants, which are exposed to real scenarios of ALAN during their night displacements.

Keywords: Artificial Light at Night, circadian clock, avian performance, activity patterns

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*Speaker

Inferring dispersal and reproductive success in an Atlantic salmon population

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Atlantic salmon (*Salmo salar*) is an iconic species of great socio-economic value, which is directly affected by climate change, especially populations from France that are located at the south of its distribution range. After spending one or two years in freshwater, juveniles migrate to marine growth areas, and then return as adults to their natal river for reproduction. However, some individuals can disperse to nearby or more distant rivers, leading to a metapopulation functioning. Theory predicts that dispersing individuals should have a lower fitness than local individuals, but this prediction has been rarely investigated. The objectives of this study were to: i) identify the immigrants in a focal population (Nivelle river, France), and ii) compare their reproductive success with local individuals. We combined pedigree and population genetic approaches using 4331 individuals genotyped with 14 microsatellites and/or 164 SNPs over a sixteen years period. Adding parentage analysis allowed to refine estimates of dispersal rates from three adjacent rivers (19.5% overall) compared to clustering assignment methods only (27.4% overall). In most cases, dispersing individuals had a lower reproductive success than local fish, but fitness was also dependent on population of origin and life-history traits. Our results show an origin-dependent reproductive success of dispersing individuals and illustrate the trade-off between gene flow and local adaptation.

Keywords: dispersal, local adaptation, fitness, parentage analysis, salmonids

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*Speaker

Genetic architectures of migration in the Painted Lady butterfly (Vanessa cardui)

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Insect migration is a multifaceted trait encompassing morphological, behavioural and physiological adaptations to environmental seasonality. While such complex traits are often highly polygenic and contributing variants are numerous and distributed across the genome, some are shaped by discrete genomic regions with large effects on heritable variation. Insects exhibit a remarkable diversity in their movement types, shaping connectivity and, ultimately, species' genetic diversity. This phenotypic variation is evident even at the intraspecific level, as exemplified in the cosmopolitan Painted Lady (Vanessa cardui) butterfly, which displays differences in migration timing and orientation, and potentially, even migratory loss. In this study, we investigate V. cardui migratory dynamics effects on genetic variation across its nearly cosmopolitan range. Analyzing 358 genomes, we test the hypothesis whether populations in two tropical island archipelagos -Indonesia and Hawaii- have independently adapted to a sedentary lifestyle, a phenomenon known as "migratory drop-off". In contrast, we also test the hypothesis whether sympatric populations at each Earth's hemisphere have evolved alternative migratory strategies in the light of opposite seasonal regimes-a mechanism we term "hemispherality". Our results reveal widespread genomic signatures associated with migration loss in island populations, consistent with polygenic selection acting on many small-effect variants. Conversely, we uncover a single 9 Mb chromosomal inversion distinguishing mainland Northern and Southern hemisphere populations, suggesting a modular genomic architecture underpinning alternative migratory strategies at each hemisphere. Finally, we characterize genes and regulatory pathways associated with migratory behaviour, including relevant loci related to neuronal and hormonal regulation. Altogether, our study highlights the diversity of genetic architectures underlying insect migration and sheds light on the evolutionary mechanisms underlying complex adaptive traits in natural populations.

Keywords: insect migration, migratory divides, polygenic traits, chromosomal inversions, popula-

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*Speaker

tion genomics, lepidoptera

Social transmission of privileges across generations can flip sex differences in reproductive inequality

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Reproductive inequality, i.e., the uneven distribution of reproductive success, plays a central role in sexual selection and alters long-term evolutionary trajectories by influencing genetic diversity and selection pressures. In many human and non-human species, privileges that influence reproductive success can be socially transmitted to the next generation, often favoring one sex over the other. Yet, most theoretical and empirical studies of reproductive inequality measure success within the first generation (i.e., the number of offspring). Here we assess reproductive inequality across multiple generations in male and female spotted hyenas (*Crocuta crocuta*), a group-living carnivore with social transmission of social rank, associated fitness benefits from mother to offspring, and male-biased dispersal. We found that reproductive inequality among females increased drastically with increasing generation. After six generations, nearly all native individuals of all eight study clans descended from a single top-ranking female ancestor from their respective clan, illustrating the long-term accumulation of reproductive privileges. In contrast, reproductive inequality among males increased only moderately across generations. The trajectories of reproductive inequality across generations in the two sexes differed because social rank and fitness benefits are transmitted through the maternal lineage. As a result of these differences in trajectories, females exhibited greater reproductive inequality than males after only two generations, reversing the typical male-biased pattern. These findings illustrate that multigenerational dynamics influence reproductive inequality, emphasizing the role of social inheritance in shaping evolutionary patterns.

Keywords: Social inheritance, Intergenerational wealth inequality, Privilege, Reproductive inequality, Reproductive Skew, Spotted hyena, Long, term study, Multiple generations, Sexual selection.

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*Speaker

Do poison frogs use heterospecific calls to discover new breeding sites?

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Neotropical poison frogs transport tadpoles to various small pools in the rainforest. Stable breeding pools are few and parents need to travel tens to hundreds of meters to locate suitable sites for tadpoles development. Previous studies have investigated how poison frogs can accurately navigate to known breeding locations, but what sensory mechanisms allow them to discover new pools remains poorly understood. Field observations indicate that other frog species frequently call at the pools used by poison frogs. Here, we tested whether males of poison frogs *Allobates femoralis* and *Dendrobates tinctorius* can use these heterospecifics cues to discover new breeding locations. We are currently testing the heterospecific acoustic attraction hypothesis in the field by conducting playback experiments of treefrogs *Trachycephalus hadroceps* and toads *Rhinella castaneotica* combined with artificial pools and video recordings. Both species display calling behaviours from pools for mate attraction, which can be a reliable indicator of pool availability for poison frogs. We are examining the following questions: (1) How fast poison frogs discover new artificial sites, (2) Are poison frogs attracted to heterospecific calls and (3) Do parents engage in exploratory behaviour prior to tadpoles transport. We expect the two species to discover pools paired with acoustic cues faster as it might indicate pool availability and stability. Moreover, we predict that males discover and assess the pool quality prior to tadpoles deposition. The results will advance our understanding of amphibians' sensory navigation in complex environments. Overall, these findings could also have implications for the conservation of amphibians to increase the attraction and occupation of natural sites.

Keywords: poison frogs, sensory navigation, heterospecific acoustic eavesdropping, tadpole transport, playback experiments

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*Speaker

Coupling of habitat-preference barriers leads to reproductive isolation in sympatric speciation.

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Habitat preference is a widely recognized mechanism of reproductive isolation, yet its role in initiating premating barriers and coupling with other barrier mechanisms to establish robust and irreversible reproductive isolation (RI) in sympatric speciation remains unclear. In this study, we developed mathematical models and computer applications to investigate one- and two-allele models of habitat-preference barriers in sympatric populations under disruptive ecological selection. We examined two spatial arrangements: an open-space model inspired by sympatric cichlid fishes that meet in open water with niche habitats that are small relative to lake size, and a no-open-space model inspired by sympatric hawthorn and apple maggot flies that move directly between trees without lingering in midair. Next, we examined coupling between habitat-preference barriers and a two-allele mating-bias barrier developed in a prior study to analyze how their invasion and coupling dynamics could lead to stronger RI. Our findings confirm that habitat preference is an independent mechanism capable of establishing initial premating barriers in sympatric speciation. Moreover, it can couple with additional barriers, such as those based on mating-trait discrimination, to enhance overall RI. Because habitat preference is an adaptive barrier mechanism, its invasion and coupling are driven by selection pressures arising from maladaptive hybrid loss, and it is readily reversed when disruptive ecological selection weakens. The one-allele model is easier to evolve than the two-allele model because it is immune to recombination by gene flow. Habitat-preference barriers can facilitate the emergence of mating-bias barriers. Open-space systems provide fewer opportunities for inter-niche encounters and tend to result in stronger RI compared to closed-space systems. By elucidating the habitat-preference mechanism, our study reinforces the important role of habitat preference barriers in sympatric speciation. It also provides insights into a wide range of premating isolating mechanisms-temporal, behavioral, and mechanical-that function similarly by reducing mating encounters.

Keywords: Habitat Preference, Sympatric Speciation, Reproductive Isolation, Premating Barriers, Mating Bias, Disruptive Ecological Selection

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*Speaker

Genomic study of the genetic structure and molecular ecology of endemic seabird species of the Mediterranean

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Seabirds are key indicators of marine ecosystem health, as their population dynamics reflect changes in the state of the marine environment. Scopoli's shearwater (Calonectris diomedea) is one of the most abundant seabird species, endemic to the Mediterranean and wintering in the central and south Atlantic. It is currently classified as Least Concern by the IUCN, yet its populations are experiencing a negative trend due to multiple anthropogenic pressures. Despite previous studies on the population structure of the species, comprehensive genomic data remain scarce, particularly for colonies in the Eastern Mediterranean. The present study aims to bridge this gap by employing genome-wide data to examine the population structure and adaptive variation of Scopoli's shearwater across the Mediterranean, with a special focus on the under-represented Eastern Mediterranean. The main objectives include whole genome resequencing of

*Speaker

individuals from colonies across the Mediterranean, assessing genetic connectivity and differentiation among populations, and the investigation of adaptive variation linked to environmental and biological parameters. To achieve this goal, samples will be collected from key breeding colonies of the focal species in the Ionian and Aegean Seas, and will be analyzed combined with existing specimens from collaborating institutions spread around the Mediterranean basin. This study will provide a more robust picture of genetic differentiation and connectivity across the species' range, while shedding light on the local adaptation that Eastern Mediterranean populations exhibit, by detecting signals of selection that could be crucial for the species' resilience to environmental change.

The Role of Pace of Life in Animal Social Network Structures

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Pace of life history is a key axis of variation in life history strategies that broadly captures the evolutionary trade-off between investing in lifespan versus reproduction. It has been suggested that social behaviour, and therefore social network structure, may vary with pace of life, but formal theory in this area remains scarce. We develop a novel mathematical model to determine how differences in the rate of demographic turnover related to pace of life could constrain emergent social network structures in natural populations. We consider these demographic processes alongside variation in social affiliation preferences and social inheritance mechanisms. Our key finding is that rapid demographic turnover, associated with faster pace of life, can substantially constrain the structure of dynamic social networks. An outcome of this is that for slow pace of life emergent social network structures are primarily determined by social preferences, while for fast pace of life they are primarily determined by mechanisms of social inheritance. By considering how demographic turnover can constrain social network organisation, our work provides important insights into social evolutionary ecology.

Keywords: Pace of life, Social networks, Social dynamics, Social inheritance, Demography, Homophily

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*Speaker

Functional Ecology

Pronotum shape of burrowing and non-burrowing cockroaches moving in granular media

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The study of form-function relationships is a key area for both evolutionary biology and the physics of locomotion, providing essential insights into fundamental concepts such as convergence and adaptation. While movement in water or air has been extensively studied from a behavioral and physical point of view, movement in granular media remains poorly understood. This study aims to help fill this gap by investigating *in silico* the efficiency of different pronotum shapes-the pronotum is the dorsal part of the first thoracic segment and it covers the head in cockroaches-in moving through a granular medium. We compare eight pronotum shapes from eight species selected for their preferred microhabitats, including both burrowing and non-burrowing species. The pronota were printed from 3D models obtained by photogrammetry. We quantified the drag and lift forces experienced by the modelled pronota as they moved through their substrate, while testing for the effect of depth and the angle of penetration (from 1∘ to 10.6∘) into the granular medium. We also tested two sizes of granulometry to see if this affected our conclusions. We show how these forces vary according to the shape of the cockroach pronota and the granulometry of the substrate. We show these forces vary according to the shape of the cockroach pronota and the granulometry of the substrate. We have highlighted that the pronotum shapes of burrowing cockroaches typically experience reduced drag forces as they advance through the substrate. Moreover, we show that the drag force is influenced by the penetration angle, with lower values observed for smaller angles (from 1∘ to 3.2∘). This study provides new insights into the biological and physical mechanisms involved in movement in granular media, and contributes to our understanding of the functional adaptations of these burrowing insects.

Keywords: comparative analysis, Blattodea, granular media, drag, lift, ecomorphology, drag coefficient

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*Speaker

Threatened freshwater fish used by humans support unique morphological traits

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Freshwater fishes are vital to human societies, supplying food, supporting cultural and recreational activities, delivering key ecosystem services such as nutrient cycling, water purification, population regulation and trophic importance. However, the global crisis is exerting severe pressure on freshwater ichthyofauna, driving unprecedented declines in both taxonomic and functional diversity. These losses jeopardize the resilience of freshwater ecosystems and the human well-being they underpin. Critically, freshwater fishes are used by diverse human populations across all biogeographic regions, highlighting the global significance of their conservation. By mapping the morphological traits from over 10,000 fish species within a trait space (i.e., *morphospace*), combined with IUCN threat status and categories of human use, we investigated which aspects of morphological diversity are associated with five types of usages -aquaculture, fisheries, game fish, aquarium and bait- and how these species support the global morphological fish diversity.

Our study demonstrated that the 2295 species used by humans (i.e., 21.6% of the freshwater fish fauna) are characterized by a high diversity of morphological traits, occupying 45.7% of the *morphospace*. Although we found a global trend toward species with distinct set of morphological traits such as species with high body mass, elongated body or mouth downwards, each category of usages occupied a distinct portion within the *morphospace*. Fisheries occupied 36.7% of the morphospace, encompassing a broad portion of the global morphological spectrum. In contrast, game fishing and aquaculture were associated with more constrained regions of the morphospace-10.7% and 9.1%, respectively-reflecting selective pressures aligned with the functional requirements of each use. Consequently, certain anthropogenic uses exert disproportionate pressure on specific morphological profiles, heightening extinction risk for species exhibiting those trait combinations.

By simulating the potential loss of threatened species identified by IUCN (i.e., CR, EN, VU and NT), we showed that the loss of morphological diversity was more important if threatened human-used species disappeared than if threatened non-used species went extinct. This result demonstrated that human-used species supported more morphological diversity than non-used species and hence highlighted the crucial importance to protect human-used species that support rare and irreplaceable ecological strategies. Yet, among them, many species are classified as Least Concern or Data Deficient by the IUCN, demonstrating the need to consider different aspect of biodiversity in conservation policies, such as the morphological diversity since they support a disproportionately large amount of global morphological diversity. In a context of

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increasing human pressures on biodiversity, the extinction of these morphologically rare species would result in the irreversible loss of functional strategies, undermining ecosystem resilience and threatening human well-being. Urgent conservation efforts are thus needed to safeguard this hidden reservoir of biodiversity that is vital to maintaining ecological integrity and long-term human benefits.

The role of large carcasses on the structure and functioning of the vertebrate scavenger guild

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Scavengers rely on carrion as a key dietary resource, and in African savannas, large herbivore carcasses provide ephemeral yet crucial inputs to scavenger guilds. In Hwange National Park (HNP), Zimbabwe, a high-density elephant (*Loxodonta africana*) population results in frequent large carcass accumulations. This study used camera trap data to examine how naturally occurring pulses of elephant carcasses shape the structure and functioning of vertebrate scavenger communities. During the dry seasons of 2022 and 2023, we monitored 12 elephant carcasses (5 adult and 7 juvenile) to assess scavenger dynamics across different carcass sizes and decomposition stages. Our first objective was to characterize the vertebrate scavenger guild by analyzing species richness, diversity, abundance, nestedness, and temporal structure. The second objective focused on scavenger co-occurrence patterns to evaluate feeding interactions and dominance hierarchies. We found that (i) species richness varied with decomposition stage, (ii) larger carcasses supported higher species diversity and a more nested scavenger assemblage, and (iii) temporal dynamics revealed distinct diel feeding patterns. Avian scavengers, including white-backed vultures (*Gyps africanus*), hooded vultures (*Necrosyrtes monachus*), and marabou storks (*Leptoptilos crumenifer*), exhibited high temporal overlap, suggesting cooperative feeding strategies. In contrast, nocturnal mammals such as lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) showed limited overlap, indicative of competitive exclusion. Behavioural analyses showed that larger carcasses facilitated prolonged feeding durations and higher feeding probabilities, particularly for species with strong dietary niche overlap. Hooded vultures and marabou storks exhibited specialized foraging behaviours, likely to mitigate competition. These findings underscore the ecological significance of large herbivore carcasses in sustaining competitive scavenger communities, which are increasingly threatened by anthropogenic pressures. By supporting nutrient cycling and disease regulation, scavengers contribute to ecosystem stability, highlighting

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the need for conservation strategies that protect both scavenger species and the megafauna that sustain them.

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Phenotypic responses to thermal variation across 84 unicellular chlorophytes suggest no overarching evidence for trait integration to constrain plasticity

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Phenotypic plasticity allows organisms to display alternative phenotypes in response to contrasting environmental conditions, potentially improving the fitness of organisms in heterogeneous environments. Despite being widespread, phenotypic plasticity appears to be somewhat constrained, characterised by plasticity operating within some limits and at a certain cost. One potential constraint on trait expression through plasticity is phenotypic integration. Phenotypic integration refers to the patterns and degree to which traits are expressed in a correlated fashion within an organism, and may arise due to genetic, developmental, or functional constraints. While phenotypic integration has been widely hypothesized to limit plasticity, empirical support for this theory remains scarce, with previous studies yielding conflicting results. We tested this hypothesis using 84 unicellular chlorophyte isolates (hereafter "strains") from diverse phylogenetic background, isolated from Pyrenean mountain lakes. In a laboratory microcosm experiment, we exposed each strain to either of five temperatures (14∘C, 18∘C, 22∘C, 26∘C, and 30∘C) for 10 days. We then measured both morphological traits (size and shape) and cells' fluorescent emission at several excitation wavelengths (linked to pigment content) using flow cytometry. This data allowed us to assess trait-specific plastic capacity (*i.e.*, the variation in median trait values across temperatures) and trait-specific integration (*i.e.*, the degree to which traits are correlated with one another). By regressing plasticity against integration for each of the 84 isolates, we observed that trait integration did not significantly affect plasticity in the majority of strains (66 out of 84 correlations). When significant, correlations indicated a slight trend suggesting that trait integration may limit plasticity (12 negative *vs.* 6 positive). Ultimately, the average correlation between plasticity and integration did not significantly differ from zero. Our results thus indicate the absence of an overarching link between trait integration and plasticity and underscore the importance of inter-species variability in shaping this relationship. This variability likely explains the conflicting results seen in previous empirical studies. This study emphasizes the need for extensive empirical testing of widely acknowledged hypotheses in the field of ecology and evolution, and encourages further efforts towards a more comprehensive understanding of plasticity, its underlying mechanisms and functioning.

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[*]Speaker

Host plant-driven physiological variation in a polyphagous migratory butterfly

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Migratory behaviour is a response to ecological heterogeneity. In Lepidoptera, the evolution of migration is often linked to polyphagy – the adaptation of immatures to develop on multiple hostplants. This adaptive strategy increases their potential biogeographic ranges and facilitate survival under changing conditions. Moreover, the use of different hostplants across regions may shape physiological capacity and influence migratory decisions. Yet, the physiological implications of larval host breadth on traits underlying migratory capacity remain poorly understood. Here, through an integrative approach, we explore how dietary variation during development affects multiple functional scales in the painted lady butterfly (*Vanessa cardui*), a cosmopolitan, polyphagous, and migratory species. We reared ca. 300 individuals on 14 host plants to evaluate how developmental conditions influence metabolic rate, energy reserves, wing morphology, gut microbiota, and differential gene expression (RNA) across developmental stages. Our results show host-dependent differences in metabolic rate (MR), oxygen consumption (VO), carbon dioxide production (VCO), and RQ values, suggesting variations in metabolic processes across host plants. These changes may reflect differences in lipid accumulation, which could be influenced by host plant treatment, potentially affecting energy reserves for large-scale movements. Adult butterflies show host-related variation in wing morphology, potentially influencing flight efficiency. In larvae, gene expression (RNA) analyses highlight unique transcriptional responses to dietary variation, while gut microbiome further explore whether dietary effects on gut community composition influence nutrient assimilation and metabolic performance. With this integrative study we contribute to a growing understanding of how polyphagy can shape the functional architecture underlying migration in insects.

Keywords: Polyphagy, Migratory capacity, Vanessa cardui, Host plants, Insect migration, Metabolic rate (MR), Lipid reserves, Wing morphology, Gut microbiome, Gene expression (RNA)

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*Speaker

Gametes in a changing climate: a meta-analysis of the effects of temperature extremes on sperm function and performance

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Human-induced climate change is having a dramatic effect on the global thermal environment. In addition to increases in average local temperatures, climate change is predicted to drive increases in climatic extremes, including heatwaves. The range of temperatures that organisms can physiologically tolerate plays a critical role in their distributions across space and time, thus heatwaves can pose a significant threat to the persistence of natural populations. Thermal tolerance studies, however, have typically focused on how extreme heat events impact survival, ignoring potentially critical sub-lethal impacts of extreme temperature. Most notably, recent evidence suggests that extreme temperatures can impact fertility traits, such as the number and viability of sperm and eggs, which can in turn lead to infertility and reproductive failure. Ultimately, thermal limits to reproduction rather than lethal temperature limits can dictate global species distributions. Thus, extreme heat events may have important wider impacts on biodiversity.

Although evidence for negative effects of temperature extremes on fertility traits is accumulating, what is needed now is a comprehensive assessment of how extreme temperatures impact primary sexual traits critical to fertility across a broad range of taxa. We conducted a systemic review and meta-analysis to evaluate the impact of temperature extremes on sperm, egg and gonad traits on non-human animal species.

Our meta-analysis aims to answer three main questions: 1) Do extreme temperatures impact sperm (e.g., sperm quantity, sperm form, or sperm performance) or egg traits (e.g., egg quantity, egg size)? 2) Does the effect of high temperatures on gamete traits across taxonomic groups? Among species species inhabiting different habitats (i.e., aquatic vs terrestrial)? With fertilization environment (i.e., internal vs external fertilizers)? 3) Does the effect of high temperature on gamete traits differ with methodology-related differences, such as natural vs experimental studies, gamete sampling methods or the duration of exposure to temperatures extremes?

We screened over 1600 recent studies and incorporated existing data from a systematic map of studies examining the relationship between temperature and animal reproduction. From this, we extracted over 700 effect sizes (mean and variance) from 204 published studies. Our data includes studies on 18 different taxonomic groups, the 3 most represented being Mammalia, Actinopterygii and Insecta. Most included studies were conducted on lab-reared adult males,

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*Speaker

but we also included female and released gametes data, for a total of 9 trait categories: sperm and egg quality and quantity, sperm form, function and morphology, gonad size and fertilization. Our aim is to provide critical information on how widespread thermal fertility impacts are and reveal aspects of animal life history and biology that may make animals more or less susceptible to extreme heat events. With this knowledge, we hope to be able to consider the potential future impact of our changing environment on the reproductive health of wild animal populations.

Intraspecific differences in income versus capital breeding strategy in two neighbouring populations of barren-ground caribou in West Greenland

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Arctic animals alter behaviour and morphology in accordance with the annual cycle of primary production. Income breeders rely on their current diet for survival and reproduction while others, known as capital breeders, rely on body reserves acquired from feeding in a prior season. Contrasting breeding strategies are typically associated with differences at large spatial and temporal scales among populations, and capitalization from summer intakes is particularly beneficial in ecosystems where resource quality and quantity vary significantly, such as the Arctic. Here we explored the income-capital breeder's continuum in two neighbouring populations of barren-ground caribou (*Rangifer tarandus groenlandicus*) located in an inland (KQ) and coastal (AK) area of West Greenland. In late winter, we measured body condition (i.e., bulkiness, kidney fat and peroneus muscle weight), DNA diet (i.e., faeces metabarcoding) and stable isotopes $\delta15N$ (i.e., faeces, muscle, blood) from 81 cows and 38 calves. Body conditions and muscle $\delta15N$ were also measured for 48 foetuses. We compared long- (blood clot and muscle) and short-term (serum and free amino acids in blood and faeces) sources of protein to determine whether the animal mobilized proteins from its own reserves or directly from its diet. Accounting for pregnancy status, age, and date of capture, we found that inland caribou were bulkier, while coastal ones had more kidney fat. Calves and cows had a similar diet, that reflected the contrasted vegetation of each area. Indeed, caribou diet was up to 52% lichen in the coastal and 6% lichen in inland population, while shrubs represented 22% and 39% of diet in coastal and inland areas, respectively. Kidney fat weight increased with lichen consumption in both populations. Stable isotope analysis clearly unravelled that inland caribou relied more on their body reserves to support pregnancy (as a capital breeder), while coastal caribou appeared to rely on energy directly extracted from their diet to support pregnancy (as an income breeder). This study uniquely track physiliogical mechanisms leading to two different caribou phenotypes having different income to capital breeder's strategies. These results have large implications for an effective management of the species in West Greenland as changes in climate and hunting practices likely affects these two caribou's phenotypes differently.

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*Speaker

Shifts in the conditions for pollen diffusion related to fruiting dynamics in temperate oak species: a regional and temporal perspective since 1960

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Masting is a widespread reproductive strategy among perennial plants, characterised by an annual seed production that is highly variable between years and synchronised within a population. These fruiting dynamics have major cascading effects in forest ecosystems, impacting the population demography of the fruit consumers. Pollen limitation, is a key phenomenon in the reproductive success of forest tree species that exhibit masting, as it captures the direct link between the pollen available for reproduction and the amount of fruit produced. It is largely driven by the conditions at the timing of pollen emission, i.e. pollen phenology. Both pollen phenology and weather conditions are affected by climate change. Pollen limitation is therefore highly susceptible to be shifting, but the direction and magnitude of this shift remain to be assessed. We lead a retrospective analysis of how these conditions have changed since 1960, integrating the phenological responses of the widely distributed temperate oak species across France, *Quercus petraea* and *Q. robur*. We used a comprehensive pollen dataset collected from 34 sites monitored over periods ranging from 8 to 32 years to establish the contribution of weather conditions around pollen phenology to pollen limitation, and mobilised a mechanistic model of pollen phenology to retrace its trajectory across mainland France since 1960 from weather records. Combining these two results, we estimate pollen diffusion conditions and its trajectory. We reveal considerable spatiotemporal heterogeneity in pollen diffusion conditions, with marked differences in its shifts over recent decades between regions. Notably, we observe that they have become more systematically favourable to pollen diffusion. Such a change could lead to more cyclical masting, increasing seed predation and reducing reproductive success. Our research encourages integrative approaches that encompass pollen phenology and pollen diffusion conditions.

Keywords: Pollen phenology, pollen limitation, masting, climate change

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*Speaker

Long-term monitoring of zooplanktonic communities in the Bay of Villefranche-Sur-Mer in a context of climate change over 55 years

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Global changes affect ecosystem structure and functioning. In the ocean, the effects of global warming can be direct (e.g., increase in salinity and temperature of surface waters) or indirect (e.g., changes in precipitations and winds for example). Those modifications affect living organisms, especially plankton that, by definition, can not move when facing unfavorable conditions. For this reason, plankton is considered as a good sentinel of the global state of open sea ecosystems. In addition, plankton plays a key role in the functioning of marine ecosystems, as a main actor of the carbon cycle or as the base of food webs. Monitoring and understanding how planktonic communities respond to global changes is therefore a major priority at global scale.

In this context, long time series of plankton biodiversity observations are a key tool. In the Mediterranean Sea, considered as a global warming hotspot, the historical marine station of Villefranche-Sur-Mer continues to carry out one of the oldest zooplanktonic time series in the world. Starting in 1967, a 330 μm mesh sized net has been deployed bimonthly, all year round, between 75 m and the surface. Over 900 formalin-preserved samples were recently re-processed with a quantitative imagery device (the ZooScan) and the resulting 2M individual images processed through an artificial intelligence pipeline to provide individual measurements and taxonomic classifications.

From this data, we describe long term trends, seasonal changes, and regime shifts in the meso-zooplanktonic community, in relation to environmental conditions (temperature, oxygen, chlorophyll a). And, since the images provide access to individual measurements, we can also explore changes in ecologically-relevant traits such as size, transparency, etc. Among other things, we show, together with significant warming and decrease of chlorophyll a concentration; changes in zooplankton concentrations and shifts in community composition. These changes also translate into significant changes in individual-level traits. Causal inference approaches indicate significant top-down control of zooplankton on phytoplankton, which seems to be increasing with time. Such extraordinarily long observations give us access to these long term, climate-scale processes and are therefore precious in our globally changing world.

Keywords: zooplankton, time series, monitoring diversity, Mediterranean Sea, global warming

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*Speaker

Contribution and biases of INaturalist in understanding Heteropteran biodiversity around Montpellier

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Background

Citizen science (CS) has gained significant importance in recent years, with records now being collected on an unprecedented scale. One of the most prominent CS platforms, iNaturalist (iNat), hosts over 223 million records of wild biodiversity. Despite its substantial contributions to ecological research, using spontaneous CS data to address ecological questions remains challenging. Our understanding of the inherent biases in such data is still limited, particularly for insects. In this study, we examine if spontaneous observations made by citizen scientists on this platform provide a good picture of bug diversity in terms of taxonomic diversity and functional aspects. We compare a dataset of spontaneous observations contributed by citizen scientists to an academic dataset. In this context, we will focus on Heteroptera (bugs), a group of insects that fulfill key ecological functions.

Methods

We surveyed 27 sites arranged in a grid within a 30 km radius around Montpellier. The sampling was conducted rigorously using three different methods : sweeping net, beating and visual searching. At each site, we use 3 pseudoreplicates, focusing on the different micro-habitat. Sampling period spanned from the 18 of September to the 23 October 2024 (academic dataset). We extracted all iNat observations recorded within the same sampling area and between the same calendar days (iNat dataset). We also compiled a species functional traits database. Our statistical analysis aimed at comparing potential taxonomic and functional differences between both datasets.

Results

The iNat dataset recorded higher richness, with 105 species compared to 88, along with more unique species. While our dataset reached the threshold for exhaustivity, the iNat dataset did not. A strong difference emerged in the relative abundance of species in the two datasets, with a Bray-Curtis distance of 0.5 indicating moderate dissimilarity. Substantial functional differences were also observed: the mean imago size was 1.5 mm larger in the iNat dataset. Additionally, colorful bugs (yellow, orange, red) were more frequently sampled in the iNat dataset, whereas

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dull-colored bugs (black, grey, beige) dominated our sampling.

Discussion

The two datasets provided contrasting perspectives on Heteroptera biodiversity, revealing differences in species richness and abundance distribution. Unlike previous findings, the iNaturalist dataset exhibited higher species richness. This discrepancy might stem from our uniform large-scale sampling design, which may fail to adequately cover rare habitats. The iNaturalist dataset's overrepresentation of larger and more colorful bugs aligns with expectations, as such species are more easily detected by observers. The former trend, previously noted for birds and bees in iNaturalist observations, could also reflect the characteristics of species inhabiting potentially undersampled environments. By combining academic and citizen science data, we gain a more comprehensive understanding of biodiversity, as their integration provides a more comprehensive perspective than either dataset could achieve independently

Keywords: citizen science, iNaturalist, Heteroptera, sampling bias, functional traits

Seasonal dependence of phytoplankton response to climate change

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Phytoplankton is a major component of freshwater ecosystems, underpinning many ecosystem services and benefits to society. However, forecasting the ecological responses of phytoplankton to climate change remains a major challenge as its species are controlled by a set of variables that dynamically interact, often leading to nonlinear (state-dependent) responses to environmental forcings. To accommodate such inherent dynamic complexity, we applied Empirical Dynamic Modelling (EDM), an equation-free framework based on state space reconstruction, to the long-term phytoplankton time series (monthly sampled over 40 years) of Lake Geneva. Causality analysis identified major drivers of phytoplankton dynamics, enabling to reconstruct multivariate attractors that permit tracking the variations of temperature direct effects (TDE) on phytoplankton genera over time. Thermal constraints varied greatly over seasons and among genera, highlighting genus-specific dependence on temperature. Furthermore, TDE was clearly temperature-dependent and exhibited variable patterns among genera, enabling to identify possible winners and losers in a climate change context. To forecast possible changes in phytoplankton abundance and functional composition with global warming, we then conducted scenario explorations (temperature increase from 0.5 to 4∘C) and investigated how phosphorus management could actually limit phytoplankton abundance in a warming context. Our results indicate that global warming may lead to a season-specific increase in phytoplankton abundance associated to functional turnover.

Finally, phosphorus management was identified as a decisive key to limit massive positive responses of phytoplankton to temperature increase highlighting the role of local stakeholders in mitigating the impacts of climate change on freshwater ecosystems.

Keywords: climat change, phytoplankton, non, linear dynamic, functional trait

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*Speaker

Sinking vs. Buoyancy! Interspecific Competition for Light and Nutrients between Sinking and Buoyancy-Regulating Phytoplankton Species along a Stratified Water Column

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In the temperate zone of the Northern Hemisphere, lakes typically exhibit seasonal patterns of thermally stratified and fully mixed periods. Global warming is altering these patterns and notably leads to prolonged summer stratification. Phytoplankton dynamics are closely linked to these seasonal patterns, phytoplankton growth typically peaking during the stratified summer period in the epilimnion, where sufficient light is available. At the same time, stratification increases the risk of phytoplankton sinking out of the euphotic layer of the water column. Consequently, planktonic primary producers have evolved different adaptive traits to counteract sinking, including flagella and buoyancy regulation. In recent years, the cyanobacterium *Planktothrix rubescens* has proliferated in several deep, stratifying lakes across Europe. One suggested explanation is that *Planktothrix rubescens* strongly profits from lengthened periods of summer stratification due to its ability to migrate below the thermocline, providing a competitive advantage over passively sinking phytoplankton by counteracting sinking as well as mitigating nutrient limitation in the epilimnion. Nevertheless, existing phytoplankton competition models often do not consider vertical resource gradients nor account for species-specific vertical movement strategies. This limits our ability to predict how changes in stratification regimes will influence phytoplankton growth and community composition. To contribute to closing this gap, this study theoretically investigates competition between two phytoplankton species along a one-dimensional stratified water column featuring heterogeneous resource gradients (light and nutrients): one species is a passively sinking algae while the other species has a buoyancy regulation trait. With a reaction-advection-diffusion model, we explored how equilibrium states are shaped by physiological traits related to light and nutrient utilization and vertical movement strategies, as well as physical and chemical determinants such as background turbidity, turbulent mixing intensity, and nutrient availability. Our results emphasize the crucial role of vertical movement strategies in shaping biomass distributions and determining community composition. Furthermore, the coexistence between buoyancy-regulating and sinking phytoplankton is critically dependent on differences in resource-use efficiencies for light *vs.* nutrients, as well as environmental conditions, both species blooming in the same or separate water layers. We also observed possible oscillatory coexistence states. Overall, our findings highlight the importance of vertical movement strategies in structuring phytoplankton communities under changing

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[*]Speaker

stratification regimes.

The role of gut microbiota in the invasion success and insecticide resistance of Spodoptera frugiperda

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Symbiotic interactions play a crucial role in insect biology, influencing nutrition, development, and adaptation to environmental stressors. Microbial communities associated with insects contribute to essential functions such as detoxification of plant allelochemicals and resistance to abiotic stressors, including pesticides. In agricultural systems, the ability of insect pests to metabolize toxic compounds is particularly concerning, as it can drive the evolution of insecticide resistance and complicate pest management strategies. Understanding these mechanisms is especially critical in invasive species, such as the fall armyworm (Spodoptera frugiperda). This Lepidoptera, native to the Americas, has rapidly spread in Africa since 2016, causing severe damage to maize crops. Recent studies highlight the relationship between resistance mechanisms and microbiota dynamics, emphasizing the need for a deeper understanding of these interactions. We hypothesized that insecticide pressure alters insect microbiota and contributes to the development of resistance. To test this, we first assessed variation in insecticide resistance toward lambda-cyhalothrin (a pyrethroid) and emamectin benzoate (an avermectin) across wild Kenyan S. frugiperda populations while examining shifts in bacterial community diversity and abundance. In this goal, larvae were fed with maize leaves treated with different insecticide concentrations, and life-history traits such as survival, development time, and growth rate were measured. In parallel, individuals from each sampled population were used to characterize gut bacterial diversity and composition by using both 16S rRNA metabarcoding and culturomics, this last approach allowing to subsequently perform functional analyses. We expect to observe a gradient of resistance, with corresponding changes in microbiota composition. Next, an experiment involving reciprocal transplantation of the digestive microbiota of larvae from susceptible and resistant populations was used to test the link between changes in the composition and diversity of the microbiota and pesticide resistance. We expect that larvae receiving microbiota from resistant populations to show lower mortality under insecticide exposure compared to control groups. This study will provide valuable insights into the microbiota-mediated mechanisms underlying insecticide resistance and the invasion success of S. frugiperda, potentially opening new avenues for pest management strategies.

*Speaker

Grazing the plastisphere reduces biofilm consumption and modifies energy allocation strategies in freshwater snail Physa acuta

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Plastics are emerging pollutants that pose a global threat to the environment and human health. Eighty percent of plastic waste accumulates in the environment, where it fragments and spreads across all ecosystems. Beyond concerns about their ubiquity, plastics exhibit highly diverse chemical compositions due to the mixing of polymers and additive chemicals to enhance their technical properties and suit their intended applications. However, despite more than a decade of scientific research, the environmental impacts of plastics and their chemical composition remain only partially understood.

Freshwater ecosystems are particularly underrepresented in plastic pollution research, accounting for less than 15% of scientific publications. Moreover, studies rarely focus on the lower levels of the trophic network, such as microbial communities. Yet, these communities can colonize plastic surfaces, forming biofilms known as the plastisphere, which serve as a food source for primary consumers like grazers.

Primary consumers occupy an intermediate trophic level between biofilms and other benthic organisms. They are recognized as bioindicators, responding to changes in their food sources and environmental disturbances, including the presence of pollutants. However, the effects of plastics on the biofilm–consumer relationship remain understudied.

To address this knowledge gap, we investigated the effects of different plastic-associated biofilms on the freshwater gastropod *Physa acuta*. We conducted field incubations of biofilms using an inert control and four plastic materials selected for their distinct polymer types and applications-each representing a different chemical composition. The gastropods were then exposed to the developed biofilms in the laboratory for three weeks.

We used an integrative approach, assessing the nutritional quality of the biofilm, individual snail biofilm consumption, excretion, phenotypic and fitness responses as well as their exposure to microplastics.

We hypothesized that plastic-associated biofilms quality would be lowered, thus snails feed-

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[*]Speaker

ing on the plastisphere would consume more biofilm to compensate and would display more ecotoxicological effects compared to snails exposed to control biofilms. Additionally, we expected greater microplastic exposure in grazers feeding on plastic-associated biofilms.

Our results revealed three key findings:

- Biofilm quality may be lower on certain plastics than on the control, yet snails feeding on the plastisphere consumed less biofilm over time than control snails, regardless of plastic type.

- Despite reduced consumption, snails showed varying feces production and growth responses depending on the plastic type, while reproduction remained unaffected. We hypothesize that *P. acuta* adopts different energy allocation strategies, prioritizing less energy for growth.

- Snails were exposed to microplastics through grazing on plastic surfaces, as plastic particles of the corresponding polymer were more frequently recovered in their feces.

The observed effects on snail growth could affect the population dynamics of grazers, meaning that plastic-associated biofilms could indeed impact trophic networks and energy flows in freshwater ecosystems. We also highlight that the responses of snails depend on the plastic type, indicating the urgent need to characterize the plastics and the biofilms that grow on them, as well as the exposure of grazers to microplastics, to provide better explanations on the mechanisms involved in grazer-biofilm specific interactions.

Keywords: plastics, microplastics, grazers, trophic network, energy fluxes, freshwater ecosystems

Trade-offs of Anthropogenic Foraging: Effects of Landfill Diets on the Growth and Health of White Stork Nestlings (Ciconia ciconia)

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Human activities are driving a significant decline in global faunal diversity. Nevertheless, some species have exhibited remarkable adaptability to rapid environmental changes and are able to persist, and even thrive, in anthropogenically modified habitats. Proximity to human settlements offers multiple advantages, including warmer microclimates, reduced predation pressures, and reliable access to anthropogenic food sources such as organic waste. Over 250 species of birds and mammals are known to scavenge regularly at open dumps and landfills, a behavior associated with improved body condition, increased reproductive success, and, in some cases, positive population trends. However, foraging in such environments also carries potential risks, including exposure to pathogens, toxins, and anthropogenic contaminants.

The European white stork (Ciconia ciconia), a migratory species known to exploit landfill sites, provides a relevant model for exploring the mechanisms underlying anthropogenic foraging. While landfill foraging is well-documented in Western Europe and has been linked to population recoveries in several countries, this behavior remains relatively recent in Eastern European populations, including Poland. Interestingly, while Western populations have experienced notable growth, Polish populations are in decline or stable. This discrepancy raises important questions regarding the ecological and evolutionary implications of landfill foraging in different regional contexts. As the Polish population of white storks is not increasing despite using landfills, perhaps physiological costs and/or health issues are involved.

This study aims to evaluate the physiological and health-related consequences of parental feeding behavior on nestling development in a wild population of white storks in western Poland. During the 2024 breeding season (with continued data collection in 2025), we monitored approximately 40 broods, classifying nests based on proximity to the nearest landfill as a proxy for foraging strategy. We collected biometric measurements, blood samples, and microbiological data at two key developmental stages: early (4-7 days) and late (45–52 days) nestling phases.

We hypothesize that nestlings provisioned by landfill-foraging parents will exhibit enhanced growth due to higher nutritional intake, but also increased immune activity and pathogen exposure. Such responses may lead to energetic trade-offs, potentially compromising developmental stability and long-term survival. Preliminary analyses suggest that landfill proximity has limited influence on nestling condition in years of high natural food availability (like it was observed in

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*Speaker

2024). Ongoing analyses of immunological and microbial data will further elucidate the costs and benefits associated with anthropogenic foraging.

Difference in the global association between trophic and functional diversity of fish communities between rivers and lakes

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Understanding the global association between the different facets of biological diversity is challenging. The functional diversity of a community, based on the diversity of ecological traits of the species it contains, is expected to reflect the theoretical ecological niche of this community, including the differentiation in resource use favouring species co-existence. Functional diversity of communities is thus expected to be positively associated with trophic diversity in communities that reflect the realized niche of organisms. However, physical and environmental characteristics of ecosystems may modify this relationship because they drive species richness,

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*Speaker

resource availability and biotic interactions within ecosystems. Yet, this assumption remains to be tested at the global scale. Here, we investigated the link between trophic diversity (based on stable isotope values) and functional diversity (based on morphological traits) in freshwater fish communities worldwide. Specifically, we aimed to test whether this relationship differs between rivers and lakes and investigate its dependency on key environmental drivers.

We estimated trophic diversity using the standard ellipse area ($SEAc$) computed on $\delta13C$ and $\delta15N$ values for 793 fish communities obtained from the global ISOFRESH database referencing stable isotope measures in a wide variety of freshwater ecosystems worldwide. Functional diversity was assessed using the ISOMORPH database by calculating functional richness ($fric$) from the morphological traits available for the fish species in the 793 fish communities. We then investigated the link between $SEAc$ and $fric$ using linear mixed effect models, fitted independently for rivers and lakes, and analysed their dependency on climate zones, natural discharge, non-native dominance in communities and human footprint.

Overall, we found that trophic diversity generally increased with functional diversity in both rivers and lakes ($p < 0.005$). While no effect was found in lakes, we revealed in rivers the significant dependency of this relationship on the climate zone ($p < 0.005$), with a positive relationship in humid zones with severe winter (slope $= 0.26 \pm 0.08$), that progressively decreases along latitude, becoming negative in tropical zones (slope $= -0.074 \pm 0.05$). Finally, none of the studied environmental factors affected the relationship but we found that trophic diversity significantly decreased when increasing human footprint index in both river and lakes. This work highlights for the first time the relationship between trophic and functional diversities in freshwater ecosystems at the global scale. It underlines the significant differences in constraints driving this relationship in rivers and lakes across the world, and especially the importance of climate influence in ecosystems submitted to dynamic physical constraints. These outcomes open perspectives to improve our ability to predict the impact of climate change at the global scale on the association between the different facets of biological diversity.

Behaviour

Behavioral impact of Road Dust and Tire Wear Particle on gammarids and potential functional consequences

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Tire Wear Particles (TWPs), a major component of road dust (RD), pose a significant threat to aquatic ecosystems. Abrasion of tires on roads generates microplastic-like particles that are transported to freshwater ecosystems via storm runoff. While the lethal effects of TWPs have been established for some species like Coho Salmon, their sublethal impacts on other aquatic organisms remain poorly understood. This study investigates the behavioral alterations in gammarids (*Gammarus fossarum*), a ubiquitous sentinel species, following long-term exposure to road dust contamination. Over 21 days, we measured weekly changes in activity levels (percentage of active time), swimming speed, distance traveled, and nearest neighbor distance (NND) using video tracking. Our results demonstrate a noticeable decrease in distance traveled, speed, and active time after 21 days of exposure. We hypothesize that these behavioral changes may be attributed to energy reallocation towards detoxification processes, potentially compromising energy available for essential activities like swimming. This reduced swimming capacity could increase predation risk and negatively impact gammarid population dynamics. Future research will focus on assessing the vulnerability of contaminated gammarids to predation cues and exploring the behavioral effects of TWPs on other aquatic species.

Keywords: Tire Wear Particle, Road Dust, Invertebrate behavior, Ecotoxicology

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*Speaker

Studying Forficula pubescens (Dermaptera : Forficulidae): a promising natural enemy to adress global changes in apple orchards

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Apple orchards are of great economic importance in southeastern France. In this Mediterranean region, orchards managers face two common pests, *Cydia pomonella* (Lepidoptera: Tortricidae) and *Dysaphis plantaginea* (Hemiptera: Aphididae) as well as climate change while maintaining sustainable production methods such as biological control. Earwigs are important generalist predators in apple orchards, but little is known about *Forficula pubescens*, a species commonly found in the Mediterranean basin and thus likely adapted to warmer climates. In such a context, we aim to evaluate the biocontrol potential of *F. pubescens* under abiotic and biotic stress. In laboratory experiments, two abiotic stressors are tested: (1) temperature, considering short-term temperature extremes and (2) pesticides, including products compatible with organic farming. Intraguild interactions with another common earwig, *F. auricularia*, are also tested in small areas with varying prey densities to assess synergy, competition and/or predation between these two generalist predators. Our study also aims to target the variation in earwig response to these conditions at different developmental stages: third and fourth instar nymphs, males and females. The results will help demonstrate the relationship between stress and the biological control provided by these species, which is directly related to the need for sustainable and conservative biological control programs in apple orchards.

Keywords: Biological control, Forficulidae, Climate change, Ecotoxicology

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*Speaker

Scale matters: fusion fission dynamic of belugas herds in the St. Lawrence Estuary from 30 years of herd follows

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Fusion-fission dynamics are a fundamental aspect of social behavior in many animal species, allowing individuals to balance the benefits of group living with environmental and social constraints. Individuals form groups (fusion) or split apart (fission), leading to temporal variations in group cohesion, size and composition. However, accurately quantifying these dynamics remains challenging, largely due to the difficulty of selecting an appropriate temporal scale for analysis.

In this study, we used an extensive 30-years dataset of belugas herds monitored in St. Lawrence Estuary (Canada) to investigate the factors shaping their fusion-fission dynamics. Specifically, we analysed 2900 herds, each followed for an average of 4 hours at a constant 30 min interval, to quantify temporal variation in herd size, composition and spatial dispersion.

Over 50,000 fusion-fission events were identified across 8 temporal scales (from 30 minutes to 4 hours). Cross-sectional analysis revealed that the frequency of fusion-fission events increased with temporal scale. Herd size and spatial cohesion exhibited higher fusion-fission frequencies than herd composition, suggesting that while belugas adjust size and spacing flexibility, composition remains a more stable social dimension. Longitudinal analysis showed that fusion-fission dynamics occured throughout the population, but the high variability in fusion-fission rates across herds indicated that their intensity and temporal patterns differ among herds. These findings highlight that fusion-fission dynamic may operate at different timescales depending on the herd type.

These multi-scale events will be discussed in relation to extrinsic (areas used and previously attributed functions), intrinsic (herd geometry, dynamism, and movement) and anthropogenic (vessel traffic) factors. By integrating a multi-scale approach, this study will advance ecological knowledge in social dynamic of belugas, with direct implications for assessing how social flexibility influences space use and resilience to human disturbances such as vessel traffic.

Keywords: Fusion, fission dynamic, sociality, marine mammals, temporal scale

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*Speaker

Impact of the presence of solar hedges and the microclimate induced on cow behaviour

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Agrivoltaic systems combine agricultural production with solar energy generation on a given land. In France, this practice has gained importance as a way to help achieve the target of generating between 35 and 44 GW of photovoltaic power by 2028. The impact of photovoltaic panels is being increasingly studied, but is mainly focused on tilted solar panels in the presence of sheep grazing or crop production. In our research, we studied the impact of vertical bifacial solar panels in the form of a hedge on the behaviour of heifers from the Prim'Holstein cattle species (*Bos taurus*). We hypothesised that the panels would have a wind-breaking effect that could be beneficial for livestock during cool weather, but detrimental during hot weather. We also assumed an improved grass digestibility thanks to the presence of shade between the panels but a biomass less important. Using a remote sensing approach with GPS, light and activity sensors, we were able to track the various activities carried out by the heifers in space and time and observe whether the monitored behaviours differed from a control group on an adjacent parcel without solar panels. We set up a three-week rotational grazing scheme to monitor variations in microclimate conditions between the panels, and their impact on grassland production and cow behaviour. In parallel, the biomass, composition and digestibility of the vegetation were assessed at different positions of the panels. Our results showed similar activity patterns of both cattle groups. In term of space use, cattle seeked for shade during the midday, however it was not provided by the bifacial solar panels during this period. They moved in between the solar panels during the day but preferred to stay in the North of the parcel during night time, outside of the solar panel area. I will also present how cattle space use and behaviour are affected by solar hedges through microclimate and grassland changes. This study will help

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understand the impact of vertical bifacial photovoltaic power plants on cattle behaviour, the induced microclimate and associated grasslands.

Investigating mating choice in wild-living vervet monkeys (Chlorocebus pygerythrus) through interdependence and social bonds

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Mate choice is a key element for reproduction. Phenotypic traits, access to resources or the quality of parental care are factors commonly used to explain what leads to the choice of a partner. In social groups, partner choice is known to be a common mechanism to maintain cooperation, with tolerance and social bonds playing a key role in its success and stability. According to the shared-stakes theory, the fitness of regular partners is positively correlated, and partners can become interdependent. Yet the extent to which these factors apply in the context of mating choice remains understudied. Although intrasexual hierarchy modifies access to potential partners, the factors that further modulate mating choices are unknown. In this study, we experimentally created interdependencies between specific intersex dyads of wild-living vervet monkeys by regularly exposing them to a social tolerance task during the mating season. We assessed social bond strength and recorded sexual behaviours to test the effects of interdependence on social bonds and their influence on mating choice. We found that males showed a significant increase in sexual behaviours right after the experiment, largely focused on their dyadic female. Thus, physical proximity brought by our experiment might play a role in modifying male mating behaviour. However, these behavioural changes tend to lead to more refusals, and there was no evidence that males are less refused by their dyadic female than by other females. More generally, we found a positive correlation between social bond strength and the number of sexual interactions between a male and a female. These results show that social bonds and interdependency can alter mating behaviour in wild primates. This study thereby highlights the role of interdependency in partner choice within a sexual context and provides new insights into adaptive benefits of male-female relationships.

Keywords: Mating choice, Primate, Social bond, Shared stake, Sexual behaviour

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*Speaker

Hormonal trade-offs in parental investment: effects of corticosterone on prolactin and behaviour in king penguin

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Parental investment in long-lived species involves trade-offs between self-maintenance and offspring care, particularly when faced with harsh environmental conditions. Hormonal regulation plays a crucial role in this balance, with corticosterone facilitating self-maintenance and prolactin promoting parental investment. King penguins (*Aptenodytes patagonicus*) breed in a challenging environment characterised by extreme intra-specific aggression and prolonged fasting, both of which could elevate corticosterone levels. Previous evidence suggests that king penguins are relatively resilient to increased baseline corticosterone levels, but the extent to which elevated corticosterone influences prolactin levels (i.e., its antagonistic effect on prolactin) and behaviour during breeding in this species remains unknown.

To address this knowledge gap, we implanted wild-caught breeding adult king penguins with 90-day continuous time-release corticosterone pellets. Throughout the breeding season, we monitored their plasma hormone levels and behavioural responses, specifically aggression, vigilance, resting, time spent foraging at sea, and parental care. Based on existing literature, we predict that individuals with corticosterone implants will exhibit higher corticosterone levels and lower prolactin levels. In terms of behaviour, we predict that corticosterone-implanted individuals will (1) be more reluctant to return to the nest and therefore spend more time foraging at sea; (2) display increased aggression and vigilance, which should come at the expense of other behaviours such as resting; and (3) prioritise self-maintenance behaviours, such as grooming, over parental care behaviours.

Corticosterone treatment significantly elevated plasma corticosterone levels for at least one month, after which levels returned to pre-treatment values, likely due to a negative feedback loop. This experimental increase in corticosterone resulted in a prolonged (> 1 month) reduction in prolactin levels. Individuals with corticosterone implants did not spend more time foraging at sea but, in contrast, spent significantly less time at sea. We are currently performing

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*Speaker

multivariate analyses on other behaviours to confirm or refute our predictions. These findings will provide insights into the intricate hormonal trade-offs that king penguins may face between self-maintenance and parental investment under challenging environmental conditions.

The impact of urban road noise on free ranging wildlife : Are electric vehicles better than conventional ones ?

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The rise of electric vehicles (EVs) and the implementation of lower speed limits are transforming urban soundscapes by reducing overall noise levels. Conventional internal combustion engine vehicles (CVs) are significant contributors to urban noise pollution, which negatively impact both human health and wildlife behaviour. The transition to quieter EVs, along with reduced speed limits, is expected to benefit wildlife. However, whilst reduced noise may lower stress levels for some animal species, the near-silent operation of EVs could hinder their ability to detect approaching vehicles, potentially increasing the risk of collisions. Understanding wildlife responses to road noise is difficult due to the range of other confounding factors in urban landscapes (e.g. light pollution, habitat fragmentation) that hinder the assessment of these effects. Therefore, to address this gap, we conducted an experiment in an isolated northern region of Greece from July to September 2024 and examined the impact of CV noise versus EV noise at low speeds (30 mph) on wildlife. Our findings revealed that exposure to conventional noise led to an overall significant decrease in wildlife sightings when compared to EV noise with significant decrease in sightings of bears, badgers, and pine martens at the species-level. This study highlights how the rise of EVs is changing urban soundscapes and affecting wildlife differently than CVs, emphasizing the need to continue integrating and exploring wildlife-friendly infrastructure (such as crossings and buffer zones) and measures into urban planning.

Keywords: Urban soundscape, EVs, Behaviour, Free ranging wildlife

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*Speaker

Individual and brood variation in begging calls and offspring recognition in pied flycatcher (Ficedula hypoleuca)

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Offspring survival and development rely on the care provided by parents in numerous species across the animal kingdom. Nonetheless, this care can be detrimental for parental fitness if supplied to unrelated offspring. Many bird species utilize begging calls for parent-offspring communication, and variation in those calls could enable parents to individually identify nestlings to better fulfill their needs, but also to avoid feeding unrelated offspring. Recognizing and restricting care to own offspring has been well studied in colonial breeders, where the risks of encountering unrelated offspring are presumed to be high. However, many non-colonial breeding species also risk feeding unrelated offspring, particularly after nestlings fledge from the nest, and how they avoid this is unknown. In this study we first examined begging calls from nestlings of pied flycatcher (*Ficedula hypoleuca*) to assess the presence of brood and individual signatures. For this purpose, we gathered multiple begging calls from nestlings close to fledging and analyzed their acoustic parameters. We subsequently determined the ability of parents to differentiate their offspring from unrelated nestlings by comparing their responses to their offspring's begging calls versus to other nestlings' calls. Our acoustic analyses showed that begging calls vary across nests and individuals such that calls could be correctly assigned to their corresponding nest and individual with high confidence. Moreover, parents were significantly more likely to respond to their own nestlings' begging calls compared to unrelated nestlings. These findings demonstrate both an unrecognized degree of variation in begging calls of pied flycatcher and that this variation directly underlies parental recognition of their offspring. Future studies on the topic could help shed more light on how widespread this communication method is and the exact mechanisms behind it.

Keywords: Parental care, acoustic communication, begging call, signature, offspring recognition, pied flycatcher

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[*]Speaker

Interindividual and intergroup differences in context-dependent vocalizations in carrion and hooded crows

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Communication is key to successful social interactions. In birds, sound is one of the primary communication channels, allowing for broad and rapid signal propagation and facilitating interactions between individuals. Vocal communication, thus, plays a central role in the social structuring of gregarious species. Corvids are highly suitable models for studying vocal communication due to their advanced cognitive capacities and complex social life. Given their high complexity and variability, the vocalizations of corvid species remain understudied, and little is known about contextual and interindividual variations - despite extensive research into their social and cognitive abilities. Here, we investigated the influence of age, sex, social hierarchy, and group size on interindividual and intergroup differences in vocalizations. In particular, we expected (1) juveniles to exhibit a larger vocal diversity than adults; (2) male and female vocalizations to differ in frequency and duration; (3) dominant individuals to vocalize more than subordinates; and (4) larger groups to display more vocal diversity. We recorded 13 carrion (*Corvus corone*) and hooded crows (*Corvus cornix*) housed at the Haidlhof Research Station (University of Vienna). Birds were of varying ages (7 adults and 6 juveniles) and sexes (7 females, 6 males) and house in three groups of different sizes (2, 4, and 7 individuals). Data were collected over a 10-week period, three times per week. We present our results with a focus on differences in the frequencies and durations of vocalizations at both individual and group levels and discuss our findings in light of the cognitive and behavioural foundations of vocal communication in birds. These findings advance our understanding of context-dependent vocalizations, highlighting the role of individual differences and group composition in corvid communication.

Keywords: communication, vocalizations, corvids, interindividual differences, vocal repertoire

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*Speaker

Honey, I'm home! Effects of short-term separations on long-term pair bonded corvids

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Separating highly social animals from each other often triggers strong behavioral responses which are believed to allow re-establishing connections upon reunion. Depending on the species, individuals have been shown to exhibit either a temporary increase in attachment behaviors or a phase of detachment. While previous research has primarily focused on social separation from a group and on species with short-term pair bonds, little is known about how long-term pair-bonded species respond to temporary separations. In this study, we investigated the effects of short-term partner removal on the behavior of 3 corvid species that form life-long pair bonds. Captive raven pairs (Corvus corax, 8 pairs) and crow pairs (Corvus cornix and C. corone, 4 pairs) were filmed for 20 minutes before experiencing a 4-hour separation from their partners and then for another 20 minutes after reunion.Behavioral observations were conducted using the behavioral scoring software Loopy to measure the duration of seven key pair-bond maintenance behaviors, including spatial proximity, affiliative and displaying behaviors. We used generalized linear mixed modeling to compare the duration of these behaviors before and after partner removal. By examining how these long-term pair bonded birds respond to temporary separation, our study provides valuable insights into the behavioral mechanisms underlying pair-bond maintenance in corvids, contributing to a broader understanding of social bonding in monogamous species.

Keywords: Corvids, Social bonding, Pairbond maintenance, Partner removal

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*Speaker

Pelagic productivity and abundance of competitors influence on trophic niche segregation among large pelagic predators

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In the open ocean, large pelagic predators often share similar food resources and feeding grounds, likely avoiding competition and coexisting through niche partitioning. Here, we combined spatial distribution data, isotopic niche metrics, and dietary reconstructions to describe spatial patterns of intra- and interspecific competition of three sympatric large pelagic predators: the swordfish (*Xiphias gladius*), the blue shark (*Prionace glauca*), and the shortfin mako (*Isurus oxyrinchus*). We used stable isotopes (δ15N and δ13C) to calculate the isotopic niche width and the overlap among the species based on Kernel Utilization Density estimators, the isotopic distance between species, the Intraspecific Trophic Pressure index, and diet proportions using mixing models. Mako sharks had a high isotopic niche overlap with blue sharks, with similar prey consumption. We found a high niche overlap between swordfish and blue sharks in the Mediterranean, although the diet estimates suggested that these two species rely on different prey groups. We fit Generalized Additive Models (GAM) to evaluate the relationships among competition metrics and biological (competitor abundance), environmental (pelagic productivity), and anthropogenic (fishing pressure) drivers. Our results suggest pelagic productivity and abundance of competitors are key drivers of intra- and interspecific trophic niche segregation among large sympatric pelagic predators. They support the hypothesis of niche partitioning being reduced under a high resource availability scenario.

Keywords: swordfish, blue shark, shortfin mako, pelagic fish, isotopic niche, competition

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[*]Speaker

Combining accelerometery and GPS data to investigate grooming reciprocity in wild female chacma baboons (Papio ursinus)

Jemima Frame * [1], Charlotte Christensen , Anna Bracken , Justin O'riain [2], Andrew King [1], Ines Fürtbauer [1]

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Grooming is widely recognised as the main affiliative behaviour in social primates, building, strengthening, and maintaining social bonds between individuals. The cooperation between unrelated individuals to perform this seemingly altruistic behaviour may be explained by reciprocal altruism, where grooming functions as a service in the 'biological marketplace' – exchanged for the opportunity to receive grooming in return. However, reliance on direct observation often limits our understanding of reciprocity by capturing only immediate exchanges. In this study, we combine accelerometer-derived given and received grooming with GPS data to identify grooming partners and reciprocity in wild female chacma baboons (*Papio ursinus*). Using this unique continuous dataset, we show that: 1) The occurrence of grooming as a result of direct reciprocity is significantly higher than grooming by random chance. 2) Dyad partners' daily grooming durations as well as bout frequencies of grooming given were significantly positively correlated. These findings indicate that grooming reciprocity involves a time-keeping element, i.e. individuals appear to track the time spent grooming rather than reciprocating based solely on the action itself, deepening our understanding of the underlying (cognitive) mechanisms in primate grooming reciprocity. Conflicting with several short-timescale studies that report absence of time-keeping, our results suggest that grooming reciprocity is not necessarily immediate and occurs over a larger timescale, supporting the theory of reciprocation by partner choice over partner control. More broadly, our study highlights the importance of temporal scale in behavioural studies.

Keywords: Grooming, reciprocity, chacma baboons, accelerometery data

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*Speaker

The mystery of female mallard odour: attraction or protection?

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In 1979, Jacob *et al.* discovered diester chemicals in the preen oil of female mallards (*Anas platyrhynchos*) during breeding, and proposed they function as sex pheromones to attract males. While this study pioneered research on olfactory communication in birds, no study has ever properly tested this hypothesis in mallards. Meanwhile, research on shorebirds suggests that diester chemicals may instead aid in olfactory crypsis, helping to conceal the odour of the nest from predators. Since female mallards nest on the ground, they (and their nest) are vulnerable to olfactorily searching predators (e.g. foxes, mustelids), and should also benefit from olfactory crypsis. The mystery remains: do the diester chemicals of females mallards have a role in olfactory sex signalling, olfactory crypsis, or both? To answer this, I will conduct behavioural experiments (olfactory preference trials, field predation experiments) combined with chemical analyses (GC-MS). This research project aims to uncover the role of preen oil and body odour in the breeding biology of ducks-and in birds in general.

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[*]Speaker

Domestic cats' personality influences their predation through diverse behavioral and owner-linked drivers

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If domestic cats (*Felis catus*) are worldwide known as popular domestic animals, they are also very abundant generalist predators, whose impact on biodiversity is now established. Their remnant predation rates on birds, rodents and reptiles are highly variable, as well as their owners' view on their pets' behavior and associated mitigation strategies. Emerging studies indicate the possibility and necessity of limiting these predatory behaviors through strategies that take into account the cats' well-being and free-will. This highlights the importance of considering intrinsic and owner-linked drivers of predation, to try and influence at its root the cat's likeliness to consume wild preys. Meanwhile, the impact of various personality traits on hunting frequency is increasingly well documented. To further investigate these results, we analyzed the responses of over 1000 cat owners to questionnaires about their cats' personalities and behaviors. We looked for trends linking personality traits - defined by the 'Feline Five' method - to owner management, cats' daily movements, and their natural tendencies to hunt. We then tested whether these correlations may constitute underlying factors involved in the personality-predation relationships observed. We found that extraversion and dominance are traits that favor hunting, respectively through an increase in time spent outdoors and a more predatory behavior towards preys; and conversely that neuroticism is associated with a lower frequency of hunting, which we explained by owners' desire to protect their cats by keeping them more inside.

Keywords: Personality, predation, domestic cat

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*Speaker

Assessing the personality of Hermann's tortoises: A promising cue to improve translocation success

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In a context of biodiversity crisis, the need to implement effective conservation measures of animal populations is paramount. Although largely underexploited, taking into account the variability of individuals' behaviors and personality could improve the success of many conservation efforts. In the particular case of translocations, bold and exploratory personality traits may influence the survival and settlement of individuals after release. The Hermann's tortoise (*Testudo hermanni*) is an endangered Mediterranean reptile, for which translocation represents a promising tool to restore populations impacted by forest fires. As a prerequisite, this study aimed to determine the exploratory and bold personalities of Hermann's tortoises. The behaviors of juvenile and adult tortoises bred or temporarily held in captivity, were repeatedly assessed using three different tests (crossing experiment with difficulty gradient, righting and anti-predator tests). The good repeatability of the behaviors allowed us to determine the personality of the tortoises along the *continuums* of exploration and boldness. Knowing the personality of individuals before their release will allow us to assess possible correlations with the success of translocations.

Keywords: Behavior, Exploration, Boldness, Ex situ, Conservation

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*Speaker

Stranger in the nest: experimental design to test the role of kinship in sibling interactions and development in zebra finches

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In many species, offspring are not raised alone but in a shared environment with siblings. Sibling interactions can range from intense rivalry to cooperation, shaped by both the need to compete for limited resources and the inclusive fitness benefits of tolerating or helping kin. However, brood-mates are not always full siblings: brood mixing, conspecific egg parasitism, and extra-pair mating are widespread in the wild and introduce genetic diversity within a brood. Similarly, in science, cross-fostering experiments have been used for decades to disentangle genetic and environmental effects, or as a convenient way to manipulate brood size or hatching asynchrony. Since fostered chicks are generally accepted by their foster parents, it is often assumed that changes in genetic diversity within broods have no impact on chick performance and family life. Yet, recent findings suggest that this variation in relatedness may influence sibling interactions, potentially altering social dynamics and inducing early-life stress with long-term consequences. To investigate whether and how the swapping of single or multiple eggs-and the resulting increase in genetic diversity among brood-mates-affects development, we will conduct a cross-fostering experiment and compare the behaviour and development of chicks from full-sibling broods with those from mixed broods in domesticated Zebra Finches (*Taeniopygia castanotis*). In this experiment, we will also examine short- and long-term effects of genetic diversity on stress levels across different life stages and on fitness later in life. We plan to implement two treatments. In half of the broods, only one egg will be exchanged; in the other half, all eggs except one will be swapped. We will record the development, stress physiology, begging intensity, interactions between nestlings, and parental care directed toward each individual chick. This experiment will be the first to systematically explore whether and how egg cross-fostering affects not only the exchanged chicks but also their brood-mates and foster parents. Our results could fundamentally change how cross-fostering experiments are designed, while shedding light on the social and developmental consequences of growing up among non-kin.

Keywords: cross fostering experiment, kin selection theory, kin recognition, zebra finch, mixed brood, brood genetic diversity, nestling performance, sibling competition, early life stress

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[*]Speaker

Effects of artficial light on the behavioural actvity budgets of free-roaming nightjars

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Many species, including the crepuscular, visually hunting European Nightjar (Caprimulgus europaeus) align their behaviour with the available light. However, natural light cycles are increasingly, and substantially, altered by artificial light at night (ALAN).

We used supervised machine learning (XGBoost) to identify four different types of behaviour (resting, singing, flying, leaping) in data from biologgers attached to nightjars and constructed a detailed time use sequence over the course of the night. Combined with multiple data sources this provides a comprehensive picture of how natural and artificial light influences the nightjars' behaviour.

Biologgers were deployed to 41 nightjars and recorded GPS coordinates and acceleration during 263 nights in the breeding seasons from 2020 to 2023. Three-dimensional acceleration data was processed with XGBoost to identify behaviours, while GPS data contributed to labelling and mapping behaviours to land cover types.

The study sites varied in light pollution levels, yet moon and sun luminance and temporal variation in skyglow explained most variation in available light. Linear mixed-effects models indicated a dependency of multiple behaviours, particularly movement, on the moon phase. However, this dependency diminished with high skyglow, i.e. high cloud cover (a proxy for skyglow).

Nightjars were as active in nights lit up by skyglow as in nights lit up by the moon. This generally leads to more possibilities to be active and indicates that overcast nights resemble the light environment of those with a full moon for nightjars. These findings could help to integrate light pollution mitigation into wildlife conservation strategies.

Keywords: European Nightjar, Caprimulgus europaeus, Biologging, Accelerometer, Light Pollution, ALAN, XGBoost

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[*]Speaker

Can social proximity predict audio-visual similarities in the courtship of spotted bowerbirds?

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Bowerbird males build a structure – the bower – where they perform a multi-modal courtship display consisting of sequences of vocalizations, postures and movements. In spotted bowerbirds, subordinate males are tolerated by bower owners and participate in various bower activities such as performing or receiving courtship displays. Subordinate males may benefit from these male-male partnerships by learning the skills needed for sexual signaling. In such case, similarities in audio-visual signals may emerge between socially interacting individuals, potentially resulting in geographical patterns of courtship. In this study, we tested whether male-male social interactions can predict similarities in courtship display within a single population of spotted bowerbirds. Video recordings were taken at bower sites to determine whether (i) individuals exhibit similarities in their audio-visual courtship display at micro-geographical scale and (ii) the strength of social interactions between males can predict these similarities. Our results show that geographic proximity among bowers explains similarities of audio-visual signals. For acoustic display components, in addition, social interactions could predict courtship similarities. Moreover, ongoing work using automated tracking methods will alow us to quantify highly detailed measures of the visual display similarities. These findings give novel observational evidences of social learning in wild birds at the small geographic scale.

Keywords: Social learning, Male, male cooperation, Sexual selection, Courtship display

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*Speaker

Impact of urbanisation on interspecific competition between Blue and Great tits

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Acoustic communication in birds is a central process in evolution and ecology as it is involved in mate attraction and territorial defense. However, ambient noise exerts strong selection pressure by masking signals. With the advent of urban ecology, it has been showed that acoustic pollution in cities, characterized by low frequencies, leads to a decrease of acoustic niches available for birds singing at these frequencies. Added to this urban pressure, interspecific competition might also decrease the acoustic space available for individuals to communicate. In a previous study, we revealed that Great tits increase their maximal song frequency in cities, in response to urban noise while sing with lower minimum frequency where Blue tits density is high. To investigate whether these changes on Great tits song frequency increases territorial response in Blue tits, we conducted two playback experiments in spring 2025 in urban (Dijon, Besançon) and forest (Chaux, Auxonne) habitats. We used songs of Great tits emitted i) in noisy and quiet environments and ii) in high versus low density of Blue tits. We expected Blue tits to react more aggressively to Great tit songs from places with i) high acoustic pollution and ii) low Blue tit density, because of their higher frequency

Keywords: Urbanisation, Interspecific competition, Acoustic niche

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*Speaker

Description of the behavioural contexts of underwater sound production in juvenile green turtles Chelonia mydas

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Green sea turtles *Chelonia mydas* have the ability to hear and produce sounds under water, with some of them potentially involved in social communication. To investigate the potential biological function of these sounds, we used a combination of acoustic, video and multi-sensor recordings of 23 free-ranging juvenile green turtles and we examined the co-occurrences of sounds with behaviours or external events. Our study revealed that most of the sounds were produced when the sea turtles were resting or swimming. However, four sound types were produced in more specific contexts. Long sequences of rumbles were recorded after sunset and mainly during resting. All these rumbles appear to have been produced by several individuals recorded simultaneously, suggesting that rumbles may be used for social interactions. The frequency modulated sound was highly associated with scratching behaviour. The grunt that was produced occasionally when green turtles were vigilant or approaching a conspecific. The long squeak was produced significantly by a small number of individuals in the presence of humans. The grunt and the long squeak may be the first evidence of an alarm or warning signal for intra-specific communication in green turtles. Our results mark a significant milestone in advancing the understanding of sound production in the behavioural ecology of sea turtles. Further experimental investigations (i.e., playback experiments) are now required to test the hypotheses suggested by our findings. Warning signals could be used to prevent sea turtles of a danger and may contribute to their conservation.

Keywords: Behaviour, Chelonia mydas, Chelonians, Juveniles, Underwater sound production

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*Speaker

The effects of temperature and sleep disruption on sociability and metabolism in the Trinidadian guppy, Poecilia reticulata

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Sleep is a fundamental neurophysiological and behavioural state, observed ubiquitously across the animal kingdom. While the function of sleep remains elusive, its importance is evident through the deleterious effects of sleep deprivation. In fish- an understudied taxon in the context of sleep behaviour and ecophysiology- sleep deprivation has been linked to impaired cognition, altered movement, and reduced predator avoidance responses. As ectotherms, fish are particularly vulnerable to climate change, with increased temperatures and hypoxia associated with a plethora of behavioural and physiological changes. However, the impact of climate-related stressors on sleep in fish is largely unexplored.

The present study aimed to address this gap by investigating: 1) how temperature changes influence sleep behaviour; 2) the effects of altered sleep on subsequent daytime activity, sociability, and metabolism; and 3) whether temperature modulates the consequences of sleep deprivation. Using Trinidadian guppies (*Poecilia reticulata*), we implemented six experimental treatments: at 24∘C and 28∘C, fish experienced either no physical disruption, nighttime physical (sleep) disruption, or daytime physical disruption.

To assess the effects of temperature on sleep behaviour, fish were filmed at night, and sleep patterns were quantified through video analysis. The following day, fish were placed in sociability assays, and we assessed behavioural changes using video-tracking software. Subsequently, we conducted intermittent-flow respirometry, to measure standard metabolic rate (SMR) and explore metabolic patterns following sleep alterations. This study represents the first investigation into the effects of climate-related stressors on sleep in fish and the potential repercussions of sleep alterations in the context of a changing environment.

Keywords: sleep, fish, metabolism, sociability, shoaling, temperature

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*Speaker

Beyond Inactivity: Identifying True Sleep in Southern Elephant Seals Using EEG

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Sleep is a homeostatic trait for enhancing cognitive and developmental processes, supporting maintenance and restoration, and thereby improving animal performance. However, sleeping animals also become vulnerable by reducing activity and environmental awareness. Therefore, animals should optimize their sleep strategies to balance these costs and benefits. In wild animal studies, sleep is often inferred from inactivity, measured through direct observation or devices like accelerometers and gyroscopes. Accelerometry, in particular, is widely used to detect inactive states across species from small rodents to large mammals. However, inactivity does not necessarily equate to sleep, especially in species where low movement is typical or where unique sleep adaptations exist. Marine mammals provide a compelling example: cetaceans, otariids, and odobenids, exhibit uni-hemispheric sleep, enabling them to remain partially awake while one hemisphere of their brain sleeps. This highlights the risk of misidentifying true sleep when relaying solely on inactivity metrics. To explore this issue, we conducted a field study on southern elephant seals (*Mirounga leonina*) during their moulting period-a time when they fast and remain mostly on land. Although they appear to sleep for the prolonged period on the beach, their rapid responses to external stimuli suggest otherwise. To disentangle true sleep from mere inactivity, we deployed EEG recording devices alongside accelerometers, gyroscope on southern elephant seals. Additionally, we installed video camcorders near the seals to record overall behaviors. From the EEG data, we classified sleep states by slow waves and high-amplitude signals and compared them to accelerometry-derived inactive periods and video-based assessments of eye states and body movements. Our findings reveal that accelerometry alone often misclassifies true sleep in seals, as extended inactivity did not coincide with EEG-defined sleep. This underscores the need for multi-modal approaches, including brain EEG, to accurately identify sleep in wild animals.

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*Speaker

Individualised niches in the city: Do personality traits mediate habitat and feeding niche specialisation in two Apodemus spp. along an urbanisation gradient?

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Individuals often use a small subset of the population's resource base. This process is called individual specialisation. Interestingly, this among-individuals' variation (i.e. niche variation) is still observed even after correcting for the classical 'sex, age or discrete morphological group' determinants. It has been hypothesized that consistent individual differences in behaviour (e.g. personality trait) could explain individual's resource-use variation and, thus individual specialisation. However, overall evidence that personality traits mediate individual specialisation is scarce especially investigating several niche dimensions at the same time. In addition, niche variation results in important fitness consequences especially in fluctuating and heterogenous environments such as urban habitat. Yet, few studies have investigated individual niche specialisation in the context of urbanisation. In our study, we aimed to i) test whether individuals of *Apodemus sylvaticus* (n=190) and *Apodemus flavicollis* (n=63) exhibit behavioural differences leading to microhabitat use and diet variation along an urbanisation gradient, ii) quantify whether habitat and feeding niches are repeatable and, iii) determine if these two niches' dimensions correlate with each other. We found that boldness, exploration, and docility were repeatable (R = 0.25 to 0.55), and that docility and boldness changed along the urbanisation gradient in a different fashion for each species. Personality traits did not correlate with habitat use. Patterns related to the feeding niche are unclear at the moment and need further investigation to understand their ecological relevance. Overall, our results suggest that urbanisation elicit new environmental conditions favouriting certain behavioural responses which turn to affect how individuals specialise and express different niche. Our study highlights the importance to consider individual variation and several niche dimensions as they can have profound effect on population dynamics and community structures. We believe that our framework of individualised niche can benefit both ecological and evolutionary studies by fine tuning models via the incorporation of individual variation.

Keywords: individual niche specialisation, animal personality, isotopic niche, habitat niche, urban-

*Speaker

isation

Cryptic evolution of body size in response to climate change in a social mammal : the Alpine marmot

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Climate change is profoundly altering ecosystems functioning, leading to significant consequences for biodiversity like population declines and an increased risk of local extinctions. By causing both biotic and abiotic changes in environmental conditions, climate change generates strong selection pressures on organisms that need to respond in order to maintain their fitness. Alongside geographical shifts in better suited areas and advanced phenology, body size shrinkage has been proposed as a third universal response to climate change. However, the adaptive nature and the mechanisms of such changes are still poorly known despite the significant impact of body size on life-history traits. Using a 34-year long-term monitoring of Alpine marmots in the French Alps, we investigated changes in body size to explore their adaptiveness and plastic/evolutionary nature using a quantitative genetic framework. Our results show a non-adaptive decrease in body size at the phenotypic scale. Notably, these phenotypic changes masked the effect of positive evolution favoring bigger individuals. Thus, although Alpine marmots are becoming smaller, larger individuals still have fitness advantages. This evolutionary dynamic, in which phenotypic changes mask the effects of counter-directional evolution, is a case of "cryptic evolution". This scenario emphasizes the necessity of explicitly disentangling phenotypic versus genetic effects in order to conclude for the mechanisms at play in response to climate change.

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*Speaker

Not in my backyard: territorial dynamics and behavioural plasticity of alternative reproductive tactics in the ruff (Calidris pugnax)

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Ruffs (*Calidris pugnax*) display three alternative reproductive tactics (ARTs) that are genetically determined and maintained for life. 'Independent' males compete aggressively for a display territory within a lek, while two other tactics ('satellites' and 'faeders') are non-territorial and opportunistically capitalize on lekking Independents to secure copulations. Prior observations indicate a degree of plasticity within each tactic, yet the extent to which these ARTs can adapt to changes in their social environment remains unclear. In this study, we examined the effect of experimentally altering the social environment on the expression of lekking behaviour in a captive population of ruffs. We kept males either in mixed or pure morph groups together with females and then used machine learning techniques to precisely track the movements of lekking ruffs and investigate space use within the experimental arenas. Specifically, we assessed whether separating birds by morph influences lek dynamics and alters spatial behaviour in males, potentially causing sneaker males to adopt territorial behaviors in the absence of dominant independent males. Our results suggest that experimentally manipulating the social environment has an effect on space use in pure-morph groups, however it does not promote the emergence of territorial patterns in sneaker morphs. We discuss these results in light of the genetic, physiological and social factors the underlie morph differentiation in the ruff.

Keywords: behavioural plasticity, alternative reproductive tactics, Calidris pugnax, aggressive behaviour, lek

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*Speaker

Comportement thermique de l'omble de fontaine (Salvelinus fontinalis) : exploration des incursions dans les couches thermiques des lacs stratifiés en période estivale.

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L'omble de fontaine (*Salvelinus fontinalis*) est une espèce sténotherme connue pour occuper préférentiellement le métalimnion des lacs stratifiés. L'utilisation de l'épilimnion, plus chaud, ou de l'hypolimnion, plus froid, pour répondre à des besoins alimentaires l'expose à des températures suboptimales pouvant engendrer des contraintes physiologiques. Notre étude se concentre sur la plasticité comportementale de thermorégulation adopté par l'omble de fontaine lors de la recherche de nourriture afin de faire face aux variations de température, notamment durant l'été, en explorant ses incursions dans les couches thermiques suboptimales d'un lac oligotrophe. Les recherches précédentes se sont intéressées à l'occurrence des poissons dans les zones thermiques, mais les déplacements détaillés entre ces couches n'ont été que rarement étudiés. Nous utilisons des données de télémétrie acoustique à haute fréquence pour analyser (1) la fréquence et la durée des incursions dans l'épilimnion et l'hypolimnion pendant l'été, (2) les variations journalières de l'utilisation de ces couches thermiques pour identifier des stratégies comportementales, et (3) les différences comportementales entre les couches thermiques, notamment en termes de vitesse et de distance par rapport au fond du lac. Nous émettons l'hypothèse que l'omble de fontaine réduit ses incursions dans l'épilimnion et augmente celles dans l'hypolimnion avec l'augmentation de la température. De plus, nous prévoyons que les incursions dans l'épilimnion soient particulièrement concentrées au crépuscule, moment où la disponibilité alimentaire est maximale. Enfin, nous anticipons des différences de vitesse entre les couches thermiques, avec des mouvements dans l'épilimnion ou l'hypolimnion caractérisés par une vitesse moyenne plus élevée, correspondant à une recherche active de proies, tandis que dans le métalimnion, les mouvements devraient être plus lents, correspondant à une période inactive de thermorégulation. Les résultats de cette étude permettront de mieux évaluer les impacts du changement climatique sur la dynamique des populations de salmonidés, dont les habitats sont susceptibles d'être modifiés par l'augmentation des températures de surface et la réduction des zones froides propices à leur survie.

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*Speaker

Does timing matter? The impact of hypoxia at different developmental stages on fish cognition

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Low oxygen concentration in the water, known as hypoxia, occurs naturally but is expected to become more frequent and severe due to current global changes and anthropogenic pressures. Organisms can adjust to a change in their environment via plasticity, but the timing of this plasticity has been overlooked, especially in ecophysiology aspects such as cognition. Cognition, referring to the ability of animals to make decisions, is essential for successful foraging, anti-predatory responses, and many other key functions linked directly to survival. Hypoxia, for instance, may modify different aspect of cognition, like the problem-solving and/or learning/memorizing cognition, what is then crucial to study in the current context of global changes. To address this question, we exposed three groups of *Gasterosteus aculeatus* to different hypoxia regimes: a control group that has always been in normoxia ($> 90\%$ of O2 throughout the day), a group that has always been exposed to fluctuating hypoxia ($> 90\%$ of O2 during the day and 30% of O2 during the night to mimic more natural conditions), and a group that has been in normoxia until 4 months-old, and then exposed to fluctuating hypoxia. Their problem-solving and learning/memorizing cognition were assessed using a decision-making and a detour test with an increase of complexity, leading to a reward. Assessing the impact of hypoxia at different developmental stages on cognition provides important insights on the capacity of fish to deal with their changing environments, primordial for predicting the global response of an organism to environmental changes.

Keywords: Cognition, Behaviour, Hypoxia, Plasticity

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[*]Speaker

Kin recognition and inbreeding avoidance in Venturia canescens: behavioral and transcriptomic insights

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Kin recognition plays a pivotal role in animal mating behavior, preventing inbreeding and preserving genetic diversity. Inbreeding is known to drive genetic erosion across species and can ultimately lead to population extinction. In this study, we investigated inbreeding avoidance in the parasitoid wasp *Venturia canescens*. In this species, the decision to mate or not is assigned to the female. Behavioral assays revealed that sibling mating occurred at a lower frequency compared to unrelated pairings. Males exhibited delayed, less frequent, and shorter courtship interactions when exposed to sibling females. These results suggest that both male and female mate choice contributes to inbreeding avoidance. To elucidate the molecular basis of this selective mating behavior, we performed RNA sequencing on the heads of both males and females. Our transcriptomic analysis demonstrated that the presence of a related mate triggers a specific gene expression response. Among the differentially expressed genes, we identified those involved in the production of neuropeptides, which can influence decision-making. These findings provide novel insights into the mechanisms underlying kin discrimination and mate selection. In addition, we draw parallels with findings from another species exhibiting an opposite mate choice strategy: *Drosophila melanogaster*, which preferentially engages in inbred matings. This comparison offers a broader perspective on the conserved mechanisms of kin recognition and highlights the diversity of mating responses across taxa.

Keywords: Kin recognition, Mate choice, Venturia canescens, transcriptomic analysis

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[*]Speaker

Conservation Ecology

Space use and habitat selection by a threatened semi-aquatic mammal, the Pyrenean desman (Galemys pyrenaicus)

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Mountain aquatic ecosystems are currently facing multiple pressures whereas they provide habitats for many animal and plant species with high conservation value and/or endemic species. Among them, the Pyrenean desman (*Galemys pyrenaicus*, É. Geoffroy Saint-Hilaire, 1811) is a small semi-aquatic mammal endemic to the Pyrenees and the north-west of the Iberian Peninsula. Its range has shrunk by half between 1990 and 2015, and today, the Pyrenean desman is classified as Endangered according to the IUCN Red List of Threatened species. It lives and forages in dynamic and fluctuating habitats modulated by variations in flow. These fluctuations in flow conditions can be large and sudden, for instance when they are induced by extreme weather events (e.g. intense rainfall, rapid snowmelt, severe droughts) or human activities (e.g. hydropower production, water withdrawals for agriculture). To date, knowledge of the use of space and habitat selection by the Pyrenean desman remains limited, hindering to improve the protection of this species and its habitats. The aim of this study was therefore to answer two main questions:
- how does the Pyrenean desman use its aquatic environment?

- are there differences in the hydrology and topography of areas selected and areas avoided by the Pyrenean desman?

Thirteen individuals were captured, fitted with VHF transmitters and monitored continuously by radiotracking in six streams in the French Pyrenees between 2014 and 2024. This extensive monitoring revealed non-random use of the home range by the individuals. During its aquatic activity phases, the Pyrenean desman tended to select a few areas of its home range, where it was observed regularly and where it spent a large proportion of its activity time.
Then, modelling of flow conditions was conducted on the home range of six individuals monitored, in order to describe the hydrology and topography of available microhabitats. By linking hydrological modelling outputs with radiotracking data, we highlighted differences between the microhabitats selected and avoided by the Pyrenean desman. Individuals tended to spend more

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*Speaker

time in cascades and step-pools, where flows are more turbulent (steeper slope, higher water velocity) and where boulders are present, than in runs and pools, where conditions are calmer. The final goal of this study is to provide detailed information on the species' habitat requirements and preferences, so that appropriate and relevant conservation measures can be urgently implemented to stop the decline of this endangered species.

Unraveling social networks in free-ranging wild boar (Sus scrofa): Insights from GPS tracking data of elusive species

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By living in social groups, wild boars (*Sus scrofa*) obtain different benefits, such as more efficient foraging or behavior transmission and, by extension, an improved survival rate. Wild boars are thought to live in complex social structures, known as a fission-fusion system, characterized by changing group size and dynamic interactions. Yet, despite the ecological and practical importance for population management, wild boar social structure and interactions remain poorly studied due to tracking challenges of all individuals in free-ranging populations. This study aims to investigate the social structure of wild boar populations and understand how group membership fluctuates within their fission-fusion system. Using previously collected GPS data from two free-ranging wild boar populations in the Czech Republic, we will infer wild boar social interactions through proximity and co-occurrence, applying the new R package "AniSNA" to construct reliable social networks, account for missing data, and assess key parameters of sociality (e.g., degree, betweenness, centrality). This project will provide the first detailed insights into wild boar social networks using GPS-tracking data, confirming the presence of a fission-fusion structure. Understanding wild boar social dynamics will aid in explaining their ecological success and adaptability. These results will help find solutions in the management of these key species, particularly in anthropogenic landscapes, where wild boar populations are expanding drastically, by highlighting how group interactions drive their behavior and spatial movements.

Keywords: gps data, social network, wild boar, management, aniSNA

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*Speaker

Vulnerability of small cetaceans to anthropogenic activities: Insights from two case studies

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Anthropogenic activities are currently a major threat to cetacean conservation worldwide. In particular, harmful interactions with marine traffic and fisheries are of great concern, causing high levels of mortality through incidental bycatch and collisions, but also through potential disruption of key behavioural activities such as foraging, resting or reproduction. Not all individuals within a population may be exposed to the same risk from anthropogenic disturbance. However, few studies have investigated how individual-level characteristics (such as age, sex, body size, behaviour, etc.) correlate with the effects of anthropogenic disturbance. Here, we investigate the existence of such vulnerability profiles for the effects of marine traffic and fishing activities on the bycatch risk and habitat choice of small cetaceans. We used two case studies: the phenotype and spatio-temporal dependence of bycatch risk in common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) in the Northeast Atlantic, and habitat selection and use in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in the tropical lagoon of Mayotte.

First, using French bycatch observations, declarations and stranding databases in the Northeast Atlantic, we found males and smaller individuals to be more prone to bycatch, with some spatio-temporal patterns in bycatch sensitivity. Smaller individuals appeared to be caught off the northern French coast and in spring, and more males were caught off the southern French coast. We then found larger body-sized dolphins to be more vulnerable to trawls compared to gillnets. For the latter fisheries, the size and body weight of by-caught harbour porpoises were positively correlated with mesh size. Targeting soles or hakes was also associated with larger body sizes of bycaught dolphins compared with targeting Sparidae or sea bass. Finally, we found larger individuals to be bycaught in the presence of an acoustic deterrent device. These results suggest age-specific bycatch sensitivity and vulnerability to fishing techniques, which may be

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due to biological factors such as diet, reproduction and social behaviour.

Second, using transect and scan sampling in the Mayotte lagoon, we conducted distributional modelling of dolphin groups and behaviours as a function of environmental parameters and anthropogenic activities (marine traffic, fishing). We found that group structure was influenced by the intensity of marine traffic: the presence of juveniles was less likely in areas with dense motorised boat traffic. Analysing behavioural transitions using Markov models, we then found that behavioural patterns were highly dependent on anthropogenic activities: longer foraging sequences were observed in areas of dense fishing activity, while the probability of foraging decreased with the number of nearby boats; longer milling sequences were observed in areas of dense motorised boat traffic, with travelling and milling increasing in the presence of nearby boats. These results suggest potential competition for fish resources between dolphins and fisheries, and a clear pattern of avoidance and disturbance in the presence of intense marine traffic. Overall, these results argue for better consideration of trait and behavioural vulnerability to anthropogenic marine activities, and for specific conservation measures targeting activities, areas and periods that are most detrimental to vulnerable individuals.

Variations in arthropod community structure and composition in protected and non-protected Swedish oak forests: environmental drivers of species richness, functional diversity and red-listed species prevalence

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Arthropod communities are declining in many regions around the world in diversity and abundance, yet arthropods are still generally overlooked when deciding where and how to implement protected areas to safeguard biodiversity values. In this thesis, I investigated the factors shaping arthropod community diversity and structure in 21 oak forests, which are known to host a wide variety of arthropod species. I compared stands located within protected areas to stands under no protection status to investigate if current protection measures efficiently promote arthropod diversity in general and threatened species in particular. To do so, I evaluated the impact of protection status, habitat structure and complexity - quantified through oak genetic diversity, host tree species diversity and stand age range, and latitude on arthropod species richness, using generalized linear mixed models. I performed binomial and ordinal models to evaluate the impact of site protection status over the prevalence of species assessed as 'Near threatened', 'Vulnerable' and 'Endangered' on the IUCN red list. I also used ordination methods to test for differences in community composition between stands and search for patterns in functional diversity structure. Arthropod species richness was significantly higher in sites located at higher latitudes than sites located at lower latitudes, potentially because of the northward expansions of some arthropod species' distribution range, as well as the stronger urbanization of southern Sweden. Sites with narrower age ranges also showed significantly higher arthropod species richness. Sites located inside protected areas did not show higher arthropod diversity than their unprotected counterparts, but hosted more species classified as 'Near threatened', 'Vulnerable' and 'Endangered' on the IUCN red list. Protected sites' arthropod communities differed more from one another than communities in unprotected sites, which were more uniform. Functional diversity, represented by feeding groups, showed different structural patterns across the stands: sites with high prevalence of herbivores and predators showed lower prevalence of decomposers and vice-versa. Tree species diversity had a significant impact on functional arthropod community structure, with high tree diversity being associated with high prevalence of filter feeders and saprotrophs. Although protection status was not associated with increased overall species richness, the higher representation of red-listed species and greater compositional heterogeneity in protected stands indicates potential conservation value.

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[*]Speaker

Habitat changes at the local scale have major impacts on waterfowl populations across a migratory flyway

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Migratory waterbirds are experiencing severe declines worldwide due to habitat loss. Their life cycles often span different countries and continents, highlighting the need for safeguarding wetland networks along migratory flyways. However, there are gaps in understanding how changes in specific sites can impact species at the biogeographical scale. Here we used a wetland of international importance (the Guadalquivir marshes, SW Spain) as a case study to investigate the causes and consequences at the flyway scale of annual changes in wintering waterbird assemblages. To do so, we combined 38 years of local and international waterfowl winter counts, environmental and remote sensing data encompassing 432 Ramsar sites, and a functional approach through structural equation modelling (SEM). We show that the environmental conditions experienced by wintering waterfowl in the study area were correlated with changes in their biogeographical populations in the East Atlantic Flyway. We found that during the last 40 years, the waterfowl assemblage wintering at the Guadalquivir marshes has shifted from a community composed mainly by herbivores and pre-Saharan dabbling granivores, to the current one dominated by Trans-Saharan dabbling granivores. Declines in 9/15 of the species studied were associated with the deterioration of the Doñana National Park natural marshes, whereas changes in the remnant six species responded mainly to global factors, such as the increase in winter temperatures in other areas of their distribution range. These results underscore the importance of considering global factors and flyway population data when interpreting regional trends of migratory animals. But also, that changes in specific wetlands can have measurable global impacts. Being that the long-term persistence of migratory animals in a changing world entails the protection and integrity of migratory flyways beyond national borders.

Keywords: Wetland Conservation, carry, over effects, East Atlantic flyway, habitat loss, migration, population dynamics, waterbirds

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*Speaker

Improving bird detection of wind turbine rotatory motion: Experimental insights of black and white patterns painted on wind turbines

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In the context of addressing global warming, the development of wind energy is continuously increasing, driven and supported by environmental policies. This development does not come without environmental impact, including bird collisions with turbines. One potential mitigation measure involves detection-reaction systems that identify approaching birds and slow down the blades if their trajectory is predicted to cross the area swept by the blades. Despite their installations in some wind energy facilities, bird mortality due to collisions remains a concern.
Observations indicate that collisions occur even when the blades are stationary or rotating slowly, suggesting that the birds' detection of rotating blades may be insufficient, depending on the speed of movement. Since birds have limited contrast sensitivity, a good approach to reduce bird mortality is to enhance visual contrast based on bird visual perception. One potential solution is to paint the blades in black and white to increase contrast. This approach is encouraging, as a previous study demonstrated a significant effect on a bird species painting one blade in black. To improve the blade rotation detection by birds at different speeds, it would be interesting to paint all the blades with black and white patterns rather than one blade.

Our study aims to identify the most effective pattern for birds to detect blade movement. Specifically, we intend to determine whether birds can perceive blade movement depending on speed, contrast, and pattern. To study birds' detection of rotating blades, we conducted an operant conditioning experiment with captive individuals from three species: domestic homing pigeons (Columba livia), black kites (Milvus migrans), and griffon vultures (Gyps fulvus). We tested three patterns at different speeds and contrasts -one black blade, striped blades, and checked blades- against a control condition in which all blades remained white.

Birds' detection of rotating blades was strongly influenced by contrast, with lower contrast reducing their capacity to perceive blade movement. At lower speeds, detection of blade rotation was lower, with most failing to detect movement at 1 and 5 rotations per minute. Striped and checked patterns improved the black kite's detection of rotating blades at low speeds. For

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[*]Speaker

pigeons and vultures, no pattern significantly enhanced their detection of blade rotation, and both the one-black-blade and checked patterns appeared to reduce their detection of blade rotation. The stripped one emerged as the best compromise for all three species among the tested patterns.

These findings are encouraging as striped patterns can enhance birds' detection of rotating blades. The pattern choice seems crucial, and we recommend testing the striped pattern in natura to validate these results under natural conditions.

Evaluation of the contribution of environmental and remote-sensing data on rule-based resistance connectivity models. Study case on the African elephants of the region of Binga, Zimbabwe.

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The Kavango Zambezi Transfrontier Conservation Area (KaZa TFCA) hosts many protected areas and is home to a great diversity of fauna including emblematic species. However, these animals frequently move beyond core protected areas, coexisting with rural human communities. There is a need to preserve the functional connectivity between those protected areas for a better conservation. Most existing connectivity models rely heavily on expert knowledge or literature-based assumptions. Few studies incorporating expert knowledge have integrated environmental variables beyond Land Use Land Cover (LULC). Additionally, with more accurate tools available from remote-sensing, describing better the environment is now possible and cheaper. This work aims to create a new framework to evaluate the contribution of environmental and remote sensing data in the modeling of the rule-resistance based functional connectivity of a very well-known species the African elephants in the Binga region of Zimbabwe. We generated resistance maps based on two LULC classifications, one distinguishing woodland types and structure and one without. We also incorporated various ecological and geographical variables known to influence elephant movement. Connectivity was then modelled through graph theory analysis. The models were evaluated using elephant presence/absence data collected along transects and corridors validated through stakeholder participatory mapping. Contrary to our initial hypothesis, incorporating woodland type distinctions in LULC did not enhance connectivity predictions. However, specific combinations of additional environmental variables significantly improved model performance. This study presents a resource-efficient, operational framework for testing the influence of ecological and geographical factors on connectivity models, offering valuable insights for landscape-level conservation planning.

Keywords: Connectivity, Elephants, Modeling, Landscape ecology

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[*]Speaker

Different demographic trends by migratory strategy: evidence of community reorganisation in European birds

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Bird communities across Europe have undergone significant changes in recent decades, with the intensity of these changes varying based on species' ecology. Long-distance migratory birds, travelling from sub-Saharan Africa to breed in Europe, are showing greater declines compared with their resident or short-distance counterparts. Although these aggregated trends establish a clear link between demography and migratory strategy, this relationship may not be occurring uniformly across European countries, which differ in species composition (species and abundance) and anthropogenic pressures. This study investigates how migration strategies shape changes in avian breeding community composition across European countries. We combined national demographic indices with absolute abundance data to characterize these communities in recent decades. We used ringing data to identify migratory strategies, and then explored how these strategies relate to community changes. The results indicate a general decline in the proportion of long-distance migrants over the past three decades, unhomogeneous across European countries. As predicted, the pattern follows a latitudinal gradient, with a more pronounced decline of the proportion of long-distance migrants at lower latitudes, and a lesser decline in northern countries. These recompositions reflect country-specific variations in species abundance. We also examine changes in resident and short-distance migrant populations, and further analysis would identify potential causes behind these recompositions. These results provide a better understanding of how avian assemblages are responding to large-scale anthropogenic changes, with implications for the conservation of migratory species along the Afro-European flyway.

*Speaker

Feathers and forests: How do trees, crop diversity, and canopy cover affect bird diversity and abundance in west Bali's polyculture agroforests?

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Agriculture is one of the main drivers of tropical deforestation, with 6.4-8.8 million hectares of forest being lost annually due to crops/livestock. Deforestation and the use of agrochemicals has led to significant declines in insects, birds, bats, and other organisms which provide essential ecosystem services. The demand for agricultural commodities is projected to increase 70-100% by 2050, and experts predict there may not be substantial tropical forest remaining by 2100. Meeting global food demands whilst preventing further biodiversity loss is a critical challenge for the 21st century.

The top driver of pantropical deforestation is cattle pasture expansion, followed by commodity crops. Indonesia, a deforestation hotspot, is a major global producer and exporter of commodity crops such as oil palm, rubber, cocoa, and coffee. A third of all employment in Indonesia is through agriculture, and most Indonesian farmers, (_~93%), are smallholders who occupy less than 1 hectare of land. Due to its insular nature and complex geological history, the Indonesian archipelago also hosts high levels of species richness and endemism. For Indonesia, reconciling economic development with the protection of its rich ecosystems is critical for a sustainable future.

Agroforestry, the practice of growing crops under the shade of trees or alongside non-cropping trees, poses a possible win-win solution which can benefit livelihoods and serve as a refuge for nature. The integration of trees into croplands has been shown to provide potential habitat for invertebrates, amphibians and reptiles, birds and mammals. Research from tropical regions has shown that agroforestry also has the potential to improve the income and quality of life of local farmers. Our research focuses on agroforests in Bali, an island province in Indonesia with a population of _~3.4 million people. Bali lies within the biodiversity hotspot of Sundaland, and is a growing hub for tourism and the export of coffee, cocoa, vanilla, banana, durian, etc.

In western Bali, locals grow crops in complex agroforestry systems using traditional farming methods. For our research, we wanted to understand how the arrangement of native forest trees and crops affects yields and biodiversity in tropical agroforests. We set up 67 plots (25 x 25m)

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*Speaker

across varying habitat types in west Bali, and collected data on vegetation and birds across plots with a mix of forest trees and cropping trees ("rustic"), plots with only cropping trees ("polyculture"), and plots inside the protected forest ("core forest"). We collected bird data using bird point counts (with trained local bird experts) and acoustic recorders.

This data is currently being analyzed, with preliminary results showing that rustic agroforest plots with high crop diversity and increased canopy cover are associated with high bird abundance, and high crop yields. High crop richness and tree richness also favour frugivorous birds such as hornbills and fruit-doves, both in abundance and number of species, showing that retaining forest trees in agroforests can assist in bird conservation without reducing farmers' income. Our final results will be used to make recommendations for wildlife-friendly farming in Bali, and other parts of Indonesia.

Strengths and limitations of official sources of wildlife poisoning data: A case study in Europe

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The cryptic nature of wildlife crimes, such as poaching, challenges the effective monitoring of their impacts on biodiversity, thus jeopardizing the adequate addressing of this critical threat. Official databases serve as the main sources of information for delineating strategies and actions against wildlife crimes. However, their reliability requires proper evaluation. To shed light on these databases' major strengths and limitations, we conducted a comparative analysis of species composition, richness, and abundance of individuals consuming simulated poisoned baits across mainland Spain, a country with a significant compilation of official records of wildlife poisoning. Our comparison shows that while official databases reflect the poisoned species pool, such official records fail to approximate species richness and individual abundance per poisoning event. Specifically, common generalist species are often under-represented, in contrast to legally protected species and domestic mammals. Common species that may go unnoticed or omitted during official inspections emerge as good sentinels of wildlife poisoning. Taking appropriate actions to combat wildlife poisoning based on official records requires accurate and consistent information, achievable through systematic inspections and data-gathering protocols.

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[*]Speaker

Linking conservation status and species traits: a case study on European dragonflies

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Aquatic insects and other freshwater taxa are particularly vulnerable to anthropogenic pressures causing a sixth mass extinction event. Although many species are negatively affected by global changes, their responses are very diverse. In this context, trait-based approaches are particularly relevant to understand why species respond differently and identify actions to slow or halt their decline. Dragonflies, a charismatic and relatively well-studied insect group typical of wetlands, offer an excellent model for studying freshwater biodiversity and the relationships between traits and conservation status.

Here, we explored how species traits relate to conservation status in European dragonflies. We built a comprehensive traits database, using literature and expert knowledge. We then applied ordination methods to link the species traits with European red list status, population trend, and area of occupancy.

Our analysis highlights the importance of habitat for determining dragonflies' conservation status, with species from nutrient-poor habitats and southern streams being more at risk. Species' generation time is also important, with species completing their life cycle more slowly being more threatened than those with a faster life cycle.

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These results are important to inform conservation. From an applied standpoint, a trait-based understanding helps to prioritize conservation strategies: in particular, our analysis suggests directing conservation efforts towards species from nutrient-poor and southern streams habitats. Second, from a more fundamental standpoint, they provide a basis to test hypotheses on the effect of different pressures on dragonflies, mediated by their traits. Finally, due to their ecological characteristics, dragonflies could be used as indicators to monitor more broadly the environmental health of freshwater ecosystems: our trait-based analysis suggests that different functional groups could be used to this end.

Major entomological communities in French agro-ecosystems and their relationships with climate, agricultural landscapes and management intensity.

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Insects play a crucial role in ecosystems, particularly through pollination, which is essential for agriculture. However, despite growing evidence of their decline and the impact of farming practices on this trend, current research remains insufficient. It is often geographically restricted, focused on a few charismatic species, and based on low-resolution indicators of agricultural practices. Additionally, field margins-key semi-natural habitats within agroecosystems that serve as biodiversity refuges-are largely overlooked.

Leveraging a national monitoring network across metropolitan France, we aimed to provide a comprehensive taxonomic and functional synthesis of field margin entomofauna, with a specific focus on the Coleoptera community and the agro-environmental factors shaping its composition. Using a combination of molecular and morphological approaches for precise species-level identification, along with multivariate analyses, we examined 1,774 samples collected from 374 distinct field margins across continental France between 2020 and 2023.

Our survey revealed a high diversity of Coleoptera, with 797 distinct species identified. Among them, 233 species were recorded only once, and nearly 400 remain to be identified. Twenty-one taxa were particularly dominant, each accounting for more than 1% of total abundance and occurring, on average, in 26% of field samples. Functionally, we identified 125 flower-visiting species and 84 zoophagous species, likely contributing to pollination and pest regulation, respectively, alongside 64 pest species. Furthermore, we identified five distinct field margin communities, each associated with specific climatic, soil, landscape, and agricultural conditions.

This study represents the first synthesis of field margin entomofauna, an often-overlooked habitat from an entomological perspective. Field margins provide unique habitats that host fauna from

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diverse environments, including numerous flower-visiting species that likely contribute to pollination services within adjacent fields. Beyond simple classification, our findings demonstrate that taxonomic and functional community traits can serve as indicators of agricultural disturbance, similar to what is done with plants and ecobordure indicators. Overall, the typology developed here offers a valuable framework for assessing the impact of agricultural practices by enabling the consideration of more homogeneous agro-ecological conditions and species assemblages.

Where do vultures feed? Using biologging to quantify the real use of supplementary feeding stations

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As strict scavengers, vultures have to find food resource unpredictable in space and time. As conservation measure, feeding stations had been deployed in partnership with local farmers. However, vultures seemed to rely in unknown proportions on other food resources, natural wild ungulates or undeclared domestic livestock. To identify the location of these resources and their contribution to vultures' diet, we used biotelemetric monitoring of Eurasian Griffon Vultures (*Gyps fulvus*) in three French mountain ranges.

129 adult vultures were tracked between 2018 and 2024 in the Grands Causses region, in the Alps and in the Pyrenees. We developed an automatic discrimination method to separate feeding behaviours from other behaviours, thanks to accelerometric sensors. This monitoring allowed us to identify feeding sites that were not associated to a supplementary feeding station.

We detected individual strategies in the use of feeding sites, with the proportion of feeding at unknown feeding sites (UFS) differing between the high mountains of the Alps and Pyrenees and low mountains of Grands Causses. The great majority of these sites were visited only once, indicating predominantly opportunistic use of unpredictable resources. Yet, we identified sites cumulating up to 50 feeding events, reflecting periodic illegal deposits. Variations in the proportion of feeding at UFS were better explained by environmental parameters such as the region and season than individual features (age, breeding status, sex). The selection of UFS was more likely in pastures and at close distance to supplementary feeding station.

These results indicate that Griffon vultures in France do not rely exclusively on supplementary

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[*]Speaker

feeding, with unpredictable natural food sources remaining a significant component of their diet. Supplementary feeding stations are nonetheless crucial to support reintroduction and to recover vultures' ecosystemic role in trophic cycles. The use of biologging to detect major unknown feeding sites visited several times raises the issue of the origins of illegal deposits. Our results on resource selection also suggests an important role of local livestock farming practices in vultures feeding strategies, which is to be considered when working on this species' conservation.

Under heat stress: Investigating the drivers of physiological and behavioral responses of king penguins to warm environmental conditions.

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Due to global warming, warm events such as heat waves are expected to become more frequent, especially in polar regions where temperatures are rising three times faster than the rest of the earth. Polar species might be especially at risk due to their adaptations to cold climates that favor high capacity for heat retention rather than dissipation. There is a need to model accurately these species' physiological and behavioral response to heat stress, by identifying the main parameters influencing body temperature and thermoregulatory behaviors. King penguins spend most of the year foraging in cold waters, but breed on land during spring and summer, where they alternate between egg/chick care on land and foraging at sea. This alternance between land environment and cold marine environment limits their ability to adjust body insulation, making them potentially susceptible to heat stress. In this study, we monitored thermoregulatory behaviors, heart rate, body temperature, physical activity and dehydration levels to assess their physiological responses to warm environmental conditions. In respirometry settings, thermal responses to warm environmental conditions are primarily studied by increasing ambient temperature. However, in the wild, animals experience fluctuations in solar radiation, wind speed, humidity and ambient temperature. We found that variations of these parameters and their interactions, significantly influence body temperature, heat releasing behaviors, and heart rate. Those interactions must be considered when modelling heat stress in endothermic species. We found that sex has no impact on body temperature nor heart rate, however the duration of the time on land decreases the influence of meteorological parameters on body temperature and heart rate. This could indicate a short term acclimation to the environmental conditions. Additionally, our results suggest that warm environmental conditions, (i.e. high solar radiation and ambient temperature, low wind speed) and elevated body temperature are associated with low heart rate. Low heart rate is indicative of a slow metabolism, possibly meaning that heat releasing strategies at the conditions experienced do not induce a significant

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metabolic cost, or alternatively that metabolism is adaptively slowed-down under high heat-load to limit hyperthermia.

Fly high for conservation: assessing area-based conservation in a temperate Mediterranean forest through parasitoid fly communities

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Area-based conservation-relying on the strategic designation and zoning of protected areas-remains one of the most effective approaches to counter global biodiversity loss. This strategy facilitates the integration of conservation objectives with sustainable development, ensuring that ecological and social needs are balanced. This is particularly important in ecosystems highly sensitive to global change such as Mediterranean mountain forests, which often harbor ecological communities typical of temperate regions yet are subject to prolonged summer drought and warmer conditions.

The Gariglione forest, located within the Sila National Park (Southern Italy), exemplifies this scenario. Historically managed until the mid-20th century, Gariglione has since undergone substantial rewilding thanks to its designation as a reserve, regaining key features of old-growth structure-such as tall canopies and abundant late-successional species like *Abies alba* and *Fagus sylvatica*. Furthermore, its location within a buffer zone where only activities compatible with conservation objectives are permitted makes Gariglione an ideal testing ground to evaluate conservation strategies that extend beyond the traditional assumption that stricter protection always yields higher biodiversity. Indeed, growing evidence suggests that intermediate-disturbance mosaics-where low-intensity human uses coexist with conservation objectives-can enhance ecological complexity while supporting local livelihoods.

Building on this foundation, the aim of this work is to assess the effectiveness of zoning and to investigate the factors contributing to biodiversity patterns in these dynamic ecosystems. In this regard, insects represent the ideal target for monitoring changes in ecosystem health. With their short generation times and high sensitivity to microenvironmental changes, insects serve as early-warning indicators, capable of revealing subtle shifts in forest structure, microclimate, and resource dynamics long before these changes become apparent in vegetation or larger fauna.

Bristle flies (Diptera: Tachinidae) and woodlouse flies (Diptera: Rhinophoridae) exhibit high functional and taxonomic diversity yet are rarely studied in the context of forest conservation in southern Europe. By monitoring these parasitoid flies, we can assess their diversity and indirectly infer the health and composition of their host communities-critical for processes such as pest regulation and nutrient cycling.

Comparing communities of Tachinidae and Rhinophoridae across an integral reserve gradient

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[*]Speaker

of structural complexity and managed areas where moderate human activities are allowed, we present preliminary results that explore the potential of these parasitoids to signal changes in forest integrity. We integrate classical diversity metrics and compositional analyses with forest structural indices and functional trait data to reveal the ecological mechanisms driving the observed community patterns.

Ongoing analyses suggest that areas with intermediate disturbance can create a mosaic of microhabitats-through the formation of canopy gaps, varied light conditions, and a dynamic understory-that enhances habitat heterogeneity and supports higher parasitoid diversity. In strictly protected, old-growth conditions-where the natural decay of senescent trees, accumulation of deadwood, and formation of canopy openings generate diverse microhabitats-the forest also supports rich assemblages of host and parasitoid species. However, in some strictly protected areas, the forest may have experienced less recent structural heterogeneity, potentially resulting in a somewhat reduced niche diversity for insects.

Living at the edge: are abundances of vertebrates changing at the borders of species ranges?

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Vertebrate populations are declining at a global scale and understanding which are at higher risk is essential to design conservation strategies, especially in tropical regions where declines are stronger. There is evidence of species' range changes as climate warms: more likely to contract at their warmer limits (the 'trailing edge') and to expand at their colder limits (the 'leading edge'). These changes in range limits are likely accompanied by changes in population of abundances at the edge of ranges, yet this remains to be tested.

Here we investigate if the abundance of populations of vertebrates closer to the trailing edge is decreasing and/or if the abundance of populations closer to the leading edge is increasing. We compiled global data on time-series of abundance of amphibians, reptiles, birds and mammals from published databases and calculated the trend in relative abundance for each population. We then estimated the relative distance of each population to the trailing (equatorwards) and leading (polewards) edges of the species range. We modelled how the probability of abundance decrease changes with relative distance to the trailing edge for each taxonomic group, adding the effect of latitude and local temperature. We also separately did the same for the probability of abundance increase related to the relative distance to the leading edge.Our results suggest that populations closer to the trailing edge are more likely to experience abundance decrease, especially for reptiles and amphibians. On the other hand, only populations of birds closer to the leading edge were especially likely to experience abundance increase. Our findings highlight how climate is shaping species distribution and abundance, especially at lower latitudes, with differences across taxonomic groups. By understanding how and where the abundance of vertebrates is changing, we can more efficiently design and inform conservation actions at large spatial scales.

Keywords: conservation, macroecology, climate, spatial, distribution

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*Speaker

Improving predictions of species distribution dynamics by integrating heterogeneous long-term monitoring datasets

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Accurate and efficient assessment of spatial and temporal patterns in species distributions remains a major ecological challenge. Reliable estimates of species distribution trends are critical for effective conservation and informed resource allocation in species management. Traditionally, analyses of distribution changes have relied on data from individual monitoring schemes. However, the increasing availability of diverse ecological datasets presents new opportunities to integrate multiple sources of data and potentially gain more robust ecological insights.

In this study, we evaluate whether combining count data and detection-nondetection data from two distinct long-term bird monitoring programs within an integrated modeling framework improves predictions of species distribution dynamics compared to models built from single datasets alone. We compare predicted spatiotemporal patterns of species occurrence and abundance between integrated and single-dataset models and identify how the distinct ecological information provided by each dataset contributes to model improvements. Furthermore, we assess the impact of variable selection strategies-conducted either separately per dataset or jointly using combined datasets-on model performance.

We conduct species-specific evaluations of predictive performance across six bird species characterized by contrasting population trends, including three species undergoing range contraction and population declines and three experiencing range expansion with increasing populations. Finally, we explore how species-specific ecological traits influence the degree of performance improvement obtained from data integration. Our findings provide important insights into when and how the integration of heterogeneous monitoring datasets can significantly enhance the understanding and prediction of species distribution dynamics.

Keywords: Integrated models, Species distribution dynamics, Data integration, Monitoring programs, Detection probability, Variable selection, Population trends, Ecological modeling

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Climate change and the world's rarest albatross: Impacts on demographic trends of the Amsterdam Albatross

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The impact of global climate change on the viability of animal populations is now well documented. Seabirds, as long-lived species with extensive foraging ranges, are particularly vulnerable to climate variability, which can significantly influence prey availability, breeding success, and overall population dynamics. Small populations are especially susceptible to environmental fluctuations, as even minor shifts in climate variables can lead to significant changes in demographic parameters and overall population growth rates. One of the seabird species of greatest concern is the Endangered Amsterdam Albatross (*Diomedea amsterdamensis*), one of the rarest bird species, consisting of a single population on the plateau of Amsterdam Island (SE Indian Ocean). When the species was discovered in the early 1980s, it numbered fewer than a dozen pairs. The population has been increasing over the past few decades, with 82 pairs recorded in 2024, but it remains fragile. Understanding the relationship between climate variables and demographic parameters (such as survival rates, breeding success, and recruitment) is critical for predicting the long-term viability of this albatross population under ongoing global climate change. Our study aims to quantify the impact of climate variability on the demographic trends of the Amsterdam Albatross population, providing insights into how this species may adapt to or be threatened by future environmental shifts. Using an integrated population model with 41 years of capture–recapture and count data, along with population viability analysis, we will assess the effect of large-scale climatic variables on demographic parameters and population growth rates. We hypothesize that the observed increase in this population is not linked to changes in climatic conditions. However, future climatic changes may have significant impacts on this population, particularly on juvenile survival and recruitment rates.

Keywords: Seabirds, Albatross, climate change, population dynamics, demographic parameters, climatic conditions, popualtion viability, small population

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*Speaker

Ecology and society

Branching out: How urban trees and people help clean the air

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Urban trees play a crucial role in mitigating air pollution, yet their effectiveness varies based on species-specific traits and environmental conditions. This study explores the relationship between tree morphological functional traits and air purification services across a pollution gradient, examining both intra- and interspecific variations. By assessing how these traits contribute to air quality improvement in an urbanized area and comparing our findings with societal preferences for tree species, we aim to provide insights that inform urban greening strategies for healthier cities. To achieve this, functional leaf traits and particle material on leaves (PM10) were measured in five tree species with distinct traits in three urban parks in Granada, Spain. People's preferences were assessed through surveys evaluating the use of urban green infrastructures and the perceived ecosystem services and disservices provided by urban trees. We calculated functional diversity indices and used multivariate analyses combined with comparison tests to assess differences along the gradient. Our results will contribute to more informed public policy to maximize the benefits of urban green infrastructures. This work is part of BioCiTrees, a larger European-funded research project aimed at optimizing urban green space design to maximize both ecological and societal benefits.

Keywords: nature's contributions to people, people's perceptions, air pollution, functional traits, climate change, cities

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*Speaker

Development of a Biological Response Matrix for Vulnerability Management in Bottom-Cultured Peruvian Scallops under Temperature and Hypoxia Stress

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The production of *Argopecten purpuratus* (Peruvian scallop) is an economically important activity in Peru, supporting coastal communities and seafood industry. However, bottom-culture farms experience mass mortality events linked to temperature anomalies and hypoxic conditions, both exacerbated by climate change and ocean deoxygenation. The Peruvian coast is influenced by the Humboldt Current upwelling system, which sustains high biological productivity but also generates fluctuating oxygen levels and temperature shifts. These variations are further intensified by anomalous climate events such as El Niño, exposing scallops to sudden environmental stressors.

Temperature, oxygen availability, and exposure duration are key factors influencing *A.purpuratus* survival. Temperature affects metabolic rates increasing oxygen demand, while hypoxia limits oxygen supply. Although *A.purpuratus* is a strong oxyregulator, prolonged exposure to low oxygen or high temperatures can push it beyond its physiological limits, leading to metabolic stress and mortality.

In this study, we developed a **biological response matrix** to assess the impact of temperature, oxygen depletion, and exposure time on *A. purpuratus* cultures, integrating oxygen saturation levels ($< 2\%$, $2\text{-}5\%$, $5\text{-}24\%$, and $> 24\%$), temperature ranges (14-16∘C, 16-20∘C, 20-25∘C, 25-29∘C, and > 29∘C), and exposure time (6-12h, 12-24h, 24-48h, and 48-120h).

Based on published experimental data, *A. purpuratus* responses were classified as follows:

- **Innocuous**: No signs of stress or mortality.

- **Physiological stress**: When oxygen saturation drops to $\leq 24\%$ (the threshold at which respiration rate decreases significantly, Aguirre-Velarde *et al.* 2016).

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- **Probability of mortality**: Conditions where mortality occurs but do not exceed 50% lethality. (Cueto-Vega *et al.* 2022, Cruz *et al.* in prep).

- **Lethal**: Environmental conditions leading to ≥50% mortality (Cueto-Vega *et al.* 2022, Cruz *et al.* in prep).

Application of the matrix:

Temperature-driven mortality (March 2017): During an El Niño event, temperature anomalies reached 28∘C, pushing scallops into a high-risk physiological state, even under normoxic conditions. Elevated temperatures increased metabolic demands, reducing scallop tolerance to stress. A shift from probability of mortality to lethal conditions occurred when sustained exposure exceeded 24h.

Hypoxia-driven mortality (March 2019): A prolonged hypoxic event ($< 5\%$ O saturation for ˜120h) led to significant mortality, with scallops experiencing severe metabolic suppression. The biological response matrix confirmed that longer exposures under severe hypoxic conditions resulted in lethal effects, regardless of temperature.
Comparing both events, we found that temperature and hypoxia can independently cause mass *A. purpuratus* mortality. However, exposure duration plays a critical role in determining the intensity of physiological stress, as prolonged exposure-whether due to temperature or to oxygen depletion-significantly increases mortality risk.

This matrix provides a structured approach to assessing environmental risks in scallop farming. Our findings highlight the need for real-time environmental monitoring. Deploying oceanographic buoys capable of continuous temperature and oxygen monitoring could provide important data to anticipate extreme conditions and mitigate mortality risks. This in turn could help scallop farmers improve site selection, harvesting schedules, and management strategies.Furthermore, the biological response matrix serves as a decision-support tool for adapting scallop farming to oceanographic variations. It offers a scientifically grounded framework for policymakers, farmers and researchers to anticipate environmental threats and enhance the sector's resilience.

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Human Dimension of Wildlife Conservation: Broadening our knowledge of stakeholders' perceptions towards scavengers

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All around the world Human-Wildlife Conflicts (HWC) threaten human livelihoods and wellbeing and jeopardize biodiversity conservation through, for example, promoting the use of lethal control. Resolving HWC outstands therefore as an important challenge for human-wildlife coexistence, which requires multidisciplinary conservation approaches. Since humans are the constant component of HWC, psychological analysis is increasingly relevant in conservation sciences. Among the various concepts from psychology applied in wildlife conservation, perception is surely one of the most studied. Perceptions are the individual's way to observe, understand, interpret and evaluate a referent (*e.g.*, object, individual, policy). Numerous studies find that the way stakeholders perceive a certain wild species strongly affects their behaviours impacting this species' conservation (*e.g.* poaching). Perceptions of wildlife can be driven by a lot of factors such as education, culture or even environmental beliefs.

In this study, we used semi-structured interviews with livestock farmers from the Southern French Alps (N=92) to identify key factors shaping their perceptions towards vertebrate scavengers, a very heterogeneous guild. Indeed, scavenging *i.e.* the consumption of carrions, concerns large carnivores, vultures, some birds of prey and some generalist species like wild boars *Sus scrofa*, red foxes *Vulpes vulpes* or corvids. Perceptions were measured on a Likert scale from very harmful to very beneficial and analysed by Cumulative Link Models specific to ordinal data. We found that environmental values, i.e., individual ecological worldview, were the main drivers of farmers' perceptions towards scavengers. Specifically, farmers acknowledging the current ecological crisis perceived controversial scavengers (*i.e.* wolves *Canis lupus* and griffon vultures *Gyps fulvus*) as more beneficial. Other factors affecting farmers' perceptions include sex and farming practices, matching with previous results obtained in Spain and Portugal. A comparison between our results and previous ones, collected from 109 farmers in the Iberian Peninsula, allowed us to reveal inter-cultural differences in famers' perception towards scavengers.

Our results suggest that although perceptions towards scavengers are shaped by easily quantifiable factors (*e.g.*, socio-demographic data, farming practices), they are mainly driven by more complex constructs such as people's environmental values or culture. These results have allowed us to implement some specific awareness campaigns to improve the cohabitation between pastoralism and wildlife in the Southern French Alps. However, more investigations are needed on the concrete mechanisms that relate stakeholders' perceptions with scavenger vertebrates' conservation.

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*Speaker

Key success characteristics of nature-based interventions to improve human-nature connection, human health and ecosystem welfare

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In the current context of global change, the relationship between humans and nature must evolve to ensure human health and, more broadly, the well-being of the entire biosphere (IPBES 2019; IPCC 2023; Rabinowitz *et al.* 2018). Improving Human Nature Connectedness (HNC) – the extent to which people see themselves as part of nature – (Barragan-Jason *et al.* 2022) is a key lever for shifting from a dominant, utilitarian view of nature to one based on interdependence (Fitzpatrick 2023). Indeed, Human-nature connectedness is significantly correlated with better mental and physical health, as well as higher levels of pro-environmental values and behaviors (Barragan-Jason *et al.* 2023). Nature-Based Interventions (NBIs) – nature educational and awareness programs in which participants engage in outdoor activities – have been shown to increase human well-being (Bloomfield 2017; Catissi *et al.* 2024; Kuo 2015), but the simultaneous increases in human-nature connectedness and pro-environmental values and behaviors have rarely been tested together. It is now crucial to determine the key characteristics that make a program effective in improving (i) Human-nature connectedness, (ii) human health and well-being and (iii) pro-environmental values and behaviors. Experimental and correlational studies report that direct contact with nature and focus attention (or mindfulness) can act synergistically to strengthen human-nature connectedness (Barragan-Jason *et al.* 2022). However, this prediction has never been tested empirically on a large scale, partly due to the scarcity of databases compiling existing programs – an effort that involves collaboration with numerous environmental organizations. To address this challenge, we studied pre-existing programs managed by more than 80 organizations – such as WWF France, Fondation pour la Nature et l'Homme, GRAINE – in a meta-experiment. Our goal was to extract key characteristics of each program and test their effectiveness in improving human-nature connectedness, human health and wellbeing, but also pro-environmental values and behaviors.

Keywords: Behavioral intervention efficiency, environmental education efficacy, pro, environmental behavior, human health and well, being, people and nature, meta, experiment

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[*]Speaker

Restoring socio-ecosystems in an anthropocenic landscape: the example of the riparian wetlands of the Gironde estuary

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Humans have a long history of adapting, through cultural changes mainly, to the ecosystems of which they are part. At the same time, like other species, they modify these ecosystems through their biotic and abiotic interactions. By co-evolving together in complex ecologies, nonhumans and humans created socio-ecosystems that sustained both biological and cultural diversity. However, over the past centuries, industrialization and globalization have threatened the capacity of socio-ecosystems to maintain these two aspects of diversity and have led to what has been termed the Anthropocene. Restoring such socio-ecosystems with complex and co-evolving nonhuman-human ecologies is therefore vital for the maintenance of both biological and cultural diversity.

Using the Gironde estuary as an example, my work examines how two key components of socio-ecosystems and their nonhuman-human ecologies – species assemblages and local practices that humans have with nonhumans – are shaped by social and environmental drivers in the current landscape ; and what are the trajectories of these nonhuman-human ecologies in areas undergoing restoration. Until the end of the XVIth century, most of the socio-ecosystems of the Gironde estuary's floodplain consisted of riparian wetlands: areas connected to the estuary waters and periodically submerged by these waters. These socio-ecosystems hosted co-evolving nonhuman-human ecologies for thousands of years. From the end of the XVIth century onwards, different projects of modernization (drying and polderisation of riparian wetlands for agricultural and industrial purposes) completely transformed the landscape, with most socio-ecosystems shifting from riparian wetlands to non riparian and industrialized socio-ecosystems. With the globalization of the economy at the end of the XXth century, some areas were abandoned by industrial agriculture, which became locally less profitable. Because of the resulting lack of seawall maintenance, these areas are now shifting back to riparian wetlands and are therefore undergoing restoration. In some cases, they have been institutionalized as formal restoration projects now managed by the 'Département de la Gironde' and the 'Conservatoire du Littoral'. The first aim of my work is to identify, at the scale of the estuary's floodplain, the drivers that shape socio-ecosystems and their nonhuman-human ecologies in the landscape (looking at both species assemblages and local practices that humans have with nonhumans). The second aim focuses on the areas shifting back to riparian wetlands, where I study the trajectories of emerging species assemblages and local practices that humans have with non humans. To grasp both the social and ecological aspects of these questions, I use an interdisciplinary approach combining methods from landscape, community and restoration ecology as well as anthropology to foster a dialogue between floristic and faunistic inventories, geographical data and ethnographic data.

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*Speaker

In the face of the sea level rise and the loss of both biological and cultural diversity, this project sheds light on the potential for areas undergoing restoration to enable the emergence of socio-ecosystems with complex, co-evolving nonhuman-human ecologies that maintain both biological and cultural diversity.

Influence of feeding practices in urban areas on bird communities and nature experiences in the city

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At a time of unprecedented biodiversity loss and increasing urbanization, people living in more urbanized lifestyles can face a progressive disengagement with the natural world, called the extinction of experience. Wild bird feeding is one of the most common form of human-animal interaction in the Western world. Perceptions of this practice vary: encouraged in winter in response to harsh climatic conditions, the impacts on bird communities, disease transmission, predation and others are recurrent subjects of discussion. In addition to the potential consequences of feeding on birds, this also brings up the issue of nature experiences through observation, learning benefits, well-being and social ties for people living in cities.

This thesis project looks at the practice of bird feeding from an ecological point of view through its effects on birds in different urban contexts (from individual behaviour to the species community) and the role of the urban dimension on species present at feeders. It will also adopt a socio-ecological perspective to study bird feeding as an experience of nature in the city, in order to explore the ecosystem services associated with this activity in different neighbourhood contexts and human populations.

These questions will be adressed based on data obtained by the BirdLab citizen science program, launched in 2014 and supported by Vigie Nature & the Muséum National d'Histoire Naturelle. The scientific protocol involves private individuals installing feeders at home and reporting the species and behaviours of the birds observed via a mobile application. The research being part of a CIFRE project with the City of Paris, it focuses on the urban environment, with the city of Paris as a case study. User surveys and questionnaires will be conducted to complete the social part of the dataset. The interdisciplinary dimension of this project will enable a global understanding of the socio-ecological issues involved in bird feeding in urban environments. My poster will explain the project, the objectives and eventual initial results.

Keywords: Birds, bird feeding, citizen science, urban ecology, BirdLab

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[*]Speaker

Quantifying pre- and post-Columbian human-plant interactions and ecosystem resilience in South America

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Understanding past human-plant interactions is crucial for informing contemporary conservation strategies. This research investigates human-vegetation dynamics in South America during the late Holocene, focusing on how land management practices have influenced vegetation resilience. We hypothesize that European colonization triggered an ecological state shift, fundamentally altering ecosystem resilience and biodiversity.

We employ palaeoecological techniques that serve as "biodiversity time machines", providing unique insights into long-term vegetation dynamics. Our objectives include identifying proxies for human activity, documenting past disturbance history, generating new vegetation reconstructions, and investigating ecosystem changes in response to varying phases of human activity.

To achieve these objectives, we will develop a novel Past Anthropogenic Activity Index (PAAI) for South America using multivariate statistical methods. This index will integrate multiple proxy datasets to identify and quantify indicators of human activity. We will gather data from the Neotoma database for pollen types, Global Paleofire Database for charcoal records, and People 3000 Radiocarbon Database for archaeological remains(Bird et al., 2022).

Additionally, we will reference known pollen indicators of human presence(Flantua and Hooghiemstra, 2023) and derive proxies such as sedimentation rates through radiocarbon dating. We will characterize natural and human-induced disturbance types, including natural fires, floods, extreme temperatures, human-caused fires, forest clearance, species introduction, and cultivation. Using Principal Component Analysis, if the first Principal Component accounts for at least 50% of the variation in the data, its variable loadings will be used as coefficients for the index. The PAAI will then be applied to investigate the effect of land management throughout South America.

To address data gaps, we begin with two new records from Northeast Brazil, the region with the largest deficit in palaeoecological studies(Silva et al., 2023). We will reconstruct vegetation and fire histories from two sediment cores in Northeast Brazil representing different ecosystem types: (i) seasonally dry tropical forest and (ii) mangrove. These cores span the past 1,000 and 7,000 years and represent areas with long-term human occupation. We will prioritize high temporal resolution, processing 0.5cm3 samples at 2 cm intervals and counting a minimum of 300 terrestrial pollen grains. The samples will be prepared using classic pollen extraction protocols (Faegri and Iversen, 1989). Charcoal analysis will follow a chemical digestion method (Winkler,

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[*]Speaker

1985).

To investigate the effect of human activity on ecosystem resilience, we will identify disturbances and calculate the recovery rate. Additionally, we will assess changes in ecosystem composition, calculating alpha diversity with Hill numbers and exploring how this has changed in relation to human activity. Then, an analysis of similarity will be performed between the different resilience metrics to test the hypothesis.

By reconstructing historical vegetation composition and identifying the effects of human activities, this study will contribute to a broader understanding of ecological resilience and inform conservation strategies in the face of ongoing environmental changes. Ultimately, this research will advance our understanding of neotropical paleoecology.

Keywords: Holocene, Human impact, Vegetation reconstruction, Paleoecology, Human ecology